Restoration of a boulder reef in temperate waters: Strategy, methodology and lessons learnt

Anthropogenic impacts on marine habitats are a global problem, particularly in coastal areas. While boulder reefs in temperate waters hold high biomass and biodiversity, and may be unable to recover from anthropogenic stressors without restoration efforts, little is known about how to restore and conserve this important marine habitat. Limited knowledge is a serious impediment to projects aimed at restoring boulder reefs that have been degraded or removed by substrate extraction. In 2008, a boulder reef was restored in Kattegat, the transitional waters between the North Sea and the Baltic Sea, using differently sized boulders. The restored reef covered approximately 27,600 m² seafloor and included 100,712 tons of boulders added at depths ranging between 4 and 11 m. This paper describes methodology and lessons learned during the restoration project. Before the restoration, geological and geotechnical surveys confirmed that the sea bed could support added boulders, and high resolution bathymetric surveys provided input for the design of the reef, particularly for numerical modelling of the hydrographic and sediment transport conditions. Numerical modelling was used to derive hydrographic design conditions for boulder placements and further, to ensure that the restored reef would not affect the sea bed morphology and hydrographic conditions at a local harbour and at a protected habitat, both situated in the vicinity of the restoration area. Data on the physical structure of the restored boulder reef, collected in 2009, demonstrated that cavernous structures and shallow reef areas were restored. Moreover, data collected in 2012 confirmed the stability of the restored reef. Finally, results highlighted the importance of stakeholder mapping at the outset, appropriate timing of stakeholder involvement and ongoing consideration of stakeholder perceptions. Charting strategy and introducing a checklist for marine restoration projects, this paper outlines important considerations and methodology needed to ensure that restoration of temperate reef structures meet the objectives, without having undesirable effects on existing hydrographic and morphological conditions, including nearby coastal areas and protected marine habitats.

General information
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Authors: Støttrup, J. G. (Intern), Dahl, K. (Ekstern), Niemann, S. (Ekstern), Stenberg, C. (Intern), Reker, J. (Ekstern), Stamphøj, E. M. (Ekstern), Göke, C. (Ekstern), Svendsen, J. C. (Intern)
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Scopus rating (2013): SJR 1.225 SNIP 2.108 CiteScore 3.55
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
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Scopus rating (2012): SJR 1.791 SNIP 2.111 CiteScore 3.48
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Web of Science (2009): Indexed yes
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Scopus rating (2008): SJR 1.104 SNIP 1.537
Scopus rating (2007): SJR 1.373 SNIP 1.444
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Scopus rating (2005): SJR 0.93 SNIP 1.488
Scopus rating (2004): SJR 0.704 SNIP 1.13
Scopus rating (2003): SJR 1.056 SNIP 1.42
Scopus rating (2002): SJR 0.77 SNIP 0.97
Scopus rating (2001): SJR 0.42 SNIP 0.84
Scopus rating (2000): SJR 0.328 SNIP 0.823
Scopus rating (1999): SJR 0.486 SNIP 0.924
Original language: English
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Best practice for restoration of stone reefs in Denmark (codes of conduct)
This report includes recommendations for all phases of a boulder reef restoration project. The document includes an initial
identification of relevant objectives for restoration, public involvement and identifies possible sources of relevant historic
information as well as risks to be considered. A set of specific biological and environmental objectives that can influence
the choice of design of the new reef structure is also presented. The report also includes a set of recommendations for the
construction phase, requirements for safety navigation when the restoration work is finalized and presents suggestions for
monitoring and management efforts

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Danish
Agency for Water and Nature Management, Danish Nature Agency, Aarhus University
Authors: Dahl, K. (Ekstern), Støttrup, J. G. (Intern), Stenberg, C. (Intern), Berggren, U. C. (Ekstern), Jensen, J. H.
(Ekstern)
Number of pages: 33
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Publication information
Publisher: Aarhus University
Recent trends in the abundance of plaice Pleuronectes platessa and cod Gadus morhua in shallow coastal waters of the Northeastern Atlantic continental shelf – a review

Shallow, near-shore water habitats on the continental shelf of the Northeast Atlantic have been productive fishing areas in the past. Here, we review the present knowledge about (i) recent trends in the abundance of plaice and cod in these habitats and (ii) hypotheses regarding the factors responsible for any trends. At present, only a few studies exist on the trends of abundance of plaice or cod, namely from the Bay of Biscay, the North Sea and the Skagerrak/Kattegat. They suggest a declining abundance in coastal, shallow areas and – at least for plaice – a latitudinal gradient with an erosion of the southern distribution boundary in the Bay of Biscay and deepening of stocks in the North Sea. In contrast, no trend in shallow water abundance of plaice similar to a decline in deep-water stocks during the 1970s and their slow recovery during the 2000s is apparent in the Skagerrak/Kattegat. Although shallow habitats fundamentally differ from deeper areas by the prevalence of juvenile stages, the declining trends coincide with decreasing abundance/landings and spatial stock relocations in the deeper areas. Whether this indicates a common trend pointing at connectivity between shallow and deep water remains open. Fundamental differences exist in the suggested causes of the trends in different geographical areas. High fishing pressure together with low local recruitment apparently prevents the recovery of overexploited plaice and cod stocks in the Skagerrak/Kattegat. In contrast, the responses of juveniles and adult fish to increasing seawater temperature are the main hypotheses for changes in distribution and abundance of both fish species in the North Sea/Bay of Biscay. However, temperature alone cannot explain the observed decline of fish in coastal areas, and the causes may be more complex, involving nutrient loading, primary productivity or food availability, although at present, knowledge of these factors is insufficient.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Baltic Sea Research Institute
Authors: Dutz, J. (Ekstern), Støttrup, J. G. (Intern), Stenberg, C. (Intern), Munk, P. (Intern)
Pages: 785-796
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Main Research Area: Technical/natural sciences

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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.8 SNIP 0.835 CiteScore 1.45
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.674 SNIP 0.872 CiteScore 1.34
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Adfærd hos torsk på et kunstigt stenrev i et baglokale på den Blå Planet

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Ecosystem based Marine Management, Centre for Ocean Life, Den Blå Planet, Aarhus University, DHI Denmark
Authors: Deurs, M. V. (Intern), Stenberg, C. (Intern), Mariani, P. (Intern), Mohn, C. (Ekstern), Mandviwalla, X. (Ekstern), Hansen, F. T. (Ekstern), Gravlund, P. (Ekstern), Støttrup, J. (Intern)
Publication date: 2015
Event: Abstract from 18. Danske Havforskermøde, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2015

Aggregation and attachment responses of blue mussels, Mytilus edulis—impact of substrate composition, time scale and source of mussel seed

Survival after transplantation of mussel seeds is crucial for the production output of blue mussels (Mytilus edulis L.) in bottom cultures. Hence, an understanding of the interactions between bed formation, habitat structure and performance of mussel seed of different origins can contribute to an optimization of the production. The effect of substrate composition and timing of formation of a mussel bed in relation to aggregation and attachment of mussels were investigated with mussel seeds obtained from two different sources: mussel seed dredged from a natural mussel bed and mussel seed collected from a suspended long line culture. The mussels were applied to experimental units of complex and smooth substrate on the sea bed. Data on aggregation (day 0, day 1 and day 2), attachment strength (day 2 and 30), loss (day 2 and 30) and growth (day 0–30) of mussels were collected during the experiment. The results showed that complex substrate indeed had a stabilizing effect on the mussel structure resulting in less aggregation and increased attachment strength. The 3D matrix forming a mussel bed was achieved faster on complex substrate, and led to reduced mortality of transplanted mussels. Despite significantly lower specific growth rates on the complex substrate, the total biomass of mussels was significantly higher on complex substrate compared to on smooth substrate due to the higher survival of mussels. Furthermore, suspended mussels aggregated more and faster and had a stronger and more rapid attachment as compared
to bottom mussels. Consequently, it was concluded that when transplanting mussels, seeding with substrate increases surface complexity on the seabed and increases survival of the mussels.
Best practice for restoration of stone reefs in Denmark (codes of conduct) 2013

General information
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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Aarhus University, Naturstyrelsen
Authors: Dahl, K. (Ekstern), Støttrup, J. (Intern), Stenberg, C. (Intern), Berggreen, U. C. (Ekstern), Jensen, J. H. (Ekstern)
Number of pages: 26
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http://naturstyrelsen.dk/media/nst/Attachments/Bestpracticestonereefenglishversion.pdf
Publication: Commissioned › Report – Annual report year: 2015

Ecological benefits from restoring a marine cavernous boulder reef in Kattegat, Denmark

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Aarhus University
Authors: Stenberg, C. (Intern), Støttrup, J. (Intern), Dahl, K. (Ekstern), Lundsteen, S. (Ekstern), Göke, C. (Ekstern), Andersen, O. (Ekstern)
Number of pages: 43
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Main Research Area: Technical/natural sciences
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Establishment of blue mussel beds to enhance fish habitats

Human activity has impacted many coastal fjords causing degeneration of the structure and function of the fish habitats. In Nørrefjord, Denmark, local fishermen complained of declining fish catches which could be attributed to eutrophication and extraction of sediments over several decades. This study aimed to establish blue mussel beds (Mytilus edulis) to increase structural complexity and increase the abundance of fish and epifauna in Nørrefjord. It was expected that the mussels would improve water transparency and increase the depth range and coverage of eelgrass (Zostera marina). New methods for mussel production and -bed construction were investigated in collaboration with local volunteer fishermen.

