A comparison of the survival and migration of wild and F1-hatchery-reared brown trout (Salmo trutta) smolts traversing an artificial lake

Supplementing salmonid populations by stocking is a widely-used method to improve catch or to rehabilitate populations. Though, most studies found that survival and fitness of hatchery-reared salmonids is inferior to wild fish. We compared survival, emigration patterns, migration speed and return rates from the sea of wild and 1-year old F1-hatchery-reared brown trout smolts in a Danish lowland stream that contains an artificial lake using passive integrated transponder telemetry in the years 2011–2013 and 2016. The majority of hatchery-reared smolts descended within 72 h after their release, whereas wild fish migration was mainly triggered by increased water discharge. Increased probability of a successful lake passage was found at higher discharge. Within years, the groups differed in lake passage time, but without a significant overall difference. Overall, there was no difference in lake survival (wild: 30%, hatchery-reared: 32%) between the two groups, but survival differed between years. Only a single fish (0.9%) of the hatchery-reared smolts tagged in 2011–2013 returned from the sea compared to 11 (6.4%) wild smolts tagged in that period, which questions the value of supplementary stocking of smolts for conservation purposes.
Følg den daglige smoltvandring i europæiske vandløb

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Authors: Aarestrup, K. (Intern), Baktoft, H. (Intern), Sivebæk, F. (Intern)
Publication date: 2017

Publication information
Source/Publisher: Fiskepleje.dk
Main Research Area: Technical/natural sciences
Links:
http://www.fiskepleje.dk/nyheder/2017/05/smolt-udvandring-2017?id=54e0230c-aa41-47c8-8a7a-ef1ddf0b0ce&utm_source=newsletter&utm_media=mail&utm_campaign=2017_05_10_Nyhedsbrev
Oxidative stress and partial migration in brown trout (Salmo trutta)

During migration, animals are typically limited by their endogenous energetic resources which must be allocated to the physiological costs associated with locomotion, as well as avoiding and/or compensating for oxidative stress. To date, there have been few attempts to understand the role of oxidative status in migration biology, particularly in fish. Semi-anadromous brown trout (Salmo trutta, Linnaeus 1758) exhibit partial migration, where some individuals smoltify and migrate to sea, and others become stream residents, providing us with an excellent model to investigate the link between oxidative stress and migration. Using the brown trout, we obtained blood samples from juveniles from a coastal stream in Denmark in the fall prior to peak seaward migration which occurs in the spring, and assayed for antioxidant capacity (oxygen radical absorbance capacity) and oxidative stress levels (ratio of oxidized to reduced glutathione). We found that individuals that migrated had higher antioxidant capacity than residents and that future migration date was negatively correlated with both antioxidant capacity and body length in the fall. This study provides the first evidence that oxidative status is associated with migration strategy and timing, months in advance of the actual migration, and provides insight into the role of oxidative status in animal migration.
Pike (Esox lucius L.) on the edge: consistent individual movement patterns in transitional waters of the western Baltic

Pike in the western Baltic Sea live on the edge of their salinity tolerance. Under physiologically challenging conditions, organism may respond by moving to environmentally more benign areas during critical periods, such as during spawning. We hypothesised that pike in a brackish lagoon (8–10 ppt salinity) would perform spawning- and feeding-related movements between areas with different salinity regimes. Twenty-two pike were caught prior to spawning, tagged with acoustic transmitters, and their movements were tracked for 18 months. Pike showed two main patterns of movements that were consistent within individuals across two years. Whereas some individuals stayed in the lagoon year-round, most pike left the lagoon for longer periods after spawning and returned to the lagoon prior to following year’s spawning season. We found no evidence that probability of moving out of the lagoon co-varied with either length or condition factor. Despite the fact that the lagoon’s salinity is close to the reported upper limit for pike egg development, results indicated that all pike spawned in the lagoon. Correspondingly, genetic data showed that all fish belonged to the same reproductive population unit. Movement patterns thus appear to reflect individual variation in home-range and/or resource optimisation following ideal free principles.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Section for Marine Living Resources, Institute Management
Authors: Jacobsen, L. (Intern), Bekkevold, D. (Intern), Berg, S. (Intern), Jepsen, N. (Intern), Koed, A. (Intern), Aarestrup, K. (Intern), Baktoft, H. (Intern), Skov, C. (Intern)
Pages: 143–154
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Hydrobiologia
Volume: 784
Issue number: 1
ISSN (Print): 0018-8158
Ratings:
Positioning of aquatic animals based on time-of-arrival and random walk models using YAPS (Yet Another Positioning Solver)

Aquatic positional telemetry offers vast opportunities to study in vivo behaviour of wild animals, but there is room for improvement in the data quality provided by current procedures for estimating positions. Here we present a novel positioning method called YAPS (Yet Another Positioning Solver), involving Maximum Likelihood analysis of a state-space model applied directly to time of arrival (TOA) data in combination with a movement model. YAPS avoids the sequential positioning-filtering-approach applied in alternative tools by using all available data in a single model, and offers better accuracy and error control. Feasibility and performance of YAPS was rigorously tested in a simulation study and by applying YAPS to data from an acoustic transmitter towed in a receiver array. Performance was compared to an alternative positioning model and proprietary software. The simulation study and field test revealed that YAPS performance was better and more consistent than alternatives. We conclude that YAPS outperformed the compared alternative methods, and that YAPS constitute a vast improvement to currently available positioning software in acoustic telemetry. Additionally, in contrast to vendor-supplied solutions, YAPS is transparent, flexible and can easily be adapted and extended for further improvements or to meet study specific requirements such as three-dimensional positioning.
Species integrity enhanced by a predation cost to hybrids in the wild

Species integrity can be challenged, and even eroded, if closely related species can hybridize and produce fertile offspring of comparable fitness to that of parental species. The maintenance of newly diverged or closely related species therefore hinges on the establishment and effectiveness of pre- and/or post-zygotic reproductive barriers. Ecological selection, including predation, is often presumed to contribute to reduced hybrid fitness, but field evidence for a predation cost to hybridization remains elusive. Here we provide proof-of-concept for predation on hybrids being a postzygotic barrier to gene flow in the wild. Cyprinid fishes commonly produce fertile, viable hybrid offspring and therefore make excellent study organisms to investigate ecological costs to hybrids. We electronically tagged two freshwater cyprinid fish species (roach Rutulus rutilus and bream Abramis brama) and their hybrids in 2005. Tagged fish were returned to their lake of origin, exposing them to natural predation risk from apex avian predators (great cormorant, Phalacrocorax carbo). Scanning for regurgitated tags under cormorant roosts 3-4 years later identified cormorant-killed individual fish and allowed us to directly test for a predation cost to hybrids in the wild. Hybrid individuals were found significantly more susceptible to cormorant predation than individuals from either parental species. Such ecological selection against hybrids contributes to species integrity, and can enhance species diversification.
Survival of migrating sea trout (Salmo trutta) smolts during their passage of an artificial lake in a Danish lowland stream

