Assessing stakeholder's experience and sensitivity on key issues for the economic growth of organic aquaculture production

Participatory management is widely recognised as a working method of paramount importance, based on the principles of knowledge sharing, accountability and legitimacy. Hence, it is broadly considered suitable for addressing issues related to the sustainable development of the seafood industry, and specifically, of the aquaculture system. A survey focused on the current EU regulatory framework was carried out to elicit stakeholders’ preferences, knowledge and experience on key issues for the development of organic aquaculture, supported by science-based regulations. The survey was completed by 65 stakeholders belonging to several categories, and it was supported by the implementation of the Analytic Hierarchy Process method. Stakeholders’ preferences were elicited on organic production methods and control systems, the quality of the environment and organic products, fish health and welfare. The views expressed by the participants revealed both competence and awareness, despite the complexity of the subject. Several ideas and useful suggestions emerged regarding unresolved technical issues. In addition, the need for a targeted communication strategy on the quality of organic aquaculture products and the necessity of fostering European/national programs to support the production and marketing of organic aquaculture products were highlighted.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, COISPA, Stazione Sperimentale per lo Studio delle Risorse del Mare
Authors: Lembo, G. (Ekstern), Jokumsen, A. (Intern), Spedicato, M. T. (Ekstern), Facchini, M. T. (Ekstern), Bitetto, I. (Ekstern)
Pages: 84-93
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Policy
Volume: 87
ISSN (Print): 0308-597X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.7 SJR 1.335 SNIP 1.182
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.591 SNIP 1.397 CiteScore 3.07
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.438 SNIP 1.56 CiteScore 3.09
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.472 SNIP 1.635 CiteScore 2.71
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.339 SNIP 1.495 CiteScore 2.54
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.406 SNIP 1.263 CiteScore 2.07
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.289 SNIP 1.483
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Combined effects of microplastics and chemical contaminants on the organ toxicity of zebrafish (Danio rerio)

Microplastics contamination of the aquatic environment is considered a growing problem. The ingestion of microplastics has been documented for a variety of aquatic animals. Studies have shown the potential of microplastics to affect the bioavailability and uptake route of sorbed co-contaminants of different nature in living organisms. Persistent organic pollutants and metals have been the co-contaminants majorly investigated in this field. The combined effect of microplastics and sorbed co-contaminants in aquatic organisms still needs to be properly understood. To address this, we have subjected zebrafish to four different feeds: A) untreated feed; B) feed supplemented with microplastics (LD-PE 125–250 µm of diameter); C) feed supplemented with 2% microplastics to which a mixture of PCBs, BFRs, PFCs and methylmercury were sorbed; and D) feed supplemented with the mixture of contaminants only. After 3 weeks of exposure fish were dissected and liver, intestine, muscular tissue and brain were extracted. After visual observation, evaluation of differential gene expression of some selected biomarker genes in liver, intestine and brain were carried out. Additionally, quantification of perfluorinated compounds in liver, brain, muscular tissue and intestine of some selected samples were performed. The feed supplemented with microplastics with sorbed contaminants produced the most evident effects especially on the liver. The results indicate that microplastics alone does not produce relevant effects on zebrafish in the experimental conditions tested; on the contrary, the combined effect of microplastics and sorbed contaminants altered significantly their organs homeostasis in a greater manner than the contaminants alone.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, National Food Institute, Research Group for Analytical Food Chemistry, AZTI Technalia
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Pages: 135-143
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication Information
Journal: Environmental Research
Volume: 162
ISSN (Print): 0013-9351
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.12 SJR 1.394 SNIP 1.334
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.449 SNIP 1.349 CiteScore 3.71
Interplay between daily rhythmic serum-mediated bacterial killing activity and immune defence factors in rainbow trout (Oncorhynchus mykiss)

Circadian rhythm is emerging as an important regulator of immune functions. However, there is a paucity of information on the influence of this biological phenomenon in the antimicrobial factors in teleost fish. This study investigated the dynamics and interplay of serum-mediated bacterial killing activity and immune defence factors throughout the light:dark (LD) cycle in rainbow trout (Oncorhynchus mykiss). The juvenile fish came from two different emergence time fractions (i.e., late and early) that were believed to exhibit behavioural and physiological differences. Serum collected during the day from fish (mean ± SD: 39.8 ± 6.3 g) reared under 14L:10D photoperiod demonstrated bactericidal activity against Flavobacterium psychrophilum, Yersinia ruckeri and Aeromonas salmonicida subsp. salmonicida of varying magnitude, but no significant differences between the emergence fractions were observed. A day-night comparison in the same batch of fish revealed time-of-day dependence in the bactericidal activity against F. psychrophilum and Y. ruckeri amongst emergence fractions.

A group of fish (63.3 ± 4.7 g) from each fraction was entrained to 12L:12D photoperiod for 21 days to investigate whether serum bactericidal activity exhibit daily rhythm. Serum-mediated bacterial killing activity against F. psychrophilum and Y. ruckeri displayed significant daily rhythm in both emergence fractions, where the peak of activity was identified during the light phase. Moreover, several serum defence factors manifested variations during the LD cycle, where anti-protease (ANTI) and myeloperoxidase (MPO) activities exhibited significant daily oscillation. However, there were no remarkable differences in the daily changes of serum factors amongst emergence fractions. Acrophase analysis revealed that the peaks of activity of alkaline phosphatase (only in late fraction), ANTI, lysozyme (only in early fraction) and MPO were identified during the light phase and corresponded with the period when serum-mediated bacterial killing activity was also at its highest. The daily dynamics of bactericidal activity and immune defence factors displayed positive correlation, particularly between MPO and, the two pathogens (i.e., F. psychrophilum and Y. ruckeri). Taken together, the study revealed that serum-mediated bacterial killing activity and immune defence factors remarkably varied during the LD cycle.
in rainbow trout. In addition, the two emergence fractions displayed nearly comparable immunological profiles.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, National Veterinary Institute, Fish Diseases
Authors: Lazado, C. C. (Intern), Gesto, M. (Intern), Madsen, L. (Intern), Jokumsen, A. (Intern)
Pages: 418-425
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Fish and Shellfish Immunology
Volume: 72
ISSN (Print): 1050-4648
Ratings:

BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.36 SJR 1.114 SNIP 1.16
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.268 SNIP 1.171 CiteScore 3.19
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.138 SNIP 1.089 CiteScore 2.92
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.001 SNIP 1.149 CiteScore 3.11
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.151 SNIP 1.174 CiteScore 3.02
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.196 SNIP 1.265 CiteScore 3.52
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.131 SNIP 1.056
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.96 SNIP 1.101
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.952 SNIP 1.062
Scopus rating (2007): SJR 0.842 SNIP 1.378
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.954 SNIP 1.298
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.789 SNIP 0.861
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.835 SNIP 1.148
Short-term exposure to repeated chasing stress does not induce habituation in Senegalese sole, Solea senegalensis

Animals can habituate to certain repeated stressors and reduce the physiological response that such stressor evoked initially. Studies related to stress habituation in fish are scarce and the available data differ depending on the species and on the type, duration and severity of the stressor. The main objective of this study was to investigate the stress response of juvenile Senegalese sole (Solea senegalensis) submitted to repeated chasing stress for 3 days previous to the experiment in order to evaluate the occurrence of habituation to those stress conditions in this fish species. Thus, five different experimental groups were evaluated: not stressed fish (control, C), fish stressed only on the experimental day (ST/naïve), and fish stressed on the experimental day and on the 3 previous days: during the day (ST/Dt), at night (ST/Nt) or both (ST/Dt + Nt). Parameters related to primary and secondary responses to chasing were evaluated in plasma, liver and brain. Chasing in ST/naïve group induced incremented values of plasma cortisol, glucose and lactate but no changes in catecholamine levels compared to controls. In trained fish, higher cortisol but decreased glucose, lactate and catecholamine levels were observed after stress compared to controls and to ST/naïve groups. In the liver, stress did not induce any changes with respect to controls whereas ST/Dt and ST/Dt + Nt showed lower values of glucose and glycogen than stressed naïve fish. In the brain, ST/naïve group presented no significant changes in serotonergic activity. However, incremented serotonergic activity was detected in fish previously trained. Furthermore, dopaminergic activity decreased in diurnal trained and nocturnal trained groups with respect to ST/naïve fish. Crh expression in hypothalamus was higher in ST/naïve fish but not in fish submitted to repeated stress compared to controls. In summary, it seems that there was no habituation to the repeated acute stress protocol in Solea senegalensis in terms of serotonergic activity and cortisol release during the physiological stress response. However, the decreased levels of plasma catecholamines and energy metabolites, and of the hypothalamic crh mRNA abundance and dopaminergic activity, indicate a modulation of the stress response in trained fish. Altogether, the results suggest that either the chasing stressor was too strong or the training period too short for the animals to habituate, indicating that repeated chasing within short periods should be avoided when manipulating fish in order to keep proper welfare conditions in this species.
A comprehensive approach to assess feathermeal as an alternative protein source in aquafeed

The effect of partially replacing fishmeal in aquafeed with feathermeal (FTH) at three levels (0%: FTH0, 8%: FTH8, 24%: FTH24) and two extrusion temperatures (100 and 130 °C) were evaluated in rainbow trout (Oncorhynchus mykiss) with respect to growth performance, metabolism response, and oxidative status of the feed proteins. Multivariate data analyses revealed that FTH24 correlated positively with high levels of: oxidation products, amino acids (AA) racemization, glucogenic AAs level in liver, feed intake (FI), specific growth rate (SGR), and feed conversion ratio (FCR); and low AAs digestibility. Both FI and SGR were significantly increased when 8 and 24% feathermeal was included in the feed extruded at 100 °C, while there was a negative effect on FCR in fish fed FTH24. In conclusion, higher oxidation levels in FTH24 may give rise to metabolic alterations while lower levels of FTH may be considered as fishmeal substitute in aquafeed for rainbow trout.
Acute and long-term CO2 exposure reduces the performance of Atlantic salmon in RAS

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Khan, J. R. (Intern), Johansen, D. (Ekstern), Skov, P. V. (Intern)
Number of pages: 56
Pages: 47
Alternative prophylaxis/disinfection in aquaculture - Adaptable stress induced by peracetic acid at low concentration and its application strategy in RAS

• Stress was monitored by measuring cortisol in water instead of in blood.
• Fish adapted to regular prophylaxis/disinfection with peracetic acid by showing reduced stress. • A mathematic model was established to improve understanding of substance distribution in RAS.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin, Agricultural Research Service
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Pages: 82-85
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Aquaculture
Volume: 474
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.136 SNIP 1.3 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.212 SNIP 1.487 CiteScore 2.32
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Aqualase, a yeast-based in-feed probiotic, modulates intestinal microbiota, immunity and growth of rainbow trout

Oncorhynchus mykiss

Yeast probiotics have great promise, yet they received little attention in fish. This study investigated the influence of Aqualase, a yeast-based commercial probiotic composed of Saccharomyces cerevisiae and Saccharomyces elipsoedas, on health and performance of rainbow trout (Oncorhynchus mykiss). Probiotics were incorporated in the diets at three different inclusion levels (1%, 1.5% and 2%) and administered to the fish for a period of 8 weeks. After the feeding trial, intestinal total viable aerobic bacterial count was significantly higher in fish group that received 2% in-feed probiotics. In addition, a significant increase in at least 11% in intestinal lactic acid bacteria population was observed in all probiotic-fed groups. Total protein level and lysozyme activity in skin mucus were significantly elevated following probiotic feeding. Inhibitory potential of skin mucus against fish pathogens was significantly enhanced by at least 50% in probiotic-fed groups. Humoral and cellular immune parameters were influenced by probiotic feeding and the effects were dependent on inclusion level. Digestive physiology was affected by infeed probiotics through improvement of intestinal enzyme activities. All growth performance parameters were significantly improved following probiotic administration specifically at inclusion rate 1.5% and above. Taken together, the results revealed that Aqualase is a promising yeast-based probiotic for rainbow trout with the capability of modulating the intestinal microbiota, immunity and growth.
Bacterial activity dynamics in the water phase during start-up of recirculating aquaculture systems

Microbial water quality in recirculating aquaculture systems (RAS) is important for successful RAS operation but difficult to assess and control. There is a need to identify factors affecting changes in the bacterial dynamics – in terms of abundance and activity – to get the information needed to manage microbial stability in RAS. This study aimed to quantify bacterial activity in the water phase in six identical, pilot scale freshwater RAS stocked with rainbow trout (Oncorhynchus mykiss) during a three months period from start-up. Bacterial activity and dynamics were investigated by the use of a patented method, BactiQuant®. The method relies on the hydrolysis of a fluorescent enzyme-substrate and is a rapid technique for quantifying bacterial enzyme activity in a water sample. The results showed a forty-fold increase in bacterial activity within the first 24 days from start-up. Average BactiQuant® values (BQV) were below 1000 at Day 0 and stabilized around 40,000 BQV after four weeks from start. The study revealed considerable variation in initial BQV levels between identically operated and designed RAS; over time these differences diminished. Total ammonia nitrogen, nitrite and nitrate levels were very similar in all six RAS and were neither related to nor affected by BQV. Chemical oxygen demand (COD) and biological oxygen demand (BOD5) were highly reproducible parameters between RAS with a stable equilibrium dynamic over time. This study showed that bacterial activity was not a straightforward predictable parameter in the waterphase as e.g. nitrate-N would be in identical RAS, and showed unexpected sudden changes/fluctuations within specific RAS. However, a bacterial activity stabilization phase was observed as systems matured and reached equilibrium, suggesting a successive transition from fragile to robust microbial community compositions.
Bigger is not better: cortisol-induced cardiac growth and dysfunction in salmonids

Stress and elevated cortisol levels are associated with pathological heart growth and cardiovascular disease in humans and other mammals. We recently established a link between heritable variation in post-stress cortisol production and cardiac growth in salmonid fish too. A conserved stimulatory effect of the otherwise catabolic steroid hormone cortisol is probably implied, but has to date not been established experimentally. Furthermore, whereas cardiac growth is associated with failure of the mammalian heart, pathological cardiac hypertrophy has not previously been described in fish. Here, we show that rainbow trout (Oncorhynchus mykiss) treated with cortisol in the diet for 45 days have enlarged hearts with lower maximum stroke volume and cardiac output. In accordance with impaired cardiac performance, overall circulatory oxygen-transporting capacity was diminished as indicated by reduced aerobic swimming performance. In contrast to the well-known adaptive/physiological heart growth observed in fish, cortisol-induced growth is maladaptive. Furthermore, the observed heart growth was associated with up-regulated signature genes of mammalian cardiac pathology, suggesting that signalling pathways mediating cortisol-induced cardiac remodelling in fish are conserved from fish to mammals. Altogether, we show that excessive cortisol can induce pathological cardiac remodelling. This is the first study to report and integrate the etiology, physiology and molecular biology of cortisol-induced pathological remodelling in fish.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Center for Electron Nanoscopy, University of Oslo, University of Gothenburg, Swedish University of Agricultural Sciences, Norwegian University of Life Sciences
Authors: Johansen, I. B. (Ekstern), Sandblom, E. (Ekstern), Skov, P. V. (Intern), Gråns, A. (Ekstern), Ekström, A. (Ekstern), Lunde, I. G. (Ekstern), Vindas, M. A. (Ekstern), Zhang, L. (Intern), Höglund, E. (Intern), Frisk, M. (Ekstern), Sjaastad, I. (Ekstern), Nilsson, G. E. (Ekstern), Øverli, Ø. (Ekstern)
Pages: 2545-2553
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Blood O2 affinity of a large polar elasmobranch, the Greenland shark *Somniosus microcephalus*

The Greenland shark (*Somniosus microcephalus*, Bloch & Schneider 1801) is a polar elasmobranch that is hypothesised to possess a unique metabolic physiology due to its extreme large size, the cold waters it inhabits and its slow swimming lifestyle. Our results therefore provide the first insight into the metabolic physiology of this unique shark, with a focus on blood O2 affinity. An evaluation of blood O2 affinity at 2 °C using tonometry revealed a P50 of 11.7 mmHg at a PCO2 of 2.25 mmHg and a Bohr effect (binding sensitivity of blood to pH, $\phi = \Delta \log P50/\Delta pH$) of $-0.26$. A comparative evaluation of blood O2 affinity across elasmobranch fishes suggests that *S. microcephalus* has a high blood O2 affinity (i.e., low P50) and a small Bohr effect but these are common traits in sluggish elasmobranch fishes, with little evidence for any relationship of blood O2 affinity to the low metabolic rates, low environmental temperatures, or large body mass of *S. microcephalus*. After gathering this physiology data, a subsidiary aim attempted to understand whether a warming scenario would impose a negative effect on blood O2 binding. Incubating blood to a slightly elevated temperature of 7 °C resulted in a small but significant reduction of blood O2 affinity, but no significant change in the Bohr effect. The Hill’s cooperativity coefficient ($nH$) was also small (1.6–2.2) and unaffected by either PCO2 or temperature. The moderate sensitivity of Greenland shark blood O2 affinity to warming potentially implies little vulnerability of functional O2 supply to the temperature changes associated with the regular vertical movements of this species or warming of polar seas resulting from directional climate change.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, University of Auckland, University of Copenhagen, Indiana University-Purdue, NOAA, Dalhousie University
Authors: Herbert, N. (Ekstern), Skov, P. V. (Intern), Tirsgaard, B. (Ekstern), Bushnell, P. G. (Ekstern), Brill, R. W. (Ekstern), Harvey Clark, C. (Ekstern), Steffensen, J. F. (Ekstern)
Pages: 2297-2305
Publication date: 2017
Main Research Area: Technical/natural sciences

Journal Information

Journal: Polar Biology
Volume: 40
Issue number: 11
ISSN (Print): 0722-4060
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.72 SJR 0.866 SNIP 0.761
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.985 SNIP 0.751 CiteScore 1.62
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.931 SNIP 0.81 CiteScore 1.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.109 SNIP 1.054 CiteScore 2.07
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Carryover of CH₃Hg from feed to sea bass and salmon

Contamination of food generally has a negative impact on the quality and may imply a risk to human health. Mercury (Hg) is one of the most hazardous compounds in our environment and is released from the earth's crust by both natural and anthropogenic processes. The mercury species 'methylmercury' is highly toxic, because affects the function of enzymes, easily crosses the blood-brain and the placenta barriers and is toxic to the nervous system (especially the developing brain). It bioaccumulates and biomagnifies through the aquatic food chain. Methylmercury is the most common mercury species in fish and humans are also mainly exposed to methylmercury from consumption of fish and other seafood.

The aims of the present controlled fish feeding trials were to study the carryover from feed to fish fillets (at low spike levels (1x background level of methylmercury) and to determine toxicokinetic parameters.

The study included Atlantic salmon (Salmo salar), which is one of the main farmed seafood product consumed in Europe and with production in Northern Europe as well as European seabass (Dicentrarchus labrax) produced in Southern Europe, where it is a highly consumed seafood product. The weight gain of the fish, their feed intake, feed and fish fillet contaminant level were determined to model the uptake and elimination of methylmercury. The toxicokinetics for feed with low levels of methylmercury (41-75 ng/g) showed high assimilation and low elimination.

Acknowledgments

The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under the ECsafeSEAFOOD project (grant agreement n° 311820).

General information

State: Published
Authors: Rasmussen, R. R. (Intern), Håland, W. (Ekstern), Larsen, B. K. (Intern), Kotterman, M. (Ekstern), Sloth, J. J. (Intern), Marques, A. T. (Ekstern), Granby, K. (Intern)
Number of pages: 1
Publication date: 2017
CARRYOVER OF METHYLmercury FROM FEED TO SEABASS AND SALMON

General information
State: Published
Authors: Rasmussen, R. R. (Intern), Håland, W. (Ekstern), Larsen, B. K. (Intern), Kotterman, M. (Ekstern), Sloth, J. J. (Intern), Marques, A. T. (Ekstern), Granby, K. (Intern)
Pages: 41-41
Publication date: 2017

HOST PUBLICATION INFORMATION
Title of host publication: Seafood safety new findings & innovation challenges - abstract book
Place of publication: Brussels, Belgium
Publisher: Royal Flemish Academy of Science and the Arts (KVAB)
Main Research Area: Technical/natural sciences
Conference: Seafood Safety, Brussels, Belgium, 25/01/2017 - 25/01/2017
Electronic versions:
ECsafeSEAFOOD_Carryover_of_MeHg_final.pdf
Publication: Research › Poster – Annual report year: 2017

COMBINED EFFECTS OF CHRONIC EXPOSURE TO SUSPENDED SOLID LOAD AND INCREASED UNIONIZED AMMONIA CONCENTRATIONS ON THE PHYSIOLOGY AND GROWTH PERFORMANCE OF RAINBOW TROUT (ONCORHYNCHUS MYKISS)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Fisheries Research Station of Baden-Württemberg, University of Veterinary Medicine, Technical University of Munich
Authors: Becke, C. (Ekstern), Schumann, M. (Ekstern), Steinhagen, D. (Ekstern), Rojas-Tirado, P. A. (Intern), Geist, J. (Ekstern), Brinker, A. (Ekstern)
Number of pages: 56
Pages: 44
Publication date: 2017

HOST PUBLICATION INFORMATION
Title of host publication: 4th NordicRAS Workshop on Recirculating Aquaculture Systems. Aalborg, Denmark, 12-13 October 2017 : Book of Abstracts
Publisher: Technical University of Denmark, National Institute for Aquatic Resources
Editor: Dalsgaard, A. J. T.
ISBN (Print): 978-87-7481-241-8
ISBN (Electronic): 978-87-7481-240-1
Series: DTU Aqua Report
Number: 321-17
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Conference: NordicRAS Workshop on Recirculating Aquaculture Systems, Aalborg, Denmark, 12/10/2017 - 12/10/2017
Electronic versions:
Publishers version
Publication: Research › Conference abstract in proceedings – Annual report year: 2017

CONTRASTING COPING STYLES MEET THE WALL: A DOPAMINE DRIVEN DICHOTOMY IN BEHAVIOR AND COGNITION
Individual variation in the ability to modify previously learned behavior is an important dimension of trait correlations referred to as coping styles, behavioral syndromes or personality. These trait clusters have been shaped by natural selection, and underlying control mechanisms are often conserved throughout vertebrate evolution. In teleost fishes, behavioral flexibility and coping style have been studied in the high (HR) and low-responsive (LR) rainbow trout lines.
Generally, proactive LR trout show a behavior guided by previously learned routines, while HR trout show a more flexible behavior relying on environmental cues. In mammals, routine dependent vs. flexible behavior has been connected to variation in limbic dopamine (DA) signaling. Here, we studied the link between limbic DA signaling and individual variation in flexibility in teleost fishes by a reversal learning approach. HR/LR trout were challenged by blocking a learned escape route, previously available during interaction with a large and aggressive conspecific. LR trout performed a higher number of failed escape attempts against the transparent blockage, while HR trout were more able to inhibit the now futile escape impulse. Regionally discrete changes in DA neurochemistry were observed in micro dissected limbic areas of the telencephalon. Most notably, DA utilization in the dorsomedial telencephalon (DM, a suggested amygdala equivalent) remained stable in HR trout in response to reversal learning under acute stress, while increasing from an initially lower level in LR trout. In summary, these results support the view that limbic homologs control individual differences in behavioral flexibility even in non-mammalian vertebrates.

Coping styles in farmed fish: consequences for aquaculture

Individual differences in physiological and behavioural responses to stressors are increasingly recognised as adaptive variation and thus raw material for evolution and fish farming improvements including selective breeding. Such individual variation has been evolutionarily conserved and is present in all vertebrate taxa including fish. In farmed animals, the interest in consistent trait associations, that is coping styles, has increased dramatically over the last years because many studies have demonstrated links to performance traits, health and disease susceptibility and welfare. This study will review (i) the main behavioural, neuroendocrine, cognitive and emotional differences between reactive and proactive coping styles in farmed fish; (ii) the methodological approaches used to identify coping styles in farmed fish, including individual (group) mass-screening tests; and (iii) how knowledge on coping styles may contribute to improved sustainability of the aquaculture industry, including welfare and performance of farmed fish. Moreover, we will suggest areas for future research, where genetic basis (heritability/epigenetic) of coping styles, and the neuroendocrine mechanisms behind consistent as well as flexible behavioural patterns are pinpointed as central themes. In addition, the ontogeny of coping styles and the influence of age, social context and environmental change in coping styles will also be discussed.
Dietary l-tryptophan leaves a lasting impression on the brain and the stress response

Comparative models suggest that effects of dietary tryptophan (Trp) on brain serotonin (5-hydroxytryptamine; 5-HT) neurochemistry and stress responsiveness are present throughout the vertebrate lineage. Moreover, hypothalamic 5-HT seems to play a central role in control of the neuroendocrine stress axis in all vertebrates. Still, recent fish studies suggest long-term effects of dietary Trp on stress responsiveness, which are independent of hypothalamic 5-HT. Here, we investigated if dietary Trp treatment may result in long-lasting effects on stress responsiveness, including changes in plasma cortisol levels and 5-HT neurochemistry in the telencephalon and hypothalamus of Atlantic salmon. Fish were fed diets containing one, two or three times the Trp content in normal feed for 1 week. Subsequently, fish were reintroduced to control feed and were exposed to acute crowding stress for 1, 8 and 21 d post Trp treatment. Generally, acute crowding resulted in lower plasma cortisol levels in fish treated with 3×Trp compared with 1×Trp- and 2×Trp-treated fish. The same general pattern was reflected in telencephalic 5-HTergic turnover, for which 3×Trp-treated fish showed decreased values compared with 2×Trp-treated fish. These long-term effects on post-stress plasma cortisol levels and concomitant 5-HT turnover in the telencephalon lends further support to the fact that the extrahypothalamic control of the neuroendocrine stress response is conserved within the vertebrate lineage. Moreover, they indicate that trophic/structural effects in the brain underlie the effects of dietary Trp treatment on stress reactivity.
Effect of some common West African farm-made feeds on the oxygen consumption and ammonia excretion rates of Nile tilapia, Oreochromis niloticus

General information
Effects of dietary digestible protein and energy levels on growth performance, feed utilization, and body composition of juvenile permit, *Trachinotus falcatus* (Linnaeus, 1758)

A 9-wk study was conducted to evaluate the effect of dietary protein and energy on growth performance of juvenile permit, *Trachinotus falcatus*, growing from approximately 30 to 150g. Nine experimental diets were formulated to contain three levels of crude protein (400, 450, and 500g/kg dry matter [DM]); and three levels of crude lipid (100, 200, and 300g/kg DM) in a 3 x 3 factorial design. Growth rate and feed efficiency were significantly improved with increasing dietary protein levels from 400 to 500g/kg and with dietary lipid levels from 100 to 200g/kg. Fish body protein content was positively correlated with dietary ratio of digestible protein (DP) to digestible energy (DE) ($P<0.01$, $R^2=0.83$), while body lipid was negatively correlated with dietary DP/DE ($R^2=0.55$, $P<0.05$) but positively correlated with dietary DE levels ($R^2=0.66$, $P<0.01$).

Results showed a protein-sparing effect, as protein retention was significantly increased by increasing dietary lipid level. In conclusion, the diet containing DP of 392.7g/kg and DE of 18.8 MJ/kg (DM), corresponding to a DP/DE of 20.9g/MJ, is suggested as an optimal feed for growth and feed efficiency in juvenile permit.

General information

State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Research Institute for Aquaculture No. 1, Aquaculture Research Sub-Institute for North Central
Authors: Nguyen, H. Q. (Ekstern), Chu, T. C. (Ekstern), Nguyen, T. T. L. (Ekstern), Lund, I. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of the World Aquaculture Society
ISSN (Print): 0893-8849
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.15 SJR 0.504 SNIP 0.826
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.552 SNIP 0.769 CiteScore 0.89
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.514 SNIP 0.794 CiteScore 1.02
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.489 SNIP 0.72 CiteScore 0.99
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.502 SNIP 0.666 CiteScore 0.83
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.542 SNIP 0.707 CiteScore 0.92
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.494 SNIP 0.684
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.558 SNIP 0.806
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.485 SNIP 0.53
Scopus rating (2007): SJR 0.443 SNIP 0.579
Scopus rating (2006): SJR 0.592 SNIP 0.817
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.588 SNIP 0.884
Scopus rating (2004): SJR 0.638 SNIP 0.983
Scopus rating (2003): SJR 0.801 SNIP 1.279
Effects of high-frequency strobed laser light on Atlantic cod (Gadus morhua) physiology and behavior

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Aquaculture, Centre for Ocean Life, SINTEF, Swedish University of Agricultural Sciences
Authors: Behrens, J. (Intern), Jarnit, S. (Intern), Methling, C. (Intern), Mariani, P. (Intern), Thorstensen, J. (Ekstern), Risholm, P. (Ekstern), Thielemann, J. T. (Ekstern), Haugholt, K. H. (Ekstern), Gräns, A. (Ekstern), Visser, A. (Intern)
Publication date: 2017
Event: Abstract from Dansk Havforsormøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017

Effects of repeated acute stress in Senegalese sole Solea senegalensis. Can this species habituate to reiterated handling stress?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, University of Vigo, University of Porto
Authors: Conde-Sieira, M. (Ekstern), Gesto, M. (Intern), Comesaña, S. (Ekstern), Velasco, C. (Ekstern), Hernandez-Perez, J. (Ekstern), Valente, L. M. P. (Ekstern), Soengas, J. (Ekstern)
Publication date: 2017
Event: Abstract from Congress of Iberian Association for Comparative Endocrinology, Vigo, Spain.
Main Research Area: Technical/natural sciences
Electronic versions: Publishers version

Bibliographical note
conference abstract for conference
Source: PublicationPreSubmission
Source-ID: 134064315
Publication: Research › Conference abstract for conference – Annual report year: 2017

Emergence time and skin melanin spot patterns do not correlate with growth performance, social competitive ability or stress response in farmed rainbow trout

In wild salmonid fish, specific individual behavioral traits have been correlated with the timing of fry emergence from their gravel spawning nests; Early emerging fish display more aggressive behavior and have a higher probability of becoming socially dominant, compared to fish that emerge at a later stage. Apart from aggression and dominance, other behavioral and metabolic traits, such as boldness, metabolic rate, or growth, have also been linked to emergence time. Altogether, the traits of early- and late-emerging fish resemble those of the proactive and reactive stress-coping style, respectively. As proactive fish are considered more resilient to stress, it may be desirable to select these for aquaculture production. However, it is currently unclear to what extent the link between emergence time and stress-coping styles is maintained in the selective breeding of farmed fish. In the present study, eyed eggs from a commercial supplier were hatched, and larvae fractionated according to their emergence time. Later on, juvenile fish from different emergence fractions were subjected to a stress challenge and also tested to evaluate their competitive ability for food. Beyond some slight dissimilarities in the acute stress responses, emergence fraction displayed no correlation with growth rates, or the ability to compete for feed. Within the whole group of fish utilized in the experiments, no relationship between skin melanin spot pattern and growth performance, stress response intensity, or competitive ability was found. Altogether, the differences in physiological traits related to emergence time were not as strong as those found in earlier studies. It is hypothesized, that the origin and degree of domestication of the fish might be partly responsible for
The predictive value of skin spots or emergence time to infer the fish stress coping style in farmed fish is also discussed.

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Gesto, M. (Intern), Skov, P. V. (Intern), Jokumsen, A. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Frontiers in Neuroscience
Volume: 11
Article number: 319
ISSN (Print): 1662-4548
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.85 SJR 1.88 SNIP 1.087
Scopus rating (2015): SJR 2.022 SNIP 1.093 CiteScore 3.72
Scopus rating (2014): SJR 2.04 SNIP 1.097 CiteScore 3.84
Scopus rating (2013): SJR 2.068 SNIP 1.089 CiteScore 3.61
Scopus rating (2012): SJR 1.718 SNIP 1.004 CiteScore 3.25
Scopus rating (2011): SJR 1.707 SNIP 1.268
Scopus rating (2010): SJR 1.326 SNIP 0.709
Original language: English
Electronic versions:
Publishers version
DOIs:
10.3389/fnins.2017.00319
Source: PublicationPreSubmission
Source-ID: 133201967
Publication: Research - peer-review › Journal article – Annual report year: 2017

**"End-of-Pipe treatment" y "residual resource"**

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Letelier-Gordo, C. O. (Intern)
Pages: 50-56
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Salmonexpert
Volume: 47
Issue number: 7
Original language: Spanish
Publication: Research › Journal article – Annual report year: 2017

**First experiences from full-scale denitrifying woodchip bioreactors operated end-of-pipe at commercial RAS**

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: von Ahnen, M. (Intern), Pedersen, P. B. (Intern), Dalsgaard, A. J. T. (Intern)
Number of pages: 56
Pages: 34
Fishmeal with different levels of biogenic amines in Aquafeed: Comparison of feed protein quality, fish growth performance, and metabolism

General information
State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, BioMar AS, Aarhus University
Authors: Jasour, M. S. (Ekstern), Wagner, L. (Ekstern), Sundekilde, U. K. (Ekstern), Larsen, B. K. (Intern), Tolderlund Rasmussen, H. (Ekstern), Harthøj Hjermitslev, N. (Ekstern), Hammershøj, M. (Ekstern), Dalsgaard, A. J. T. (Intern), Dalsgaard, T. K. (Ekstern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.136 SNIP 1.3 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.212 SNIP 1.487 CiteScore 2.32
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.294 SNIP 1.542 CiteScore 2.39
ISI indexed (2011): ISI indexed yes
How do individuals cope with stress? Behavioural, physiological and neuronal differences between proactive and reactive coping styles in fish

Despite the use of fish models to study human mental disorders and dysfunctions, knowledge of regional telencephalic responses in non-mammalian vertebrates expressing alternate stress coping styles is poor. Since perception of salient stimuli associated with stress coping in mammals is mainly under forebrain limbic control, we tested region-specific forebrain neural (i.e. mRNA abundance and monoamine neurochemistry) and endocrine responses at basal and acute stress conditions for previously characterised proactive and reactive Atlantic salmon. Reactive fish show a higher degree of the neurogenesis marker proliferating cell nuclear antigen (pcnA) and dopamine activity under basal conditions in Dl (proposed hippocampus homologue) and higher post-stress plasma cortisol levels. Proactive fish displayed post-stress higher serotonergic signalling (i.e. higher serotonergic activity and expression of the 5-HT1A receptor abundance) in the proposed amygdala homologue (Dm), increased expression of the neuroplasticity marker brain derived neurotropic factor (bdnf) in both Dl and Vv (lateral septum homologue), as well as increased expression of the corticotropin releasing factor 1 (crf1) receptor in the Dl, in line with active coping neuro-profiles reported in the mammalian literature. We present novel evidence of proposed functional equivalences in the fish forebrain with mammalian limbic structures.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Uni Research AS, Radboud University Nijmegen, The University Centre of Svalbard, Uppsala University, Norwegian University of Life Sciences
Authors: Vindas, M. A. (Ekstern), Gorissen, M. (Ekstern), Höglund, E. (Intern), Flik, G. (Ekstern), Tronci, V. (Ekstern), Damsgård, B. (Ekstern), Thörnqvist, P. (Ekstern), Nilsen, T. O. (Ekstern), Winberg, S. (Ekstern), Øverli, Ø. (Ekstern), Ebbesson, L. O. E. (Ekstern)
Pages: 1524-1532
Publication date: 2017
Main Research Area: Technical/natural sciences
Atlantic salmon, BDNF, limbic areas, neural plasticity, serotonin

Electronic versions:
Publishers version
DOIs:
10.1242/jeb.153213
Links:
http://jeb.biologists.org/content/early/2017/02/02/jeb.153213
Source: FindIt
Source-ID: 2352296957
Publication: Research - peer-review › Journal article – Annual report year: 2017

Influence of fixed and moving bed biofilters on micro particle dynamics in a recirculating aquaculture system

Accumulation of fine particulate organic matter in recirculating aquaculture systems (RAS) is a balance between system input (from feed to waste), internal transformation, removal and dilution. The mechanisms leading to fine particle accumulation in RAS are not fully understood, and neither is the potential influence of biofilters in this aspect. This study describes the effect of fixed bed biofilters (FBB) and moving bed biofilters (MBB) on particlesize distribution and organic matter. It was conducted in an 8.5 m³ RAS with four equal biofilters – two FBB and two MBB. The RAS was stocked with rainbow trout (Oncorhynchus mykiss), and operated under constant feed loading conditions (1 kg feed/m³ of make-up water) for more than three months. Production or removal of micro particles according to biofilter mode of operation (FBB vs. MBB) was assessed by operating all biofilters simultaneously as well as separately. In periods where FBB and MBB effects were assessed separately, particle concentration was reduced by approximately 195 particles/mL (from 1117 to 922 particles/mL) per passage through FBB, and increased by 252 particles (from 2409 to 2667 particles/mL) per passage through MBB. In FBB, a 10% reduction in particle concentration also represented a 10% reduction in total particle surface area and particle volume. In MBB, a 10% increase in particle concentration also represented a 10% increase in total particlesurface area, but had no effect on total particle volume. A volumetric reduction of particles >100 m, and an equivalent volumetric increase of particles <40 m, showed that MBB produced fine particles by disintegration of larger particles. A constant removal of particulate volume through all size classes by FBB demonstrates their function as secondary particle removal units. Net removal of organic matter (ConcentrationIN − ConcentrationOUT), as biochemical oxygen demand after 5 days (BOD5), occurred at the same rates in both modes of operation. While FBB removed a higher amount of filtered BOD5 (material filtered through a 1.6 m filter) than MBB, MBB removed more particulate BOD5 (Particulate = Raw − Filtered) than FBB, presumably due to disintegration of particles in MBB. In the RAS, ammonia and nitrite were observed at concentrations below 0.20 mg N/L throughout the majority of the experiment. However, during the phase where only MBB were in operation, TAN (Total Ammonia Nitrogen) and nitrite levels increased significantly. Nitrate levels ranged between 40 and 44 mg N/L, reflecting stable operating conditions and constant feed loading. The trends observed when FBB or MBB were operated separately were also observed when all filters were operated simultaneously. Differences in biofilm formation, development and maintenance, coupled to reactor flow characteristics are discussed in relation to the fate of micro particles and organic matter when operating fixed or moving bed biofilters in RAS.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Fernandes, P. (Intern), Pedersen, L. (Intern), Pedersen, P. B. (Intern)
Pages: 32-41
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquacultural Engineering
Volume: 78 A
ISSN (Print): 0144-8609
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.09 SJR 0.798 SNIP 1.525
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.723 SNIP 1.148 CiteScore 1.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Los pros y los contras del percarbonato de sodio

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Pedersen, L. (Intern), Jokumsen, A. (Intern)
Pages: 1-7
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Global Aquaculture Alliance
Issue number: May
Original language: Spanish
Publication: Research › Journal article – Annual report year: 2017

Micro particles in Danish Model Trout Farms

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Monitoring abrupt changes in bacteria within biological stable RAS water

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Norwegian University of Science and Technology
Authors: Rojas-Tirado, P. A. (Intern), Pedersen, P. B. (Intern), Vadstein, O. (Ekstern), Pedersen, L. (Intern)
Number of pages: 56
Pages: 21
Publication date: 2017

Host publication information
Title of host publication: 4th NordicRAS Workshop on Recirculating Aquaculture Systems. Aalborg, Denmark, 12-13 October 2017 : Book of Abstracts
Publisher: National Institute of Aquatic Resources, Technical University of Denmark
Editor: Dalsgaard, A. J. T.
ISBN (Print): 978-87-7481-241-8
ISBN (Electronic): 978-87-7481-240-1

Series: DTU Aqua Report
Number: 321-17
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Conference: NordicRAS Workshop on Recirculating Aquaculture Systems, Aalborg, Denmark, 12/10/2017 - 12/10/2017
Electronic versions:
Publishers version
Publication: Research › Conference abstract in proceedings – Annual report year: 2017

Neuroendocrine and immune responses undertake different fates following tryptophan or methionine dietary treatment: tales from a teleost model

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin, Universidade do Porto, Universidad Autonoma de Barcelona, Universidade de Vigo, University of Vigo
Publication date: 2017
Event: Abstract from Congress of Iberian Association for Comparative Endocrinology, Vigo, Spain.
Neuroendocrine and immune responses undertake different fates following tryptophan or methionine dietary treatment: tales from a teleost model

Methionine and tryptophan appear to be fundamental in specific cellular pathways involved in the immune response mechanisms, including stimulation of T-regulatory cells by tryptophan metabolites or pro-inflammatory effects upon methionine supplementation. Thus, the aim of this study was to evaluate the immunomodulatory effect of these amino acids on the inflammatory and neuroendocrine responses in juveniles of European seabass, Dicentrarchus labrax. To achieve this, goal fish were fed for 14 days methionine and tryptophan-supplemented diets (MET and TRP, respectively, 2x dietary requirement level) or a control diet meeting the amino acids requirement levels (CTRL). Fish were sampled for immune status assessment and the remaining fish were challenged with intraperitoneally injected inactivated Photobacterium damselae subsp. piscicida and sampled either 4 or 24 h post-injection. Respiratory burst activity, brain monoamines, plasma cortisol, and immune-related gene expression showed distinct and sometimes opposite patterns regarding the effects of dietary amino acids. While neuroendocrine intermediates were not affected by any dietary
treatment at the end of the feeding trial, both supplemented diets led to increased levels of plasma cortisol after the inflammatory insult, while brain monoamine content was higher in TRP-fed fish. Peripheral blood respiratory burst was higher in TRP-fed fish injected with the bacteria inoculum but only compared to those fed MET. However, no changes were detected in total antioxidant capacity. Complement factor 3 was upregulated in MET-fed fish but methionine seemed to poorly affect other genes expression patterns. In contrast, fish fed MET showed increased immune cells numbers both before and after immune challenge, suggesting a strong enhancing effect of methionine on immune cells proliferation. Differently, tryptophan effects on inflammatory transcripts suggested an inhibitory mode of action. This, together with a high production of brain monoamine and cortisol levels, suggests that tryptophan might mediate regulatory mechanisms of neuroendocrine and immune systems cooperation. Overall, more studies are needed to ascertain the role of methionine and tryptophan in modulating (stimulate or regulate) fish immune and neuroendocrine responses.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin, Universidade do Porto, Universidad Autonoma de Barcelona, Universidade de Vigo, University of Vigo
Number of pages: 14
Publication date: 2017
Main Research Area: Technical/natural sciences
Optimum ozonation of freshwater pilot recirculating aquaculture system - Water quality

General information
State: Published
Number of pages: 56
Pages: 48
Publication date: 2017

Host publication information
Title of host publication: 4th NordicRAS Workshop on Recirculating Aquaculture Systems. Aalborg, Denmark, 12-13 October 2017 : Book of Abstracts
Publisher: Technical University of Denmark, National Institute for Aquatic Resources
Editor: Dalsgaard, A. J. T.
ISBN (Print): 978-87-7481-241-8
ISBN (Electronic): 978-87-7481-240-1

Series: DTU Aqua Report
Number: 321-17
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Conference: NordicRAS Workshop on Recirculating Aquaculture Systems, Aalborg, Denmark, 12/10/2017 - 12/10/2017
Electronic versions:
Publishers version
Publication: Research › Conference abstract in proceedings – Annual report year: 2017

Particle surface area and bacterial activity in recirculating aquaculture systems
Suspended particles in recirculating aquaculture systems (RAS) provide surface area that can be colonized by bacteria. More particles accumulate as the intensity of recirculation increases thus potentially increasing the bacterial carrying capacity of the systems. Applying a recent, rapid, culture-independent fluorometric detection method (Bactiquant®) for measuring bacterial activity, the current study explored the relationship between total particle surface area (TSA, derived from the size distribution of particles >5 μm) and bacterial activity in freshwater RAS operated at increasing intensity of recirculation (feed loading from 0.043 to 3.13 kg feed m−3 make-up water). Four independent sets of water samples from different systems were analyzed and compared including samples from: (i) two individual constructed wetlands treating the effluent system water from two commercial, freshwater rainbow trout (Oncorhynchus mykiss) farms of different recirculation intensity; (ii) an 8.5 m3 pilot scale RAS; and (iii) twelve identical, 1.7 m3 pilot scale RAS assigned one of four micro-screen treatments (no micro-screen, 100, 60, or 20 μm mesh size micro-screens) in triplicate. There was a strong, positive, linear correlation (p < 0.05) between TSA and bacterial activity in all systems with low to moderate recirculation intensity (i.e. feed loading ≤1 kg feed m−3 make-up water). However, the relationship apparently ceased to exist in the systems with highest recirculation intensity (feed loading 3.13 kg feed m−3 make-up water; corresponding to 0.32 m3 make-up water kg−1 feed). This was likely due to the accumulation of dissolved nutrients sustaining free-living bacterial populations, and/or accumulation of suspended colloids and fine particles less than 5 μm in diameter, which were not characterized in the study but may provide significant surface area. Hence, the study substantiates that particles in RAS provide surface area supporting bacterial activity, and that particles play a key role in controlling the bacterial carrying capacity at least in less intensive RAS. Applying fast, culture-independent techniques for determining bacterial activity might provide a means for future monitoring and assessment of microbial water quality in aquaculture farming systems.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Christian-Albrechts-Universität zu Kiel
Pages: 18-23
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquacultural Engineering
Volume: 78 A
ISSN (Print): 0144-8609
Ratings:
Performance of a marine activated sludge system for N removal using external and internal carbon sources

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Letelier-Gordo, C. O. (Intern)
Periodic bacterial control with peracetic acid in a recirculating aquaculture system and its long-term beneficial effect on fish health

Fish in a recirculating aquaculture system (RAS) live with abundant microorganisms. These can become a health threat when the fish immune system cannot counterbalance the pathogenic microbial colonization. Therefore, microbial control in a RAS can potentially reduce the risk of infections and hence improve fish health. In the present study, a periodic microbial control was performed in a RAS with 16 tanks stocked with mirror carp (Cyprinus carpio) for 3 months. Half of the fish culture tanks were treated with 1 mg L⁻¹ peracetic acid (PAA) twice per week, while the other half remained untreated. The water circulation was interrupted immediately before each PAA-treatment, and resumed after 3 h. The total aerobic bacterial density was similar in all culture tanks, except during the PAA-treatments and the concurrent circulation interruptions. During these periods, the bacterial density decreased up to 90% in PAA-treated water, while a 6-fold bacterial increase was observed in untreated water. In the first 2 months of treatment, PAA-exposed fish showed lower plasma cortisol concentration than the unexposed fish. Subsequently, the trunk kidney leukocytes of PAA-exposed fish showed stronger respiratory burst than the unexposed fish. By the end of the experiment, the PAA-exposed fish had better gill morphology, compared to the unexposed fish. The present study indicates that periodic disinfection of culture water in a RAS with PAA could transiently reduce the suspended bacteria density, modulate the fish stress response, and have an overall beneficial effect on fish health in the long term.
Physiological roles of tryptophan in teleosts: current knowledge and perspectives for future studies

Tryptophan is an essential amino acid with a huge functional versatility, in addition to its participation in protein synthesis. Because of the complexity of its metabolism, and the functional relevance of several of its metabolites, it directly or indirectly participates in a wide array of physiological pathways. This amino acid is a precursor for the synthesis of the neurotransmitter/neuromodulator serotonin (5HT), the hormone melatonin and kynurenine and related compounds such as kynurenic acid, quinolinic acid or niacin. Because of this, it has a
A key role in the regulation of processes ranging from the neuroendocrine to the immune system in vertebrates. In aquaculture, extensive research has been performed to optimize the levels of tryptophan in the commercial diets for many fish species. Providing adequate levels of this amino acid is critically important for fish growth but also for fish welfare, as tryptophan has been shown to modulate fish behaviour, stress responses, and antioxidant and immune systems. Currently, available data suggest a wide variation in tryptophan requirements of different species ranging 0.3–1.3% of dietary protein level, but recent evidence also shows that fish tryptophan requirements can greatly vary depending on the rearing conditions of the fish. We also review here the participation of tryptophan and related metabolites in different physiological functions that are crucial for fish welfare. The review covers the involvement of tryptophan in 5HT- and melatonin-mediated functions, along with its participation in the regulation of the immune system and its role as an antioxidant and antitoxic agent in fish.

General information
State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Iranian Fisheries Science Research Institute (IFSRI), Universidad De Granada, Universidade do Porto
Authors: Hoseini, S. M. (Ekstern), Pérez-Jiménez, A. (Ekstern), Costas, B. (Ekstern), Azeredo, R. (Ekstern), Gesto, M. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication Information
Journal: Reviews in Aquaculture (Print)
ISSN (Print): 1753-5123
Ratings:
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed Yes
Scopus rating (2016): CiteScore 4.75 SJR 1.818 SNIP 2.764
Scopus rating (2015): SJR 1.552 SNIP 2.016 CiteScore 3.82
Scopus rating (2014): SJR 1.51 SNIP 1.757 CiteScore 3.38
Scopus rating (2013): SJR 0.979 SNIP 1.142 CiteScore 2.05
Scopus rating (2012): SJR 1.001 SNIP 1.83 CiteScore 2.48
Scopus rating (2011): SJR 0.658 SNIP 1.658 CiteScore 1.13
Scopus rating (2010): SJR 0.233 SNIP 0.324
Original language: English
DOIs: 10.1111/raq.12223. Embargo ends: 09/03/2019
Publication: Research - peer-review • Journal article – Annual report year: 2017

Prediction of required ozone dosage for pilot recirculating aquaculture systems based on laboratory studies
In recirculating aquaculture systems (RAS), the water quality changes continuously. Organic and inorganic compounds accumulates creating toxic conditions for the farmed organisms. Ozone improves water quality diminishing significantly both bacteria load and dissolved organic matter. However, in a non-meticulously designed system, residual ozone might reach the culture tanks causing significant harm to cultured species or excess costs. The aim of the study was to predict the suitable ozone dosage in pilot RAS, for water treatment purposes, based on laboratory studies. The ozone effect on water quality of freshwater RAS and system’s ozone demand was investigated. Bench-scale ozonation experiments revealed the ozone demand of the system to be 180 mg O3/h. Three different ozone dosages were applied to four replicated systems with fixed feed loading (1.56 kg feed/m3 make up water). Results suggested that the optimal ozone dosage was 15g O3/ kg feed. Selected water quality parameters were measured, assessing biofilters performance as well as nitrogen and carbon-based compound concentration change during ozonation. Overall, this study contributed to a better understanding of the challenges of an ozonated RAS leading to the optimal design of such systems.

General information
State: Published
Authors: Spiliotopoulou, A. (Intern), Rojas-Tirado, P. A. (Intern), Kaarsholm, K. M. S. (Intern), Martin, R. (Ekstern), Pedersen, L. (Intern), Andersen, H. R. (Intern)
Number of pages: 4
Pulse versus continuous peracetic acid applications: Effects on rainbow trout performance, biofilm formation and water quality

Peracetic acid (PAA) products are being introduced to aquaculture as sustainable disinfectants. Two strategies are used to apply PAA: high dose pulse applications, or low dose continuous application. In the present study, their impacts on fish health and water quality were investigated in triplicate flow-through tanks stocked with rainbow trout. The gentler and shorter water cortisol increase measured along twice-per-week pulse applications of 1 mg L⁻¹ PAA indicated a progressive adaptation of fish. In contrast, the continuous application of 0.2 mg L⁻¹ PAA caused no stress to fish. Meanwhile, no mortality and no impact on growth or innate cellular immunity were observed. The pulse applications restricted biofilm formation, and partially inhibited nitrification. Additionally, the highest oxygen concentration and stable pH were observed. In contrast, the continuous application promoted biofilm formation, and caused a pH increase and intermediate oxygen concentration. The contrast was probably due to different susceptibility of microbes to PAA-induced oxidative stress. To summarize, pulse PAA applications cause minor stress in fish, but have advantages over continuous application by ensuring better water quality.
Reflex impairment, physiological stress, and discard mortality of European plaice Pleuronectes platessa in an otter trawl fishery

The reformed European Common Fisheries Policy introduced a discard ban, with a possibility of exempting species where a high discard survival can be demonstrated. This necessitates a validation of the methods used for estimating the discard mortality of candidate species. In this study, we assess whether reflex impairment can predict short-term mortality in commercially trawled European plaice upon landing and after air exposure of up to 90 min. Sub-lethal stress was assessed by a suite of physiological variables. Over a 10-day period, mortality was monitored for a total of 199 plaice following trawl and air exposure of varying duration, and for 50 control fish scored for reflex impairment on board the vessel. Mortality was only observed in fish exposed to air for >60 min, and averaged 11.1% (95% CI = 7.1–16.3%). Reflex impairment was found to be a significant (P < 0.001) predictor of mortality in a generalized linear model, excluding other initially included variables by using a stepwise method. Plasma cortisol, haematocrit, and plasma osmolality all indicated a profound and increasing level of stress with air exposure, accompanied by a near depletion of muscle phosphocreatine and nucleotides. Fishing site had an unexpected, but significant (p < 0.05) effect on stress levels, which was also reflected in reflex impairment and mortality. Based on these findings, a possible exemption from the discard ban should include considerations on the duration of air exposure.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Aalborg University
Authors: Methling, C. (Intern), Skov, P. V. (Intern), Madsen, N. (Forskerdatabase)
Pages: 1660-1671
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Journal of Marine Science
Volume: 74
Issue number: 6
Repeated intra-specific divergence in lifespan and ageing of African annual fishes along an aridity gradient

Lifespan and ageing are substantially modified by natural selection. Across species, higher extrinsic (environmentally-related) mortality (and hence shorter life expectancy) selects for the evolution of more rapid ageing. However, among populations within species, high extrinsic mortality can lead to extended lifespan and slower ageing as a consequence of condition-dependent survival. Using within-species contrasts of eight natural populations of Nothobranchius fishes in common garden experiments, we demonstrate that populations originating from dry regions (with short life expectancy) had shorter intrinsic lifespans and a greater increase in mortality with age, more pronounced cellular and physiological deterioration (oxidative damage, tumor load), and a faster decline in fertility than populations from wetter regions. This parallel intra-specific divergence in lifespan and ageing was not associated with divergence in early life history (rapid
growth, maturation) or pace-of-life syndrome (high metabolic rates, active behavior). Variability across four study species suggests that a combination of different ageing and life history traits conformed with or contradicted the predictions for each species. These findings demonstrate that variation in lifespan and functional decline among natural populations are linked, genetically underpinned, and can evolve relatively rapidly. This article is protected by copyright. All rights reserved.
Digestive physiology is considered to be under circadian control, but there is little evidence in teleost fish. The present study explored the rhythmicity and plasticity to feeding schedules of enzymatic digestion in a candidate aquaculture fish, the permit (Trachinotus falcatus). The first experiment identified the rhythms of digestive factors throughout the light-dark (LD) cycle. Gastric luminal pH and pepsin activity showed significant daily variation albeit not rhythmic. These dynamic changes were likewise observed in several digestive enzymes, in which the activities of intestinal protease, chymotrypsin and lipase exhibited significant daily rhythms. In the second experiment, the existence of feed anticipatory activity in the digestive factors was investigated by subjecting the fish to either periodic or random feeding. Anticipatory gastric acidification prior to feeding was identified in periodically fed fish. However, pepsin activity did not exhibit such anticipation but a substantial postprandial increase was observed. Intestinal protease, leucine aminopeptidase and lipase anticipated periodic mealtime with elevated enzymatic activities. Plasma melatonin and cortisol demonstrated robust daily rhythms but feeding time manipulations revealed no significant impact. Plasma ghrelin level remained constant during the LD cycle and appeared to be unaffected by differing feeding regimes as well. Taken together, the digestive factors of permit were highly dynamic during the LD cycle. Periodic feeding entrained digestive physiology and mediated anticipatory gastric acidification and intestinal enzymatic activities. This knowledge will be essential in developing feeding protocols and husbandry-related welfare strategies that will further advance this candidate finfish as an aquaculture species.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Norwegian Institute of Food, Fisheries and Aquaculture Research, Research Institute for Aquaculture No. 1
Authors: Lazado, C. C. (Intern), Pedersen, P. B. (Intern), Nguyen, H. Q. (Ekstern), Lund, I. (Intern)
Pages: 107-116
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Comparative Biochemistry and Physiology. Part A: Molecular & Integrative Physiology
Volume: 212
ISSN (Print): 1095-6433
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.16 SJR 0.794 SNIP 0.879
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.917 SNIP 0.915 CiteScore 2.01
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.983 SNIP 0.94 CiteScore 2.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.956 SNIP 1.058 CiteScore 2.36
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.773 SNIP 1.032 CiteScore 2.18
Semi-continuously addition of peracetic acid to a flow-through fish farm: Technical note

- Demonstration of a safe and reliable practical method to reduce ectoparasites related mortality of farmed fish.
- Central peracetic acid application caused even distribution to all ponds and considered suitable for organic fish farming.
- Low dose and easy degradable peracetic acid is an alternative aquaculture management approach to formalin flush treatment.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Danish Aquaculture Organisation
Authors: Pedersen, L. (Intern), Henriksen, N. H. (Ekstern)
Pages: 2606-2608
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Journal of Cleaner Production
Volume: 142
ISSN (Print): 0959-6526
Ratings:
- BFI (2018): BFI-level 2
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 2
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 2
- Scopus rating (2016): CiteScore 5.83 SJR 1.615 SNIP 2.382
Short-term feed and light deprivation reduces voluntary activity but improves swimming performance in rainbow trout Oncorhynchus mykiss

Rainbow trout Oncorhynchus mykiss (~180 g, 16 °C and <5 kg m−3) that were feed deprived and kept in total darkness showed a significant increase in critical swimming speed (Ucrit) between 1 and 12 days of deprivation (from 3.35 to 4.46 body length (BL) s−1) with no increase in maximum metabolic rate (MMR). They also showed a significant decrease in the estimated metabolic rate at 0 BL s−1 over 12 days which leads to a higher factorial aerobic metabolic scope at day 12 (9.38) compared to day 1 (6.54). Routine metabolic rates were also measured in ~90 g rainbow trout that were swimming freely in large circular respirometers at 16 °C. These showed decreasing consumption oxygen rates and reductions in the
amount of oxygen consumed above standard metabolic rate (a proxy for spontaneous activity) over 12 days, though this happened significantly faster when they were kept in total darkness when compared to a 12:12-h light–dark (LD) photoperiod. Weight loss during this period was also significantly reduced in total darkness (3.33% compared to 4.98% total body weight over 12 days). Immunological assays did not reveal any consistent up- or downregulation of antipathogenic and antioxidant enzymes in the serum or skin mucus of rainbow trout between 1 and 12 days of feed and light deprivation. Overall, short periods of deprivation do not appear to significantly affect the performance of rainbow trout which appear to employ a behavioural energy-sparing strategy, albeit more so in darkness than under a 12:12-h LD regime.