The effect of the artificial mussel beds was most evident on a small scale. Video observations directly at the beds (Impact area) demonstrated increased biodiversity and a three times higher abundance of mesopredator fish compared to the Control area. Water clarity and eelgrass coverage were unchanged. Two methods for establishing mussel beds were tested. A total of 44 tons of blue mussels were produced and established in beds over an area of 121,000 m². Production of blue mussels directly on hemp sacs hanging on long-lines was the most effective method. This new method is potentially a useful management tool to improve fish habitats.
Long-term effects of an offshore wind farm in the North Sea on fish communities

Long-term effects of the Horns Rev 1 offshore wind farm (OWF) on fish abundance, diversity and spatial distribution were studied. This OWF is situated on the Horns Reef sand bank in the North Sea. Surveys were conducted in September 2001, before the OWF was established in 2002, and again in September 2009, 7 yr post-establishment. The sampling surveys used a multi-mesh-size gillnet. The 3 most abundant species in the surveys were whiting Merlangius merlangus, dab Limanda limanda and sandeels Ammodytidae spp. Overall fish abundance increased slightly in the area where the OWF was established but declined in the control area 6 km away. None of the key fish species or functional fish groups showed signs of negative long-term effects due to the OWF. Whiting and the fish group associated with rocky habitats showed different distributions relative to the distance to the artificial reef structures introduced by the turbines. Rocky habitat fishes were most abundant close to the turbines while whiting was most abundant away from them. Species diversity was significantly higher close to the turbines. Overall, these results indicate that the artificial reef structures were large enough to attract fish species with a preference for rocky habitats, but not large enough to have adverse negative effects on species inhabiting the original sand bottom between the turbines.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Aarhus University, Geological Survey of Denmark and Greenland, DHI Denmark
Authors: Stenberg, C. (Intern), Dahl, K. (Ekstern), Al-Hamdani, Z. (Ekstern), Mehlenberg, F. (Ekstern), Støttrup, J. (Intern)
Publish date: 2015
Event: Abstract from 18. Danske Havforskermøde, Copenhagen, Denmark.
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RevFisk – et projekt som kvantificerer stenrevs betydning for fisk

General information
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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,
RevFisk – et projekt som kvantificerer stenrevs (et lavtliggende stenrev i den fotiske zone og et dybere liggende stenrev i den afotiske zone) betydning for fisk

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Aarhus University
Authors: Kristensen, L. D. (Intern), Støttrup, J. (Intern), Stenberg, C. (Intern), Grønkjær, P. (Ekstern)
Publication date: 2015
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Vigtigheden af habitatkompleksitet i kystnære områder

General information
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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Aarhus University
Authors: Kristensen, L. D. (Intern), Støttrup, J. (Intern), Stenberg, C. (Intern), Grønkjær, P. (Ekstern)
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Publication: Research › Conference abstract for conference – Annual report year: 2015

A Sustainability Index of potential co-location of offshore wind farms and open water aquaculture
This paper presents the definition of a Sustainability Index for the co-location in marine areas of offshore wind farms and aquaculture plans. The development of the index is focused on the application of MCE technique based on physical constraints and biological parameters that are directly linked to the primary production. The relevant physical factors considered are wind velocity and depth range (which directly governs the choice of the site for energy production and for offshore technology), the relevant biological parameters are SST, SST anomaly and CHL-a concentration (as a measurement of the productivity). The further development of the technique, already used in open water aquaculture localization, consists in converting raw data into sustainability scores, which have been combined using additive models, in order to define the overall sustainability. The study area used to implement the computation of the Sustainability Index (SI) was identified in the Danish portion of the Baltic Sea and in the western part of the Danish North Sea. Results on the spatial distribution of the SI underline different responses as a function of the physical and biological main influencing parameters

General information
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Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Ecosystem based Marine Management, University of Naples "Parthenope"
Authors: Bennassai, G. (Ekstern), Mariani, P. (Intern), Stenberg, C. (Intern), Christoffersen, M. (Intern)
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BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.783 SNIP 1.002 CiteScore 1.92
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.883 SNIP 1.306 CiteScore 2.05
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.719 SNIP 1.394 CiteScore 1.84
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.724 SNIP 1.061 CiteScore 1.72
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.85 SNIP 0.986 CiteScore 1.65
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.852 SNIP 0.958
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.539 SNIP 0.875
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.541 SNIP 0.926
Scopus rating (2007): SJR 0.835 SNIP 1.073
Scopus rating (2006): SJR 0.914 SNIP 1.477
Scopus rating (2005): SJR 0.718 SNIP 1.274
Scopus rating (2004): SJR 0.642 SNIP 0.84
Scopus rating (2003): SJR 0.462 SNIP 0.897
Scopus rating (2002): SJR 0.567 SNIP 0.92
Scopus rating (2001): SJR 0.4 SNIP 0.577
Scopus rating (2000): SJR 0.272 SNIP 0.484
Scopus rating (1999): SJR 0.291 SNIP 0.548
Original language: English
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Fiskeriforvaltning i Natura 2000 områder

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Monitoring and Data, Research Secretariat, Section for Marine Living Resources
KYSTFISK I. Kortlægning af de kystnære fiskebestandes udvikling på basis af fiskernes egne observationer i perioden fra 1980’erne til 2013

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Monitoring and Data, Section for Marine Ecology and Oceanography
Authors: Støttrup, J. (Intern), Lund, H. S. (Ekstern), Kindt-Larsen, L. (Intern), Egekvist, J. (Intern), Munk, P. (Intern), Stenberg, C. (Intern)
Number of pages: 45
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Publication: Research › Report – Annual report year: 2014

KYSTFISK I. Udviklingen i kystnære fiskebestande. Slutrapport

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Section for Monitoring and Data
Authors: Støttrup, J. (Intern), Lund, H. S. (Ekstern), Munk, P. (Intern), Dutz, J. (Intern), Kindt-Larsen, L. (Intern), Egekvist, J. (Intern), Stenberg, C. (Intern), Nielsen, T. G. (Intern)
Number of pages: 21
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Links:
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008
Publication: Research › Report – Annual report year: 2014
Restoration of a temperate reef: Effects on the fish community

The extraction of large boulders from coastal reefs for construction of harbours and coastal protection has led to habitat degradation for local fish populations through the destruction of cavernous reefs and changes in macroalgal cover resulting from a loss of substrate. The temperate reef at Læsø Trindel in Kattegat, Denmark, has now been re-established with the aim of restoring the reef’s historical structure and function. The effects of the restoration on the local fish community are reported here. Fishing surveys using gillnets and fyke nets were conducted before the restoration (2007) and four years after the restoration of the reef (2012). Species of the family Labridae, which have a high affinity for rocky reefs, dominated both before and after the restoration. Commercially important species such as cod Gadus morhua, and saithe Pollachius virens, occurred infrequently in the catches in 2007 but were significantly more abundant in the catches in 2012. Cods were especially attracted to the shallow part of the reef that was restored by adding stones. For some species, such as ballan wrasse Labrus bergylta, and cod, the proportion of larger individuals increased after the restoration. The findings highlight the importance of reef habitats for fish communities and the need for their protection.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Aarhus University, University of Copenhagen
Authors: Støttrup, J. (Intern), Stenberg, C. (Intern), Dahl, K. (Ekstern), Kristensen, L. D. (Intern), Richardson, K. (Ekstern)
Pages: 1045-1059
Publication date: 2014
Main Research Area: Technical/natural sciences

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Journal: Open Journal of Ecology
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
ISI indexed (2012): ISI indexed no
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Publication: Research - peer-review › Journal article – Annual report year: 2015

Scanning for PIT-tagged flatfish in a coastal area using a sledge equipped with an RFID antenna

A radio frequency identification (RFID) antenna system, build into a sledge that can be towed behind a vessel like a trawl and thereby has the potential to detect the position of a passive inductor technology (PIT)-tagged fish in a wide variety of habitats, is presented. By scanning for hatchery-reared PIT-tagged turbot Psetta maxima released into a natural habitat, the performance of the system was compared to a standard juvenile trawl and results suggested that the efficiency of the sledge was five times that of the trawl, which in absolute values corresponds to 75% of P. maxima lying in the pathway of the sledge.

