Development of a broodstock diet to improve developmental competence of embryos in European eel, Anguilla anguilla

We examined the effect of dietary arachidonic acid (ARA) and eicosapentaenoic acid (EPA) on the production of embryos and hatched larvae in the European eel, Anguilla anguilla. Two diets with high and intermediate levels of ARA and low and intermediate levels of EPA (Feed 1: ARA 1.9%, EPA 4.2%; Feed 2: ARA 1.2%, EPA 5.1% of total fatty acids) were tested against a commercial diet (DE: ARA: 0.5%, EPA: 8.2% of total fatty acids). After 24 weeks of feeding, ARA levels in the muscles and ovaries increased to 0.9% and 1.3% of total fatty acids, respectively, in Feed 1 and were significantly higher than in Feed 2 and DE. Female broodstock was not fed during hormonal treatment to induce vitellogenesis and ovulation. EPA levels in females fed the test diets decreased in the both muscle and ovary and were significantly lower in eggs from females fed Feed 1. The highest percentage of stripped females, producing viable eggs and larvae, were those females fed the highest dietary ARA levels (Feed 1). The level of lipid peroxidation products in eggs was similar among treatment, indicating that the lowest dietary levels of vitamin C and vitamin E were sufficient. In the unfertilized eggs, ARA levels were also highest (1.1% of total fatty acids) in the diet with highest ARA levels (Feed 1).
Impact of dietary fatty acids on muscle composition, liver lipids, milt composition and sperm performance in European eel

In order for European eel aquaculture to be sustainable, the life cycle should be completed in captivity. Development of broodstock diets may improve the species' reproductive success in captivity, through the production of high-quality gametes. Here, our aim was to evaluate the influence of dietary regime on muscle composition, and liver lipids prior to induced maturation, and the resulting sperm composition and performance. To accomplish this fish were reared on three "enhanced" diets and one commercial diet, each with different levels of fatty acids, arachidonic acid (ARA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). Neutral lipids from the muscle and liver incorporated the majority of the fatty acid profile, while phospholipids incorporated only certain fatty acids. Diet had an effect on the majority of sperm fatty acids, on the total volume of extractable milt, and on the percentage of motile sperm. Here, our results suggest that the total volume of extractable milt is a DHA-dependent process, as we found the diets with the highest DHA levels induced the most milt while the diet with the lowest DHA level induced the least amount of milt. The diet with the highest level of ARA induced medium milt volumes but had the highest sperm motility. EPA also seems important for sperm quality parameters since diets with higher EPA percentages had a higher volume of milt and higher sperm motility. In conclusion, dietary fatty acids had an influence on fatty acids in the tissues of male eel and this impacted sperm performance.
Larval production and survival during the early larval stage in European eel

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Billund Aquaculture Service Aps, Danish Aquaculture Organisation
Authors: Tomkiewicz, J. (Intern), Butts, I. (Intern), Sørensen, S. R. (Intern), Politis, S. N. (Intern), Lauesen, P. (Ekstern), Krüger-Johnsen, M. (Intern), Graver, C. (Ekstern)
Publication date: 2014
Main Research Area: Technical/natural sciences

Development of a broodstock diet to improve embryonic development competence in female European eel Anguilla anguilla

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, National Food Institute, Division of Industrial Food Research
Authors: Støttrup, J. (Intern), Tomkiewicz, J. (Intern), Jacobsen, C. (Intern), Krüger-Johnsen, M. (Intern), Holst, L. (Ekstern), Lauesen, P. (Intern)
Publication date: 2013
Main Research Area: Technical/natural sciences

Reproduction of European eel and larval culture: state of the art

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Centre for Ocean Life
Authors: Tomkiewicz, J. (Intern), Støttrup, J. (Intern), Corraze, G. (Ekstern), Kausik, S. (Ekstern), Holst, L. (Ekstern), McEvoy, F. (Ekstern), Dufour, S. (Ekstern), Lafont, A. (Ekstern), Asturiano, J. (Ekstern), Sørensen, S. R. (Intern), Tveiten, H. (Ekstern), De Schryver, P. (Ekstern), Butts, I. (Intern), Munk, P. (Intern), Zambonino-Infante, J. (Ekstern), Politis, S. N. (Intern), Krüger-Johnsen, M. (Intern), Lauesen, P. (Intern)
Publication date: 2013
Main Research Area: Technical/natural sciences