General information
State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Norwegian Institute of Food, Fisheries and Aquaculture Research
Authors: Khan, J. R. (Intern), Lazado, C. C. (Intern), Methling, C. (Intern), Skov, P. V. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Fish Physiology & Biochemistry
ISSN (Print): 0920-1742
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.7 SJR 0.562 SNIP 0.821
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.736 SNIP 0.918 CiteScore 1.59
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.652 SNIP 0.891 CiteScore 1.77
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.708 SNIP 0.952 CiteScore 1.72
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.6 SNIP 1.192 CiteScore 1.76
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.659 SNIP 1.033 CiteScore 1.6
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.506 SNIP 0.858
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.444 SNIP 0.703
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.34 SNIP 0.54
Scopus rating (2007): SJR 0.253 SNIP 0.331
Scopus rating (2006): SJR 0.304 SNIP 0.389
Scopus rating (2005): SJR 0.406 SNIP 0.426
Scopus rating (2004): SJR 0.248 SNIP 0.246
Scopus rating (2003): SJR 0.465 SNIP 0.875
Scopus rating (2002): SJR 0.469 SNIP 0.633
Scopus rating (2001): SJR 0.494 SNIP 0.655
Web of Science (2001): Indexed yes
The composition of readily available carbon sources produced by fermentation of fish faeces is affected by dietary protein:energy ratios

Fish solid waste (faeces) produced in recirculated aquaculture systems (RAS) might be used for on-farm, single-sludge denitrification if transformed into soluble organic carbon substances. The current study investigated the effect of feeding diets with increasing protein to energy ratios (P:E_15, 17, 19, 21 and 23 g/MJ) to rainbow trout (Oncorhynchus mykiss) on the production of volatile fatty acids (VFAs) and ethanol during 7 days fermentation of the produced fish faeces. The total yields of VFAs and ethanol obtained (expressed as chemical oxygen demand (COD)) ranged between 0.21â€“0.24 gCOD/gTCOD, showing no differences between treatments. However, the type and quantities of individual VFAs and ethanol changed according to the dietary treatment. Lower P:E ratio diets resulted in higher production of butyric acid and ethanol, whereas higher P:E ratio diets resulted in an increased production of acetic and valeric acid. Changing the diet composition thus affects the composition of readily available carbon that can be derived from the faeces. This can be applied to enhance on-farm single sludge denitrification and reduce the need for adding external carbon sources such as e.g. methanol.
The influence of microplastic inclusion in feed on carryover of environmental pollutants from feed to seabass and salmon

**General information**

State: Published
Authors: Granby, K. (Intern), Rasmussen, R. R. (Intern), Kotterman, M. (Ekstern), Sloth, J. J. (Intern), Cederberg, T. L. (Intern), Marques, A. T. (Ekstern), Koelmans, A. (Ekstern), Larsen, B. K. (Intern)
Pages: 16-16
Publication date: 2017

**Host publication information**

Title of host publication: Seafood safety new findings & innovation challenges - abstract book
Place of publication: Brussels, Belgium
Publisher: Royal Flemish Academy of Science and the Arts (KVAB)
Main Research Area: Technical/natural sciences
The influence of ration size on energetics and nitrogen retention in tilapia (Oreochromis niloticus)

Proper nutrient management is essential for the environmental sustainability of aquaculture. While increasing daily rations generally may lead to improved growth rates, this does not necessarily mean that nutrients are utilized more efficiently. To investigate how ration size affects partitioning of dietary nutrient intake, the effects of meal size on growth and metabolism were examined in triplicate groups of adult Nile tilapia (Oreochromis niloticus) receiving daily rations corresponding to 1, 2, 3, or 4% of their biomass. While biomass gain and specific growth rates were positively correlated with ration size, feed conversion and protein retention were most efficient at ration sizes of 3%. Although the magnitude of the SDA response following feeding also increased with ration size, this was not proportionate to meal size. Therefore the metabolic cost of meal processing (SDA coefficient) was found to be lowest in the 3% ration group. The lowest rates of nitrogen excretion as well as the lowest SDA coefficients were also observed for fish receiving meal sizes corresponding to 3% of their body mass. In contrast, fish fed ration sizes of 1% displayed a reduction in apparent digestibility of protein, nitrogen free extract and dry matter, in addition to excreting a disproportionate amount of ingested nitrogen as ammonia and urea.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Kwame Nkrumah University of Science and Technology
Authors: Skov, P. V. (Intern), Duodu, C. P. (Ekstern), Adjei-Boateng, D. (Ekstern)
Pages: 121-127
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture
Volume: 473
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.136 SNIP 1.3 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.212 SNIP 1.487 CiteScore 2.32
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.294 SNIP 1.542 CiteScore 2.39
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Tilapia, Nutrient retention, Energetics, Oxygen consumption, Ammonia, Urea, Excretion, Specific dynamic action, Feed conversion, Protein retention, Aquatic Science, Oreochromis niloticus

The pros and cons of sodium percarbonate

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Pedersen, L. (Intern), Jokumsen, A. (Intern)
Pages: 1-7
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Global Aquaculture Alliance
Issue number: April
Original language: English
Publication: Research - peer-review › Journal article – Annual report year: 2017

The role of local adaptation in shaping fish-mussel coevolution
1. The survival of affiliate (dependent) species in a changing environment is determined by the interactions between the affiliate species and their available hosts. However, the patterns of spatial and temporal changes in host compatibility are often unknown despite host shifts having direct impact on the persistence of local populations. Bivalves of the order Unionida (freshwater mussels) are a functionally important but declining group of affiliate species, which are dependent on freshwater fish to host their parasitic larvae. The role of local adaptations and host fish resistance in shaping freshwater mussel host relationships remains poorly understood.2. We used an invasive East Asian unionid bivalve, Sinanodonta woodiana, and its potential host fishes to study the mechanisms shaping fish-mussel coevolution using a combination of laboratory cross-exposure methods and field-collected data. We tested whether generalist host use of S.woodiana is
pertinent to native host species, with special attention to bitterling fishes (Cyprinidae: Acheilognathinae) that are characterised by a mutual association with freshwater mussels. We also tested whether the pattern of the parasite-host association varies temporally (between areas of ancient and recent sympatry) and spatially (at a sub-basin level in its native range). Results revealed the ability of S.woodiana to widely exploit non-bitterling host fishes at a global scale. In contrast, the ability of S.woodiana to exploit closely associated bitterling fishes was low in its native range (with ancient sympatry). In areas of recent sympatry (non-native S.woodiana range in Europe), S.woodiana glochidia were demonstrated to readily parasitise local, evolutionarily naive bitterling species at high density. The results of a population-level experiment with three native populations of S.woodiana and rose bitterling, Rhodeus ocellatus, from various sub-basins of the River Yangtze confirmed that mussel populations vary in their compatibility with particular host populations. However, there was no evidence of population-specific adaptive coevolution. This study provides the first evidence for a role of fish counter-adaptations against freshwater mussel glochidia, and documents the importance of population-level variation in shaping compatibility between glochidia and their host fishes. This outcome can inform predictions on the impact of biotic homogenisation on endangered affiliate species in general and freshwater mussels in particular.

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Czech University of Life Sciences Prague, Chinese Academy of Sciences, Academy of Sciences of the Czech Republic
Authors: Douda, K. (Ekstern), Liu, H. (Ekstern), Yu, D. (Ekstern), Rouchet, R. (Ekstern), Liu, F. (Ekstern), Tang, Q. (Ekstern), Methling, C. (Intern), Smith, C. (Ekstern), Reichard, M. (Ekstern)
Pages: 1858-1868
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Freshwater Biology
Volume: 62
Issue number: 11
ISSN (Print): 0046-5070
Ratings:
- BFI (2018): BFI-level 2
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 2
- Web of Science (2017): Indexed Yes
- BFI (2016): BFI-level 2
- Scopus rating (2016): CiteScore 3.36 SJR 1.568 SNIP 1.41
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 2
- Scopus rating (2015): SJR 1.537 SNIP 1.371 CiteScore 2.95
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 1.487 SNIP 1.473 CiteScore 3.03
- BFI (2013): BFI-level 2
- Scopus rating (2013): SJR 2.045 SNIP 1.9 CiteScore 4.02
- ISI indexed (2013): ISI indexed yes
- BFI (2012): BFI-level 2
- Scopus rating (2012): SJR 2.075 SNIP 1.755 CiteScore 3.76
- ISI indexed (2012): ISI indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 1.927 SNIP 1.628 CiteScore 3.33
- ISI indexed (2011): ISI indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 1.736 SNIP 1.525
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 1.734 SNIP 1.514
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 1.618 SNIP 1.502
- Web of Science (2008): Indexed yes
Toxicity of emerging chemical contaminants evaluated in vivo with classic and alternative approaches using the zebrafish animal model

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, National Food Institute, Research Group for Analytical Food Chemistry
Authors: Rainieri, S. (Ekstern), Conlledo, N. (Ekstern), Larsen, B. K. (Intern), Granby, K. (Intern), Barranco, A. (Ekstern)
Pages: 13-13
Publication date: 2017

Host publication information
Title of host publication: Seafood safety new findings & innovation challenges - abstract book
Place of publication: Brussels, Belgium
Publisher: Royal Flemish Academy of Science and the Arts (KVAB)
Main Research Area: Technical/natural sciences
Conference: Seafood Safety, Brussels, Belgium, 25/01/2017 - 25/01/2017
Electronic versions:
21042f_6f62ebecb4654c2fac338c857d6be15.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Toxicity of peracetic acid to fish: Variation among species and impact of water chemistry: PAA toxicity to various fish
There has been strong interest in the use of peracetic acid (PAA) in aquaculture as it can be used to disinfect water and hard surfaces and thereby eliminate or lower the burden of fish pathogens. Unfortunately, there has been little research on the toxicity of PAA to fish. Twelve species of fingerling fish that are important to aquaculture were exposed to PAA for 24 h in static toxicity bioassays in well water. These fish were: fathead minnow, Pimephales promelas; black-nose crappie, Pomoxis nigromaculatus; blue tilapia, Oreochromis aureus; channel catfish, Ictalurus punctatus; golden shiner, Notemigonus crysoleucas; goldfish, Carassius auratus; grass carp, Ctenopharyngodon idella; largemouth bass, Micropterus salmoides; rainbow trout, Oncorhynchus mykiss; sunshine bass, Morone chrysops × M. saxatilis; and walleye, Sander vitreus. Median lethal concentration (LC50) values were estimated with the trimmed Spearman–Karber method using nominal PAA concentrations. The mean 24-h LC50 values ranged from 2.8 to 9.3 mg/L PAA. Fathead minnow were very sensitive and blue tilapia were very tolerant to PAA exposure; LC50 values of other species tested were within the range of 4.1–6.2 mg/L PAA. More importantly, the 24-h no-observed-effect concentration (NOEC) ranged from 1.9 to 5.8 mg/L PAA: the NOEC would be considered as the safe range for culturists to investigate the use of PAA. Decreased alkalinity/hardness increased the toxicity of PAA, while a small increase of dissolved organic content had no effect on PAA toxicity. Results of the present study are important information on the safe application of PAA for the aquaculture industry

General information
State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Agricultural Research Service, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin, Department of Ecophysiology and Aquaculture; Leibniz-Institute of Freshwater Ecology and Inland Fisheries; Müggelseedamm 301, 12587 Berlin Germany
Transforming waste into new resources: optimizing sludge hydrolysis to improve nitrogen removal in aquaculture through denitrification
Use of fluorescence spectroscopy to control ozone dosage in recirculating aquaculture systems

The aim of this study was to investigate the potential of fluorescence spectroscopy to be used as an ozone dosage determination tool in recirculating aquaculture systems (RASs), by studying the relationship between fluorescence intensities and dissolved organic matter (DOM) degradation by ozone, in order to optimise ozonation treatment. Water samples from six different Danish facilities (two rearing units from a commercial trout RAS, a commercial eel RAS, a pilot RAS and two marine water aquariums) were treated with different O3 dosages (1.0–20.0 mg/L ozone) in bench-scale experiments, following which fluorescence intensity degradation was eventually determined. Ozonation kinetic experiments showed that RAS water contains fluorescent organic matter, which is easily oxidised upon ozonation in relatively low concentrations (0–5 mg O3/L). Fluorescence spectroscopy has a high level of sensitivity and selectivity in relation to associated fluorophores, and it is able to determine accurately the ozone demand of each system. The findings can potentially be used to design offline or online sensors based on the reduction by ozone of natural fluorescent-dissolved organic matter in RAS. The suggested indirect determination of ozone delivered into water can potentially contribute to a safer and more adequate ozone-based treatment to improve water quality.
Acute toxicity of peracetic acid to fish

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Agricultural Research Service, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin
Authors: Straus, D. L. (Ekstern), Ledbetter, C. (Ekstern), Farmer, B. (Ekstern), Meinelt, T. (Ekstern), Pedersen, L. (Intern)
Publication date: 2016
Event: Abstract from Aquaculture America 2016, Las Vegas, United States.
Main Research Area: Technical/natural sciences

A holistic approach to provide recommendations for potential updates of the EU organic aquaculture regulation

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Lembo, G. (Ekstern), Abbink, W. (Ekstern), Blancheton, J. (Ekstern), Espmark, Ä. (Ekstern), Honkanen, P. (Ekstern), Jokumsen, A. (Intern), Ljung, M. (Ekstern), Olesen, I. (Ekstern)
Publication date: 2016
Event: Poster session presented at Aquaculture Europe 2016, Edinburgh, United Kingdom.
Main Research Area: Technical/natural sciences

A novel role for pigment genes in the stress response in rainbow trout (Oncorhynchus mykiss)

In many vertebrate species visible melanin-based pigmentation patterns correlate with high stress- and disease-resistance, but proximate mechanisms for this trait association remain enigmatic. Here we show that a missense mutation in a classical pigmentation gene, melanocyte stimulating hormone receptor (MC1R), is strongly associated with distinct differences in steroidogenic melanocortin 2 receptor (MC2R) mRNA expression between high- (HR) and low-responsive (LR) rainbow trout (Oncorhynchus mykiss). We also show experimentally that cortisol implants increase the expression of agouti signaling protein (ASIP) mRNA in skin, likely explaining the association between HR-traits and reduced skin melanin patterning. Molecular dynamics simulations predict that melanocortin 2 receptor accessory protein (MRAP), needed for MC2R function, binds differently to the two MC1R variants. Considering that mRNA for MC2R and the MC1R variants are present in head kidney cells, we hypothesized that MC2R activity is modulated in part by different binding affinities of the MC1R variants for MRAP. Experiments in mammalian cells confirmed that trout MRAP interacts with the two trout MC1R variants and MC2R, but failed to detect regulation of MC2R signaling, possibly due to high constitutive MC1R activity.

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, University of Rochester Medical Center, King Abdullah University of Science and Technology, University of Oslo, Norwegian School of Veterinary Medicine, Norwegian Institute for Water Research, Norwegian University of Life Sciences
Authors: Khan, U. W. (Ekstern), Øverli, Ø. (Ekstern), Hinkle, P. M. (Ekstern), Pasha, F. A. (Ekstern), Johansen, I. B. (Ekstern), Bergit, I. (Ekstern), Silva, P. I. M. (Ekstern), Kittilsen, S. (Ekstern), Höglund, E. (Intern), Omholt, S. W. (Ekstern), Våge, D. I. (Ekstern)
Publication date: 2016
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Scientific Reports
Volume: 6
Article number: 28969
ISSN (Print): 2045-2322
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
A simple melatonin treatment protocol attenuates the response to acute stress in the sole Solea senegalensis
Several compounds have been tested in fish in order to attenuate the effects of different stressors, most often following previous observations in mammals. The hormone melatonin (MEL) and the amino acid L-tryptophan have been tested for this purpose with different degree of success. In Senegalese sole (Solea senegalensis) we have previously observed that during prolonged exposure to relatively mild stressors, the presence of MEL in the water helped to reduce the stress response. Here, we aimed to investigate the potential anti-stress effects of a short melatonin exposure that could be easily performed in fish farms before an intended manipulative event with the animals. Our results demonstrate that adding MEL to the tanks 30 min before an acute chasing stress is effective in reducing the intensity of the stress response in fish from its beginning, as evidenced by the attenuated and delayed cortisol response in MEL-exposed animals. The hypothalamic levels of serotonergic activity and the mRNA levels of corticotropin-releasing factor were also attenuated in MEL-treated fish, suggesting that MEL effects occur through its inhibitory actions on the CNS pathways controlling the stress response in Senegalese sole. In view of the observed anti-stress effects of MEL, further research is warranted in order to optimize doses and timing of application to improve the effectiveness of the MEL treatment for aquaculture purposes.
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.136 SNIP 1.3 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.212 SNIP 1.487 CiteScore 2.32
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.294 SNIP 1.542 CiteScore 2.39
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.151 SNIP 1.394
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.941 SNIP 1.263
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.909 SNIP 1.173
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.019 SNIP 1.318
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.008 SNIP 1.689
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.915 SNIP 1.236
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.016 SNIP 1.627
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.121 SNIP 1.926
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.992 SNIP 1.418
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.049 SNIP 1.317
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.908 SNIP 1.113
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.049 SNIP 1.251
Original language: English
DOIs:
10.1016/j.aquaculture.2015.11.006
Source: PublicationPreSubmission
Source-ID: 117795343
Publication: Research - peer-review › Journal article – Annual report year: 2015
Assessing the effectiveness of peracetic acid to remediate post-vaccination Saprolegnia spp.-associated mortality in Atlantic salmon Salmo salar parr in recirculation aquaculture systems

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Good, C. (Ekstern), Davidson, J. (Ekstern), Straus, D. (Ekstern), Wolters, W. (Ekstern), Peterson, B. (Ekstern), Pedersen, L. (Intern)
Publication date: 2016
Event: Abstract from International Conference on Recirculating Aquaculture, Roanoke, VA, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2016

Brain serotoninergic activation in growth-stunted farmed salmon: adaption versus pathology
Signalling systems activated under stress are highly conserved, suggesting adaptive effects of their function. Pathologies arising from continued activation of such systems may represent a mismatch between evolutionary programming and current environments. Here, we use Atlantic salmon (Salmo salar) in aquaculture as a model to explore this stance of evolutionary-based medicine, for which empirical evidence has been lacking. Growth-stunted (GS) farmed fish were characterized by elevated brain serotoninergic activation, increased cortisol production and behavioural inhibition. We make the novel observation that the serotoninergic system in GS fish is unresponsive to additional stressors, yet a cortisol response is maintained. The inability of the serotoninergic system to respond to additional stress, while a cortisol response is present, probably leads to both imbalance in energy metabolism and attenuated neural plasticity. Hence, we propose that serotonin-mediated behavioural inhibition may have evolved in vertebrates to minimize stress exposure in vulnerable individuals.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, University of Oslo, Uni Research AS, Institute of Marine Research, Radboud University Nijmegen, Norwegian University of Life Sciences
Authors: Vindas, M. A. (Ekstern), Johansen, I. B. (Ekstern), Folkedal, O. (Ekstern), Höglund, E. (Intern), Gorissen, M. (Ekstern), Flik, G. (Ekstern), Kristiansen, T. S. (Ekstern), Øverli, Ø. (Ekstern)
Publication date: 2016
Main Research Area: Technical/natural sciences

Characterization of melatonin synthesis in the gastrointestinal tract of rainbow trout (Oncorhynchus mykiss): distribution, relation with serotonin, daily rhythms and photoperiod regulation

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Vindas, M. A. (Ekstern), Johansen, I. B. (Ekstern), Folkedal, O. (Ekstern), Höglund, E. (Intern), Gorissen, M. (Ekstern), Flik, G. (Ekstern), Kristiansen, T. S. (Ekstern), Øverli, Ø. (Ekstern)
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Royal Society Open Science
Volume: 3
Issue number: 5
Article number: 160030
ISSN (Print): 2054-5703
Ratings:
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed Yes
Scopus rating (2016): CiteScore 2.27 SJR 0.957 SNIP 1.017
Web of Science (2016): Indexed yes
Scopus rating (2015): SNIP 0.957 SJR 0.636 CiteScore 1.92
Original language: English
Biology (whole organism)
Electronic versions:
Publishers version
DOIs: 10.1098/rsos.160030
Links:
http://rsos.royalsocietypublishing.org/content/3/5/160030
Source: Findit
Source-ID: 277650889
Publication: Research - peer-review › Journal article – Annual report year: 2016
Cognitive appraisal of aversive stimulus differs between individuals with contrasting stress coping styles; evidences from selected rainbow trout (Oncorhynchus mykiss) strains

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, University of Copenhagen, Uni Research AS, Norwegian Institute for Water Research, Norwegian University of Life Sciences, Uppsala University, UAEMéx, Mexico, Facultad de Ciencias
Authors: Moltesen, M. (Intern), Vindas, M. A. (Ekstern), Winberg, S. (Ekstern), Ebbesson, L. (Ekstern), Ruiz-Gomez, M. L. (Ekstern), Skov, P. V. (Intern), Dabelsteen, T. (Forskerdatabase), Øverli, Ø. (Ekstern), Höglund, E. (Intern)
Pages: 1567-1587
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Behaviour
Volume: 153
Issue number: 13-14
ISSN (Print): 0005-7959
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.38 SJR 0.729 SNIP 0.686
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.705 SNIP 0.538 CiteScore 1.33
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.815 SNIP 0.81 CiteScore 1.48
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.763 SNIP 0.689 CiteScore 1.44
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.946 SNIP 0.792 CiteScore 1.69
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.879 SNIP 0.7 CiteScore 1.58
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.95 SNIP 0.707
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.951 SNIP 0.736
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.041 SNIP 0.878
Scopus rating (2007): SJR 1.201 SNIP 0.818
Scopus rating (2006): SJR 0.949 SNIP 0.985
Scopus rating (2005): SJR 0.797 SNIP 0.72
Scopus rating (2004): SJR 0.932 SNIP 0.917
Scopus rating (2003): SJR 0.871 SNIP 0.876
Scopus rating (2002): SJR 1.042 SNIP 0.854
Scopus rating (2001): SJR 0.978 SNIP 0.847
Scopus rating (2000): SJR 1.097 SNIP 1.006
Scopus rating (1999): SJR 1.049 SNIP 0.946
Original language: English
DOIs:
Coping with a changing environment: The effects of early life stress

Ongoing rapid domestication of Atlantic salmon implies that individuals are subjected to evolutionarily novel stressors encountered under conditions of artificial rearing, requiring new levels and directions of flexibility in physiological and behavioural coping mechanisms. Phenotypic plasticity to environmental changes is particularly evident at early life stages. We investigated the performance of salmon, previously subjected to an unpredictable chronic stress (UCS) treatment at an early age (10 month old parr), over several months and life stages. The UCS fish showed overall higher specific growth rates compared with unstrressed controls after smoltification, a particularly challenging life stage, and after seawater transfer. Furthermore, subjecting fish to acute stress at the end of the experiment, we found that UCS groups had an overall lower hypothalamic catecholaminergic and brain stem serotonergic response to stress compared with control groups. In addition, serotonergic activity was negatively correlated with final growth rates, which implies that serotonin responsive individuals have growth disadvantages. Altogether, our results may imply that a subdued monoaminergic response in stressful farming environments may be beneficial, because in such situations individuals may be able to reallocate energy from stress responses into other life processes, such as growth.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Uni Research AS, Institute of Marine Research, Norwegian University of Life Sciences, Norwegian Institute for Water Research, Norwegian University of Science and Technology
Authors: Vindas, M. A. (Ekstern), Madaro, A. (Ekstern), Fraser, T. W. (Ekstern), Höglund, E. (Intern), Olsen, R. E. (Ekstern), Øverli, Ø. (Ekstern), Kristiansen, T. S. (Ekstern)
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Royal Society Open Science
Volume: 3
Issue number: 10
Article number: 160382
ISSN (Print): 2054-5703
Ratings:
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed Yes
Scopus rating (2016): CiteScore 2.27 SJR 0.957 SNIP 1.017
Web of Science (2016): Indexed yes
Scopus rating (2015): SNIP 0.957 SJR 0.636 CiteScore 1.92
Original language: English
Multidisciplinary, Atlantic salmon, Catecholamines, Neurochemistry, Phenotypic plasticity, Serotonin
Electronic versions:
Publishers version
DOIs:
10.1098/rsos.160382
Source: FindIt
Source-ID: 2346699968
Publication: Research - peer-review › Journal article – Annual report year: 2016

Denmark – European champion in organic rainbow trout

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Aquaculture
Authors: Larsen, E. (Intern), Nielsen, M. (Ekstern), Larsen, V. J. (Ekstern), Jokumsen, A. (Intern)
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: ICROFS news
Dietary phytoimmunostimulant Persian hogweed (Heracleum persicum) has more remarkable impacts on skin mucus than on serum in common carp (Cyprinus carpio)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Gorgan University of Agricultural Sciences and Natural Resources
Authors: Hoseinifar, S. H. (Ekstern), Zoheiri, F. (Ekstern), Lazado, C. C. (Intern)
Pages: 77-82
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Fish and Shellfish Immunology
Volume: 59
ISSN (Print): 1050-4648
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.36 SJR 1.114 SNIP 1.16
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.268 SNIP 1.171 CiteScore 3.19
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.138 SNIP 1.089 CiteScore 2.92
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.001 SNIP 1.149 CiteScore 3.11
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.151 SNIP 1.174 CiteScore 3.02
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.196 SNIP 1.265 CiteScore 3.52
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.131 SNIP 1.056
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.96 SNIP 1.101
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.952 SNIP 1.062
Scopus rating (2007): SJR 0.842 SNIP 1.378
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.954 SNIP 1.298
Discontinuation of anti-VEGF cancer therapy promotes metastasis through a liver revascularization mechanism

The impact of discontinuation of anti-VEGF cancer therapy in promoting cancer metastasis is unknown. Here we show discontinuation of anti-VEGF treatment creates a time-window of profound structural changes of liver sinusoidal vasculatures, exhibiting hyper-permeability and enlarged open-pore sizes of the fenestrated endothelium and loss of VE-cadherin. The drug cessation caused highly leaky hepatic vasculatures permit tumour cell intravasation and extravasation. Discontinuation of an anti-VEGF antibody-based drug and sunitinib markedly promotes liver metastasis. Mechanistically, host hepatocyte, but not tumour cell-derived vascular endothelial growth factor (VEGF), is responsible for cancer metastasis. Deletion of hepatocyte VEGF markedly ablates the 'off-drug'-induced metastasis. These findings provide mechanistic insights on anti-VEGF cessation-induced metastasis and raise a new challenge for uninterrupted and sustained antiangiogenic therapy for treatment of human cancers.
Disinfection with peracetic acid (PAA), an alternative against fish pathogens

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin, Agricultural Research Service
Authors: Meinelt, T. (Ekstern), Pedersen, L. (Intern), Straus, D. L. (Ekstern), Liu, D. (Ekstern)
Publication date: 2016
Event: Abstract from International Conference on Recirculating Aquaculture, Roanoke, VA, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2016

Effects of acute and chronic stress on telencephalic neurochemistry and gene expression in rainbow trout (Oncorhynchus mykiss)

By filtering relevant sensory inputs and initiating stress responses, the brain is an essential organ in stress coping and adaptation. However, exposure to chronic or repeated stress can lead to allostatic overload, where neuroendocrinal and behavioral reactions to stress become maladaptive. This work examines forebrain mechanisms involved in allostatic processes in teleost fishes. Plasma cortisol, forebrain serotonergic (5-HTergic) neurochemistry, and mRNA levels of corticotropin-releasing factor (CRF), CRF-binding protein (CRFBP), CRF receptors (CRFR1 and CRFR2), mineralocorticoid receptor (MR), glucocorticoid receptors (GR1 and GR2) and serotonin type 1A (5-HT1A) receptors (5-HT1Aα and 5-HT1Aβ) were investigated at 1 h before and 0, 1 and 4 h after acute stress, in two groups of rainbow trout held in densities of 25 and 140 kg m-3 for 28 days. Generally, being held at 140 kg m-3 resulted in a less pronounced cortisol response. This effect was also reflected in lower forebrain 5-HTergic turnover, but not in mRNA levels in any of the investigated genes. This lends further support to reports that allostatic load causes fish to be incapable of mounting a proper cortisol response to an acute stressor, and suggests that changes in forebrain 5-HT metabolism are involved in allostatic processes in fish. Independent of rearing densities, mRNA levels of 5-HT1Aα and MR were downregulated 4 h post-stress compared with values 1 h post-stress, suggesting that these receptors are under feedback control and take part in the downregulation of the hypothalamic-pituitary-interrenal (HPI) axis after exposure to an acute stressor.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, University of Copenhagen, Uppsala University, Lund University, Norwegian Institute for Water Research
Authors: Moltesen, M. (Intern), Laursen, D. C. (Intern), Thörnqvist, P. O. (Ekstern), Åberg Andersson, M. (Intern), Winberg, S. (Ekstern), Höglund, E. (Intern)
Effects of dietary prebiotic GroBiotic®-A on growth performance, plasma thyroid hormones and mucosal immunity of great sturgeon, Huso huso (Linnaeus, 1758)

The present study was conducted to evaluate the effects of Grobiotic®-A, a commercial prebiotic, when administered in feed on the growth performance, plasma thyroid hormones and mucosal immunity of great sturgeon (Huso huso). The commercial prebiotic mixture was supplemented in the diets at four different levels (i.e. 0.0% as control, 0.5%, 1% and 2%, in three replicates, 20 fish per replicate) and fed to the fish for an 8-week period wherein 240 fish were cultured in 1,800-L fiberglass tanks that formed part of a flow-through system. Water temperature was maintained at 20.4 ± 1.5°C. Significant changes in growth performance parameters were observed, but only in those groups fed with 1% and 2% prebiotics. Specifically, marked improvements relative
to the control group were observed in percentage weight gain, body weight gain, feed conversion ratio and specific growth rate in prebiotic-fed fish. The levels of plasma thyroid hormones, specifically thyroxine and thyroid stimulating hormones were significantly elevated in the group receiving 2% prebiotics. Activities of lysozyme and alkaline phosphatase in skin mucus were significantly enhanced in prebiotics-fed groups, particularly at an inclusion level of 1% and higher (2% group compared to the control). Inhibitory activity of the skin mucus against pathogens, particularly Streptococcus iniae and Yersinia ruckeri, was significantly improved following prebiotic feeding. Taken together, dietary inclusion of GroBiotic®-A promoted growth, modulated thyroid hormones, and enhanced mucosal immunity of H. huso. This prebiotic mixture has the potential for use in improving the growth performance and health status of farmed great sturgeon.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Iranian Fisheries Science Research Institute (IFSRI), North Orissa University, Sari University of Agricultural Sciences and Natural Resources
Authors: Adel, M. (Ekstern), Nayak, S. (Ekstern), Lazado, C. C. (Intern), Yeganeh, S. (Ekstern)
Pages: 825-831
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Applied Ichthyology
Volume: 32
Issue number: 5
ISSN (Print): 0175-8659
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.94
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.84
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.06
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.99
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.99
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.04
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Web of Science (2008): Indexed yes
Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
Electronic versions: Publishers version
Effects of feed loading on microbial water quality in RAS

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Rojas-Tirado, P. A. (Intern), Pedersen, P. B. (Intern), Vadstein, O. (Ekstern), Pedersen, L. (Intern)
Publication date: 2016
Event: Abstract from International Conference on Recirculating Aquaculture, Roanoke, VA, United States.
Main Research Area: Technical/natural sciences
Links:
http://media.wix.com/ugd/9c091d_bda94a40dd8a48f8af6a55712b95f4ab.pdf
Publication: Research › Conference abstract for conference – Annual report year: 2016

Feed requirements in organic aquaculture

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Jokumsen, A. (Intern), Lembo, G. (Ekstern)
Publication date: 2016
Event: Abstract from Aquaculture Europe 2016, Edinburgh, United Kingdom.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2016

Final Report on Aquaculture (Part C)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Lembo, G. (Ekstern), Sossidou, E. (Ekstern), Estevez, A. (Ekstern), Mente, E. (Ekstern), Jokumsen, A. (Intern), Sorgeloos, P. (Ekstern)
Number of pages: 13
Publication date: 2016
Publication information
Publisher: European Commission
Original language: English
Main Research Area: Technical/natural sciences
Publication: Research › Report – Annual report year: 2016

First feeding behavior: A potential tool to select robust trout for organic aquaculture

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Gesto, M. (Intern)
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication information
Journal: ICROFS news
Original language: English
Bibliographical note
Communication to ICROFS bulletin (icrofs.dk)
Source: PublicationPreSubmission
Source-ID: 128002431
Growth performance, feed utilization and sensory characteristics of Nile Tilapia, Oreochromis niloticus fed diets with high inclusion levels of copra meal

Background: The low cost and wide-availability of copra meal in many tropical countries where aquaculture is practiced have generated much interest in its potential inclusion in fish diet formulations. The present study was designed to investigate the effect of very high inclusions of autoclaved copra meal on the growth and feed utilization parameters as well as the sensory qualities of the Nile tilapia, Oreochromis niloticus. Methods: Fish were fed three experimental diets, a control (CTRL) diet which had fishmeal as the main protein source at an inclusion of 365 g kg\(^{-1}\) and two test diets which contained copra meal at 680 g kg\(^{-1}\) inclusions for a 6-week period. One of the copra meal diets contained sesame meal supplementation (CM+S) as a natural high source of methionine which is the first limiting essential amino acid in copra meal. Results: The dietary treatments had no differential effects on growth, feed intake, or feed utilization parameters in O. niloticus. With the exception of the significantly higher lipid content of the CM+S group, the whole body compositions of the different fish groups were not significantly affected by the different dietary treatments. Remarkably, the high dietary inclusions of copra meal did not have any significant effects on fillet sensory attributes. Conclusions: The results of this study demonstrate that it is possible to include autoclaved copra meal up to 680 g kg\(^{-1}\) in Nile tilapia diets without any deleterious effects on fish growth or on flesh sensory characteristics.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Kwame Nkrumah University of Science and Technology
Authors: Obirikorang, K. A. (Ekstern), Amisah, S. (Ekstern), Skov, P. V. (Intern)
Number of pages: 7
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Animal Research and Nutrition
Volume: 1
Issue number: 4
Article number: 18
Original language: English
Electronic versions:
Publishers version
Links:
Publication: Research - peer-review › Journal article – Annual report year: 2016

Host-derived probiotics Enterococcus casseliflavus improves resistance against Streptococcus iniae infection in rainbow trout (Oncorhynchus mykiss) via immunomodulation

The present study evaluated the benefits of dietary administration of host-derived candidate probiotics Enterococcus casseliflavus in juvenile rainbow trout Oncorhynchus mykiss. Experimental diets were prepared by incorporating the microorganisms in the basal feed at 3 inclusion levels (i.e. 107 CFU g\(^{-1}\) of feed [T1], 108 CFU g\(^{-1}\) of feed [T2], 109 CFU g\(^{-1}\) of feed [T3]). The probiotic feeds were administered for 8 weeks, with a group fed with the basal diet serving as control. The effects on growth performance, gut health, innate immunity and disease resistance were evaluated. Results showed that growth performance parameters were significantly improved in T2 and T3 groups. Activities of digestive enzymes such as trypsin and lipase were significantly higher in these two groups as well. Gut micro-ecology was influenced by probiotic feeding as shown by the significant increase in intestinal lactic acid bacteria and total viable aerobic counts in T2 and T3. Humoral immunity was impacted by dietary probiotics as total serum protein and albumin were significantly elevated in T3. The levels of serum IgM significantly increased in all probiotic fed groups at week 8; with the T3 group registering the highest increment. Respiratory burst activity of blood leukocytes were significantly improved in T2 and T3. Hematological profiling further revealed that neutrophil counts significantly increased in all probiotic fed groups. Challenge test showed that probiotic feeding significantly improved host resistance to Streptococcus iniae infection, specifically in T2 and T3 where a considerable modulation of immune responses was observed. Taken together, this study demonstrated E. casseliflavus as a potential probiotics for rainbow trout with the capability of improving growth performance and enhancing disease resistance by immunomodulation

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Sari University of Agricultural Sciences and Natural Resources, Shahid Chamran University of Ahvaz, Agricultural Research Education and Extension Organization, Temasek Polytechnic
Impact of temperature on ammonium and nitrite removal rates in RAS moving bed biofilters

The impact of temperature on bacterial processes is well known; however temperature related data on nitrification rates in aquaculture systems are fragmented and compiled from different studies. We sought to determine ammonium and nitrite removal kinetics over a temperature range from 6 to 36 °C by using moving bed bio-elements from a freshwater RAS in steady state operated at 18 °C. The impact of temperature on ammonium and nitrite oxidation rates was evaluated by transferring the colonized bio elements to six liter batch reactors (triplicated setup). Each reactor was acclimatized for 24 h at each of the six temperatures (6, 12, 18, 24, 30 and 36 °C) and then spiked with ammonium chloride or sodium nitrite under identical conditions. The average surface specific TAN removal (STR) increased a six-fold from 6 to 30 °C (0.04–0.25 g TAN m−2 day−1) and dropped significantly at 36 °C–0.14 g TAN m−2 day−1. The surface specific nitrite removal (SNR) increased linearly from 0.04 g N m−2 d−1 at 6 °C–0.14 g N m−2 d−1 at 30 °C, decreasing to 0.12 g N m−2 day−1 at 36 °C. Throughout the temperature range tested, STR remained significantly larger than SNR. The temperature coefficient, ø (6–30 °C) for ammonium oxidation was 1.079; for nitrite oxidation the temperature coefficient was found to be 1.054. The data provided by this study can be applied dimensioning future RAS that utilizes temperature ranges below 10 and above 30 °C.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Sokoine University of Agriculture
Authors: Kinyage, J. P. H. (Ekstern), Pedersen, L. (Intern)
Pages: 51-55
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information

Journal: Aquacultural Engineering
Volume: 75
ISSN (Print): 0144-8609
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.09 SJR 0.798 SNIP 1.525
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.723 SNIP 1.148 CiteScore 1.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.72 SNIP 1.437 CiteScore 1.61
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.666 SNIP 1.511 CiteScore 1.8
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.946 SNIP 1.377 CiteScore 1.72
ISI indexed (2012): ISI indexed yes
Increasing levels of dietary crystalline methionine affect plasma methionine profiles, ammonia excretion, and the expression of genes related to the hepatic intermediary metabolism in rainbow trout (Oncorhynchus mykiss)

Strictly carnivorous fish with high requirements for dietary protein, such as rainbow trout (Oncorhynchus mykiss) are interesting models for studying the role of amino acids as key regulators of intermediary metabolism. Methionine is an essential amino acid for rainbow trout, and works as a signalling factor in different metabolic pathways. The study investigated the effect of increasing dietary methionine intake on the intermediary metabolism in the liver of juvenile rainbow trout. For this purpose, five diets were formulated with increasing methionine levels from 0.60 to 1.29% dry matter. The diets were fed in excess for six weeks before three sampling campaigns carried out successively to elucidate (i) the hepatic expression of selected genes involved in lipid, glucose and amino acid metabolism; (ii) the postprandial ammonia excretion; and (iii) the postprandial plasma methionine concentrations. The transcript levels of enzymes involved in lipid metabolism (fatty acid synthase, glucose 6 phosphate dehydrogenase and carnitine palmitoyl transferase 1 a), gluconeogenesis (fructose-1,6-biphosphatase) and amino acid catabolism (alanine amino transferase and glutamate dehydrogenase) were significantly affected by the increase in dietary methionine. Changes in gene expression reflected to some extent the decrease in ammonia excretion (P=0.022) and in the hepatosomatic index (HSI; P
Innate immune defenses exhibit circadian rhythmicity and differential temporal sensitivity to a bacterial endotoxin in Nile tilapia (Oreochromis niloticus)

The present study investigated the daily dynamics of humoral immune defenses and the temporal influence in the sensitivity of these responses to a bacterial endotoxin in Nile tilapia (Oreochromis niloticus). The first experiment subjected the fish to two photoperiod conditions, 12L:12D (LD) and 0L:24D (DD), for 20 days to characterize the rhythms of humoral immunity. Serum alkaline phosphatase (ALP), lysozyme (LYZ), peroxidase (PER) and protease (PRO) exhibited significant rhythmicity under LD but not in DD. No significant rhythms were observed in esterase (ESA) and anti-protease (ANTI) in both photoperiod conditions. Fish reared...
under LD were subsequently subjected to DD while the group previously under DD was exposed to LD, and this carried on for 3 days before another set of samples was collected. Results revealed that the rhythms of LYZ, PER and PRO but not ALP persisted when photoperiod was changed from LD to DD. Nonetheless, immune parameters remained arrhythmic in the group subjected from DD to LD. Cluster analysis of the humoral immune responses under various light conditions revealed that each photic environment had distinct daily immunological profile. In the second experiment, fish were injected with bacterial endotoxin lipopolysaccharide (LPS) either at ZT3 (day) or at ZT15 (night) to evaluate the temporal sensitivity of humoral immunity to a pathogen-associated molecular pattern. The results demonstrated that responses to LPS were gated by the time of day. LPS significantly modulated serum ALP and ANTI activities but only when the endotoxin was administered at ZT3. Serum LYZ and PER were stimulated at both injection times but with differing response profiles. Modulated LYZ activity was persistent when injected at ZT3 but transient when LPS was applied at ZT15. The magnitude of LPS-induced PER activity was higher when the endotoxin was delivered at ZT3 versus ZT15. It was further shown that plasma cortisol was significantly elevated but only when LPS was administered at ZT3. On the other hand, plasma melatonin was significantly affected by LPS injection but only when exposed at ZT15. Taken together, this study shows that several key components of humoral immunity in tilapia exhibit circadian rhythms and adapt to photoperiodic changes. Further, results of the bacterial endotoxin challenge suggest that responsiveness of serum humoral factors to a biological insult is likely mediated by the time of day, highlighting the importance of circadian rhythm in the immunological functions of fish.
Investigating the effectiveness of paracetic acid water disinfection to reduce post-vaccination Saprolegnia spp.-associated mortality in Atlantic salmon Salmo salar paa while assessing impact on nitrification in replicated Recirculating Aquaculture Systems

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Agricultural Research Service
Publication date: 2016
Event: Abstract from Aquaculture Europe, Edinburgh, United Kingdom.
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Linking water treatment practices and fish welfare
Peracetic acids can be used as sanitizers to control water quality in aquaculture systems. As an alternative to formalin, chloramine-T or copper sulphate, PAA has strong anti-microbial effects, degrades quickly and is relatively safe to use. Its mode of action and associated rapid decay can make optimizing treatment protocols a challenge. Continuous low-dose applications seem to be a promising solution. In this preliminary study behavioral response was used to assess potential correlations with PAA dosage. A behavioral change or response is not necessarily an indication of compromised welfare. Supportive enzymatic, biochemical and physiological biomarkers can be used along with gill and epidermal histological measures to evaluate the effects on water treatment regimens. The ultimate goal is to define the therapeutic window where fish welfare is not compromised. PAA is among the few disinfectants approved for organic aquaculture.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Aquaculture
Authors: Zubiaurre, C. (Intern), Pedersen, L. (Intern)
Long-term tryptophan supplementation decreased the welfare and innate immune status of pikeperch juveniles

It has been demonstrated that short-term supplementation of L-tryptophan (TRP) can mitigate the primary neuroendocrine response to stress in some fish species, but such stress reduction was reported to be both dose- and context-dependent (Basic et al, 2013; Machado et al, 2015). So, the TRP responses may be species related or depend on the stress levels experienced by the fish. Since percid fish were reported to be more stress responsiveness than common aquaculture species such as rainbow trout (Jentoft et al, 2005), this study aimed (1) to determine to what extent a long-term dietary TRP mitigate the physiological response of pikeperch (Sander lucioperca) to emersion stress, and (2) to characterize the related immune status. Pikeperch juveniles of 10 g received four experimental diets: (CT) = control groups without any stress and any feed TRP supplement, (CTS) = control groups submitted to emersion stress but without any feed TRP supplement, 3TRPs = groups receiving 3-time TRP diet and submitted to emersion stress, 6TRPs = groups receiving 6-time TRP diet and submitted to emersion stress. Various organs were sampled on D7, D37 and D91 of TRP supplementation for evaluation of physiological and immune responses; samplings were done one hour after the emersion challenge stress. Specific growth rate (SGR) as well as food conversion rate (FCR) were also checked. Emersion stress induced a significant increase in plasma cortisol both after a single stress or repeated stress challenges. Dietary TRP significantly decreased cortisol levels in a dose related manner both after a single or repeated stress; but plasma glucose level was only affected after a single stress but not after long-term feeding. The two stress indicators measured showed that pikeperch displayed higher stress responsiveness as already demonstrated for European perch in comparison to salmonids (Jentoft et al, 2005). The reduction in physiological stress status by dietary TRP was associated to a significant decrease in plasma lysosomal activity, especially on D91; indicating negative interaction with the innate immune pathways. Growth rate was slowed by the long- term dietary TRP in association to an increase in FCR values. The available results indicate that long-term TRP supplementation has negative impact on the overall welfare status of pikeperch. Other analyses are ongoing and more results concerning key-brain neurotransmitters such as serotonin, dopamine and their metabolites concentrations as well as on the expressions of key-immune genes (C3-1, TNF-α, IL-1β, etc) will be discussed.
L-tryptophan, stress responsiveness, immunity, welfare status, pikeperch

Microbial water quality - tools and challenges
Modelling the effects of dietary methionine level and form on postprandial plasma essential amino acid profiles in rainbow trout (Oncorhynchus mykiss)

Aquafeed formulation is susceptible to affect amino acid (AA) availability for metabolic functions. Statistical models were applied to quantify the effect of dietary methionine level (from 6.01 to 16.17 g kg\(^{-1}\) dry matter) and form (free, coated or bound) on postprandial concentrations of plasma essential amino acid (EAA) in rainbow trout. Twelve diets were formulated with pea and soya protein concentrate or fish meal as the main protein ingredients and were supplemented or not with increasing amount of either crystalline or agar-coated methionine. Fish were acclimatized to one of the 12 diets for 6 weeks before postprandial plasma sampling (six sampling points up to 36 h, seven fish each time), further analysed for EAA content. Using generalized additive models, we show that (i) dietary methionine level and form explained 74% postprandial methionine plasma variations and that (ii) the methionine dietary form and plasma concentrations significantly affected the plasma concentrations of the other EAAs. Finally, linear model revealed a positive relationship (R\(^2\) > 0.9) between plasma concentrations of the three branched-chain AAs under the present experimental conditions. The results obtained add new information on the dietary effects on EAAs in the plasma availability and the interactions between them.
New approaches to improve the removal of dissolved organic matter and nitrogen in aquaculture

Reducing the environmental impact of aquaculture requires that waste treatment practices are further improved. Currently applied treatment technologies achieve good solids removal and nitrification. Yet discharge of nitrogen (N) and organic matter (OM) from fish farms is still often an important issue constraining aquaculture development, especially in sensitive areas. Possibilities for efficient end-of-pipe treatment exist for large intensive recirculating aquaculture systems (RAS), while smaller and especially the technically less advanced fish farms, struggle to reduce nutrient discharge further due to the lack of cost-effective and easy applicable treatment methods for removing dissolved N and OM. The purpose of this PhD thesis was to assess the problem of removing dissolved N and OM in the context of the large differences in system intensity between farms, and to devise new, simple methods for removing dissolved N and OM from aquaculture effluents of technically less advanced farms in particular. The work split in two parts. The first part focused on the turnover of dissolved N-compounds (Paper I) and dissolved organic matter (DOM) (Paper II) and in aerobic biofilters operated at increasing long-term waste loadings. The second part examined the potential of using anoxic denitrifying woodchip bioreactors for removal of nitrate from aquaculture effluent (Paper III-V). Investigations within the first part showed that the effectiveness of biofilters, as determined by their areal removal rates, for removing DOM and degrading ammonia, nitrite and urea, increased with increasing long-term waste loading. The findings sustained/suggested? that DOM to (some extend)? can be removed by biofiltration, and that biofilters therefore may be applied for removing DOM from aquaculture effluents. The studies furthermore showed that degradation of urea contributes to the ongoing nitrification activity in aquaculture biofilters, and that the transition zone from first order (substrate dependent) to zero order (substrate independent) degradation of ammonia and nitrite was elevated with increasing long-term biofilter loading up to a certain threshold. The latter indicated that the removal capacity of biofilters operated at lower loadings is easily exceeded, and that they may not respond very well to sudden increases in total ammonia nitrogen (TAN) concentrations. In the second part of the thesis, a field study documented the start-up performance of a pilot-scale, denitrifying woodchip bioreactor at a commercial outdoor fish farm (Paper III). Nitrate removal was immediate after bioreactor start-up and was accompanied by short-term leaching of nutrients and organic matter from the woodchips. The study demonstrated that woodchip bioreactors are able to remove nitrate from dilute aquaculture effluents under commercial conditions. The obtained nitrate removal rate (7.06±0.81 g NO3-N/m3/d at ~8°C) was, however, relatively low, signifying that a quite large reactor would be required for complete removal of NO3-N at commercial farms. Laboratory studies were therefore carried out to test whether removal rates in woodchip bioreactor could be improved. Paper IV demonstrated that simultaneously changing the hydraulic retention time and adding bicarbonate to the inlet water of laboratory-scale woodchip bioreactors improved N removal. Moreover, the study indicated that sulfur-based autotrophic denitrification is potentially important to the overall N removal in woodchip bioreactors. A subsequent laboratory study demonstrated that higher N removal rates could be achieved in mixotrophic denitrification reactors containing mixtures of woodchips, sulfur granules and seashells (Paper V).

12 Altogether, the woodchip studies sustained that denitrifying woodchip bioreactors may represent an alternative and simple method for removing nitrate from dilute/low-organic-strength aquaculture effluents for which application of, for example, heterotrophic denitrification reactors needing input of organic carbon sources is generally not feasible.
**Nye miljøvenlige desinfektsionsmidler til økologiske dambrug**


**Optimizing nitrate removal in woodchip beds treating aquaculture effluents**

Nitrate is typically removed from aquaculture effluents using heterotrophic denitrification reactors. Heterotrophic denitrification reactors, however, require a constant input of readily available organic carbon (C) sources which limits their application in many aquaculture systems for practical and/or economic reasons. A potential alternative technology for removing nitrate currently applied for treating surface and drainage water is based on using wood by-products as a carbon source for denitrification. Using lab-scale horizontal-flow woodchip filters, the current study investigated the potential of optimizing woodchip reactors for treating aquaculture effluent. A central composite design (CCD) was applied to assess the effects of simultaneously changing the empty bed contact time (EBCTs of 5.0-15.0 h; corresponding to theoretical hydraulic retention times of 3.3-9.9 h) and bicarbonate (HCO₃⁻) inlet concentration (0.50-1.59 g HCO₃⁻/l) on the removal rate of NO₃⁻-N, and additional organic and inorganic nutrients, in effluent deriving from an experimental recirculating aquaculture system (RAS). Volumetric NO₃⁻-N removal rates ranged from 5.20 ± 0.02 to 8.96 ± 0.19 g/m³/day and were enhanced by adding bicarbonate, suggesting that parts of the removal was due to autotrophic denitrification. The highest N removal rate (8.96 ± 0.05 g/m³/day) was achieved at an EBCT and HCO₃⁻ combination of 15 h and 1.59 g HCO₃⁻/l. Bicarbonate inlet concentration as a single factor had the strongest effect on N removal rates followed by the interaction with EBCT, and EBCT² (quadratic term). The study thus indicates that woodchip beds may be applied and optimized for removing nitrate from aquaculture effluents. Statement of relevance: This study is a relevant contribution to research in aquaculture as it presents an alternative method for removing nitrates from aquaculture effluents especially for less intensive fish farms. Furthermore, it shows how this method can be optimized to yield higher removal rates of nitrate.
Publication information
Journal: Aquaculture
Volume: 458
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.136 SNIP 1.3 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.212 SNIP 1.487 CiteScore 2.32
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.294 SNIP 1.542 CiteScore 2.39
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.151 SNIP 1.394
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.941 SNIP 1.263
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.909 SNIP 1.173
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.019 SNIP 1.318
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.008 SNIP 1.689
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.915 SNIP 1.236
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.016 SNIP 1.627
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.121 SNIP 1.926
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.992 SNIP 1.418
Peracetic acid is a suitable disinfectant for recirculating fish-microalgae integrated multi-trophic aquaculture systems

Integrated multi-trophic aquaculture (IMTA) is a promising direction for the sustainable development of aquaculture. Microalgae have good potential to be integrated with recirculating aquaculture systems because they can use the nitrogen excreted from fish and share the same optimal pH value as in aquaculture. As a byproduct, the microalgae biomass can be used for fish feed or biofuel. How-ever, the recirculating fish-microalgae IMTA system is under constant threat from fish pathogens and phytoplankton-lytic bacteria. Therefore, it is necessary to apply proper disinfectants as prophylaxis or treatment which are effective against these threats, but safe to fish and microalgae. For this purpose, peracetic acid (PAA) is a valid option because it is highly effective against fish pathogens and bacteria at low concentrations and degrades spontaneously to harmless residues. In the present study, we exposed the culture of a marine microalgae Tetraselmis chuii once per day for four days to four PAA products with differing hydrogen peroxide (H2O2)/PAA proportions at two concentrations (1 and 2 mg L−1PAA). The H2O2 solutions at equivalent total peroxide (H2O2+ PAA) concentrations were tested in parallel. The results show that the growth and photosynthesis of T. chuii were not affected by three of the PAA products (Wofasteril® E400, Wofasteril® E250 and Applichem® 150) and equivalent H2O2 solutions at both concentrations. In contrast, Wofasteril® Lspez and an equivalent H2O2 solution at both concentrations caused irreversible culture collapse, photosynthesis dysfunction and irreversible cell damage. In conclusion, PAA products with low proportions of H2O2 are optimal disinfectants for fish-microalgae IMTA systems.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin, Agricultural Research Service
Authors: Liu, D. (Ekstern), Behrens, S. (Ekstern), Pedersen, L. (Intern), Straus, D. L. (Ekstern), Meinelt, T. (Ekstern)
Pages: 136-142
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture Reports
Volume: 4
ISSN (Print): 2352-5134
Ratings:
Scopus rating (2016): CiteScore 1.06 SJR 0.499 SNIP 0.742
Web of Science (2016): Indexed yes
Original language: English
Electronic versions: Publishers_version.pdf
Probiotics as beneficial microbes in aquaculture: an update on their multiple modes of action: a review

Wide and discriminate use of antibiotics has resulted in serious biological and ecological concerns, especially the emergence of antibiotic resistance. Probiotics, known as beneficial microbes, are being proposed as an effective and eco-friendly alternative to antibiotics. They were first applied in aquaculture species more than three decades ago, but considerable attention had been given only in the early 2000s. Probiotics are defined as live or dead, or even a component of the microorganisms that act under different modes of action in conferring beneficial effects to the host or to its environment. Several probiotics have been characterized and applied in fish and a number of them are of host origin.

Unlike some disease control alternatives being adapted and proposed in aquaculture where actions are unilateral, the immense potential of probiotics lies on their multiple mechanisms in conferring benefits to the host fish and the rearing environment. The staggering number of probiotics papers in aquaculture highlights the multitude of advantages from these microorganisms and conspicuously position them in the dynamic search for health-promoting alternatives for cultured fish. This paper provides an update on the use of probiotics in finfish aquaculture, particularly focusing on their modes of action. It explores the contemporary understanding of their spatial and nutritional competitiveness, inhibitory metabolites, environmental modification capability, immunomodulatory potential and stress-alleviating mechanism. This timely update affirms the importance of probiotics in fostering sustainable approaches in aquaculture and provides avenues in furthering its research and development.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Iranian Fisheries Science Research Institute (IFSRI), Shiraz University, Indian Veterinary Research Institute
Number of pages: 14
Pages: 228-241
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Veterinary Quarterly
Volume: 36
Issue number: 4
ISSN (Print): 0165-2176
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.94 SJR 0.465 SNIP 0.536
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.395 SNIP 0.513 CiteScore 0.76
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.418 SNIP 0.429 CiteScore 0.83
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.294 SNIP 0.423 CiteScore 0.58
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.247 SNIP 0.511 CiteScore 0.72
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Pulse vs. Continuous treatment: which is better for applying peracetic acid in RAS?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Agricultural Research Service, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin
Authors: Liu, D. (Ekstern), Pedersen, L. (Intern), Lazado, C. C. (Intern), Straus, D. L. (Ekstern), Meinelt, T. (Ekstern)
Publication date: 2016
Event: Abstract from International Conference on Recirculating Aquaculture, Roanoke, VA, United States.
Main Research Area: Technical/natural sciences
Start-up performance of a woodchip bioreactor operated end-of-pipe at a commercial fish farm—A case study
There is a need for simple, maintenance-free technologies for removing nitrogen (N) from aquaculture effluents. Denitrifying woodchip bioreactors have been used successfully to remove nitrate-N (NO₃-N) from ground and surface waters and may potentially be applied to dilute aquaculture effluents as well. Real-life applicability in commercial, outdoor fish farms including practical start-up issues such as e.g. time till stable performance and potential leaching are, however, unknown to the industry. This case study consequently investigated the temporal performance of a woodchip bioreactor (12.5 m³) during start-up. The bioreactor was operated end-of-pipe at a commercial, outdoor rainbow trout (Oncorhynchus mykiss) farm in Denmark operated at low recirculation intensity. Applying an empty bed contact time (EBCT) of 5 h, the specific objectives of the study were to resolve: i) how fast the bioreactor would start to remove NO₃-N; ii) how fast steady state was achieved; iii) which NO₃-N removal rates could be attained at the relatively low effluent temperature (~8 °C) and iv) to which extent any concomitant leaching of phosphorous (P), ammonia or organic matter would occur. In- and outlet grab samples were obtained every 6 h until the bioreactor was in steady state (2 weeks) followed by weekly 24 h pooled samples for another 3 weeks (5 weeks in total). Additional grab samples were obtained from 9 sampling ports within the bioreactor on 3 consecutive days during steady state. Samples were analyzed for dissolved nutrients (total N, nitrate, nitrite, ammonium, total phosphorous, ortho-phosphorous, BOD₅ and COD). In addition, oxygen, temperature and pH were logged every 30 min while sampling and alkalinity were measured once a week. Removal of NO₃-N started immediately and remained stable at 7.06 ± 0.81 g NO₃-N/m³/d (n = 6) throughout the sampling period. Increased effluent NO₂-N concentrations (peaking at 1.14 mg NO₂-N/l after 4–5 days) were transiently observed during the initial 11 days. After that, the woodchip bioreactor was largely in steady state with respect to N-balances corroborated by a close match between filtered total-N (TN̄₅) and NO₃-N removal rates. Measurements within the bed showed that the majority of the influent dissolved oxygen (DO) was consumed within the first part of the bioreactor and that NO₃-N removal thereafter proceeded gradually with distance within the bed. Leaching of non-structural, dissolved organic compounds were observed just after startup, causing a short-term (1 week) increase in effluent concentrations of COD, BOD₅, P and ammonium. Additional measurements carried out until 147 days after start-up showed that the woodchip bioreactor continued to remove TN̄₅ at an average removal rate of 7.81 ± 0.82 g N/m³/d, and that the initial leakage of P stopped altogether. In summary, the study demonstrated that woodchip bioreactors can effectively remove NO₃-N from dilute aquacultural effluents at low temperatures and commercial conditions and that stable performance is achieved within a few weeks.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: von Ahnen, M. (Intern), Pedersen, P. B. (Intern), Dalsgaard, A. J. T. (Intern)
Pages: 96-104
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquacultural Engineering
Volume: 74
ISSN (Print): 0144-8609
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.09 SJR 0.798 SNIP 1.525
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.723 SNIP 1.148 CiteScore 1.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.72 SNIP 1.437 CiteScore 1.61
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.666 SNIP 1.511 CiteScore 1.8
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.946 SNIP 1.377 CiteScore 1.72
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.69 SNIP 1.406 CiteScore 1.54
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.55 SNIP 0.945
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.717 SNIP 1.424
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.734 SNIP 1.154
Scopus rating (2007): SJR 0.699 SNIP 1.088
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.629 SNIP 1.191
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.615 SNIP 1.123
Scopus rating (2004): SJR 0.547 SNIP 1.204
Scopus rating (2003): SJR 0.893 SNIP 1.435
Scopus rating (2002): SJR 0.344 SNIP 0.737
Scopus rating (2001): SJR 0.617 SNIP 0.825
Scopus rating (2000): SJR 0.307 SNIP 0.785
Scopus rating (1999): SJR 0.313 SNIP 0.644
Original language: English
Aquatic Science, Denitrification, End-of-pipe treatment, Field study, Nitrogen, Alkalinity, Aquaculture, Bioreactors, Dissolution, Dissolved oxygen, Effluents, Fish, Leaching, Nitrates, Nitrogen oxides, Organic compounds, Phosphorus, Aquaculture effluents, Dissolved organic compounds, Effluent concentrations, Empty bed contact time, Field studies, Rainbow trouts (Oncorhynchus mykiss), Temporal performance, Bioconversion, Oncorhynchus mykiss
DOIs: 10.1016/j.aquaeng.2016.07.002
Source: FindIt
Source-ID: 2306369502
Publication: Research - peer-review › Journal article – Annual report year: 2016

Stress-resilience differences related to emergence time in farmed rainbow trout

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Gesto, M. (Intern), Jokumsen, A. (Intern)
Publication date: 2016
Event: Abstract from 8th International Symposium on Fish Endocrinology, Gothenburg, Sweden.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2016

Stress-resilience differences related to emergence time in rainbow trout

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Gesto, M. (Intern), Jokumsen, A. (Intern)
Publication date: 2016
Event: Abstract from 8th International Symposium on Fish Endocrinology, Gothenburg, Sweden.
Main Research Area: Technical/natural sciences

Bibliographical note
Supplementing enzymes to extruded, soybean based diet improves breakdown of non-starch polysaccharides in rainbow trout (Oncorhynchus mykiss)

Plant-based feed ingredients typically contain remnants of dietary fibres [DF; non-starch polysaccharides (NSP) and lignin] that have various antinutritive effects in carnivorous fish. Exogenous enzymes have been shown to improve the apparent digestibility coefficients (ADC) of plant-based diets presumably by assisting in the breakdown of NSP. This study examined the effects on NSP degradation when supplementing β-glucanase, xylanase, protease or a mix of the three enzymes to an extruded, juvenile rainbow trout (Oncorhynchus mykiss) diet containing 344 g kg⁻¹ de-hulled, solvent-extracted soybean meal (SBM). The NSP content in the non-supplemented control diet and in faecal samples from the dietary treatment groups was analysed to determine the recovery/apparent digestibility of cellulose and total non-cellulosic polysaccharide (T-NCP) sugar monomers. The enzymes had significant, positive effects at the pH range and temperature prevailing in the gastrointestinal tract: β-glucanase improved the ADC of mannose, galactose and uronic acids; xylanase and protease improved the ADC of xylose; and protease furthermore improved the ADC of mannose and uronic acids. There were no effects when supplementing all three enzymes together. In conclusion, exogenous enzymes may potentially be applied to fish feed containing SBM, assisting in the breakdown of NSP and alleviating some of the antinutritive effects.