Artificial lake development is often used as a management tool to reduce nutrient runoff to coastal waters. Denmark has restored more than 10 000 ha of wetlands and lakes in the last 14 years as a consequence of 'Action Plans for the Aquatic Environment', which aim to meet the demands of the European Union’s Water Framework Directive. Juvenile, seaward migrating salmonids are highly affected by impounded waterbodies, as they are subjected to extraordinary high mortalities due to predation and altered habitat. From 2005 to 2015, survival and migration patterns of wild brown trout (Salmo trutta) smolts were investigated by using radio, acoustic and Passive Integrated Transponder telemetry both before and after the development of an artificial lake in a small Danish lowland stream. In 2005 and 2006, before the lake developed, survival was estimated to be 100% in the river stretch where the lake later developed. In 2007 and in the period between 2009 and 2015, mean yearly survival decreased to 26%. Mean time for passing the area increased significantly after the development of the lake from 0.42 to 5.95 days. Generalized additive models were used to model the probability of a successful passage. Water temperature and discharge were key environmental factors affecting survival of the smolts during the passage of the lake. Furthermore, smolt survival was negatively correlated with condition factor. This elevated level of smolt mortality may seriously compromise self-sustaining anadromous salmonid populations when artificial lakes are developed in connection with rivers.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Institute Management, Aarhus University
Authors: Schwinn, M. (Intern), Aarestrup, K. (Intern), Baktoft, H. (Intern), Koed, A. (Intern)
Pages: 558-566
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: River Research and Applications
Volume: 33
Issue number: 4
ISSN (Print): 1535-1459
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.787 SNIP 1.186 CiteScore 2.07
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.952 SNIP 1.108 CiteScore 1.99
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.955 SNIP 1.343 CiteScore 2.11
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.921 SNIP 1.15 CiteScore 2.08
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.057 SNIP 1.555 CiteScore 2.23
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.069 SNIP 1.126 CiteScore 1.92
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.905 SNIP 0.996
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.17 SNIP 1.243
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.184 SNIP 1.37
Attraction and repulsion measures for safe bypass of Atlantic salmon smolts

General information
State: Published
Authors: Fjeldstad, H. (Ekstern), Gjelland, K. Ø. (Ekstern), Silva, A. T. (Ekstern), Uglem, I. (Ekstern), Baktoft, H. (Intern), Forseth, T. (Ekstern), Økland, F. (Ekstern)
Number of pages: 5
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication: Research › Paper – Annual report year: 2016

De naturlige bestande af ørreder i danske ørredvandløb målt i forhold til ørredindekset DFFVø

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Institute Management
Authors: Nielsen, J. (Intern), Koed, A. (Intern), Baktoft, H. (Intern)
Publication date: 2016
Event: Paper presented at Ferskvandssymposiet, København, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Paper – Annual report year: 2016

Investigating the phenology of seaward migration of juvenile brown trout (Salmo trutta) in two European populations

Recent evidence supports the existence of a downstream autumn-migratory phenotype in juvenile anadromous brown trout (Salmo trutta), however the precise timing, extent and ecological significance of such behaviour remains ambiguous. We investigated the phenology of downstream migration of wild juvenile trout using passive integrated transponder (PIT) telemetry over an eight-month period in two European rivers; the River Deerness, north-east England, and the River Villestrup, Denmark. The incidence of autumn–winter seaward migration was greater in the Deerness than the Villestrup, with at least 46% of migrating juveniles detected prior to spring smoltification in the Deerness. Timing of migration was strongly regulated by factors associated with river discharge in both systems. While autumn and spring downstream migrants did not differ in size at the time of tagging in either system, evidence that spring migrants were of better condition, travelled faster (autumn: 11.0 km day–1; spring: 24.3 km day–1) and were more likely to leave the Deerness suggests that autumn and spring migrant conspecifics respond to different behavioural motivations. Further investigation into the sex of autumn migrant juveniles, as well as the temporal and geographical variability in the incidence and fitness consequences of autumn emigration by juvenile trout would be beneficial.
Naturlig smoltudvandring fra danske vandløb

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Durham University
Authors: Winter, E. R. (Ekstern), Tummers, J. S. (Ekstern), Aarestrup, K. (Intern), Baktoft, H. (Intern), Lucas, M. C. (Ekstern)
Pages: 139-151
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Applied Phycology
Volume: 775
Issue number: 1
ISSN (Print): 0921-8971
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.46
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.32
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.88
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.78
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.68
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.29
ISI indexed (2011): ISI indexed yes
Web of Science (2011): 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 (2007): Indexed yes
Web of Science (2003): Indexed yes
Web of Science (2002): Indexed yes
Web of Science (2001): Indexed yes
Original language: English
DOIs:
10.1007/s10750-016-2720-z
Source: FindIt
Source-ID: 2303926804
Publication: Research - peer-review › Journal article – Annual report year: 2016
Phenotypic variation in metabolism and morphology correlating with animal swimming activity in the wild: relevance for the OCLTT (oxygen- and capacity-limitation of thermal tolerance), allocation and performance models

Ongoing climate change is affecting animal physiology in many parts of the world. Using metabolism, the oxygen- and capacity-limitation of thermal tolerance (OCLTT) hypothesis provides a tool to predict the responses of ectothermic animals to variation in temperature, oxygen availability and pH in the aquatic environment. The hypothesis remains controversial, however, and has been questioned in several studies. A positive relationship between aerobic metabolic scope and animal activity would be consistent with the OCLTT but has rarely been tested. Moreover, the performance model and the allocation model predict positive and negative relationships, respectively, between standard metabolic rate and activity. Finally, animal activity could be affected by individual morphology because of covariation with cost of transport. Therefore, we hypothesized that individual variation in activity is correlated with variation in metabolism and morphology. To test this prediction, we captured 23 wild European perch (Perca fluviatilis) in a lake, tagged them with telemetry transmitters, measured standard and maximal metabolic rates, aerobic metabolic scope and fineness ratio and returned the fish to the lake to quantify individual in situ activity levels. Metabolic rates were measured using intermittent flow respirometry, whereas the activity assay involved high-resolution telemetry providing positions every 30 s over 12 days. We found no correlation between individual metabolic traits and activity, whereas individual fineness ratio correlated with activity. Independent of body length, and consistent with physics theory, slender fish maintained faster mean and maximal swimming speeds, but this variation did not result in a larger area (in square metres) explored per 24 h. Testing assumptions and predictions of recent conceptual models, our study indicates...
that individual metabolism is not a strong determinant of animal activity, in contrast to individual morphology, which is correlated with in situ activity patterns.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Institute Management, Section for Ecosystem based Marine Management, University of Porto
Publication date: 2016
Main Research Area: Technical/natural sciences

Behavioural strategy of large perch Perca fluviatilis varies between a mesotrophic and a hypereutrophic lake