Reproduction of European eel: towards a self-sustained aquaculture (PRO-EEL)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Centre for Ocean Life, National Food Institute, Division of Industrial Food Research
Thermal dynamics of ovarian maturation in Atlantic cod (Gadus morhua)

General information
State: Published
Organisations: Centre for Environment Fisheries and Aquaculture Science, Institute of Marine Research
Authors: Kjesbu, O. S. (Ekstern), Righton, D. (Ekstern), Krüger-Johnsen, M. (Intern), Thorsen, A. (Ekstern), Michalsen, K. (Ekstern), Fonn, M. (Ekstern), Witthames, P. R. (Ekstern)
Pages: 605-625
Publication date: 2010
Main Research Area: Technical/natural sciences

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BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.256 SNIP 1.051 CiteScore 2.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.443 SNIP 1.379 CiteScore 2.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.421 SNIP 1.081 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
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Scopus rating (2012): SJR 1.324 SNIP 1.196 CiteScore 2.29
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.423 SNIP 1.09 CiteScore 2.13
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.425 SNIP 1.118
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.451 SNIP 1.196
Web of Science (2009): Indexed yes
Oocyte development in captive Atlantic horse mackerel Trachurus trachurus

Ndjaula, H. O. N., Hansen, T., Krüger-Johnsen, M., and Kjesbu, O. S. 2009. Oocyte development in captive Atlantic horse mackerel Trachurus trachurus. – ICES Journal of Marine Science, 66: 623–630. This 13-month experimental study focused on developing oocyte production in 101 adult female Atlantic horse mackerel. In addition, proxies of energy patterns in relation to oocyte development were investigated. The fish were captured off western Norway and fed to satiation from October 2005 to November 2006 in two replicate adjacent circular tanks. Monthly histological examination of the ovaries indicated that vitellogenic oocytes were present at all times throughout the study period, but that oocyte development did not progress past the incipient migratory nucleus stage. The oocyte diameter (OD) threshold between pre-vitellogenic and vitellogenic oocytes and the mean OD of the leading cohort were investigated, and no hiatus was observed within the OD size distribution around the 185-µm pre-vitellogenic and vitellogenic threshold. Variation in gonadosomatic index, hepatosomatic index, condition factor, and fat content (as measured by the use of a Distell Fish Fatmeter) increased with oocyte development. The observed development of oocyte recruitment and the absence of a hiatus in the oocyte distribution are characteristics of an asynchronous spawner. The species seems to have a prolonged spawning season, judging from the advanced and variety of maturity stages throughout the study period.

General information
State: Published
Organisations: Institute of Marine Research
Authors: Ndjaula, H. O. N. (Ekstern), Hansen, T. (Ekstern), Krüger-Johnsen, M. (Intern), Kjesbu, O. S. (Ekstern)
Pages: 623-630
Publication date: 2009
Main Research Area: Technical/natural sciences

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Journal: ICES Journal of Marine Science
Volume: 66
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BFI (2018): BFI-level 1
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Web of Science (2017): Indexed yes
Horse mackerel fecundity in relation to lipid content

General information
State: Published
Organisations: Netherlands Institute for Fisheries Research, National University of Ireland, Instituto Español de Oceanografía, Federal Research Centre for Fisheries, CEFAS Lowestoft Laboratory, Institute of Marine Research
Authors: van Damme, C. (Ekstern), Dransfeld, L. (Ekstern), Eltink, A. (Ekstern), Krüger-Johnsen, M. (Intern), Perez, J. (Ekstern), Ulleweit, J. (Ekstern), Witthames, P. (Ekstern)
Pages: 17
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES C.M.
Spawning time, age and size at maturity, and fecundity of sandeel, Ammodytes marinus, in the north-eastern North Sea and in unfished coastal waters off Norway