General Information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Aarhus University, DSM Nutritional Products, BioMar A/S
Authors: Dalsgaard, A. J. T. (Intern), Knudsen, K. E. B. (Ekstern), Verlhac, V. (Ekstern), Ekmann, K. S. (Ekstern), Pedersen, P. B. (Intern)
Pages: 419–426
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture Nutrition
Volume: 22
Issue number: 2
ISSN (Print): 1353-5773
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.957 SNIP 1.448 CiteScore 1.96
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.005 SNIP 1.216 CiteScore 1.86
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.159 SNIP 1.285 CiteScore 1.8
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.205 SNIP 1.207 CiteScore 2.16
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.343 SNIP 1.158 CiteScore 1.9
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.216 SNIP 1.654 CiteScore 2.15
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
The relation between EU regulation on organic aquaculture and scientific knowledge on production systems

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Abbink, W. (Ekstern), Lembo, G. (Ekstern), Jokumsen, A. (Intern), Sæther, B. (Ekstern), Noble, C. (Ekstern), Nielsen, H. (Ekstern), Adámek, Z. (Ekstern)
Publication date: 2016
Event: Abstract from Aquaculture Europe 2016, Edinburgh, United Kingdom.
Main Research Area: Technical/natural sciences

Welfare, Health and Individuality in Farmed FISH: The WINFISH project

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, IFREMER, Uppsala University
Authors: Winberg, S. (Ekstern), Bégout, M. (Ekstern), Roque, A. (Ekstern), Manfrin, A. (Ekstern), Villarroel, M. (Ekstern), Gesto, M. (Intern)
Publication date: 2016
Event: Abstract from 8th International Symposium on Fish Endocrinology, Gothenburg, Sweden.
Main Research Area: Technical/natural sciences

Bibliographical note
Conference abstract for conference
Source: PublicationPreSubmission
Source-ID: 125988198
Publication: Research › Conference abstract for conference – Annual report year: 2016

3rd NordicRAS Workshop on Recirculating Aquaculture Systems, Molde, Norway, 30 September - 1 October 2015: Book of Abstracts

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Dalsgaard, A. J. T. (ed.) (Intern)
Acute toxicity of peracetic acid (PAA) to fish

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Agricultural Research Service, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin
Authors: Ledbetter, C. K. (Ekstern), Farmer, B. D. (Ekstern), Straus, D. L. (Ekstern), Meinelt, T. (Ekstern), Pedersen, L. (Intern)
Publication date: 2015
Event: Abstract from Food Security for the Future: The Role of Aquatic Health, Mississippi, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2016

Acute toxicity of peracetic acid to various fish species

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Agricultural Research Service, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin
Authors: Straus, D. L. (Ekstern), Ledbetter, C. K. (Ekstern), Farmer, B. D. (Ekstern), Meinelt, T. (Ekstern), Pedersen, L. (Intern)
Pages: 188-188
Publication date: 2015

Host publication information
Title of host publication: 17th International Conference on Diseases of Fish and Shellfish: Abstract book
Place of publication: Las Palmas
Publisher: European Association of Fish Pathologists
Article number: O-180
Main Research Area: Technical/natural sciences
Conference: 17th International Conference on Diseases of Fish and Shellfish, Las Palmas, Spain, 07/09/2015 - 07/09/2015
Electronic versions:
Book_of_abstracts_17th_International_conference_on_Diseases_of_Fish_and_Shellfish.pdf
Publication: Research › Conference abstract in proceedings – Annual report year: 2015

Anaerobic digestion of solid waste in RAS: Effect of reactor type on the biochemical acidogenic potential (BAP) and assessment of the biochemical methane potential (BMP) by a batch assay

Anaerobic digestion is a way to utilize the potential energy contained in solid waste produced in recirculating aquaculture systems (RASs), either by providing acidogenic products for driving heterotrophic denitrification on site or by directly producing combustive methane. In this study the biochemical acidogenic potential of solid waste from juvenile rainbow trout was evaluated by measuring the yield of volatile fatty acids (VFA) during anaerobic digestion by batch or fed-batch reactor operation at hydrolysis time (HT) / hydraulic retention time (HRT) of 1, 5, or 10 days (and for batch additional 14 and 20 days) in continuously stirred tank reactors. Generally, the VFA yield increased with time and no effect of the reactor type used was found within the time frame of the experiment. At 10 days HT or 10 days HRT the VFA yield reached 222.3 ± 30.5 and 203.4 ± 11.2 mg VFA g-1 TVS0 (total
volatile solids at day 0) in batch and fed-batch reactor, respectively. For the fedbatch reactor, increasing HRT from 5 to 10
days gained no significant additional VFA yield. Prolonging the batch reactor experiment to 20 days increased VFA
production further (273.9 ± 1.6 mg VFA g⁻¹ TVS₀, n=2). After 10 days HT / HRT, 16.8 - 23.5 % of total Kjeldahl N was
found as TAN and 44.3 - 53.0 % of total P was found as ortho-phosphate. A significant difference between reactor types
was detected for the phosphorous dissolution at 5 days HT / HRT as a relatively steep increase (of a factor 2-3) in
ortho-P content occurred in fed-batch reactors but similar steep increase was only notable after 10 days HT for batch
reactors. No differences between reactor types at the other HT / HRT were recorded for P as well as (for all HT / HRT for)
N. Based on this study a HRT of approximately 5 days would be recommended for the design of an acidogenic
continuously stirred reactor tank in a RAS single-sludge denitrification set-up. The biochemical methane potential of the
sludge was estimated to 310 ± 29 g CH₄ g⁻¹ TVS₀ by a batch assay and represented a higher utility of the solid waste
when comparing the methane yield with the VFA yield (in COD units). This points towards a technological challenge of
ultimately increase the acidogenic output to match the methane yield as both products are formed from the same
reference point

**General information**

**State:** Published
**Organisations:** National Institute of Aquatic Resources, Section for Aquaculture
**Authors:** Suhr, K. I. (Intern), Letelier-Gordo, C. O. (Intern), Lund, I. (Intern)
**Pages:** 65-71
**Publication date:** 2015
**Main Research Area:** Technical/natural sciences

**Publication Information**

**Journal:** Aquacultural Engineering
**Volume:** 443
**ISSN (Print):** 0144-8609
**Ratings:**
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 2.09 SJR 0.798 SNIP 1.525
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 0.723 SNIP 1.148 CiteScore 1.63
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 0.72 SNIP 1.437 CiteScore 1.61
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 0.666 SNIP 1.511 CiteScore 1.8
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 0.946 SNIP 1.377 CiteScore 1.72
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 0.69 SNIP 1.406 CiteScore 1.54
- ISI indexed (2011): ISI indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 0.55 SNIP 0.945
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.717 SNIP 1.424
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 0.734 SNIP 1.154
An optimized and simplified method for analysing urea and ammonia in freshwater aquaculture systems

This study presents a simple urease method for analysis of ammonia and urea in freshwater aquaculture systems. Urea is hydrolysed into ammonia using urease followed by analysis of released ammonia using the salicylate-hypochlorite method. The hydrolysis of urea is performed at room temperature and without addition of a buffer. A number of tests were performed on water samples obtained from a commercial rainbow trout farm to determine the optimal urease concentration and time for complete hydrolysis. One mL of water sample was spiked with 1.3 mL urea at three different concentrations: 50 lg L\(^{-1}\), 100 lg L\(^{-1}\) and 200 lg L\(^{-1}\) urea-N. In addition, five concentrations of urease were tested, ranging from 0.1 U mL\(^{-1}\) to 4 U mL\(^{-1}\). Samples were hydrolysed for various time periods ranging from 5 to 120 min. A urease concentration of 0.4 U mL\(^{-1}\) and a hydrolysis period of 120 min gave the best results, with 99.6–101% recovery of urea-N in samples spiked with 100 or 200 lg L\(^{-1}\) urea-N.

The level of accurate quantification of ammonia using the method is 50 lg L\(^{-1}\) NH\(_4^+\)-N, and the detection level is 5–10 lg L\(^{-1}\) NH\(_4^+\)-N.
Biofilter effects on micro particle dynamics

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Fernandes, P. (Intern), Pedersen, L. (Intern), Pedersen, P. B. (Intern)
Pages: 22
Publication date: 2015

Host publication information
Title of host publication: 3rd NordicRAS Workshop on Recirculating Aquaculture Systems Molde, Norway, 30 September - 1 October 2015: Book of Abstracts
Publisher: National Institute of Aquatic Resources, Technical University of Denmark
Editor: Dalsgaard, A. T.
Series: DTU Aqua Report
Number: 301-2015
Boom for økologiske linemuslinger

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Jokumsen, A. (Intern)
Publication date: 2015

Publication information
Source/Publisher: OrganicToday
Main Research Area: Technical/natural sciences
Publication: Communication › Internet publication – Annual report year: 2016

Boom in production of organic line mussels in Denmark

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Jokumsen, A. (Intern)
Pages: 3
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture Europe Magazine
Issue number: March/April
ISSN (Print): 1018-9661
Original language: English
Publication: Research › Journal article – Annual report year: 2015

Boosting the quality of organic trout fry

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Jokumsen, A. (Intern)
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Hatchery International
ISSN (Print): 1498-136X
Original language: English
Electronic versions:
Publishers_version
Publication: Research › Journal article – Annual report year: 2015

Challenges in sourcing of feed ingredients for organic production of carnivorous Fish

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Berge, G. (Ekstern), Jokumsen, A. (Intern), Lembo, G. (Ekstern), Spedicato, M. (Ekstern)
Publication date: 2015
Event: Abstract from Aquaculture Europe 2015, Rotterdam, Netherlands.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2016
Characterising organic matter in recirculating aquaculture systems with fluorescence EEM spectroscopy

The potential of recirculating aquaculture systems (RAS) in the aquaculture industry is increasingly being acknowledged. Along with intensified application, the need to better characterise and understand the accumulated dissolved organic matter (DOM) within these systems increases. Mature RASs, stocked with rainbow trout and operated at steady state at four feed loadings, were analysed by dissolved organic carbon (DOC) analysis and fluorescence excitation-emission matrix (EEM) spectroscopy. The fluorescence dataset was then decomposed by PARAFAC analysis using the drEEM toolbox. This revealed that the fluorescence character of the RAS water could be represented by five components, of which four have previously been identified in fresh water, coastal marine water, wetlands and drinking water. The fluorescence components as well as the DOC showed positive correlations with feed loading, however there was considerable variation between the five fluorescence components with respect to the degree of accumulation with feed loading. The five components were found to originate from three sources: the feed; the influent tap water (groundwater); and processes related to the fish and the water treatment system. This paper details the first application of fluorescence EEM spectroscopy to assess DOM in RAS, and highlights the potential applications of this technique within future RAS management strategies.
Comparison of the toxicity of Wofasteril Peracetic Acid formulations E400, E250, and Lspez to Daphnia magna with emphasis on the effect of hydrogen peroxide

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Humboldt-Universität zu Berlin, Agricultural Research Service, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin
Authors: Liu, D. (Ekstern), Straus, D. L. (Ekstern), Pedersen, L. (Intern), Meinelt, T. (Ekstern)
Pages: 128-135
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: North American Journal of Aquaculture
Volume: 77
Issue number: 2
ISSN (Print): 1522-2055
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.438 SNIP 0.719 CiteScore 0.85
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.436 SNIP 0.516 CiteScore 0.7
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Consumer perception and scientific knowledge of stocking density in organic aquaculture

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Espmark, Å. (Ekstern), Honkanen, P. (Ekstern), Altintzoglou, T. (Ekstern), Sæther, B. (Ekstern), Noble, C. (Ekstern), Abbink, W. (Ekstern), Jokumsen, A. (Intern), Lembo, G. (Ekstern), Spedicato, M. (Ekstern), Ljung, M. (Ekstern), Blancheton, J. (Ekstern), Olesen, I. (Ekstern)
Publication date: 2015
Event: Abstract from Aquaculture Europe 2015, Rotterdam, Netherlands.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2016

Cortisol levels and expression of selected stress- and apoptosis-related genes in the embryos of Atlantic cod, Gadus morhua following short-term exposure to air

Embryos (morula stage) of Atlantic cod, Gadus morhua L., were collected and subjected to air exposure for 2 min. followed by recovery at ambient conditions in the rearing container. Total immunoreactive cortisol and transcription of selected stress- and apoptosis-related genes of the embryos were determined before the application of the stressor and at 0.5, 1 and 24 h post-exposure. There was no significant difference in the total cortisol levels of the fertilized eggs before and after handling stress. There was high expression level of hsp70 and sod before application of the stressor and significantly increased at 0.5 h postexposure. The expression levels of cat and gpx were weak to moderate and were not affected by the stressor. The apoptotic genes, mcl1 and NR-13 were highly expressed and significantly increased after exposure to air.
Bcl-X1 and Bcl-X2 were moderately expressed in the control samples, but only the expression level of Bcl-X1 significantly increased following exposure to air. Cluster analysis of the different gene expression levels indicated three categories: those genes that did not show any change in the expression levels post-air exposure; those that had low expression level in the control followed by a significant increase after air exposure; and those that had high expression levels in the control followed by a further increase in expression after air exposure. These results clearly demonstrate that there are potential molecular biomarkers of the response in cod embryos as a consequence of air exposure at a time when cortisol is not fully active.
Danish organic mussel production boom

Degradation of urea, ammonia and nitrite in moving bed biofilters operated at different feed loadings
Dietary methionine level affects growth performance and hepatic gene expression of GH-IGF system and protein turnover regulators in rainbow trout (Oncorhynchus mykiss) fed plant protein-based diets

The effects of dietary level of methionine were investigated in juvenile rainbow trout (Oncorhynchus mykiss) fed five plant-based diets containing increasing content of crystalline methionine (Met), in a six week growth trial. Changes in the hepatic expression of genes related to i) the somatotropic axis: including the growth hormone receptor I (GHR-I), insulin-like growth hormones land II (IGF-I and IGF-II, respectively), and insulin-like growth hormone binding protein-1b (IGFBP-1b); and ii) protein turnover: including the target of rapamycin protein (TOR), proteasome 20 delta (Prot 20D), cathepsin L, calpains 1 and 2 (Capn 1 and Capn 2, respectively), and calpastatin long and short isoforms (CAST-L and CAST-S, respectively) were measured for each dietary treatment. The transcript levels of GHR-I and IGF-I increased linearly with the increase of dietary Met content (P <0.01), reflecting overall growth performances. The apparent capacity for hepatic protein degradation (derived from the gene expression of TOR, Prot 20D, Capn 1, Capn 2, CAST-L and CAST-S) decreased with increasing dietary Met level in a relatively linear manner. Our results suggest that Met availability affects, directly or indirectly, the expression of genes involved in the GH/IGF axis response and protein turnover, which are centrally involved in the regulation of growth. (C) 2014 Elsevier Inc. All rights reserved.
The present study was undertaken to evaluate the potential for using oilseed by-products (soybean, copra and palm kernel meals) as partial replacements of fishmeal in feeds for Nile tilapia (Oreochromis niloticus). Nutrient digestibility and
postprandial ammonia excretion rates were examined. A fishmeal-based diet served as control against three test diets in which 30% of each of the oilseed by-products was included. Diets were randomly assigned to triplicate groups of fish (similar to 1 kg bulk weight) for the digestibility trials which spanned a total of 9 days. The partial inclusion of oilseed meals did not significantly affect apparent protein digestibility, although lipid, ash and dry matter digestibilities were significantly affected (p <0.05). Fish fed the soybean meal diets significantly reduced their feed intake and showed lower growth and feed utilization efficiencies over the trial period. The inclusions of the plant proteins caused a reduction in ammonia excretion rates with the palm kernel meal diet recording the lowest mean excretion rates of 117 mg kg(-1) day(-1) which was twofold lower than the highest mean daily ammonia excretion rate of the fish group fed the fishmeal-based control diets. Overall, the study confirmed the potential of using copra and palm kernel meals to partially replace fishmeal in Nile tilapia diets based on their effects on short-term growth and feed utilization, nutrient digestibilities and lower ammonia excretion rates, while soybean meal in an unrefined form is not a promising replacement for fishmeal in tilapia diets.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Kwame Nkrumah University of Science and Technology
Authors: Obirikorang, K. A. (Intern), Amisah, S. (Ekstern), Fialor, S. C. (Ekstern), Skov, P. V. (Intern)
Pages: 1249-1260
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture International
Volume: 23
Issue number: 5
ISSN (Print): 0967-6120
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.34 SJR 0.563 SNIP 1.014
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.585 SNIP 0.763 CiteScore 1.08
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.553 SNIP 0.765 CiteScore 1.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.626 SNIP 0.796 CiteScore 1.17
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.599 SNIP 1.04 CiteScore 1.15
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.553 SNIP 0.857 CiteScore 0.99
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.533 SNIP 0.832
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.43 SNIP 0.775
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.488 SNIP 0.566
Effect of plant proteins and crystalline amino acid supplementation on postprandial plasma amino acid profiles and metabolic response in rainbow trout (Oncorhynchus mykiss)

The use of aquafeeds formulated with plant protein sources supplemented with crystalline amino acids (CAAs) is believed to influence amino acid (AA) uptake patterns and AA metabolic fate. Oxygen consumption and ammonia excretion rates were measured in rainbow trout (468.5 +/- A 86.5 g) force fed 0.75 % of their body mass with a diet based on either (1) fish meal (FM), (2) pea protein concentrate (PPC), or (3) pea protein concentrate supplemented with histidine, lysine, methionine and threonine (PPC+) to mimic FM AA profile. The specific dynamic action and nitrogen quotient (NQ) were calculated for 48 h of the postprandial period. In parallel, plasma AA concentrations were measured in blood samples withdrawn from the caudal vein before and then 2, 4, 6, 8, 12, 20, 32 and 48 h after feed administration. The unbalanced diet PPC had a significantly higher NQ compared to FM (0.29 +/- A 0.09 and 0.18 +/- A 0.04, respectively), and plasma profiles of essential AAs reflected the dietary deficiencies. Supplementation with CAA in diet PPC+ resulted in an intermediary NQ (0.21 +/- A 0.04) and significantly affected plasma AA profiles, presenting greater and faster rises followed by sharp decreases compared to FM. The strongest effect was observed for methionine, presenting threefold higher concentrations at peak time for PPC+ compared to FM (297.0 +/- A 77.0 and 131.8 +/- A 39.0 nmol ml(-1), respectively). The differences in AA availability and metabolic profile in the pea diets compared to the FM diet were believed to be caused by an unbalanced dietary AA profile and CAA supplementation, rather than inclusion of plant protein concentrate.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, BioMar A/S
Authors: Rolland, M. (Intern), Larsen, B. K. (Intern), Holm, J. (Ekstern), Dalsgaard, A. J. T. (Intern), Skov, P. V. (Intern)
Number of pages: 17
Pages: 1071-1087
Publication date: 2015
Main Research Area: Technical/natural sciences
Publication information
Journal: Aquaculture International
Volume: 23
Issue number: 4
ISSN (Print): 0967-6120
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Effects of dietary inclusions of oilseed meals on physical characteristics and feed intake of diets for the Nile Tilapia, Oreochromis niloticus

The present study investigated the effects of the inclusion of three oilseed by-products (soybean, copra and palm kernel meals) on some physical characteristics of pelletized feeds as well as on voluntary feed intake and faecal matter production by the Nile tilapia, Oreochromis niloticus. The dietary inclusion of soybean meal resulted in a significantly higher feed bulk density relative to the fishmeal control diet. The inclusions of copra and palm kernel meals, however, resulted in lower feed bulk densities. Sinking rates, water stabilities and nutrient retention efficiencies of feed pellets were directly related to feed bulk densities. The soybean meal diet had the fastest sinking velocities, greatest water stability and highest nutrient retention rates. The dietary inclusion of soybean meal, however, significantly impaired feed intake
compared to the other three diets. Mean daily feed intakes of the control, palm kernel meal and copra meal diets
corresponded to 28.88, 27.01 and 28.31g during the experimental period and varied significantly from the mean daily
intake of the soybean meal diet which corresponded to 20.01g. Faecal matter production (g dry mass kg−1 ingested feed)
was significantly higher in the tilapia groups fed the copra and palm kernel meals. The results obtained from this study
show that 30% inclusions of unrefined forms of copra and palm kernel meal in Nile tilapia diets is possible, without
adversely affecting feed intake or pellet nutrient losses prior to ingestion.

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Obirikorang, K. A. (Intern), Amisah, S. (Ekstern), Fialor, S. C. (Ekstern), Skov, P. V. (Intern)
Pages: 43-49
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture Reports
Volume: 1
ISSN (Print): 2352-5134
Ratings:
Scopus rating (2016): CiteScore 1.06 SJR 0.499 SNIP 0.742
Web of Science (2016): Indexed yes
Original language: English
Oilseed byproducts, Water stability, Nutrient leaching, Feed intake, Nile Tilapia
Electronic versions:
Publishers version
DOIs:
10.1016/j.aqrep.2015.01.002
Links:
http://www.sciencedirect.com/science/article/pii/S2352513415000046#
Source: FindIt
Source-ID: 274951508
Publication: Research - peer-review › Journal article – Annual report year: 2015

Effects of emergence time and early social rearing environment on behaviour of Atlantic salmon: Consequences for
juvenile fitness and smolt migration
Consistent individual differences in behaviour have been well documented in a variety of animal taxa, but surprisingly little
is known about the fitness and life-history consequences of such individual variation. In wild salmonids, the timing of fry
emergence from gravel spawning nests has been suggested to be coupled with individual behavioural traits. Here, we
further investigate the link between timing of spawning nest emergence and behaviour of Atlantic salmon (Salmo salar),
test effects of social rearing environment on behavioural traits in fish with different emergence times, and assess whether
behavioural traits measured
in the laboratory predict growth, survival, and migration status in the wild. Atlantic
salmon fry were sorted with respect to emergence time from artificial spawning nest into three groups: early, intermediate,
and late. These emergence groups were hatchery-reared separately or in co-culture for four months to test effects of
social rearing environment on behavioural traits. Twenty fish from each of the six treatment groups were then subjected to
three individual-based behavioural tests: basal locomotor activity, boldness, and escape response. Following behavioural
characterization, the fish were released into a near-natural
experimental stream. Results showed differences in escape behaviour between emergence groups in a net restraining
test, but the social rearing environment did not affect individual behavioural expression. Emergence time and social
environment had no significant effects on survival, growth, and migration status in the stream, although migration
propensity was 1.4 to 1.9 times higher for early emerging individuals that were reared separately. In addition, despite
individuals showing considerable variation in behaviour across treatment groups, this was not translated into differences in
growth, survival, and migration status. Hence, our study adds to the view that fitness (i.e., growth and survival) and life-
history
predictions from laboratory measures of behaviour should be made with caution and ideally tested in nature

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Section for Aquaculture,
University of Gothenburg, Uppsala University, University of Agder, Carleton University
Authors: Larsen, M. H. (Intern), Johnsson, J. I. (Ekstern), Winberg, S. (Ekstern), Wilson, A. D. M. (Ekstern), Hammenstig,
D. (Ekstern), Thörnqvist, P. (Ekstern), Midwood, J. D. (Ekstern), Aarestrup, K. (Intern), Höglund, E. (Intern)
Publication date: 2015
Main Research Area: Technical/natural sciences
End-of-pipe removal of nitrogen using woodchip beds

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: von Ahnen, M. (Intern), Pedersen, P. B. (Intern), Dalsgaard, A. J. T. (Intern)
Estrés en peces: respuesta fisiológica y sus implicaciones en el cultivo de salmónidos

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Universidad de los Pagos, Universidad Austral de Chile
Authors: Munoz, J. L. P. (Ekstern), Mardones, O. (Ekstern), Chacoff, L. (Ekstern), Gesto, M. (Intern)
Pages: 55-57
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Salmonexpert
Issue number: 5
Original language: English

Bibliographical note
Communication to Salmonexpert journal (Chilean Journal, in Spanish)
Source: PublicationPreSubmission
Source-ID: 128002493
Publication: Research › Journal article – Annual report year: 2016

Evaluation of locally-available agroindustrial byproducts as partial replacements to fishmeal in diets for Nile Tilapia (Oreochromis niloticus) production in Ghana

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Kwame Nkrumah University of Science and Technology
Authors: Obirikorang, K. A. (Ekstern), Amisah, S. (Ekstern), Agbo, N. W. (Ekstern), Adjei-Boateng, D. (Ekstern), Adjei, N. G. (Ekstern), Skov, P. V. (Intern)
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Animal Research and Nutrition
Volume: 1
Issue number: 1:2
Article number: 2
Original language: English
Electronic versions:
Publishers version
Links:
http://animalnutrition.imedpub.com/archive.php
Publication: Research - peer-review › Journal article – Annual report year: 2016
Fast-starting after a breath: air-breathing motions are kinematically similar to escape responses in the catfish Hoplosternum littorale

Fast-starts are brief accelerations commonly observed in fish within the context of predator–prey interactions. In typical C-start escape responses, fish react to a threatening stimulus by bending their body into a C-shape during the first muscle contraction (i.e. stage 1) which provides a sudden acceleration away from the stimulus. Recently, similar C-starts have been recorded in fish aiming at a prey. Little is known about C-starts outside the context of predator–prey interactions, though recent work has shown that escape response can also be induced by high temperature. Here, we test the hypothesis that air-breathing fish may use C-starts in the context of gulping air at the surface. Hoplosternum littorale is an air-breathing freshwater catfish found in South America. Field video observations reveal that their air-breathing behaviour consists of air-gulping at the surface, followed by a fast turn which re-directs the fish towards the bottom. Using high-speed video in the laboratory, we compared the kinematics of the turn immediately following air-gulping performed by H. littorale in normoxia with those of mechanically-triggered C-start escape responses and with routine (i.e. spontaneous) turns. Our results show that air-breathing events overlap considerably with escape responses with a large stage 1 angle in terms of turning rates, distance covered and the relationship between these rates. Therefore, these two behaviours can be considered kinematically comparable, suggesting that air-breathing in this species is followed by escape-like C-start motions, presumably to minimise time at the surface and exposure to avian predators. These findings show that C-starts can occur in a variety of contexts in which fish may need to get away from areas of potential danger.

Feed composition affects sludge as a resource for denitrification

Feed composition affects sludge as a resource for denitrification
Fish-friendly prophylaxis/disinfection in aquaculture: Low concentration of peracetic acid is stress-free to the carp (Cyprinus carpio) after repeated applications

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin
Authors: Liu, D. (Ekstern), Pedersen, L. (Intern), Straus, D. (Ekstern), Meinelt, T. (Ekstern)
Publication date: 2015
Event: Abstract from 17th International Conference on Diseases of Fish and Shellfish, Las Palmas, Spain.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2016

Growth inhibition of Aeromonas salmonicida and Yersinia ruckeri by disinfectants containing peracetic acid
Peracetic acid (PAA) is a therapeutic agent used for disinfection in aquaculture, but it must be investigated thoroughly in order to mitigate diseases without harming the fish. Successful disinfectants (like PAA) should not leave dangerous residues in the environment in order to successfully contribute to sustainable aquaculture. The aim of our study was to compare the effectiveness of 6 commercial PAA products with different molecular PAA:H2O2 ratios to reduce bacterial growth of Aeromonas salmonicida and Yersinia ruckeri and to determine effective concentrations and exposure times. All products reduced colony-forming units (CFUs) of A. salmonicida and Y. ruckeri. Products with higher molecular PAA:H2O2 ratios inhibited growth better than products with lower molecular PAA:H2O2 ratios at the same PAA concentration; this indicates that H2O2 is not the driving force in the reduction of A. salmonicida and Y. ruckeri growth by PAA in vitro. The practical application of the products with high molecular PAA:H2O2 ratios should be prioritized if these pathogens are diagnosed

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin, Agricultural Research Service
Authors: Meinelt, T. (Ekstern), Phan, T. (Ekstern), Behrens, S. (Ekstern), Pedersen, L. (Intern), Wienke, A. (Ekstern), Liu, D. (Ekstern), Straus, D. L. (Ekstern)
Pages: 207-213
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Diseases of Aquatic Organisms
Volume: 113
Issue number: 3
ISSN (Print): 0177-5103

Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.95 SJR 0.858 SNIP 0.929
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.949 SNIP 0.935 CiteScore 1.96
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.889 SNIP 0.881 CiteScore 1.86
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.812 SNIP 0.918 CiteScore 1.77
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.912 SNIP 1.092 CiteScore 2.04
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.11 SNIP 1.165 CiteScore 2.29
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.91 SNIP 0.951
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.889 SNIP 0.99
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.859 SNIP 0.998
Scopus rating (2007): SJR 0.949 SNIP 1.054
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.868 SNIP 0.964
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.898 SNIP 1.046
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.972 SNIP 1.105
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.931 SNIP 1.187
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.083 SNIP 1.187
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.347 SNIP 1.197
Web of Science (2001): Indexed yes
Humoral and mucosal defense molecules rhythmically oscillate during a light–dark cycle in permit, Trachinotus falcatus

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Ministry of Agriculture and Rural Development
Authors: Lazado, C. C. (Intern), Lund, I. (Intern), Pedersen, P. B. (Intern), Nguyen, H. Q. (Ekstern)
Pages: 902-912
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Fish and Shellfish Immunology
Volume: 47
Issue number: 2
ISSN (Print): 1050-4648
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.36 SJR 1.114 SNIP 1.16
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.268 SNIP 1.171 CiteScore 3.19
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.138 SNIP 1.089 CiteScore 2.92
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.001 SNIP 1.149 CiteScore 3.11
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.151 SNIP 1.174 CiteScore 3.02
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.196 SNIP 1.265 CiteScore 3.52
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.131 SNIP 1.056
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.96 SNIP 1.101
Hydrogen peroxide decomposition kinetics in aquaculture water

Hydrogen peroxide (HP) is used in aquaculture systems where preventive or curative water treatments occasionally are required. Use of chemical agents can be challenging in recirculating aquaculture systems (RAS) due to extended water retention time and because the agents must not damage the fish reared or the nitrifying bacteria in the biofilters at concentrations required to eliminating pathogens. This calls for quantitative insight into the fate of the disinfectant residuals during water treatment. This paper presents a kinetic model that describes the HP decomposition in aquaculture water facilitated by microbial enzyme activity. The model describes how the hydrogen peroxide removal declines and eventually stops at relatively low chemical oxygen demand (COD) concentrations. It is hypothesized that this is due to an enzyme deficit because it is destructed due to the reactive radicals created during the HP decomposition. The model assumes that the enzyme decay is controlled by an inactivation stoichiometry related to the HP decomposition. In order to make the model easily applicable, it is furthermore assumed that the COD is a proxy of the active biomass concentration of the water and thereby the enzyme activity. This was, however, not measured. The model developed successfully described the removal of HP in aquaculture water from three types of RAS and model parameters are estimated. The model and the model parameters provide new information and are valuable tools to improve HP application in RAS by addressing disinfection demand and identify efficient and safe water treatment routines.

General information
State: Published
Organisations: Department of Environmental Engineering, National Institute of Aquatic Resources, Section for Aquaculture
Authors: Arvin, E. (Intern), Pedersen, L. (Intern)
Pages: 1-7
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquacultural Engineering
Volume: 64
ISSN (Print): 0144-8609
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
Improved growth performance in rainbow trout Oncorhynchus mykiss reared at high densities is linked to increased energy retention

Behaviour has been suggested as an underlying factor influencing how rearing density affects growth performance in Salmonid fishes. At low densities there is an elevated intensity of aggressive interactions and the formation of dominance hierarchies. As density increases, it is commonly assumed that aggression decreases, as the cost and effort required to establish and maintain dominance hierarchies increase. The increased energy expenditure associated with aggressive interactions has been identified as one mechanism causing a reduced efficiency in feed utilisation and therefore decreased growth performance. Manipulating aggressive behaviour through density may have advantages from a
practical perspective. In the present study the energetic expenditure of rainbow trout held at three densities, 25, 80 and 140 kg m\(^{-3}\), were related to growth performance parameters. Measurements for growth performance and parameters of energetics were investigated at the three densities during a four week growth period. The results showed a significant increase in routine metabolism in fish reared at 25 kg m\(^{-3}\) compared to groups reared at higher densities. The study concludes that in fish reared at density of 25 kg m\(^{-3}\), a higher fraction of the dietary energy intake was used to fuel activity rather than growth, as evidenced by significantly higher routine metabolism, reduced feed utilisation efficiency and a tendency for lower growth performance compared to fish reared at the higher densities. These results indicate a bioenergetic advantage of crowding. (C) 2015 Published by Elsevier B.V.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, University of Agder
Authors: Laursen, D. C. (Intern), Larsen, B. K. (Intern), Skov, P. V. (Intern), Höglund, E. (Intern)
Pages: 69-73
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture
Volume: 442
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.136 SNIP 1.3 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.212 SNIP 1.487 CiteScore 2.32
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.294 SNIP 1.542 CiteScore 2.39
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.151 SNIP 1.394
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.941 SNIP 1.263
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.909 SNIP 1.173
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.019 SNIP 1.318
Interactions between micro-particles and the rearing environment in recirculating aquaculture systems

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Fernandes, P. (Intern)
Number of pages: 122
Publication date: 2015

Publication information
Publisher: DTU Aqua. National Institute of Aquatic Resources
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:

Interactions between micro-particles and the rearing environment in recirculation aquaculture systems

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Fernandes, P. (Intern), Pedersen, L. (Intern), Pedersen, P. B. (Intern)
Number of pages: 113
Publication date: 2015

Publication information
Place of publication: Charlottenlund
Publisher: National Institute of Aquatic Resources, DTU Aqua. Technical University of Denmark
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Is gill cortisol concentration a good acute stress indicator in fish? A study in rainbow trout and zebrafish

Cortisol is the main biomarker of physiological stress in fish. It is usually measured in plasma, which requires blood collection. Though cortisol is produced in the anterior kidney, it can diffuse easily through cell membranes due to its lipophilic nature. Taking advantage of that, some non-invasive techniques have been developed to measure cortisol directly in the water from fish-holding tanks, in skin mucus or in scales. In this study, we explored the possibility to analyze fish cortisol from gill filaments as a reliable acute stress marker. Our results show that gill cortisol levels correlate well with plasma cortisol levels in both rainbow trout and zebrafish exposed or not to an acute stress protocol. Measuring cortisol in gill filaments increases the available possibilities for stress assessment in fish. Although this approach should yet be tested for its use with other stressors, it has several advantages: In relatively large fish (i.e. above 30 g) gill cortisol levels could be measured in vivo. Sampling of gill biopsies is very fast and easy, and the procedure does not induce stress if properly performed, making it an ideal option for in vivo stress assessment. In small fish, the use of gill tissue to measure cortisol has important technical advantages with respect to the current methods using whole-body homogenates. Gill homogenates could be used directly for ELISA cortisol analysis, avoiding the need of tedious and expensive cortisol extraction protocols, and, since no organic solvent is required, contributing for a more environmentally friendly analysis.

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Is warm-up important in fish locomotion? Recovery from anaerobic metabolism during exercise in striped surfperch Embiotoca lateralis

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Aquaculture, University of Porto, University of Iowa, University of Copenhagen, Consiglio Nazionale delle Ricerche
Authors: Svendsen, J. C. (Intern), Methling, C. (Intern), Tirsgaard, B. (Ekstern), Cordero, G. A. (Ekstern), Steffensen, J. F. (Ekstern), Domenici, P. (Ekstern)
Publication date: 2015
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2015

Live and let die: The rapid development of research to assess survival of discards in European fisheries

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Aquaculture
Authors: Catchpole, T. (Ekstern), Marlen, B. V. (Ekstern), Uhlmann, S. S. (Ekstern), Theunyck, R. (Ekstern), Randall, P. (Ekstern), Nilsson, H. (Ekstern), Mehault, S. (Ekstern), Kopp, D. (Ekstern), Wilms, I. (Ekstern), van der Reijden, K. (Ekstern), Molenaar, P. (Ekstern), Madsen, N. (Intern), Methling, C. (Intern), Breen, M. (Ekstern)
Publication date: 2015
Event:
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers_version
Local agro-industrial by-products with potential use in Ghanaian aquaculture: a review

The inability of Ghana's capture-based fisheries to meet national demand has placed aquaculture in an advantageous position to satisfy this supply deficit. The majority of fish farmers in Ghana, however, resort to local feed mixtures, occasionally in combination with commercial aquafeeds, demonstrating that the sector has not yet reached its full potential in terms of production volumes and efficiency. Fish meal is available in limited quantities and is prohibitively expensive in Ghana, making it essential to develop suitable complete and supplementary diets using low-cost and locally available plant by-products for use in fish grow-out facilities, particularly in tilapia production, which accounts for over 80% of aquaculture production. This review thus identifies local agro-industrial by-products with potential use in fish feeds based on their nutritional composition, total annual production, competition for and seasonal availability and dynamics of these products as well as prices. The effects of dietary inclusions of these by-products on fish growth and feed utilisation are also reviewed. Based on the published works and other practical information reviewed, these by-products represent huge potentials as alternative aquafeed protein sources because of their abundance, very affordable prices and healthy nutritional profiles for fish growth. Although this review focuses on Ghana, it can also be of direct benefit to fish farmers, feed manufacturers, researchers and the policy-makers in other regions of the world where these crops and their resulting by-products are produced in commercial quantities.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Kwame Nkrumah University of Science and Technology
Authors: Obirikorang, K. A. (Intern), Amisah, S. (Ekstern), Fialor, S. C. (Ekstern), Skov, P. V. (Intern)
Pages: 403-425
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture International
Volume: 23
Issue number: 2
ISSN (Print): 0967-6120
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.34 SJR 0.563 SNIP 1.014
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.585 SNIP 0.763 CiteScore 1.08
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.553 SNIP 0.765 CiteScore 1.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.626 SNIP 0.796 CiteScore 1.17
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.599 SNIP 1.04 CiteScore 1.15
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.553 SNIP 0.857 CiteScore 0.99
ISI indexed (2011): ISI indexed yes
Mechanisms of probiotic actions in shrimp: Implications to tropical aquaculture

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Bureau of Fisheries and Aquatic Resources, Temasek Polytechnic
Authors: Lazado, C. C. (Intern), Lacsamana, J. I. (Ekstern), Caipang, C. M. (Ekstern)
Pages: 89-114
Publication date: 2015

Host publication information
Title of host publication: Biotechnological Advances in Shrimp Health Management in the Philippines
Place of publication: Kerala
Publisher: Research Signpost
Editors: Caipang, C. M. A., Bacano-Maningas, M. B. I., Fagutao, F. F.
ISBN (Print): 978-81-308-0558-0
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Book chapter – Annual report year: 2015

Microbial water quality dynamics in RAS during system start-up

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Rojas-Tirado, P. A. (Intern), Pedersen, P. B. (Intern), Pedersen, L. (Intern)
Pages: 36
Publication date: 2015

Host publication information
Title of host publication: 3rd NordicRAS Workshop on Recirculating Aquaculture Systems Molde, Norway, 30 September - 1 October 2015 : Book of Abstracts
Publisher: National Institute of Aquatic Resources, Technical University of Denmark
Editor: Dalsgaard, A. T.
This study investigated the effects of three microscreen mesh sizes (100, 60 and 20 μm) on water quality and rainbow trout (Oncorhynchus mykiss) performance compared to a control group without microscreens, in triplicated recirculating aquaculture systems (RAS). Operational conditions were kept constant during a 6-week period where the microscreens were manually rinsed three times a day. The effects of microscreen cleaning frequency and nitrification performance were subsequently assessed.

Compared to the control group, microscreens removed particles, reduced particulate organic matter, and increased β-values. Particulate parameters reached steady-state in all treatment groups having microscreens at the end of the trial. The time to reach equilibrium seemingly increased with increasing mesh size but the three treatment groups (100, 60 and 20 μm) did not significantly differ at the end of the trial. Increased backwashing frequency over a 24-h period had no further significant effects on the parameters measured. The results demonstrated the role and importance of a microscreen, and showed that mesh size, within the range tested, is less important at long operations under constant conditions.

Fish performed similarly in all treatments. Preliminary screening of trout gills did not reveal any pathological changes related to microscreen filtration and the resulting water quality. Biofilter performance was also unaffected, with 0'-order nitrification rates (k0a) being equivalent for all twelve systems (0.148 ± 0.022 g N m⁻² d⁻¹).

Mechanisms for RAS equilibrium establishment, within and between systems with different mesh sizes, are discussed.
Monitoring RAS organic matter by fluorescence EEM spectroscopy

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Department of Environmental Engineering, Section for Aquaculture
Authors: Hambly, A. (Intern), Arvin, E. (Intern), Pedersen, L. (Intern), Pedersen, P. B. (Intern), Stedmon, C. (Intern)
Pages: 25
Publication date: 2015

Host publication information
Title of host publication: 3rd NordicRAS Workshop on Recirculating Aquaculture Systems Molde, Norway, 30 September - 1 October 2015 : Book of Abstracts
Publisher: National Institute of Aquatic Resources, Technical University of Denmark
Editor: Dalsgaard, A. T.

Series: DTU Aqua Report
Number: 301-2015
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Electronic versions:

Publication: Research › Conference abstract in proceedings – Annual report year: 2015
Natural selection constrains personality and brain gene expression differences in Atlantic salmon (Salmo salar)

In stream-spawning salmonid fishes there is a considerable variation in the timing of when fry leave the spawning nests and establish a feeding territory. The timing of emergence from spawning nests appears to be related to behavioural and physiological traits, e.g. early emerging fish are bolder and more aggressive. In the present study, emerging Atlantic salmon (Salmo salar L.) alevins were sorted into three fractions: early, intermediate and late emerging. At the parr stage, behaviour, stress responses, hindbrain monoaminergic activity and forebrain gene expression were explored in fish from the early and late emerging fractions (first and last 25%). The results show that when subjected to confinement stress, fish from the late emerging fraction respond with a larger activation of the brain serotonergic system than fish from the early fraction. Similarly, in late emerging fish, stress resulted in elevated expression of mRNA coding for serotonin 1A receptors (5-HT1A), GABA-A receptor-associated protein and ependymin, effects not observed in fish from the early emerging fraction. Moreover, fish from the early emerging fraction displayed bolder behaviour than their late emerging littermates. Taken together, these results suggest that time of emergence, boldness and aggression are linked to each other, forming a behavioural syndrome in juvenile salmon. Differences in brain gene expression between early and late emerging salmon add further support to a relationship between stress coping style and timing of emergence. However, early and late emerging salmon do not appear to differ in hypothalamus–pituitary–interrenal (HPI) axis reactivity, another characteristic of divergent stress coping styles.
Nitrification performance and robustness of fixed and moving bed biofilters having identical carrier elements

This study compared moving bed (MB) and fixed bed (FB) biofilter performance. The experimental recirculating aquaculture system had four equal biofilters in parallel. Each of the two replicated FB biofilters (with heavy elements) and the two MB biofilters (with neutral elements) had 200 l carrier media with a surface specific area to volume ratio of 750 m2/m3. Total ammonia nitrogen (TAN) and apparent nitrite removal rates were measured during identical steady-state conditions and during a water treatment event where 50 mg/l hydrogen peroxide was applied. FB biofilters were found to perform equal to or better than MB biofilters during the experimental phases. The average (n = 2) surface specific TAN removal in the FB biofilters was significantly higher than the MB biofilters (0.20 vs. 0.14; g N/m2/d) at steady state. The FB biofilters had a positive apparent nitrite removal (0.02 g N/m2/d) at steady state in contrast to MB biofilters releasing nitrite (~0.02 g N/m2/d). Application of H2O2 caused a transient five-fold TAN increase up to 1.05 mg N/l in the system. Prolonged elevated nitrite levels up to 2.85 mg N/l (>15 fold increase) was observed for one week due to reduced nitrite oxidation particularly in the MB biofilters. The findings indicate FB biofilters to be more resistant against the sanitizer applied, due to increased organic matter in the biofilters compared to MB biofilters. Aspects of the experimental setup are discussed in relation to other studies and commercial biofilter operations.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Pedersen, L. (Intern), Oosterveld, R. (Intern), Pedersen, P. B. (Intern)
Pages: 37-45
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquacultural Engineering
Volume: 65
ISSN (Print): 0144-8609
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.09 SJR 0.798 SNIP 1.525
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.723 SNIP 1.148 CiteScore 1.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.72 SNIP 1.437 CiteScore 1.61
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.666 SNIP 1.511 CiteScore 1.8
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.946 SNIP 1.377 CiteScore 1.72
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.69 SNIP 1.406 CiteScore 1.54
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.55 SNIP 0.945
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.717 SNIP 1.424
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.734 SNIP 1.154
Nitrogen waste from rainbow trout (Oncorhynchus mykiss) with particular focus on urea

Particulate and dissolved nitrogen (N) waste components are removed in recirculating aquaculture systems (RAS) using different cleaning technologies, and to dimension and optimize their removal efficiency requires that the expected daily load of the different waste forms can be estimated. Using a laboratory, mass-balance approach, the current study examined the effects of commercially applied feeding levels on the loading of different N waste forms, including daily fluctuations in dissolved total nitrogen (TN), total ammonia nitrogen (TAN), urea-N, and non-characterized, dissolved N deriving from juvenile rainbow trout (Oncorhynchus mykiss). In addition, the study examined whether there was a removal of urea-N across a moving bed biofilter operated as end-of-pipe under commercial conditions. The laboratory, mass-balance study showed that there were no effects of feeding levels (1.3, 1.5 or 1.7% of the biomass per day) on the excretion of dissolved N components, which constituted the majority of total N waste (>81.6% on average). The excretion of urea-N and non-characterized, dissolved N components constituted 12–13% and 9–11%, respectively of dissolved TN. The excretion of urea-N was largely constant and independent of the daily feeding practice, whereas that of non-characterized N appeared to reflect the daily feeding activity, following the trends in TN and TAN. The time limited feeding regime applied in the laboratory study resulted in a pulse in the excretion of TAN that a biofilter may be unable to fully level out, potentially resulting in unnoticed, critical water quality conditions in intensive RAS during certain times of the day. Particulate N waste constituted a minor fraction of total N waste (<18.4% on average), and the actual loading depended on the digestibility of dietary protein/nitrogen. Results from the commercially operated, nitrifying biofilter showed that urea-N was removed at a rate of 0.014 g N m⁻² day⁻¹. Compared to the removal of TAN (0.208 g N m⁻² day⁻¹), the moving bed biofilter was 1.07 times more active in removing dissolved N than immediately expected when only considering TAN.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Dalsgaard, A. J. T. (Intern), Larsen, B. K. (Intern), Pedersen, P. B. (Intern)
Pages: 2-9
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquacultural Engineering
Volume: 65
ISSN (Print): 0144-8609
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.09 SJR 0.798 SNIP 1.525
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.723 SNIP 1.148 CiteScore 1.63
Web of Science (2015): Indexed yes
Daily fluctuations, Feeding level, Nitrogen waste, TAN, Urea, Waste form

No evidence for a bioenergetic advantage from forced swimming in rainbow trout under a restrictive feeding regime

Sustained swimming at moderate speeds is considered beneficial in terms of the productive performance of salmonids, but the causative mechanisms have yet to be unequivocally established. In the present study, the effects of moderate exercise on the bioenergetics of rainbow trout were assessed during a 15 week growth experiment, in which fish were reared at three different current speeds: 1 BL s\(^{-1}\), 0.5 BL s\(^{-1}\) and still water (approximate to 0 BL s\(^{-1}\)). Randomly selected groups of 100 fish were distributed among twelve 600 L tanks and maintained on a restricted diet regime. Specific growth rate (SGR) and feed conversion ratio (FCR) were calculated from weight and length measurements every 3 weeks. Routine metabolic rate (RMR) was measured every hour as rate of oxygen consumption in the tanks, and was positively correlated with swimming speed. Total ammonia nitrogen (TAN) excretion rates showed a tendency to decrease with increasing swimming speeds, yet neither they nor the resulting nitrogen quotients (NQ) indicated that swimming significantly reduced the fraction of dietary protein used to fuel metabolism. Energetic budgets revealed a positive correlation between energy expenditure and the current speed at which fish were reared, fish that were forced to swim and were fed restrictively consequently had poorer growth and feed utilization. The results show that for rainbow trout, water current can negatively affect growth despite promoting minor positive changes in substrate utilization. We hypothesize that this may be the result of either a limited dietary energy supply from diet restriction being insufficient for both covering the extra costs of swimming and supporting enhanced growth.

General information

State: Published
Nutritional impacts on fish mucosa: immunostimulants, pre- and probiotics

Preventive health care by dietary manipulation has been regarded as a sustainable approach in modern aquaculture. This strategy is substantiated by remarkable evidence that nutrition is an important modulator of the fish immune system. From a plethora of feed supplements that are being utilized as health promoters in aquaculture, there are three major groups that have generated considerable attention: immunostimulants, prebiotics, and probiotics. These feed supplements vary in their modes of action in fish but their ability to boost not only the innate immunity but also the mucosal immunity positioned them as significant promoters of fish health. This chapter provides the basic concepts of immunostimulants, prebiotics, and probiotics and their contemporary importance in the health and welfare of aquacultured fish. Specifically, this chapter highlights the current understanding of the roles of each substance through dietary administration on the mucosal immunity of fish and provides a platform for the advancement and multi-contextual understanding of these feed supplements in future studies.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Temasek Polytechnic
Organic Trout Ova/Fry is already available from Danish Hatcheries

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Jokumsen, A. (Intern)
Pages: 1
Publication date: 2015
Main Research Area: Technical/natural sciences

**Publication information**
Journal: ICROFS news
Original language: English
Electronic versions:
28721.pdf
Links:
http://orgprints.org/28721/
Publication: Research › Journal article – Annual report year: 2015

Organic Trout Ova/Fry is already available from Danish Hatcheries

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Jokumsen, A. (Intern)
Pages: 27+36
Publication date: 2015
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Aquaculture Europe Magazine
Volume: 40
Issue number: 1
ISSN (Print): 1018-9661
Original language: English
Electronic versions:
28721.pdf
Links:
http://orgprints.org/28721/
Publication: Research › Journal article – Annual report year: 2015

Peracetic acid products expand sanitizing, organic water treatment options

**General information**
State: Published
Prospects of host-associated microorganisms in fish and penaeids as probiotics with immunomodulatory functions

Aquatic animals harbor a great number of microorganisms with interesting biological and biochemical diversity. Besides serving as the natural defense system of the host, the utilization potential of this microbial association has been identified particularly as reservoirs of candidate probiotics. Host-derived probiotics have gained popularity in recent years as they offer an alternative source of beneficial microbes to the industry that is customarily dependent on the use of terrestrial microorganisms. At present, there is an overwhelming number of candidate probiotics in aquaculture but their large-scale application is restricted by bio-technological concerns and fragmentary documented probiotic actions. This paper presents the current understanding on the use of probiotics as a sustainable alternative that promotes health and welfare in fish and penaeids. In particular, this paper discusses the relevance of host microbiota and its potential as a source of candidate probiotics. It also revisits the interaction between probiotics and host immunity to provide the foundation of the immunomodulatory functions of host-derived probiotics. Several studies demonstrating the immunomodulatory capabilities of host-derived candidate probiotics are given to establish the current knowledge and provide avenues for future research and development in this thematic area of probiotics research in aquaculture.
Recirculation technology getting mature: Preface

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Dalsgaard, A. J. T. (Intern), Pedersen, L. (Intern), Pedersen, P. B. (Intern)
Pages: 1
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information

Journal: Aquacultural Engineering
Reducing the dietary protein: Energy (P: E) ratio changes solubilization and fermentation of rainbow trout (Oncorhynchus mykiss) faeces

Nutrients discharged from aquaculture industries can detrimentally affect water recipients, and this problem must be addressed if the production is to be decoupled from the natural environment. Denitrification is a process by which nitrate is removed using soluble, readily biodegradable carbon compounds. Hydrolysis and concomitant fermentation of organic solids produces such soluble carbon compounds e.g. in the form of volatile fatty acids (VFAs). The current study examined the hydrolysis and the production of VFAs, the carbon:nitrogen ratio (C:N), and the release of nutrients (phosphorus and ammonium) from hydrolyzing and fermenting settable faecal solids (SFS) obtained from rainbow trout (Oncorhynchus mykiss). Triplicate tanks of fish were fed five isoenergetic experimental diets with different protein:energy (P:E) ratios: 15, 17, 19, 21, and 23. The SFS from four consecutive days were collected and pooled prior to incubation in 15, 1L anoxic/anaerobic batch reactors maintained at 20±2°C and continuous magnetic stirring. Daily samples from the batch reactors were obtained for 7 successive days and analyzed for total ammonia nitrogen (TAN), phosphorus expressed as orthophosphate (PO43--P), VFA, and soluble COD (sCOD). The results showed that the two lowest P:E ratio diets (i.e. 15 and 17) produced SFS with a significantly higher degree of solubilization measured as sCOD:total chemical oxygen demand (TCOD), compared to the higher P:E ratio diet 21 (0.30-0.29 versus 0.24g sCOD/g TCOD). Inversely, SFS deriving from the lowest P:E ratio diet (i.e. 15) displayed the lowest degree of fermentation measured as VFAs/sCOD, compared to SFS deriving from the four higher P:E diets (0.36 versus 0.51-0.56g VFA/g sCOD). In the same way, the lowest P:E diet showed a significantly lower solubilization of nitrogen measured as TAN:total Kjeldahl Nitrogen (TKN) compared to the three highest P:E diets (i.e. 19-23; 0.14 versus 0.26-0.34g TAN/g TKN). The two lowest P:E diets (i.e. 15-17) showed on the contrary the highest solubilization of phosphorus expressed as PO43--P:total phosphorus (TP) (0.15 and 0.08g/g, respectively) probably due to the lower pH obtained. All SFS produced enough soluble carbon, measured as VFAs, to stoichiometrically denitrify the nitrogen (N) contained in the faeces and potentially additionally 86-100% of all N produced from the fish culture process.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, BioMar A/S
Authors: Letelier-Gordo, C. O. (Intern), Dalsgaard, A. J. T. (Intern), Suhr, K. I. (Intern), Pedersen, P. B. (Intern), Ekmann, K. S. (Ekstern)
Pages: 22-29
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication Information
Journal: Aquacultural Engineering
Volume: 66
ISSN (Print): 0144-8609
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.09 SJR 0.798 SNIP 1.525
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.723 SNIP 1.148 CiteScore 1.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.72 SNIP 1.437 CiteScore 1.61
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.666 SNIP 1.511 CiteScore 1.8
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.946 SNIP 1.377 CiteScore 1.72
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Robust fiskeyngel en nødvendighed

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Jokumsen, A. (Intern)
Publication date: 2015

Publication information
Source/Publisher: www.okologi.dk
Main Research Area: Technical/natural sciences
Links:
Publicaion: Research › Internet publication – Annual report year: 2015

Room for all? - particulate surface area and bacterial activity in RAS

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Christian-Albrechts-Universität zu Kiel
Pages: 28
Publication date: 2015

Host publication information
Title of host publication: 3rd NordicRAS Workshop on Recirculating Aquaculture Systems Molde, Norway, 30 September - 1 October 2015: Book of Abstracts
Single-sludge denitrification in recirculating aquaculture systems: effects of pre-fermentation and pH

Single-sludge denitrification (DN) reactors in aquaculture use the carbonous solid fish waste produced in the system to reduce the discharged nitrate load. The solid waste is available for denitrifiers when present in soluble, readily biodegradable form, and the transformation is accomplished by bacterial hydrolysis and fermentation. The objective of this study was to quantify the effect of pre-fermentation of solid fish waste on single-sludge DN reactor efficiency. Pre-fermentation times tested were 0 d (no pre-fermentation), 1 d, 5 d, and 10 d, and the efficiency was quantified as the potential DN rate obtained in laboratory assays. Results showed that the highest DN rate was achieved with 1 d pre-fermentation. The volumetric DN rates measured in decreasing order were 23.4 +/- 0.00 mg NO3-N L-1 h(-1) (1 d), 20.5 +/- 0.35 mg NO3-N L-1 h(-1) (5 d), 17.0 +/- 0.47 mg NO3-N L-1 h(-1) (10 d), and 14.2 +/- 0.24 mg NO3-N L-1 h(-1) (0 d). It was suspected that the poor utilization of soluble COD (sCOD) in the 5 d and 10 d pre-fermentation treatments was due to the low starting pH (pH <7). Subsequently, the experiments were repeated in 0.1 M HEPES buffer (pH = 7.1) and showed a clear correlation between specific DN rate and sCOD content. Overall, the highest increase in potential specific DN rate was achieved by applying pre-fermentation; e.g., from 0 d to 1 d, the increase was 123% and 106% at unadjusted pH and pH 7.1, respectively. An additional 20% increase was achieved at pH 7.1 by prolonging the pre-fermentation time to 5 d.
Stress and fear responses in the teleost pallium

Evolution has resulted in behavioural responses to threat which show extensive similarities between different animal species. The reaction to predator cues is one example of such prevailing responses, and functional homologies to mammalian limbic regions involved in threat-sensitive behaviour have been found in the teleost telencephalon. The dorsolateral (Dl) and dorsomedial (Dm) regions of the pallium are thought to perform hippocampus and amygdala-like
functions respectively. To what degree these regions are involved in the neuroendocrine responses to stress and predator cues however remains largely unknown. In the present study the involvement of DI and Dm in such responses was investigated by exposing Nile tilapia (Oreochromis niloticus) to a standardized confinement stress and to skin extract from conspecifics. Nile tilapia develops a characteristic anticipatory behaviour to hand feeding, and effects of skin extract on this behaviour and locomotor activity were studied to characterise threat sensitive behaviour. Nile tilapia responded behaviourally to conspecific alarm cues by reducing feeding anticipatory behaviour. This may reflect a general elevation of alertness, and further studies combining skin extract with other challenges are needed to reveal neuroendocrine effects associated with this predator cue. Confinement stress resulted in an elevation of cortisol and serotonin (5-hydroxytryptamine, 5-HT) metabolism in both DI and Dm. A similar tendency was observed in fish exposed to chemical alarm cues, but this effect did not reach the level of statistical significance. Hence, limbic responses to stress and fear, akin to those seen in extant mammals, are also present in the teleost lineage

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, University of Algarve, Norwegian University of Life Sciences
Pages: 17-22
Publication date: 2015
Main Research Area: Technical/natural sciences

**Publication Information**

Journal: Physiology & Behavior
Volume: 141
ISSN (Print): 0031-9384
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed Yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 2.53 SJR 1.05 SNIP 0.856
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 1.286 SNIP 1.006 CiteScore 2.92
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 1.489 SNIP 1.081 CiteScore 3.17
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 1.473 SNIP 1.107 CiteScore 3.29
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 1.287 SNIP 1.046 CiteScore 3.25
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 1.227 SNIP 1.039 CiteScore 3.23
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 1.271 SNIP 1.051
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 1.399 SNIP 1.184
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 1.283 SNIP 1.046
- Scopus rating (2007): SJR 1.162 SNIP 1.033
The relation between EU regulations on organic aquaculture and scientific knowledge of different welfare issues

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Abbink, W. (Ekstern), Lembo, G. (Ekstern), Jokumsen, A. (Intern), Spedicato, M. (Ekstern), Espmark, Å. (Ekstern), Sæther, B. (Ekstern), Nobile, C. (Ekstern), Manfrin, A. (Ekstern), Fiocchi, E. (Ekstern), Adámek, Z. (Ekstern), Röcklingsberg, H. (Ekstern), Olesen, I. (Ekstern)
Publication date: 2015
Event: Abstract from Aquaculture Europe 2015, Rotterdam, Netherlands.
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Journal article – Annual report year: 2015

Udvikling af dansk økologisk yngelopdræt

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Dansk Akvakultur
Authors: Larsen, V. J. (Ekstern), Henriksen, N. H. (Ekstern), Pedersen, L. (Intern), Jokumsen, A. (Intern)
Number of pages: 53
Publication date: 2015

Publication information
Publisher: Dansk Akvakultur
ISBN (Print): 978-87-997876-2-3
Original language: Danish
Series: Faglig rapport fra Dansk Akvakultur
Number: 2015-3
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers_version
Links:
http://www.danskaakvakultur.dk/media/12669/Projekt-%C3%98K0-yngel-projektrapport-230215-ENDELIG-VJL.pdf
Publication: Research › Report – Annual report year: 2015

Viral diseases of shrimp in the Philippines

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, University of the Philippines Visayas
Authors: Andrino-Felarca, K. G. S. (Ekstern), Estante, E. G. (Ekstern), Lazado, C. C. (Intern)
Pages: 19-44
Publication date: 2015

Host publication information
Coping with unpredictability: Dopaminergic and neurotrophic responses to omission of expected reward in Atlantic salmon (Salmo salar L.).