Behaviour of large perch Perca fluviatilis was studied in two lakes differing in environmental state i.e. mesotrophic v. hypereutrophic. A total of 20 adult perch P. fluviatilis (29–42 cm total length) in each lake were tagged with radio-transmitters, tracked and located eight times a day during six 24 h tracking
periods over a year, enabling detection of differences in diel activity patterns and habitat use during summer and winter under two different environmental regimes. During summer, P. fluviatilis in the mesotrophic lake showed a distinct crepuscular activity pattern and a change from pelagic residency during daytime towards the littoral zone at night. In contrast, P. fluviatilis in the hypereutrophic lake were active during the entire diel cycle and were spread throughout the lake also during dark. During winter, crepuscular patterns of activity were seen in both lakes. Condition factor of large P. fluviatilis did not differ between the two lakes. Thus, it is suggested that P. fluviatilis in the hypereutrophic turbid lake adopted an alternative behaviour for successful foraging, being uniformly active throughout the diel cycle.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Authors: Jacobsen, L. (Intern), Berg, S. (Intern), Baktoft, H. (Intern), Skov, C. (Intern)
Pages: 1016-1029
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 86
Issue number: 3
ISSN (Print): 0022-1112
Ratings:
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
Escaping peril: perceived predation risk affects migratory propensity

Although migratory plasticity is increasingly documented, the ecological drivers of plasticity are not well understood. Predation risk can influence migratory dynamics, but whether seasonal migrants can adjust their migratory behaviour according to perceived risk is unknown. We used electronic tags to record the migration of individual roach (Rutilus rutilus), a partially migratory fish, in the wild following exposure to manipulation of direct (predator presence/absence) and indirect (high/low roach density) perceived predation risk in experimental mesocosms. Following exposure, we released fish in their lake summer habitat and monitored individual migration to connected streams over an entire season. Individuals exposed to increased perceived direct predation risk (i.e. a live predator) showed a higher migratory propensity but no change in migratory timing, while indirect risk (i.e. roach density) affected timing but not propensity showing that elevated risk carried over to alter migratory behaviour in the wild. Our key finding demonstrates predator-driven migratory plasticity, highlighting the powerful role of predation risk for migratory decision-making and dynamics.
Følg ørrederne, når de vandrer fra vandløb og ud i havet

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Authors: Aarestrup, K. (Intern), Sivebæk, F. (Intern), Baktoft, H. (Intern)
Publication date: 2015

Publication information
Source/Publisher: Fiskepleje.dk
Main Research Area: Technical/natural sciences
Links:
http://www.fiskepleje.dk/Nyheder/2015/03/Smoltudvandring-fra-vandloeb-2015

Performance assessment of two whole-lake acoustic positional telemetry systems - is reality mining of free-ranging aquatic animals technologically possible?
Acoustic positional telemetry systems (APTs) represent a novel approach to study the behaviour of free ranging aquatic animals in the wild at unprecedented detail. System manufactures promise remarkably high temporal and spatial resolution. However, the performance of APTs has rarely been rigorously tested at the level of entire ecosystems. Moreover, the effect of habitat structure on system performance has only been poorly documented. Two APTs were deployed to cover two small lakes and a series of standardized stationary tests were conducted to assess system performance. Furthermore, a number of tow tests were conducted to simulate moving fish. Based on these data, we quantified system performance in terms of data yield, accuracy and precision as a function of structural complexity in relation to vegetation. Mean data yield of the two systems was 40%(Lake1) and 60%(Lake2). Average system accuracy (acc) and precision (prec) were Lake1: acc = 3.1 m, prec = 1.1 m; Lake2: acc = 1.0 m, prec = 0.2 m. System performance was negatively affected by structural complexity, i.e., open water habitats yielded far better performance than structurally complex vegetated habitats. Post-processing greatly improved data quality, and sub-meter accuracy and precision were, on average, regularly achieved in Lake2 but remained the exception in the larger and structurally more complex Lake1. Moving transmitters were tracked well by both systems. Whereas overestimation of moved distance is inevitable for
stationary transmitters due to accumulation of small tracking errors, moving transmitters can result in both over-and underestimation of distances depending on circumstances. Both deployed APTs were capable of providing high resolution positional data at the scale of entire lakes and are suitable systems to mine the reality of free ranging fish in their natural environment. This opens important opportunities to advance several fields of study such as movement ecology and animal social networks in the wild. It is recommended that thorough performance tests are conducted in any study utilizing APTs. The APTs tested here appear best suited for studies in structurally simple ecosystems or for studying pelagic species. In such situations, the data quality provided by the APTs is exceptionally high.
Phenotypic variation in metabolism and morphology correlating with fish movements in the wild: a study combining respirometry and telemetry

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Institute Management, University of Porto
Authors: Svendsen, J. C. (Intern), Baktoft, H. (Intern), Skov, C. (Intern), Aarestrup, K. (Intern), Koed, A. (Intern), Jacobsen, L. (Intern)
Publication date: 2015
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2015

Præcis 3D-overvågning af ørred- og laksesmolt

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Authors: Baktoft, H. (Intern), Aarestrup, K. (Intern)
Publication date: 2015

**Publication information**
Source/Publisher: Fiskepleje.dk
Main Research Area: Technical/natural sciences
Links: http://www.fiskepleje.dk/Nyheder/2015/06/Hvor-er-fiskene-i-en-soe?id=87ee334-dd22-448e-a8cb-2656fca0d6fc&utm_source=newsletter&utm_media=mail&utm_campaign=
Publication: Communication › Internet publication – Annual report year: 2015

RevFisk – et projekt som kvantificerer stenrevs betydning for fisk

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Freshwater Fisheries Ecology, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Aarhus University, DHI Denmark
Publication date: 2015
Event: Poster session presented at 18. Danske Havforskermøde, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions: Publishers version
Survival and progression rates of anadromous brown trout kelts *Salmo trutta* during downstream migration in freshwater and at sea

The marine migration of post-spawning anadromous fish remains poorly understood. The present study examined survival and progression rates of anadromous brown trout *Salmo trutta* L. after spawning (kelts) during downriver, fjord, and sea migration. Kelts (*n* = 49) were captured in the Danish River Gudenaa, tagged with acoustic transmitters and subsequently recorded by automatic receivers. Kelts spent on average 25 d moving down the 45 km river and through the brackish fjord. The fish entered the Kattegat Sea between 14 April and 30 May. Eighteen of the 49 kelts disappeared in the river and fjord during outward migration, likely due to mortality. Survival was not significantly related to gill Na+/K+-ATPase activity, suggesting that physiological adaptation to saltwater may be less critical for adults compared to juveniles (smolts). Of the 31 fish that entered the Kattegat Sea, 45% survived and returned to the fjord. The duration of the entire marine migration, from leaving to entering the river, was on average 163 d. The fish returned from the Kattegat Sea to the fjord between 22 July and 21 October. Upon return, the fish spent 1–90 d passing through Randers Fjord, with most individuals completing the reach within 4 d, suggesting that the kelts spent limited time foraging after returning to the fjord. The total survival during the entire marine migration, including the fjord, was a minimum of 29%. Our study provides data that are important for management of anadromous brown trout, and the high survival highlights that kelts may represent a valuable resource for both population reproduction and recreational fisheries.
Comparison of the riverine and early marine migration behaviour and survival of wild and hatchery-reared sea trout Salmo trutta smolts