General information
State: Published
The "mapping out" approach: effectiveness of marine spatial management options in European coastal waters

General information
State: Published
Authors: Soma, K. (Ekstern), Ramos, J. (Ekstern), Bergh, Ø. (Ekstern), Schulze, T. (Ekstern), van Oostenbrugge, H. (Ekstern), van Duijn, A. (Ekstern), Kopke, K. (Ekstern), Stelzenmüller, V. (Ekstern), Grati, F. (Ekstern), Mäkinen, T. (Ekstern), Stenberg, C. (Intern), Buisman, E. (Ekstern)
Pages: 2630-2642
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Main Research Area: Technical/natural sciences

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Journal: ICES Journal of Marine Science
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Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 2.63
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.46
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.35
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.32
Blue Reef - Reetableret stenrev og deres effekt på fiskefaunen – foreløbige resultater af fiskeundersøgelsene på Læsø Trindel

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Danish Shellfish Centre
Authors: Stenberg, C. (Intern), Støttrup, J. (Intern), Dolmer, P. (Intern)
Publication date: 2013
Event: Poster session presented at 17. Danske havforskermøde, Roskilde, Denmark.
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Publication: Research › Poster – Annual report year: 2013

Co-use of wind farms for aquaculture: simulation analysis for northern and southern Europe, and assessment of overall potential

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Universidade Nova de Lisboa
Authors: Brandao, L. (Ekstern), Ferreira, J. (Ekstern), Saurel, C. (Intern), Stenberg, C. (Intern), Estanqueiro, A. (Ekstern)
Publication date: 2013
Main Research Area: Technical/natural sciences
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Dannelse af bankestruktur hos blåmuslinger: effekt af substrat, tid og muslingernes oprindelse

General information
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Organisations: National Institute of Aquatic Resources, Danish Shellfish Centre, Section for Ecosystem based Marine Management, Roskilde University
Authors: Christensen, H. T. (Intern), Dolmer, P. (Intern), Hansen, B. W. (Forskerdatabase), Holmer, M. (Forskerdatabase), Kristensen, L. (Intern), Poulsen, L. K. (Intern), Stenberg, C. (Intern), Støttrup, J. (Intern)
Publication date: 2013
Event: Poster session presented at 17. Danske havforskermøde, Roskilde, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2013
Fish benefits from offshore wind farm development

The studies up until 2006 showed few effects on the fish fauna that could be attributed to the establishment and operation of the wind farms. Fish abundance and diversity were not higher inside the wind farms than in the areas outside the wind farms. One obvious reason for this could be that the studies and investigations were made during the early stages of colonisation of the turbine foundations at Horns Rev that constitute artificial reefs. At Nysted, the effect was weak, presumably because the benthic community consisted of a monoculture of large common mussels (Mytilus edulis) that are only moderately attractive to fish.

Also investigations into the effects on fish and fish behaviour from electromagnetic fields were made at Nysted. Data documented some effects from the cable route on fish behaviour, with some species avoiding the cable, while other species were attracted. However, only flounder (Platichthys flesus) showed correlation between the phenomena observed and the strength of the magnetic fields.

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**General information**

State: Published

Organisations: National Institute of Aquatic Resources, Section for Coastal Ecology, Section for Population Ecology and Genetics, Orbicon

Authors: Leonhard, S. B. (Ekstern), Stenberg, C. (Intern), Støttrup, J. (Intern), Deurs, M. V. (Intern), Christensen, A. (Intern), Pedersen, J. (Ekstern)

Pages: 31-45

Publication date: 2013

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**Host publication information**

Title of host publication: Danish offshore wind - key environmental issues – a follow-up

Place of publication: Copenhagen

Publisher: Danish Energy Agency

ISBN (Print): 978-87-7844-979-5

ISBN (Electronic): 978-87-7844-980-1

Chapter: 3

Main Research Area: Technical/natural sciences

Electronic versions:

Havvindmøllebog.pdf

Links:

http://www.orbicon.dk/media/Havvindmøllebog.pdf

Publication: Research › Book chapter – Annual report year: 2012

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**Fiskeriets påvirkning af naturtypen ’Rev’ (1170) i Natura 2000 området i Lillebælt**

**General information**

State: Published

Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Monitoring and Data, Research Secretariat, Danish Shellfish Centre

Authors: Christoffersen, M. O. (Intern), Dinesen, G. E. (Intern), Geitner, K. (Intern), Stenberg, C. (Intern), Lisbjerg, D. (Intern), Dolmer, P. (Intern)

Publication date: 2013

Event: Abstract from 17. Danske havforskermøde, Roskilde, Denmark.

Main Research Area: Technical/natural sciences

Publication: Research › Conference abstract for conference – Annual report year: 2013

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**Genskabelse af biogene rev i Nørrefjord**

**General information**

State: Published

Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Danish Shellfish Centre, Section for Monitoring and Data

Authors: Kristensen, L. (Intern), Poulsen, L. K. (Intern), Christensen, H. T. (Intern), Stenberg, C. (Intern), Thorsen, S. W. (Ekstern), Rejbek, M. (Intern), Andersen, S. K. (Intern), Dolmer, P. (Intern), Geitner, K. (Intern), Gram, V. (Ekstern), van Deurs, M. (Ekstern), Holm, N. (Intern), Holmer, M. (Ekstern), Knudsen, J. (Ekstern), Knudsen, M. (Ekstern), Støttrup, J. (Intern)

Publication date: 2013

Event: Abstract from 17. Danske havforskermøde, Roskilde, Denmark.

Main Research Area: Technical/natural sciences

Publication: Research › Conference abstract for conference – Annual report year: 2013
Guidance on a better integration of aquaculture, fisheries, and other activities in the coastal zone: from tools to practical examples

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Danish Shellfish Centre, Institute of Marine Research, New University of Lisbon
Number of pages: 79
Publication date: 2013

Publication information
ISBN (Print): 978-0-9926602-0-8
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version
Publication: Research › Report – Annual report year: 2014

Havvindmølleparker og deres indflydelse på fisk - et casestudy fra Horns Rev havvindmøllepark

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Department of Applied Mathematics and Computer Science, Dynamical Systems
Publication date: 2013
Event: Abstract from 17. Danske havforskermøde, Roskilde, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2013

Monitering af fisk på strukturer – et spørgsmål om skala

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Authors: Kristensen, L. (Intern), Stenberg, C. (Intern), Hansen, K. S. (Intern)
Publication date: 2013
Event: Poster session presented at 17. Danske havforskermøde, Roskilde, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2013

Stenrev: Gennemgang af den biologiske og økologiske viden, der findes om stenrev og deres funktion i tempererede områder

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Danish Shellfish Centre, Section for Monitoring and Data
Authors: Støttrup, J. (Intern), Stenberg, C. (Intern), Dinesen, G. E. (Intern), Christensen, H. T. (Intern), Wieland, K. (Intern)
Number of pages: 57
Publication date: 2013

Publication information
Offshore windfarms and their impact on fish abundance and community structure

Deployment of offshore windfarms (OWF) is rapidly expanding. A before–after control impact (BACI) approach was used to study the impact of one of the world's largest offshore windfarms (Horns Rev Offshore Windfarm) on fish assemblages and species diversity. Fish were generally more abundant in the control than the impact area before the establishment of the OWF. Eight years later fish abundance was similar in both the impact and control area but the abundance of one of the most frequently occurring species, whiting, was much lower compared to 2001. However, the changes in whiting reflected the general trend of the whiting population in the North Sea. The introduction of hard bottom resulted in higher species diversity close to each turbine with a clear spatial (horizontal) distribution. New reef fish such as goldsinny wrasse (Ctenolabrus rupestris), viviparous eelpout (Zoarces viviparous), and lumpsucker (Cyclopterus lumpus), established themselves on the introduced reef area. In contrast very few gobies were caught near or at the OWF, presumably owing to the highly turbulent hydrographical conditions in the OWF. We suggest that the lack of this common prey fish is the main reason for the absence of larger predatory fish species.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Coastal Ecology, Section for Population Ecology and Genetics, Department of Informatics and Mathematical Modeling, Mathematical Statistics
Authors: Stenberg, C. (Intern), Dinesen, G. E. (Intern), Deurs, M. V. (Intern), Berg, C. W. (Intern), Mosegaard, H. (Intern), Leonhard, S. (Ekstern), Groome, T. (Ekstern), Støttrup, J. (Intern)
Number of pages: 18
Publication date: 2012
Main Research Area: Technical/natural sciences
Electronic versions: O0912.pdf
Publication: Research › Paper – Annual report year: 2012