Comparative studies are imperative for understanding the evolution of adaptive neurobiological processes such as neural plasticity, cognition, and emotion. Previously we have reported that prolonged omission of expected rewards (OER, or ‘frustrative nonreward’) causes increased aggression in Atlantic salmon (Salmo salar). Here we report changes in brain monoaminergic activity and relative abundance of brain derived neurotrophic factor (BDNF) and dopamine receptor mRNA transcripts in the same paradigm. Groups of fish were initially conditioned to associate a flashing light with feeding. Subsequently, the expected food reward was delayed for 30 minutes during two out of three meals per day in the OER treatment, while the previously established routine was maintained in control groups. After 8 days there was no effect of OER on baseline brain stem serotonin (5-HT) or dopamine (DA) activity. Subsequent exposure to acute confinement stress led to increased plasma cortisol and elevated turnover of brain stem DA and 5-HT in all animals. The DA response was potentiated and DA receptor 1 (D1) mRNA abundance was reduced in the OER-exposed fish, indicating a sensitization of the DA system. In addition OER suppressed abundance of BDNF in the telencephalon of non-stressed fish. Regardless of OER treatment, a strong positive correlation between BDNF and D1 mRNA abundance was seen in non-stressed fish. This correlation was disrupted by acute stress, and replaced by a negative correlation between BDNF abundance and plasma cortisol concentration. These observations indicate a conserved link between DA, neurotrophin regulation, and corticosteroid-signaling pathways. The results also emphasize how fish models can be important tools in the study of neural plasticity and responsiveness to environmental unpredictability.
Daily micro particle distribution of an experimental recirculating aquaculture system – A case study

The particle size distribution (PSD) in a recirculating aquaculture system (RAS) was investigated during a 24-h cycle. PSD was analyzed in water sampled at several locations in a recirculation loop containing a 60-m drum filter, a submerged...
fixed-bed biofilter and a trickling filter. In relation to total counts, the system was dominated by micro-particles with particles smaller than 20 m comprising >94% of the distribution in all samples. However, the system presented a substantial volumetric influence of larger particles, reflected by a PSD derivate \( \gamma \)-value of 3.40 ± 0.18. Overall \( \gamma \)-value throughout the compartments \( p = 0.584 \) and experimental period \( p = 0.217 \) were not significantly different, although specific components seemed to marginally affect the PSD. A high internal water turnover rate (one system passage every 50 min) promoted the rapid removal of large particles from the system. Permanent volumetric particle removal above 60 m (31% reduction in the relative contribution from each size by the drum filter) per passage, but marginal production and removal of particles throughout the rest of the system further support the \( \gamma \)-value stability and consequent PSD equilibrium. The results showed a stable \( \gamma \)-value in the mature RAS. The \( \gamma \)-value is influenced by the contained compartments and system configuration, and may be used as a system performance-predicting tool. Mechanisms of particle influence on system and fish performance should be addressed in future studies, and are herein discussed.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Fernandes, P. (Intern), Pedersen, L. (Intern), Pedersen, P. B. (Intern)
Pages: 28-34
Publication date: 2014
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Aquacultural Engineering
Volume: 60
ISSN (Print): 0144-8609
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 2.09 SJR 0.798 SNIP 1.525
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 0.723 SNIP 1.148 CiteScore 1.63
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 0.72 SNIP 1.437 CiteScore 1.61
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 0.666 SNIP 1.511 CiteScore 1.8
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 0.946 SNIP 1.377 CiteScore 1.72
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 0.69 SNIP 1.406 CiteScore 1.54
- ISI indexed (2011): ISI indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 0.55 SNIP 0.945
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.717 SNIP 1.424
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 0.734 SNIP 1.154
- Scopus rating (2007): SJR 0.699 SNIP 1.088
Dietary LC-PUFA deficiency early in ontogeny induces behavioural changes in pike perch (Sander lucioperca) larvae and fry

This study examined whether dietary supply of DHA and phospholipids during early ontogeny affected the outcome of behavioural challenges in pike perch larvae and fry, and whether the history of lipid nutrition carried over in long-term effects on learning ability. Pike perch larvae were fed Artemia enriched with either refined olive oil high in oleic acid (A); refined olive oil supplemented with a low (B) or a high (C) level of DHA; or refined olive oil acid supplemented with fish oil with a high content of phospholipids (PL) and DHA (D). The enriched live diets were provided until 28 days post hatch (dph), at which time larval behavioural responses to visual and mechano-sensory stimuli were assessed. All dietary groups were subsequently fed an identical enriched live feed (diet D) and gradually weaned to an extruded dry feed, on which they were maintained for 112 days. At the end of this period, assessment of fry avoidance behaviour was repeated and individuals were tested for spatial learning ability in a maze. At the larval stage, individuals maintained on Artemia rich in DHA showed a 5–8 fold increase in swimming speed when subjected to a visually simulated predator test, a response that was not observed for larvae on diets low in DHA content. Independent of the predator simulation, larvae deficient or low in DHA exhibited significantly more time swimming along the edge of a test arena and had overall higher locomotor activities compared to larvae fed a diet with a high DHA content. Larvae on DHA rich diets showed an ability to achieve significantly higher peak acceleration rates during the escape response, which was maintained at 112 dph. Time spent locating the exit of a maze decreased with repetitious training sessions, although fish fed diets low in DHA spent longer time in the maze, caused by extended periods of inactivity or “freezing” behaviour (time lag) prior to the onset of active searching behaviour. The consistency of behavioural responses to mechano-sensory stimuli in larvae and fry suggests long-term effects on the neuromuscular path-way involved in escape responses. A longer period of freezing in the learning test may reflect a more anxious and fragile behaviour profile in fish fed low levels of DHA. Further studies should aim at verifying whether this affects performance related traits, such as immune competence and robustness.
Effects of dietary methionine on feed utilization, plasma amino acid profiles and gene expression in rainbow trout (Oncorhynchus mykiss)

Aquafeed formulation has evolved dramatically in response to shortages in marine raw materials, driven in part by the sustainable management of the wild stocks and an increased demand for nutrient-dense diets. Aquaculture of carnivorous species such as salmonids relies on extruded feeds with optimal protein and energy ratio to maximize the growth
performances. To support the increasing demands, aquafeeds contain increasing contributions of protein products from alternative origin. Plant raw materials can be suitable substitutions for fish meal, benefiting from a high availability, low cost and similar nutritive properties. The major limitation in using pant derived protein, at least when using high quality protein concentrate, is the amino acid profiles of plant protein, which differs from that of fish meal. Their inclusion in aquafeed results in a product deficient in essential amino acids (EAA) compared to dietary requirements. Supplementation with amino acids in crystalline from (CAA) is a common practice to balance the dietary amino acid profile to achieve high growth performances. However, complete substitution of fish meal using plant proteins and CAAs often results in poorer growth performances. The reason for this is often suggested to be related to difference in amino acid uptake kinetics during digestion, resulting in a temporal mismatch in amino acid availability, resulting in poorer at protein synthesis site. In addition to their role as building blocks in protein synthesis, amino acids also serve as substrates for synthesis of metabolic intermediates, and increasing evidence shows that amino acids also function as signaling factors in the regulation of intermediary metabolism and growth related pathways.

The present thesis comprises four supporting papers, based on two laboratories studies, investigating the effect of dietary amino acid level and form on i) growth performances, ii) plasma amino acid profiles and iii) on the expression of genes involved in hepatic metabolic and growth-related pathways in rainbow trout (Oncorhynchus mykiss).

The results from the first study are presented in Paper I and show that the protein source itself (fish meal or plant based) does not affect the plasma EAA profiles, but rather that plasma EAA levels reflect the dietary level. Supplementation with histidine, lysine and threonine in crystalline form to a plant based diet was, on the other hand, found to result in their plasma concentrations peaking earlier during the digestive process when comparing to other AAs supplied as protein-bound. In addition, to these early peaks in the plasma concentration, supplementation with crystalline methionine resulted in what can be best described as an apparent “accumulation” in the plasma, compared to fish fed similar dietary level but in protein bound form. The study further showed that the nitrogen excretion resulting from feeding an AA deficient diet was higher than for the fish meal control diet. Supplementation of the plant meal diet with crystalline amino acids tended to improved nitrogen utilization, almost equaling the results obtained for the fish meal control diet.

The relationship between dietary methionine level and form (free, coated and bound), and plasma amino acid profiles was further investigated in Paper II by applying statistical modeling to a large dataset (504 individuals and 20 variables). Using generalized additive models, it was shown that i) dietary methionine level and form explained 74 % of the variance in methionine plasma concentrations observed during digestion, and ii) that the dietary form of methionine and concomitant changes in methionine plasma concentrations significantly affected the plasma concentrations of several other essential AAs (arginine, histidine, isoleucine, leucine, lysine, phenylalanine, threonine and valine). Linear models revealed a positive relationship (R²=0.9) between plasma concentrations of the three branched chain amino acids (BCAAs; isoleucine, leucine and valine) during digestion of meals differing in dietary methionine levels.

Results from Paper III showed that dietary level and form (crystalline or protein-bound) of methionine affected the expression of hepatic genes related to i) the somatotropic axis and ii) protein turnover. For this purpose seven diets were fed to juvenile rainbow trout under control condition. The diets were formulated to differ only in methionine content (ranging from 0.6 to 1.29 % dry matter), supplied either in crystalline or protein-bound form. The transcript levels of the growth hormone receptor I (GHR-I) and insulin-like growth hormone I (IGF-I) increased linearly with dietary methionine content (P<0.01), which was reflected in the overall growth performances. In addition, the expressions of four components of the somatotropic axis investigated were significantly (P<0.05) affected by dietary methionine. The apparent capacity for hepatic protein degradation decreased with increasing dietary methionine level in a more or less linear manner. In comparison, the methionine source appeared to have limited effect on the expression pattern of protein degradation enzymes. The results suggest that methionine availability, influenced by dietary content or form, modulates the expression of genes involve in the GH/IGF response and protein turnover, further affecting growth performances.

Paper IV presents the results of the effects of dietary methionine level and form (free or bound) on hepatic intermediary metabolism using the same diets as in Paper III. The diets were fed to rainbow trout for 6 weeks, followed by sampling for i) hepatic gene expressions, ii) hepatosomatic index (HSI), iii) postprandial ammonia excretion, and iv) plasma methionine levels. The expression of several genes coding for enzymes involved in lipid metabolism (FAS, G6PD, CPT1a), gluconeogenesis (FBPase) and amino acid catabolism (ALT1, GHD and GLS01) responded in a linear manner (P<0.05) to gradual increase of dietary crystalline methionine; and were associated with a decrease in nitrogen excretion and relative liver mass. Additionally, the dietary form of methionine significantly affected postprandial plasma methionine concentrations as well as the expression of specific hepatic genes (G6PD, PEPCK, FBPase, G6Pase, ALT1, GHD and GLS02; P<0.05). Nitrogen excretion was found to be consistently higher for fish fed diets supplied with crystalline methionine than fish fed protein-bound methionine (P<0.05). This study is the first to demonstrate that expression of several genes related to intermediary metabolism respond in a dose-response manner to increasing levels of dietary methionine, and that the dietary source of methionine affect hepatic metabolism at the transcriptional level.

Dietary methionine, possibly in concert with other amino acids, appears to be a key regulatory factor in the expression of several genes involved in growth and intermediary metabolism. Furthermore, the gene expression seem to be significantly affected by crystalline methionine supplementation, as a possible explanation to the different utilization of CAA supplemented plant based diets, compared to conventional fish meal based diets.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Rolland, M. (Intern), Skov, P. V. (Intern), Dalsgaard, A. J. T. (Intern)
Number of pages: 173
Publication date: 2014
End-of-pipe single-sludge denitrification in pilot-scale recirculating aquaculture systems

A step toward environmental sustainability of recirculating aquaculture systems (RAS) is implementation of single-sludge denitrification, a process eliminating nitrate from the aqueous environment while reducing the organic matter discharge simultaneously. Two 1700 L pilot-scale RAS systems each with a 85 L denitrification (DN) reactor treating discharged water and hydrolyzed solid waste were setup to test the kinetics of nitrate and COD removal. Nitrate removal and COD reduction efficiency was measured at two different DN-reactor sludge ages (high X: 33–42 days and low X: 17–23 days). Nitrate and total N(NO3−+ NO2−+ NH4+) removal of the treated effluent water ranged from 73–99% and 60–95% during the periods, respectively, corresponding to an overall maximum RAS nitrate removal of approximately 75%. The specific nitrate removal rate increased from 17 to 23 mg NO3−-N (g TVS d)−1 and the maximal potential DN rate (measured at laboratory ideal conditions) increased correspondingly from 64–68 mg NO3−-N (g TVS d)−1 to 247–294 mg NO3−-N (g TVS d)−1 at high and low X, respectively. Quantification of denitrifiers in the DN-reactors by qPCR showed only minor differences upon the altered sludge removal practice. The hydrolysis unit improved the biodegradability of the solid waste by increasing volatile fatty acid COD content 74–76%. COD reductions in the DN-reactors were 64–70%. In conclusion, this study showed that single-sludge denitrification was a feasible way to reduce nitrate discharge from RAS, and higher DN rates were induced at lower sludge age/increased sludge removal regime. Improved control and optimization of reactor DN-activity may be achieved by further modifying reactor design and management scheme as indicated by the variation in and between the two DN-reactors.

Publication information

Journal: Aquacultural Engineering
Volume: 62
ISSN (Print): 0144-8609
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.09 SJR 0.798 SNIP 1.525
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.723 SNIP 1.148 CiteScore 1.63
General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Lembo, G. (Ekstern), Mente, E. (Ekstern), Garcia, A. E. (Ekstern), Jokumsen, A. (Intern)
Number of pages: 35
Publication date: 2014

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version
Links:
European Commission: Final report on aquaculture (part B)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Lembo, G. (Ekstern), Speiser, B. (Ekstern), Casey, J. (Ekstern), Garcia, A. E. (Ekstern), Jokumsen, A. (Intern), Papandroulakis, N. (Ekstern), Sorgeloos, P. (Ekstern)
Number of pages: 35
Publication date: 2014

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Links:

Feasibility case study in Belarus on the feasibility of Danish recirculation technology

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Nielsen, P. (Ekstern), Martti, N. (Ekstern), Roze, A. (Ekstern), Barulin, N. (Ekstern), Jokumsen, A. (Intern)
Number of pages: 39
Publication date: 2014

Publication information
ISBN (Print): 978-952-303-091-6
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Links:

Feasibility study guidelines to implement innovative land-based farm concepts

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Nielsen, P. (Ekstern), Järvisalo, O. (Ekstern), Jokumsen, A. (Intern)
Number of pages: 13
Publication date: 2014

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Links:
Feeding motivation as a personality trait in Nile tilapia (Oreochromis niloticus): role of serotonergic neurotransmission

Consistent individual variation in behaviour and physiology (i.e. animal personality or coping style) has emerged as a central topic in many biological disciplines. Yet, underlying mechanisms of crucial personality traits like feeding behaviour in novel environments remain unclear. Comparative studies, however, reveal a strong degree of evolutionary conservation of neural mechanisms controlling such behaviours throughout the vertebrate lineage. Previous studies have indicated duration of stress-induced anorexia as a consistent individual characteristic in teleost fishes. This study aims to determine to what degree brain 5-hydroxytryptamine (5-HT, serotonin) activity pertains to this aspect of animal personality, as a correlate to feed anticipatory behaviour and recovery of feed intake after transfer to a novel environment. Crucial to the definition of animal personality, a strong degree of individual consistency in different measures of feeding behaviour (feeding latency and feeding score), was demonstrated. Furthermore, low serotonergic activity in the hypothalamus was highly correlated with a personality characterized by high feeding motivation, with feeding motivation represented as an overall measure incorporating several behavioural parameters in a Principle Component Analyses (PCA). This study thus confirms individual variation in brain 5-HT neurotransmission as a correlate to complex behavioural syndromes related to feeding motivation.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Universidade do Algarve, Norwegian University of Life Sciences
Authors: Silva, P. (Ekstern), Martins, C. (Ekstern), Höglund, E. (Intern), Gjeen, H. M. (Ekstern), Øverli, Ø. (Ekstern)
Pages: 1547-1557
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Fish Physiology & Biochemistry
Volume: 40
Issue number: 5
ISSN (Print): 0920-1742
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.7 SJR 0.562 SNIP 0.821
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.736 SNIP 0.918 CiteScore 1.59
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.652 SNIP 0.891 CiteScore 1.77
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.708 SNIP 0.952 CiteScore 1.72
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.6 SNIP 1.192 CiteScore 1.76
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.659 SNIP 1.033 CiteScore 1.6
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.506 SNIP 0.858
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.444 SNIP 0.703
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.34 SNIP 0.54
Scopus rating (2007): SJR 0.253 SNIP 0.331
Forced swimming in rainbow trout does not confer a bioenergetic advantage but reduces the fraction of protein oxidized to fuel

Frustrative reward omission increases aggressive behaviour of inferior fighters
Animals use aggressive behaviour to gain access to resources, and individuals adjust their behaviour relative to resource value and own resource holding potential (RHP). Normally, smaller individuals have inferior fighting abilities compared with larger conspecifics. Affective and cognitive processes can alter contest dynamics, but the interaction between such effects and that of differing RHPs has not been adjudged. We investigated effects of omission of expected reward (OER) on competing individuals with contrasting RHPs. Small and large rainbow trout (Oncorhynchus mykiss) were conditioned to associate a light with reward. Thereafter, the reward was omitted for half of the fish prior to a contest between individuals possessing a 36–40% difference in RHP. Small control individuals displayed submissive behaviour and virtually no aggression. By contrast, small OER individuals were more aggressive, and two out of 11 became socially dominant. Increased aggression in small OER individuals was accompanied by increased serotonin levels in the dorsomedial pallium (proposed amygdala homologue), but no changes in limbic dopamine neurochemistry were observed in OER-exposed individuals. The behavioural and physiological response to OER in fish indicates that frustration is an evolutionarily conserved affective state. Moreover, our results indicate that aggressive motivation to reward unpredictability affects low RHP individuals strongest

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Skov, P. V. (Intern)
Publication date: 2014
Event: Abstract from 11th International Congress on the Biology of Fish, Edinburgh, United Kingdom.
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 98275563
Publication: Research › Conference abstract for conference – Annual report year: 2014
Future opportunities for bioeconomy in the West Nordic countries

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Icelandic Food Research, University of Iceland, Ministry of Fisheries, Hunting and Agriculture, SYNTESA, NordGen, iNOVA, Environment Agency of Iceland, Matis ltd.
Authors: Smáradóttir, S. E. (Ekstern), Magnúsdóttir, L. (Ekstern), Smára son, B. Ö. (Ekstern), Pórðarson, G. (Ekstern), Johannessen, B. (Ekstern), Stefansdóttir, E. K. (Ekstern), Jacobsen, B. (Ekstern), Laksá, U. (Ekstern), Solberg, S. Ö. (Ekstern), Vang, J. (Ekstern), Gunnarsdóttir, R. (Ekstern), Hreggviðsson, G. Ö. (Ekstern), Ingvarsson, G. B. (Ekstern), Jörundsdóttir, H. Ó. (Ekstern), Kristófersson, D. M. (Ekstern), Reykdal, Ó. (Ekstern), Paulsen, H. (Intern), Margeirsson, S. (Ekstern)
Number of pages: 118
Publication date: 2014

Influence of dietary lipid and protein sources on the sensory quality of organic rainbow trout (Oncorhynchus mykiss) after ice storage

The influence of dietary protein and lipid sources on the sensory quality of organic rainbow trout (Oncorhynchus mykiss) was studied. The protein and oil sources were fishmeal, fish oil, and organic vegetable protein and oils. Sensory profiling was performed during 3 to 14 days of ice storage along with lipid analyses of the fillet. Overall, the results showed that the sensory characteristics of the trout were affected in different ways during ice storage. The source of lipid seemed to affect the sensory quality at the beginning of the storage period, while the protein source seemed to have a more pronounced impact at the end of the storage period.

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, National Institute of Aquatic Resources, Section for Aquaculture
Pages: 333-346
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Publisher: Matis
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version
Publication: Research › Report – Annual report year: 2014

Influence of dietary lipid and protein sources on the sensory quality of organic rainbow trout (Oncorhynchus mykiss) after ice storage

The influence of dietary protein and lipid sources on the sensory quality of organic rainbow trout (Oncorhynchus mykiss) was studied. The protein and oil sources were fishmeal, fish oil, and organic vegetable protein and oils. Sensory profiling was performed during 3 to 14 days of ice storage along with lipid analyses of the fillet. Overall, the results showed that the sensory characteristics of the trout were affected in different ways during ice storage. The source of lipid seemed to affect the sensory quality at the beginning of the storage period, while the protein source seemed to have a more pronounced impact at the end of the storage period.
Microbial interference and potential control in culture of European eel (Anguilla anguilla) embryos and larvae

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Aquaculture, Billund Aquaculture Service Aps, Ghent University
Authors: Sørensen, S. R. (Intern), Skov, P. V. (Intern), Lauesen, P. (Ekstern), Tomkiewicz, J. (Intern), Bossier, P. (Ekstern), Schryver, D. (Ekstern)
Pages: 1-8
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture
Volume: 426-427
ISSN (Print): 0044-8486
Ratings:
Nitrogen removal in RAS farms for Baltic Sea coastal farming 2014

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Suhr, K. I. (Intern)
Number of pages: 21
Publication date: 2014

**Publication information**
Publisher: Aquabest
Original language: English
Main Research Area: Technical/natural sciences
Baltic sea, nitrate removal, recirculation aquaculture systems, single-sludge denitrification reactors

**Relations**
Activities:
Nitrogen removal in RAS farms for Baltic Sea coastal farming
Publication: Research - peer-review › Report – Annual report year: 2014

Ozone in a jar: water treatment with peracetic acid products

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Danish Aquaculture Organisation
Authors: Pedersen, L. (Intern), Henriksen, N. (Ekstern), Pedersen, P. B. (Intern)
Publication date: 2014
Event: Abstract from 10th International Conference on Recirculating Aquaculture, Roanoke, VA, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014

Removal of urea, ammonium and nitrite in moving bed biofilters operated at different loadings

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: von Ahnen, M. (Intern), Pedersen, L. (Intern), Pedersen, P. B. (Intern), Dalsgaard, A. J. T. (Intern)
Publication date: 2014
Event: Abstract from 10th International Conference on Recirculating Aquaculture, Roanoke, VA, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014


**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Jokumsen, A. (Intern), Pedersen, L. (Intern)
Number of pages: 37
Publication date: 2014

**Publication information**
ISBN (Print): 978-952-303-092-3
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions: Publishers version
Links:
Robustfish: New possibilities for growth and robustness in organic aquaculture

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, National Veterinary Institute, Section for Bacteriology, Pathology and Parasitology, Section for Ecosystem based Marine Management, University of Copenhagen, Dansk Akvakultur
Authors: Jokumsen, A. (Intern), Höglund, E. (Intern), Lund, I. (Intern), Madsen, L. (Intern), Pedersen, L. (Intern), Nielsen, M. (Ekstern), Nielsen, T. (Ekstern), Larsen, V. J. (Ekstern), Larsen, E. (Intern)
Publication date: 2014
Event: Poster session presented at Aquaculture Europe 14, Donostia-San Sebastian, Spain.
Main Research Area: Technical/natural sciences
Publication: Research › Report – Annual report year: 2014

Salinity, dissolved organic carbon and water hardness affect peracetic acid (PAA) degradation in aqueous solutions
Peracetic acid (PAA) is used in aquaculture under different conditions for disinfection and therapeutic purposes. There is limited information about its environmental fate, particularly its persistence in aquatic systems with different physical–chemical conditions. This study investigated PAA-degradation of three commercial products, Wofasteril® E400, Wofasteril® E250 and Wofasteril® Lspez, at a nominal concentration of 1 mg L−1 in relation to two levels of salinity, water hardness, or dissolved organic carbon (DOC). The results showed that salinity and DOC stimulate PAA-degradation, while water hardness had only minor impact. For commercial aquaculture, actual PAA concentration in the raw product needs to be measured; the fate of PAA in individual facilities must be carefully monitored and feasible application strategies need to be investigated to achieve maximal disinfection and therapeutic efficiency

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Humboldt-Universität zu Berlin, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin
Authors: Liu, D. (Ekstern), Steinberg, C. E. (Ekstern), Straus, D. L. (Ekstern), Pedersen, L. (Intern), Meinelt, T. (Ekstern)
Number of pages: 6
Pages: 35-40
Publication date: 2014
Main Research Area: Technical/natural sciences
Publication information
Journal: Aquacultural Engineering
Volume: 60
ISSN (Print): 0144-8609
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.09 SJR 0.798 SNIP 1.525
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.723 SNIP 1.148 CiteScore 1.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.72 SNIP 1.437 CiteScore 1.61
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.666 SNIP 1.511 CiteScore 1.8
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Single-sludge denitrification in recirculating aquaculture systems: Effects of pre-fermentation and pH

Single-sludge denitrification (DN) reactors in aquaculture utilize the solid fish waste produced in the system to reduce the nitrate load discharged. The solid waste is available for denitrifiers when present in soluble readily biodegradable form. A transformation accomplished by bacterial hydrolysis (and fermentation). The objective of this study was to quantify the effect of pre-fermentation of the solid fish waste on single-sludge DN-reactor efficiency. Pre-fermentation times tested were; 0 (no pre-fermentation), 1 d, 5 d, and 10 d. The efficiency was quantified as the potential DN-rates in laboratory assessments. Results showed that the highest DN-rate obtained was achieved by 1 d pre-fermentation. The volumetric DN-rate measured in decreasing order was; 23.4 ± 0.00 (1 d); 20.5 ± 0.35 (5 d); 17.0 ± 0.47 (10 d); 14.2 ± 0.24 (0 d) mg NO3-N (L*h)-1. It was suspected that the poor utilization of sCOD in 5 and 10 d pre-fermentation treatments were due to low start pH (below 7). Subsequently, the experiments were repeated in 0.1 M HEPES buffer pH=7.1, and showed a clear correlation between specific DN-rate and soluble COD content. Overall, the highest increase in potential specific DN-rate was achieved by applying pre-fermentation, e.g. from 0 d to 1 d the increase was 85 % and 106 % at unadjusted pH and pH 7.1, respectively. Additional 20 % increase was achieved at pH 7.1 by prolonging the pre-fermentation time to 5 d. At unadjusted pH conditions, the higher sCOD obtained by longer pre-fermentation was futile due to inhibitory effect of low pH

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Department of Environmental Engineering
Authors: Suhr, K. I. (Intern), Letelier Gordo, C. O. (Intern), Prat Busquets, P. (Intern)
Pages: 3050-3057
Publication date: 2014

Host publication information
Title of host publication: Proceedings / American Society of Agricultural and Biological Engineers Annual International Meeting 2014
Publisher: American Society of Agricultural and Biological Engineers
ISBN (Print): 978-183266845-5
Temperature and oxygen as determining factors in post-stress recovery profiles of Norwegian lobster Nephrops norvegicus

-General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Aquaculture
Authors: Behrens, J. (Intern), Höglund, E. (Intern), Larsen, B. K. (Intern), Skov, P. V. (Intern)
Publication date: 2014
Event: Poster session presented at Society of Experimental Biology. Annual Main Meeting, Manchester, United Kingdom.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2014

The dinoflagellates Pfiesteria shumwayae and Luciella masanensis cause fish kills in recirculation fish farms in Denmark
Fish kills in two geographically separate fish farms in northern Denmark in 2012, one using marine, the other brackish water 'Recirculation Aquaculture Systems' (RAS), were found to be caused by Pfiesteria shumwayae and Luciella masanensis, two species of dinoflagellates belonging to the family Pfiesteriaceae. There were no other harmful algae present in either of the aquaculture plants. Serious fish kills in the US have been attributed to Pfiesteria during the past 20 years, but this type of mortality has not been documented elsewhere. L. masanensis, described recently from Korea and USA, has not been previously reported to be the source of fish kills. In the marine farm, the affected fish was rainbow trout, in the brackish water farm pikeperch. Light microscopy is presently insufficient to discriminate between the approx. 20 species of the family Pfiesteriaceae described. Identification of the two algal species was therefore based on molecular sequencing of nuclear-encoded LSU rDNA, confirmed by scanning electron microscopy and, eventually, also by examination of the very thin amphiesmal plates of the flagellates by calcofluor-stained cells in a fluorescence microscope. Although the two fish farms differed in light and salinity conditions, both farms used re-circulating water in closed circuit systems. The dinoflagellates were examined in detail and shown to feed on organic material such as live, damaged nematodes, as described for the single pfiesteriacean flagellate known from freshwater, Tyrannodinium edax. Algal cells were observed to attach to their prey by an attachment filament and subsequently used a peduncle to suck up the food. Fish farms utilizing water recirculation technology are gaining popularity due to their reduced effect on the environment. The two cases from Denmark are apparently the first RAS farms in which serious fish kills have been reported. In the marine farm (Luciella) fish mortality increased dramatically despite treatment of the water with peracetic acid and chloramine-T. The plant was temporarily closed down pending investigation into the cause of mortality and subsequently to determine a method of management to control the dinoflagellate and avoid future fish kills. In the brackish water farm (Pfiesteria), water was treated with chloramine-T, which caused the dinoflagellates to disappear temporarily from the water column, apparently forming temporary cysts. The treatment was repeated after a few days to a week, when the temporary cysts appeared to germinate and the dinoflagellates reappeared in the water column.
Water quality in an experimental Recirculating Aquaculture System as affected by biofilter mode of operation

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Fernandes, P. (Intern), Pedersen, L. (Intern), Pedersen, P. B. (Intern)
Publication date: 2014
Event: Abstract from 10th International Conference on Recirculating Aquaculture, Roanoke, VA, United States.
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version

Relations
Activities:
10th International Conference on Recirculating Aquaculture
Source: PublicationPreSubmission
Source-ID: 101971308
Publication: Research › Conference abstract for conference – Annual report year: 2014
Background paper on aquaculture research

The Board of MISTRA established in 2012 a Working Group (WG) on Aquaculture to provide the Board with background information for its upcoming decision on whether the foundation should invest in aquaculture research. The WG included Senior Advisor Axel Wenblad, Sweden (Chairman), Professor Ole Torrissen, Norway, Senior Advisory Scientist Unto Eskelinen, Finland and Senior Advisory Scientist Alfred Jokumsen, Denmark. The WG performed an investigation of the Swedish aquaculture sector including interviews with a range of stakeholders within aquaculture research, farming organisations, authorities, NGOs and the Ministry of Rural Affairs. The term aquaculture corresponds to the Swedish term Vattenbruk. Aquaculture is the cultivation of fish, shellfish or plants in fresh water (FW) or sea water (SW). Aquaculture has become the fastest growing food producing sector currently producing totally about 80 million tonnes accounting for close to 50% of all aquatic food destined for the global human consumption.

The Swedish aquaculture production currently includes about 11,000 tonnes rainbow trout in FW and SW, 1,100 tonnes arctic char (FW), 90 tonnes eel (FW), 1,500 tonnes mussels (SW) and a few tonnes of crayfish altogether corresponding to a total value of SEK 328 million in 2011. Further about 1,000 tonnes of fish and crustaceans were produced for restocking as well as about 3 million fry of salmon and trout were released into rivers. Swedish aquaculture research was overall assessed to be of very high quality and highly acknowledged at international level. However, integration of the research issues with the main stakeholders in the aquaculture sector needs focus; i.e. integration of the political frameworks, regional administrations, the aquaculture producers and the research groups on aquaculture. A closer connection and dialogue between the stakeholders may be facilitated through the regional aquaculture centres interconnected through the National Competence Centre for Aquaculture, and the National Aquaculture Council being established. These structures may create a common and focused platform for cooperation on research and education, exchange and transfer of knowledge from research to aquaculture practice.

Further, integration of biological and technological research combined with education and training of skilled professionals as well as authority staff dealing with aquaculture is strongly called upon. Hence, a strong integration of the stakeholders within the aquaculture sector is assessed to be an important platform for a trans-disciplinary research and development program for strategic and efficient development of Swedish Aquaculture. Sweden has large potentials for aquaculture due to the availability of vast water resources of good quality (both marine and fresh water), a high veterinary status and generally well developed public infrastructure. Swedish aquaculture has the potential to develop into a green business producing environmentally sustainable healthy food with low ecosystem and climate impact. Swedish import of aquaculture products may be reduced by increased domestic production. Further Swedish aquaculture may be a driving force in the development of employment, infrastructures and improvement of economic and social conditions in rural areas. Sweden 4 • mistra aquaculture has the potential to contribute significantly to food security.

It is therefore important that aquaculture becomes an integrated part of the food production system, i.e. being accepted as an equal food producing sector in line with the agricultural sector. Innovative development of Swedish aquaculture requires production systems with minimal environmental impact, e.g. recirculation technology, efficient feeds and waste management. Although the nutrient-poor hydropower dams in northern Sweden may tolerate nutrient load the strategy for the required development of Swedish aquaculture has to include technologies and strategies to minimize the...
environmental impact, in particular to the Baltic Sea. Swedish aquaculture may develop to be an environmental service, which may be exported. The governmental policy on aquaculture should reflect the conclusions of the official report Det växande vattenbruket and the strategy Svenskt vattenbruk – en grön näring på blå åkrar, Strategi 2012–2020. Implementing the strategy will require a real management of aquaculture that secures the balance between responsibility for the environment and development of aquaculture production. For a significant and powerful Swedish aquaculture to develop, strong and committing policy instruments should be coordinated and managed. This means that the strategy for aquaculture needs to be followed by a long term focused research policy on aquaculture and responsibility for putting it into force as well as availability of adequate funding from national and international sources (e.g. EMFF, research councils, EU, Nordic and BONUS). Finally, the financial sector should be made more confident with aquaculture to facilitate investments in aquaculture. The integration of environmental, economic and social sustainability is essential for the development of a dynamic Swedish aquaculture industry. Research should include basic and applied aquaculture research integrated with resilience science and take a food systems approach considering relevant aspects of the food chain between farm and fork (e.g. producers, food industry, retail and consumers).

Aiming to enable a progressive change of the Swedish aquaculture sector the Working Group recommends that MISTRA establishes a research program on aquaculture including: 1. Global ecosystem aspects of aquaculture production including diversification, production systems, species, products, etc. 2. Environmental efficient production with trapping of solid waste and balanced nutrient management (recirculation technology, waste heat/green energy/integrated production systems). 3. Policy instruments: legislation, economic incentives, socioeconomic

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Wenblad, A. (Ekstern), Jokumsen, A. (Intern), Eskelinen, U. (Ekstern), Torrissen, O. (Ekstern)
Number of pages: 80
Publication date: 2013

Biofilter nitrification performance in replicated RAS at different salinities

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Cavrois, T. (Intern), Pedersen, L. (Intern)
Publication date: 2013
Event: Abstract from 2nd Workshop on Recirculating Aquaculture System, Aalborg, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014

Biofilter-specific responses to intense water treatment in RAS

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Pedersen, L. (Intern), Oosterveld, R. (Intern), Pedersen, P. B. (Intern)
Publication date: 2013
Event: Abstract from 2nd Workshop on Recirculating Aquaculture System, Aalborg, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014
Changes in regional brain monoaminergic activity and temporary down-regulation in stress response from dietary supplementation with l-tryptophan in Atlantic cod (Gadus morhua)

The brain monoamines serotonin (5-hydroxytryptamine; 5-HT) and dopamine (DA) both play an integrative role in behavioural and neuroendocrine responses to challenges, and comparative models suggest common mechanisms for dietary modulation of transmission by these signal substances in vertebrates. Previous studies in teleosts demonstrate that 7 d of dietary administration with l-tryptophan (Trp), the direct precursor of 5-HT, suppresses the endocrine stress response. The present study investigated how long the suppressive effects of a Trp-enriched feed regimen, at doses corresponding to two, three or four times the Trp levels in commercial feed, last in juvenile Atlantic cod (Gadus morhua) when the fish are reintroduced to a diet with standard amino acid composition. We also wanted to determine whether Trp supplementation induced changes in brain monoaminergic neurochemistry in those forebrain structures innervated by DA- and 5-HTergic neurones, by measuring regional activity of DA and 5-HT in the lateral pallial regions (Di) of the telencephalon and nucleus lateralis tuberis (NLT) of the hypothalamus. Dietary Trp resulted in a dose-dependent suppression in plasma cortisol among fish exposed to confinement stress on the first day following experimental diet; however, such an effect was not observed at 2 or 6 d after Trp treatment. Feeding the fish with moderate Trp doses also evoked a general increase in DA and 5-HTergic activity, suggesting that these neural circuits within the NLT and Di may be indirectly involved in regulating the acute stress response.
Coupling between stress coping style and time of emergence from spawning nests in salmonid fishes: Evidence from selected rainbow trout strains (Oncorhynchus mykiss)

Correlations between behavioral and physiological traits, often referred to as stress coping styles, have been demonstrated in numerous animal groups. Such trait variations often cluster in two contrasting styles, with animals characterized as either proactive or reactive. In natural populations of salmonid fishes, emergence from spawning nests, when fry establish a territory and shifts from exogenous to endogenous feeding, is a crucial niche shift with a high selection pressure. The timing of this event is correlated to behavioral and physiological traits such as aggression, boldness/shyness, dominance, and metabolic rate; resembling those of proactive and reactive stress coping styles. In farmed fish populations, however the relation between emergence and stress coping styles seems to be absent, an effect which has been related to lack of selection pressure during emergence. In the present study two rainbow trout strains genetically selected as LR (low-responsive) and HR (high-responsive) trout, characterized with proactive (LR) and reactive (HR) stress coping traits, was used to further investigate the relationship between the time of emergence and stress coping style in salmonid fishes. For this task LR and HR larvae were hatched in mixed batches, and thirty individuals from the earliest and latest 25% of emerging larvae were randomly collected. Thereafter, a line specific genetic marker was used to distinguish the proportion of LR and HR occurring in early and late fractions. The result demonstrates a higher proportion of LR fry in the early fraction in comparison to the HR fry, which emerged at a higher proportion during the late period. Early emerging individuals had larger yolk reserves at emergence, lending further support to a relationship between emergence times, yolk reserves at emergence and stress coping styles in salmonids. Smaller larval bodies in early compared to late emerging individuals suggest that this difference in yolk size reflects differences in developmental stages at emergence. These data suggests that a genetic link between emergence time and stress coping style persists in captive salmonid fishes.
Divergent stress responses and behaviour in early and late emerging Atlantic salmon (Salmo salar)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Section for Aquaculture
Authors: Winberg, S. (Ekstern), Thörnqvist, P. (Ekstern), Larsen, M. H. (Intern), Höglund, E. (Intern), Johnsson, J. (Ekstern), Aarestrup, K. (Intern)
Publication date: 2013
Main Research Area: Technical/natural sciences

Effect of water hardness on peracetic acid toxicity to zebrafish, Danio rerio, embryos
The use of peracetic acid (PAA) in aquaculture has been suggested as an alternative therapeutic agent. Few data are available concerning fish toxicity by PAA or factors that modify this toxicity. The aim of this study was to investigate the influence of water hardness on the acute toxicity of PAA products to embryos of zebrafish (Danio rerio). Embryos were exposed to PAA ranging from 0 to 9 mg/L in low-hardness (1.4 dH or 25 mg/L hardness as CaCO₃), medium-hardness (14 dH or 250 mg/L hardness as CaCO₃) and high-hardness (140 dH or 2,500 mg/L hardness as CaCO₃) waters. The lowest LC₅₀ value was 2.24 mg/L PAA in the low-hardness water, and the highest LC₅₀ value was 7.14 mg/L PAA in the high-hardness water. Toxicity of PAA to embryos was found to be negatively correlated with water hardness. The pH decreased with increasing concentrations of PAA, and the test waters were observed to become more acidic in low hardness. In conclusion, aquaculturists using PAA should pay attention to water hardness to avoid acidosis.
Effects of dietary energy density and digestible protein:energy ratio on de novo lipid synthesis from dietary protein in gilthead sea bream (Sparus aurata) quantified with stable isotopes

The effects of varying dietary digestible protein (DP) and digestible energy (DE) content on performance, nutrient retention efficiency and the de novo lipogenesis of DP origin were examined in triplicate groups of gilthead sea bream (Sparus aurata), fed nine extruded experimental diets. In order to trace the metabolic fate of dietary protein, 1.8% fishmeal was replaced with isotope-labelled whole protein (.98% 13C). The experiment was divided into a growth period lasting 89 d,
growing fish from approximately 140 to 350 g, followed by a 3 d period feeding isotope-enriched diets. Isotope ratio MS was applied to quantify the 13C enrichment of whole-body lipid from dietary DP. Between 18.6 and 22.4% of the carbon derived from protein was recovered in the lipid fraction of the fish, and between 21.6 and 30.3% of the total lipid deposited could be attributed to dietary protein. DP retention was significantly improved by reductions in dietary DP:DE ratio, while the opposite was true for apparent digestible lipid retention. Both overall DE retention and whole-body proximate composition of whole fish were largely unaffected by dietary treatments, while feed conversion ratios were significantly improved with increasing dietary energy density. The present study suggests that gilthead sea bream efficiently utilises dietary nutrients over a wide range of DP:DE ratios and energy densities. In addition, they appear to endeavour a certain body energy status rather than maximising growth, which in the present trial was apparent from inherently high de novo lipogenesis originating from DP.

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, BioMar A/S
Authors: Ekmann, K. S. (Intern), Dalsgaard, A. J. T. (Intern), Holm, J. (Ekstern), Campbell, P. J. (Ekstern), Skov, P. V. (Intern)
Pages: 1771-1781
Publication date: 2013
Main Research Area: Technical/natural sciences

**Publication information**
Journal: British Journal of Nutrition
Volume: 110
ISSN (Print): 0007-1145
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 3.46 SJR 1.983 SNIP 1.533
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 1.583 SNIP 1.446 CiteScore 3.52
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 1.468 SNIP 1.278 CiteScore 3.18
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 2.72 SNIP 2.521 CiteScore 3.61
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 2.263 SNIP 2.484 CiteScore 3.12
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 2.079 SNIP 1.661 CiteScore 3.13
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 1.248 SNIP 1.277
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.62 SNIP 0.581
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
Effects of dietary nutrient composition on de novo lipogenesis in gilthead sea bream (Sparus aurata)

Despite more than 20 years of nutritional research and intensive culture, gilthead sea bream appear to utilise diets inherently worse than many others species in aquaculture. Thus, while salmonids at typical slaughter size typically require between 0.9 – 1.1 kg of feed for growing one kg, gilthead sea bream typically require between 1.6 – 2.0 kg, which is similarly reflected in the efficiency with which dietary protein is retained in body growth. While salmonids have been reported to retain as much as 55% of the dietary protein as growth, gilthead sea bream typically retains less than 30%. So far, there are no indications that differences in nutrient digestibility coefficients can explain these differences, since gilthead sea bream largely digests dietary nutrients similarly or better than salmonids. As dietary nutrients upon digestion can be endogenously converted into other nutrients or metabolites, it can be hard to quantitatively conclude on the fate of them. Using stable isotope tracers (such as 13C labelled starch or protein) allows us to trace specific nutrients and determine to which extent they are endogenously converted into other metabolites. The present thesis comprises three supporting papers which look into the conversion of dietary starch and protein into body lipids as well as the consequences of this on fatty acid profile of the fish. Results from paper I showed that between 4.2 and 8.4% of digested starch was converted into body lipids de novo, corresponding to a synthesis rate of 18.7 to 123.7 mg/kg biomass/day, when feeding iso-DP and iso-DE diets ranging between 6 and 24% dietary starch, respectively. Additionally, up to 68.8% of the hepatic glycogen pool could be attributed to dietary starch, while the same was true for up to 38.8% of the whole body glycogen pool. In turn, this implies that almost two thirds of the whole body glycogen and approximately one third of the liver glycogen must have originated from sources other than dietary starch, even when feeding the high starch diet.

Using nine experimental diets differing in dietary DP (33 – 40%) and DE (19.5 – 21.5 MJ/kg), results from paper II showed that between 18.6 and 22.4% of the DP was converted into lipid de novo, corresponding to between 21.6 and 30.3% of the total lipid deposited in the fish during the study. The nutrient retention results combined showed that while protein was spared by a decreasing dietary DP/DE level, the opposite was true for lipid, substantiating that deaminated DP was indeed converted into body lipids. Additionally, a very clear improvement of FCR with increasing DE level combined with an improvement of digestible protein retention with decreasing DP/DE levels suggest that gilthead sea bream are capable of efficiently utilising feeds within a wide range of dietary DP/DE ratios and energy densities. Results from paper III showed that both fatty acid retention dynamics and final fatty acid profile of the fish were clearly influenced by an increment in dietary starch content (using diets otherwise iso-DP and iso-DE). The apparent retention of saturated fatty acids (SAFA) and mono unsaturated fatty acids (MUFA) were positively related to dietary starch level (and negatively related to dietary lipid level), exceeding 100% in fish fed high starch diets. These findings substantiate that considerable de novo lipogenesis was taking place and apparently subject to nutritional control, while apparent retention of poly unsaturated fatty acids (PUFA) appeared to be un-affected by dietary treatment. Combined, this caused the SAFA and MUFA content of the fish to increase and the PUFA content to decrease when increasing dietary starch level, adversely affecting the overall FA quality of the final product. Considering lipogenesis results, nutrient retention efficiencies and body composition results...
obtained in the three trials collectively, gilthead sea bream appear to endeavour to rigorously maintain a certain whole body energy status under a wide variety of dietary DP/DE ratios, energy densities and nutrient compositions, even if substantial amounts of dietary protein is sacrificed to achieve this. This may indicate that this species has evolved to maximise energy storage in the from of lipid for seasonal, migratory or maturation purposes at the expense of increasing body size through more efficient use of protein for growth. De novo lipogenesis appear to play a key role in maintaining this energy homeostasis

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Ekmann, K. S. (Intern)
Number of pages: 159
Publication date: 2013

Publication information
Place of publication: Charlottenlund
Publisher: DTU aqu. National Institute of Aquatic Resources
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Kim_Ekmann_PhD_thesis_Orbit.pdf
Publication: Research › Ph.D. thesis – Annual report year: 2013

Effects of organic plant oils and role of oxidation on nutrient utilization in juvenile rainbow trout (Oncorhynchus mykiss)
Producing organic fish diets requires that the use of both fishmeal and fish oil (FO) be minimized and replaced by sustainable, organic sources. The purpose of the present study was to replace FO with organic oils and evaluate the effects on feed intake, feed conversion ratio (FCR), daily specific growth rate (SGR) and nutrient digestibility in diets in which fishmeal protein was partly substituted by organic plant protein concentrates. It is prohibited to add antioxidants to organic oils, and therefore the effects of force-oxidizing the oils (including FO) on feed intake and nutrient digestibility was furthermore examined. Four organic oils with either a relatively high or low content of polyunsaturated fatty acids were considered: linseed oil, rapeseed oil, sunflower oil and grapeseed oil. Substituting FO with organic oils did not affect feed intake (P>0.05), FCR or SGR (P>0.05) despite very different dietary fatty acid profiles. All organic plant oils had a positive effect on apparent lipid digestibility compared with the FO diet (P<0.05), whereas there were no effects on the apparent digestibility of other macronutrients when compared with the FO diet (P>0.05). Organic vegetable oils did not undergo auto-oxidation as opposed to the FO, and the FO diet consequently had a significantly negative effect on the apparent lipid digestibility. Feed intake was not affected by oxidation of any oils. In conclusion, the study demonstrated that it is possible to fully substitute FO with plant-based organic oils without negatively affecting nutrient digestibility and growth performance. Furthermore, plant-based organic oils are less likely to oxidize than FOs, prolonging the shelf life of such organic diets

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, National Food Institute, Division of Industrial Food Research, Danish Technological Institute, BioMar A/S
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Pages: 394-403
Publication date: 2013
Main Research Area: Technical/natural sciences

Publication Information
Journal: Animal
Volume: 7
Issue number: 3
ISSN (Print): 1751-7311
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.94 SNIP 1.18 CiteScore 1.94
BFI (2015): BFI-level 1
End-of-pipe denitrification using RAS effluent waste streams: Effect of C/N-ratio and hydraulic retention time

Environmentally sustainable aquaculture development requires increased nitrogen removal from recirculating aquaculture systems (RAS). In this study, removed solids from a large commercial outdoor recirculated trout farm (1000 MT year\(^{-1}\)) were explored as an endogenous carbon source for denitrification. This was done by (1) a controlled laboratory experiment on anaerobic hydrolysis of the organic matter (from sludge cones, drumfilter, and biofilter back-wash) and (2) an on-site denitrification factorial experiment varying the soluble COD (CODS)/NO\(_3\)-N ratio from 4 to 12 at hydraulic retention times (HRT) from 50 to 170 min in simple 5.5 m\(^3\) denitrification reactors installed at the trout farm. The lab-experiments showed that the major part of the readily biodegradable organic matter was hydrolyzed within 14 days, and the hydrolysis rate was fastest the first 24 h. Organic matter from the sludge cones generated 0.21 ± 0.01 g volatile fatty acids (VFA) g\(^{-1}\) total volatile solids (TVS), and the VFAs constituted 75% of CODS. Analogously, 1 g TVS from the drum filter generated 0.15 ± 0.01 g VFA, constituting 68% of the CODS. Comparison of the laboratory hydrolysis experiments and results from the on-farm study revealed as a rough estimate that potentially 17–24% of the generated VFA was lost due to the current sludge management. Inlet water to the denitrification reactors ranged in NO\(_3\)-N concentration from 8.3 to 11.7 g m\(^{-3}\) and CODS from 52.9 to 113.4 g m\(^{-3}\) (10.0 ± 1.2 °C). The highest NO\(_3\)-N removal rate obtained was at the intermediate treatments; 91.5–124.8 g N m\(^{-3}\) reactor d\(^{-1}\). The effect of the C/N ratio depended on the HRT. At low HRT, the variation in C/N ratio had no significant effect on NO\(_3\)-N removal rate, contrary to the effect at the high HRT. The stoichiometric ratio of CODS/NO\(_3\)-N was 6.0 ± 2.4, ranging from 4.4 (at the high HRT) to 9.3 (at the low HRT). A simple model of the denitrification reactor developed in AQUASIM showed congruence between modeled and measured data with minor exceptions. Furthermore, this study pointed to the versatility of the NO\(_3\)-N removal pathways expressed by the bacterial population in response to changes in the environmental conditions; from autotrophic anammox activity presumably present at low C/N to dissimilatory nitrate reduction to ammonia (DNRA) at high C/N, besides the predominate “normal” heterotrophic dissimilatory nitrate reduction (denitrification)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Department of Environmental Engineering, Urban Water Engineering
Authors: Suhr, K. I. (Intern), Pedersen, P. B. (Intern), Arvin, E. (Intern)
Pages: 57-64
Farming different species in RAS in Nordic countries: Current status and future perspectives

Recirculating aquaculture systems (RAS) have gained increasing interest in recent years as a means to intensify fish production while at the same time minimize the environmental impact. Considerable hands-on experience has accumulated within the Nordic countries over the last 20-30 years in designing, building, and operating intensive land-based RAS for different species. This study compiles and assesses published literature along with unpublished hands-on experiences with rearing different species in RAS in the Nordic countries, including Atlantic salmon (Salmo salar), rainbow trout (Oncorhynchus mykiss), European eel (Anguilla anguilla), pike perch (Stizostedion lucioperca), Arctic char (Salvelinus alpinus), sturgeon (order Acipenseriformes), Nile tilapia (Oreochromis niloticus), and European lobster (Homarus gammarus). High capital costs are one of the biggest challenges to sustainable RAS calling for large scale intensive productions to reduce investment and operation costs. Consistent with this, production of Atlantic salmon smolts in indoor RAS and rainbow trout in outdoor Model-Trout-Farms (MTFs) have been the commercially most successful productions so far. Aside from end-of-pipe treatment including sludge handling and efficient nitrogen removal, much of the RAS technology applied is well known and is, as such, more or less ready to apply for culturing a variety of species. Successful production of “new” species in RAS therefore largely comes down to identifying the biological requirements of that specific species, and designing the RAS to fulfill and support the specific requirements. Well established brood-stocks and continuous supply of offspring is furthermore a prerequisite for successful RAS production of most species. Successful operations of less intensive RAS such as aquaponic systems appear to be feasible primarily when culturing more exotic species targeted for selected customers.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Svinna-verkfrædi, Norwegian Lobster Farm AS, Arvo-Tec
Authors: Dalsgaard, A. J. T. (Intern), Lund, I. (Intern), Thorarinsdottir, R. (Ekstern), Drengstig, A. (Ekstern), Arvonen, K. (Ekstern), Pedersen, P. B. (Intern)
Pages: 2-13
Publication date: 2013
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquacultural Engineering
Volume: 53
ISSN (Print): 0144-8609
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.09 SJR 0.798 SNIP 1.525
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.723 SNIP 1.148 CiteScore 1.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.72 SNIP 1.437 CiteScore 1.61
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.666 SNIP 1.511 CiteScore 1.8
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.946 SNIP 1.377 CiteScore 1.72
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.69 SNIP 1.406 CiteScore 1.54
Feed intake as explanation for density related growth differences of common sole Solea solea

Growth of common sole Solea solea is negatively correlated to density, which affects productivity in culture and hence commercial success. Studies of individual feed intake were performed to examine growth and population dynamics at different densities. Three initial stocking densities: 1.0, 2.1 and 3.9 kg m\(^{-2}\) of individually tagged sole, referred to as low density (LD), medium density and high density (HD), were examined during 145 days. Despite that tank productivity (g m\(^{-2}\) day\(^{-1}\)), was highest for the HD group, the specific growth rate (SGR) decreased significantly with increase in stocking density. Individual size variation was similar between densities, indicating that growth was not associated with hierarchy and dominant behaviour. Individual data indicated that increased density reduced the growth potential of all individuals in a population. Individual feed intake was positively correlated to both fish size and individual SGR. Feed conversion ratio was likewise positively correlated to feed intake. The relative feed intake (g feed g fish\(^{-1}\)) was not correlated to fish size at any density tested, but was significantly highest for the LD population. This explains a substantial part of the better growth in the LD group supported by indications of better utilization of the ingested feed.
Fisk viser selv, hvad de foretrækker

**General information**

State: Published  
Organisations: National Institute of Aquatic Resources, Section for Aquaculture  
Authors: Laursen, D. C. (Intern)  
Pages: 6-7  
Publication date: 2013
Glycogenesis and de novo lipid synthesis from dietary starch in juvenile gilthead sea bream (Sparus aurata) quantified with stable isotopes

The effects of replacing a digestible energy source from fat (fish oil) with carbohydrate (wheat starch) on performance, glycogenesis and de novo lipogenesis was examined in triplicate groups of juvenile gilthead sea bream (Sparus aurata), fed four extruded experimental diets. In order to trace the metabolic fate of dietary starch, 0.7% wheat starch was replaced with isotope-labelled starch (98% 13C). Fish were fed the experimental diets for three consecutive 10 d periods, and isotope ratio MS was applied to quantify 13C enrichment of liver and whole-body glycogen and lipid pools over the three feeding periods. Glycogenesis originating from dietary starch accounted for up to 68.8 and 38.8% of the liver and whole-body glycogen pools, respectively, while up to 16.7% of the liver lipid could be attributed to dietary starch. Between 5 and 8% of dietary starch carbon was recovered in whole-body lipid, and estimated deposition rates of de novo synthesised lipid originating from starch ranged from 18.7 to 123.7 mg/kg biomass per d. Dietary treatments did not significantly affect growth, feed performance or body composition of the fish, while the hepatosomatic index and glycogen content of whole fish and livers correlated directly with dietary starch inclusion level. The study suggests that gilthead sea bream efficiently synthesises glycogen from both dietary starch and endogenous sources. In contrast, lipogenesis from carbon derived from starch seems to play a minor role in overall lipid synthesis and deposition under the specified experimental conditions.
High oxygen consumption rates and scale loss indicate elevated aggressive behaviour at low rearing density, while elevated brain serotonergic activity suggest chronic stress at high rearing densities in farmed rainbow trout Oncorhynchus mykiss.
The effect of stocking density on indicators of welfare has been investigated by several studies on farmed rainbow trout Oncorhynchus mykiss. However, the densities at which welfare are compromised remain ambiguous. Here three different stocking density treatments were selected based on the results of a previous study, where levels of crowding where determined using the spatial distribution of fish in two-tank systems. An un-crowded low density of 25 kg m−3, the highest density accepted by the fish without showing indications of crowding stress of 80 kg m−3 as the intermediate density, and the highest density accepted by the fish showing indications of crowding stress of 140 kg m−3 as the high density were investigated. The aim of the present study was to examine the effect of being held at these densities on indicators of welfare. This was achieved through oxygen consumption measurements using automated respirometry, recording fin erosion, determining scale loss and analysing plasma cortisol and brain serotonergic activity levels. The results obtained in the present study indicated that at the lowest density the fish had the space and opportunity to display their natural aggressive behaviour and that the fish held at the highest density were exposed to a situation of confinement.

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Universidade do Algarve
Authors: Laursen, D. C. (Intern), Silva, P. (Ekstern), Larsen, B. K. (Intern), Höglund, E. (Intern)
Pages: 147-154
Publication date: 2013
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Physiology & Behavior
Volume: 122
ISSN (Print): 0031-9384
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.53 SJR 1.05 SNIP 0.856
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.286 SNIP 1.006 CiteScore 2.92
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.489 SNIP 1.081 CiteScore 3.17
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.473 SNIP 1.107 CiteScore 3.29
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.287 SNIP 1.046 CiteScore 3.25
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.227 SNIP 1.039 CiteScore 3.23
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.271 SNIP 1.051
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.399 SNIP 1.184
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.283 SNIP 1.046
Scopus rating (2007): SJR 1.162 SNIP 1.033
Scopus rating (2006): SJR 1.094 SNIP 1.055
Hypercapnia adversely affects postprandial metabolism in the European eel (Anguilla anguilla)
The present study examined the effects of elevated CO2 partial pressure on the specific dynamic action (SDA) and ammonia excretion in European eel (Anguilla anguilla) following forced feeding. Two different hypercapnic scenarios were investigated; one in which pCO2 oscillated between 20 and 60 mm Hg over 24 hour cycles, and one in which pCO2 was constant at 60 mm Hg. Since high CO2 results in low pH with unchanged alkalinity, a normocapnic group at low pH (pCO2 = 3 mm Hg, pH = 6.5) was included to investigate possible direct effects of pH. Constant hypercapnia (60 mm Hg) and lowpH (pH = 6.5) both significantly increased the duration of the SDA response by 22% and 29%, respectively. Hypercapnia had no effect on standard metabolic rate, while constant or oscillating hypercapnia significantly lowered the maximum metabolic rate compared to controls, causing a significant reduction of the aerobic scope during constant hypercapnia. Under conditions of oscillating pCO2, the temporal and spatial postprandial increase in ammonia nitrogen excretion was significantly reduced. This group also excreted significantly less ammonia after ingesting a meal. No significant effects on the magnitude or duration of postprandial ammonia excretion were observed at high pCO2 or low pH/normocapnia. The results demonstrate that despite an exceptional tolerance towards elevated pCO2 and acidosis, postprandial metabolic processes of the European eel are adversely affected by hypercapnia and low pH

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Methling, C. (Ekstern), Pedersen, P. B. (Intern), Steffensen, J. F. (Ekstern), Skov, P. V. (Intern)
Pages: 166-172
Publication date: 2013
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture
Volume: 416
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Influence of inclusion level and form of dietary methionine in plant protein based diets on growth performances, ammonium excretion and postprandial methionine plasma levels in rainbow trout (Oncorhynchus mykiss).