The seaward migration of wild (n = 61) and hatchery-reared (n = 46) sea trout smolts was investigated in the Danish River Gudenaa and Randers Fjord (17.3 and 28.6 km stretch, respectively) using acoustic telemetry. Their riverine and early marine migration was monitored by deploying automatic listening stations (ALS) at four locations in the river and fjord. Migration speeds were approximately three to eleven times faster in the river than in the early marine environment. Hatchery-reared smolts migrated faster than wild smolts, but the difference was small, especially compared to the large differences in migration speeds among habitats. There was no difference in the diurnal activity pattern between wild and hatchery-reared smolts. Both the riverine and early marine migration activity was primarily nocturnal, although some individuals were also recorded by the ALSs during daytime. The survival of the wild smolts was 1.8 and 2.9 times higher than that of the hatchery-reared smolts in the two study years, respectively, from release in the river to the outermost marine ALS site, 46 km from the release site. Overall, survival from release to the outermost ALS site was 79% for wild and 39% for hatchery-reared smolts. Since the lower survival of the hatchery-reared compared to the wild smolts could not be explained by differences in migration speeds or diurnal migration patterns, behavioural differences on a smaller scale than those recorded in the present study may explain the difference in survival.
Cormorant predation on PIT-tagged lake fish

The present study use data from recovered PIT (Passive Integrated Transponder) tags to explore species-and size-specific annual predation rates by cormorants on three common lacustrine fishes (size range 120-367 mm) in a European lake; roach (Rutilus rutilus), common bream (Abramis brama) and perch (Perca fluviatilis). In addition, we quantify the level of age/size truncation that cormorant predation could introduce in a population of perch, an important fish for recreational angling as well as for trophic interactions and ecosystem function in European lakes. Based on three years of PIT tagging of fish in Lake Viborg and subsequent recoveries of PIT tags from nearby cormorant roosting and breeding sites, we show that cormorants are major predators of roach, bream and perch within the size groups we investigated and for all species larger individuals had higher predation rates. Perch appear to be the most vulnerable of the three species and based on a comparison with mortality estimates from lakes without significant avian predation, this study suggest that predation from cormorants can induce age/size truncation in Lake Viborg, leaving very few larger perch in the lake. This truncation reduces the likelihood of anglers catching a large perch and may also influence lower trophic levels in the lake and thus turbidity as large piscivorous perch often play an important structuring role in lake ecosystem functioning.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Section for Marine Living Resources, Institute Management
Pages: 177-186
Publication date: 2014

Electronic versions:

DOIs:
10.4081/jlimnol.2014.715
Effect of boat noise and angling on lake fish behaviour

The effects of disturbances from recreational activities on the swimming speed and habitat use of roach Rutilus rutilus, perch Perca fluviatilis and pike Esox lucius were explored. Disturbances were applied for 4h as (1) boating in short intervals with a small outboard internal combustion engine or (2) boating in short intervals combined with angling with artificial lures between engine runs. The response of the fish species was evaluated by high-resolution tracking using an automatic acoustic telemetry system and transmitters with sub-minute burst rates. Rutilus rutilus swimming speed was significantly higher during disturbances [both (1) and (2)] with an immediate reaction shortly after the engine started. Perca fluviatilis displayed increased swimming activity during the first hour of disturbance but not during the following hours. Swimming activity of E. lucius was not significantly different between disturbance periods and the same periods on days without disturbance (control). Rutilus rutilus increased their use of the central part of the lake during disturbances, whereas no habitat change was observed in P. fluviatilis and E. lucius. No difference in fish response was detected between the two types of disturbances (boating with and without angling), indicating that boating was the primary source of disturbance. This study highlights species-specific responses to recreational boating and may have implications for management of human recreational activities in lakes.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Authors: Jacobsen, L. (Intern), Baktoft, H. (Intern), Jepsen, N. (Intern), Aarestrup, K. (Intern), Berg, S. (Intern), Skov, C. (Intern)
Pages: 1768-1780
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 84
Issue number: 6
ISSN (Print): 0022-1112
Ratings:
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
Nervøse skaller og kølige gedder – bådsejlads, fiskeri og fiskeadfærd

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Authors: Jacobsen, L. (Intern), Baktoft, H. (Intern), Skov, C. (Intern)
Pages: 18-19
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Sportsfiskeren
Issue number: 8
ISSN (Print): 0038-8211
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: 2014

Rovfisk på menuen

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Authors: Skov, C. (Intern), Jepsen, N. (Intern), Baktoft, H. (Intern), Koed, A. (Intern)
Pages: 14-15
Publication date: 2014
Sex identification and PIT-tagging: tools and prospects for studying intersexual differences in freshwater fishes

This study evaluated a technique to allow the long-term monitoring of individual fishes of known sex in the wild using sex confirmation in close proximity to the reproductive period combined with individual tagging. Hundreds of partially migratory roach Rutilus rutilus were tagged with passive integrated transponders (PIT) following sex determination in spring and
various performance measures were compared with fish tagged outside the reproductive period in autumn. Short-term survival was >95% for *R. rutilus* sexed and tagged under natural field conditions. Total length (LT) did not affect the probability of survival within the size range tagged (119–280 m), nor were there differences in timing of migration the following season between individuals sexed and tagged in spring and individuals tagged in autumn (i.e. outside the reproductive period). Also, a similar per cent of *R. rutilus* sexed and tagged in spring and tagged in autumn migrated the following season (34.5 and 34.7%). Moreover, long-term recapture data revealed no significant differences in body condition between *R. rutilus* individuals sexed and tagged in spring, individuals tagged in autumn and unmanipulated individuals. The observed sex ratio of recaptured fish did not differ from the expected values of equal recapture rates between males and females. Hence, there is no observable evidence for an adverse effect of tagging close to the reproductive period and therefore this method is suitable for studying intersexual differences and other phenotypic traits temporarily expressed during reproduction at the individual level in fishes.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Lund University, Swiss Federal Institute of Aquatic Science and Technology
Authors: Hulthén, K. (Ekstern), Chapman, B. (Ekstern), Nilsson, P. (Ekstern), Hansson, L. (Ekstern), Skov, C. (Intern), Baktoft, H. (Intern), Brodersen, J. (Ekstern), Brönmark, C. (Ekstern)
Pages: 503-512
Publication date: 2014
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Journal of Fish Biology
Volume: 84
ISSN (Print): 0022-1112
Ratings:
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
Skader skarven søerne