Short-term and long-term effects of an offshore wind farm on three species of sandeel and their sand habitat

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Coastal Ecology, Section for Monitoring
Authors: Deurs, M. V. (Intern), Grome, T. (Ekstern), Kaspersen, M. (Ekstern), Jensen, H. (Ekstern), Stenberg, C. (Intern), Sørensen, T. K. (Intern), Støttrup, J. (Intern), Warnar, T. (Intern), Mosegaard, H. (Intern)
Pages: 169-180
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology - Progress Series
Volume: 458
ISSN (Print): 0171-8630
Ratings: BFI (2018): BFI-level 2
Slutrapport for Projekt BioRev 2010-2012

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Coastal Ecology, Danish Shellfish Centre, Section for Marine Services
Small-scale distribution of fish in offshore windfarms

Knowledge about small-scale distribution of fish around turbines in offshore windfarms (OWF) remains relatively scarce. In the present study we used underwater video camera installations to access abundance of fish at 0, 25, and 50 m around the turbine foundations in Middelgrund and Lillgrund OWFs in Øresund between Denmark and Sweden in the period August–November 2011.

Fish fauna in both localities were dominated in terms of numbers by two-spotted gobies (Gobiusculus flavescens). Average number of fish observed per hour was a factor 100 higher at Lillgrund and a factor of 2 higher at Middelgrund at 0 m from the turbine compared to 25 and 50 m away. At Lillgrund sediment was dominated by bare sand while Middelgrund had more heterogeneous sediment types with sand, boulder, pebbles, and dense eelgrass areas. This suggests that OWFs in areas with homogeneous sand sediment have a higher impact on fish fauna compared to OWFs in areas with heterogeneous sediment. Furthermore, the effect of OWFs on fish appears to be of a much smaller scale than previously thought.

Towards sustainable coexistence of aquaculture and fisheries in the coastal zone

Globally, coastal areas are subject to an increase in competing activities. Coastal fisheries and aquaculture are highly dependent on availability and accessibility of appropriate sites. Aquaculture production is increasing, whereas fisheries are at best stagnant. Coastal activities also include activities such as recreation, tourism, facilities for renewable energy production, all of which are expected to increase in importance. There is also increasing focus on Marine Protected Areas (MPAs). Thus, competition for available sites will probably increase, emphasizing the need for Marine Spatial Planning (MSP) and improved management tools supporting policies for space allocation along the entire European coastline. Successful MSP is not likely to be achieved without a certain level of conflict, and without iterative adaptations in management actions. MSP is viewed an essential part of advancing ecosystem-based management as demanded by the Marine Strategy Directive. The biological interconnectedness of fisheries and aquaculture is strong, with factors such as competition for space, disease transmission, genetic impact from escapees, availability of food for cultured finfish, and organic and inorganic waste management. Furthermore, the public perception of aquaculture in Europe and North America may be characterized by the view of aquaculture being a “new” and “unnatural” activity, whereas fisheries are viewed as “traditional” and “natural”. However, in an ecosystem-based management context, both industries represent human activities strongly influencing, and influenced by, the environment. Management of aquaculture and fisheries, as well as other uses of the coastal zone, should be considered integral parts with local variations in their respective importance.
Towards sustainable coexistence of aquaculture and fisheries in the coastal zone

Globally, coastal areas are subject to an increase in competing activities. Coastal fisheries and aquaculture are highly dependent on availability and accessibility of appropriate sites. Aquaculture production is increasing, whereas fisheries are at best stagnant. Coastal activities also include activities such as recreation, tourism, facilities for renewable energy production, all of which are expected to increase in importance. There is also increasing focus on Marine Protected Areas (MPAs). Thus, competition for available sites will probably increase, emphasizing the need for Marine Spatial Planning (MSP) and improved management tools supporting policies for space allocation along the entire European coastline.

Successful MSP is not likely to be achieved without a certain level of conflict, and without iterative adaptations in management actions. MSP is viewed an essential part of advancing ecosystem-based management as demanded by the Marine Strategy Directive. The biological interconnectedness of fisheries and aquaculture is strong, with factors such as competition for space, disease transmission, genetic impact from escapees, availability of food for cultured finfish, and organic and inorganic waste management. Furthermore, the public perception of aquaculture in Europe and North America may be characterized by the view of aquaculture being a “new” and “unnatural” activity, whereas fisheries are viewed as “traditional” and “natural”. However, in an ecosystem-based management context, both industries represent human activities strongly influencing, and influenced by, the environment. Management of aquaculture and fisheries, as well as other uses of the coastal zone, should be considered integral parts with local variations in their respective importance.
Marin fiskepleje

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources
Authors: Nicolajsen, H. (Intern), Sparrevohn, C. R. (Intern), Stenberg, C. (Intern), Kristensen, L. (Intern), Støttrup, J. (Intern)
Publication date: 2011
Event: Poster session presented at 16. danske havforskermøde, Mols, Denmark.
Main Research Area: Technical/natural sciences

Bibliographical note
Poster og abstract
Source: orbit
Source-ID: 278054
Publication: Research › Poster – Annual report year: 2011

Metode til bestemmelse af habitatkompleksitet

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources
Authors: Kristensen, L. (Intern), Stenberg, C. (Intern), Grønkjær, P. (Ekstern), Støttrup, J. (Intern)
Publication date: 2011
Event: Poster session presented at 16. danske havforskermøde, Mols, Denmark.
Main Research Area: Technical/natural sciences

Bibliographical note
Poster og abstract
Source: orbit
Source-ID: 278052
Publication: Research › Poster – Annual report year: 2011

Interaction in coastal waters: a roadmap to sustainable integration of aquaculture and fisheries — the COEXIST project

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Public Sector Consultancy
Publication date: 2010
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 267511
Publication: Research › Poster – Annual report year: 2010
Offshore wind farms and their potential for shellfish aquaculture and restocking

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Authors: Stenberg, C. (Intern), Christoffersen, M. O. (Intern), Krog, C. (Ekstern), Mariani, P. (Intern), Dolmer, P. (Intern)
Publication date: 2010
Main Research Area: Technical/natural sciences
Links:
Source: orbit
Source-ID: 267505
Publication: Research › Poster – Annual report year: 2010

Sexual maturity cycle and spawning of Greenland halibut Reinhardtius hippoglossoides in the Davis Strait
Female sexual maturation cycle and the main spawning time of Greenland halibut Reinhardtius hippoglossoides in the Davis Strait were studied through regularly collected samples during 1 year starting in spring 2003. Samples were collected from the southern slope of the Davis Strait Ridge between Canada and Greenland in the depth range 1000-1500 m. Female sexual maturation was described using different approaches: gonado-somatic index, visual macroscopic maturity stage index, histological microscopic maturity index and oocyte diameter measurements. A significant increase in the gonado-somatic index was seen from September onwards until February with a maximum estimated value of 18%. The proportion of mature fish increased from December until March. At the same time, the proportion of females with a low gonado-somatic index also increased from February, indicating that spawning had occurred and females were recovering. Oocyte diameter distribution revealed a leading cohort development during autumn through to December to February. A coupling between sexual maturity and fish condition was seen for females in maturing condition indicating a steady build up of stored energy in the liver from June to November.