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, BioMar A/S
Authors: Rolland, M. (Intern), Larsen, B. K. (Intern), Holm, J. (Ekstern), Dalsgaard, A. J. T. (Intern), Skov, P. V. (Intern)
Publication date: 2013
Event: Abstract from Aquaculture Europe 13, Trondheim, Norway.
Main Research Area: Technical/natural sciences
Links:
https://www.was.org/easonline/Mobile/Paper.aspx?i=2075
Source: dtu
Source-ID: u::8417
Introduction of the stress hormone cortisol through food pellets induces cardiac remodelling in rainbow trout Oncorhynchus mykiss

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, University of Oslo, Oslo University Hospital, Norwegian School of Veterinary Science, Norwegian University of Life Sciences
Authors: Johansen, I. B. (Ekstern), Lunde, I. G. (Ekstern), Vindas, M. A. (Ekstern), Skov, P. V. (Intern), Mayer, I. (Ekstern), Nilsson, G. E. (Ekstern), Höglund, E. (Intern), Øverli, Ø. (Ekstern)
Publication date: 2013
Main Research Area: Technical/natural sciences
Source: dtu
Source-ID: u::8486
Publication: Research › Conference abstract for conference – Annual report year: 2013

Introduktion og ny viden om hjælpestoffer i danske akvakultur

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, University of Copenhagen, Dansk Akvakultur
Authors: Pedersen, L. (Intern), Buchmann, K. (Ekstern), Clausen, T. (Ekstern), Henriksen, N. H. (Ekstern)
Number of pages: 60
Publication date: 2013

Publication information
Place of publication: København
Publisher: Ministeriet for Fødevarer, Landbrug og Fiskeri
ISBN (Print): 978-87-994996-6-3
Original language: Danish
Series: Faglig rapport fra Dansk Akvakultur
Volume: 2013
Number: 1
Main Research Area: Technical/natural sciences
Electronic versions:
Introduktion og ny viden om hjælpestoffer_maj_2013
Links:
http://www.danskakvakultur.dk/images/nh%20veterin%C3%A6r/Introduktion%20og%20ny%20viden%20om%20hj%C3%A6lpestoffer_maj_2013.pdf
Publication: Research › Report – Annual report year: 2013

Linking development and growth to personalities in farmed rainbow trout (Oncorhynchus mykiss)
Individual variation in behavior and physiology has been described throughout the vertebrate phylum. Seemingly completely different behaviors can be related to each other and to physiological traits such as metabolism, hormone responses and brain neurochemistry. Stable suits of behavioral traits which are consistent between situations and over time, are often termed personalities. Moreover, the term stress coping style is used when trait correlations includes individual differences in physiological responses to a stressor. Personalities and stress coping styles may vary along a continuum, where the extremes have been categorized as active versus passive and proactive versus reactive, respectively. The behavioral profiles of the active/proactive extreme include being more bold, aggressive, and socially dominant. In contrast passive/reactive individuals are shy and socially subordinate. Physiologically traits of proactive individuals include higher metabolic rate and a less pronounced cortisol response to a stressor, compared to their reactive counterpart. Providing information on the correlation of traits expressed early in ontogeny could give valuable insight on the physiological processes involved in the organization of behavioral and physiological traits. However, most research on trait correlations is performed relatively late in ontogeny and the information about expression of personalities/stress coping styles during early development is meager. In salmonid fishes, the timing of emergence from spawning nests is related to behavioral and physiological traits. Generally, early emerging individuals exhibit active/proactive traits. Later emerging individuals, on the other hand, display passive/reactive characteristics. Coherent to this, there are studies suggesting that selection pressures early in ontogeny promotes the co-existence of two energetically different strategies in salmonids. Early emerging fish have been demonstrated to have a higher metabolic rate compared to those individuals who emerge
at a later stage during the emergence period. There is a growing interest in the presence of individual trait variation in aquaculture, however, elusive results have been presented, and whether personalities/stress coping styles are present in domesticated fish remains debated. The emphasis of this PhD work was to investigate the relationship between individual variation in developmental rate during early ontogeny, personality/stress coping styles, and growth potential in farmed rainbow trout. Two strains of rainbow trout selected for a low (LR) and high (HR) post stress plasma cortisol response have been shown to resemble proactive and reactive coping styles respectively. Results presented here showed that LR females produced large eggs that hatched into larvae with large yolk reserves. In comparison, HR females produced smaller eggs and offspring with smaller yolk reserves. Although no difference in larval growth and development was observed between the two lines a majority of the LR individuals emerged from artificial spawning nests early, prior to fully consuming their yolk reserves. In comparison a higher frequency of reactive HR fry emerged later after the yolk reserves had been fully depleted. This confirms proactive characteristics of early emerging fry. Moreover, the larger yolk in early emerging individuals was suggested to support a more energetically demanding proactive stress coping style during the initial social interaction and territory defense. This was further supported by newly emerged individuals with large yolk reserves showing a higher probability to obtain social dominance compared to individuals with smaller yolk reserves. Moreover, socially inexperienced individuals with large yolks, and a propensity for social dominance had lower brain concentrations of serotonin, suggesting a causative effect of this neurotransmitter on social dominance and aggression. Furthermore, the results demonstrated that farmed rainbow trout with an intermediate emergence time grew larger compared to both early and late emerging fry, suggesting that intermediate emerging individuals have a stress coping style lying in-between the proactive-reactive continuum, and that the behavioral and physiological traits of these fish are beneficial in aquaculture settings. Taken together, the results presented in this thesis demonstrate a relationship between traits expressed early in development and differences in personalities/stress coping styles and growth later in ontogeny of farmed rainbow trout.
Microbial water quality – concepts and examples

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Pedersen, L. (Intern)
Publication date: 2013
Event: Abstract from Aquaculture Innovation Workshop, Shepherdstown, West Virginia, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2015

Nitrogen waste load from juvenile rainbow trout (Oncorhynchus mykiss)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Dalsgaard, A. J. T. (Intern), Larsen, B. K. (Intern), Pedersen, P. B. (Intern)
Publication date: 2013
Event: Abstract from Workshop on Recirculating Aquaculture Systems , Aalborg, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2013

Nutrient digestibility and growth in rainbow trout (Oncorhynchus mykiss) are impaired by short term exposure to moderate supersaturation in total gas pressure

Excess levels of dissolved nitrogen gas (N2) may occur in recirculating aquaculture systems, as a result of aeration efforts, localized occurrences of denitrification, or from insufficient degassing of makeup water. If levels of dissolved N2 are sufficiently high, or if oxygen (O2) is also maintained at or above saturation, this leads to a supersaturation in total gas pressure (TGP). Depending on severity, total gas pressures above saturation may lead to gas bubble trauma, evident by visual inspection of the fish. Physiological effects of subclinical levels of TGP are not well known and have not been investigated for rainbow trout. The present study examined the effects of N2 supersaturation, with or without simultaneous excess TGP. Supersaturation with N2 (ΔP 22mmHg) without total gas supersaturation (ΔTGP −6mmHg) did not have any significant effects on feed intake, feed conversion or growth. Short term (16days) exposure to N2 supersaturation (ΔP 36mmHg) in combination with a ΔTGP of 23mmHg did not affect feed intake, nor did it cause GBT or any apparent changes in behaviour. Excess TGP did, however, significantly reduce apparent lipid digestibility, feed conversion, and the thermal growth coefficient, compared to control treatments in which N2 and O2 were maintained below saturation levels. In addition to a significant decrease in available metabolizable energy (energy intake corrected for faecal loss), this group also had significantly higher cost of growth. These results suggest that even moderate TGP supersaturation negatively affect aquaculture production by a dual effect on energy uptake and energy expenditure, possibly caused by a general stress response to dissolved gases. Continuing the experiment over 25days eliminated any significant differences on production variables, suggesting that rainbow trout exposed to moderate excess levels of TGP for longer periods were able to adapt to some degree

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Skov, P. V. (Intern), Pedersen, L. (Intern), Pedersen, P. B. (Intern)
Pages: 179-184
Publication date: 2013
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture
Volume: 416-417
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
Gas bubble trauma, Digestibility, Feed conversion, Total gas pressure, Nitrogen, Supersaturation

Original language: English

DOIs:
10.1016/j.aquaculture.2013.09.007

Source: dtu
Source-ID: n:oai:DTIC-ART:elsevier/424420742::33867

Publication: Research - peer-review › Journal article – Annual report year: 2013
Organic plant ingredients in the diet of Rainbow trout (Oncorhynchus mykiss): Impact on fish muscle composition and oxidative stability

Rainbow trout were fed diets containing either fish meal and fish oil (FM-FO) (control) or diets in which 40% of the fishmeal was substituted with a mixture of ingredients grown organically including plant protein concentrate (PP) in combination with either fish oil (FO) as lipid source, or one of the following organic plant oils; rapeseed (RO), linseed/flaxseed (LO), grape seed (GO), or sunflower (SO). The impact of these substitutions was investigated by measuring fish muscle fatty acid profile as well as oxidative and color stability of the fillet during 14 days ice storage. The inclusion of plant protein concentrate did not affect the fatty acid profile significantly but resulted in a slightly improved oxidative stability of the fish fillets as compared to the control diet. The fatty acid profile of the oil used was in general well reflected in the fish muscle fatty acid profile. Fish fed PP-RO were the most oxidatively stable during ice storage but the omega-3 fatty acid content was reduced by 40% compared to fish fed the FM-FO control diet. Replacing FO by LO was not suitable as it induced oxidation and the fillet contained 40–50% less of long chain omega-3 fatty acids.
Peracetic acid (PAA) is a highly reactive peroxygen compound with wide-ranging antimicrobial effects and is considered an alternative sanitizer to formaldehyde. Products containing PAA are available in solution with acetic acid and hydrogen peroxide to maintain the stability of the chemical, and it decays rapidly when applied to freshwater in aquaculture systems. The rapid decay is beneficial in an environmental context but a challenge to aquaculturists. To assess the impact of organic matter content and temperature on PAA decay, twenty-four batch experiments were set up using PAA doses ranging from 0 to 2.0 mg/l. The results revealed that increasing organic matter content significantly facilitated PAA decay, and positive temperature-decay correlations were found. Instantaneous PAA consumption above 0.2 mg/l was observed, and PAA half-lives were found to be in the order of a few minutes. The relative PAA recovery, calculated as measured PAA concentration over time compared to the PAA concentration applied, decreased with declining dose. Measurements of PAA residuals during water treatment scenarios at three different freshwater fish farms revealed moderate to substantial PAA consumption, documenting a large discrepancy between delivered quantities and realized residuals. Recent investigations of PAA application to manage parasitic diseases in aquaculture are briefly reviewed, and practical implication and guidelines are addressed.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin, Agricultural Research Service
Authors: Pedersen, L. (Intern), Meinelt, T. (Ekstern), Straus, D. L. (Ekstern)
Pages: 65-71
Publication date: 2013
Perfluorinated compounds in fish and carryover from fishfeed to farmed rainbow trout

Perfluorooctanesulfonate (PFOS) and perfluorooctanoate (PFOA) bioaccumulate in humans and the half-life is around 4-6 years. As fish for many people is the largest source of PFOS exposure, the occurrence and the exposure of PFOS from fish was estimated. Today a significant proportion of the fish consumption is from aquaculture produce (~40% of the world’s fisheries (FAO 2012)). Hence the carryover of PFOS and PFOA from aquaculture feed to fish was studied. In 2011 and 2012 fish were collected from Danish catching areas in the Baltic Sea and the North Sea and from Danish aquaculture farms and analysed for PFOS and PFOA.

The impact of chemical exposure on the cause in a feeding trial with rainbow trout (Oncorhynchus mykiss) accumulation and elimination of PFOS and PFOA was studied. PFOS was added to the fish feed at a level of 3 µg/g and PFOA at 0.5 µg/g. The fish were fed with the contaminated fish feed in an accumulation period of 12 weeks following an 8 weeks elimination period where unspiked feed were used. The feeding trials were carried out in tanks and the experiment included a control study of fish which were exposed only to unspiked feed. All feeding trials were conducted in duplicates. Fish were sampled 5 times during accumulation and 6 times during elimination. Analysis of PFOS and PFOA were performed on trout filet and liver.

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry, National Institute of Aquatic Resources, Section for Aquaculture
Authors: Granby, K. (Intern), Larsen, B. K. (Intern), Cederberg, T. L. (Intern)
Number of pages: 1
Publication date: 2013
Event: Abstract from 5th international workshop on Per- and polyfluorinated substances (PFAS), Helsingør/ Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions: prod21384168836415.Kit_Granby_1_.pdf

Bibliographical note
Poster presentation
Source: dtu
Source-ID: u:9461
Publication: Research › Conference abstract for conference – Annual report year: 2013

Perspectives for sustainable development of Nordic aquaculture: The Paban-Report

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Rosten, T. W. (Ekstern), Paulsen, H. (Intern), Alanära, A. (Ekstern), Eskelinen, U. (Ekstern), Bergsson, B. A. (Ekstern), Olafsen, T. (Ekstern)
Number of pages: 138
Publication date: 2013

Publication information
Publisher: Nordic Council of Ministers, TemaNord
ISBN (Print): 978-92-893-2571-4
Original language: English
Series: TemaNord
Number: 2013:546
ISSN: 0908-6692
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version
DOIs: 10.6027/TN2013-546
Publication: Research › Report – Annual report year: 2013

Physiological and behavioral responses to stress in cultivated fish – Effects of selective breeding and exposure to cortisol and tryptophan
Removal of nitrogen, phosphorous and organic matter in a constructed wetland treating effluents from a Model Trout Farm

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Dalsgaard, A. J. T. (Intern), von Ahnen, M. (Ekstern), Pedersen, P. B. (Intern)
Publication date: 2013
Event: Poster session presented at Aquaculture 2013, Gran Canaria, Spain.
Main Research Area: Technical/natural sciences
Publication: Research – Poster – Annual report year: 2013

Short- and long-term effects of dietary l-tryptophan supplementation on the neuroendocrine stress response in seawater-reared Atlantic salmon (Salmo salar)

The essential amino acid l-tryptophan (Trp) is the immediate precursor of the neurotransmitter serotonin (5-HT). Supplementing Trp through diet has been shown to suppress the neuroendocrine stress response in vertebrates including teleosts. In salmonid fish, adjusting to the social environment as well as habituation to seawater involves the neuroendocrine stress response, suggesting that such environmental factors may modulate the stress-reducing effects of Trp. To date, studies that have investigated the neuroendocrine effects of dietary Trp have only been conducted in rainbow trout (Oncorhynchus mykiss), a salmonid species, under conditions featuring social isolation in the freshwater environment. Here, we address the effects of dietary Trp on post-stress plasma cortisol and hypothalamic monoamines in seawater-adapted Atlantic salmon (Salmo salar), reared at densities relevant for aquaculture. Fish were given feed containing 1, 2, 3 or 4 times the Trp content in normal feed for one week. Subsequently, the fish were reintroduced to feed containing the lowest Trp level, corresponding to standard commercial feed for a number of days prior to exposure to an acute confinement stressor. Basal plasma cortisol levels were lower among non-stressed fish at 1 and 10 days post dietary Trp supplementation. By comparison, stressed fish displayed stimulatory post-stress plasma cortisol responses at 1 and 2 days after the Trp regimen was terminated. However, a reversed pattern was observed among these fish at 10 days after Trp treatment. The overall effects of dietary Trp were more pronounced in dopamine (DA) neurochemistry compared to 5-HT in the hypothalamus. The results demonstrate both short- and long-term effects of elevated dietary Trp on the neuroendocrine stress response. These findings suggest that hypothalamic DA may be more involved than 5-HT in the stress reducing effects of Trp in seawater-adapted Atlantic salmon, reared at densities relevant for aquaculture

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Norwegian School of Veterinary Science, Uppsala University, BioMar A/S, Norwegian University of Life Sciences
Authors: Basic, D. (Ekstern), Krogdahl, T. (Ekstern), Scholden, J. (Ekstern), Winberg, S. (Ekstern), Vindas, M. (Ekstern), Hillestad, M. (Ekstern), Mayer, I. (Ekstern), Skjerve, E. (Ekstern), Höglund, E. (Intern)
Pages: 8-13
Publication date: 2013
Main Research Area: Technical/natural sciences
Publication information
Journal: Aquaculture
Volume: 388
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
The effect of tryptophan supplemented diets on brain serotonergic activity and plasma cortisol under undisturbed and stressed conditions in grouped-housed Nile tilapia Oreochromis niloticus

Tryptophan (TRP) supplemented diets have been shown to have therapeutic effects in farmed animals including fish by modulating the activity of the neurotransmitter serotonin (5-hydroxytryptamine; 5-HT). The effects reported in fish have been obtained using individually-housed fish and include a reduction in stress response, aggression and stress-induced anorexia. In land farmed animals, TRP supplemented diets have also been shown to improve meat quality as a result of reduced stress during slaughter while in fish no data is currently available. This study aims at investigating whether short-term supplementation with TRP supplemented diets changes brain serotonergic activity and the stress response associated with slaughter handling in grouped-housed Nile tilapia Oreochromis niloticus. Adult fish (n. = 108, 490.6. ± 4.0. g, 12 individuals per tank) were exposed to one of the three treatments (triplicates per treatment were used): control (0.48. g/100. g), TRP 4. × (1.87. g/100. g) and TRP 10. × (4.45. g/100. g) diets during 7. days. Afterwards, half of the fish in each tank were subjected to an acute stressor consisting of a combination of crowding and chasing, just prior to slaughter. The other half of the fish represented undisturbed conditions. Blood and brain samples were collected for cortisol and serotonergic activity analyses, respectively. Flesh quality was also assessed in both undisturbed and stressed fish for all treatments by measuring muscle pH and rigor mortis over a 72. h period. Results showed that the highest TRP supplemented diet (TRP 10. ×) induced a significant reduction in undisturbed plasma cortisol (10.57. ±. 2.71. ng/ml) as compared to TRP 4. × (24.93. ±. 3.19. ng/ml) and control diets (18.69. ±. 2.94. ng/ml) and no effect on post-stress cortisol levels. After stress, the major 5-HT metabolite (5-hydroxyindoleacetic acid, 5-HIAA) was higher in the TRP 10. × (471.31. ±. 60.95. ng/g) as compared to the other diets (TRP 4. ×: 313.52. ±. 30.12. ng/g; control: 260.36. ±. 19.65. ng/g). Stress before slaughter induced a significant increase in plasma cortisol (from 18.40. ±. 1.76. ng/ml under undisturbed conditions to 80.34. ±. 7.16. ng/ml), however, it was not sufficient to cause a faster deterioration of flesh quality. TRP supplement diets had also no effect on muscle pH and rigor mortis during the 72. h observation period. In conclusion, this study showed that only the highest levels of supplementation (10. × the control diet) affect serotonergic activity. However, these levels did not result in reduced stress responsiveness or improved flesh quality when an acute stressor is applied before slaughter. Therefore, these results underline the fact that effects of TRP on cortisol production are dose- and context-dependent, and further experiments are needed to determine under which conditions the optimal effect is obtained.
The effects of temperature on specific dynamic action and ammonia excretion in pikeperch (Sander lucioperca)

The magnitude and kinetics of the postprandial metabolic response are strongly affected by temperature. From an aquaculture perspective, it is of interest to determine the temperature at which the lowest digestive energy expenses occur. We have previously demonstrated that the optimal aerobic scope for pikeperch ranges between 11°C and 27°C. The aim of the present study was to investigate the thermal biology of pikeperch, by examining how specific dynamic action (SDA) and total ammonia nitrogen excretion (TAN) are affected by temperature, within this optimal temperature range. From oxygen consumption rate and TAN excretion measurements, we established nitrogen quotients at 13°C, 19°C, and 25°C. Nitrogen quotients were used to calculate instantaneous protein catabolism at the different temperatures. We found, that protein usage (17%–29%) was unaffected by temperature during fasting, but increased significantly in the course of digestion, where it became the main energy source at all experimental temperatures. Energy spent on digestion and the relationship between excreted and ingested nitrogen were unchanged with temperature. However, SDA was of shorter duration at 19°C than at 13°C, and a smaller fraction of metabolic scope was utilized for digestion at 19°C, compared to at 25°C. We therefore conclude that 19°C is a more favorable metabolic temperature for this species.
The relationship between emergence from spawning gravel and growth in farmed rainbow trout Oncorhynchus mykiss

The relationship between the timing of emergence from spawning gravel and growth after emergence was investigated in farmed Oncorhynchus mykiss. A relationship between the time of emergence and growth became evident after 6 months of rearing, where individuals with an intermediate emergence time had grown larger compared with early and late emerging individuals.

General information
State: Published
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Pages: 214-219
Publication date: 2013
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 83
Issue number: 1
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.741 SNIP 0.882
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.951 SNIP 0.935 CiteScore 1.64
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.944 SNIP 0.934 CiteScore 1.76
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.049 SNIP 1.118 CiteScore 1.98
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.035 CiteScore 1.88
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Utilising spatial distribution in two-tank systems to investigate the level of aversiveness to crowding in farmed rainbow trout Oncorhynchus mykiss

In aquaculture, fish are exposed to a range of unfavourable environmental conditions. Amongst these, stocking density has attracted considerable attention as inappropriate densities may compromise welfare and negatively impact production. However, the recommendations for stocking remain elusive. The aim of the present study was to apply a novel method to investigate a level of crowding that indicated aversiveness in rainbow trout (Oncorhynchus mykiss). In a two-tank system, where two identical tanks were connected via a doorway, it was observed that social behaviour controlled the distribution of the fish between the tanks. Fish were stocked at equal quantities in each tank of the system. The doorway was opened and the fish moved between the two tanks. Typically, this resulted in one tank being occupied by a few highly aggressive dominant individuals (“dominant” tank) and the majority of the fish occupying the second tank (“crowded” tank). Here, the potential of this unequal spatial distribution for quantifying aversion to crowding was explored. Fish were stocked in three two-tank systems at a total density of 20, 40 and 80kgm⁻³ respectively. The number of fish in each tank was determined every three days throughout the duration of the experiment and the percentage of fish in the “crowded” tank was used as an indicator of the distribution pattern in the two-tank systems. The results indicated a negative relationship between the total density stocked (20, 40 and 80kgm⁻³) and the percentage of fish in the “crowded” tank. A subsample of individuals was sacrificed for blood and brain samples every three days from the “crowded” tank, prior to the fish count. The neuroendocrine indicators of stress, elevated serotonergic activity levels which were not associated with high plasma levels of cortisol, suggested chronic stress in the fish at the highest total density stocked (80kgm⁻³). Taken together, these results indicated that a level of aversiveness to crowding had been reached at the highest density stocked, where the mean absolute density, irrespective of time of day, observed in the “crowded” tank was 126.5±3.7kgm⁻³.
Welfare aspects of stocking density in farmed rainbow trout, assessed by behavioural and physiological methods

There is an increasing amount of interest in the welfare of fish from aquaculture. There are several aquaculture practices that may act as chronic stressors and therefore have the potential to negatively impact welfare. Stocking density has been highlighted as a particular welfare concern, from both an ethical and practical point of view. A quantity of research has been conducted on the relationship between stocking density and indicators of welfare in farmed rainbow trout Oncorhynchus mykiss. The studies to date have revealed that both low and high densities have the potential to detrimentally affect welfare in rainbow trout. Several studies have endeavoured to make specific recommendations for maximum stocking density limits for rainbow trout. However, wide discrepancies exist, highlighting the fact that it has been a challenge to identify density limits that promote optimal welfare and production in rainbow trout. This emphasises the significance of developing alternative methods that provide insight into the potential density limits that are optimal for welfare and performance in rainbow trout. Here, a behavioural method using two-tank systems was developed and applied. The twotank systems consisted of two identical tanks which were attached to each other with a doorway allowing the fish to move freely between the two tanks. By studying the spatial distribution of fish in two-tank systems stocked with different densities and the neuroendocrine stress levels of the fish, a density level was established that showed indications of crowding. The results revealed that a level of aversion to crowding had been reached at an absolute density of approximately 140 kg m⁻³. Additionally, the influence of the established density limit on physiological indicators of welfare and performance were investigated. At this density of 140 kg m⁻³, the lower oxygen consumption rates and lower quantity of scale loss collected from the tanks suggested reduced levels of social hierarchy related aggressive encounters. Higher brain serotonergic activity in the brain stem of individuals held at this density indicated elevated stress levels, despite low concentrations of plasma cortisol. The reduced energetic expenditure at 140 kg m⁻³ resulted in a better utilisation of ingested feed and hence growth performance. Taken together, despite the chronic stress levels at this density, the results showed that at this density the reduced energy expenditure, attributed to reduced aggressive social interactions, resulted in a better growth performance. Therefore, it may be concluded that application of the method using the two-tank systems provided new insight into an optimal stocking density limit for rainbow trout. Furthermore, the method presented here provides a promising tool for investigating stocking density levels in rainbow trout. Further development of the current method would consider it applicable for determining limits for a range of culture situations.

**AquaResp® — free open-source software for measuring oxygen consumption of resting aquatic animals**

AquaResp® is a free open-source software program developed to measure the oxygen consumption of aquatic animals using intermittent flow techniques. This free program is based on Microsoft Excel, and uses the MCC Universal Library and a data acquisition board to acquire analogue readings from up to four input ports and output control via two digital and two analogue ports. In addition AquaResp can read one COM-port if the oxygen analyser has a RS-232 output signal. The present version of the program has options for parsing data strings generated by two major fibre optic oxygen electrode
manufacturers. AquaResp was developed with the intention of automating data acquisition and control by programming in commonly-available software (Microsoft Excel) and allowing customization by the user without restrictions. The program has been tested in different laboratories for an extended period.

**General information**
State: Published
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Publication date: 2012
Event: Poster session presented at Society for Experimental Biology Annual Main Meeting, Salzburg, Austria.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2012

Brain activation and appraisal of hypoxia in two strains of rainbow trout (Oncorhynchus mykiss) displaying divergent stress coping styles

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Uni Research AS, Uppsala University
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Publication date: 2012
Event: Poster session presented at Society for Neuroscience, New Orleans, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2012

Context-dependent responses to novelty in Rainbow trout (Oncorhynchus mykiss), selected for high and low post-stress cortisol responsiveness

Previous studies in a rainbow trout model, selectively bred for high (HR) and low (LR) post stress plasma cortisol levels, have yielded data that are indicative of contrasting stress coping styles. Fish from the HR line have been suggested to display a more diverse behavioral repertoire in challenging situations than the LR counterpart. The present study addressed whether such variation in behavioral flexibility traits was evident in different experimental settings using these selection lines. The fish were subjected to three sets of challenges (novel object test, resident–intruder test and confinement stressor test), all of which were repeated a week later. Introducing a novel object evoked a divergent behavioral response in association with feeding: fish from the LR line displayed consistently suppressed feed intake while the HR fish remained unaffected. This observation was found to be repeatable along with attack latency and movement activity from the resident–intruder and confinement stressor tests. These results indicate that the behavioral responses in this animal model are context-dependent and shed new light on the expression of behavioral flexibility.

**General information**
State: Published
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Pages: 1175-1181
Publication date: 2012
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Physiology & Behavior
Volume: 105
Issue number: 5
ISSN (Print): 0031-9384
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.53 SJR 1.05 SNIP 0.856
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Dietary supplementation of essential fatty acids in larval pikeperch (Sander lucioperca); short and long term effects on stress tolerance and metabolic physiology

The present study examined the effects of feeding pike perch larvae Artemia, enriched with either docosahexanoic acid (DHA), arachidonic acid (ARA), oleic acid (OA), olive oil (OO) or a commercial enrichment DHA Selco (DS) on tissue lipid deposition, stress tolerance, growth and development, and metabolic rate. There was higher tissue retention of ARA than DHA at comparable inclusion levels. No differences were observed between diets on the percentage contribution of ARA or DHA to the fatty acid profile of tissues (head and trunk). Total fatty acid content (mgg⁻¹) was significantly higher in the head, reflecting its high content of neural tissue. Observations on larval erratic behaviour and mortality following exposure to salinity stress suggested that high inclusions levels of DHA had an alleviating effect, while ARA did not. Particularly larval groups reared for 16 days on diets enriched with OO and OA had mortality rates approaching 100% within two hours. Interestingly, this tendency, although not as pronounced, was also apparent in juvenile fish after 120 days of rearing on a common diet. Standard metabolic rate in larvae on an OO enriched diet was significantly elevated, but otherwise no groups had significant changes to their respiratory physiology. In addition to increased stress challenge sensitivity, early feeding with OA had long term impact on pikeperch neural development indicated by a smaller brain size in juvenile fish. In conclusion, lack of DHA in the diet of pikeperch larvae suggests that this long chain polyunsaturated fatty acid is involved in processes that increase stress tolerance and that lack of dietary DHA in early larval stage caused increased stress sensitivity and long-term impaired neural development, while it does not appear to affect metabolic rate at rest.
Effects of exogenous enzymes on apparent nutrient digestibility in rainbow trout (Oncorhynchus mykiss) fed diets with high inclusion of plant-based protein

General information
State: Published
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Pages: 181-191
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Animal Feed Science and Technology
Volume: 171
ISSN (Print): 0377-8401
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): SJR 0.903 SNIP 1.425 CiteScore 2.11
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.162 SNIP 1.495 CiteScore 1.97
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.234 SNIP 1.71 CiteScore 2.4
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.129 SNIP 1.356 CiteScore 2.07
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.012 SNIP 1.306 CiteScore 1.72
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.12 SNIP 1.587 CiteScore 2.13
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.147 SNIP 1.423
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.25 SNIP 1.755
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.267 SNIP 1.639
Effects of feed loading on nitrogen balances and fish performance in replicated recirculating aquaculture systems

This study investigated the effects of applying four fixed feed loadings to three replicated recirculating aquaculture systems (RAS) on water quality changes, nitrogenous balances and growth performance of rainbow trout (Oncorhynchus mykiss). Feed loadings ranged from 1.6 to 6.3 kg feed/m³ make-up water, with a constant make-up water renewal of 4.7% of total water volume per day in all twelve RAS. Fish densities ranged from 14 to 92 kg/m³ during the prolonged trial of 10 weeks. Selected water quality parameters were measured during two intensive sampling campaigns, evaluating biofilter nitrification performance and diurnal patterns of total ammonia nitrogen (TAN) and nitrite concentrations. No fish mortality occurred during the study. Feed conversion ratios varied between 0.91±0.04 and 0.95±0.02, and were unaffected by feeding load. Mean nitrate-nitrogen levels ranged from 54±7 to 196±10 mg/L at steady state, and the concentration of nitrogenous compounds and organic matter were all positively correlated to feed loading. The TAN loading to the RAS from the specific feed type was assessed in a separate mass-balance study and used as input in a descriptive mathematical model (AQUASIM® software) developed to simulate processes affecting N mass-balances in the RAS. Nitrification kinetic rate constants were applied to the biofilter, and fractions of nitrifiers in suspended solids in the water phase were estimated based on existing information from waste water treatment processes. Two model scenarios successfully simulated the measured TAN concentration in the experimental RAS. The first model scenario applied a first-order area-based nitrification rate (k1a) constant of 0.2 m/d, estimating a fraction of active nitrifiers (fN) in the water phase of 4% of the total suspended solids. The second model scenario used a k1a of 0.1, estimating a fN of 8% with similar predictability as in the first scenario. Overall, this study provided new information on fish performance and resulting water quality during steady state RAS operation. Furthermore, the study demonstrated that kinetic modeling can be applied to simulate measured TAN concentrations in experimental RAS.

General information
State: Published
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Pages: 237-245
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture
Volume: 338-341
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2

DOI: 10.1016/j.anifeedsci.2011.10.005
Source: orbit
Source-ID: 286904
Publication: Research - peer-review → Journal article – Annual report year: 2011
Effects of plant proteins on postprandial, free plasma amino acid concentrations in rainbow trout (Oncorhynchus mykiss)

Postprandial patterns in plasma free amino acid concentrations were investigated in juvenile rainbow trout (Oncorhynchus mykiss) fed either a fish meal based diet (FM) or a diet (VEG) where 59% of fish meal protein (corresponding to 46% of total dietary protein) was replaced by a matrix of plant proteins from wheat, peas, field beans, sunflower and soybean. Blood samples were obtained from the caudal vein of 7 fish in each dietary treatment group prior to feeding, as well as: 2, 4, 6, 8, 12, 24, 48 and 72 h after feeding (sampling 7 new fish at each time point), and plasma amino acid concentrations were subsequently measured by HPLC. Nutrient digestibility and ammonia excretion of the two experimental diets were measured in a parallel experiment using a modified Guelph setup. Results showed that the appearance of most amino
acids (essential and non-essential) in the plasma was delayed in fish fed the VEG diet compared to those fed the FM diet. Essential and non-essential amino acids furthermore appeared more or less synchronously in the plasma in fish fed the FM diet, while the appearance was less synchronised in fish fed the VEG diet. Differences in plasma concentrations between the two dietary treatment groups correlated largely with the amino acid content of the two diets except for methionine, lysine and arginine, where the differences were more extreme than what would be expected from differences in dietary concentrations. The apparent protein digestibility coefficient was higher in the VEG diet than in the FM diet (93 versus 92%; t-test, Pb0.05), supporting that protease inhibitors from plant protein ingredients were not the cause of the delay. The apparent digestibility coefficient of carbohydrates (calculated as nitrogen-free extract (NFE)) was much lower in the VEG than in the FM diet (51 versus 76%; t-test, Pb0.05). Combined with a higher NFE content in the VEG diet, this meant that there was 2.7 times more indigestible NFE in the VEG than in the FM diet (6.1 versus 2.2 g 100−1 g feed).

Such difference may suggest that the uptake of amino acids (AA) was affected by dietary carbohydrates. Total ammonia-nitrogen (TAN) excretion was slightly, but non-significantly, higher in VEG fed fish than in FM fed fish (59 versus 55 mg TAN g−1 digested protein; t-test, P>0.05). In conclusion, the study showed that amino acid uptake patterns are affected when replacing fish meal with plant based protein ingredients.
Effects of stocking density and sustained aerobic exercise on growth, energetics and welfare of rainbow trout

Two stocking densities, “low” (L, between ~19 and ~25 kgm⁻³) and “high” (H, between ~75 and ~100 kgm⁻³) were compared for effects on specific growth rate (SGR), feed conversion, energetics and welfare of rainbow trout reared at 14 °C either in static water (S) or swimming in a gentle current of ~0.9 bodylengths s⁻¹ (C). Trout (initial mass ~110 g) were reared for 9 weeks in circular tanks (volume 0.6 m³), in triplicate of four conditions (LS, LC, HS, HC). Fish were fed ad libitum daily; waste pellets were swirl-collected at the outflow to calculate feed intake. SGR was measured each three weeks for the last six weeks of the trial. The tanks functioned as intermittent-stopped flow respirometers, to permit metabolic rate to be measured as instantaneous oxygen uptake once per hour. Mean (±SD) SGR was significantly lower at H than L (1.51±0.03 vs 1.44±0.04% day⁻¹, respectively, n=6) and lowest in HC. When compared over a similar interval of mass gain, H groups had approximately 25% higher metabolic rates than L, with the highest rates in the HC condition. As a result, fish in the H groups dissipated a greater amount of feed energy as metabolism and, across all groups, there was a direct negative relationship between the quantity of energy dissipated and their SGR. There was no evidence of a neuroendocrine stress response, plasma cortisol was around 1 ng ml⁻¹ in all conditions. An acute crowding stress increased plasma cortisol to above 120 ng ml⁻¹ in all groups, but C groups recovered to control levels within 8 h whereas S groups required 20 h. Respirometry on individuals revealed that H fish had approximately 14% higher metabolic rates than L fish, indicating that increased metabolic rate in rearing tanks was in part physiological. The H groups had approximately 15% lower critical swimming speeds than the L groups which, together with their raised metabolic rate, indicated a physiological impairment. Thus, high density reduced SGR by raising energy dissipation, at least partially as a physiological response by the fish, although there was no evidence of an endocrine stress response. The only beneficial effect of C was in recovery from acute stress.
Fast-starting for a breath: Air breathing in Hoplosternum littorale

Fast starts are brief accelerations commonly observed in fish within the context of predator–prey interactions. In typical C-start escape responses, fish react to a threatening stimulus by bending their body into a C-shape. Recently, similar C-starts have been recorded in archerfish stimulated by the fall of a prey item on the water surface, and in tapping motions of goldfish, a behaviour that was interpreted to be food-related. Little is known about C-starts being used outside the context of escaping or feeding. Here, we test the hypothesis that air-breathing fish may use C-starts when gulping air at the surface. Air breathing is a common behaviour in many fish species when exposed to hypoxia, although certain species perform air-breathing in normoxia to fill their swim bladders for buoyancy control and/or sound transduction. Hoplosternum littorale is an air-breathing freshwater catfish found in South America. Field video observations reveal that their air-breathing behaviour consists of a fast air-gulping motion at the surface, followed by swimming towards the bottom. Using high-speed video in the laboratory, we compared the kinematics of spontaneous air-gulping performed by H. littorale in normoxia, with those of mechanically-triggered C-start escape responses. Our results show that these two behaviours overlap considerably in their kinematics (turning rates and distance covered), suggesting that air breathing in this species is performed using escapelike C-start motions. This demonstrates that C-starts in fish do not need external stimulation and can be spontaneous behaviours used outside the context of predator–prey interactions.
Impact of water boundary layer diffusion on the nitrification rate of submerged biofilter elements from a recirculating aquaculture system

Total ammonia nitrogen (TAN) removal by microbial nitrification is an essential process in recirculating aquaculture systems (RAS). In order to protect the aquatic environment and fish health, it is important to be able to predict the nitrification rates in RAS’s. The aim of this study was to determine the impact of hydraulic film diffusion on the nitrification rate in a submerged biofilter. Using an experimental batch reactor setup with recirculation, active nitrifying biofilter units from a RAS were exposed to a range of hydraulic flow velocities. Corresponding nitrification rates were measured following ammonium chloride, NH4Cl, spikes and the impact of hydraulic film diffusion was quantified.

The nitrification performance of the tested biofilter could be significantly increased by increasing the hydraulic flow velocity in the filter. Area based first order nitrification rate constants ranged from 0.065 m d−1 to 0.192 m d−1 for flow velocities between 2.5 m h−1 and 40 m h−1 (18 °C). This study documents that hydraulic film diffusion may have a significant impact on the nitrification rate in fixed film biofilters with geometry and hydraulic flows corresponding to our experimental RAS biofilters. The results may thus have practical implications in relation to the design, operational strategy of RAS biofilters and how to optimize TAN removal in fixed film biofilter systems

General information
State: Published
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Pages: 3516-3524
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Water Research
Volume: 46
Issue number: 11
ISSN (Print): 0043-1354
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.49 SJR 2.629 SNIP 2.558
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.689 SNIP 2.507 CiteScore 6.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.957 SNIP 2.727 CiteScore 6.13
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.693 CiteScore 6.02
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.966 SNIP 2.456 CiteScore 5.15
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.867 SNIP 2.374 CiteScore 5.43
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.582 SNIP 2.196
Influence of protein source on amino acid uptake patterns and protein utilization in rainbow trout Oncorhynchus mykiss

Matrixes of different protein sources (fish and plant products) combined with the use of crystalline amino acids allow for formulation of diets that meet fish requirements with little or no effect on protein digestibility and/or feed intake. Despite this, a total or partial replacement of fish meal induces reduced growth performances that remain partly unexplained. The aim of the current study was to investigate the effect of exchanging the protein source on protein utilization. Marine (fish meal) and vegetable (pea protein) sources were used with or without supplementation of crystalline amino acids to the fishmeal diet level (see Table 1). Amino acid uptake patterns were assessed by the appearance of amino acids in the blood stream following the ingestion of a meal, while dietary protein utilization was evaluated by examining the metabolic response to digestion and ammonium and urea excretion rates during digestion. Four treatments, 3 diets and 1 control (no feeding), were applied to rainbow trout with an average body mass of 500 grams. Fish were either force fed one of the 3 diets at a ration corresponding to 0.75% of the body mass, or no force feeding. Four fish at a time (one per treatment) were placed in individual chambers for 48h. Blood and water samples were collected at time 0 and then at 2, 4, 6, 8, 12, 20, 32 and 48 hours post feeding. The protocol was repeated until 8 replicates per treatment were obtained.

The results were obtained through 2 separate experiments.

In the first part, oxygen consumption was recorded continuously, while water was sampled as detailed above and analyzed for ammonium and urea content.

The second part of the experiment was designed to collect blood samples. After the feeding treatment fish were held in separate containers for the above described time sampling. Fish were killed by a blow in the head and blood was collected from the caudal vein with heparinized syringes. Plasma and red blood cells content were stored separately at -80 for amino acid content analysis.

The ammonium excretion profiles (Figure 1) will be correlated with the amino acid profile in the blood and oxygen consumption during digestion to investigate the effect on protein utilization for each treatment.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, BioMar A/S
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Linking personality to larval energy reserves in rainbow trout (Oncorhynchus mykiss).

There is a surging interest in the evolution, ecology and physiology of personality differences. However, most of the studies in this research area have been performed in adult animals. Trait variations expressed early in development and how they are related to the ontogeny of an animal's personality are far less studied. Genetic differences as well as environmental factors causing functional variability of the central serotonergic system have been related to personality differences in vertebrates, including humans. Such gene-environment interplay suggests that the central serotonergic system plays an important role in the ontogeny of personality traits. In salmonid fishes, the timing of emergence from spawning nests is related to energy reserves, aggression, and social dominance. However, it is currently unknown how the size of the yolk reserve is reflected on aggression and dominance, or if these traits are linked to differences in serotonergic transmission in newly emerged larvae. In this study we investigated the relationship between yolk reserves, social dominance, and serotonergic transmission in newly emerged rainbow trout (Oncorhynchus mykiss) larvae. This was conducted by allowing larvae with the same emergence time, but with different yolk sizes, to interact in pairs for 24 h. The results show that individuals with larger yolks performed more aggressive acts, resulting in a suppression of aggression in individuals with smaller yolks. A higher brain serotonergic activity confirmed subordination in larvae with small yolks. The relationship between social dominance and yolk size was present in siblings, demonstrating a link between interfamily variation in energy reserves and aggression, and suggests that larger yolk reserves fuel a more aggressive personality during the initial territorial establishment in salmonid fishes. Furthermore, socially naïve larvae with big yolks had lower serotonin levels, suggesting that other factors than the social environment causes variation in serotonergic transmission, underlying individual variation in aggressive behavior.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
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Pages: e49247
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: P L o S One
Volume: 7
Issue number: 11
ISSN (Print): 1932-6203
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.11 SJR 1.201 SNIP 1.092
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.414 SNIP 1.131 CiteScore 3.32
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.545 SNIP 1.141 CiteScore 3.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.74 SNIP 1.147 CiteScore 3.94
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.945 SNIP 1.142 CiteScore 4.15
Low-dose hydrogen peroxide application in closed recirculating aquaculture systems

The aim of the present work was to simulate water treatment practices with hydrogen peroxide (HP) in recirculating aquaculture systems (RAS). Six identical 1,700-L pilot-scale RAS were divided into two experimental groups based on daily feed allocation and operated under constant conditions for a period of 3 months. The organic and nitrogenous loadings of the systems differed fourfold between the two groups and were achieved by predefined constant daily feed loads and constant additions of water. The fixed cumulative feed burden was $1.6 \times 10^3$ mg feed/L in the low-intensity RAS and $6.3 \times 10^3$ mg/L in the high-intensity RAS. The decay of HP in rearing tanks and disconnected biofilter units was investigated by means of HP spiking experiments. The decay in high-intensity RAS rearing units and biofilters was orders of magnitude faster than that in low-intensity units. The application of HP impaired biofilter nitrite oxidation in low-intensity RAS but not in high-intensity RAS. The impact of HP exposure time on biofilter nitrification capacity was then assessed in biofilter bench-scale experiments with nitrite spiking. Exposure time was found to significantly affect nitrite oxidation. Compared with unexposed biofilter elements, nitrite oxidation was reduced more than 90% following 3 h of exposure to 15 mg HP/L, whereas 30 min of exposure had only minor negative effects on nitrite oxidation. The findings of this study demonstrate the potential for developing HP water treatment practices for RAS and contradict prevailing notions that HP cannot be used safely in RAS that employ biofiltration. The development of effective new HP treatment protocols for recirculating aquaculture could reduce the current dependence on formalin to improve water quality and control parasitic loads.
Lower brain levels of serotonin in rainbow trout larvae with a propensity for social dominance

There is general consensus that low levels of brain serotonin are associated with aggression and social dominance. However, most of the studies investigating the relationship between serotonin (5-HT) and aggressive behavior have been performed in animals with previous social experience. Studies performed on socially naive animals, predisposed to different levels of aggression, are needed to investigate to which extent inherited differences in 5-HTergic transmission underlie this behavioral variability. In this work we show that rainbow trout larvae, having a large yolk during emergence from the spawning nests, also have higher probability to become social dominant. Furthermore, newly emerged socially naïve individuals with larger yolk also had lower brain 5-HT levels. This demonstrates a propensity to social dominance, which is associated with lower brain serotonin levels, in larvae that emerge from the spawning nests with a big yolk. Further studies utilizing this animal model may reveal inherited differences in 5-HTergic transmission underlying individual variation in aggressive behavior.
Motion gav regnbueørreden fordele - men også ulemper

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Rasmussen, R. S. (Intern)
Pages: 11-13
Publication date: 2012
Main Research Area: Technical/natural sciences
Publication information
Journal: Ferskvandsfiskeribladet
Volume: 110
Issue number: 3
ISSN (Print): 0015-0223
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Publication: Communication › Journal article – Annual report year: 2012

Move or rest: Nitrification performance of fixed bed and moving bed biofilters

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Pedersen, L. (Intern), Nielsen, J. (Ekstern), Pedersen, P. B. (Intern)
Publication date: 2012
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2012

Når fysikken styrer de biologiske processer - med nitifikation i biofiltre som eksempel

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Engineering, National Institute of Aquatic Resources, Section for Aquaculture, Water Resources Engineering, Slagelse Kommune
Authors: Arvin, E. (Intern), Lopato, L. R. (Intern), Pedersen, L. (Intern), Prehn, J. (Ekstern), Binning, P. J. (Intern)
Pages: 124-127
Publication date: 2012
Main Research Area: Technical/natural sciences
Publication information
Journal: Vand & Jord
Volume: 19
Issue number: 4
ISSN (Print): 0908-7761
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Neural plasticity is affected by stress and heritable variation in stress coping style

Here we use a comparative model to investigate how behavioral and physiological traits correlate with neural plasticity. Selection for divergent post-stress cortisol levels in rainbow trout (Oncorhynchus mykiss) has yielded low- (LR) and high responsive (HR) lines. Recent reports show low behavioral flexibility in LR compared to HR fish and we hypothesize that this divergence is caused by differences in neural plasticity. Genes involved in neural plasticity and neurogenesis were investigated by quantitative PCR in brains of LR and HR fish at baseline conditions and in response to two different stress paradigms: short-term confinement (STC) and long-term social (LTS) stress. Expression of proliferating cell nuclear antigen (PCNA), neurogenic differentiation factor (NeuroD) and doublecortin (DCX) was generally higher in HR compared to LR fish. STC stress led to increased expression of PCNA and brain-derived neurotrophic factor (BDNF) in both lines, whereas LTS stress generally suppressed PCNA and NeuroD expression while leaving BDNF expression unaltered. These results indicate that the transcription of neuroplasticity-related genes is associated with variation in coping style, while also being affected by STC – and LTS stress in a biphasic manner. A higher degree of neural plasticity in HR fish may provide the substrate for enhanced behavioral flexibility.
Omission of expected reward sensitizes the brain dopaminergic system of classically conditioned Atlantic salmon

For several reasons, such as easy maintenance, rapid generation times, and increasingly mapped genomes, teleost fishes are emerging as an alternative to small mammals in biomedical, neural, and behavioral research. Behavioral, genetic, and physiological screening of high numbers of individuals across treatments and generations is one particularly attractive feature of fish model systems. Both animal welfare considerations and fundamental scientific questions regarding the evolution of learning and memory have directed particular attention towards possible cognitive and emotional processes in fishes. Here we show that the omission of expected reward (OER) leads to increased aggression towards conspecifics in classically conditioned Atlantic salmon (Salmo salar). Furthermore, in response to an acute stressor, OER fish displayed increased dopaminergic (DA) neurotransmission compared to controls. There was also a general downregulation of dopamine receptor D1 gene expression in the telencephalon of OER groups, which suggests a coping mechanism in response to unbalanced DA metabolism. These results indicate that animals subjected to unpredictable reward conditions develop a sensitization of the DA signalling system, manifest as a potentiated response to novel, stressful stimuli. Similarities between fish and mammals in this response to unpredictability illustrates a role for teleost fish as models to understand the development of different types of DA dysfunction

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Institute of Marine Research, University of Oslo, Norwegian University of Life Sciences
Authors: Vindas, M. (Ekstern), Höglund, E. (Intern), Folkedal, O. (Ekstern), Johansen, I. (Ekstern), Braastad, B. (Ekstern), Stien, L. (Ekstern), Kristiansen, T. (Ekstern), Overli, O. (Ekstern)
Publication date: 2012
Event: Poster session presented at Society for Neuroscience, New Orleans, United States.
Main Research Area: Technical/natural sciences
Publication information
Publisher: Dansk Akvakultur
Original language: Danish
Series: Faglig rapport fra Dansk Akvakultur
Number: 2012-5
Main Research Area: Technical/natural sciences
Electronic versions:
Klassiske dambrug_samlerapport_030213
Links:
Publication: Research › Report – Annual report year: 2013
Reducing nitrate emission from RAS by End-of-pipe single-sludge denitrification

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Suhr, K. I. (Intern)
Publication date: 2012
Event: Abstract from 9th International Conference on Recirculating Aquaculture, Roanoke, VA, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2013

Reproduction of European Eel in Aquaculture (REEL): Consolidation and new production methods
Project aim: Enhance methods and technology applied to produce and culture European eel larvae as basis for the development of a future self-sustained eel aquaculture.
Background: The severe decline of the European eel stock calls for conservation measures including national eel management plans and establishment of a self-sustained eel aquaculture. In 2005, the National Institute of Aquatic Resources at the Technical University of Denmark (DTU Aqua), the Faculty of Life Sciences at Copenhagen University (KU-Life) and the eel aquaculture industry started to build up a research and technology platform for the development of methods to reproduce European eel in aquaculture. Two major projects: Artificial Reproduction of Eels II and III (ROE II and III) succeeded during 2005-2008 to produce viable eggs and larvae that lived up to 12 days. The larvae thereby accomplished the yolk-sac stage and became ready to start feeding. The results were in particular promising because they evidenced that methods successfully applied to Japanese eel has a potential for application also to the European eel. ROE II and III were supported by the Ministry of Food, Agriculture and Fisheries and the European Commission through the Financial Instrument for Fisheries Guidance (FIFG) and the Danish Food Research Program 2006, respectively.
Results: The REEL project accomplished through three series of experiments to consolidate previous results. The longevity of larvae was extended from 12 to 20 days after hatch in first feeding experiments thereby entering the leptocephalus phase. Maturation potential and methods to induce maturation were further tested, and farmed and wild eel broodstocks as well as different treatments were compared. In particular, fertilisation procedures to produce fertilised eggs and embryos and monitoring techniques were enhanced. The technology needed to culture embryos and larvae was substantially improved. The potential for new hormonal treatments was explored and recombinant eel hormones have been produced. New broodstock diets were developed with focus on the lipid composition essential for development and survival of fish larvae. In addition, the experimental facility established by DTU Aqua at Lyksvad Fish Farm was enhanced by improving the experimental and laboratory facilities. The REEL project provided the basis for the establishment of an EU collaborative research project: Reproduction of European Eel: Towards a Self-sustained Aquaculture (PRO-EEL) coordinated by DTU Aqua. REEL included the partners DTU Aqua, KU-Life, Danish Eel Farmers Association (DEFA), Billund Aquaculture Service (BA), BioMar, and Bioneer of which four are integrated in the PRO-EEL project that in total has 15 international partners

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Coastal Ecology, Section for Ocean Ecology and Climate, National Food Institute, Division of Industrial Food Research, Section for Aquaculture
Number of pages: 47
Publication date: 2012

Publication information
Place of publication: Charlottenlund
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
ISBN (Print): 978-87-7481-151-0
ISBN (Electronic): 978-87-7481-154-1
Original language: English
Series: DTU Aqua-rapport
Number: 249-2012
Note re. dissertation: Projektet blev finansieret af DTU Aqua og Ministeriet for Fødevarer, Landbrug og Fiskeri via LAG Fyn gennem Den Europæiske Fiskerifond: Danmark og EU investerer i bæredygtigt fiskeri og akvakultur
Main Research Area: Technical/natural sciences
Electronic versions:
249_2012_reproduction_of_european_eel_in_aquaculture.pdf
Links:
Study tests disinfectant alternatives to formalin

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Henriksen, N. H. (Ekstern)
Pages: 78-79
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Global Aquaculture Advocate
Issue number: Jan/Feb
ISSN (Print): 1540-8906
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Links:
http://www.gaalliance.org/mag/2012/Jan-Feb/index.html
Source: orbit
Source-ID: 316376
Publication: Communication › Journal article – Annual report year: 2012

Test and implementation of easy degradable aquaculture sanitizers

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Pedersen, L. (Intern), Henriksen, N. (Ekstern), Pedersen, P. B. (Intern)
Publication date: 2012
Event: Abstract from 9th International Conference on Recirculating Aquaculture, Roanoke, VA, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2012

The effect of protein and lipid source in organic feed for (organic) rainbow trout on sensory quality

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, National Institute of Aquatic Resources, Section for Aquaculture
Number of pages: 1
Publication date: 2012
Event: Poster session presented at EuroSense 2012 Fifth European Conference on Sensory and Consumer research, Berne, Switzerland.
Main Research Area: Technical/natural sciences
Electronic versions:
The effect of protein and lipid source in organic feed for (organic) rainbow trout on sensory quality.pdf
Source: dtu
Source-ID: u::5996
Publication: Research › Poster – Annual report year: 2012

The effects of stocking density and low level sustained exercise on the energetic efficiency of rainbow trout (Oncorhynchus mykiss) reared at 19°C
A 9 week growth trial was performed at two rearing densities; low (~25 kg m⁻³) and high (~100 kg m⁻³), in combination with either static water or a water current corresponding to 0.9 body lengths s⁻¹, to investigate the effects of density and exercise on the bioenergetics of rainbow trout reared at 19 °C, particularly routine metabolic rate (RMR), specific growth rate (SGR), and feed conversion ratio (FCR). The growth trial showed that high rearing density resulted in significantly lower SGR and increased FCR, with no significant alleviating effects of a water current, although slight improvement in both parameters were observed at low density. A significant linear relationship between SGR and FCR suggested that increased energy expenditure was the primary cause of reduced growth. Hourly measurements of instantaneous oxygen uptake, during a period of similar growth (200–350 g), revealed clear effects of the experimental conditions. Energetic budgets were calculated from feed intake and routine metabolic rate (RMR) and revealed that whilst feed intake was similar for all groups, a higher RMR in the high density groups resulted in a higher daily rate of energy utilization for routine activity, leading to slower growth. However, a lower RMR in fish subjected to a current resulted in a greater proportion of energy being retained, leading to significantly higher SGR for the selected period, at both low and high density. Furthermore, the presence of a water current was observed to induce schooling behaviour, which is known to reduce aggression and stress. It is thereby likely that the presence of a current had a positive effect on welfare in addition to its effect on energy metabolism. We conclude that the presence of a water current to some extent could alleviate the negative effects of high density at 19 °C, a relatively high temperature experienced in farming of rainbow trout during hot seasons.

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Larsen, B. K. (Intern), Skov, P. V. (Intern), McKenzie, D. J. (External), Jokumsen, A. (Intern)
Pages: 226-233
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture
Volume: 324-325
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.136 SNIP 1.3 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.212 SNIP 1.487 CiteScore 2.32
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.294 SNIP 1.542 CiteScore 2.39
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.151 SNIP 1.394
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Pikeperch is of increasing interest to the aquaculture industry, as a novel high value species. To our knowledge there is currently no information available on the metabolic rates of adult pikeperch. The present study determined the standard and maximum metabolic rates and ventilation frequency at six temperatures, ranging from 13 to 28 °C, in order to identify the temperature where pikeperch has the largest metabolic scope (MS). Between 13 and 25 °C, standard metabolic rates (SMR) increased as expected with a Q10=1.8 in response to increasing temperatures, while maximum metabolic rate (MMR) did not change significantly within this temperature range. As a result, MS was not significantly affected by acclimation temperature between 13 and 25 °C. Above 25 °C, SMR increased significantly with a Q10=2.5 while MMR declined, resulting in a decreased MS. In the present study, the maximum MS (MSMAX) was found at 18.8 °C. Defining the optimal temperature as the thermal range where fish can maintain 80% of MSMAX, shows that adult pikeperch have a broad thermal optimum between 10.4 and 26.9 °C. Since earlier studies on juvenile pikeperch have reported an optimal temperature range of 25–30 °C, we show that pikeperch have an ontogenetic shift in their thermal optimum, emphasizing the importance of considering fish size when deciding the temperature in aquaculture facilities. As a secondary objective we investigated whether gill ventilation frequency (fV) could be used as an accurate predictor of oxygen consumption rate (M\textsubscript{O\textsubscript{2}}), during normoxia and progressive hypoxia. A strong correlation was found between fV and M\textsubscript{O\textsubscript{2}} across all temperatures, and fV could predict M\textsubscript{O\textsubscript{2}} with a high degree of accuracy in normoxia.
The temperature challenges on cardiac performance in winter-quiescent and migration-stage eels Anguilla anguilla

The present study was undertaken to examine cardiac responses to some of the temperature challenges that eels encounter in their natural environment. The contractile properties of ventricular muscle was studied on electrically paced tissue strips after long term acclimation at 0 °C, 10 °C, or 20 °C, and following acute ± 10 °C temperature changes. The time-course of contraction, and thus maximal attainable heart rates, was greatly influenced by working temperature, but was independent of acclimation history. The absolute force of contraction and power production (i.e. the product of force and stimulation frequency) was significantly influenced by acute temperature decrease from 20 °C to 10 °C. The role of adrenaline as a modulator of contraction force, power production, rates of contraction and relaxation, and minimum time in contraction was assessed. Increased adrenergic tonus elicited a positive inotropic, temperature-dependent response, but did not influence twitch duration. This suggests that adrenaline acts as an agent in maintaining an adequate contractile force following temperature challenges. A significant increased relative ventricular mass was observed in 0 °C and 10 °C-acclimated eels compared to 20 °C-acclimated, which suggests that at low temperatures, eels secure cardiac output by heart enlargement. Inhibition of specific sarcolemmal Ca 2+ channels by selective drug treatment revealed that, depending on temperature, L-type channels is the major entry site, but also that reverse-mode Na+/Ca 2+-exchange and store operated calcium entry contribute to the pool of activator Ca 2+.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, University of Copenhagen
Authors: Methling, C. (Ekstern), Steffensen, J. F. (Ekstern), Skov, P. V. (Intern)
Pages: 66-73
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Comparative Biochemistry and Physiology. Part A: Molecular & Integrative Physiology
Volume: 163
Issue number: 1
ISSN (Print): 1095-6433
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.16 SJR 0.794 SNIP 0.879
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.917 SNIP 0.915 CiteScore 2.01
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.983 SNIP 0.94 CiteScore 2.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.956 SNIP 1.058 CiteScore 2.36
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.773 SNIP 1.032 CiteScore 2.18
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.858 SNIP 1.048 CiteScore 2.2
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
Time-depedant changes in protein expression in rainbow trout muscle following hypoxia

Adaptation to hypoxia is a complex process, and individual proteins will be up- or down-regulated in order to address the main challenges at any given time. To investigate the dynamics of the adaptation, rainbow trout (Oncorhynchus mykiss) was exposed to 30% of normal oxygen tension for 1, 2, 5 and 24h respectively, after which muscle samples were taken. The successful investigation of numerous proteins in a single study was achieved by selectively separating the sarcoplasmic proteins using 2-DE. In total 46 protein spots were identified as changing in abundance in response to hypoxia using one-way ANOVA and multivariate data analysis. Proteins of interest were subsequently identified by MS/MS following tryptic digestion. The observed regulation following hypoxia in skeletal muscle was determined to be time specific, as only a limited number of proteins were regulated in response to more than one time point. The cellular response to hypoxia included regulation of proteins involved in maintaining iron homeostasis, energy levels and muscle structure. In conclusion, this proteome-based study presents a comprehensive investigation of the expression profiles of numerous proteins at four different time points. This increases our understanding of timed changes in protein expression in rainbow trout muscle following hypoxia.

Public information

Journal: Journal of Proteomics
Volume: 75
Issue number: 8
ISSN (Print): 1874-3919
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.05 SJR 1.383 SNIP 1.055
Trout farming in Denmark: recent trends and future prospects

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Dalsgaard, A. J. T. (Intern), Pedersen, P. B. (Intern)
Pages: 2-4
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: AES Newsletter
Volume: 15
Issue number: 1
Original language: English
Electronic versions:
An estrogen-responsive plasma protein expression signature in Atlantic cod (Gadus morhua) revealed by SELDI-TOF MS

Compound-specific protein expression signatures (PESs) can be revealed by proteomic techniques. The SELDI-TOF MS approach is advantageous due to its simplicity and high-throughput capacity, however, there are concerns regarding the reproducibility of this method. The aim of this study was to define an estrogen-responsive PES in plasma of Atlantic cod (Gadus morhua) using the SELDI-TOF MS technique. Protein expression analysis of male cod exposed to 17 b-estradiol (E2) showed that 27 plasma peaks were differentially expressed following exposure. The productivity of this result was evaluated by reanalyzing the samples six months later, and a significant change in expression was confirmed for 13 of the 27 peaks detected in the first analysis. The performance of the reproducible E2-responsive PES, constituting these 13 peaks, was then tested on samples from juvenile cod exposed to 4-nonylphenol, North Sea oil, or North Sea oil spiked with alkylphenols. Principal component analysis revealed that nonylphenol-exposed cod could be separated from unexposed cod based on the E2-responsive PES, indicating that the PES can be used to assess estrogenic exposure of both juvenile and adult specimens of cod. A targeted antibody-assisted SELDI-TOF MS approach was carried out in an attempt to identify the E2-responsive peaks. Results indicated that 2 peaks were fragments of the well-known biomarkers VTG and/or ZRP. In this study, the SELDI-TOF MS technology has shown its potential for defining compound-specific PESs in fish. Nevertheless, thorough validation of reproducibility, specificity, and sensitivity of a PES is required before it can be applied in environmental monitoring.
Application and analytical verification of peracetic acid use in different types of freshwater aquaculture systems

Peracetic acid (PAA) is a highly reactive peroxygen compound with wide-ranging antimicrobial effects. PAA has recently gained substantial attention, due to additional beneficial attributes such as easily degradability and harmless disinfection byproducts. However, PAA is only sporadically used by the aquaculture industry as it is difficult to apply in correct dosages. This study describes the degradation kinetics of PAA when used as an aquaculture disinfectant. Effects of temperature, organic matter content and initial PAA dosage on the chemical fate of PAA is reported. Furthermore, investigations of water sanitation with PAA application were used to analytically verify actual PAA concentration under real conditions at different kinds of aquaculture systems. A characteristic instant disinfection demand was found to be significantly positively related to water COD content, and PAA half-lives were found to be in the order of a few minutes. The study revealed that PAA degrades so rapidly that insufficient disinfection is a likely outcome. The observations have applications for optimizing water treatment strategies with PAA. The investigations also indicated that the rapid degradation and hence swift presence of PAA in RAS made raceway disinfection possible without bypassing the biofilters. Future perspectives, benefits and drawbacks on the use of PAA in RAS are discussed.