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Authors: Skov, C. (Intern), Jepsen, N. (Intern), Baktoft, H. (Intern), Koed, A. (Intern)
Pages: 16-17
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Sportsfiskeren
Issue number: 1
ISSN (Print): 0038-8211
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Links:
http://sportsfiskeren.dk/sites/default/files/Skarv%202b[smallpdf.com].pdf
Publication: Communication › Journal article – Annual report year: 2014

Skarvpædation på søfisk: Et indblik fra Viborg Søerne

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Institute Management
Authors: Skov, C. (Intern), Jepsen, N. (Intern), Baktoft, H. (Intern), Pedersen, S. (Intern), Koed, A. (Intern)
Pages: 34-38
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Vand & Jord
The effect of turbidity and prey fish density on consumption rates of piscivorous Eurasian perch Perca fluviatilis

Predator-prey interaction strengths in variable environments constitute a fundamental link to the understanding of aquatic ecosystem responses to environmental change. The present study investigates the effects of visibility conditions and prey fish density on predation rates of visually oriented piscivorous Eurasian perch Perca fluviatilis L. This was done in outdoor mesocosm (16 m²) experiments with clear water and two levels of turbidity (25 and 105 NTU) and two prey fish densities [3.1 and 12.5 roach Rutilus rutilus (L.) individuals m⁻²]. Perch consumption rates were affected by visibility less than expected, while they were highly affected by increased prey fish density. Perch responded to high prey density in all visibility conditions, indicating that prey density is more crucial for consumption than visibility in turbid lakes.
The physiological basis of the migration continuum in brown trout (Salmo trutta)

Partial migration is common in many animal taxa; however, the physiological variation underpinning migration strategies remains poorly understood. Among salmonid fishes, brown trout (Salmo trutta) is one of the species that exhibits the most complex variation in sympatric migration strategies, expressed as a migration continuum, ranging from residency to anadromy. In looking at brown trout, our objective with this study was to test the hypothesis that variation in migration strategies is underpinned by physiological variation. Prior to migration, physiological samples were taken from fish in the stream and then released at the capture site. Using telemetry, we subsequently classified fish as resident, short-distance migrants (potamodromous), or long-distance migrants (potentially anadromous). Our results revealed that fish belonging to the resident strategy differed from those exhibiting any of the two migratory strategies. Gill Na,K-ATPase activity, condition factor, and indicators of nutritional status suggested that trout from the two migratory strategies were smoltified and energetically depleted before leaving the stream, compared to those in the resident strategy. The trout belonging to the two migratory strategies were generally similar; however, lower triacylglycerides levels in the short-distance migrants indicated that they were more lipid depleted prior to migration compared with the long-distance migrants. In the context of migration cost, we suggest that additional lipid depletion makes migrants more inclined to terminate migration at the first given feeding opportunity, whereas individuals that are less lipid depleted will migrate farther. Collectively, our data suggest that the energetic state of individual fish provides a possible mechanism underpinning the migration continuum in brown trout.
Winter activity of roach and perch in a temperate lake by high resolution positioning telemetry

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Institute Management
Authors: Jacobsen, L. (Intern), Baktoft, H. (Intern), Berg, S. (Intern), Jepsen, N. (Intern), Koed, A. (Intern), Aarestrup, K. (Intern), Skov, C. (Intern)
Publication date: 2014
Event: Abstract from EcoFiL, Ceske Budejovice, Czech Republic.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014

A foraging cost of migration for a partially migratory cyprinid fish

Migration has evolved as a strategy to maximise individual fitness in response to seasonally changing ecological and environmental conditions. However, migration can also incur costs, and quantifying these costs can provide important clues to the ultimate ecological forces that underpin migratory behaviour. A key emerging model to explain migration in many systems posits that migration is driven by seasonal changes to a predation/growth potential (p/g) trade-off that a wide range of animals face. In this study we assess a key assumption of this model for a common cyprinid partial migrant, the roach Rutilus rutilus, which migrates from shallow lakes to streams during winter. By sampling fish from stream and lake habitats in the autumn and spring and measuring their stomach fullness and diet composition, we tested if migrating roach pay a cost of reduced foraging when migrating. Resident fish had fuller stomachs containing more high quality prey items than migrant fish. Hence, we document a feeding cost to migration in roach, which adds additional support for the validity of the p/g model of migration in freshwater systems.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Aarhus University
Authors: Chapman, B. B. (Ekstern), Eriksen, A. (Intern), Baktoft, H. (Intern), Brodersen, J. (Ekstern), Nilsson, P. A. (Ekstern), Hulthen, K. (Ekstern), Brönmark, C. (Ekstern), Hansson, L. (Ekstern), Grønkjær, P. (Forskerdatabase), Skov, C. (Intern)
Pages: e61223
Publication date: 2013
Main Research Area: Technical/natural sciences
Publication information
Journal: P L o S One
Volume: 8
Issue number: 5
ISSN (Print): 1932-6203
Ratings:
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
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Can sea trout Salmo trutta compromise successful eradication of Gyrodactylus salaris by hiding from CFT Legumin (rotenone) treatments?

In this study, 34 anadromous brown trout (sea trout) Salmo trutta were equipped with acoustic transmitters in order to examine whether they performed avoidance behaviour in response to a CFT Legumin (rotenone) treatment in the Norwegian River Vefsna. Migratory behaviour of the S. trutta was monitored by use of 15 automatic listening stations and manual tracking in the lower part of the river, in the estuary and in the fjord. None of the studied S. trutta survived the rotenone treatment and no indications of successful avoidance behaviour were observed.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Norwegian University of Science and Technology, National Veterinary Institute, University of Tromsø, Norwegian Institute for Nature Research
Authors: Davidsen, J. G. (Ekstern), Thorstad, E. B. (Ekstern), Baktoft, H. (Intern), Aune, S. (Ekstern), Økland, F. (Ekstern), Rikardsen, A. H. (Ekstern)
Pages: 1411-1418
Publication date: 2013
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 82
Issue number: 4
ISSN (Print): 0022-1112
Ratings:
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
Effects of angling and manual handling on pike behaviour investigated by high-resolution positional telemetry

Human disturbances such as angling and manual handling may have long-term effects on the behaviour of pike, Esox lucius L., an ecologically important species. Using continuous high-resolution positional telemetry, this study compared the swimming activity of handled and unhandled pike in a small lake. Pike pre-equipped with acoustic transmitters were angled and exposed to a handling protocol including measurements of length and mass. Pike not recaptured constituted an unhandled control group. Results demonstrated that the handling protocol caused temperature-dependent changes in pike activity, with higher temperatures leading to lower activity of the recaptured pike. The effects, however, were transitory and not detectable after 48-h post-release. These findings indicate that pike are relatively resilient to handling and quickly resume pre-handling activity.
Marine survival in wild sea trout (Salmo trutta) post-smolts. Why little fish matter!