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Public Sector Consultancy, Section for Management Systems
Authors: Gundersen, A. C. (Ekstern), Stenberg, C. (Intern), Fossen, I. (Ekstern), Lyberth, B. (Ekstern), Boje, J. (Intern), Jørgensen, O. A. (Intern)
Pages: 211-226
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication Information
Journal: Journal of Fish Biology
Volume: 77
Issue number: 1
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.741 SNIP 0.882
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.951 SNIP 0.935 CiteScore 1.64
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.944 SNIP 0.934 CiteScore 1.76
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.049 SNIP 1.118 CiteScore 1.98
ISI indexed (2013): ISI indexed yes
Temperature effects on growth of juvenile Greenland halibut (Reinhardtius hippoglossoides Walbaum) in West Greenland waters

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Greenland Institute of Natural Resources, Aarhus University
Authors: Sünksen, K. (Ekstern), Stenberg, C. (Intern), Grønkjær, P. (Ekstern)
Pages: 125-132
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Sea Research
Vurdering af mulighederne for linedyrkning af blåmuslinger i Nysted Havmøllepark

General information
State: Published
Organisations: Section for Shellfish, National Institute of Aquatic Resources
Authors: Christensen, H. T. (Intern), Christoffersen, M. O. (Intern), Dolmer, P. (Intern), Stenberg, C. (Intern), Kristensen, P. S. (Intern)
Number of pages: 28
Publication date: 2009

Publication information
Original language: Danish
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 253079
Publication: Research › Report – Annual report year: 2009

Taskekrabben: Biologi, fiskeri, afsætning og forvaltningsplan

General information
State: Published
Organisations: Section for Shellfish, National Institute of Aquatic Resources, Section for Software and GIS development
Authors: Stenberg, C. (Intern), Dolmer, P. (Intern), Krog, C. (Ekstern), Madsen, S. (Ekstern), Nannerup, L. (Ekstern), Wall, M. (Ekstern), Geitner, K. (Intern)
Number of pages: 129
Publication date: 2008

Publication information
Place of publication: Charlottenlund
Publisher: Danmarks Fiskeriundersøgelser
Original language: Danish
Series: DTU Aqua-rapport
Number: 183-08
Main Research Area: Technical/natural sciences
Electronic versions: 183-08_elektronisk_samlet.pdf
Source: orbit
Source-ID: 227523
Publication: Research › Report – Annual report year: 2008

Do Greenland halibut, R. hippoglossoides, spawn in inshore Disko Bay, West Greenland?

General information
State: Published
Organisations: Section for Shellfish, National Institute of Aquatic Resources, Section for Management Systems, Section for Fisheries Advice
Authors: Fossen, I. (Ekstern), Gundersen, A. (Ekstern), Stenberg, C. (Intern), Lyberth, B. (Ekstern), Jørgensen, O. A. (Intern), Boje, J. (Intern)
PUBLICATION DATE: 2007
Event: Poster session presented at PICES/ICES/NAFO Symposium on Reproductive and Recruitment Processes in Exploited Marine Fish Stocks, 1-3 October, Lisboa, Portugal, Lissabon, Portugal.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 225443
Publication: Research › Poster – Annual report year: 2007
Recruitment processes in West Greenland waters: With special focus on Greenland halibut (Reinhardtius hippoglossoides, W.)

**General information**
State: Published
Organisations: Section for Shellfish, National Institute of Aquatic Resources
Authors: Stenberg, C. (Intern)
Publication date: 2007

**Publication information**
Publisher: University of Bergen
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
PhD_stenberg_2007.pdf
Source: orbit
Source-ID: 227521
Publication: Research › Ph.D. thesis – Annual report year: 2007

Sexual maturity cycle and spawning of Greenland halibut, R. hippoglossoides Walbusm, in the Davis Strait

**General information**
State: Published
Organisations: Section for Shellfish, National Institute of Aquatic Resources, Section for Management Systems, Section for Fisheries Advice
Authors: Gundersen, A. (Ekstern), Stenberg, C. (Intern), Fossen, I. (Ekstern), Lyberth, B. (Ekstern), Jørgensen, O. A. (Intern), Boje, J. (Intern)
Publication date: 2007
Event: Poster session presented at PICES/ICES/NAFO Symposium on Reproductive and Recruitment Processes in Exploited Marine Fish Stocks, Lissabon, Portugal, 1-3 October.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 225580
Publication: Research › Poster – Annual report year: 2007

Taskekrabben - Biologi, fiskeri, afsætning og forvaltningsplan

**General information**
State: Published
Organisations: Section for Shellfish, National Institute of Aquatic Resources
Authors: Stenberg, C. (Intern), Dolmer, P. (Intern), Krog, C. (Ekstern), Madsen, S. (Ekstern), Nannerup, L. (Ekstern), Wall, M. (Ekstern)
Publication date: 2007

**Publication information**
Publisher: [s.n.]
Original language: Danish
Main Research Area: Technical/natural sciences

**Bibliographical note**
Slutrapport for projektet Vestjyske skaldyr fase II
Source: orbit
Source-ID: 227522
Publication: Research › Report – Annual report year: 2007

Feeding ecology of Greenland halibut and sandeel larvae off West Greenland

Feeding ecology of Greenland halibut (Gr. halibut) (Reinhardtius hippoglossoides) and sandeel (Ammodytes sp.) larvae on the West Greenland shelf was studied during the main part of the productive season (May, June and July). Copepods were the main prey item for larval Gr. halibut and sandeel, constituting between 88 and 99% of the ingested prey biomass. For both species, absolute size of preferred prey increased during ontogeny. However, preferred copepod size in relation to larval length differed markedly. In Gr. halibut, the relative size of the prey declined during growth of the larvae, while it remained constant for sandeel at a level of 2.7% of larval length. This led to a reduction in prey niche overlap between the two species. The available prey copepod biomass differed distinctly across the shelf area. In May, the prey density of Gr.
halibut was the highest in the off-shelf area in Davis Strait. In June and July, the prey-rich areas for both species were mainly located at the slopes of the banks and at the shelf break area. Gut fullness was higher in these areas than in neighbouring areas, suggesting that the larval food resource could be scarce. The feeding ecology of Gr. halibut and sandeel could explain why larval abundance indices of the two species have historically shown opposite responses to yearly environmental conditions and total zooplankton occurrence.
Analyse af temperaturens betydning for vækst af juvenile hellefisk (Reinhardtius hippoglossoides)

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Sünksen, K. (Ekstern), Grønkjær, P. (Ekstern), Stenberg, C. (Intern)
Publication date: 2005
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 279132
Publication: Research › Poster – Annual report year: 2005

Micro- and mesozooplankton in Southwest Greenland waters in relation to environmental factors

Plankton samples and oceanoographic data were obtained during transect studies across fishing banks over the Southwest Greenland shelf in June 1999, May, and July 2000. The study gives a detailed description of micro- and mesozooplankton distributions and community structures during spring bloom and post bloom periods. Plankton distributions were related to the physical environment described by a hydrodynamic ocean circulation model. More than 30 species and a larger number of taxonomic categories were identified in the zooplankton samples. Large copepodes of Calanus finmarchicus, Calanus glacialis, and Calanus hyperboreus generally dominated the micro- and mesozooplankton biomass, with Pseudocalanus spp., Metridia longa, and Oithona spp. comprising most of the remaining biomass. By number, bivalves larvae and relatively large copepod nauplii (> 200 mu m) dominated the zooplankton community (> 50 mu m) in May, whereas smaller copepod nauplii (<200 mu m) were dominating in June and July. By number, bivalves larvae and relatively large copepod nauplii (> 200 mu m) dominated the zooplankton community (> 50 mu m) in May, whereas smaller copepod nauplii (<200 mu m) were dominating in June and July. In May during a spring bloom period, diatoms, Thalassiosira spp. and Chaetoceros spp., generally dominated the biomass of the plankton community of the upper 100 m followed by heterotrophic flagellates, copepods, other invertebrates, and ciliates. Conversely in June (and July) during post bloom, large copepods were dominating. Hydrodynamic model simulations of ocean currents and trajectories of potential plankton transports showed differences in potential advection of plankton across shelf banks. The circulation around the banks seems to create retention areas entrapping plankton for periods. Model simulations predict that upwelling occurs west of the shelf banks and to a lesser extent in the deep channels separating the banks. This upwelling, caused by wind and tidal motions, probably increases productivity and carbon cycling over the shelf areas. (c) 2004 Elsevier B.V. All rights reserved.
Ovary development in Greenland halibut (Reinhardtius hippoglossoides) in west Greenland waters

General information
State: Published
Organisations: Section for Shellfish, National Institute of Aquatic Resources
Authors: Stenberg, C. (Intern), Gundersen, A. (Ekstern)
Pages: 1299-1317
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 67
Issue number: 5
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.741 SNIP 0.882
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.951 SNIP 0.935 CiteScore 1.64
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.944 SNIP 0.934 CiteScore 1.76
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.049 SNIP 1.118 CiteScore 1.98
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.035 CiteScore 1.88
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.895 SNIP 0.946 CiteScore 1.66
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.774 SNIP 0.834
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.773 SNIP 0.891
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.883 SNIP 0.968
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.996 SNIP 1.06
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.897 SNIP 1.051
Web of Science (2006): Indexed yes
Settling and factors affecting 0-group distribution of Greenland halibut, R. hippoglossoides (Walbaum), in west Greenland waters

General information
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources, Section for Shellfish
Authors: Boje, J. (Intern), Stenberg, C. (Intern)
Pages: 1-15
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES C.M. 2004/
Volume: J:08
Original language: English
Source: orbit
Source-ID: 224969
Publication: Research › Conference article – Annual report year: 2004

An Assessment of the Greenland Halibut Stock Component in NAFO Division 1A Inshore