General information
Behavioural responses to hypoxia provide a non-invasive method for distinguishing between stress coping styles in fish

Two divergent behavioural and physiological response patterns to challenges have been identified in mammals and birds, frequently termed the proactive and reactive coping styles. In recent years, individually distinct coping styles have also been observed in several species of fish. These individual differences may result in suboptimal production and compromised welfare in aquaculture. An approach to overcome these problems could be to sort fish and optimise rearing conditions according to coping style. It has been previously demonstrated that the proactive and reactive coping styles in fish can be characterised by contrasting behavioural responses to hypoxia. Two rainbow trout (Oncorhynchus mykiss) strains, bred for a low- (LR) and high- (HR) cortisol response to a standardized stressor, are suggested to resemble the proactive and reactive coping styles respectively. Therefore, these fish provided an opportunity for verifying a method for sorting fish with respect to coping style by exposure to hypoxia. Groups consisting of 24 individually tagged fish, 12 HR and 12 LR were exposed to hypoxia in a two choice system. The system consisted of a “home” tank provided with cover connected to a second brightly “illuminated” tank via a closable doorway. During the experiment, the doorway between the two tanks was opened and hypoxic conditions were gradually induced in the “home” tank by bubbling with nitrogen. The latency time to move away from hypoxic conditions to normoxic conditions in the second tank was recorded for each individual. The oxygen saturation in each tank was measured every 30 min. The experiment consisted of two trials. Each trial was carried out in two sessions, switching the “home” tank and “illuminated” tank between Sessions 1 and 2. The results indicated that the response to hypoxia differed significantly between LR and HR individuals in both Session 1 (P <0.05) and Session 2 (P ≤ 0.001). Furthermore, a higher number of HR individuals left hypoxic conditions compared to LR individuals in both Session 1 (P = 0.001) and Session 2 (P ≤ 0.001). Taken together, the findings of the present study demonstrate a repeatable difference in behavioural response to hypoxia between the two strains. The method presented could be utilized as a non-invasive method for sorting fish according to stress coping style.
Changes in growth, feed utilisation and muscle fibre size distribution when rearing rainbow trout in steady or varying water currents

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Rasmussen, R. S. (Intern)
Publication date: 2011
Event: Poster session presented at FitFish Workshop on the Swimming Physiology of Fish, Barcelona, Spain.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 277504
Publication: Research - peer-review › Journal article – Annual report year: 2011

Consistent boldness behaviour in early emerging fry of domesticated Atlantic salmon (Salmo salar): Decoupling of behavioural and physiological traits of the proactive stress coping style

Individual variation in the way animals cope with stressors has been documented in a number of animal groups. In general, two distinct sets of behavioural and physiological responses to stress have been described: the proactive and the
reactive coping styles. Some characteristics of stress coping style seem to be coupled to the time to emerge of fry from spawning redds in natural populations of salmonid fishes. In the present study, behavioural and physiological traits of stress coping styles were compared two and five months after emergence in farmed Atlantic salmon (Salmo salar), using individuals with an early or late time to emerge. Initially, compared to late emerging individuals, early emerging individuals showed a shorter time to resume feeding after transfer to rearing in isolation. Resumption of feeding after isolation was suggested to be related to boldness behaviour, rather than hunger, in the present study. This observation was repeated five months after emergence, demonstrating behavioural consistency over time in this trait. However, in other traits of proactive and reactive stress coping styles, such as social status, resting metabolism or post stress cortisol concentrations, early and late emerging individuals did not differ. Therefore, this study demonstrates that boldness in a novel environment is uncoupled from other traits of the proactive and reactive stress coping styles in farmed salmonids. It is possible that this decoupling is caused by the low competitive environment in which fish were reared. In natural populations of salmonids, however, the higher selection pressure at emergence could select for early emerging individuals with a proactive coping style.

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Norwegian University of Life Sciences, UAEMéx, Mexico, Facultad de Ciencias, University of Glasgow
Authors: Vaz-Serrano, J. (Ekstern), Ruiz-Gomez, M. L. (Ekstern), Gjøen, H. M. (Ekstern), Skov, P. V. (Intern), Huntingford, F. A. (Ekstern), Øverli, Ø. (Ekstern), Höglund, E. (Intern)
Pages: 359-364
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication Information
Journal: Physiology & Behavior
Volume: 103
Issue number: 3-4
ISSN (Print): 0031-9384
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.53 SJR 1.05 SNIP 0.856
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.286 SNIP 1.006 CiteScore 2.92
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.489 SNIP 1.081 CiteScore 3.17
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.473 SNIP 1.107 CiteScore 3.29
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.287 SNIP 1.046 CiteScore 3.25
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.227 SNIP 1.039 CiteScore 3.23
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.271 SNIP 1.051
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.399 SNIP 1.184
BFI (2008): BFI-level 1
Controlling effluents from RAS – waste management strategies important for commercial RAS sustainability

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, P. B. (Intern), Suhr, K. I. (Intern), Pedersen, L. (Intern)
Publication date: 2011

Host publication information
Title of host publication: Book of Abstracts
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 276720
Publication: Research › Conference abstract in proceedings – Annual report year: 2011

Dambrugsteknologi – Formalinsubstitution: Undersøgelse af vandbehandlingspraksis med brintoverilte og pereddlkesyreprodukter på forskellige typer dambrug

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Henriksen, N. H. (Ekstern)
Number of pages: 47
Publication date: 2011

Publication information
Place of publication: Charlottenlund
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
ISBN (Print): 978-87-7481-134-3
Original language: Danish

Series: DTU Aqua Report
Number: 236-2011
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Electronic versions:

54BB3d01.pdf

Links:
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008
Source: orbit
Source-ID: 281778
Dambrugsteknologi – reduktion af kvælstofudledning fra Modeldambrug: Test af denitrifikationsfiltre

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Suhr, K. I. (Intern), Pedersen, P. B. (Intern)
Number of pages: 35
Publication date: 2011

Publication information
Place of publication: Charlottenlund
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
ISBN (Print): 978-87-7481-132-9
Original language: Danish
Series: DTU Aqua Report
Number: 234-2011
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Electronic versions: 94080d01.pdf
Links: http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008
Source: orbit
Source-ID: 277502
Publication: Research › Report – Annual report year: 2011

Dambrugsteknologi – reduktion af kvælstofudledning fra Modeldambrug: Undersøgelse af biofilterelementer, biofilterkinetik og forhold af betydning for nitrifikationen

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Suhr, K. I. (Intern), Pedersen, P. B. (Intern)
Number of pages: 41
Publication date: 2011

Publication information
Place of publication: Charlottenlund
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
ISBN (Print): 978-87-7481-131-2
Original language: Danish
Series: DTU Aqua Report
Number: 233-2011
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Electronic versions: 14FC1d01.pdf
Links: http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008
Source: orbit
Source-ID: 277503
Publication: Research › Report – Annual report year: 2011

Dataopsamling, Renseeffektivitet på model 1 dambrug: Fra: Dambrugsteknologi. Samlerapport

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Svendsen, L. M. (Ekstern), Larsen, S. E. (Ekstern), Dalsgaard, A. J. T. (Intern)
Effects of maternal stress coping style on offspring characteristics in rainbow trout (Oncorhynchus mykiss)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Åberg Andersson, M. (Intern), Silva, P. (Ekstern), Steffensen, J. (Ekstern), Höglund, E. (Intern)
Pages: 699-705
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: Hormones and Behavior
Volume: 60
Issue number: 5
ISSN (Print): 0018-506X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.605 SNIP 1.151 CiteScore 3.5
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.926 SNIP 1.214 CiteScore 4.2
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.201 SNIP 1.291 CiteScore 4.32
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.068 SNIP 1.354 CiteScore 4.47
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.552 SNIP 1.159 CiteScore 3.87
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.609 SNIP 1.147 CiteScore 3.81
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.502 SNIP 1.185
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.77 SNIP 1.283
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.524 SNIP 1.197
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.453 SNIP 1.16
Scopus rating (2006): SJR 1.48 SNIP 1.331
Scopus rating (2005): SJR 1.485 SNIP 1.397
Scopus rating (2004): SJR 1.477 SNIP 1.343
Scopus rating (2003): SJR 1.209 SNIP 1.198
Effects of rearing density and water current on the respiratory physiology and haematology in rainbow trout, *Oncorhynchus mykiss* at high temperature

**General information**

State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Skov, P. V. (Intern), Larsen, B. K. (Intern), Frisk, M. (Ekstern), Jokumsen, A. (Intern)
Pages: 446-452
Publication date: 2011
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Aquaculture
Volume: 319
ISSN (Print): 0044-8486
Ratings:
- BFI (2018): BFI-level 2
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 2
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 2
- Scopus rating (2016): CiteScore 2.75 SJR 1.101 SNIP 1.524
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 2
- Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 1.136 SNIP 1.3 CiteScore 2.18
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 1.212 SNIP 1.487 CiteScore 2.32
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 1.294 SNIP 1.542 CiteScore 2.39
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 1.151 SNIP 1.394
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.941 SNIP 1.263
Effects of substituting lipid with starch as metabolic fuel on performance and nutrient utilization in gilthead sea bream (Sparus aurata) juveniles

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Ekmann, K. S. (Intern), Dalsgaard, A. J. T. (Intern), Holm, J. (Ekstern), Campbell, P. J. (Ekstern), Skov, P. V. (Intern)
Publication date: 2011
Event: Poster session presented at European Aquaculture Society Meeting, Rhodes, Greece, .
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 314635
Publication: Research › Conference abstract in proceedings – Annual report year: 2011

Entwicklungen in der dänischen Fischzucht: nachhaltige Umweltmaßnahmen zahlen sich aus

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern)
Publication date: 2011
Event: Poster session presented at European Aquaculture Society Meeting, Rhodes, Greece, .
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 312645
Publication: Research › Poster – Annual report year: 2011

Host publication information
Title of host publication: Book of Abstracts
Main Research Area: Technical/natural sciences
Conference: Deutscher Fischereitag Dresden Sachsen, Dresden, Germany, 01/01/2011
Source: orbit
Source-ID: 312645
Publication: Research › Conference abstract in proceedings – Annual report year: 2011
Feed and organic matter

Organic waste from fish production is conventionally measured as BOD5 (biological oxygen demand measured during 5 days) and COD (chemical oxygen demand (includes BOD5)). Organic waste is of particular concern for several reasons. The easily degradable part (BOD5) may have an immediate, negative impact on the receiving water body by reducing dissolved oxygen concentrations and increasing sedimentation. Within aquaculture systems, a high organic load may affect fish health and performance directly (e.g., gill disease) as well as indirectly (proliferation of pathogenic bacteria and parasites, reduction of dissolved oxygen concentrations, etc.). In recirculating aquaculture systems (RAS), a high organic load caused by limited water exchange may affect biofilter performance by favouring heterotrophic bacteria at the expense of autotrophic, nitrifying bacteria. Organic waste in RAS primarily originates from undigested feed, but also metabolic losses, mucus, dead tissue, feed waste and intake water may contribute. The nutrient composition of the feed affects the quantity and composition of the organic (undigested) waste, and including for example plant protein ingredients may affect the distribution between particulate and unsedimented (suspended and dissolved) organic waste. Quantifying aquaculture waste, including organic matter, nitrogen (N) and phosphorus (P), into different waste fractions (particulate and unsedimented) is essential for optimising the design of different treatment setups with specific cleaning objectives. A series of studies were carried out to measure the solid and unsedimented waste from juvenile rainbow trout (Oncorhynchus mykiss) fed three commonly applied commercial diets (Dalsgaard and Pedersen, 2011). Furthermore, it was hypothesized that particulate COD can be calculated from undigested nutrients. There were only minor differences between the diets. Generally, 48% of ingested N was recovered in the water and 7% in the solids. For phosphorus, 1% was recovered in the water and 43% in the solids. More COD was recovered as solids than as unsedimented waste, while it was opposite for BOD5. A BOD5/COD ratio of 0.5 was derived, indicating that unsedimented organic waste is characterized by easily degradable organic matter. In comparison, a solid BOD5/COD ratio of 0.2 indicated that this waste fraction contains high amounts of hard-to-degrade organic matter. The study confirmed that solid COD can be quite accurately calculated from the composition of undigested nutrients.
Influence of feed ingredients on water quality parameters in RAS

Although feed by far is providing the major input to RAS, relatively little is published about the correlation between feed composition and the resulting water quality in such systems. In a set-up with 6 identical RAS, each consisting of a fish tank (0.5 m³), a swirl separator, a submerged biofilter (0.67 m³/100 m²) and a trickling filter (0.17 m³/33 m²), two different feed types were tested in a triplicate set-up. The two feed types used were identical recipes (44% protein, 30% fat) except for the inclusion of 0.2 % guar gum (Grindsted Guar, Danisco) in one of the types. The inclusion level of plant-based protein in the diets was relatively high (68% of protein). Growth performance (SGR, FCR) was not different between the feed types. Fish in each system - and thereby the system itself - were fed 500 g feed/day. After 8 weeks on the same commercial feed type, test feed was administered to the systems for 49 consecutive days. Each week, 24h-water samples (1 sample/hour) were collected from each system. The sludge collected in the swirl separator that day was also collected. Water and sludge were subsequently analysed for nitrogen, phosphorous and organic matter content. Inclusion of guar gum had impact on water quality in the systems as well as on matter removed by the swirl separators. In the RAS water, phosphorous (Ptot and Pdiss) concentrations were reduced by guar gum. Organic matter content (CODdiss) in the water was also reduced. Corresponding to this, more dry matter, more COD and more phosphorous were removed by the swirl separators. As might be expected from the high protein digestibility (determined in a separate study), no effects were generally observed on nitrogen compounds.
Is batch variability in hatching time related to size heterogeneity and cannibalism in pikeperch (Sander lucioperca)?

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Steenfeldt, S. J. (Intern), Lund, I. (Intern), Höglund, E. (Intern)
Pages: 727-732
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture Research
Volume: 42
Issue number: 5
ISSN (Print): 1355-557X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.23 SJR 0.555 SNIP 0.926
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.79 SNIP 1.1 CiteScore 1.37
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.674 SNIP 0.943 CiteScore 1.23
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.815 SNIP 0.984 CiteScore 1.43
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.77 SNIP 0.958 CiteScore 1.29
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.725 SNIP 0.964 CiteScore 1.37
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.645 SNIP 0.936
Web of Science (2010): Indexed yes
Linking fearfulness and coping styles in fish

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Martins, C. I. (Ekstern), Silva, P. I. (Ekstern), Conceicao, L. E. (Ekstern), Costas, B. (Ekstern), Höglund, E. (Intern), Øverli, Ø. (Ekstern), Schrama, J. W. (Ekstern)
Pages: Art. no. e28084
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: PLoS ONE
Volume: 6
Issue number: 11
ISSN (Print): 1932-6203
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.11 SJR 1.201 SNIP 1.092
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.414 SNIP 1.131 CiteScore 3.32
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.545 SNIP 1.141 CiteScore 3.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.74 SNIP 1.147 CiteScore 3.94
ISI indexed (2013): ISI indexed yes
Manupulation of the stress responsiveness through dietary tryptophan in Atlantic salmon (Salmo salar) smolt: Consequences on skin pigmentation and behaviour

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Basic, D. (Ekstern), Höglund, E. (Intern), Winberg, S. (Ekstern), Hillestad, M. (Ekstern), Mayer, I. (Ekstern), Krogdahl, Å. (Ekstern)
Publication date: 2011
Event: Poster session presented at 9th International Congress on Biology of Fish, Barcelona, Spain.
Main Research Area: Technical/natural sciences
Links:
- http://www.fishbiologycongress.org/
Source: orbit
Source-ID: 277506
Publication: Research › Poster – Annual report year: 2011

Marine Model Trout Farms: developments in marine RAS
Economical and environmentally sustainable production of large salmonids in sea water has in Denmark been called for during some years. Based on the experience gained from the Danish Model Trout Farms in freshwater, a rather similar concept has been developed for farming of larger fish in sea water. This development and demonstration unit in commercial scale will during the next four years hopefully provide scientific and practical basis and support for further development in coming generations of Marine Model Trout Farms for large salmonids. The unit consist in the recirculation loop of one large fish tank, ø25 m, depth 4.5 m, i.e. tank volume some 2.000 m³; a drum filter (HydroTech); 9 separate pumps (Grundfos NB 150-200/224). 2 for each of 3 submerged biofilter-sections and 3 pumps bypassing the submerged biofilters, leading directly to the large trickling filter where the water from the submerged biofilters also enter. Each submerged biofilter contains 22.6 m³ filter elements (RK BioElements 750 m²/m³; RK plast) and the trickling filters contains 90 m³ (BioBlock 200, Exponet). From the trickling filter water is led directly back to the fish tank. According to fish stock, feeding level and water temperature the pumps can be individually turned on/off primarily in relation to oxygen need and consumption in the fish tank. In a 1 year batch production some 20 t of fish will be introduced in April and some 80 t are supposed to be harvested in December. End-of-pipe treatment is a two-step process. First, nitrogen is removed in a
full-scale experimental set-up where sludge from the drum filter is hydrolysed and the VFAs generated used as energy-source for the denitrification process in separate tanks/filters. Final polishing follows in a constructed wetland. For the first 2 years of operation production will be focussed on rainbow trout production, mimicking the typical Danish net cage farming cycle, where the cages are stocked with fish of 750 – 1,000 g in April/May and all harvested before Christmas weighing some 4 kg/pcs. During these two years important production parameters such as growth-rate, feed conversion and pigmentation will be compared to net-cage results and a full-cost comparison will be performed. After 2 years Atlantic salmon will be farmed in all-year operation. The project is supported by the Danish GUDP joint cooperation between research and industry, and the participants are: The North Sea Center (facilities); AquaPri (fish producer); Biomar (feed producer); Billund Aquaculture (system supplier); RK Plast (producer of biofilter elements) and DTU Aqua. Facts, Experience gained, facts and figures will be presented

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, P. B. (Intern)
Number of pages: 52
Publication date: 2011

Host publication information
Title of host publication: Workshop on Recirculating Aquaculture Systems Helsinki, October 5-6, 2011
Volume: No. 42
Place of publication: Charlottenlund
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
Editor: Dalsgaard, A. J. T.
ISBN (Print): 978-87-7481-136-7
Series: DTU Aqua Report
Number: 237-2011
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Conference: Workshop on Recirculating Aquaculture Systems, Helsinki, Finland, 01/01/2011
Source: orbit
Source-ID: 312656
Publication: Research › Conference abstract in proceedings – Annual report year: 2011

Modeling of TAN in recirculating aquaculture systems by AQUASIM
Modeling of total ammonium nitrogen (TAN) in recirculating aquaculture systems (RAS) contribute to identifying and quantifying the most important processes and their relative contribution to removal of TAN. AQUASIM is a flexible modular simulation system for water quality in natural and technical systems developed by EAWAG (Reichert, 1994). AQUASIM allows simulating complex biological, chemical and physical processes in standardized hydraulic systems. We used AQUASIM to model the steady state TAN concentrations in 12 experimental recirculating aquaculture systems (RAS) operated by DTU AQUA in Hirtshals, Denmark (Pedersen et al., 2009). Water from the fish rearing tank is treated in a sedimentation tank and subsequently by biological treatment in a submerged biofilter and in a trickling filter. Generally, the performance of the biological treatment was very well and average TAN concentrations in the RAS were in the range 0.1-0.4 mg TAN/L depending on the cumulative feed load. The average nitrite concentrations were a little higher than the average TAN concentrations, in the range 0.2-0.6 mg N/L. Our TAN model simulated TAN removal by the following processes: 1 & 2: Nitrification in the biofilm in the submerged biofilter and in the trickling filter, 3. nitrification by suspended nitrifiers (flocs) in all compartments of the RAS, and 4. TAN assimilation associated to biomass growth. The simulation model was able to describe the measured TAN concentration very well after least square optimization of the nitrification rate constants in the biofilm and in the suspended biomass. Thus, it was demonstrated that AQUASIM is a very useful tool that can be applied to improving process understanding as well as to contributing to fish production optimization

General information
State: Published
Organisations: Urban Water Engineering, Department of Environmental Engineering, Section for Aquaculture, National Institute of Aquatic Resources
Authors: Arvin, E. (Intern), Pedersen, L. (Intern)
Number of pages: 52
Publication date: 2011

Host publication information
Title of host publication: Workshop on Recirculating Aquaculture Systems Helsinki, October 5-6, 2011
Volume: No. 32
Place of publication: Charlottenlund
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
Moderate exercise of rainbow trout induces only minor differences in fatty acid profile, texture, white muscle fibres and proximate chemical composition of fillets

These experiments studied how moderate water velocities (0.9 body length second⁻¹ (bl s⁻¹)) may influence different quality characteristics of rainbow trout when compared to fish kept in standing water (b0.1 bl s⁻¹). Fish fed at 1.3% of their body weight per day were slaughtered at a weight of 350 g after nine weeks of experiment at 15.0 °C. The fatty acid composition in fillets differed only marginally between exercised fish (excF) and control fish (ctrlF) kept in standing water. ExcF fillets had a significantly lower content of fatty acids 16:0 (P<0.05) and 18:1 (n−7) (P<0.01) and a higher content of 20:2 (n−6) (P<0.05) compared to ctrlF fish, but all differences were small (b7%). The percentage of n−3 fatty acids was not significantly affected by the applied training regime and neither was the n−3 : n−6−1 ratio. The percentage of n−3 fatty acids, however, decreased linearly in both groups when the lipid content in the fillet increased (R²≥0.85, P<1·10⁻⁶). Fillet texture measured instrumentally as shear force (g) after 72 h of ice storage did not differ between the two experimental groups, and neither did the content of lipid, protein or dry matter in the fillet. Muscle fibre sizes have a possible role in textural characteristics and were determined by histological analyses of white, glycolytic muscle tissue. These data showed that although differences in average fibre diameters were small (excF: 75.04 (s.d.=48.96)μm; ctrlF: 74.50 (46.21)μm) the general fibre size distribution differed significantly among the two groups (P<0.01). Moreover, moderate exercise induced small but significant changes in fibre circularity (excF: circ.=0.724; ctrlF:=0.720, P<0.05) but neither muscle fibre diameter nor circularity was significantly related to fillet texture. Altogether, the results suggest that moderate water velocities have limited impact on quality of pan-sized rainbow trout but subtle changes in the fillets indicate that other training strategies may induce stronger responses.
Muscle quality in exercised rainbow trout

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Rasmussen, R. S. (Intern)
Publication date: 2011
Event: Abstract from FitFish Workshop on the Swimming Physiology of Fish, Barcelona, Spain.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 274950
Publication: Research - peer-review » Journal article – Annual report year: 2011
Økologisk akvakultur – Fra niche til vækstområde

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: Økologi & Erhverv
Issue number: 3. juni, 479
ISSN (Print): 1904-1586
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Source: orbit
Source-ID: 277477
Publication: Research › Journal article – Annual report year: 2011

Økologisk fiskeproduktion (ORAQUA)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Jokumsen, A. (Intern)
Pages: 16-19
Publication date: 2011

Host publication information
Title of host publication: Resultater fra den økologiske forskning 2006 – 2010
Publisher: Internationalt Center for Forskning i Økologisk Jordbrug og Fødevaresystemer (ICROFS)
ISBN (Print): 978-87-92499-14-1
Main Research Area: Technical/natural sciences
Publication: Communication › Report chapter – Annual report year: 2012
Optimeret nitrifikation i biofiltre på modeldambrug type 3: Fra: Dambrugsteknologi. Samlerapport

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Janning, K. (Ekstern), Pedersen, P. B. (Intern), Michelsen, K. (Ekstern), Olsen, B. H. (Ekstern)
Publication date: 2011

Publication information
Publisher: Dansk Akvakultur
Original language: Danish
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 278134
Publication: Research › Report – Annual report year: 2011

Optimering af driften på etablerede modeldambrug og fortsat videreudvikling af recirkuleringssteknologien: Rapport for arbejdspakke 3b : Undersøge graden af gasovermætning samt evaluere betydningen

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Skov, P. V. (Intern), Henriksen, N. H. (Ekstern), Andreasen, A. (Ekstern), Clausen, T. (Ekstern)
Number of pages: 15
Publication date: 2011

Publication information
Publisher: Dansk Akvakultur
Original language: Danish
Series: Faglige rapporter
Main Research Area: Technical/natural sciences
Links:
Source: orbit
Source-ID: 278131
Publication: Research › Report – Annual report year: 2011

Pop up satellite tags impair swimming performance and energetics of the European eel (Anguilla anguilla)

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Methling, C. (Ekstern), Tudorache, C. (Ekstern), Skov, P. V. (Intern), Steffensen, J. F. (Ekstern)
Pages: e20797
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: PLoS ONE
Volume: 6
Issue number: 6
ISSN (Print): 1932-6203
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.11 SJR 1.201 SNIP 1.092
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Renseeffektivitet på Model 1 dambrug: Rapportering af WP4 under dambrugsteknologiprojektet

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Svendsen, L. M. (Ekstern), Larsen, S. E. (Ekstern), Dalsgaard, A. J. T. (Intern), Plesner, L. J. (Ekstern), Michelsen, K. (Ekstern)
Number of pages: 106
Publication date: 2011

Publication information
Publisher: Aarhus Universitet. Danmarks Miljøundersøgelser
ISBN (Print): 978-87-7073-252-9
Original language: Danish
Series: Faglig rapport fra DMU
Number: 842
ISSN: 1600-0048
Main Research Area: Technical/natural sciences
Replacement of fish meal with a matrix of organic plant proteins in organic trout (Oncorhynchus mykiss) feed, and the effects on nutrient utilization and fish performance

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Lund, I. (Intern), Dalsgaard, A. J. T. (Intern), Rasmussen, H. T. (Ekstern), Holm, J. (Ekstern), Jokumsen, A. (Intern)
Pages: 259-266
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture
Volume: 321
Issue number: 3-4
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.136 SNIP 1.3 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.212 SNIP 1.487 CiteScore 2.32
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.294 SNIP 1.542 CiteScore 2.39
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.151 SNIP 1.394
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.941 SNIP 1.263
Web of Science (2009): Indexed yes
Response to environmental change in rainbow trout selected for divergent stress coping styles

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Ruiz-Gomez, M. (Ekstern), Huntingford, F. (Ekstern), Øyvind, Ø. (Ekstern), Thörnqvist, P. (Ekstern), Höglund, E. (Intern)
Pages: 317-322
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: Physiology & Behavior
Volume: 102
Issue number: 3-4
ISSN (Print): 0031-9384
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.53 SJR 1.05 SNIP 0.856
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.286 SNIP 1.006 CiteScore 2.92
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.489 SNIP 1.081 CiteScore 3.17
BFI (2013): BFI-level 1
Solid and suspended/dissolved waste (N, P, O) from rainbow trout (Oncorhynchus mykiss)

Quantifying aquaculture waste into different waste fractions will make it possible to design different treatment setups for obtaining specific cleaning objectives. The aim of this study was therefore to measure “all” solid and suspended/dissolved (i.e. unsedimented) waste from juvenile rainbow trout (Oncorhynchus mykiss) fed three commonly applied commercial diets, “all” waste referring to: total nitrogen (N), total ammonia nitrogen (TAN=NH3-N+NH4-N), total phosphorus (P), and organic matter characterized by the chemical oxygen demand (COD) and the biological oxygen demand after 5 days (BOD5). Furthermore, it was hypothesized that solid COD waste can be calculated from undigested nutrients. Two experiments were carried out using a modified Guelph System. Nitrogen and phosphorus wastewas derived from mass-balances based on all measured values in the first experiment. Apparent digestibility coefficients (ADCs) were used to calculate the solid amounts of undigested nutrients. These were subsequently used for calculating the solid COD output, verified by direct COD measurements. The output of solid and suspended/dissolved BOD5 and COD was measured in the second experiment. There were just minor differences between the dietary treatment groups in the waste produced. On average, 48% of the ingested N was recovered in the water (TAN constituting 64–79% of this) and 7% in the solids. In comparison, 1% of the ingested P was recovered in the water and 43% in the solids. A breakpoint value of 5.6 g standardized available P kg−1 dry feed was found, below which the dissolved P excretion was minimal and above which it increased rapidly. More COD was recovered as solid waste than as suspended/dissolved waste, while it was opposite for BOD5. A BOD5/COD ratio of 0.5 indicated that the suspended/dissolved waste was characterized by easily degradable organic matter, while a solid BOD5/COD ratio of 0.2 indicated that this waste fraction contained high amounts of hard-to-degrade organic matter. Finally, the study showed that solid COD waste can be quite accurately calculated from the composition and content of undigested nutrients.
The effect of protein and lipid source in organic feed for (organic) rainbow trout on sensory quality

The aim of this work was to study which effects protein and lipid source in feed for organic rainbow trout (Oncorhynchus mykiss) may have on the sensory quality of the final product after up to 14 days of storage in ice. The protein sources used in the experiment were fishmeal and a mixture of vegetable protein. While the lipid sources were fish, linseed, sunflower, rapeseed and grape seed oil. After slaughtering all fish were frozen (-40°C) until the sensory experiment was performed, for which the trout were thawed and stored for 3, 5, 7 and 14 days in ice respectively. The sensory experiment included objective sensory profiling, of samples which were heat treated in a convention oven at 100°C until the core temperature was 70°C. The sensory panel consisted of 11 assessors which all were tested and trained. The sensory analysis included descriptors related to the odour, appearance, flavour and texture. After 3 days of storage in ice an impact of lipid source is seen. Inclusion of linseed oil resulted in a sensory profile comparable to the use of fish oil in the feed. While some of the other vegetable oils, especially grape seed oil results in a sensory profile rather different from the trout that had fish oil. However, this difference observed after 3 days of storage did not appear after a longer storage time, and consequently no differences in the sensory characteristics is observed after the 5 days of storage in ice. Nevertheless after 7 days in ice some differences are appearing again. Here the trout which have had rapeseed and grape seed oil in the feed has a more neutral flavour and odour compared to the other ones. After 14 days of storage the protein source had an effect, and the trout which received fishmeal in the feed were more tainted. Therefore, it is seen that the shelf-life is increased by feeding the fish with vegetable protein compared to fish meal. The conclusion of the experiment therefore was that both dietary vegetable protein and lipid sources can influence on sensory characteristics of trout stored in ice.
The effects of dietary long-chain essential fatty acids on growth and stress tolerance in pikeperch larvae (Sander lucioperca L.)

The nutritional requirements of pikeperch larvae have been sparsely examined. Dietary polyunsaturated fatty acids, arachidonic acid (ARA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) may affect growth and physiological stress response in marine fish larvae, but these mechanisms have not received as much attention in freshwater fish. Pikeperch larvae were reared on Artemia from day 3 until 21 days posthatch. Artemia were enriched with six formulated emulsions, with inclusion of either fish oil, pure olive oil (POO) or olive oil supplemented with various combinations of ARA, EPA and DHA. Larval tissue FA was significantly related to the content in the diets, but larval growth was similar for all treatments. When exposed to stress by confinement in small tanks with culture tank water or saline water (15 g L−1.), mortality in larvae treated with POO was significantly higher than in the remaining treatments while tissue cortisol contents in these fish seemed lower. The findings of a lower stress response in larvae fed POO may be related to the lower tissue content in these larvae of essential fatty acids especially DHA but also EPA and ARA.
The two-choice system is a non-invasive method for identifying socially dominant individuals from a group of fish

Towards environmentally sustainable aquaculture: Exploiting fermentation products from anaerobic sludge digestion for fueling nitrate removal in RAS

Aquaculture is the world’s fastest growing food production sector (FAO, 2007). The continuous growth in many countries, however, relies heavily on the ability to reduce the emission of nutrients and chemicals from the fish farms. A way to manage and treat the nutrient aquaculture wastes is by production in recirculating aquaculture systems (RAS). In Denmark, more than 50% of total fresh-water rainbow trout production is made in semi-intensive RAS, called ModelTroutFarms (MTF). MTF efficiently removes organic matter (93%), phosphorous (76%), and nitrogen (50%) (Svendsen et al., 2008). This makes nitrogen the limiting process parameter for further environmentally viable increase in production. Nitrogen removal is a two step transformation process, with (1) ammonia-N oxidation to nitrate-N in the RAS’ biofilter, and subsequently (2) nitrate-N reduction to N2 in the constructed wetlands. The latter being the final cleaning component of the MTF set-up. No specific denitrification filter has so far been implemented in Danish MTFs. An in-situ study was conducted at a commercial MTF (1000 ton/year) for evaluating the potential of using the fermentation products from anaerobic digestion in the sludge storage basins, to fuel denitrification in specific denitrification filters. In experimental filters (5.5 m3) nitrate-containing outlet water was mixed with drainage water from the sludge storage basins according to a factorial design varying C/N ratio from 4 to 12 (CODs /NO3-N) and hydraulic retention time (HRT) from 50 to 180 min. The highest removal rate recorded, 125 g NO3-N/m3reactor/d, was found in treatments at the design center point, and multivariate response surface analysis modeled a maximum N-removal at C/N ratio of 8.8 and HRT of 114 min. The effect of C/N ratio depended on the HRT: At low HRT, variation in C/N ratio had no effect on N-removal. On the contrary, at high HRT, the highest N-removal was measured at high C/N ratio but significant ammonia-N was simultaneously produced, most probably by dissimilatory nitrate reduction to ammonia (DNRA). Running the filters at high HRT and low C/N ratio rendered a relatively lower nitrate-N removal rate but significantly higher ammonia-N reduction, which could indicate anaerobic ammonia oxidation (anammox) activity. A controlled laboratory anaerobic MTF sludge digestion experiment showed that app. 40% additional nitrate-N reduction could theoretically be achieved if implementing the use of fermented
sludge as carbon source for denitrification. Besides the N-reduction, the directly linked sludge (/organic matter) reduction is a beneficial side effect of such an operational set-up.

**General information**

State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Suhr, K. I. (Intern), Pedersen, P. B. (Intern)
Number of pages: 52
Publication date: 2011

**Host publication information**

Title of host publication: Workshop on Recirculating Aquaculture Systems Helsinki, October 5-6, 2011
Volume: No. 36
Place of publication: Charlottenlund
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
Editor: Dalsgaard, A. J. T.
ISBN (Print): 978-87-7481-136-7

Series: DTU Aqua Report
Number: 237-2011
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Conference: Workshop on Recirculating Aquaculture Systems, Helsinki, Finland, 01/01/2011
Source: orbit
Source-ID: 312655
Publication: Research › Conference abstract in proceedings – Annual report year: 2011

**Undersøgelse af biofilterelementer, biofilterkinetik og forhold af betydning for nitrifikationen: Fra: Dambrugsteknologi. Samlerapport**

**General information**

State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Suhr, K. I. (Intern), Pedersen, P. B. (Intern)
Number of pages: 10
Publication date: 2011

**Publication information**

Publisher: Dansk Akvakultur
Original language: Danish
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 281197
Publication: Research › Report – Annual report year: 2011

**Undersøgelse af vandbehandlingspraksis med brintoverilte og pereddikesyreprodukter på forskellige typer dambrug**

**General information**

State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Henriksen, N. (Ekstern)
Number of pages: 41
Publication date: 2011

**Publication information**

Original language: Danish
Main Research Area: Technical/natural sciences
Links:
http://www.danskakvakultur.dk/images/nh%20veterin%C3%A6r/Formalinsubstitution_Hovedrapport.pdf
Source: orbit
Source-ID: 281266
Publication: Research › Report – Annual report year: 2011
Vækst og kvalitet af motioneret regnbueørred

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Division of Industrial Food Research, National Food Institute
Authors: Rasmussen, R. S. (Intern), Oksbjerg, N. (Ekstern), Hyldig, G. (Intern), Jacobsen, C. (Intern), Jessen, F. (Intern), Nielsen, H. H. (Intern)
Number of pages: 38
Publication date: 2011

Publication information
Place of publication: Charlottenlund
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
ISBN (Print): 978-87-7481-141-1
Original language: Danish
Series: DTU Aqua-rapport
Number: 242-2011
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Electronic versions:
Source: orbit
Source-ID: 316379
Publication: Research › Report – Annual report year: 2011

Welfare of farmed rainbow trout (Oncorhynchus mykiss), preferences for stocking density

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Laursen, D. C. (Intern), Silva, P. (Ekstern), Åberg Andersson, M. (Ekstern), Höglund, E. (Ekstern)
Publication date: 2011
Event: Abstract from European Aquaculture Society Annual Conference, Rhodes, Greece, .
Main Research Area: Technical/natural sciences
Bibliographical note
Extended abstract
Source: orbit
Source-ID: 316709
Publication: Research › Conference abstract for conference – Annual report year: 2011

Welfare of farmed rainbow trout (Oncorhynchus mykiss), preferences for stocking density

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Laursen, D. C. (Intern), Åberg Andersson, M. (Ekstern), Silva, P. (Ekstern), Höglund, E. (Ekstern)
Publication date: 2011
Main Research Area: Technical/natural sciences
Bibliographical note
Both poster presentation and abstract
Source: orbit
Source-ID: 277998
Publication: Research › Poster – Annual report year: 2011

Workshop on Recirculating Aquaculture Systems Helsinki, October 5-6, 2011: Book of abstracts

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Yolk reserves predicts social status in rainbow trout (Oncorhynchus mykiss) larvae

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Åberg Andersson, M. (Intern), Höglund, E. (Intern)
Publication date: 2011
Event: Abstract from Annual Meeting The Society of Experimental Biology, Glasgow, Scotland.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2011

Akvakultur – Nye udfordringer og nye muligheder

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Publication date: 2010
Main Research Area: Technical/natural sciences

Avoidance behaviour of rainbow trout (Oncorhynchus mykiss) to hypoxia: a non-invasive method for sorting fish according to stress coping style

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Laursen, D. C. (Intern), Olsén, H. (Ekstern), Ruix-Gomez, M. L. (Ekstern), Winberg, S. (Ekstern), Höglund, E. (Intern)
Publication date: 2010
Event: Poster session presented at 9th International Congress on Biology of Fish, Barcelona, Spain.
Main Research Area: Technical/natural sciences
Chronic exposure of adults and embryos of Pandalus borealis to oil causes PAH accumulation, initiation of biomarker responses and an increase in larval mortality

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Center for Biological Sequence Analysis, Department of Systems Biology
Authors: Bechmann, R. (Ekstern), Larsen, B. K. (Intern), Taban, I. (Ekstern), Hellgren, L. (Intern), Møller, P. (Intern), Sanni, S. (Ekstern)
Pages: 2087-2098
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Pollution Bulletin
Volume: 60
Issue number: 11
ISSN (Print): 0025-326X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.46 SJR 1.302 SNIP 1.331
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.245 SNIP 1.277 CiteScore 3.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.304 SNIP 1.425 CiteScore 3.04
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.208 SNIP 1.546 CiteScore 2.89
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.241 SNIP 1.377 CiteScore 2.64
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.248 SNIP 1.336 CiteScore 2.57
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.284 SNIP 1.284
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.302 SNIP 1.202
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Degradation and effect of hydrogen peroxide in small-scale recirculation aquaculture system biofilters

From an environmental point of view, hydrogen peroxide (HP) has beneficial attributes compared with other disinfectants in terms of its ready degradation and neutral by-products. The rapid degradation of HP can, however, cause difficulties with regard to safe and efficient water treatment when applied in different systems. In this study, we investigated the degradation kinetics of HP in biofilters from water recirculating aquaculture systems (RAS). The potential effect of HP on the nitrification process in the biofilters was also examined. Biofilter elements from two different pilot-scale RAS were exposed to various HP treatments in batch experiments, and the HP concentration was found to follow an exponential decay. The biofilter ammonia and nitrite oxidation processes showed quick recuperation after exposure to a single dose of HP up to 30 mg L⁻¹. An average HP concentration of 10–13 mg L⁻¹ maintained over 3 h had a moderate inhibitory effect on the biofilter elements from one of the RAS with relatively high organic loading, while the nitrification was severely inhibited in the pilot-scale RAS, equipped with two biofilter units, both a moving-bed (Biomedia) and a fixed-bed (BIO-BLOK®) biofilter, was subjected to an average HP concentration of ~12 mg L⁻¹ for 3 h. The ammonium- and nitrite-degrading efficiencies of both the Biomedia and the BIO-BLOK® filters were drastically reduced. The filters had not reverted to pre-HP exposure efficiency after 24 h, suggesting a possible long-term impact on the biofilters.

General information

State: Published
Organisations: Urban Water Engineering, Department of Environmental Engineering, Section for Aquaculture, National Institute of Aquatic Resources, Technical University of Denmark
Authors: Møller, M. S. (Ekstern), Arvin, E. (Intern), Pedersen, L. (Intern)
Pages: 1113-1122
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication information

Journal: Aquaculture Research
Volume: 41
Issue number: 8
ISSN (Print): 1355-557X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.23 SJR 0.555 SNIP 0.926
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.79 SNIP 1.1 CiteScore 1.37
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Differences in growth and behaviour between early and late swim-up salmon

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Publication date: 2010

Host publication information
Title of host publication: Book of Abstracts
Main Research Area: Technical/natural sciences
Conference: 9th International Congress on Biology of Fish, Barcelona, Spain, 05/07/2010 - 05/07/2010
Links:
http://www.fishbiologycongress.org/
Differences in post hatch metabolic rate and developmental rate in Atlantic salmon (Salmo salar L.): Evidence for compensatory growth?

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Vaz-Serrano, J. (Ekstern), Åberg, M. (Intern), Gjøen, H. (Ekstern), Steffensen, J. (Ekstern), Höglund, E. (Intern)
Publication date: 2010
Event: Poster session presented at 9th International Congress on Biology of Fish, Barcelona, Spain.
Main Research Area: Technical/natural sciences
Links:
http://www.fishbiologycongress.org/

Effects of supplemental enzymes on apparent nutrient digestibility in rainbow trout (Oncorhynchus mykiss) fed plant-based diets
Exogenous enzymes are widely applied in feed for monogastric animals including pigs and poultry as a means to increase the nutritional value of viscous grains by reducing the anti-nutritional effects of primarily non-starch polysaccharides (NSPs). In comparison, there is very limited information on the effects of enzymes in fish feed apart from phytase. Phytase works by hydrolyzing phytic acid, and numerous studies have documented that phytase supplementation increases phosphorus availability in fish fed diets with high inclusion levels of plant proteins. Plant derived proteins are increasingly used in fish feed due to growing demands for and high price variations in fish meal, but high inclusion levels in diets for carnivorous fish are hampered by a great variety of anti-nutritional factors (ANFs), which reduce nutrient utilisation. Exogenous dietary enzymes may potentially help to alleviate these effects, and the objective of the present study was to evaluate the effects of supplementing protease and pectinase to a diet containing approximately 30% soybean meal, rapeseed meal or sunflower meal on nutrient digestibility in juvenile rainbow trout (Oncorhynchus mykiss). Digestibility trials were carried out using a modified Guelph set-up. Rainbow trout were fed the un-supplemented diets and enzyme supplemented plant-based diets in triplicates for three weeks. While moderate effects of the enzymes on nutrient digestibility were obtained with sunflower and rapeseed meal based diets, both enzymes significantly increased (P <0.05) the apparent digestibility coefficients (ADCs) of protein, lipid and nitrogen-free extract (NFE) in soybean meal based diets. Hence, the study provided preliminary results on the potential of protease and pectinase to increase the nutritional value of proteinaceous feed ingredients for fish. However, it also reinforces the complexity of using exogenous dietary enzymes and that more research is required to better understand the mechanisms of actions.

Embryonic suckling and maternal specializations in the live-bearing teleost Zoarces viviparus
The European eelpout follows an aplacental viviparous reproductive strategy, in which gestation lasts 4–5months. During the last months of development yolk reserves are depleted, and embryos depend on an external source of nutrients. Here we provide evidence for novel specialized physiological, morphological and behavioural adaptations, which we propose as the responsible mechanisms for the exchange of nutrients and gases between the maternal organism and her embryos. Ovarian follicles contain an internal glomerulus-like structure within the distal tip of each follicle. Ultrastructural examination indicated a capacity for steroid synthesis and secretion. Gel electrophoresis demonstrated a protein size
distribution in the follicular fluid different from that of the maternal serum, and that ovarian fluid is devoid of protein. From vascular casts and histological sections the follicle was reconstructed. The glomerulus has a central canal that is exteriorized at the tip of the follicle, allowing passage of follicular fluid. Oxygen measurements across the ovary of near-term females showed a strongly hypoxic ovary lumen, yet ovarian fluid adjacent to follicles was oxygen saturated. As another novel observation, embryos were seen engaged in suckling on follicles. We hypothesize that embryos use the follicles on the ovarian wall as placental analogues and that they use their mobile jaw apparatus to attach themselves and apply suction.

**General information**

State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Roskilde Universitet, University of Copenhagen
Authors: Skov, P. V. (Intern), Steffensen, J. F. (Ekstern), Sørensen, T. F. (Ekstern), Qvortrup, K. (Ekstern)
Pages: 120-127
Publication date: 2010
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of Experimental Marine Biology and Ecology
Volume: 395
Issue number: 1-2
ISSN (Print): 0022-0981
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed Yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 2.03 SJR 0.937 SNIP 0.914
  - Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 1.043 SNIP 0.823 CiteScore 1.87
  - Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 1.145 SNIP 1.045 CiteScore 2.41
  - Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 2
- Scopus rating (2013): SJR 1.294 SNIP 1.08 CiteScore 2.45
  - ISI indexed (2013): ISI indexed yes
  - Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 2
- Scopus rating (2012): SJR 1.186 SNIP 1.021 CiteScore 2.27
  - ISI indexed (2012): ISI indexed yes
  - Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 1.067 SNIP 1.007 CiteScore 2.14
  - ISI indexed (2011): ISI indexed yes
  - Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 1.239 SNIP 1.017
  - Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 1.299 SNIP 1.208
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 1.26 SNIP 1.134
- Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 1.214 SNIP 1.308
European eel and aquaculture

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Section for Public Sector Consultancy, Section for Aquaculture, Section for Population Ecology and Genetics
Number of pages: 19
Publication date: 2010

Publication information
Place of publication: Charlottenlund
Publisher: DTU Aqua, Institut for Akvatiske Ressourcer
ISBN (Print): 978-87-7481-127-5
Original language: English
Series: DTU Aqua-rapport
Number: 229-2010
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Electronic versions:
229-2010_European-Eel-and-Aquaculture.pdf
Links:
Source: orbit
Source-ID: 270913
Publication: Research › Report – Annual report year: 2010

Farming of freshwater rainbow trout in Denmark

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern), Svendsen, L. M. (Ekstern)
Number of pages: 47
Publication date: 2010
Hestebønne-, ærte- og raps-protein samt hørfrøolie i foder til økologiske fisk

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Pages: 6-7
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication information
Journal: ICROFS nyt
Issue number: 1
Original language: Danish
Links: http://orgprints.org/16891/
Source: orbit
Source-ID: 264943
Publication: Research › Journal article – Annual report year: 2010

Horse bean-, pea- and rape protein and flax seed oil in feed for organic trout

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Pages: 7
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication information
Journal: ICROFS news
Issue number: 1
Original language: English
Source: orbit
Source-ID: 264946
Publication: Research › Journal article – Annual report year: 2010

Hydrogen peroxide: Disinfectant for recirculating aquaculture systems

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Pedersen, P. B. (Intern)
Pages: 72-74
Influence of dietary arachidonic acid combined with light intensity and tank colour on pigmentation of common sole (Solea solea L.) larvae

Supplementation of dietary arachidonic acid (ARA) is known to cause hypopigmentation in common sole larvae (Solea solea L.). This study examined a possible link between dietary ARA supplementation - light intensity and tank colour on pigment defects in common sole larvae. Larval tissue ARA and prostaglandin PGE(2) content increased significantly when fed Artemia enriched by a fish oil emulsion supplemented with 24% dietary ARA during premetamorphosis (until 11 days post hatch, dph) as compared to larvae fed on Artemia enriched by a fish oil based emulsion. More than 90% of all larvae in groups treated with the ARA supplemented emulsion during premetamorphosis showed partly or complete dorsal hypopigmentation. There were no significant effects of light intensity or tank background colour in combination with ARA on malpigmentation. Larval hypopigmentation was below 10% in the groups not treated with ARA supplemented diets. In these groups, however, the proportion of hypopigmented larvae increased significantly by a combination of a high visual light intensity (4000 lx) and transparent tanks. A high light intensity of 4000 lx increased growth as compared to low intensity of 100 lx, suggested to be related to a higher feed intake. Early pigment cell (chromatophor) development until 11 dph (i.e. start of metamorphosis) was not significantly related to dietary treatment, but during metamorphosis (from 16 dph) total chromatophore concentration (cells larva(-1)) was significantly lower for larvae treated with ARA and a possible lack of pigment cell differentiation or degeneration/cytolysis continued for this group during post metamorphosis.
Intraspecific growth variation among rainbow trout and brook trout: Impact of initial body weight and feeding level

This study describes growth variation within groups of salmonids and the relation to initial fish weights and feeding levels. PIT-tagged rainbow trout (RT) and brook trout (BT) of start weight 120–170 g were reared in separate tanks for 9 weeks. Both species were fed each day either a high ration close to satiation (H) or half of this ration (L). Four experimental groups (RT-H, RT-L, BT-H, BT-L) were studied with regard to their propensity to increase weight in accord with their initial weight. The slope of the regression line between initial weights (g) and weight increases for individuals in each tank in each period was applied as indicator for this propensity (termed "slope"). All calculated slopes in the experiment were positive which indicates the general ability of weighty fish to gain more weight than smaller individuals. The average slope during all 9 weeks was 2–4 times higher for RT-L (5.91) than for all other groups (RT-H: 1.50, P <0.01; BT-H: 1.76, P <0.01 and BT-L: 2.88, P <0.05), indicating the particular propensity of large RT to gain weight when feed was restricted. Overall, ration level had large impact on slopes (H: 1.63, L: 4.39, P <0.01), while this was not the case for species (RT: 3.71, BT: 2.32, P > 0.05). The magnitude of slopes decreased over time (weeks 0–3:4.27, weeks 3–6:3.02 and weeks 6–9:1.74, P <0.05). The observed differences in weight gains between experimental groups were reflected in differences
in coefficients of variations (CVs) for body growth. RT had larger body weight (BW) CVs compared to BT (0.257 vs. 0.206, P <0.01) indicating more uneven feed share among RT than among BT in general. RT-L had significantly higher BW CVs than all other groups (0.300 vs. 0.184–0.229, P <0.01). The observed differences in weight gains enhance size variations in terms of higher CVs, and this may have implications for feeding tactics in aquaculture where large size variations in groups may be disadvantageous to fish farmers.

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Rasmussen, R. S. (Intern), Ostenfeld, T. (Ekstern)
Pages: 933-941
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture International
Volume: 18
Issue number: 5
ISSN (Print): 0967-6120
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.34 SJR 0.563 SNIP 1.014
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.585 SNIP 0.763 CiteScore 1.08
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.553 SNIP 0.765 CiteScore 1.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.626 SNIP 0.796 CiteScore 1.17
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.599 SNIP 1.04 CiteScore 1.15
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.553 SNIP 0.857 CiteScore 0.99
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.533 SNIP 0.832
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.43 SNIP 0.775
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.488 SNIP 0.566
Scopus rating (2007): SJR 0.519 SNIP 0.73
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.603 SNIP 0.974
Scopus rating (2005): SJR 0.449 SNIP 0.536
Scopus rating (2004): SJR 0.424 SNIP 0.68
Scopus rating (2003): SJR 0.415 SNIP 0.699
Repetitive long term formalin application at low dose was investigated to determine the effect on formaldehyde removal rate, biofilter nitrification and the microbial composition in small-scale recirculation aquaculture biofilters. Six pilot-scale recirculation aquaculture systems holding rainbow trout (Oncorhynchus mykiss) were designated to formalin treatments (C-0 at 10 and 20mg/L formaldehyde) on a daily or weekly basis. Formaldehyde removal rates were measured over 10 weeks, during which biofilter nitrification rates were measured in terms of standardized NH4Cl spiking events. The rates were positively correlated to the amount and frequency of formalin treatment. In systems with regularly low formalin dosage, the formaldehyde removal rate increased up to tenfold from 0.19 +/- 0.05 to 1.81 +/- 0.13 mg/(L h). Biofilter nitrification was not impaired in systems treated with formalin on a daily basis as compared to untreated systems. In systems intermittently treated with formalin, increased variation and minor reductions of ammonium and nitrite oxidation rates were observed. Nitrifying bacteria were screened by specific gene probes using fluorescence in situ hybridization and quantified by digital image analysis. The relative abundance of ammonia-oxidizing bacteria (AOB) was up to 5.4% of all Bacteria (EUB) positive cells, predominantly Nitrosomonas oligotropha. Nitrite-oxidizing bacteria (NOB), mainly consisting of Nitrospira sp. were found in all biofilm samples up to 2.9%, whereas Nitrobacter sp. was not detected. The relative abundances of AOB and NOB in the untreated system were generally higher compared to the system exposed to formalin. Low dose formalin in recirculated aquaculture systems proved to be a possible treatment strategy, as the effect on nitrification was minimal. Since formaldehyde was steadily removed by microorganisms, available biofilter surface area, hydraulic retention time and temperature can be used to predict removal and hence estimate e.g. effluent concentration.

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Pedersen, P. B. (Intern), Nielsen, J. L. (Ekstern), Nielsen, P. H. (Ekstern)
Nitrification in moving bed and fixed bed biofilters treating effluent water from a large commercial outdoor rainbow trout RAS

The nitrification performance of two fixed bed (FB) biofilters and two moving bed (MB) biofilters was evaluated. They received the same cold (8 degrees C) influent water from a commercial outdoor RAS facility producing rainbow trout (average density 32 kg m(-3)). The filters were constructed as four identical 5.5 m(3) tanks with different filter media inside and tested simultaneously in duplicate. FB filters were filled with 4.2 m(3) polyethylene netshaped cylinders (Bioblok (R), 200 m(2):n(-3)), and MB filters with 2 m(3) polypropylene carriers (Biomedia, 850 m(2) m(-3)). Nitrification rates were measured 3(1/2) months after start-up, and inlet water was supplemented with ammonium chloride in order to determine maximum nitrification rates (0-order kinetics). The filters were conditioned at in inlet TAN concentration of 2.89 +/- 0.1 mg l(-1) and water in-flow ranging from 1 l s(-1) to 4 l s(-1). Expressed as volumetric total ammonia-N (TAN) removal rate, the MB filters had significantly higher removal rate (23 +/- 17 g N-1 m(-3) d(-1)) compared to the FB filters (92 +/- 2 g N-1 m(-3) d(-1)). Expressed as surface specific TAN removal rate MB filters had significantly lower removal (0.27 +/- 0.02 g m(-2) d(-1)) than FB filters (0.46 +/- 0.01 g m(-2) d(-1)). When conditioned to a higher inlet TAN concentration (6.27 +/- 0.39 mg l(-1)) for 2 weeks, the FB filters increased the removal rate (146 +/- 3 g m(-3) d(-1) or 0.73 +/- 0.01 g m(-2) d(-1)) while the MB filters had unaltered performance. The results indicate, that the more heterogeneous and stratified biofilm to be expected in FB, can react more flexibly when challenged with changes such as differences in TAN loading. The effect of dissolved oxygen level on FB filter nitrification rates was additionally tested at TAN 5.35 +/- 0.06 mg l(-1). Below approximately 60% saturation (7.1 mg O-2 l(-1)) measured at the filter outlet, nitrification rates started decreasing rapidly. An exponential expression (y = -10.05 + 10.48(1 - e(-0.0798x)), R=2=0.96) was found to model the whole data range from 40% to 80% DO saturation well. (C) 2009 E sevier B.V. All rights reserved.

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Suhr, K. (Intern), Pedersen, P. B. (Intern)
Pages: 31-37
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquacultural Engineering
Volume: 42
Issue number: 1
ISSN (Print): 0144-8609
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.09 SJR 0.798 SNIP 1.525
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.723 SNIP 1.148 CiteScore 1.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.72 SNIP 1.437 CiteScore 1.61
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.666 SNIP 1.511 CiteScore 1.8
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.946 SNIP 1.377 CiteScore 1.72
ISI indexed (2012): ISI indexed yes
Organic vegetable proteins and oil in feed for organic rainbow trout (Oncorhynchus mykiss)

The demand for organic trout is increasing, stressing the need for organic, vegetable feed ingredients as replacement for fish meal, as the principles of organic aquaculture encourage the development of feed that do not deplete global fish stocks. In addition, the organic code of practice does not allow addition of artificial amino acids to the feed, and
optimization of the amino acid profile of organically based diets must therefore derive from the protein sources alone. The aim of this study was to evaluate the digestibility and growth performance of organic vegetable dietary ingredients as replacement for fish meal and fish oil in feed for organic rainbow trout (Oncorhynchus mykiss). Six iso-energetic and iso-nitrogenous diets were prepared, comprising a fish meal and fish oil based control diet and three diets in which the inclusion of fish meal was gradually reduced from 59 to 35 % and replaced by a matrix of organic horse bean, pea and rape in the proportion of 1:1:0.7. In the last two diets, the inclusion of fish oil was reduced by 50 and 100 %, respectively and replaced by flax seed oil high in omega-3 fatty acids. Digestibility was measured directly using a modified, flow-through Guelph System consisting of 18 tanks, and feeding each diet in triplicate. Growth performance was measured using a recirculation system consisting of 12 square formed fibre glass tanks. The fish were reared in duplicate for 9 weeks, from an initial individual weight of about 60 g to a final weight of about 200 g. The fish showed good growth performance with a specific growth rate (SGR) of 1.8 % d-1, and a feed conversion ratio (FCR) of 0.75, and there were no significant differences between the groups. Likewise, there were no significant differences in nutrient digestibility between the diets. The results indicate that a matrix of organic horse bean, pea and rape may partially replace fish meal, and flax seed oil may replace fish oil in feed for organic rainbow trout without compromising growth performance and feed utilization.