Migration confers survival benefits against avian predators for partially migratory freshwater fish

The importance of predation risk in shaping patterns of animal migration is not well studied, mostly owing to difficulties in accurately quantifying predation risk for migratory versus resident individuals. Here, we present data from an extensive field study, which shows that migration in a freshwater fish (roach, Rutilus rutilus) that commonly migrates from lakes to streams during winter confers a significant survival benefit with respect to bird (cormorant, Phalacrocorax carbo spp.) predation. We tagged over 2000 individual fish in two Scandinavian lakes over 4 years and monitored migratory behaviour using passive telemetry. Next, we calculated the predation vulnerability of fish with differing migration strategies, by recovering data from passive integrated transponder tags of fish eaten by cormorants at communal roosts close to the lakes. We show that fish can reduce their predation risk from cormorants by migrating into streams, and that probability of being preyed upon by cormorants is positively related to the time individuals spend in the lake during winter. Our data add to the growing body of evidence that highlights the importance of predation for migratory dynamics, and, to our knowledge, is one of the first studies to directly quantify a predator avoidance benefit to migrants in the field.
Aspects of lentic fish behaviour studied with high resolution positional telemetry

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Baktoft, H. (Intern), Skov, C. (Intern), Svendsen, J. C. (Intern), Berg, S. (Intern), Aarestrup, K. (Intern), Koed, A. (Intern), Jacobsen, L. (Intern)
Number of pages: 118
Publication date: 2012
Effect of anthropogenic disturbances on lake fish individual behaviour

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Authors: Jacobsen, L. (Intern), Baktoft, H. (Intern), Berg, S. (Intern), Jepsen, N. (Intern), Skov, C. (Intern), Aarestrup, K. (Intern)
Publication date: 2012
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2012

Effekten af rekreative aktiviteter på fiskenes adfærd i en lille sø

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Authors: Jacobsen, L. (Intern), Baktoft, H. (Intern), Berg, S. (Intern), Jepsen, N. (Intern), Skov, C. (Intern), Aarestrup, K. (Intern)
Publication date: 2012
Event: Abstract from Ferskvandssymposium på Syddansk Universitet, Odense, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2012

Seasonal and diel effects on the activity of northern pike studied by high-resolution positional telemetry
Temperate lakes can be ice covered for several months each year, yet little is known about the behaviour and activity of the fish during the cold season. As northern pike represents the top of the food web in many northern temperate lakes and may structure the ecosystem both directly and indirectly, a detailed understanding of the behaviour of this species during winter is important. We continuously monitored the activity of adult northern pike (Esox lucius) in a small temperate lake from late summer to winter for two consecutive years using an automatic acoustic positional telemetry system. Four subsample periods representing different temperature regimes from each year were chosen for further investigation. The results revealed that pike activity was similar between seasons. In all periods, a distinct diel pattern, showing increased activity during day as compared to night, was evident. Our findings indicate that the fish component of temperate lentic ecosystems can be more active during the cold season than previously assumed. This may have implications for the structuring effect of pike on the lower trophic levels

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Fisheries and Oceans Canada
Pages: 386-394
Publication date: 2012
Main Research Area: Technical/natural sciences
Publication Information
Journal: Ecology of Freshwater Fish
Volume: 21
Issue number: 3
ISSN (Print): 0906-6691
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
Visibility conditions and diel period affect small-scale spatio-temporal behaviour of pike Esox lucius in the absence of prey and conspecifics

Pike Esox lucius in the absence of prey and conspecifics were shown to have the highest habitat-change activity during dusk and to decrease preference for complex habitats in turbid water. As the behaviours indicate routine responses in the absence of behavioural interactions, E. lucius spatio-temporal distributions should be directly affected and thereby more easily assessed and avoided by prey, with potential consequences for encounter rates.
Can metabolic properties explain variation in individual behaviour?

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Publication date: 2011
Event: Abstract from 1st International Conference on Fish Telemetry, Sapporo, Japan.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 281697
Publication: Research › Conference abstract for conference – Annual report year: 2011

Can metabolic properties explain variation in individual behaviour? Attempting to link physiology and morphology with field behavior

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Publication date: 2011
Event: Abstract from 1st International Conference on Fish Telemetry, Sapporo, Japan.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 279001
Publication: Research › Conference abstract for conference – Annual report year: 2011

Disturbance by human activities on fish individual behaviour in a small lake

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Authors: Jacobsen, L. (Intern), Baktoft, H. (Intern), Berg, S. (Intern), Jepsen, N. (Intern), Skov, C. (Intern), Aarestrup, K. (Intern)
Publication date: 2011
Event: Abstract from World Recreational Fisheries Congress, Berlin, Germany.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 281696
Publication: Research › Conference abstract for conference – Annual report year: 2011
Individual based population inference using tagging data

General information
State: Published
Organisations: Mathematical Statistics, Department of Informatics and Mathematical Modeling, Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Publication date: 2011
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 279243
Publication: Research › Conference abstract for conference – Annual report year: 2011

Linking individual behaviour and migration success in Salmo salar smolts approaching a water withdrawal site: implications for management

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Svendsen, J. C. (Intern), Aarestrup, K. (Intern), Malte, H. (Ekstern), Thygesen, U. H. (Intern), Baktoft, H. (Intern), Koed, A. (Intern), Deacon, M. G. (Ekstern), Cubitt, K. F. (Ekstern), McKinley, R. S. (Ekstern)
Pages: 201-209
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquatic Living Resources
Volume: 24
Issue number: 2
ISSN (Print): 0990-7440
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.41 SJR 0.59 SNIP 0.743
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.747 SNIP 0.848 CiteScore 1.39
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.641 SNIP 0.905 CiteScore 1.25
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.547 SNIP 0.68 CiteScore 1.15
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.554 SNIP 0.618 CiteScore 1.19
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.628 SNIP 0.697 CiteScore 1.17
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.589 SNIP 0.545
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.493 SNIP 0.56
Performance of a wireless acoustic telemetry system in a natural lake: the role of data processing and habitat structure

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Authors: Zajicek, P. (Ekstern), Baktoft, H. (Intern), Klefoth, T. (Ekstern), Pedersen, M. W. (Intern), Sisak, M. M. (Ekstern), Arlinghaus, R. (Ekstern)
Publication date: 2011
Event: Abstract from 1st International Conference on Fish Telemetry, Sapporo, Japan.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 278074
Publication: Research - peer-review › Journal article – Annual report year: 2011

Progression rates and survival of Sea trout smolts in the early stage of their marine migration

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Authors: Del Villar, D. (Intern), Aarestrup, K. (Intern), Baktoft, H. (Intern)
Publication date: 2011
Event: Abstract from 1st International Conference on Fish Telemetry, Sapporo, Japan.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 279244
Publication: Research › Conference abstract for conference – Annual report year: 2011

Sizing up your enemy: individual predation vulnerability predicts migratory probability

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Authors: Skov, C. (Intern), Baktoft, H. (Intern), Brodersen, J. (Ekstern), Brönmark, C. (Ekstern), Chapman, B. B. (Ekstern), Hansson, L. (Ekstern), Nilsson, P. A. (Ekstern)
Vandringsadferd hos sjøørret i esturie og nedre deler av Vefsna under dosering av CFT-Legumin (rotenon)