We studied the reproductive biology of the lesser sandeel, Ammodytes marinus, on the fishing grounds of the east central North Sea and on an unfished ground off the coast of southwest Norway. As in other parts of the North Sea, gonad growth appeared to start in September and spawning occurred in December-January. Based on data from the spawning period, maturity ogives by length and age were derived. The length and age at 50% maturity was 14 cm and 3.2 years respectively in both study areas. The age estimate is 1 year higher than that found previously in the southern North Sea and adopted for the ICES-assessments of the North Sea spawning stock. Estimates of fecundity appeared higher in the North Sea than in coastal waters, at least for large fish. The coastal water estimates also seemed low compared with fecundity at length relationships previously published from Shetland, Fair Isle, and Dogger bank. The sex ratio seldom deviated substantially from the 1:1 ratio, but in summer there appeared to be a surplus of females. Due to spatial differences in age-structure, the proportion of adults was generally much lower on the fishing grounds of the North Sea proper than on the unfished coastal ground. In the middle of the spawning period, however, aggregations of adults occurred on the North Sea grounds.

General information
State: Published
Organisations: Institute of Marine Research
Authors: Bergstad, O. A. (Ekstern), Hoines, Å. S. (Ekstern), Krüger-Johnsen, M. (Intern)
Pages: 293-301
Publication date: 2001
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquatic Living Resources
Volume: 14
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Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
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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
Projects:

**BONUS BIO-C3 Cruise (39117-DCH)**

The multidisciplinary research cruise (16-30 September 2015) was aiming to investigate the distribution, abundance, biomass, production, nutritional condition and genetic diversity of several, trophically interlinked Baltic key species, ranging from zoo-, and ichthyoplankton over gelatinous organisms to adult fish, including non-indigenous species. The collected samples and data are used in the BONUS project Biodiversity changes—causes, consequences and management implications (BIO-C3), aiming to significantly advance our knowledge base towards the importance and management of the Baltic Sea biodiversity in an ecosystem perspective.

Using the contrasting environments of the Arkona, Bornholm, Gdansk and Gotland Basin, the major scientific goals of the cruise have been to resolve:

- Physiological preferences and tolerances of key meso-zooplankton species (*Pseudocalanus acuspes, Temora longicornis, Centropages hamatus* and *Acartia spp*), through controlled experiments on board with specimens caught in different areas of the central Baltic in contrasting environments, including a verification of species based on genetics,
- Abundance, distribution, nutritional condition and phenology of key zooplankton (see above) and their life stages as well as gelatinous plankton species (*Aurelia aurita, Cyanea capillata, Mertensia ovum, Mnemiopsis leidyi*) in different areas of the central Baltic, through net-sampling and deploying hydroacoustics and optics, as well as biochemical analyses,
- Individual condition, abundance and distribution of spawning herring and cod based on trawl sampling and hydroacoustics including biochemical investigations on the quality of spawning products,
- Abundance and survival of herring and cod ichthyoplankton, through net-sampling based stage specific production estimates, including age determination, nutritional condition and growth in relation to abundance, phenology and composition of zooplankton prey,
- Predation pressure on copepods and fish early life stages by herring and sprat as well as gelatinous plankton (see above) through resolving the spatial overlap between predator and prey at relevant scales as well as diet composition analyses,
- Distribution (vertical and horizontal) of sprat and herring through trawl sampling and hydroacoustics in relation to hydrography, zooplankton prey and predator (cod) abundance, with specific focus on growth, condition and survival of young of the year sprat in different areas of the central Baltic.

This project was coordinated by DTU Aqua.

The project was funded by Danish Center for Marine Research.
Eel hatchery technology for a sustainable aquaculture (EEL-HATCH) (39181)

Hatchery and rearing technology for commercial production of glass eels is fundamental to sustainable and profitable eel aquaculture. The vision is to enhance existing technology to rear European eel larvae to the glass eel stage, thereby closing the lifecycle in captivity. Pioneering research of the consortium has raised eel breeding from a state of reproductive failure to stable production of viable larvae.

Objectives include: Design “state of the art” hatchery facilities, optimize broodstock feeds, enhance assisted reproductive technology, and develop larval culture systems and diets. The main success criterion is achievement of large scale culture of larvae throughout the larval stage, leading to glass eel production. The establishment of sustainable aquaculture of this endangered species, presently relying on captive glass eel will rebuild the highly profitable market for eel aquaculture and suppliers as well as assist in conservation and stock management plans.