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Lund, I. (Intern), Dalsgaard, A. J. T. (Intern), Jokumsen, A. (Intern), Larsen, B. K. (Intern)
Publication date: 2010
Event: Poster session presented at 14th International Symposium on Fish Nutrition & Feeding, Qingdao, China.
Main Research Area: Technical/natural sciences
Links:
http://www.isfnf2010.com
Source: orbit
Source-ID: 263962
Publication: Research › Poster – Annual report year: 2010

Relation between stress coping style, larval development and time to emergence in rainbow trout (Oncorhynchus mykiss)

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Åberg, M. (Intern), Khan, U. W. (Ekstern), Øverli, Ø. (Ekstern), Gjøen, H. M. (Ekstern), Steffensen, J. F. (Intern), Höglund, E. (Intern)
Publication date: 2010
Event: Poster session presented at 9th International Congress on Biology of Fish, Barcelona, Spain.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 274815
Publication: Research › Poster – Annual report year: 2010

Stress coping styles ion farmed tilapia (Oreochromis niloticus): Consistent individual behavioral differences and response to conspecific alarm cues

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Silva, P. (Ekstern), Martins, C. (Ekstern), Höglund, E. (Intern), Øverli, Ø. (Ekstern)
Publication date: 2010
Event: Poster session presented at 9th international congress on biology of fish,5-9 July, Barcelona, Spain.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 274817
Publication: Research › Poster – Annual report year: 2010

Stress responsiveness, energetics and life history traits in salmonid fish

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Höglund, E. (Intern)
The effects of grading on the growth and survival of juvenile Dover sole (Solea solea L)

A 3-month study was carried out to investigate the effects of grading on the overall production, growth performance and survival of juvenile Dover sole (Solea solea L.). Juvenile fish (4.0–40.4 g) were sorted into three size groups: small (4.0–15.5 g), medium (16.0–21.5 g) and large (22.0–40.5 g). In addition, a group of unsorted fish was followed for comparison. The fish from each sorted group and the unsorted group were divided between triplicate tanks at a stocking density of 1.5 kg m−2. The fish were weighed and counted 21, 42, 63 and 92 days after stocking. In addition, 30 randomly chosen fish in each tank (=90 from each group) were individually tagged. The survival, size distribution, growth and productivity were calculated for small, medium, large and unsorted groups. In addition, comparisons were made between combined sorted and unsorted fish. There was no significant difference between the mean weight and distribution of sorted and unsorted fish by the end of the trial. An increased overall productivity in combined sorted fish was observed. Regular grading could therefore still be beneficial for sole farming as long as the grading interval supports maximum growth (in this case over 90 days). Survival was not significantly affected by the grading process.
Undersøgelse af miljøvenlige dambrugshjælpestoffer til erstatning for formalin

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern)
Number of pages: 52
Publication date: 2010

Publication information
Place of publication: Charlottenlund
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
ISBN (Print): 978-87-7481-111-4
Original language: Danish

Series: DTU Aqua-rapport
Number: 218-2010
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Electronic versions:
218-10_undersogelse-af-miljovenlige-dambrugshjaelpestoffer.pdf
Links:
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008
Source: orbit
Source-ID: 264083
Publication: Research › Report – Annual report year: 2010
Use of flubendazole as a therapeutic agent against rotifers (Brachionus plicatilis) in intensive cultures of the harpacticoid copepod Tisbe holothuriae

Copepods are well known to be the optimal live feed for most species of marine fish larvae. Still copepods are rarely used in marine hatcheries worldwide. Lack of efficient production techniques are among the reasons for this. Consequently, Artemia and rotifers are utilized in commercial settings. One problem in intensive production of copepods is contamination with rotifers. Rotifers have higher growth rates than copepods and consequently will compete out the copepods when accidentally introduced to the copepod production systems. Once contamination has occurred, the only cure has been to shut down production and subsequently use a therapeutic agent to eliminate all zooplankton in the system before restart with a stock culture free of rotifers. We tested flubendazole as a mean of controlling rotifers (Brachionus plicatilis) in intensive laboratory cultures of the harpacticoid copepod (Tisbe holothuriae). Flubendazole was lethal to rotifers in concentrations as low as 0.05 mg L⁻¹. There was no significant effect on the concentration of copepods, even at the highest concentration tested, i.e. 5.0 mg L⁻¹ flubendazole. We conclude that flubendazole is an effective drug for control of B. plicatilis in T. holothuriae batch cultures.
Videreudvikling af intensivt opdræt af sandart i Danmark

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Steenfeldt, S. J. (Intern), Vestergaard, M. (Ekstern), Overton, J. L. (Intern), Lund, I. (Intern), Paulsen, H. (Intern), Larsen, V. J. (Ekstern), Henriksen, N. H. (Ekstern)
Publication date: 2010

Publication information
Place of publication: Charlottenlund
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
ISBN (Print): 978-87-7481-125-1
Original language: Danish
Series: DTU Aqua-rapport
Number: 228-2010
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Electronic versions:
228-2010_Videreudvikling-af-intensivt-opdraet-af-sandart-i-Danmark.pdf
Links:
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008
Source: orbit
Source-ID: 269205
Publication: Research › Report – Annual report year: 2010

Abildtrup Dambrug - et modeldambrug under forsøgsordningen. Statusrapport for 2. måleår af monitoringsprojektet med væsentlige resultater fra første måleår

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Svendsen, L. M. (Ekstern), Sortkjaer, O. (Ekstern), Ovesen, N. B. (Ekstern), Skriver, J. (Ekstern), Larsen, S. E. (Ekstern), Pedersen, P. B. (Intern), Rasmussen, R. S. (Intern), Dalsgaard, A. J. T. (Intern)
Number of pages: 88
Publication date: 2009

Publication information
Place of publication: Hirtshals
Abolition of reflex bradycardia by cardiac vagotomy has no effect on the regulation of oxygen uptake by Atlantic cod in progressive hypoxia

The functional significance of chemoreflexive hypoxic bradycardia was explored in Atlantic cod Gadus morhua L. (mean mass similar to 800 g, acclimated to a seawater temperature of 11 degrees C) by investigating responses to progressive hypoxia following section of the cardiac branches of cranial nerve X Cardiac denervation had no effect on oxygen uptake rate (M-O2), gill ventilation rate (f(G)) or opercular pressure amplitude (P-OP) under normoxic conditions, but caused a significant increase in heart rate (f(H)), to 50 +/- 1 beats min(-1) by comparison to 40 +/- 2 beats min(-1) in sham-operated cod (mean +/- s.e.m., n=9). Sham-operated cod exhibited transient profound bradycardia following oxygen chemoreceptor stimulation by bolus injection of sodium cyanide into the buccal cavity (2 mg in 2 ml seawater), but this cardiac chemoreflex was abolished in denervated cod. Both groups, however, exhibited similar marked transient chemoreflexive hyperventilation following NaCN. When exposed from normoxia (PO2 similar to 18 kPa) to progressive hypoxia at nominal water PO2'S of 8, 6, 5, 4 and 3 kPa, both groups exhibited the same pattern of homeostatic regulation of M-O2, with no significant difference in their mean critical PO2 (P-crit) values, which were 7.40 +/- 0.81 kPa and 8.73 +/- 0.71 kPa, respectively (n=9). Both groups exhibited significant bradycardia during progressive hypoxia, although denervated fish always had higher mean f(H). The incipient threshold for bradycardia coincided with P-crit in sham-operated cod whereas, in denervates, the threshold was below their P-crit and bradycardia presumably reflected direct effects of hypoxia on the myocardium. The sham-operated group displayed a significantly more pronounced ventilatory response than denervates in hypoxia, in particular for P-OP. In sham-operated cod, peak ventilatory responses occurred in deep hypoxia below P-crit whereas, in denervates, more modest peak responses coincided with Pit and, in deep hypoxia, they exhibited a significant decline in f(G) below their normoxic rate. Only a minority of shams lost equilibrium in hypoxia whereas a majority of denervates did, some of which failed to recover. The results indicate that chemoreflexive bradycardia plays no role in the homeostatic regulation of oxygen uptake by cod in hypoxia, but does contribute to maintenance of overall functional integrity below P-crit.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, University of Birmingham, Aarhus University
Authors: McKenzie, D. (Intern), Skov, P. V. (Intern), Taylor, E. (Ekstern), Wang, T. (Ekstern), Steffensen, J. F. (Intern)
Pages: 332-338
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information
Journal: Comparative Biochemistry and Physiology A
Volume: 153
Issue number: 3
ISSN (Print): 1095-6433
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.16 SJR 0.794 SNIP 0.879
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.917 SNIP 0.915 CiteScore 2.01
Sodium cyanide, Gas exchange, Ventilation, Hypoxia, Heart rate, Vagus, Fish, Cranial nerve X

DOIs:
10.1016/j.cbpa.2009.03.009

A scientific perspective on key impacts in different production systems

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Publication date: 2009
Event: Abstract from The 2nd Freshwater Trout Aquaculture Dialogue Meeting, Faroe Islands, .
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 252711
Publication: Research › Conference abstract for conference – Annual report year: 2009
Can increased water velocities improve quality of farmed rainbow trout

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Aquatic Lipids and Oxidation, Section for Aquatic Process and Product Technology
Publication date: 2009
Event: Abstract from 3rd Joint Trans-Atlantic Fisheries Technology Conference, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 252268
Publication: Research › Conference abstract for conference – Annual report year: 2009

Danish model trout farms – Technology and environmental impact

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern), Plesner, L. J. (Ekstern), Pedersen, P. B. (Intern), Dalsgaard, A. J. T. (Intern), Lund, I. (Intern), Poulson, H. (Intern), Rasmussen, R. S. (Intern)
Publication date: 2009
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 252713
Publication: Research › Conference abstract for conference – Annual report year: 2009

Digestibility in selected rainbow trout families and relation to growth and feed utilisation

Experiments have been carried out aimed at clarifying variations in the digestibility of dietary nutrients in rainbow trout families and studying how differences in digestibility may be related to growth and feed utilisation at various growth rates. The digestibility of protein, lipid, carbohydrates (nitrogen-free extracts, NFE) and dry matter was analysed in two experiments involving eight rainbow trout families [Ab, Ba, Cd, Dc (first study); V, X, Y, Z (second study)]. In the first experiment rainbow trout were reared for 128 days at 13.0A degrees C, and in the second experiment, they were reared for 84 days at 16.8A degrees C. In both experiments, the fish were fed ad libitum and reared from an initial weight of 70-100 g to a final weight of 500-700 g. When the fish reached a weight of approximately 200 g, some individuals were moved to another experimental system in which the digestibility of protein, lipid, nitrogen-free extracts and dry matter was measured. Taken as a whole, our results indicate that selective breeding still offers a large potential for improved growth and feed utilisation in rainbow trout strains. In the first study, family Dc showed a higher specific growth rate (SGR) than the other three families (P <0.05), and family Ba showed a lower feed conversion ratio (FCR) than family Ab (P <0.05); there were no observed differences in digestibility despite some differences in growth. In the second study, family Y grew faster than all of the other families (P <0.05), and family Z grew faster than families V and X (P <0.01). A comparable pattern was seen for FCR, with family Y utilising feed better than family V (P <0.05), and families V, Y and Z performing better than family X (P <0.001). Protein digestibility was higher in the two fastest growing families (Y and Z) than in the slower growing family X (P <0.05), while lipid digestion was higher in family Y than in family V (P <0.05). A comparison of the results from both experiments revealed that protein digestibility in particular was closely related to the SGR and the FCR at high growth rates. However, despite the advantageous protein digestibility on fish growth, analysis of the protein retention efficiency (PRE) showed that when protein was ingested in relatively large amounts, as in the fastest growing families, the "excess" nitrogen was excreted and therefore did not contribute to protein deposition in the fish body. Hence, the potential weight gain offered by improved protein digestibility does not materialise when the protein intake is above a certain level. Other factors must therefore explain the positive relation between fast growth and high protein digestibility.

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Rasmussen, R. S. (Intern), Jokumsen, A. (Intern)
Pages: 187-197
Publication date: 2009
Main Research Area: Technical/natural sciences
Publication information
Journal: Aquaculture International
Volume: 17
Issue number: 2
ISSN (Print): 0967-6120
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.34 SJR 0.563 SNIP 1.014
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.585 SNIP 0.763 CiteScore 1.08
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.553 SNIP 0.765 CiteScore 1.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.626 SNIP 0.796 CiteScore 1.17
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.599 SNIP 1.04 CiteScore 1.15
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.553 SNIP 0.857 CiteScore 0.99
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.533 SNIP 0.832
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.43 SNIP 0.775
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.488 SNIP 0.566
Scopus rating (2007): SJR 0.519 SNIP 0.73
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.603 SNIP 0.974
Scopus rating (2005): SJR 0.449 SNIP 0.536
Scopus rating (2004): SJR 0.424 SNIP 0.68
Scopus rating (2003): SJR 0.415 SNIP 0.699
Scopus rating (2002): SJR 0.258 SNIP 0.333
Scopus rating (2001): SJR 0.518 SNIP 0.649
Scopus rating (2000): SJR 0.48 SNIP 0.528
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.764 SNIP 0.959
Original language: English
Feed utilisation, Growth, Rainbow trout, Protein retention efficiency, Digestibility, Selective breeding
DOI: 10.1007/s10499-008-9191-9
Source: orbit
Source-ID: 229137
Publication: Research - peer-review › Journal article – Annual report year: 2009
Effect of supplemented fungal phytase on performance and phosphorus availability by phosphorus-depleted juvenile rainbow trout (Oncorhynchus mykiss), and on the magnitude and composition of phosphorus waste output

The effect of a supplemental fungal phytase on performance and phosphorus availability by juvenile rainbow trout fed diets with a high inclusion of plant-based protein and on the magnitude and composition of the waste phosphorus production was tested in a 2 × 3 factorial design at a temperature of 11 °C. Two factors comprised of two dietary fungal phytase levels (0 or 1400 U kg−1 feed−1), and three dietary total phosphorus levels (0.89, 0.97 or 1.12%). All fish were acclimated to the lowest total phosphorus diet for 16 days, which included 0.29% phytate-phosphorus and no supplemental fungal phytase, to ensure that they were depleted of phosphorus prior to the feeding trial. Growth and feed conversion ratios were not significantly affected by the increasing dietary phosphorus level or supplemental fungal phytase. Phosphorus availability increased significantly as a result of phytase supplementation, reaching an upper level of 74% at an available dietary phosphorus concentration of 0.71%. Adding fungal phytase to the diets improved the availability of phytate-phosphorus from an average of 6 to 64%. The fish retained 53–79% of the ingested phosphorus, while 24–44% was recovered in the faeces. The particulate phosphorus waste output was significantly higher in faeces from fish fed diets without fungal phytase compared to fish fed phytase supplemented diets. The dissolved/suspended phosphorus waste output represented 2–13% of the ingested phosphorus, and there was a significant increase in the dissolved/suspended phosphorus waste output from fish fed the phytase supplemented diet containing 0.71% available phosphorus, suggesting that the phosphorus requirement was reached at this phosphorus level. Consistent with this, there was a substantial increase in the dissolved/suspended phosphorus waste output from fish fed the phytase supplemented diet containing 0.81% available phosphorus, suggesting that the phosphorus requirement was exceeded in this group. This study demonstrated that phytase supplementation will be advantageous to the fish and the environment if supplemented to low-phosphorus diets containing a large share of plant-derived protein. Conversely, the results demonstrated that fungal phytase should not be supplemented to diets in which the available phosphorus level already meets the requirement of the fish, as this will lead to a significant increase in the dissolved/suspended phosphorus waste output.

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Dalsgaard, A. J. T. (Intern), Schøn Ekmann, K. (Ekstern), Pedersen, P. B. (Intern), Verlhac, V. (Ekstern)
Pages: 105-112
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture
Volume: 286
Issue number: 1-2
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.136 SNIP 1.3 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.212 SNIP 1.487 CiteScore 2.32
ISI indexed (2012): ISI indexed yes
Effects of egg size, parental origin and feeding conditions on growth of larval and juvenile cod Gadus morhua

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Paulsen, H. (Intern), Kjesbu, O. (Ekstern), Buehler, V. (Ekstern), Case, R. (Ekstern), Clemmesen, C. (Ekstern), Carvalho, G. (Ekstern), Hauser, L. (Ekstern), Hutchinson, W. (Ekstern), Moksness, E. (Ekstern), Otterå, H. (Ekstern), Thorsen, A. (Ekstern), Svaasand, T. (Ekstern)
Pages: 516-537
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 75
Issue number: 3
ISSN (Print): 0022-1112
Ratings:
Fate of water borne therapeutic agents and associated effects on nitrifying biofilters in recirculating aquaculture systems

Recent discharge restrictions on antibiotics and chemotherapeutant residuals used in aquaculture have several implications to the aquaculture industry. Better management practices have to be adopted, and documentation and further knowledge of the chemical fate is required for proper administration and to support the ongoing development of a sustainable aquaculture industry. A focal point of this thesis concerns formaldehyde (FA), a commonly used chemical additive with versatile aquaculture applications. FA is safe for use with fish and has a high treatment efficiency against fungal and parasite infections; however, current treatment practices have proven difficult to comply with existing discharge regulations. Hydrogen peroxide (HP) and peracetic acid (PAA) are potential candidates to replace FA, as they have similar antimicrobial effects and are more easily degradable than FA, but empirical aquaculture experience is limited. The two main objectives of this Ph.D. project were to 1) investigate the fate of FA in nitrifying aquaculture biofilters, focusing on factors influencing degradation rates, and 2) investigate the fate of HP and PAA in nitrifying aquaculture biofilters and evaluate the effects of these agents on biofilter nitrification performance. All experiments were conducted through addition of chemical additives to closed pilot scale recirculating aquaculture systems (RAS) with fixed media submerged biofilters under controlled operating conditions with rainbow trout (Oncorhynchus mykiss) in a factorial design with true replicates. Biofilter nitrification performances were evaluated by changes in chemical processes, and nitrifying populations were identified by fluorescence in situ hybridisation (FISH) analysis. FA was degraded at a constant rate immediately after addition, and found to positively correlate to temperature, available biofilter surface-area, and the frequency of FA-exposure. Prolonged biofilter exposure to FA did not negatively affect nitrification, and could therefore be a method to optimize FA treatment in RAS and reduce FA discharge. HP degradation was rapid and could be described as a concentration-dependent exponential decay. HP was found to be enzymatically eliminated by microorganisms, with degradation rates correlated to organic matter content and microbial abundance. Nitrification performance was not affected by HP when applied in dosages less than 30 mg/L, whereas prolonged multiple HP dosages at 10 mg/L were found to inhibit nitrite oxidation in systems with low organic loading. PAA decay was found to be concentration-dependent. It had a considerable negative effect on nitrite oxidation over a prolonged period of time when applied at a dosage ≥2 mg/L. PAA and HP decay patterns were significantly affected by water quality parameters, i.e. at low organic matter content HP degradation was impeded due to microbial inhibition. FISH analysis on biofilm samples from two different types of RAS showed that Nitrosomonas oligotropha was the dominant ammonia oxidizing bacteria, whereas abundant nitrite oxidizing bacteria consisted of Nitrospira spp. In conclusion, measures to reduce FA have been documented, and investigations of HP and PAA have reflected a relatively narrow safety margin when applied to biofilters.
Field-studies of the fate of formaldehyde applied in three different types of Danish freshwater fish farms

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Sortkjær, O. (Ekstern), Pedersen, L. (Intern)
Publication date: 2009

Host publication information
Title of host publication: Abstracts from World Aquaculture 2009, Veracruz Mexico, Sept. 2009
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 251502
Publication: Research › Conference abstract in proceedings – Annual report year: 2009

Hydrogen peroxide application in recirculating aquaculture systems - results and perspectives

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Pedersen, P. B. (Intern)
Publication date: 2009

Host publication information
Title of host publication: Abstracts from World Aquaculture 2009, Veracruz Mexico, Sept. 2009
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 251501
Publication: Research › Conference abstract in proceedings – Annual report year: 2009

Influence of dietary arachidonic acid combined with light intensity and tank background colour on pigmentation of common sole (Solea solea)

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Lund, I. (Intern)
Publication date: 2009
Event: Poster session presented at 5th Fish and Shellfish Larviculture Symposium, Ghent, Belgium.
Main Research Area: Technical/natural sciences

Bibliographical note
Published in: Special publication / European Aquaculture Society, no. 38
Source: orbit
Source-ID: 252730
Publication: Research › Poster – Annual report year: 2009

Influence of hatching time on time of first feeding and subsequent growth and cannibalism in pikeperch (Sander lucioperca)

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
**Larval developmental rate, metabolic rate and future growth performance in Atlantic salmon**

**General information**
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Serrano, J. V. (Ekstern), Åberg, M. (Intern), Gjoen, H. M. (Ekstern), Steffensen, J. F. (Ekstern), Höglund, E. (Intern)
Pages: S140-S140
Publication date: 2009
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Comparative Biochemistry and Physiology. Part A: Molecular & Integrative Physiology
Volume: 153A
Issue number: 2
ISSN (Print): 1095-6433
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed Yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 2.16 SJR 0.794 SNIP 0.879
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 0.917 SNIP 0.915 CiteScore 2.01
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 0.983 SNIP 0.94 CiteScore 2.18
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 0.956 SNIP 1.058 CiteScore 2.36
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 0.773 SNIP 1.032 CiteScore 2.18
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 0.858 SNIP 1.048 CiteScore 2.2
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 0.836 SNIP 1.041
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.794 SNIP 0.944
- Web of Science (2009): Indexed yes
Multivariate data analysis of 2 DE data: Time dependent changes in protein expression in rainbow trout following hypoxia

In the last decade there has been a growing understanding of the health benefits of fish consumption. This has lead to an increased interest in studies examining which parameters will affect eating quality of fish grown in fish farms. Especially increased softening of fish muscle is a major problem since it significantly reduces the quality of the major edible part of the fish. One important stressor affecting quality is hypoxia which will occur in fish farms, when the trout is collected for transport before slaughter. In order to explore the biochemical mechanisms responsible for the changes seen in trout muscle following hypoxia, a proteome study was conducted. This will greatly aid the aquaculture industry when evaluating the type of stressors mostly affecting food quality, allowing the industry to optimise handling of the rainbow trout accordingly. In the present study a number of rainbow trout were kept in tanks where hypoxia, (30% of normal oxygen)
when introduced, was the only stressor. The fish were sacrificed at different time points (1, 2, 5 and 24 hours) after the onset of hypoxia and muscle samples were taken from each individual fish. Protein expression profiles of the samples were achieved by 2-DE. Protein spots, which individually or in combination with other spots varied according to hypoxia were found by multivariate data analysis (partial least squares regression) on group scaled data (normalised spot volumes) followed by selection of significant spots by jack-knifing. Tandem mass spectrometry was used to identify protein spots of interest.

**General information**

State: Published
Organisations: National Food Institute, Section for Aquaculture, National Institute of Aquatic Resources
Authors: Wulff, T. (Intern), Jokumsen, A. (Intern), Jessen, F. (Intern)
Publication date: 2009
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 255870
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2009

**New methods in trout farming to reduce the farm effluents - Case study in Denmark**

**General information**

State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Aquatic Process and Product Technology
Authors: Jokumsen, A. (Intern), Pedersen, P. B. (Intern), Dalsgaard, A. J. T. (Intern), Lund, I. (Intern), Paulsen, H. (Intern), Rasmussen, R. S. (Intern), Hyldig, G. (Intern)
Number of pages: 111
Pages: 58-70
Publication date: 2009

**Host publication information**

Title of host publication: A handbook for sustainable aquaculture - Integrated approach for a sustainable and healthy aquaculture
Volume: 8
Publisher: SustainAqua Collective Research
Editors: Bardoz, V. L., Oberdieck, A.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 252725
Publication: Research - peer-review › Book chapter – Annual report year: 2009

**Nørå Dambrug - et modeldambrug under forsøgsordningen. Statusrapport for 2. måleår af monitoringsprojektet med væsentlige resultater fra første måleår**

**General information**

State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Svendsen, L. M. (Ekstern), Sortkjær, O. (Ekstern), Ovesen, N. B. (Ekstern), Skriver, J. (Ekstern), Larsen, S. E. (Ekstern), Pedersen, P. B. (Intern), Rasmussen, R. S. (Intern), Dalsgaard, A. J. T. (Intern)
Number of pages: 91
Publication date: 2009

**Publication information**

Place of publication: Hirtshals
Publisher: DTU Aqua, Institut for Akvatiske Ressourcer
ISBN (Print): 978-87-7481-099-5
Original language: Danish

Series: DTU Aqua-rapport
Number: 207-09
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Electronic versions:
Peracetic acid degradation and effects on nitrification in recirculating aquaculture systems

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Aalborg University
Authors: Pedersen, L. (Intern), Pedersen, P. B. (Intern), Nielsen, J. L. (Ekstern), Nielsen, P. .. (Ekstern)
Pages: 246-254
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture
Volume: 296
Issue number: 3-4
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.136 SNIP 1.3 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.212 SNIP 1.487 CiteScore 2.32
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.294 SNIP 1.542 CiteScore 2.39
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.151 SNIP 1.394
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.941 SNIP 1.263
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.909 SNIP 1.173
Peracetic acid degradation and effects on nitrification in submerged fixed bed biofilters from recirculating aquaculture systems

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Pedersen, P. B. (Intern), Nielsen, J. (Ekstern), Nielsen, P. (Ekstern)
Publication date: 2009

Host publication information
Title of host publication: Abstracts from World Aquaculture 2009, Veracruz Mexico, Sept. 2009
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 251500
Publication: Research › Conference abstract in proceedings – Annual report year: 2009

Pereddikesyre - et voldsomt effektivt hjælpestof

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern)
Pages: 7
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information
Journal: Dansk Akvakultur. Nyhedsbrev
Issue number: Februar
ISSN (Print): 1902-276X
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
Produktion af torskelarver til udsætning i den østlige Østersø – RESTOCK

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics, Section for Aquaculture, Section for Fish Diseases
Number of pages: 143
Publication date: 2009

Host publication information
Title of host publication: Program og abstracts
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 253917
Publication: Research › Conference abstract in proceedings – Annual report year: 2009

Proteinafgrøder til økologiske fisk

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Pages: 16
Publication date: 2009

Publication information
Pages (from-to): 16
Newspaper: LandbrugsAvisen
No.: 6
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 252709
Publication: Communication › Newspaper article – Annual report year: 2009

Proteinafgrøder til økologiske regnbueørreder (Oncorhynchus mykiss)

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Fish Diseases, Section for Aquatic Protein Biochemistry
Authors: Jokumsen, A. (Intern), Lund, I. (Intern), Dalsgaard, A. J. T. (Intern), Dalsgaard, I. (Intern), Nielsen, H. H. (Intern), Rasmussen, H. T. (Ekstern), Larsen, V. J. (Ekstern), Jessen, P. B. (Ekstern), Holm, J. (Ekstern)
Publication date: 2009
Event: Poster session presented at Økologi-kongres, Odense, Danmark
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 252715
Recovery by the Norway lobster Nephrops norvegicus (L.) from the physiological stresses of trawling: Influence of season and live-storage position

Live Norway lobsters (Nephrops norvegicus L.) were trawled at depths of 30 to 55 m off the coast of Jutland (Denmark) in late winter (March) and in summer (August) in 2006. Water temperatures at the bottom and surface of the sea were 7 °C and 2 °C during the winter, and 12 °C and 21 °C in the summer, respectively. The recovery of specific physiological and metabolic variables from the intense stresses associated with capture (trawling and air-exposure during sorting) was followed in seawater at 5 °C in winter or 18 °C in summer. Recovery was compared in lobsters held individually in two different live-storage positions, either resting vertically on the tail or sitting horizontally. In winter, many animals were alive when brought on board and approximately 86% were still alive at the end of experimentation (96 h). In summer very few animals were alive when brought on board and, of these, approximately 95% were dead at 24 h. When compared with values measured in laboratory controls, the stresses of capture elicited very high haemolymph lactate contents in both seasons, although levels recovered within 24 h. Trawling also caused very high haemolymph glucose concentrations, which differed with season. In winter, haemolymph glucose was elevated for 24 h to levels significantly higher than in summer. In summer, glucose had returned to control levels by 4 h. At 4 h after trawling, haemolymph O2 status was not markedly influenced in either season, but there were significant disturbances of acid-base status. In winter, a potential metabolic lactic acidosis was compensated by a marked respiratory alkalosis, with significantly increased haemolymph pH and decreased CO2 total content and partial pressure. These effects disappeared gradually over 96 h. Summer lobsters showed combined metabolic and respiratory acidosis at 4 h, although this had recovered to control values in the small number of survivors sampled at 24 h. The capture stresses elicited very high haemolymph crustacean hyperglycaemic hormone (CHH) titres, significantly higher in summer than in winter. In winter, CHH titre had declined significantly at 24 h, whereas it exhibited a further significant increase at 24 h in summer. Live-storage position had no significant effect on survival or recovery from capture stresses in either season. The results demonstrate that Nephrops were much more stressed by trawling at high summer temperatures and had difficulty recovering from this, with pronounced negative effects on their survival, irrespective of their live-storage position.

General information

State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Lund, H. S. (Ekstern), Wang, T. (Ekstern), Chang, E. S. (Ekstern), Pedersen, L. (Intern), Taylor, E. W. (Ekstern), Pedersen, P. B. (Intern), McKenzie, D. (Intern)
Pages: 124-132
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information

Journal: Journal of Experimental Marine Biology and Ecology
Volume: 373
Issue number: 2
ISSN (Print): 0022-0981
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.03 SJR 0.937 SNIP 0.914
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.043 SNIP 0.823 CiteScore 1.87
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.145 SNIP 1.045 CiteScore 2.41
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.294 SNIP 1.08 CiteScore 2.45
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.186 SNIP 1.021 CiteScore 2.27
Live-storage, Acid-base status, Fishery, Crustacean hyperglycaemic hormone, Lactate, Temperature, Nephrops norvegicus, Glucose

DOI: 10.1016/j.jembe.2009.04.004
Source: orbit
Source-ID: 243335
Publication: Research - peer-review › Journal article – Annual report year: 2009

Rens Dambrug - et modeldambrug under forsøgsordningen. Statusrapport for 2.måleår af monitoringsprojektet med væsentlige resultater fra første måleår

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Svendsen, L. M. (Ekstern), Sortkjær, O. (Ekstern), Ovesen, N. B. (Ekstern), Skriver, J. (Ekstern), Larsen, S. E. (Ekstern), Pedersen, P. B. (Intern), Rasmussen, R. S. (Intern), Dalsgaard, A. J. T. (Intern)
Publication date: 2009

Publication information
Place of publication: Hirtshals
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
ISBN (Print): 978-87-7481-100-8
Original language: Danish
Series: DTU Aqua-rapport
Number: 208-09
A comparison of fatty acid composition and quality aspects of eggs and larvae from cultured and wild broodstock of common sole (Solea solea L.)

Eggs from a F-1 cultured broodstock of sole were compared with eggs from wild-caught breeders throughout one spawning season, to evaluate if egg quality may be affected by culture-related conditions. Fourteen batches of eggs from cultured broodstock and 17 batches from wild-caught sole were compared with respect to fatty acid (FA) composition, egg size, fertilization rate and hatching rate. Based on a multivariate analysis of the FA profiles, it was possible to discriminate between culture and wild inheritance. Eggs from cultured broodstock had high levels of C20:1(n-9), C18:2(n-6) and C18:3(n-3), whereas eggs from wild fish had high levels of C16:1(n-7), C20:4(n-6) and C20:5(n-3). Differences in FA profiles were most likely related to dietary differences. Fertilization and hatching rates were generally low and lowest in eggs from cultured broodstock, but not related to FA composition. Larval growth of one batch from each group was compared. Larval growth was not correlated to broodstock origin, FA composition or egg or larval size. However, larval survival was significantly lower for larvae from cultured broodstock.

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Lund, I. (Intern), Steenfeldt, S. J. (Intern), Suhr, K. (Intern), Hansen, B. (Ekstern)
Pages: 544-555
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture Nutrition
Volume: 14
Issue number: 6
ISSN (Print): 1353-5773
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.957 SNIP 1.448 CiteScore 1.96
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.005 SNIP 1.216 CiteScore 1.86
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.159 SNIP 1.285 CiteScore 1.8
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.205 SNIP 1.207 CiteScore 2.16
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.343 SNIP 1.158 CiteScore 1.9
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.216 SNIP 1.654 CiteScore 2.15
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
Behavioral plasticity in rainbow trout (Oncorhynchus mykiss) with divergent coping styles: When doves become hawks

Consistent and heritable individual differences in reaction to challenges, often referred to as stress coping styles, have been extensively documented invertebrates. In fish, selection for divergent post-stress plasma Cortisol levels in rainbow trout (Oncorhynchus mykiss) has yielded a low (LR) and a high responsive (HR) strain. A suite of behavioural traits is associated with this physiological difference, with LR (proactive) fish feeding more rapidly after transfer to a new environment and being socially dominant over HR (reactive) fish. Following transport from the UK to Norway, a switch in behavioural profile occurred in trout from the 3rd generation: HR fish regained feeding sooner than LR fish in a novel environment and became dominant in size-matched HR-LR pairs. One year after transport, HR fish still fed sooner, but no difference in social dominance was found. Among offspring of transported fish, no differences in feeding were observed, but as in pre-transported 3rd generation fish, HR fish lost fights for social dominance against size-matched LR opponents. Transported fish and their offspring retained their distinctive physiological profile throughout the study; HR fish showed consistently higher post-stress cortisol levels at all sampling points. Altered risk-taking and social dominance immediately after transport may be explained by the fact that HR fish lost more body mass during transport than did LR fish. These data demonstrate that some behavioural components of stress coping styles can be modified by experience, whereas behavioural plasticity is limited by genetic effects determining social position early in life story. © 2008 Elsevier Inc. All rights reserved.
Bornholm Salmon hatchery: control of out-of-season spawning of Eurasian perch

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Overton, J. L. (Intern), Paulsen, H. (Intern), Kucharczyk, D. (Ekstern), Szczerbowski, A. (Ekstern)
Pages: 40-43
Publication date: 2008

Host publication information

Title of host publication: Abstract Book - Percid Fish Culture, From Research to Production
Place of publication: Namur
Publisher: Presses Universitaires Namur
Editors: Fontaine, P., Kestemont, P., Teletchea, F., Wang, N.
Main Research Area: Technical/natural sciences
Workshop: Percid Fish Culture, From Research to Production, Namur, Belgium, 23/01/2008 - 23/01/2008
De vestjyske fjorde: 9. Skarvens rolle i Ringkøbing Fjord belyst ved en model

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Dalsgaard, A. J. T. (Intern)
Pages: 21-25
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Nyhedsbrev / Samarbejdsprojekt om skarvregulering og fiskebestandene i de vestjyske fjorde
Volume: 4
Issue number: 4
Original language: Danish
Source: orbit
Source-ID: 231323
Publication: Research › Journal article – Annual report year: 2008

Effects of antalarmin, a CRF receptor 1 antagonist, on fright reaction and endocrine stress response in crucian carp (Carassius carassius)

The corticotrophin-releasing factor (CRF) receptors show striking homogeneity throughout the vertebrate subphylum. In mammals, the CRF1 receptor (CRFR1) plays an important role in mediating behavioral and endocrine responses to fear and stress. The specific roles of this receptor subtype in fear and stress reactions in non-mammalian vertebrates are largely unknown. Crucian carp displays the olfactory-mediated fright reaction, a stereotypic behavioral response to waterborne cues from damaged skin of conspecifics. This reaction shows several similarities to basic components of avoidance behavior in mammals. In the present study, we applied the non-peptide CRFR1 antagonist, antalarmin, to crucian carp 1 h before exposure to conspecific skin extract. This treatment resulted in a suppression of the fright reaction. After skin extract exposure, antalarmin treatment also lead to lower plasma cortisol values, as compared to vehicle treatment. This suppression of the behavioral fright reaction and the stress induced rise in plasma cortisol in crucian carp suggests that the functions of the CRFR1 are conserved by evolution.

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Lastein, S. (Ekstern), Höglund, E. (Intern), Overli, O. (Ekstern), Doving, K. B. (Ekstern)
Pages: 1007-1012
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Comparative Physiology A. Sensory, neural, and behavioral physiology
Volume: 194
Issue number: 12
ISSN (Print): 0340-7594
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.339 SNIP 0.984 CiteScore 2.18
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.117 SNIP 0.733 CiteScore 1.68
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.045 SNIP 0.925 CiteScore 1.91
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.971 SNIP 0.85 CiteScore 1.91
Ejstrupholm Dambrug - et modeldambrug under forsøgsordningen. Statusrapport for 2. måleår af moniteringsprojektet med væsentlige resultater fra første måleår

**General information**

**State:** Published  
**Organisations:** Section for Aquaculture, National Institute of Aquatic Resources  
**Authors:** Svendsen, L. (Ekstern), Sortkjær, O. (Ekstern), Ovesen, N. (Ekstern), Skriver, J. (Ekstern), Larsen, S. (Ekstern), Pedersen, P. B. (Intern), Rasmussen, R. S. (Intern), Dalsgaard, A. J. T. (Intern)  
**Number of pages:** 80  
**Publication date:** 2008

**Publication information**

**Place of publication:** Hirtshals  
**Publisher:** Danmarks Fiskeriundersøgelser  
**ISBN (Print):** 87-74-81074-2  
**Original language:** Danish

**Series:** DTU Aqua-rapport  
**Number:** 188-08  
**Main Research Area:** Technical/natural sciences  
**Electronic versions:** Rapport_188_08_elektronisk_samlet.pdf  
**Links:**  
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008  
**Source:** orbit  
**Source-ID:** 227598  
**Publication:** Research - Report – Annual report year: 2008
Environmental benefits achieved by applying recirculation technology at Danish trout farms (Model Trout Farm)

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, P. B. (Intern), Svendsen, L. (Ekstern), Sortkjær, O. (Ekstern), Ovesen, N. (Ekstern), Skriver, J. (Ekstern), Larsen, S. (Ekstern), Rasmussen, R. S. (Intern), Dalsgaard, A. J. T. (Intern)
Number of pages: 139
Publication date: 2008

Essential fatty acids influence metabolic rate and tolerance of hypoxia in Dover sole (Solea solea) larvae and juveniles
Dover sole (Solea solea, Linneaus 1758) were raised from first feeding on brine shrimp (Artemia sp.) with different contents and compositions of the essential fatty acids (EFA) arachidonic acid (ARA, 20:4n - 6); eicosapentaenoic acid (EPA, 20:5n - 3), and docosahexaenoic acid (DHA, 22:6n - 3), and their metabolic rate and tolerance to hypoxia measured prior to and following metamorphosis and settlement. Four dietary Artemia preparations were compared: (1) un-enriched; (2) enriched with a commercial EFA mixture (Easy DHA SELCO Emulsion); (3) enriched with a marine fish oil combination (VEVODAR and Incromega DHA) to provide a high ratio of ARA to DHA, and (4) enriched with these fish oils to provide a low ratio of ARA to DHA. Sole fed un-enriched Artemia were significantly less tolerant to hypoxia than the other dietary groups. Larvae from this group had significantly higher routine metabolic rate (RMR) in normoxia, and significantly higher O-2 partial pressure (PO2) thresholds in progressive hypoxia for their regulation of RMR (P-crit) and for the onset of agitation, respiratory distress and loss of equilibrium. Metamorphosis was associated with an overall decline in RMR and increase in P-crit, but juveniles fed on un-enriched Artemia still exhibited higher P-crit and agitation thresholds than the other groups. Sole fed un-enriched Artemia had significantly lower contents of EFA in their tissues, both before and after settlement. Thus, enriching live feeds with EFA has significant effects on the respiratory physiology of sole early life stages and improves their in vivo tolerance to hypoxia. We found no evidence, however, for any effect of the ratio of ARA to DHA.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: McKenzie, D. (Intern), Lund, I. (Intern), Pedersen, P. B. (Intern)
Pages: 1041-1051
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Biology
Volume: 154
Issue number: 6
ISSN (Print): 0025-3162
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.41 SJR 1.198 SNIP 0.993
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.315 SNIP 0.932 CiteScore 2.21
Web of Science (2015): Indexed yes
Feeding and nutrition of European percid broodstock and early life stages

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Kestemont, P. (Ekstern), Henrotte, E. (Ekstern), Wang, N. (Ekstern), Hamza, N. (Ekstern), Paulsen, H. (Intern), Overton, J. L. (Intern)
Pages: 28-34
Female crucian carp, Carassius carassius, lose predator avoidance behavior when getting ready to mate

In predator-prey interactions, the prey often have to compromise fitness-related behaviors such as feeding, courting, and territorial defense in order to avoid predators. In these trade-off situations, some behaviors have priority over others. These priorities are not rigid, and may be context-dependent; for instance, many animals show increased risk-taking during courtship behavior by paying less attention to potential predators. We investigated whether the fright reaction, a stereotypical avoidance response to olfactory cues from injured conspecifics, may be affected by reproductive status in a teleost fish, the crucian carp. We demonstrate that among individuals not responding to alarm substances with a fright reaction, the majority were ovulated or spermiated. In females, mean plasma concentrations of 17 beta-estradiol and testosterone, gonadal steroids known to decrease during the later stages of sexual maturation, were lower in the individuals not responding with a fright reaction compared to those responding. In males, there were no differences between responsive and non-responsive individuals in mean plasma levels of androgens (testosterone and 11-keto-testosterone) involved in spermatogenesis and male sexual behavior. As the fright reaction in crucian carp consists of behavior incompatible with spawning behavior, we hypothesize that this short-term suppression of the alarm response has evolved so that spawning can occur uninterrupted.
Formaldehyde induced variation in biofilter performance and microbial composition

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Pedersen, P. B. (Intern), Nielsen, J. (Ekstern), Nielsen, P. (Ekstern)
Pages: 430-439
Publication date: 2008
Forskning i planteflæsk til økologiske fisk

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Pages: 2-3
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication Information
Journal: ICROFSnyt
Issue number: 2
Original language: Danish
Links:
Source: orbit
Source-ID: 264047
Publication: Research › Journal article – Annual report year: 2008

Identifikation og forebyggelse af sygdom ved produktion af yngel af europæisk østers: Projektrapport

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Steenfeldt, S. J. (Intern), Holtegaard, L. E. (Ekstern)
Number of pages: 52
Publication date: 2008

Publication Information
Publisher: Dansk Skaldyrcenter
Original language: Danish
Main Research Area: Technical/natural sciences
Links:
http://www.skaldyrcenter.dk
Source: orbit
Source-ID: 231448
Publication: Research › Report – Annual report year: 2008

Improved digestibility and growth in selected families of rainbow trout (Oncorhynchus mykiss)

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern), Rasmussen, R. S. (Intern)
Publication date: 2008

Host publication Information
Title of host publication: Proceedings of the XIII International Symposium on Fish Nutrition and Feeding Florianópolis, Brazil 1 - 5 June
Volume: In Press
Main Research Area: Technical/natural sciences
Conference: XIII International Symposium on Fish Nutrition and Feeding Florianópolis, Brazil, 01/01/2008
Source: orbit
Source-ID: 229138
Kongeåens Dambrug - et modeldambrug under forsøgsordningen. Statusrapport for 2. måleår af monitoringsprojektet med væsentlige resultater fra første måleår

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Svendsen, L. (Ekstern), Sortkjær, O. (Ekstern), Ovesen, N. (Ekstern), Skriver, J. (Ekstern), Larsen, S. (Ekstern), Pedersen, P. B. (Intern), Rasmussen, R. S. (Intern), Dalsgaard, A. J. T. (Intern)
Number of pages: 74
Publication date: 2008

Publication information
Place of publication: Hirtshals
Publisher: Danmarks Fiskeriundersøgelser
ISBN (Print): 87-74-81065-0
Original language: Danish
Series: DTU Aqua-rapport
Number: 182-08
Main Research Area: Technical/natural sciences
Electronic versions: 182-08_elektronisk_samlet.pdf
Links: http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008
Source: orbit
Source-ID: 227602
Publication: Research › Report – Annual report year: 2008

Larval developmental rate, stress responsiveness and life history traits in salmonids

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Höglund, E. (Intern), Serrano, J. (Ekstern)
Pages: S209-S209
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Comparative Biochemistry and Physiology. Part A: Molecular & Integrative Physiology
Volume: 150
Issue number: 3
ISSN (Print): 1095-6433
Ratings:
  BFI (2018): BFI-level 1
  Web of Science (2018): Indexed yes
  BFI (2017): BFI-level 1
  Web of Science (2017): Indexed Yes
  BFI (2016): BFI-level 1
  Scopus rating (2016): CiteScore 2.16 SJR 0.794 SNIP 0.879
  Web of Science (2016): Indexed yes
  BFI (2015): BFI-level 1
  Scopus rating (2015): SJR 0.917 SNIP 0.915 CiteScore 2.01
  Web of Science (2015): Indexed yes
  BFI (2014): BFI-level 1
  Scopus rating (2014): SJR 0.983 SNIP 0.94 CiteScore 2.18
  Web of Science (2014): Indexed yes
  BFI (2013): BFI-level 1
Observations on within family and between families variation in growth and nutritional status of larval cod (Gadus morhua) reared in mesocosms

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Paulsen, H. (Intern), Bühler, V. (Ekstern), Case, R. (Ekstern), Clemmesen, C. (Ekstern), Carvalho, G. (Ekstern), Hutchinson, W. (Ekstern), Kjesbu, O. (Ekstern), Moksness, E. (Ekstern), Otterå, H. (Ekstern), Thorsen, A. (Ekstern), Svåsand, T. (Ekstern)
Publication date: 2008
Event: Abstract from 32nd Annual Larval Fish Conference, Kiel, Germany.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 231992
Publication: Research › Conference abstract for conference – Annual report year: 2008

Økosystemmodel for Ringkøbing Fjord: Skarvbestandens påvirkning af fiskebestandene

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Coastal Ecology, Section for Freshwater Fisheries Ecology, Section for Management Systems
Authors: Dalsgaard, A. J. T. (Intern), Christensen, V. (Ekstern), Nicolajsen, H. (Intern), Koed, A. (Intern), Støttrup, J. (Intern), Grooss, J. (Ekstern), Bregneballe, T. (Ekstern), Sørensen, H. (Ekstern), Christensen, J. (Ekstern), Nielsen, R. (Ekstern)
Number of pages: 71
Publication date: 2008

Publication information
Place of publication: Hirtshals
Publisher: Danmarks Fiskeriundersøgelser
ISBN (Print): 87-74-81055-1
Original language: Danish

Series: DTU Aqua-rapport
Number: 178-08
Main Research Area: Technical/natural sciences
Electronic versions: 178-08_elektronisk_samlet.pdf
Links:
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008
Source: orbit
Source-ID: 225222
Publication: Research › Report – Annual report year: 2008

Omsætning af ammonium-kvælstof i biofiltre på modeldambrug

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Suhr, K. (Intern), Pedersen, P. B. (Intern), Svendsen, L. (Ekstern), Michelsen, K. (Ekstern), Plesner, L. (Ekstern)
Number of pages: 58
Publication date: 2008
Omsætning af formalin i danske dambrug

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Sortkjær, O. (Ekstern), Pedersen, L. (Intern), Ovesen, N. (Ekstern)
Number of pages: 122
Publication date: 2008

Publication information
Publisher: Aarhus Universitet. Danmarks Miljøundersøgelser
ISBN (Print): 978-87-7073-077-8
Original language: Danish
Series: Faglig rapport fra DMU
Number: 699
Main Research Area: Technical/natural sciences
Links:
Source: orbit
Source-ID: 233255
Publication: Research › Report – Annual report year: 2008

Opdræt af tunge (Solea solea) - undersøgelse af mulighederne for kommercialisering

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, P. B. (Intern), Lund, L. (Intern), Steenfeldt, S. J. (Intern), Overton, J. L. (Intern), Nunn, M. (Intern)
Number of pages: 55
Publication date: 2008

Publication information
Place of publication: Hirtshals
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
ISBN (Print): 87-74-81091-x
Original language: Danish
Series: DTU Aqua-rapport
Number: 200-08
Main Research Area: Technical/natural sciences
Electronic versions:
200-08_elektronisk_samlet.pdf
Links:
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008

Bibliographical note
Optimering af behandlingseffekten i akvakultur: Minimering af forbrug og udledning af hjælpestoffer

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Sortkjær, O. (Ekstern), Henriksen, N. (Ekstern), Heinecke, R. (Ekstern), Pedersen, L. (Intern)
Number of pages: 124
Publication date: 2008

Publication information
Place of publication: Århus
Publisher: Aarhus Universitet. Danmarks Miljøundersøgelser
ISBN (Print): 87-70-73033-4
Original language: Danish
Series: Faglig rapport fra DMU
Number: 659
Main Research Area: Technical/natural sciences
Links:
http://www.dmu.dk/Pub/FR659.pdf
Source: orbit
Source-ID: 227468
Publication: Research › Report – Annual report year: 2008

Organic aquaculture - the link between sustainable production and superior products

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Original language: English
Links:
http://www.orgprints.org/view/projects/DA3_ORAQUA.html
Source: orbit
Source-ID: 229139
Publication: Commissioned › Memorandum – Annual report year: 2008

Parental stress-coping styles affect the behaviour of rainbow trout Oncorhynchus mykiss at early developmental stages
This work examined behavioural responses in yolk-sac rainbow trout Oncorhynchus mykiss larvae originating from strains selected for high (HR) or low (LR) plasma cortisol response to a standardized stressor. The results showed that yolk-sac larvae originating from the HR strain were more sensitive to environmental stressors, in that they showed a shorter reaction time to low oxygen levels. Previous studies on adult and juvenile individuals from these strains demonstrated a number of correlated physiological and behavioural differences. In yolk-sac larvae, growth and development depended mainly on internal factors, which suggest that at least some aspects of stress-coping styles are inherent to the individual, before factors such as social experience or variable access to food resources could modify behavioural strategy.

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Höglund, E. (Intern), Gjoen, H. (Ekstern), Pottinger, T. (Ekstern), Overli, O. (Ekstern)
Pages: 1764-1769
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 73
Issue number: 7
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.741 SNIP 0.882
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.951 SNIP 0.935 CiteScore 1.64
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.944 SNIP 0.934 CiteScore 1.76
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.049 SNIP 1.118 CiteScore 1.98
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.035 CiteScore 1.88
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.895 SNIP 0.946 CiteScore 1.66
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.774 SNIP 0.834
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.773 SNIP 0.891
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.883 SNIP 0.968
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.996 SNIP 1.06
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.897 SNIP 1.051
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.827 SNIP 0.898
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.945 SNIP 1.148
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.937 SNIP 1.096
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.949 SNIP 1.056
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.874 SNIP 1.1
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.751 SNIP 0.993
Produktion af vandlopper til anvendelse ved opdræt af marin fiskeøgning

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Steenfeldt, S. J. (Intern)
Number of pages: 56
Publication date: 2008

Publication information
Place of publication: Hirtshals
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
ISBN (Print): 87-7481-092-8
Original language: Danish
Series: DTU Aqua-rapport
Number: 201-08
Main Research Area: Technical/natural sciences
Electronic versions:
201_08_elektronisk_samlet.pdf
Links:
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008

Bibliographical note
Finansieret af Den Europæiske Unions Fiskerisektorprogram FIUF og Fødevareministeriet
Source: orbit
Source-ID: 231429
Publication: Research › Report – Annual report year: 2008

Proteinfoder til økologiske ørreder

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Pages: 14
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Økologisk jordbrug
Volume: 12
Issue number: 422
ISSN (Print): 0904-0595
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Source: orbit
Source-ID: 232713
Publication: Research › Journal article – Annual report year: 2008
Rationale for restocking the Eastern Baltic cod stock
The Danish Institute for Fisheries Research and Bornholm's Salmon Hatchery examined the potential for restocking Baltic cod (Gadus morhua callarias L.) in the eastern Baltic Sea. This cod population has adapted to the unique brackish water conditions where successful spawning depends on regular inflows of oxygenated saltwater from the North Sea. Hydrographical conditions are therefore considered to constitute the principal bottleneck for recruitment of this population. Successful recruitment is also dependent upon food availability and predation pressure from mainly herring (Clupea harengus L.) and sprat (Sprattus sprattus L.). A 2-to 3-month delay in the spawning period compared to 20-30 years ago has altered feeding conditions and predation susceptibility in a way that may have exacerbated the decline in recruitment. Producing and releasing cod larvae during spring would mimic the spawning period recorded in previous times and would coincide with the spring peak in copepod production. An evaluation of 3 different release scenarios showed that a release of 474 million first-feeding larvae over 5 months would enhance the average population of 2-year-olds by 10% and be biologically and economically the most feasible scenario.
Swimming performance of wild and F1-hatchery-reared Atlantic salmon (Salmo salar) and brown trout (Salmo trutta) smolts

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Authors: Pedersen, L. (Intern), Koed, A. (Intern), Malte, H. (Ekstern)
Pages: 425-431
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Ecology of Freshwater Fish
Volume: 17
ISSN (Print): 0906-6691
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.66 SJR 0.804 SNIP 0.885
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.022 SNIP 1.192 CiteScore 1.92
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.866 SNIP 0.994 CiteScore 1.58
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.971 SNIP 1.072 CiteScore 1.77
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.061 SNIP 1.247 CiteScore 2.05
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.979 SNIP 0.887 CiteScore 1.65
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.812 SNIP 0.968
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.817 SNIP 1.006
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.932 SNIP 0.985
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.791 SNIP 0.883
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.875 SNIP 1.183
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.659 SNIP 0.92
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.907 SNIP 1.191
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.955 SNIP 0.779
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.895 SNIP 1.091
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.667 SNIP 0.677
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.572 SNIP 0.884
Scopus rating (1999): SJR 0.577 SNIP 0.701
Original language: English
DOIs:
10.1111/j.1600-0633.2008.00293.x
Source: orbit
Source-ID: 227054
Publication: Research - peer-review › Journal article – Annual report year: 2008

The effects of dietary long chain essential fatty acids on growth and stress tolerance in pike perch larvae (Stizostedion lucioperca L.)

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Steenfeldt, S. J. (Intern), Lund, I. (Intern)
Publication date: 2008
Event: Poster session presented at Percid Fish Culture, From Research to Production, Namur, Belgium.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 229165
Publication: Research › Poster – Annual report year: 2008

The influence of dietary concentrations of arachidonic acid and eicosapentaenoic acid at various stages of larval ontogeny on eye migration, pigmentation and prostaglandin content of common sole larvae (Solea solea L.)

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Lund, I. (Intern), Steenfeldt, S. J. (Intern), Banta, G. (Ekstern), Hansen, B. (Ekstern)
Pages: 143-153
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture
Volume: 276
Issue number: 1-4
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
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Original language: English

DOIs: 10.1016/j.aquaculture.2008.01.004
Source: orbit
Source-ID: 226476
Publication: Research - peer-review › Journal article – Annual report year: 2008
**Tingkærved Dambrug - et modeldambrug under forsøgsordningen. Statusrapport for 2. måleår af moniteringsprojektet med væsentlige resultater fra første måleår**

**General information**
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Svendsen, L. (Ekstern), Sortkjaer, O. (Ekstern), Ovesen, N. (Ekstern), Skriver, J. (Ekstern), Larsen, S. (Ekstern), Pedersen, P. B. (Intern), Rasmussen, R. S. (Intern), Dalsgaard, A. J. T. (Intern)
Number of pages: 77
Publication date: 2008

**Publication information**
Place of publication: Hirtshals
Publisher: Danmarks Fiskeriundersøgelser
ISBN (Print): 87-74-81073-5
Original language: Danish

Series: DTU Aqua-rapport
Number: 187-08
Main Research Area: Technical/natural sciences
Electronic versions:
Rapport_187_08_elektronisk_samlet.pdf
Links:
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008
Source: orbit
Source-ID: 227608
Publication: Research › Report – Annual report year: 2008

**Tvilho Dambrug - et modeldambrug under forsøgsordningen. Statusrapport for 2. måleår af moniteringsprojektet med væsentlige resultater fra første måleår**

**General information**
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Svendsen, L. (Ekstern), Sortkjaer, O. (Ekstern), Ovesen, N. (Ekstern), Skriver, J. (Ekstern), Larsen, S. (Ekstern), Pedersen, P. B. (Intern), Rasmussen, R. S. (Intern), Dalsgaard, A. J. T. (Intern)
Number of pages: 70
Publication date: 2008

**Publication information**
Place of publication: Hirtshals
Publisher: Danmarks Fiskeriundersøgelser
ISBN (Print): 87-74-81068-1
Original language: Danish

Series: DTU Aqua-rapport
Number: 184-08
Main Research Area: Technical/natural sciences
Electronic versions:
184-08_elektronisk_samlet.pdf
Links:
Source: orbit
Source-ID: 227610
Publication: Research › Report – Annual report year: 2008

**Udvikling af produktionsmetoder til intensivt opdræt af sandartyngel: Projektrapport**

**General information**
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Steenfeldt, S. J. (Intern), Lund, I. (Intern)
Number of pages: 35
Publication date: 2008
Publication information
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
ISBN (Print): 87-74-81089-6
Original language: Danish

Series: DTU Aqua-rapport
Number: 199-08
Main Research Area: Technical/natural sciences
Electronic versions:
199_08_elektronisk_samlet.pdf
Links:
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008

Bibliographical note
Finansieret af Den Europæiske Unions Fiskerisektorprogram FIUF og Fødevareministeriet
Source: orbit
Source-ID: 229083
Publication: Research › Report – Annual report year: 2008

Abildtrup dambrug - et modeldambrug under forsøgsordningen: statusrapport for 1. måleår af monitoringsprojektet

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Svendsen, L. (Ekstern), Sortkjær, O. (Ekstern), Ovesen, N. (Ekstern), Skriver, J. (Ekstern), Larsen, S. (Ekstern), Pedersen, P. B. (Intern), Rasmussen, R. S. (Intern), Dalsgaard, A. J. T. (Intern)
Number of pages: 59
Publication date: 2007

Publication information
Place of publication: Hirtshals
Publisher: Danmarks Fiskeriundersøgelser
Original language: Danish

Series: DFU-rapport
Number: 174-07
Main Research Area: Technical/natural sciences
Electronic versions:
174-07_elektronisk_index_ny.pdf
Links:
Source: orbit
Source-ID: 227596
Publication: Research › Report – Annual report year: 2007

Application of biofilters to reduce formaldehyde discharge from fish farms

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Pedersen, P. B. (Intern), Sortkjær, O. (Ekstern)
Publication date: 2007

Host publication information
Title of host publication: Book of Abstracts
Main Research Area: Technical/natural sciences
Links:
https://www.was.org/meetings/AbstractData.asp?AbstractId=14172
Source: orbit
Source-ID: 238633
Publication: Research › Conference abstract in proceedings – Annual report year: 2007
Aspects of respiratory physiology and energetics in rainbow trout (Oncorhynchus mykiss) families with different size-at-age and condition factor

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: McKenzie, D. (Intern), Pedersen, P. B. (Intern), Jokumsen, A. (Intern)
Pages: 280-294
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture
Volume: 263
Issue number: 1-4
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.136 SNIP 1.3 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.212 SNIP 1.487 CiteScore 2.32
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.294 SNIP 1.542 CiteScore 2.39
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Web of Science (2011): Indexed yes
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Scopus rating (2010): SJR 1.151 SNIP 1.394
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Scopus rating (2009): SJR 0.941 SNIP 1.263
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.909 SNIP 1.173
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.019 SNIP 1.318
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.008 SNIP 1.689
Web of Science (2006): Indexed yes
Attenuation of stress-induced anorexia in brown trout (Salmo trutta) by pre-treatment with dietary L-tryptophan

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Höglund, E. (Intern), Sørensen, C. (Ekstern), Bakke, M. (Ekstern), Nilsson, G. (Ekstern), Øverli, Ø. (Ekstern)
Pages: 786-789
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: British Journal of Nutrition
Volume: 97
Issue number: 4
ISSN (Print): 0007-1145
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.46 SJR 1.983 SNIP 1.533
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.583 SNIP 1.446 CiteScore 3.52
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.468 SNIP 1.278 CiteScore 3.18
Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 2.72 SNIP 2.521 CiteScore 3.61
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.263 SNIP 2.484 CiteScore 3.12
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Differences in oxygen consumption, yolk adsorption and behaviour in early life stages of rainbow trout strains selected for high or low stress responsiveness

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Höglund, E. (Intern), Gjøen, H. (Ekstern), Øverli, Ø. (Ekstern)
Publication date: 2007
Main Research Area: Technical/natural sciences

Bibliographical note
Poster
Source: orbit
Source-ID: 225873
Publication: Research › Poster – Annual report year: 2007

Effect of dietary arachidonic acid, eicosapentaenoic acid and docosahexaenoic acid on survival, growth and pigmentation in larvae of common sole ( Solea solea L.)

Evidence confirms that polyunsaturated fatty acids (PUFAs), arachidonic acid (ARA), eicosapentaenoic acid (EPA) and docosahexaenoic acid, DHA are involved in growth as well in pigmentation of marine fish larvae. In the present study we
examined the performance of common sole larvae reared on Artemia enriched with 10 formulated emulsions, differing in inclusions of ARA, EPA, and DHA. The specific growth rate of the sole larvae until late metamorphosis, 21 days after hatching (dah) was 20 to 27% d(-1). Even though the relative tissue essential fatty acid (EFA) concentrations significantly reflected dietary composition, neither standard growth nor larval survival were significantly related to the absolute concentrations of ARA, EPA and DHA or their ratios. This suggests low requirements for essential polyunsaturated fatty acids (PUFAs) in common sole. Malpigmentation was significantly related to increased dietary ARA content. However, pigmentation was not affected by inclusion levels of EPA or DHA when ARA was high. This, and no relation between DHA: EPA or ARA: EPA ratios and pigmentation and only a weak relation to ARA: DHA ratio, advocate for that it is the absolute concentration of ARA in larval tissues, that is responsible for malpigmentation rather than the relative concentration to other PUFAs. Within malpigmentation, the trait "albinism" was characterised by an abnormal incomplete eye migration, but this trait is suggested not to be related to dietary ARA. Furthermore, albinism resulted in a lower growth rate, which suggests that visual aberrations affected prey capture. (C) 2007 Elsevier B.V. All rights reserved.
Effects of egg size, parental origin and feeding conditions on growth of larval and juvenile cod (Gadus morhua L.)