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Authors: Davidsen, J. (Ekstern), Thorstad, E. (Ekstern), Baktoft, H. (Intern), Aune, S. (Ekstern), Økland, F. (Ekstern), Rikardsen, A. (Ekstern)
Publication date: 2011

Publication information
Place of publication: Trondheim, Norway
Publisher: Norges teknisk-naturvidenskapelige universitet
ISBN (Print): 978-82-7126-936-4
Original language: Norwegian
Series: NTNU Vitenskapsmuseet Zoologisk notat
Number: 8
ISSN: 1504-503X
Main Research Area: Technical/natural sciences
Links:
http://www.ntnu.no/vitenskapsmuseet/zoologiske-notater
Source: orbit
Source-ID: 316132
Publication: Research › Report – Annual report year: 2011

Hvad fiskene laver i søen - døgnet rundt

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Authors: Jacobsen, L. (Intern), Baktoft, H. (Intern), Aarestrup, K. (Intern), Berg, S. (Intern), Skov, C. (Intern)
Publication date: 2010
Event: Poster session presented at Tema møde om Fiskeplejens fremtid, .
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 268793
Publication: Research › Poster – Annual report year: 2010

Individual based population inference using tagging data
A hierarchical framework for simultaneous analysis of multiple related individual datasets is presented. The approach is very similar to mixed effects modelling as known from statistical theory. The model used at the individual level is, in principle, irrelevant as long as a maximum likelihood estimate and its uncertainty (Hessian) can be computed. The individual model used in this text is a hidden Markov model. A simulation study concerning a two-dimensional biased random walk is examined to verify the consistency of the hierarchical estimation framework. In addition, a study based on acoustic telemetry data from pike illustrates how the framework can identify individuals that deviate from the remaining population.

General information
State: Published
Organisations: Mathematical Statistics, Department of Informatics and Mathematical Modeling, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Freshwater Fisheries Ecology
Publication date: 2010

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark, DTU Informatics, Building 321
Original language: English
Opgang og gydning af laks i Skjern Å-systemet 2008/2009

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Authors: Koed, A. (Intern), Jepsen, N. (Intern), Baktoft, H. (Intern), Larsen, S. (Ekstern)
Publication date: 2010

Publication information
Place of publication: Charlottenlund
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
ISBN (Print): 978-87-7481-116-9
Original language: Danish
Series: DTU Aqua-rapport
Number: 220-2010
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Electronic versions:
DTU Aqua rapport 220-2010.pdf
Links:
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008
Source: orbit
Source-ID: 268077
Publication: Research › Report – Annual report year: 2010

New insights in pike behaviour

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Authors: Baktoft, H. (Intern), Jacobsen, L. (Intern), Berg, S. (Intern), Aarestrup, K. (Intern), Skov, C. (Intern), Svendsen, J. C. (Intern)
Publication date: 2009
Event: Abstract from PhD Student Seminar, Søminestationen, Holbæk, Danmark, .
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 252607
Publication: Research › Conference abstract for conference – Annual report year: 2009

New insights in pike behaviour using 2D/3D telemetry

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Mathematical Statistics, Department of Informatics and Mathematical Modeling
Publication date: 2009
Event: Abstract from 8th Conference on Fish Telemetry held in Europe; Umeå, Sweden; September 14-18, .
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 252533
Publication: Research › Conference abstract for conference – Annual report year: 2009
Ny viden om gæddne

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Authors: Rasmussen, K. (Ekstern), Baktoft, H. (Intern)
Pages: 34-36
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information
Journal: Sportsfiskeren
Volume: 84
Issue number: 9
ISSN (Print): 0038-8211
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: 251730
Publication: Research › Journal article – Annual report year: 2009

Smøltudvandring fra Storå 2007 samt smøltdødelighed under udvandringen gennem Feisted Kog og Nissum Fjord

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Authors: Baktoft, H. (Intern), Koed, A. (Intern)
Number of pages: 25
Publication date: 2008

Publication information
Publisher: Institut for Akvatiske Ressourcer, Danmarks Tekniske Universitet
Original language: Danish
Series: DTU Aqua-rapport
Number: 186-08
Main Research Area: Technical/natural sciences
Electronic versions:
186_08_samlet_elektronisk.pdf
Links:
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008
Source: orbit
Source-ID: 224844
Publication: Research › Report – Annual report year: 2008

Causes of mortality of Atlantic salmon (Salmo salar) and brown trout (Salmo trutta) smolts in a restored river and its estuary

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Authors: Koed, A. (Intern), Baktoft, H. (Intern), Bak, B. D. (Ekstern)
Pages: 69-78
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: River Research and Applications
Volume: 22
Myndighedssamarbejdet om fiskeriet i Ringkøbing og Nissum fjorde

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Number of pages: 66
Restaurering af Skjern Å: Sammenfatning af overvågningsresultater 1999-2003

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Authors: Koed, A. (Intern), Baktoft, H. (Intern)
Number of pages: 96
Publication date: 2005

Rekordstort laksesmoltudtræk fra Skjern Å i 2002

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Authors: Koed, A. (Intern), Baktoft, H. (Intern)
Number of pages: 2-3
Publication date: 2002
Main Research Area: Technical/natural sciences
Projects:

Effects of the newly established lake on migrating juvenile salmonids (smolts)

National Institute of Aquatic Resources
Period: 01/03/2015 → 28/02/2018
Number of participants: 3
Phd Student:
Schwinn, Michael (Intern)
Supervisor:
Baktoft, Henrik (Intern)
Main Supervisor:
Koed, Anders (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Reporting tagging experiments (38250)
The project 1) manages expenses (rewards) and databases with results from tagging experiments and 2) elaborates results on selected previously not reported issues from former tagging experiments.

1) Handling incoming reports on recaptures of tagged fish comprises payment of rewards and registering of recaptures. Reports from previous experiments are normally received over a longer period of time and it is practical to locate expenses in one continuous project. Dating back to the 1970’s and until recent years numerous tagging experiments have been conducted on salmon and trout at DTU Aqua. The use of tags and tagging has been and remains a key method in fish studies. Results from tagging experiments has previously been stored in separate databases, but one objective of the project is to assemble results in a single database accessible using GIS software in order to facilitate access to conducted experiments, being relevant both for research and advisory activities.

2) The elaboration of results from former tagging experiments, where results may already have been used for their primary purpose, aims at extracting as much as possible the information available in the results. Information from the experiments are extracted ad hoc for various purposes, and elaborated for reporting on selected issues.

Presently work is being carried out on a series of tagging experiments on wild and reared sea trout (smolt and adults) in river Kolding Å, as well as on catch pattern of salmon in the Baltic Sea in relation to fishing effort and environmental variables for a selected time series. It is the intention to analyze results on data from several countries around the Baltic Sea in corporation with relevant national institutes.