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Coastal Ecology, Section for Public Sector Consultancy
Authors: Stenberg, C. (Intern), Boje, J. (Intern)
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: NAFO Scientific Council Research Documents
Issue number: 03/49
ISSN (Print): 1682-993X
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Source: orbit
Source-ID: 279146
Publication: Research › Conference article – Annual report year: 2003
Tagging mortality of Greenland halibut Reinhardtius hippoglossoides (Walbaum)
Tagging mortality for Greenland halibut (Reinhardtius hippoglossoides) was studied under summer and winter conditions. The fish were caught using longlines and tagged with a T-bar tag. The winter experiment was conducted in Cumberland Sound, Canada in May 1997. Air temperatures were below 0°C and cold water-masses were present at 0-300 m. Fish were immediately placed in a tub of water after capture and transported by snowmobile to a heated tent for tagging and then placed in cages that were submerged to 300 m depth. The summer experiment was conducted in Upernavik, Greenland in August 1998. Air temperatures were above 0°C but intermediate cold water-masses were present at 60-200 m. In the summer experiment, fish were tagged and released in an observation tank to assess immediate tagging mortality (1 to 18 hr). They were then placed in specially designed cages and submerged to 300-500 m to assess short-term tagging mortality (up to 117 hr). A total of 155 Greenland halibut were included in the study. Overall tagging mortality was estimated to be 7%. Immediate handling and tagging mortality in both winter and summer experiments was low.
An assessment of the Greenland halibut stock component in NAFO Division 1A inshore

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Coastal Ecology
Authors: Stenberg, C. (Intern)
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: NAFO Scientific Council Research Documents
Issue number: 02/55
ISSN (Print): 1682-993X

An assessment of the inshore Greenland halibut stock component in NAFO Division 1A

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Coastal Ecology
Authors: Stenberg, C. (Intern), Gundersen, A. (Ekstern)
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: NAFO Scientific Council Research Documents
Fedtkondition og fedtsyresammensætning i rejelarver ved Vestgrønland

**General information**
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources
Authors: Pedersen, S. A. (Ekstern), Storm, L. (Ekstern), Reuss, N. (Ekstern), Poulsen, L. K. (Intern), Stenberg, C. (Intern)
Publication date: 2002
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 279139
Publication: Research › Conference article – Annual report year: 2002

Fiskelarver på menu’en – juvenile havkat som prædatorer på tobislarver i et opvækstområde ud for vest Grønland

**General information**
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Coastal Ecology
Authors: Munk, P. (Intern), Stenberg, C. (Intern)
Publication date: 2002
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 279125
Publication: Research › Poster – Annual report year: 2002

Greenland halibut biology and population dynamics - State of the art and identification of research needs. Based on a Nordic Workshop

**General information**
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources, Section for Management Systems, Section for Shellfish
Authors: Albert, O. (Ekstern), Boje, J. (Intern), Bowering, W. (Ekstern), Brodie, B. (Ekstern), Gundersen, A. (Ekstern), Hjørløfssøn, E. (Ekstern), Høines, Å. (Ekstern), Junquera, S. (Ekstern), Jørgensen, O. A. (Intern), Reinert, J. (Ekstern), Stenberg, C. (Intern), Treble, M. (Ekstern), Boje, J. (ed.) (Intern)
Number of pages: 70
Publication date: 2002
Northern shrimp (Pandalus borealis) recruitment in West Greenland waters: Part I. Distribution of Pandalus shrimp larvae in relation to hydrography and plankton

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Technical University of Denmark
Authors: Pedersen, S. (Ekstern), Storm, L. (Ekstern), Stenberg, C. (Intern)
Pages: 19-46
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Northwest Atlantic Fishery Science
Volume: 30
ISSN (Print): 0250-6408
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.317 SNIP 0.442 CiteScore 0.83
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.831 SNIP 1.67 CiteScore 1.33
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.448 SNIP 0.634 CiteScore 0.91
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.246 SNIP 0.566 CiteScore 0.75
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.199 SNIP 0.423 CiteScore 0.33
ISI indexed (2012): ISI indexed no
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.646 SNIP 0.816 CiteScore 2.24
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.81 SNIP 0.747
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.609 SNIP 0.467
Web of Science (2009): Indexed yes
Scopus rating (2008): SJR 0.515 SNIP 0.514
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.656 SNIP 0.568
Scopus rating (2006): SJR 0.791 SNIP 0.722
Scopus rating (2005): SJR 0.676 SNIP 0.843
Scopus rating (2004): SJR 0.345 SNIP 0.314
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.519 SNIP 0.337
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.602 SNIP 0.206
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.384 SNIP 0.376
Variability in fecundity and total egg production for West-Nordic Greenland halibut

General information
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources, Section for Management Systems, Section for Shellfish
Authors: Gundersen, A. (Ekstern), Boje, J. (Intern), Jørgensen, O. A. (Intern), Hjørleifsson, E. (Ekstern), Stenberg, C. (Intern), Fossen, I. (Ekstern), Ofstad, L. (Ekstern), Rätz, H. (Ekstern), Gundersen, A. (ed.) (Ekstern)
Publication date: 2002

Publication information
Publisher: Nordic Council of Ministers
Original language: English
Series: TemaNord
Number: 2002:519
ISSN: 0908-6692
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 225582
Publication: Research › Report – Annual report year: 2002

An assessment of the Greenland halibut stock component in NAFO Division 1A inshore

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Coastal Ecology, Section for Public Sector Consultancy
Authors: Stenberg, C. (Intern), Boje, J. (Intern)
Pages: 37
Publication date: 2001
Main Research Area: Technical/natural sciences

Publication information
Journal: NAFO Scientific Council Research Documents
Issue number: 01/68
ISSN (Print): 1682-993X
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Source: orbit
Source-ID: 279144
Publication: Research › Conference article – Annual report year: 2001

Variability in fecundity and total egg production for West Nordic Greenland halibut (Reinhardtius hippossoides)

General information
State: Published
Organisations: Unknown
Authors: Gundersen, A. (Ekstern), Boje, J. (Intern), Hjørleifsson, O. (Ekstern), Stenberg, C. (Intern), Fossen, I. (Ekstern), Ofstad, L. (Ekstern), Rätz, H. (Ekstern)
Publication date: 2001
Main Research Area: Technical/natural sciences

Publication information
An assessment of the Greenland halibut stock component in NAFO Division 1A inshore

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Coastal Ecology, Section for Public Sector Consultancy
Authors: Stenberg, C. (Intern), Boje, J. (Intern)
Publication date: 2000
Main Research Area: Technical/natural sciences

A review using longlining to survey fish populations with special emphasis on an inshore longline survey for Greenland halibut (Reinhardtius hippoglossoides) in West Greenland, NAFO Division 1A

General information
State: Published
Organisations: Greenland Institute of Natural Resources
Authors: Stenberg, C. (Intern), Boje, J. (Intern), Kingsley, M. (Ekstern)
Publication date: 2000
Main Research Area: Technical/natural sciences

An assessment of the inshore Greenland halibut stock component in NAFO Division 1A inshore

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Coastal Ecology, Section for Public Sector Consultancy
An assessment of the inshore Greenland halibut stock component in NAFO Division 1A inshore

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Coastal Ecology
Authors: Stenberg, C. (Intern)
Pages: 18
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: NAFO Scientific Council Research Documents
Issue number: 98/44
ISSN (Print): 1682-993X
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Source: orbit
Source-ID: 279136
Publication: Research › Conference article – Annual report year: 1998

An assessment of the inshore Greenland halibut stock component in NAFO Division 1A

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Coastal Ecology, Section for Public Sector Consultancy
Authors: Stenberg, C. (Intern), Boje, J. (Intern)
Pages: 15
Publication date: 1997
Main Research Area: Technical/natural sciences

Publication information
Journal: NAFO Scientific Council Research Documents
Issue number: 97/78
ISSN (Print): 1682-993X
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Source: orbit
Source-ID: 279157
Publication: Research › Conference article – Annual report year: 1997
Projects:

**Habitat Suitability for Recreationally Important Finfish of the Inner Danish Waters**
National Institute of Aquatic Resources
Period: 01/12/2014 → 30/11/2018
Number of participants: 3
Phd Student:
Brown, Elliot John (Intern)
Supervisor:
Stenberg, Claus (Intern)
Main Supervisor:
Støttrup, Josianne Gatt (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Offentlig finansiering

**Relations**
Press / Media items:
Tilstandsrapport fra havbunden
Bønnerup og Grenaa: Små fisk – skal gerne blive større
Fintælling af bugtens fisk
Forskere undersøger fisk langs kysten
An Expedition covering covering the Danish Coast's from the 18th July - 22nd August, 2016
Indslag i 24NORDJYSKE
Project: PhD

**Coastal mussel banks: The importance for the fish fauna and possibilities for habitat restoration (MusFisk) (39133)**
Coastal mussel banks are commonly assumed to be good areas for recreational fishing, but few quantitative studies have investigated how fish abundance and diversity covary with mussel coverage. In many Danish coastal waters, mussel coverage is reduced compared to historic records, but the impact of the reduction on coastal fisheries remains largely unknown.