Results obtained during the half of the project period include the design and establishment of a dedicated research facility in relation to DTU Aqua in Hirtshals, involving several partners. The facility applies recirculation aquaculture systems with emphasis on matured water technology and microbial control. Scientific highlights include successful production of recombinant European eel gonadotrophic hormones; enhanced reproduction, fertilization and incubation procedures; and optimized larval culture conditions, including e.g. temperature, salinity, and light regime. Larval diets have been developed and tested in first feeding and behavioral experiments, leading to the first published work on larval feeding for this species. Experiments on improved diets and optimized rearing tanks for larval growth are ongoing.

This project is coordinated by DTU Aqua.

The project is funded by Innovation Fund Denmark.
Reproduction of European eel: Towards a self-sustained aquaculture (PRO-EEL) (38793)

Reproduction of European eel (Anguilla anguilla) in culture has become a research priority area due to a severe decline of natural stocks and an increasing interest to breed eels for a self-sustained aquaculture. As eels do not reproduce naturally in captivity, development of methodology and technology was needed for production of viable eggs and larvae from broodstock in a regular and predictable way.

Focus of PRO-EEL project was on the primary bottlenecks in a controlled reproduction of eels, which concern deficiencies in knowledge about eel reproductive physiology and methods applied to induce and finalize gamete development. During a 4-year period, the project significantly expanded current knowledge on the eel reproductive mechanisms and hormonal control of sexual maturation. The consortium developed standardized protocols for assisted production of high quality gametes (egg and sperm) and artificial fertilization, thereby obtaining a stable production of viable embryos. Furthermore, egg incubation procedures and culture of yolksac larvae were established for the first time for European eel, leading to the first feeding stage. The project disseminated novel literature on early life stages, including their ontogeny and requirements thereby describing egg and larval stages still unknown in nature and providing important information for future development of larval diets and rearing technology. Methodology and technology was established using small scale tests and validated in full scale experimental facilities managed by DTU.

The project was an international, EU-funded research project characterized by an integrative and multidisciplinary approach. The consortium brought together leading experts in eel reproduction complemented by expertise in disciplines filling gaps in knowledge and technology. The consortium included 15 partners, comprising European research institutes and industry partners as well as an international collaboration partner country (ICPC). Within DTU, the project involved DTU Food, Research Group for Bioactives – Analysis and Application, and several DTU Aqua research areas including Fish Biology, Aquaculture, Marine Populations and Ecosystem Dynamics, and Coastal Ecology.

The project was coordinated by DTU Aqua.

The project was funded by EU, Framework Programme 7.

National Food Institute
National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
Wageningen IMARES
Leiden University
National Centre for Scientific Research "Demokritos"
Polytechnic University of Valencia
Reproduction of European eel in aquaculture: Consolidation and new production methods (REEL) (38398)

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, DTU Aqua, University of Copenhagen 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 have a potential for application also to European eel. ROE II and III LC were supported by the Danish Ministry of Food, Agriculture and Fisheries and the Financial Instrument for Fisheries Guidance (FIFG) and RO III by the Danish Food Research Program 2006.

Results: The REEL project has accomplished through three series of experiments to consolidate previous results and extend the longevity of larvae from 12 to 20 days after hatch in first feeding experiments. Methods to induce maturation were further tested, and farmed and wild eel broodstocks and different treatments were compared. In particular, fertilization procedures to produce fertilized 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 Fishfarm was enhanced by improving the experimental and laboratory facilities. The REEL project has provided the basis for the establishment of an EU research project: Reproduction of European Eel: Towards a Self-sustained Aquaculture (PRO-EEL) (38793) coordinated by DTU Aqua. REEL included the partners DTU Aqua, the Danish Eel Producers Association, Billund Aquaculture, BioMar, Bioneer and Copenhagen University of which four are integrated in PRO-EEL.

The project was coordinated by DTU Aqua.

National Food Institute
National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
University of Copenhagen  
Bioneer A/S  
Danish Eel Farmers Association  
Billund Aquaculture Service Aps  
BioMar A/S  
Period: 01/01/2009 → 31/12/2010  
Number of participants: 8  
Research areas: Marine Populations and Ecosystem Dynamics & Fish Biology  
Project participant:  
Steenfeldt, Svend Jørgen (Intern)  
Sørensen, Sune Riis (Intern)  
Hornum, Inger (Intern)  
Krüger-Johnsen, Maria (Intern)  
Project Manager, academic:  
Tomkiewicz, Jonna (Intern)  
Munk, Peter (Intern)  
Støttrup, Josianne Gatt (Intern)  
Tybjerg, Lars (Intern)  
Project  

Artificial reproduction of eels: Phase III (ROE III) (38187)  

The steady decline of the European eel stock has adverse consequences for the Danish eel aquaculture as all eel farming is at present capture based relying on wild caught glass eels. In 2005, DTU Aqua, University of Copenhagen 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.  