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Paulsen, H. (Intern), Bühler, V. (Ekstern), Case, R. (Ekstern), Clemmesen, C. (Ekstern), Carvalho, G. (Ekstern), Hutchinson, W. (Ekstern), Kjesbu, O. (Ekstern), Moksness, E. (Ekstern), Otterå, H. (Ekstern), Thorsen, A. (Ekstern), Svåsand, T. (Ekstern)
Publication date: 2007
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 231990
Publication: Research › Conference abstract for conference – Annual report year: 2007

Fin condition and growth among rainbow trout reared at different sizes, densities and feeding frequencies in high temperature re-circulated water

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Rasmussen, R. S. (Intern), Larsen, F. (Ekstern), Jensen, S. (Ekstern)
Pages: 97-107
Publication date: 2007
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 226474
Publication: Research - peer-review › Journal article – Annual report year: 2007
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
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Scopus rating (2016): CiteScore 1.34 SJR 0.563 SNIP 1.014
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Scopus rating (2015): SJR 0.585 SNIP 0.763 CiteScore 1.08
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BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.626 SNIP 0.796 CiteScore 1.17
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Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.599 SNIP 1.04 CiteScore 1.15
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Scopus rating (2011): SJR 0.553 SNIP 0.857 CiteScore 0.99
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Scopus rating (2010): SJR 0.533 SNIP 0.832
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BFI (2009): BFI-level 1
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Scopus rating (2002): SJR 0.258 SNIP 0.333
Scopus rating (2001): SJR 0.518 SNIP 0.649
Scopus rating (2000): SJR 0.48 SNIP 0.528
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.764 SNIP 0.959
Original language: English
DOIs:
10.1007/s10499-006-9070-1
Source: orbit
Source-ID: 227208
Publication: Research - peer-review › Journal article – Annual report year: 2007

Kystfodring og kystøkologi: Evaluering af revlevodring ud for Fjaltring

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Shellfish, Section for Aquaculture
Memory of opponents is more potent than visual sign stimuli after social hierarchy has been established

During agonistic interactions between male Anolis carolinensis, perception of a visual sign stimulus (darkened eyespots) not only inhibits aggression and promotes initial attainment of dominant social status, but also evokes distinct neuroendocrine responses in each opponent. This study was designed to examine the effect of eyespot manipulation on behavior and social rank during a second interaction between opponents that had previously established a natural dyadic social hierarchy. Prior to a second interaction, eyespots of familiar size-matched combatants were manipulated to reverse information conveyed by this visual signal. Eyespots on the previously dominant male were masked with green paint to indicate low aggression and social status. Previously subordinate males had their eyespots permanently marked with black paint to convey high aggression and status. Opponents were then re-paired for a second 10 min interaction following either 1 or 3 days of separation. Aggression was generally decreased and social status between pairs remained reasonably consistent. Unlike rapidly activated monoaminergic activity that occurs following the initial pairing, most brain areas sampled were not affected when animals were re-introduced, regardless of visual signal reversal or length of separation between interactions. However in males with "normal" eyespot color, dominant males had reduced serotonergic activity in CA3 and raphe, while subordinate males exhibited elevated CA3 dopaminergic activity. Reversing eyespot color also reversed serotonergic activity in raphe and dopaminergic activity in CA3 after 3 days of separation. The results suggest that males remember previous opponents, and respond appropriately to their previous social rank in spite of eyespot color.
Nørå Dambrug - et modeldambrug under forsøgsordningen: Statusrapport for 1. måleår af moniteringsprojektet

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Svendsen, L. (Ekstern), Sortkjær, O. (Ekstern), Ovesen, N. (Ekstern), Skriver, J. (Ekstern), Larsen, S. (Ekstern), Pedersen, P. B. (Intern), Rasmussen, R. S. (Intern), Dalsgaard, A. J. T. (Intern)
Number of pages: 56
Publication date: 2007

Publication information
Place of publication: Hirtshals
Publisher: Danmarks Fiskeriundersøgelser
Original language: Danish
Series: DFU-rapport
Number: 175-07
Main Research Area: Technical/natural sciences
Electronic versions:
175-07_elektronisk_index.pdf

Perspektiver for økologisk fiskeopdræt i Danmark

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: www.aqua.dtu.dk
Original language: Danish
Links:
http://www.dfu.dtu.dk/Nyheder.aspx?guid=%7B6C0BF3D9-C53D-4DC8-A284-784118268ADA%7D
Source: orbit
Source-ID: 226069
Publication: Research › Journal article – Annual report year: 2007

Rens dambrug - et modeldambrug under forsøgsordningen: statusrapport for 1. måleår af moniteringsprojektet

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Svendsen, L. (Ekstern), Sortkjær, O. (Ekstern), Ovesen, N. (Ekstern), Skriver, J. (Ekstern), Larsen, S. (Ekstern), Pedersen, P. B. (Intern), Rasmussen, R. S. (Intern), Dalsgaard, A. J. T. (Intern)
Number of pages: 55
Publication date: 2007

Publication information
Place of publication: Hirtshals
Publisher: Danmarks Fiskeriundersøgelser
Original language: Danish
Series: DFU-rapport
Number: 176-07
**Sensory characterization of different families of farmed rainbow trout**

**General information**
- **State:** Published
- **Organisations:** Section for Aquatic Process and Product Technology, National Institute of Aquatic Resources, Section for Aquatic Protein Biochemistry, Section for Aquaculture
- **Authors:** Hyldig, G. (Intern), Leth, N. (Ekstern), Jessen, F. (Intern), Lund, I. (Ekstern), Jokumsen, A. (Intern)
- **Publication date:** 2007
- **Host publication information**
  - **Title of host publication:** 23rd NJF-congress, Copenhagen, 27th-29 June
  - **Main Research Area:** Technical/natural sciences
  - **Conference:** 23rd NJF-congress, Copenhagen, Denmark, 27/06/2007 - 27/06/2007

**Bibliographical note**
- **Abstract**
- **Source:** orbit
- **Source-ID:** 225851
- **Publication:** Research › Conference abstract in proceedings – Annual report year: 2007

**Temperature-dependent and surface specific formaldehyde degradation in submerged biofilters**

**General information**
- **State:** Published
- **Organisations:** Section for Aquaculture, National Institute of Aquatic Resources
- **Authors:** Pedersen, L. (Intern), Pedersen, P. B. (Intern), Sortkjær, O. (Ekstern)
- **Pages:** 127-136
- **Publication date:** 2007
- **Main Research Area:** Technical/natural sciences

**Publication information**
- **Journal:** Aquacultural Engineering
- **Volume:** 36
- **Issue number:** 2
- **ISSN (Print):** 0144-8609
- **Ratings:**
  - **BFI (2018):** BFI-level 1
  - **Web of Science (2018):** Indexed yes
  - **BFI (2017):** BFI-level 1
  - **Web of Science (2017):** Indexed yes
  - **BFI (2016):** BFI-level 1
  - **Scopus rating (2016):** CiteScore 2.09 SJR 0.798 SNIP 1.525
  - **Web of Science (2016):** Indexed yes
  - **BFI (2015):** BFI-level 1
  - **Scopus rating (2015):** SJR 0.723 SNIP 1.148 CiteScore 1.63
  - **Web of Science (2015):** Indexed yes
  - **BFI (2014):** BFI-level 1
  - **Scopus rating (2014):** SJR 0.72 SNIP 1.437 CiteScore 1.61
  - **Web of Science (2014):** Indexed yes
  - **BFI (2013):** BFI-level 1
  - **Scopus rating (2013):** SJR 0.666 SNIP 1.511 CiteScore 1.8
The fate of chemical additives and antimicrobial agents applied in Danish freshwater fish farms

General information
State: Published
Organisations: Section for Fish Diseases, National Institute of Aquatic Resources, Section for Aquaculture
Authors: Bruun, M. S. (Intern), Pedersen, L. (Intern), Dalsgaard, I. (Intern), Pedersen, P. B. (Intern), Sortkjær, O. (Ekstern)
Pages: 57-61
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: World Aquaculture
Volume: 38
Issue number: 1
ISSN (Print): 1041-5602
Ratings:
Web of Science (2018): Indexed yes
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2004): Indexed yes
Original language: English
Source: orbit
The impact of dietary fatty acids in common sole larval (Solea solea, L.) nutrition

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Lund, I. (Intern)
Number of pages: 190
Publication date: 2007

Publication information
Publisher: Roskilde University and Danish Institute for Fisheries Research
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
PhD_Lund.pdf
Source: orbit
Source-ID: 226475
Publication: Research › Ph.D. thesis – Annual report year: 2007

Tingkærkvad Dambrug - et modeldambrug under forsøgsordningen: Statusrapport for 1. måleår af moniteringsprojektet

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Svendsen, L. (Ekstern), Sortkjaer, O. (Ekstern), Bering Ovesen, N. (Ekstern), Skriver, J. (Ekstern), Larsen, S. (Ekstern), Pedersen, P. B. (Intern), Rasmussen, R. S. (Intern), Dalsgaard, A. J. T. (Intern)
Number of pages: 53
Publication date: 2007

Publication information
Place of publication: Hirtshals
Publisher: Danmarks Fiskeriundersøgelser
Original language: Danish
Series: DFU-rapport
Number: 173-07
Main Research Area: Technical/natural sciences
Electronic versions:
173-07, elektronisk_index.pdf
Links:
Source: orbit
Source-ID: 227607
Publication: Research › Report – Annual report year: 2007

Udvikling af opdræt af aborre – en alternativ art i ferskvandsopdræt

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Coastal Ecology
Authors: Paulsen, H. (Intern), Overton, J. L. (Intern), Røjbek, M. (Intern)
Number of pages: 43
Publication date: 2007

Publication information
Publisher: Danmarks Fiskeriundersøgelser
Original language: Danish
Main Research Area: Technical/natural sciences

Bibliographical note
Slutrapport til DFFE
90 millioner kr. skal klargøre danske dambrugers fremtid: Otte dambrug er med i spændende og næsten altfærdende forsøgsprojekt

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, P. B. (Intern)
Pages: 2-3
Publication date: 2006
Main Research Area: Technical/natural sciences


General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: EFSA Publication
Number of pages: 75
Publication date: 2006

Association between growth and Pan 1 Genotype within Atlantic cod full-sibling families

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Case, R. A. J. (Ekstern), Hutchinson, W. F. (Ekstern), Hauser, L. (Ekstern), Buehler, V. (Ekstern), Clemmesen, C. (Ekstern), Dahle, G. (Ekstern), Kjesbu, O. S. (Ekstern), Moksness, E. (Ekstern), Otterå, H. (Ekstern), Paulsen, H. (Intern), Svåsand, T. (Ekstern), Thorsen, A. (Ekstern), Carvalho, G. R. (Ekstern)
Pages: 241-250
Publication date: 2006
Main Research Area: Technical/natural sciences
Avisprogram for regnbueørred i Danmark

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Software and GIS development
Ejstrupholm Dambrug - et modeldambrug under forsøgsordningen. Statusrapport for første måleår af moniteringsprojektet

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Svendsen, L. (Ekstern), Sortkjær, O. (Ekstern), Ovesen, N. (Ekstern), Skriver, J. (Ekstern), Larsen, S. (Ekstern), Pedersen, P. B. (Intern), Rasmussen, R. S. (Intern), Dalsgaard, A. J. T. (Intern)
Number of pages: 54
Publication date: 2006

Publication information
Place of publication: Hirtshals
Publisher: Danmarks Fiskeriundersøgelser
ISBN (Print): 87-7481-024-3
Original language: Danish
Series: DFU-rapport
Number: 166-06
Main Research Area: Technical/natural sciences
Links:
http://www.difres.dk/dk/publication/files/18122006$166-06,%20elektronisk_index.pdf
Source: orbit
Source-ID: 227597
Publication: Research › Report – Annual report year: 2006

Kongeåens Dambrug - et modeldambrug under forsøgsordningen. Statusrapport for første måleår af moniteringsprojektet

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Svendsen, L. (Ekstern), Sortkjær, O. (Ekstern), Ovesen, N. (Ekstern), Skriver, J. (Ekstern), Larsen, S. (Ekstern), Pedersen, P. B. (Intern), Rasmussen, R. S. (Intern), Dalsgaard, A. J. T. (Intern)
Number of pages: 51
Publication date: 2006

Publication information
Place of publication: Hirtshals
Publisher: Danmarks Fiskeriundersøgelser
ISBN (Print): 87-7481-020-0
Original language: Danish
Series: DFU-rapport
Number: 164-06
Main Research Area: Technical/natural sciences
Electronic versions:
164-06, elektronisk.pdf
Links:
http://www.difres.dk/dk/publication/files/18122006$164-06,%20elektronisk_index.pdf
Source: orbit
Økologisk fiskeopdræt: Rapport fra en vidensyntese om udviklingsmuligheder inden for økologisk fiskeopdræt i Danmark

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Fish Diseases, Section for Aquatic Protein Biochemistry
Authors: Jokumsen, A. (Intern), Larsen, V. (Ekstern), Dalsgaard, I. (Intern), Nielsen, H. H. (Intern), Jessen, P. (Ekstern), Kold, J. (Ekstern), Jokumsen, A. (ed.) (Intern)
Number of pages: 110
Publication date: 2006

Optimering af fangstværdien for jomfruhummere (Nephrops norvegicus) - forsøg med fangst og opbevaring af levende jomfruhummere

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern)
Number of pages: 43
Publication date: 2006

Perspektiver for avlsarbejde i Danmark

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern), Nielsen, T. (Ekstern), Madsen, S. (Ekstern), Henryon, M. (Ekstern), Berg, P. (Ekstern)
Pages: 14-16
Publication date: 2006
Perspektiver for avlsarbejde i Danmark

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern), Nielsen, T. (Ekstern), Madsen, S. (Ekstern), Henryon, M. (Ekstern), Berg, P. (Ekstern)
Pages: 3-5
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: Dansk Akvakultur. Nyhedsbrev
Volume: September
ISSN (Print): 1902-276X
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Source: orbit
Source-ID: 226068
Publication: Research › Journal article – Annual report year: 2006

Technical review report: Fisheries sector programme support, Vietnam

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: EFSA Publication
Publication date: 2006

Publication information
Place of publication: Copenhagen, Denmark
Publisher: Ministry of Foreign Affairs, DANIDA
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 260317
Publication: Research › Report – Annual report year: 2004

Temperature dependent formaldehyde degradation in trickling filter

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Pedersen, P. B. (Intern)
Pages: 230-234
Tvilho Dambrug - et modelladbrug under forsøgsordenningen. Statusrapport for første måleår af moniteringsprojektet
Does serotonin influence aggression? Comparing regional activity before and during social interaction

Serotonin is widely believed to exert inhibitory control over aggressive behavior and intent. In addition, a number of studies of fish, reptiles, and mammals, including the lizard Anolis carolinensis, have demonstrated that serotonergic activity is stimulated by aggressive social interaction in both dominant and subordinate males. As serotonergic activity does not appear to inhibit agonistic behavior during combative social interaction, we investigated the possibility that the negative correlation between serotonergic activity and aggression exists before aggressive behavior begins. To do this, putatively dominant and more aggressive males were determined by their speed overcoming stress (latency to feeding after capture) and their celerity to court females. Serotonergic activities before aggression are differentiated by social rank in a region-specific manner. Among aggressive males baseline serotonergic activity is lower in the septum, nucleus accumbens, striatum, medial amygdala, anterior hypothalamus, raphe, and locus ceruleus but not in the hippocampus, lateral amygdala, preoptic area, substantia nigra, or ventral tegmental area. However, in regions such as the nucleus accumbens, where low serotonergic activity may help promote aggression, agonistic behavior also stimulates the greatest rise in serotonergic activity among the most aggressive males, most likely as a result of the stress associated with social interaction.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Pages: 679-694
Publication date: 2005
Conference: Symposium on Integration of Behaviour and Physiology held at the Annual Meeting of the Society-for-Experimental-Biology, Edinburgh, United Kingdom, 29/03/2004 - 29/03/2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Physiological and Biochemical Zoology
Volume: 78
Issue number: 5
ISSN (Print): 1522-2152
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.885 SNIP 0.749 CiteScore 1.93
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.175 SNIP 0.893 CiteScore 2.16
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.246 SNIP 0.889 CiteScore 2.26
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.999 SNIP 0.785 CiteScore 2.08
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.019 SNIP 0.875 CiteScore 2.22
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.26 SNIP 1.05 CiteScore 2.38
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.174 SNIP 0.944
BFI (2009): BFI-level 1
Ecological aquaculture - A sustainable solution

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern)
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Northern Aquaculture
Volume: 11
Issue number: 5
ISSN (Print): 1183-2428
Original language: English
Source: orbit
Source-ID: 227041
Publication: Research › Journal article – Annual report year: 2005

First feeding of perch (Perca fluviatilis) larvae: (Startfodring af aborrelarver)

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Overton, J. L. (Intern), Paulsen, H. (Intern)
Number of pages: 28
Publication date: 2005

Publication information
Place of publication: Lyngby
Publisher: Danmarks Fiskeriundersøgelser
ISBN (Print): 87-90968-84-0
Original language: English
Series: DFU-rapport
Number: 150-05
Main Research Area: Technical/natural sciences
Electronic versions: 150-05 First feeding of Perch larvae, e.pdf
Genetics - a tool in fisheries management

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Paulsen, H. (Intern)
Pages: 3
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Northern Fisheries
Volume: 26
ISSN (Print): 1903-3680
Original language: English
Source: orbit
Source-ID: 227009
Publication: Research › Journal article – Annual report year: 2005

Introduktion af økologi og kvalitetsmærkning på danske pionerdambrug

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Larsen, V. (Ekstern), Henriksen, N. (Ekstern)
Number of pages: 140
Publication date: 2005

Publication information
Place of publication: Hirtshals
Publisher: Danmarks Fiskerundersøgelser
ISBN (Print): 87-90968-75-1
Original language: Danish

Series: DFU-rapport
Number: 146-05
Main Research Area: Technical/natural sciences
Electronic versions:
146-05 Økologi og kvalitetsmærkning.pdf

Links:
Source: orbit
Source-ID: 227046
Publication: Research › Report – Annual report year: 2005

Kystfodring og godt fiskeri: Undersøgelse af strandnær kystfodring ved Agger Tange

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Shellfish, Section for Aquaculture
Authors: Støttrup, J. (Intern), Dolmer, P. (Intern), Rejbek, M. (Intern), Nielsen, E. (Intern), Ingvardsen, S. (Ekstern), Laustrup, C. (Ekstern), Sørensen, S. R. (Intern)
Number of pages: 52
Publication date: 2005

Publication information
La production aquacole durable au Danemark

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Pages: 5-8
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquafilia
Volume: 7
ISSN (Print): 1766-5930
Original language: French

Bibliographical note
Translated into french by Armand Lautraite
Source: orbit
Source-ID: 226062
Publication: Research › Journal article – Annual report year: 2005

NAPER - A contribution to a new fisheries management

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Paulsen, H. (Intern)
Pages: 3-3
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Northern Fisheries
Volume: 27
ISSN (Print): 1903-3680
Original language: English
Source: orbit
Source-ID: 227016
Publication: Research › Journal article – Annual report year: 2005

Ongrowing of perch (Perca fluviatilis) juveniles: (Videreopdræt af aborreyngel)

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Overton, J. L. (Intern), Paulsen, H. (Intern)
Number of pages: 36
Review of "The Norwegian Sea ecosystem"

General information
Selective breeding provides an approach to increase resistance of rainbow trout (Onchorhynchus mykiss) to the diseases, enteric redmouth disease, rainbow trout fry syndrome, and viral haemorrhagic septicaemia

In this study, we reasoned that if we challenged rainbow trout with the causative agents of enteric redmouth disease (ERM), rainbow trout fry syndrome (RTFS), and viral haemorrhagic septicaemia (VHS), we would: 1) detect additive genetic variation for resistance to ERM, RTFS, and VHS; and 2) find that resistance of the trout to ERM and RTFS are favourably correlated genetically, while resistance to VHS is unfavourably correlated with resistance to ERM and RTFS. We tested these premises by challenging 63 full-sib families of rainbow trout (50 sires, 38 dams) with Yersinia ruckeri, Flavobacterium psychrophilum, and VHS virus, the causative agents of ERM, RTFS, and VHS. Resistance to each disease was assessed as both a binary trait (i.e., died/survived) and a longitudinal trait (i.e., time until death following challenge). Additive genetic variation and genetic correlations for resistance to ERM, RTFS, and VHS were estimated by fitting a threshold liability model to resistance assessed as a binary trait. As a longitudinal trait, additive genetic variation and genetic correlations were estimated by fitting a Weibull frailty model to the times until death. Our findings support the first of our premises as we detected additive genetic variation for resistance to ERM, RTFS, and VHS. The heritability for resistance to ERM, RTFS, and VHS ranged between 0.42 and 0.57 on the underlying liability scale when resistance was assessed as a binary trait. As a longitudinal trait, the heritabilities ranged between 0.07 and 0.21 for time until death on the logarithmic-time scale. We were, however, unable to support our second premise as we found that resistance to each of the diseases tended to be weakly correlated genetically. The genetic correlations between the resistances ranged between -0.11 and 0.15 when resistance was assessed as a binary trait, and between -0.23 and 0.16 when resistance was assessed as a longitudinal trait. These findings are encouraging for commercial trout production. The additive genetic variation detected for resistance demonstrates that selectively breeding trout for resistance to ERM, RTFS, and VHS will be successful, providing a complementary approach to control these diseases. The weak genetic correlations suggest that it should be relatively easy to improve resistance to each of the diseases simultaneously.
Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.136 SNIP 1.3 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.212 SNIP 1.487 CiteScore 2.32
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.294 SNIP 1.542 CiteScore 2.39
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.151 SNIP 1.394
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.941 SNIP 1.263
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.909 SNIP 1.173
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.019 SNIP 1.318
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.008 SNIP 1.689
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.915 SNIP 1.236
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.016 SNIP 1.627
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.121 SNIP 1.926
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.992 SNIP 1.418
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.049 SNIP 1.317
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.908 SNIP 1.113
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.049 SNIP 1.251
Original language: English
disease resistance, genetic variation, genetic correlation, Onchorhynchus mykiss, rainbow trout
DOIs:
10.1016/j.aquaculture.2004.12.022
Source: orbit
Source-ID: 225730
Publication: Research - peer-review › Journal article – Annual report year: 2005

The potential for enhancing the cod stock in the Eastern Baltic

General information
State: Published
An inhibitor of bacterial quorum sensing reduces mortalities caused by vibriosis in rainbow trout (Oncorhynchus mykiss, Walbaum)

The fish pathogen Vibrio anguillarum produces quorum sensing signal molecules, N-acyl homoserine lactones (AHLs), which in several Gram-negative human and plant pathogenic bacteria regulate virulence factors. Expression of these factors can be blocked using specific quorum-sensing inhibitors (QSIs). The purpose of this study was to investigate the effect of a QSI, furanone C-30, on mortality of rainbow trout during challenge with V. anguillarum. Addition of 0.01 or 0.1 μM furanone C-30 to rainbow trout infected by cohabitation caused a significant reduction in accumulated mortality from 80-100% in challenge controls to 4-40%, in treated groups. Furanone C-30 had no effect in an immersion challenge system, probably due to a very high water exchange and a rapid dilution of furanone C-30. Growth and Survival of V. anguillarum were not affected by the concentrations of furanone C-30 used in the challenge experiments, thus avoiding selection for resistance. To elucidate the mechanism of disease control by furanone C-30, we determined its effect on the bacterial proteome, motility, and respiration. No effects were seen of furanone C-30 in any of these experiments. Although no cytotoxic effect on HeLa cells were observed, exposure to 1 μM (or higher) concentrations of furanone C-30 had detrimental effects on the rainbow trout. Our results indicate that QSIs can be used in non-antibiotic based control of fish diseases. However, they also underline the need for development of novel, less toxic QSI compounds and the need for understanding the exact mechanism(s) of action.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Center for Biomedical Microbiology, Department of Systems Biology, Section for Aquatic Microbiology and Seafood Hygiene
Authors: Rasch, M. (Intern), Buch, C. (Ekstern), Austin, B. (Ekstern), Slierendrecht, W. (Ekstern), Ekmann, K. S. (Intern), Larsen, J. (Ekstern), Johansen, C. (Ekstern), Riedel, K. (Ekstern), Eberl, L. (Ekstern), Givskov, M. C. (Intern), Gram, L. (Intern)
Pages: 350-359
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Systematic and Applied Microbiology
Volume: 27
Issue number: 3
ISSN (Print): 0723-2020
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.337 SNIP 1.368 CiteScore 3.35
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.285 SNIP 1.344 CiteScore 3.42
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.494 SNIP 1.166 CiteScore 3.37
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.413 SNIP 1.326 CiteScore 3.64
Danmark har enestående muligheder for at producere østers

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Steenfeldt, S. J. (Intern)
Pages: 18-29
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisk og Hav
Issue number: 58
ISSN (Print): 0105-9211
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Links:
Source: orbit
Source-ID: 155269
Dansk dambrug ved en skillevej

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Aquaculture
Authors: Thomsen, H. A. (Intern), Pedersen, P. B. (Intern), Pedersen, L. (Intern)
Pages: 4-17
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisk og Hav
Issue number: 58
ISSN (Print): 0105-9211
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Links:
Source: orbit
Source-ID: 227656
Publication: Research › Journal article – Annual report year: 2004

En hjælpende hånd til torsk i Østersøen

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics, Section for Aquaculture, Technical University of Denmark
Authors: Støttrup, J. (Intern), Tomkiewicz, J. (Intern), Paulsen, H. (Intern), Pedersen, P. B. (Intern), Overton, J. L. (Intern), Möllmann, C. (Ekstern), Lauesen, P. (Intern)
Pages: 62-71
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisk og Hav
Issue number: 58
ISSN (Print): 0105-9211
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Links:
Source: orbit
Source-ID: 227541
Publication: Research › Journal article – Annual report year: 2004

En undersøgelse af muligheder for etablering af måleprogram på såkaldte modeldambrug

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Svendsen, L. (Ekstern), Pedersen, P. B. (Intern), Svendsen, L. (ed.) (Ekstern), Pedersen, P. B. (ed.) (Intern)
Number of pages: 118
Publication date: 2004
Erfaringer med økologisk fiskeopdræt i England

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Larsen, V. (Ekstern)
Pages: 1-3
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: http://www.eco-aquafish.dk/
Original language: Danish
Links: http://www.eco-aquafish.dk/ref.aspx?id=382
Source: orbit
Source-ID: 227043
Publication: Research › Journal article – Annual report year: 2004

Fatty acid biomarkers: validation of food web and trophic markers using C-13-labelled fatty acids in juvenile sandeel (Ammodytes tobianus)

A key issue in marine science is parameterizing trophic interactions in marine food webs, thereby developing an understanding of the importance of top-down and bottom-up controls on populations of key trophic players. This study validates the utility of fatty acid food web and trophic markers using C-13-labelled fatty acids to verify the conservative incorporation of fatty acid tracers by juvenile sandeel (Ammodytes tobianus) and assess their uptake, clearance, and metabolic turnover rates. Juvenile sandeel were fed for 16 days in the laboratory on a formulated diet enriched in (13)C16:0 followed by 14 days on a formulated diet enriched in (13)C18:3(n - 3). An exponential model was employed to estimate the uptake and clearance rates of recovered labelled fatty acids as a function of growth and fatty acid metabolism. The model predicted a faster uptake of (13)C18:3(n - 3) than (13)C16:0 (0.0353 and 0.0086.day(-1), respectively), consistent with a structural role of (n - 3) polyunsaturated fatty acids in cell membranes, whereas saturated fatty acids presumably play a larger metabolic role. Clearance and metabolic rates of assimilated (13)C16:0 were estimated as 0.0572 and 0.0211.day(-1), respectively. Lack of temporal trends in nonlabelled fatty acids confirmed the conservative incorporation of labelled fatty acids by the fish.

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Dalsgaard, A. J. T. (Intern), St. John, M. (Intern)
Pages: 1671-1680
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 61
Issue number: 9
Fiskevelfærd i frembrud

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern)
Pages: 1-2
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: http://www.eco-aquafish.dk/
Original language: Danish
Links:
http://www.eco-aquafish.dk/
Source: orbit
Source-ID: 227044
Publication: Research › Journal article – Annual report year: 2004

Growth rate and nutritional status of wild and released reared juvenile turbot in southern Kattegat, Denmark

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Coastal Ecology
Authors: Paulsen, H. (Intern), Støttrup, J. (Intern)
Pages: 210-230
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 65
Issue number: Suppl. A
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.741 SNIP 0.882
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.951 SNIP 0.935 CiteScore 1.64
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.944 SNIP 0.934 CiteScore 1.76
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.049 SNIP 1.118 CiteScore 1.98
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.035 CiteScore 1.88
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Motionering af opdrætsfisk

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern)
Pages: 10-11
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Ferskvandsfiskeribladet
Volume: 102
Issue number: 1
ISSN (Print): 0015-0223
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Ny struktur for Dansk Ørredavl

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern), Thomsen, B. (Ekstern)
Pages: 126-127
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Ferskvandsfiskeribladet
Volume: 102
Issue number: 6
ISSN (Print): 0015-0223
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish

Repetitiveaccelaration swimming performance of brown trout (Salmo trutta) in freshwater and after acute seawater exposure

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Malte, H. (Ekstern)
Pages: 273-278
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 64
Issue number: 1
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.741 SNIP 0.882
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.951 SNIP 0.935 CiteScore 1.64
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.944 SNIP 0.934 CiteScore 1.76
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.049 SNIP 1.118 CiteScore 1.98
Sustainable aquaculture production in Denmark

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Pages: 10-12
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: World Aquaculture
Volume: 35
Issue number: 4
ISSN (Print): 1041-5602
Ratings:
The danish experience

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern)
Pages: 7
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Northern Aquaculture
Volume: 10
Issue number: 9
ISSN (Print): 1183-2428
Original language: English
Source: orbit
Source-ID: 227057
Publication: Research › Journal article – Annual report year: 2004

Undersøgelse af biologiske halveringstider, sedimentation og omdannelse af hjælpestoffer og medicin i dam- og havbrug, samt parameterfastsættelse og verifikation af udviklet dambrugsmodel

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Fish Diseases
Authors: Pedersen, L. (Intern), Sortkjær, O. (Ekstern), Bruun, M. S. (Intern), Dalsgaard, I. (Intern), Pedersen, P. B. (Intern)
Number of pages: 127
Publication date: 2004

Publication information
Place of publication: Hirtshals
Publisher: Danmarks Fiskerundersøgelser
ISBN (Print): 87-90968-63-8
Original language: Danish

Series: DFU-rapport
Number: 135-04
Main Research Area: Technical/natural sciences
Electronic versions:
135-04_hjælpestoffer_og_medicin.pdf
Source: orbit
Source-ID: 227058
Publication: Research › Report – Annual report year: 2004

Undersøgelse af biologiske halveringstider, sedimentation og omdannelse af hjælpestoffer og medicin i dam- og havbrug, samt parameterfastsættelse og verifikation af udviklet dambrugsmodel: Supplerende teknisk rapport

General information
State: Published

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Number of pages: 21
Publication date: 2003

Publication information
Place of publication: Bali
Publisher: Gondol Research Institute for Mariculture
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 225220
Publication: Research - peer-review › Journal article – Annual report year: 2003

Modeldambrug: Specifikationer og godkendelsesskrav: Rapport fra faglig arbejdsgruppe

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, P. B. (Intern), Grønborg, O. (Ekstern), Svendsen, L. (Ekstern)
Number of pages: 84
Økologisk ørred opdræt i Sverige

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Larsen, V. (Ekstern)
Pages: 11-12
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: Dambrugeren
Volume: 3
Original language: Danish
Source: orbit
Source-ID: 227066
Publication: Research › Journal article – Annual report year: 2003

Ørreder med 6% højere tilvækst på avlsstationen

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern), Lund, I. (Intern), Berg, P. (Ekstern), Henryon, M. (Ekstern)
Pages: 100-102
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: http://www.eco-aquafish.dk/
Original language: Danish
Links:
http://www.eco-aquafish.dk/ref.aspx?id=314
Source: orbit
Source-ID: 227061
Publication: Research › Journal article – Annual report year: 2003
Variability in condition and growth of Atlantic cod larvae and juveniles reared in mesocosms: environmental and maternal effects

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Clemmesen, C. (Ekstern), Bühler, V. (Ekstern), Carvalho, G. (Ekstern), Case, R. (Ekstern), Evans, G. (Ekstern), Hauser, L. (Ekstern), Hutchinson, W. (Ekstern), Kjesbu, O. (Ekstern), Mempel, H. (Ekstern), Moksness, E. (Ekstern), Otterå, H. (Ekstern), Paulsen, H. (Intern), Thorsen, A. (Ekstern), Svaasand, T. (Ekstern)
Pages: 706-723
Publication date: 2003
Main Research Area: Technical/natural sciences
Effects of hunger level and nutrient balance on survival and acetylcholinesterase activity of dimethoate exposed wolf spiders

The influence of two nutritional factors (food quantity and quality) on the responses of a wolf spider, Pardosa prativaga (L.K.), to a high dose of the insecticide dimethoate, was investigated in a fully factorial experimental design. Spider groups with different (good and bad) nutrient balance were created by feeding them fruit flies of either high or low nutrient content for 28 days. Both groups were then split into satiated and 14 days starved subgroups. Each of these was further divided into insecticide treated and control halves. Survivorship and acetylcholinesterase (AChE) activity measured on the survivors were used as response variables. Survivorship after topical dimethoate exposure (LD50; 48 h) was influenced by spider body weight, nutrient balance, and starvation. Furthermore, AChE activity was significantly inhibited by dimethoate exposure. A significant interaction between nutrient balance, starvation, and dimethoate exposure revealed synergistic effects of starvation and nutrient imbalance on AChE inhibition by dimethoate in surviving spiders. These results show that the tolerance of non-target arthropods to dimethoate may vary depending on the nutritional history of the animal.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Biologisk institut
Authors: Pedersen, L. (Intern), Dall, L. G. (Ekstern), Sorensen, B. C. (Ekstern), Mayntz, D. (Forskerdatabase), Toft, S. (Intern)
Pages: 197-204
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Entomologia Experimentalis et Applicata
Volume: 103
Issue number: 3
ISSN (Print): 0013-8703
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Erfaringer med økologisk fiskeopdræt i England

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, L. (Intern), Larsen, V. (Ekstern)
Pages: 248-250
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Ferskvandsfiskeribladet
Ernæringstilstand hos juvenile torsk i Kattegat-Skagerrak området : rapport til Nordisk Ministerråd

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Paulsen, H. (Intern), Svensson, A. (Ekstern), Gjøsæter, J. (Ekstern), Torstensen, E. (Ekstern)
Number of pages: 29
Publication date: 2002

Publication information
Place of publication: København
Publisher: Nordisk Ministerråd
Original language: Danish
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 227007
Publication: Research › Report – Annual report year: 2002

Fish ageing by otolith shape analysis : Final report to the European Commission

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Aquaculture
Number of pages: 204
Publication date: 2002

Publication information
Publisher: [s.n.]
Original language: English
Main Research Area: Technical/natural sciences

Bibliographical note
FAIR CT97 3402
Source: orbit
Source-ID: 224825
Publication: Research › Report – Annual report year: 2002

Forskning og udvikling inden for dansk akvakultur

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Pages: 119-124
Publication date: 2002

Host publication information
Genetic variation for growth rate, feed conversion efficiency, and disease resistance exists within a farmed population of rainbow trout

The objective of this study was to test that additive genetic (co)variation for survival, growth rate, feed conversion efficiency, and resistance to viral haemorrhagic septicaemia (VHS) exists within a farmed population of rainbow trout. Thirty sires and 30 dams were mated by a partly factorial mating design. Each sire was mated to two dams, and each dam was mated to two sires, producing 50 viable full-sib families (29 sires, 25 dams). The fish from these families were reared for a 215-day growout period, and were assessed for survival between days 52 and 215, growth rate (i.e., body weight on days 52, 76, 96, 123, 157, 185, and 215, and body length on days 52 and 215); feed conversion efficiency between days 52-215, 52-76, 77-96, 97-123, 124-157, 158-185, and 186-215, and VHS resistance. REML estimates of additive genetic variation for the body weights, body lengths, and feed conversion efficiencies were obtained by fitting univariate linear (reduced) animal models. Additive genetic variation for VHS resistance was estimated by fitting a Weibull, sire-dam frailty model to time until death of fish challenged with VHS. Genetic correlations were estimated among the body weights, body length, and feed conversion efficiencies that expressed additive genetic variation, while genetic correlations between VHS resistance and the body weights, body length, and feed conversion efficiencies were approximated as product-moment correlations among predicted breeding values of the sires and dams. Additive genetic variation was found to be very low for survival, body weight on days 52 and 76, body length on day 52, and feed conversion efficiency between days 185 and 215. However, additive genetic variation was detected for body weight on days 96, 123, 157, 185, and 215 (coefficient of additive genetic variation (CV)=8.4-28.4%, heritability (h²)=0.35 for body weight on day 215), body length on day 215 (CV=6.9%, h²=0.53), feed conversion efficiency between days 52-215, 52-76, 77-96, 97-123, 124-157, 158-185, and 158-215 (CV=4.0-13.9%), and VHS resistance (additive genetic variance for log-frailty=0.24, h² on the logarithmic-time scale=0.13). Genetic correlations among the body weights, body length, and feed conversion efficiencies that expressed additive genetic variation were generally favourable and moderate-to-very strong (0.55-0.99), though there were unfavourable correlations (-0.01 to -0.33) between the predicted breeding values for VHS resistance and the predicted breeding values for the body weights, body length, and feed conversion efficiencies. These results demonstrate that additive genetic (co)variation for growth rate, feed conversion efficiency, and VHS resistance does exist within the farmed population of rainbow trout, and indicates that selective breeding for these traits can be successful.

Source: FindIt
Source-ID: 43648939
Publication: Research - peer-review › Journal article – Annual report year: 2002
Hvordan vokser udsatte pighvarrer? - et forskningsprojekt støttet af fiskeplejemidlerne

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Coastal Ecology
Authors: Paulsen, H. (Intern), Støttrup, J. (Intern)
Pages: 4-5
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Fritidsfiskeren
Volume: 22
Issue number: 3
ISSN (Print): 0906-7752
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Source: orbit
Source-ID: 227012
Publication: Research › Journal article – Annual report year: 2002

Kvalitet af opdrætsørred – effekt af væksthastighed

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Rasmussen, R. S. (Intern)
Pages: 233-235
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Ferskvandsfiskeribladet
Issue number: 10
ISSN (Print): 0015-0223
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Source: orbit
Source-ID: 279060
Publication: Research › Journal article – Annual report year: 2002

Kvalitet af opdrætsørred – fodereffekt

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Rasmussen, R. S. (Intern)
Pages: 206-209
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Ferskvandsfiskeribladet
Issue number: 9
ISSN (Print): 0015-0223
Ratings:
ISI indexed (2013): ISI indexed no
Predation on Atlantic salmon and sea trout during their first days as postsmolts

Radio-tagged smolts of Atlantic salmon Salmo salar and sea trout Salmo trutta were predated heavily by sea birds after crossing the saline limit in the estuary of the River Skjern, Denmark. Most predation took place within the first 9 h after estuarine entry. The field data do not contradict the hypothesis of maladaptive anti-predatory behaviour. (C) 2002 The Fisheries Society of the British Isles. Published by Elsevier Science Ltd. All rights reserved.

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Authors: Dieperink, C. (Ekstern), Bak, B. (Ekstern), Pedersen, L. (Intern), Pedersen, M. I. (Intern), Pedersen, S. (Intern)
Pages: 848-852
Publication date: 2002
Main Research Area: Technical/natural sciences
Udredning vedrørende vandforbrug ved produktion af regnbueørreder i danske dambrug

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Number of pages: 63
Publication date: 2002

Publication information
Place of publication: Hirtshals
Publisher: Danmarks Fiskerundersøgelser
ISBN (Print): 87-90968-25-5
Original language: Danish

Series: DFU-rapport
Number: 106-02
Main Research Area: Technical/natural sciences
Electronic versions:
106-02_vandforbrug_ved_produktion_af_regnbueørreder.pdf
Links:
Source: orbit
Source-ID: 226074
Publication: Research › Report – Annual report year: 2002

Variations in growth among families of Atlantic cod (Gadus morhua L.)

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Pages: 494-495
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: European Aquaculture Society. Special Publications
Volume: 32
ISSN (Print): 0774-0689
Ratings:
Web of Science (2018): Indexed yes
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Source: orbit
Source-ID: 227584
Publication: Research › Journal article – Annual report year: 2002
Aqua flow - til glæde for opdrættere: Formidling af forskningsresultater

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Pages: 200-201
Publication date: 2001
Main Research Area: Technical/natural sciences

Avisarbejde på regnbueørred i Danmark

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern), Berg, P. (Ekstern), Lund, I. (Intern)
Pages: 18-27
Publication date: 2001
Main Research Area: Technical/natural sciences

Demonstration of maternal effects of Atlantic cod: Combining the use of unique mesocosm and novel molecular
Farvemøde 2001

Feeding and condition of juvenile cod (Gadus morhua): Combining experimental and field data

Growth and survival of cod larvae and juveniles - effects of parental origin
Information fra Dansk Ørredavl

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern), Lund, I. (Intern)
Pages: 257-261
Publication date: 2001
Main Research Area: Technical/natural sciences

Publication information
Journal: Ferskvandsfiskeribladet
Volume: 99
Issue number: 11
ISSN (Print): 0015-0223
Original language: Danish
Source: orbit
Source-ID: 226060
Publication: Communication › Journal article – Annual report year: 2001

Measurements of condition and growth of cod larvae reared in mesocosms: Individual variability as a function of environmental condition or genetic inheritance

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Clemmesen, C. (Ekstern), Buehler, V. (Ekstern), Carvalho, G. (Ekstern), Evans, G. (Ekstern), Hauser, L. (Ekstern), Hutchinson, W. (Ekstern), Mempel, H. (Ekstern), Moksness, E. (Ekstern), Otterå, H. (Ekstern), Paulsen, H. (Intern), Svaasand, T. (Ekstern)
Pages: 1-20
Publication date: 2001
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES C.M. 2001/
Volume: V:08
Original language: English
Source: orbit
Source-ID: 225144
Publication: Research › Conference article – Annual report year: 2001

Rapporter over foderanalyser

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, P. B. (Intern)
Publication date: 2001

Publication information
Place of publication: Hirtshals
Publisher: Danmarks Fiskerundersøgelser
Original language: Danish
Use of hydrodynamic and benthic models for managing environmental impacts of marine aquaculture

Regulation to minimize impacts from aquaculture is of key concern in coastal zone management for the sustainability of the industry and the receiving environment. Market and consumer forces are presently driving much of this regulation and its implementation. Mathematical modelling can provide the tools for planning and monitoring as well as regulation, and a number of countries have well-developed policies and procedures in place which utilize modelling tools. The main impacts currently modelled are nutrient enhancement, organic waste deposition and the dispersion and deposition of medicines and chemicals. The release of these wastes is influenced by species- and site- specific characteristics, as well as culture and husbandry techniques. The modelling process requires consideration of definitions and limitations; standards for model development including clear objectives and justification; good technical descriptions use of good and appropriate data; calibration; validation; sensitivity analysis; quality assurance; auditability and consideration of the operational needs of the user, the grower and/or the regulator. Models should have simplicity and clarity; be fit for purpose, be open to scrutiny; be accessible, user-friendly and be used with caution. Current models are considered to be limited in scope but do cover the main hydrodynamic and particulate processes. The regulation and monitoring of finfish aquaculture involving the direct use of models is apparently restricted to relatively few countries where they are involved in setting holding capacity, the licensing of medicines and for assessing site applications. Different approaches have been developed in different countries as required. In contrast, many countries do make considerable indirect use of modelling techniques within the regulation process. With respect to shellfish, models are in current use to predict and optimize exploitation capacity but there is scope for studying nutrient flux, habitat degradation and deposition below suspended systems. Future developments for finfish need to better address the main question of holding capacity or exploitation capacity in relation to nutrients and medicines release, including whole water body/regional impacts. The relationship and predictability of toxic algal blooms remains some way off. Modelling the complexities of degradation, resuspension and the effect of the scavenging process on the transport of in-feed medicines is required. Keys to future developments across Europe include accessibility, setting of Environmental Quality Standards or targets, training and support for users, resources and structured research.
Demonstration of maternal effects of Atlantic cod: Combining the use of unique mesocosm and novel molecular techniques - A new EU-project

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Pages: 1-19
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES C.M. 2000/
Volume: R:08
Original language: English
Links:
http://macom.imr.no/ICES_CM_2000.PDF
Første spadestik til avlsstationen

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Pages: 5-6
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: Ferskvandsfiskeribladet
Volume: 98
ISSN (Print): 0015-0223
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Source: orbit
Source-ID: 226058
Publication: Communication › Journal article – Annual report year: 2000

Monitoring and regulation of marine aquaculture in Denmark

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, P. B. (Intern)
Pages: 144-148
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Applied Ichthyology-Zeitschrift für Angewandte Ichthyologie
Volume: 16
Issue number: 4-5
ISSN (Print): 0175-8659
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.94
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.84
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.06
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.99
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Optimal ratio between digestible protein and digestible energy in feed for European sea bass (Dicentrarchus labrax)

**General information**
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, P. B. (Intern), Lund, I. (Intern), Holm, J. (Ekstern), Boisen, S. (Ekstern), Hjermitslev, N. (Ekstern), Autin, M. (Ekstern), Jokumsen, A. (Intern)
Publication date: 2000

**Host publication information**
Title of host publication: Book of Abstracts
Main Research Area: Technical/natural sciences
Conference: Aqua 2000, Nice, France, 01/01/2000
Source: orbit
Source-ID: 260318
Publication: Research › Conference abstract in proceedings – Annual report year: 2000

Resultater fra akvakulturforskning og teknologisk udvikling under EU-støttede forskningsprogrammer

**General information**
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Pages: 1-31
Publication date: 2000
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Aqua-Flow Nyhedsbreve
Volume: 60-90
Original language: Danish

Bibliographical note
Concerted Action - Profect - FAIR - CT98-3837
Source: orbit
Source-ID: 226070
Publication: Research › Journal article – Annual report year: 2000

Undersøgelse af eventuelle miljøpåvirkninger af hjælpestoffer og medicin i ferskvandsdambrug samt metoder til at reducere/eliminere sådanne påvirkninger

**General information**
Assistance to assess a draft regulation of the aquaculture sector in Mozambique

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, P. B. (Intern)
Number of pages: 34
Publication date: 1999

Publication information
Place of publication: Copenhagen
Publisher: DANIDA
Original language: English

Series: DANIDA - Rapport
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 227086
Publication: Research › Report – Annual report year: 1999

Avlsstation ved Nordsøcentret

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Pages: 65
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: Ferskvandsfiskeribladet
Volume: 97
Issue number: 3
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Source: orbit
Source-ID: 226056
Publication: Communication › Journal article – Annual report year: 1999
Effect of replacement of fish meal by potato protein concentrate in the diet for rainbow trout on feeding rate, digestibility and growth

Six isonitrogenous and isoenergetic diets were composed to investigate the effects of incorporation of potato protein concentrate (PPC) and supplementation of methionine in the diet for rainbow trout (Oncorhynchus mykiss) on feeding rate, digestion, growth, feed utilization and body composition. The control diet contained all Danish L T-fish meal as protein sources. The other experimental diets contained 2.2, 5.6, 8.9 and 11.1% PPC respectively. Diet 6 contained 5.6% PPC and 1.7% methionine. A 4-week trial was conducted at about 12°C. The results showed that feeding rate decreased with increased incorporation levels of PPC. Apparent digestibility of dry matter, crude protein and ash increased with increased proportion of dietary PPC, while there was no significant effect on the apparent digestibility of crude fat. The incorporation of 5.6% PPC decreased growth rate and 8.9% PPC decreased both growth and feed efficiency. Supplementation of 1.7% methionine decreased both feeding rate and growth.

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Xie, S. (Ekstern), Jokumsen, A. (Intern)
Pages: 127-133
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: Acta Hydrobiologica Sinica
Volume: 23
Issue number: 2
ISSN (Print): 1000-3207
Ratings:
Web of Science (2018): Indexed yes
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Source: orbit
Source-ID: 282542
Publication: Research - peer-review › Journal article – Annual report year: 1997

Foderrapport 1-5

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, P. B. (Intern)
Publication date: 1999

Publication information
Place of publication: Hirtshals
Publisher: Danmarks Fiskeriundersøgelser
Original language: Danish
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 227089
Publication: Research › Report – Annual report year: 1999

Information om akvakulturforskningen

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Pages: 124-125
Publication date: 1999
Main Research Area: Technical/natural sciences
Multivariate Dataanalysis of Enzyme Production for Hydrolysis Purposes

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture
Authors: Schmidt, A. S. (Intern), Suhr, K. I. (Intern)
Number of pages: 40
Publication date: 1999

Nyt om avlsstationen

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Jokumsen, A. (Intern)
Pages: 95
Publication date: 1999
Main Research Area: Technical/natural sciences

Resultater fra akvakulturforskning og teknologisk udvikling under EU-støttede forskningsprogrammer

General information
Vedrørende udvikling af en mærkningsmodel for økologisk akvakulturproduktion

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, P. B. (Intern)
Number of pages: 28
Publication date: 1999

Publication information
Place of publication: Hirtshals
Publisher: Danmarks Fiskeriundersøgelser
ISBN (Print): 87-88047 -63-3
Original language: Danish
Series: DFU-rapport
Number: 69-99
Main Research Area: Technical/natural sciences
Electronic versions:
69-99_rapport_vedr_udvikling_af_en_mærkningsmodel_for_økologisk_akvakulturproduktion.pdf
Links:
Source: orbit
Source-ID: 227098
Publication: Research › Report – Annual report year: 1999

An approach to the modelling of persistent pollutants in marine ecosystems

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Management Systems
Authors: Dalsgaard, A. J. T. (Intern), Jarre, A. (Intern), Walters, C. (Ekstern), Pauly, D. (Ekstern)
Pages: 16
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Council Meeting
Volume: V:10
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Effects of dietary incorporation of potato protein concentrate and supplementation of methionine on growth and feed utilization of rainbow trout

Four diets (1, 2, 3 and 4) were formulated to contain different potato protein concentrate (PPC) levels (0, 22, 56, and 111 g kg⁻¹). Diet 5 contained 56 g kg⁻¹ PPC and 17 g kg⁻¹ methionine. A growth trial was conducted to investigate the effect on growth and feed utilization of incorporation of PPC and supplementation of methionine in the diet of rainbow trout. When the proportion of PPC exceeded 56 g kg⁻¹ the growth of fish decreased while both growth and feed utilization decreased when the dietary PPC was 111 g kg⁻¹. Protein productive value and condition factor of the fish decreased and mortality increased with the increase in the proportion of dietary PPC.
Effects of starvation in juvenile cod, Gadus morhua

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Bech, J. (Ekstern), Korsgaard, B. (Ekstern), Paulsen, H. (Intern)
Pages: 33-68
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: Special Publication / European Aquaculture Society
Volume: 26
Original language: English
Source: orbit
Source-ID: 224874
Publication: Research - peer-review › Journal article – Annual report year: 1998

Fishing down marine food webs

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pauly, D. (Ekstern), Christensen, V. (Ekstern), Dalsgaard, A. J. T. (Intern), Froese, R. (Ekstern), Torres Jr., R. (Ekstern)
Pages: 860-863
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: Science
Volume: 279
Issue number: 5352
ISSN (Print): 0036-8075
Ratings:
BFI (2018): BFI-level 3
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Web of Science (2016): Indexed yes
Indicators of nutritional status of turbot Scophthalmus maximus (L., 1758) larvae

General information
Juvenile quality and adaptive capacity

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Coastal Ecology
Authors: Paulsen, H. (Intern), Støttrup, J. (Intern)
Pages: 17-18
Publication date: 1998
Main Research Area: Technical/natural sciences

Bibliographical note
Report from Aquaculture Europe 98
Source: orbit
Source-ID: 227014
Publication: Research › Journal article – Annual report year: 1998

Mass-balance food web ecosystem models as an alternative approach for combining multiple information sources in fisheries

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Number of pages: 815
Publication date: 1998
Restocking of marine fish in Denmark

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Coastal Ecology
Authors: Paulsen, H. (Intern), Støttrup, J. (Intern)
Publication date: 1998

Host publication information
Title of host publication: Proceedings from the EU Parlament Conference on Free Fish Farming at Sea, Bruxelles, 24-27 April 1998, University of Stirling, Stirling
Main Research Area: Technical/natural sciences
Conference: EU Parlament Conference on Free Fish Farming at Sea, Bruxelles, 24-27 April 1998, University of Stirling, Stirling, 01/01/1998
Source: orbit
Source-ID: 238769
Publication: Research › Article in proceedings – Annual report year: 1998

Spatial and temporal distribution of brown trout redds in a small temperate stream

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Aquaculture
Authors: Olofsson, H. (Ekstern), Mosegaard, H. (Intern), Höglund, E. (Intern)
Pages: 2308-2313
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: International Association of Theoretical and Applied Limnology. Proceedings
Volume: 26
ISSN (Print): 0368-0770
Ratings:
Web of Science (2018): Indexed yes
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Original language: English
Source: orbit
Status on recirculation technology in Denmark

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Pedersen, P. B. (Intern)
Pages: 1-6
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES C.M. 1998/
Volume: L:8
Original language: English
Source: orbit
Source-ID: 227097
Publication: Research › Conference article – Annual report year: 1998

Stocking of marine fish - a growing market for aquaculture

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Aquaculture
Authors: Støttrup, J. (Intern), Paulsen, H. (Intern)
Pages: 1-13
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES CM 1998/
Volume: L:3
Original language: English
Source: orbit
Source-ID: 227565
Publication: Research › Conference article – Annual report year: 1998

Large eyes as indicators of reduced growth

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources
Authors: Paulsen, H. (Intern)
Pages: 151-157
Publication date: 1996

Host publication information
Title of host publication: Feeding ecology and nutrition in fish
Main Research Area: Technical/natural sciences
Conference: International Congress of Fish Biology, San Fransisco, 01/01/1996
Source: orbit
Source-ID: 228345
Publication: Research › Article in proceedings – Annual report year: 1996

Otolith size related to growth rate in reared, restocked and wild turbot

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources

Host publication information
A multidisciplinary Danish research program on rainbow trout (Oncorhynchus mykiss) farming

A new research programme involving eight Danish institutions is described. The programme started in 1993 and is expected to run for 5 years. The primary objective of the research initiative is to exploit and integrate the knowledge of several institutions and disciplines for the benefit of the production of rainbow trout. The programme includes several projects with aspects of disease prevention, genetics, and nutrition. In most of the projects, the work has been divided into stages of 2 and 3 years, respectively. During a 2 year period, production, management and health status are recorded at the participating fish farms, and all data are organized in a database. Diseases cause major problems in rainbow trout production, therefore a great deal of the effort in this programme deals with diseases caused by viro, bacteria and parasites. On the basis of the database, epidemiological examinations are carried out as well as investigations of the possibilities of preventive measures and cost-benefit analyses. In the genetic studies, polymorphic genetic markers will be developed and used for analysis of the genetic structure of selected fish stocks. Microsatellites will be developed and introduced in the study. Primarily genetic differences between lines/strains and their crossings will be estimated with the purpose of describing the genetic level and the importance of additive and non-additive genetic effects. In the nutritional area the product quality and pollution questions will be in focus.

General information
State: Published
Organisations: Section for Fish Diseases, National Institute of Aquatic Resources, National Veterinary Institute, Section for Aquaculture
Authors: Berg, P. (Ekstern), Eggum, B. (Ekstern), Møller, S. (Ekstern), Holm, L. (Ekstern), Jørgensen, P. (Ekstern), Olesen, N. (Ekstern), Buchmann, K. (Ekstern), Larsen, J. (Ekstern), Dalsgaard, I. (Intern), Møllergaard, S. (Intern), Jeppesen, V. (Ekstern), Frier, J. (Ekstern), McLean, E. (Ekstern), Horlyck, V. (Ekstern), Graver, C. (Ekstern), Kristensen, T. (Ekstern), Birk, E. (Ekstern), Pedersen, P. B. (Intern)
Pages: 257-260
Publication date: 1995
Main Research Area: Technical/natural sciences
Publication information
Journal: Water Science and Technology
Volume: 31
Issue number: 10
ISSN (Print): 0273-1223
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.3 SJR 0.394 SNIP 0.621
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.466 SNIP 0.599 CiteScore 1.19
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.587 SNIP 0.685 CiteScore 1.14
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.568 SNIP 0.7 CiteScore 1.3
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.601 SNIP 0.669 CiteScore 1.13
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.591 SNIP 0.626 CiteScore 1.25
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.522 SNIP 0.602
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.589 SNIP 0.686
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.579 SNIP 0.697
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.749 SNIP 0.781
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.693 SNIP 0.796
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.763 SNIP 0.85
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.877 SNIP 0.904
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.882 SNIP 0.902
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.903 SNIP 0.888
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.759 SNIP 0.967
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.76 SNIP 0.885
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.889 SNIP 0.936

Original language: English
DOIs:
A multi-disciplinary Danish research programme on rainbow trout (Oncorhynchus mykiss) farming.

General information
State: Published
Organisations: Section of Fish Diseases, Division of Poultry, Fish and Fur Animals, National Veterinary Institute, Section for Fish Diseases, National Institute of Aquatic Resources, Section for Aquaculture
Authors: Berg, P. (Ekstern), Eggum, B. (Ekstern), Møller, S. (Ekstern), Holm, L. (Ekstern), Jørgensen, P. (Ekstern), Olesen, N. J. (Intern), Buchmann, K. (Intern), Larsen, J. (Ekstern), Dalsgaard, I. (Intern), Møllergaard, S. (Intern), From, J. (Ekstern), Frier, J. (Ekstern), McLean, E. (Ekstern), Hørlyck, V. (Intern), Graver, C. (Intern), Kristensen, T. (Ekstern), Birk, E. (Ekstern), Pedersen, P. B. (Intern)
Publication date: 1994
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 241591
Publication: Research › Conference abstract for conference – Annual report year: 1994

Status for marin fiskepleje - 1994

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Aquaculture
Authors: Støttrup, J. (Intern), Nicolajsen, H. (Intern), Paulsen, H. (Intern), Nitschke, K. (Ekstern), Pedersen, C. (Ekstern)
Number of pages: 17
Publication date: 1994

Publication information
Place of publication: Charlottenlund
Publisher: Danmarks Fiskeri- og Havundersøgelser
Original language: Danish
Series: DFH rapport
Number: 487
ISSN: 0109-4432
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 281788
Publication: Research › Report – Annual report year: 1994

Experimental estimation of food preference in cod - results of a pilot experiment

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Aquaculture, Section for Monitoring
Authors: Degnbol, P. (Ekstern), Christensen, V. (Ekstern), Støttrup, J. (Intern), Paulsen, H. (Intern), Stæhr, K. (Intern)
Pages: 10
Publication date: 1990
Conference: ICES Council Meeting 1990, Copenhagen, Denmark, 03/10/1990
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Council Meeting
Volume: G:63
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
Extensive rearing of turbot larvae (Scophthalmus maximus L.)

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Paulsen, H. (Intern), Andersen, N. G. (Intern)
Pages: 241-248
Publication date: 1989

Host publication information
Title of host publication: Aquaculture – A Biotechnology in Progress
Place of publication: Bredene, Belgium
Publisher: European Aquaculture Society
Editors: Pauw, N. D., Jaspers, E., Ackefors, H., Wilkins, N.
ISBN (Print): 90-71625-03-6
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 282526
Publication: Research - peer-review › Book chapter – Annual report year: 1989

Plankton dynamics and herring larval growth, drift and survival in a frontal area

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Aquaculture
Authors: Kiørboe, T. (Intern), Munk, P. (Intern), Richardson, K. (Ekstern), Christensen, V. (Ekstern), Paulsen, H. (Intern)
Pages: 205-219
Publication date: 1988
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology - Progress Series
Volume: 44
Issue number: 3
ISSN (Print): 0171-8630
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.79
Studies of a larval herring (Clupea harengus L.) patch in the Buchan area. 2. Growth, mortality and drift of larvae

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Aquaculture
Authors: Munk, P. (Intern), Christensen, V. (Ekstern), Paulsen, H. (Intern)
Pages: 11-24
Publication date: 1986
Main Research Area: Technical/natural sciences

Publication information
Journal: Dana
Volume: 6
ISSN (Print): 0106-553X
Ratings:
Web of Science (2000): Indexed yes
Original language: English
Source: orbit
Source-ID: 278672
Publication: Research - peer-review › Journal article – Annual report year: 1988

ANIMAL FEEDING STUDY WITH NITRITE-TREATED MEAT

General information
State: Published
Organisations: Division of Toxicology and Risk Assessment, National Food Institute, Section for Aquaculture, National Institute of Aquatic Resources
Authors: Olsen, P. (Ekstern), Gry, J. (Ekstern), Knudsen, I. (Ekstern), Meyer, O. A. (Intern), Poulsen, E. (Ekstern)
Pages: 667-675
Publication date: 1984