National Institute of Aquatic Resources
Section for Freshwater Fisheries Ecology
Period: 01/01/2011 → 01/01/2099
Number of participants: 2
Research area: Freshwater Fisheries and Ecology
Project participant:
Baktoft, Henrik (Intern)
Project Manager, academic:
Pedersen, Stig (Intern)

Behaviour of lake-dwelling fish

National Institute of Aquatic Resources
Period: 01/12/2008 → 19/09/2012
Number of participants: 10
Phd Student:
Baktoft, Henrik (Intern)
The project focuses on establishing new and comprehensive knowledge on behavior of lake dwelling fish and the impact of human activities, which can eventually enhance management of freshwater fish populations. The study is based on an acoustic telemetry system, which facilitates fine scale 3D positioning of fish several times a minute with sub meter accuracy. The system has been deployed in a small lake for five consecutive years and has generated data sets on pike, perch and roach behavior with unprecedented details, e.g. activity levels and habitat choice on a diel and seasonal basis coupled to environmental factors such as establishment and break of thermoclines. For instance, studies on pike winter behavior during ice cover have generated new insights and added to the increased consciousness of the importance of year-round knowledge on lake ecology processes. The remote sensed monitoring of the tagged fish without presence of personnel has allowed for comparison of fish behavior in situations with and without human disturbances, e.g. fishery-related activities. This way a distinct and instantaneous impact of boating on fish behavior has been revealed and the impact of catch and release angling has been addressed. Finally, the system has facilitated studies extending laboratory findings to behavior in the field. For instance, findings of physiological (metabolic rates) and behavioral properties of individual fish in the lab have been linked with behavior of the same individuals in nature by subsequent tagging and release in the lake.

Several issues have been studied concurrently the last years and will be continued: A principal focus area has been striving to establish which factors impact and confine natural pike populations. The majority of larger pike in the study lake have been followed for more than three years, which has provided a detailed picture of pike behavior and individual variation. The interactions between pike size groups and whether the behavior of smaller pike is controlled by larger individuals has been studied and has revealed differences in both activity patterns and habitat choice ruled by the largest pike, as well as uncovered extensive cannibalism among large individuals. Pike exploitation of various spawning habitats has been assessed and a genetic analysis of pike individuals and pike eggs will be explored, possibly facilitating assessment of the individual contribution to the population and thus enabling a cross-discipline approach to explore how behavior and reproductive fitness is related.

The studies on winter biology are not only covering pike, but are incorporating the entire fish community adding further insights to the limited overall knowledge on winter lake ecology. Further, while simultaneous tracking several species the system allows for studies of predator-prey and species interactions, shoaling etc. in a natural system.

The project was coordinated by DTU Aqua.
Some of the mechanisms guiding the interactions of fish species in clear water lakes seem to act differently in turbid water, thus more knowledge of these relationships are essential. Both in order to understand how the fish population in a lake will develop when the lake is about to change to a clear water state, but also in order to understand the stability of predator fish populations under various environmental conditions. One of the important related issues can be the capability of predator fish, to hunt in turbid water and the interactions of more predator fish species. The capacity of pike and large perch to hunt in turbid water was tested in extensive pond experiments with different clay turbidity, including also the importance of prey fish density. The experimental approach was supplemented by parallel radio telemetry field studies of both predator species, in order to explain the role of behaviour and the importance for the natural composition of fish populations in turbid and clear water lakes. Pond experiments showed that pike were perfectly able to hunt in turbid water, backed up by the field findings of higher activity levels for some pike in the turbid lake, however in general with a larger variation in behavioural strategy in turbid water. Surprisingly, perch were also capable of hunting in very low turbidity at least in high prey fish densities. The telemetry study showed two alternative behavioural patterns of perch in clear water and turbid water, perch being more active in the turbid water on a diel basis including at night and not showing any sunrise and sunset peaks in activity as was seen in the clear water lake. The alternative strategy in the turbid lake might be interpreted as a means of allocating more time for hunting due to visual constraints. Contemporary studies on prey fish behaviour in the study lakes also revealed different behaviours on a diel basis dependent on turbidity, which can be linked to predator fish behaviour.

Two peer-reviewed papers and a master thesis were published on pike-behaviour as well as two peer-reviewed papers on perch behaviour. Results were presented on international and national conferences.

The project was coordinated by DTU Aqua.

The project was funded by the Danish Rod and Net Fishing License Funds.

National Institute of Aquatic Resources
Section for Freshwater Fisheries Ecology
Lund University
Period: 01/01/2005 → 30/06/2016
Number of participants: 5
Research area: Freshwater Fisheries and Ecology
Project participant:
Andersen, Martin (Intern)
Berg, Søren (Intern)
Skov, Christian (Intern)
Baktoft, Henrik (Intern)
Project Manager, academic:
Jacobsen, Lene (Intern)

Management of the fish population in lakes under heavy human influence (38268)
The objectives of this project are to improve our understanding of how the physical conditions of lakes can affect spawning and fry mortality and growth for the most important piscivorous fish species. We will especially focus on the conditions of the littoral zone. This knowledge can be used to insure that the demands of these species in relation to spawning and YOY development are met. The results will be used as part of the web-based “Handbook on the Management of Lake Fish”, which is under development.

The majority of Danish lakes are strongly influenced by human activity, partly in the form of increased nutrient load, but also direct physical alterations are common, e.g. by regulation of the water level, consolidation of the banks or the consequences of heavy boat traffic. These types of physical alterations are often most common in lakes situated in or close to urban areas. In these kinds of lakes, lake restoration by biomanipulation might prove to be insufficient to achieve the improved environmental conditions expected, including a good population of piscivorous fish. Thus, the lakes environmental quality, as well as the possibility to use the lake for recreational activities including recreational fisheries, might be negatively influenced.

During the project, several activities related to this subject have been conducted:
1) An experiment demonstrating the importance of water depth for the mortality of 0+ pike.
2) Another experiment, which showed that it is possible to build an artificial spawning habitat for pike in an urban, artificial
lake without a natural littoral zone and that the pike did use it for spawning and that the pike fry used it as nursery habitat.
3) A stocking experiment with 0+ pike to find out if stocking is a possible way to enhance a very low population density of pike in a lake with heavy boat traffic and extensive angling. During this experiment we demonstrated that it is possible to tag 0+ pike of 6-8 cm with PIT tags without mortality, but also that the tagging has a negative effect on growth of the tagged pike.
4) An investigation on the spawning habitat choice and spawning behavior of pike in a small natural lake (in cooperation with project no 39270).

The use of specially designed “egg traps” has been used successful in two of these experiments.

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Freshwater Fisheries Ecology
City Council of Copenhagen
Period: 01/01/2003 → 31/03/2013
Number of participants: 3
Research area: Freshwater Fisheries and Ecology
Project participant:
Baktoft, Henrik (Intern)
Project Manager, academic:
Berg, Søren (Intern)
Skov, Christian (Intern)
Project