This project investigates fish abundance and diversity in various coastal habitats to predict possible effects of mussel bank restoration projects. Because it is increasingly recognized that restoration of coastal habitats support both pelagic and benthic fisheries, this study hypothesized that mussel banks may provide important shelter and foraging habitats for various trophic levels of fish. Covering different habitats, catch per unit effort (CPUE) was quantified using fyke nets, and fish abundance and behaviours were measured using stationary underwater video cameras. These studies revealed that blue mussel (Mytilus edulis) banks support fish abundance and diversity comparable to areas covered by eel grass (Zostera marina), indicating that mussel bank restoration projects could benefit fisheries in a fashion similar to eel grass habitats. Moreover, fish abundance, but not diversity, differed between mussel banks exposed to different current velocity regimes, suggesting that mussel banks exposed to higher current velocities support higher fish abundances. These findings indicate that mussel bank restoration carried out in high current velocity regimes may provide the most favorable habitats for fish. Surprisingly, fish behaviours were similar in different current velocity regimes, suggesting comparable ecological function of the habitats.

Planned data collection in 2016 includes experimental manipulations of mussel coverage in laboratory studies where habitat preferences and stress levels (cortisol) will be examined in a number of fish species. These findings will be useful to test findings from the field studies and help predicting the effects of mussel bank restoration in coastal areas.

This project is coordinated by DTU Aqua.

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

National Institute of Aquatic Resources

**Section for Ecosystem based Marine Management**
Period: 01/01/2014 → 31/12/2016
Number of participants: 4
Research areas: Coastal Ecology & Oceanography
Project participant:
Investigation of causes for declines in fish abundance in coastal areas (Kystfisk II) (39164)
The project aims to describe changes in distribution of different age groups of cod and plaice in coastal areas. Changes in the distribution of plaice off the Danish west coast were documented and correlated to changes in nutrient loadings. These results were submitted for peer review. Potential changes in the distribution of cod of different size classes in inner Danish waters are being modelled to see if there are any consistent patterns. Datamining has been undertaken to provide environmental data to conduct analyses of potential causes for changes observed.

The project is coordinated by DTU Aqua.

The project is funded by the Danish Ministry of Food, Agriculture and Fisheries through a special governmental Funding for sustainable fisheries ("Bæredygtighedspuljen").

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Period: 01/01/2014 → 31/12/2016
Number of participants: 4
Research areas: Coastal Ecology & Marine Living Resources & Oceanography
Project participant:
Munk, Peter (Intern)
Stedmon, Colin (Intern)
Stenberg, Claus (Intern)
Project Coordinator:
Støttrup, Josianne Gatt (Intern)

Boulder reefs as spawning and nursery areas for fish (RevFisk) (39144)
The project aimed to build knowledge about marine boulder reefs and their biological function for fish as spawning and nursery areas.

The field work was conducted on a stone reef, Hatter Barn at two depths 6-12 m and 13-17 m. These two depths were chosen to provide information on fauna and flora in the upper photic zone and a deeper zone. The dominant fish were labrids, which also spawned in the area and juvenile cod. Acoustic tagged cod provided information on their presence around the reef. Many exhibited a diurnal rhythm, concentrating on the reef during nighttime, although some cod were stationary on the reef the whole time. The deeper reef was more frequently visited (fourfold) by cod than the shallower reef.

Experimental work conducted at the Blue Planet aquarium revealed that corkwing wrasse are highly territorial and able to prevent juvenile cod from occupying their crevices. Goldsinny wrasse showed little interaction with cod and generally utilized very small crevices. Both labrids and cod utilized shelter from current flows provided by the structures and cod were often seen in high concentrations near the bottom where the current flows were laminar.

The results are useful for further developing models that quantify boulder reefs impact on fish (larvae, juvenile, adult) as a function of the reefs condition, size and depth location. The results are useful in helping plan and design the restoration of destroyed boulder reefs but also to manage existing boulder reefs.

The project was coordinated by DTU Aqua.

The project was funded by the Danish Ministry of Food, Agriculture and Fisheries and the European Fisheries Fund (EFF).

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
DHI Denmark
Aarhus University
Stone reefs: Review of the biological and ecological knowledge on stone reefs and their function in temperate areas (Stenrev) (39038)

Boulder reefs have been the subject of extensive mining where a number of reefs have been wholly or partially removed from the marine areas, especially the shallow coastal waters less than 10 m depth. A review on the importance of cold temperate reefs was requested. The review summary highlighted the following. Reefs are known for their high species richness and are biologically very productive. They are home to many fish using reefs for refuge. In particular cavernous reefs with high complexity and many small niches (between and around stones) are characterized by high species diversity, high productivity and have an important function as a feeding area for many species of fish and marine mammals. There are no quantitative estimates of the impact and effects of reefs for fish stocks in Danish waters. However, the relationship between refuge options and survival was shown for goby, as well as for juvenile cod. Larger cod are attracted to reefs during autumn before they start their spawning migration. Results of the first reef restoration project in Danish waters showed a clear development of both macro-algae and benthic fauna and in fish abundance for fish normally associated with reefs. The many fish had probably attracted porpoises, which are now observed more frequently and for longer periods in the area. The European lobster occurs in salty water (> 25 parts per thousand) at 2-40 m depth around vegetated reefs or rocky ground, and therefore, this habitat is an important habitat for lobster. Of the sessile invertebrates highlighted, mussels were found in several different types of habitats, including reefs and is one of the species that are first to colonize new habitats - such as newly established reefs.

This project was coordinated by DTU Aqua.
The project was funded by the Danish Minestry of Food, Agriculture and Fisheries and the European Fisheries Fund (EFF).

National Institute of Aquatic Resources

Section for Ecosystem based Marine Management

Investigation of causes for declines in fish abundance in coastal areas (KYSTFISK-I) (39031)

Danish fishermen complained of drastic declines in coastal fish populations, negatively impacting their fisheries opportunities but the nature and magnitude of the problem was uncertain.

This project aimed to collate information from fishers to map the problem, including which species and geographical areas involved. In total 74 fishers were interviewed and the problem mapped in Støttrup et al. (2014a). The project further aimed to explore existing survey data that could support the observed changes in fish distribution (Støttrup et al. 2014b) and conduct a literature review to explore if similar trends had occurred in neighboring countries and potential causes for the developments had been identified (Dutz et al. in revision).
The project is coordinated by DTU Aqua.

The project was funded by the Danish Ministry of Food, Agriculture and Fisheries and the European Fisheries Fund (EFF).

National Institute of Aquatic Resources

Section for Ecosystem based Marine Management

Danish Fishermen's Association

Period: 01/11/2012 → 01/10/2013

Number of participants: 7

Research areas: Coastal Ecology & Marine Populations and Ecosystem Dynamics

Project participant:

Munk, Peter (Intern)

Dutz, Jörg (Intern)

Stenberg, Claus (Intern)

Kindt-Larsen, Lotte (Intern)

Egekvist, Josefine (Intern)

Nielsen, Torkel Gissel (Intern)

Project Manager, academic:

Støttrup, Josianne Gatt (Intern)

Marine habitats and restorations methods (MaHaR) (38817)

Restoration of habitats in marine areas is a new research area. DTU Aqua has in recent years worked to develop and restore biogenic reefs (mussel) (project BioReef), boulder reefs (project BlueReef), habitat complexity (project Vejle Fjord), effects and solutions of coastal areas affected by suction dredging (Project Nørrefjord). The project will compile and review these projects and gather knowledge on how to further develop the concept of area "marine habitat restoration methods". Focus will be on the areas structures and functions as nurseries, refuge and feeding opportunities for fish and shellfish.

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources

Section for Ecosystem based Marine Management

Danish Nature Agency

Aarhus University

Local fishermen associations

Period: 01/01/2011 → 31/12/2013

Number of participants: 4

Research area: Coastal Ecology & Danish Shellfish Centre

Project participant:

Poulsen, Louise K. (Intern)

Støttrup, Josianne Gatt (Intern)

Dolmer, Per (Intern)

Project Manager, academic:

Stenber, Claus (Intern)

Nørrefjord: A case study of coastal habitat status and restoration possibilities (38171)

Nørrefjord has been used as a case study to study to analyze Danish coastal habitats and their fate and ecological function for fish. As many other Danish coast areas the fjord has undergone dramatic changes in its biological structure and function due to human activities and influences. The fjord is nutrient loaded and eutrophication has led to reduction in the photic zone and frequent hypoxia in fjord deeper parts (>10 m). In addition, there has formerly been extraction of gravel and sand in shallow areas of the fjord (<5 m). These activities have created suction holes which still stand despite the fact that they were created over 15 years ago. The project aims to study local fish fauna community, fish distribution and ecological structure and function for different habitat types in the fjord in order to suggest how local fish fauna could be restored.

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
Interaction in coastal waters: A roadmap to sustainable integration of aquaculture and fisheries (COEXIST) (38789)

The project aims to provide a roadmap towards improved integration, sustainability and synergies among different activities in the coastal zone.

The project will study interactions between capture fisheries and aquaculture, and evaluate mutual benefits and possible bottlenecks for concomitant development of these activities in the coastal zone within the context of the ecosystem approach to management.

The project will also develop and evaluate different forms of coastal aquaculture and fisheries at different scales and exploit mutual opportunities within a concept of competition for space by multiple users.

Furthermore, the project will address differences in acceptance of activities by society and develop a strategy for communication and involvement of stakeholder as well as for dissemination of results to general and targeted audiences. Six case studies are involved. Individual processes and their interaction will be investigated in each case study using spatial management tools and an array of models.

The project is coordinated by Institute of Marine Research, Norway.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Johann Heinrich von Thünen-Institute
University College Cork
IFREMER
National Institute of Biological Resources
Finnish Game and Fisheries Research Institute
Consiglio Nazionale delle Ricerche
Cefas
Wageningen IMARES
Aqua TT UETP Ltd
Finnish Environment Institute
Institute of Marine Research, Denmark
Wageningen University & Research
Period: 01/01/2010 → 31/12/2012
Number of participants: 7
Research area: Coastal Ecology
Project participant:
Støttrup, Josianne Gatt (Intern)
The aim of the project was to improve fish habitats and fish populations in Nærøfjord by restoring blue mussel reefs in the fjord. This was based on the assumption that blue mussel reefs would provide complex habitats for fish, and improve the conditions and availability of prey organisms and hiding places for both juvenile and adult fish in the fjord.

Blue mussels (~ 44 ton) were produced on ropes in the fjord from the indigenous mussel larvae stock in 2 years, 2010 and 2011. Harvested mussels were distributed on sandy-muddy seabed in a study area in the southern part of the fjord mainly by use of volunteer, local fishermen. The mussel reefs were laid out as small patches (3 m in diameter) with 5 to 7 m in between to increase the complexity of the fjord substrate and covered in total an area of 121,000 m². The design mimicked the observed distribution of existing mussel beds in the fjord. Different approaches for production of the mussels and deployment of the reefs were investigated to minimize costs and labor.

The production of blue mussels on suspended long lines/on hemp sacks was a more ecologically sustainable method compared to transplanting blue mussels by destructive dredging. Crowdsourcing allowed us to conduct the experiments cost-effectively although it did cause challenges in the planning and implementation processes.

A scientific monitoring program monitored the distribution of fish populations and prey organisms in the study area and a control area in 2010 and 2011, before and after the restoration of the mussel reefs in the study area. The establishment of blue mussel beds increased the abundance and diversity of fish on the mussel structures (Kristensen et al. 2015). Video observations revealed the presence of gobies were around the structures for extended periods but also larger fish such as cod, trout and flatfish were observed near the established mussel beds.

The project relied on a strong stakeholder involvement and cooperation with the local fisheries association and local users of the fjord. Field work, including mussel production and deployment of the mussel reefs was carried out by volunteers from the local Fisheries Association supervised by the Nordshell consultant and DTU Aqua staff.

The project was coordinated by DTU Aqua.

The project was funded by the Fishery LAG Funen (established under the Rural District Program in EU Fisheries Development Program) and the Danish Ministry of Food, Agriculture and Fisheries.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Faaborg Recreational Fishery Association
University of Southern Denmark
Nordshell IS
Period: 01/01/2010 → 14/04/2012
Number of participants: 4
Research area: Coastal Ecology
Project participant:
Støttrup, Josianne Gatt (Intern)
Project Manager, academic:
Poulsen, Louise K. (Intern)
Stenberg, Claus (Intern)
Kristensen, Louise Dahl (Intern)
Project

The effect of habitats on the distribution and behaviour of flatfish and cod

National Institute of Aquatic Resources
Effect of the Horns Rev 1 offshore wind farm on fish communities (38734 and 38735)
The present project focuses on the fish community at the Horns Rev 1 Offshore Wind Farm. The objective of the present study was to document possible refuge effects or changes in local fish communities, seven years after the establishment of the wind farm at a time where wind farm effects on the physical and biological environment could be assumed to have stabilized. Fish communities and sandeel assemblages were compared inside and outside the wind farm area, with the null-hypothesis that the introduction of an offshore wind farm does not affect species composition, temporal or spatial distribution of species or relative abundance.

The project is coordinated by DTU Aqua.
National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Orbicon
Period: 01/01/2009 → 31/12/2011
Number of participants: 5
Research areas: Coastal Ecology & Marine Populations and Ecosystem Dynamics
Project participant:
Støttrup, Josianne Gatt (Intern)
van Deurs, Mikael (Intern)
Dinesen, Grete E. (Intern)
Project Manager, academic:
Stenberg, Claus (Intern)
Mosegaard, Henrik (Intern)
Project

Offshore wind farms and possibilities for aquaculture/farming of shellfish (38641)
Large areas of the sea across Denmark and rest of Europe expanded these years with offshore wind farms (OWF). OWF are more or less closed to fishing and have restriction in access. OWF has been proposed for multiple use, e.g. aquaculture and seafarming for shellfish. OWF often have reduced environmental requirements and utilization of these areas for aquaculture and seafarming for shellfish cannot be expected to be in conflict with nature conservation considerations.

This project aim is to investigate whether the production of shellfish can be combined with the operation of OWF. The Danish waters offer very different physical/biological environmental aspects, mainly because of a salinity gradient from the relative fresh Baltic Sea to the North Sea salts. Three OWF along this gradient are used as cases (Horns Rev 1 OWF, Anholt OWF and Nysted OWF) thus allowing general assessment of options for production of shellfish in OWF in Denmark.

The project is coordinated by DTU Aqua.
National Institute of Aquatic Resources
BLUE REEF (38179)
The overall project objective was to restore a rare marine habitat at a strategically important locality (Læsø Trindel) with the purpose of conservation of marine biodiversity.

The more specific objectives include:
- Stabilization and restoration of a cave-forming stone reef to favorable conservation status.
- Conservation and proper management of a reef donor area (larval dispersal) for the oxygen depleted inner Danish waters.
- Implementation through dissemination and cross-sectoral co-operation among authorities and local stakeholders.

Offshore boulder reefs have a high biodiversity and are a biologically important reef type at national and European level. At national levels these reef types are rare and Læsø Trindel constitutes one of 51 reef areas included in the Danish Natura 2000 network. In Denmark, shallow water boulder reefs have been extensively exploited for about a century, targeted for their easily accessible large boulders for constructing sea defenses and harbor jetties. A cautious estimate is that at least 34 km² of boulders from predominantly shallow cavernous reefs have been extracted from Danish waters and national monitoring programs indicate that only around 5 ha of the total original cavernous reefs have been left untouched.

The field experimental work was based on baseline surveys to be followed up by a survey 4 years after the deployment of the boulders; i.e. a “Before-After” approach. One role that DTU Aqua had in the project was to participate in the design of the restoration together with the other project partners. Based on the results from the multi-beam echo-sounder survey of the area conducted by GEUS in 2005, the reef restoration design was developed through several meetings between engineers and biologists/ecologists (Støttrup et al. in prep.). DTU Aqua’s main role in the project, however, was to document the ecology and biodiversity status of Læsø Trindel with focus on fish and shellfish assemblages before and after the restoration (Støttrup et al. 2014; Kristensen et al. 2 papers close to submission). This work was carried out in close collaboration with Aarhus University who is responsible for monitoring bottom fauna and flora. The baseline study has been carried out in 2007, just before the deployment of the boulders that should stabilize the remains of the original reef and restore its earlier shallow-water cavernous reef function. In 2012 the area was revisited using the same methodology and sampling program as in the baseline study.

The project was coordinated by Danish Nature Agency.

The project was funded by EU LIFE.
Støttrup, Josianne Gatt (Intern)
Project