The focus of ROE III was to follow up the pioneering work on artificial reproduction of European eels performed in the preceding pilot projects ROE I and II. The projects ROE II and III were a collaboration among DTU Aqua, University of Copenhagen and the eel aquaculture industry following up an initial survey ROE I of suited methodology lead by University of Copenhagen.  

ROE III comprised the following activities:  
(i) Experimental series with different treatment schemes and hormone dosage to improve the maturation process and optimize gamete quality;  
(ii) Development of methods to monitor the maturation process on individual level using ultrasound scanning technology and ovary biopsy;  
(iii) Analysis of broodstock fishes and improvement of the dietary fatty acid composition;  
(iv) Investigation of parameters determining egg quality during incubation;  
(v) First-feeding trials with eel larvae testing both artificial and live feed.  

Three experimental series were completed focusing on methods for broodstock enhancement, maturation and fertilization plus culture of eggs and larvae. Already during the first experimental series, larvae accomplishing the entire yolk sac stage were achieved for the first in history for European eel. The yolksac larvae developed successfully during the period were they entirely depend on nutrition sources i.e yolk and lipid of maternal origin. The larvae were ready to start feeding day 12 post hatch. During the second experimental series, larval longevity was extended to 18 days during first feeding experiments. These recent results are a major breakthrough because they show for the first time that artificial hormone treatment can lead to viable offspring in European eel. Eggs and yolksac larvae were obtained from different hormonal treatments and mass hatchings were regularly obtained. Larval feeding using live and artificial larval feeds developed in collaboration with the food company BioMar were developed towards the end of the experiments and are ready for testing in new and coming projects.  

The success of this project on improved methods, quality criteria and larval survival has led to form the basis of the project: Reproduction of European eel in aquaculture: Consolidation and new production methods and later (REEL) (38398) and later the EU FP project: Reproduction of European eel in Aquaculture: Towards a self-sustained aquaculture (PRO-EEL) (38793).  

The project was coordinated by DTU Aqua.  

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
University of Copenhagen

Bioneer A/S

Danish Eel Farmers Association

Billund Aquaculture Service Aps
Period: 01/01/2007 → 31/12/2009
Number of participants: 9
Research areas: Marine Populations and Ecosystem Dynamics & Fish Biology
Project participant:
Steenfeldt, Svend Jørgen (Intern)
Sørensen, Sune Riis (Intern)
Hornum, Inger (Intern)
Krüger-Johnsen, Maria (Intern)
Jarlbæk, Henrik (Intern)
Project Manager, academic: Tomkiewicz, Jonna (Intern)
Munk, Peter (Intern)
Støttrup, Josianne Gatt (Intern)
Tybjerg, Lars (Intern)

Activities:

ICES - Workshop on Sexual Maturity Staging of Cod, Whiting, Haddock, Saithe and Hake - WKMSGAD (External organisation)
Period: 2013 → …
Maria Krüger-Johnsen (Participant)

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography

Related external organisation
ICES - Workshop on Sexual Maturity Staging of Cod, Whiting, Haddock, Saithe and Hake - WKMSGAD
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Working Group on Mackerel and Horse Mackerel Egg Surveys - WGMEGS (External organisation)
Period: 2012 → …
Maria Krüger-Johansen (Participant)

National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Degree of recognition: International

Related external organisation
ICES - Working Group on Mackerel and Horse Mackerel Egg Surveys - WGMEGS
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Workshop on Survey Design and Mackerel and Horse Mackerel Spawning Strategy - WKMSPA (External organisation)
Period: 2012 → …
Maria Krüger-Johansen (Participant)

National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Degree of recognition: International

Related external organisation
ICES - Workshop on Survey Design and Mackerel and Horse Mackerel Spawning Strategy - WKMSPA
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar