



International Council for
the Exploration of the Sea
Conseil International pour
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ICESCIEM

ICES Annual Science Conference

20-24 September 2005 in Aberdeen, UK

Conference papers

The following pages contain summaries of papers or posters that will be presented at the 2005 ICES Annual Science Conference, which may be of interest to the media¹. A short summary is provided and the full abstract and contact details of the author are at the end of the document.

Free entry for journalists

Representatives of the media are very welcome to attend the conference and will be exempt from all registration fees. For further information about the conference please see: <http://www.ices.dk/iceswork/asc/2005/index.asp>

Telephone interviews

Alternatively you can contact Neil Fletcher, ICES Communication Officer who will be at the conference to arrange telephone interviews. Before 16 September contact Neil on 0045 33386713. After 16 September call Mobile 0045 40847938 or E-mail: neilf@ices.dk

Theme Session “Cod in a changing climate”

This theme session will take place on Friday 23 September 10:30-18:00.
Presentations include:

The role of cod in the ecosystem

Ref AA:20 Time 14:10 (23/09/05)

Looks at the important role of cod in the ecosystem and how this role is likely to change due to climate change. The authors discuss cod stocks in the North Sea, Georges Bank/Gulf of Maine, Barents Sea, Iceland, Newfoundland/Labrador and the Baltic Sea.

¹ Please note that the papers have been chosen as an information service and do not in any way reflect the views of ICES. Also scientific papers presented at the ICES Annual Science Conference are to be regarded as work in progress. Any conclusions drawn in any of the papers are subject to change, in the light of peer review carried out at the conference and/or subsequently.

How will cod respond to warmer seas?

Ref AA:13

Time: 14:30 (23/09/05)

Climate models predict warmer temperatures due to global warming and this will mean warmer seas. Cod are essentially a cold-water species so what will warmer waters mean for them? Based on future predictions of warmer waters, stocks in the Celtic and Irish Seas are expected to disappear while those in the southern North Sea and Georges Bank will decline. Cod will probably spread northward along the coasts of Greenland and Labrador and occupy larger areas of the Barents Sea. Also growth rates of many of the stocks are likely to increase with warmer temperatures.

But the point is made that fishing will continue to play a strong, and in some cases, a dominant role on cod stocks and so any projections will be very dependant upon future fishing intensity. If fishing reduces present cod stocks to minimal levels, there may not be enough cod to expand and drive the predicted increased production – certainly not to the extent that could potentially occur if fishing pressure were to be reduced.

Declining cod stocks: the human dimension

Ref AA:03

Time 14:50 (23/09/05)

When a fish stock declines there is an obvious knock-on effect on the coastal communities that were make a living from it. In this paper the author discusses the impact of declines of cod on communities in Newfoundland, the Faroe Islands and Greenland.

All the abstracts for the “Cod in a changing climate” session can be downloaded at:
<http://www.ices.dk/iceswork/asc/2005/Abstracts/AA/AA-list.pdf>

The timetable can also be downloaded at:

<http://www.ices.dk/iceswork/asc/2005/timetables/AA.pdf>

Theme session on Elasmobranchs (Sharks, skates and rays)

This theme session will focus on Elasmobranchs on Friday 23 September 16:00-18:00 and continuing on Saturday 24 September 09:00 – 16:30. The session will include presentations and posters covering a range of issues, from the impact of fishing on deepwater sharks, to the latest findings on the poorly studied gulper shark which lives in the deepsea, feeding on fish and squid, and can grow to be 8 m long - the length of a minibus. Presentations include:

Challenges of managing deepwater shark fisheries

Ref: N:07

Time 11:15-11:30 (24/09/05)

Since the mid-1990s, a fleet of up to 50 fishing vessels have been involved in a deepwater gillnet fishery on the continental slopes to the west of the British Isles, North of Shetland, at Rockall and at Hatton Bank. Targeting monkfish and deepwater sharks, each boat can set up to 250 km of gillnets each, which they leave, largely unattended, for 3-10 days. An estimate for the total amount of gillnets in the sea in the target area, constantly fishing, is between 5800 and 8700 km (3600-5400 miles).

A recent EU study, DEEPNET, tried to find out more about this poorly monitored fishery and highlighted the high levels of discarding - many fish which could have been landed are often unmarketable after being left in the nets for so long. DEEPNET also raised concern about large amounts of gear that are likely to be lost and have the potential to carry on ghost fishing. The conclusion of the presentation is that action is urgently needed to properly monitor and control these fisheries,

particularly as they are targeting deepwater shark stocks, many of which are already thought to be in poor condition.

Full paper available at: <http://www.ices.dk/products/CMdocs/2005/N/N0705.pdf>

Elasmobranchs in the North Sea: a west-east divide

Ref N:06 Time 09:30 (24/09/05)

In this study, scientists used 30 years of surveys to map the distribution of elasmobranchs in the North Sea. One of the main findings was that elasmobranchs were much more abundant on the western side of the North Sea, along the British coast from the Channel to the Shetlands, than on the continental coast where they were virtually absent. This clear, west-east, decreasing gradient in shark biodiversity indicates that any measures to reduce fishing pressure on elasmobranchs should focus on protecting the western side of the North Sea.

The scientists also looked at catch rates of the different species and found no common trend: some species such as spurdog and common skate have declined while others such as lesser-spotted dogfish, smoothhound and tope have increased.

Full paper available at:

http://www.ices.dk/marineworld/temp/ICES_2005_N06_Daan.pdf

All the abstracts for the Elasmobranchs session can be downloaded at:

<http://www.ices.dk/iceswork/asc/2005/Abstracts/N/N-list.pdf> *The timetable can also*

be downloaded at: <http://www.ices.dk/iceswork/asc/2005/timetables/N.pdf>

Mixed bag - other interesting presentations

Marine Protected Areas as a tool to rebuild North Sea fish stocks

Ref W:04 Time 10:30 (21/09/05)

The author discusses the failure of traditional fisheries management in preventing overfishing in the North Sea and suggests that Marine Protected Areas (MPAs) covering a third of the North Sea would be a better solution. The remaining two-thirds of the North Sea should then be exploited alternately every second year.

The author discusses examples of successful MPAs from other parts of the world and suggests that the North Sea proposal would lead to recovery of threatened fish stocks and better catches of commercial stocks in the long-term.

This paper is in a theme session on rebuilding threatened fish stocks. The abstracts and timetable for this session can be downloaded at:

<http://www.ices.dk/iceswork/asc/2005/Abstracts/W/W-list.pdf>

<http://www.ices.dk/iceswork/asc/2005/timetables/W.pdf>

Algae threaten Baltic fishers' livelihood?

Ref V:12 Time 16:00 (21/09/05)

Blooms of blue-green algae are common in the Baltic Sea between July and September. When the weather is right, huge blue-green algal blooms may form, covering thousands of square kilometers and making fisher's lives a misery. These blooms affect the fish, make fishing harder and generally reduce fishers' income.

To find out more about the scale of the problem, a questionnaire was sent out to professional fishers on the Finnish coast. The returned questionnaires revealed that

blue-green algal blooms have a severe impact on fishers. In general, many fishers responded that they are also very concerned about the current state of the Baltic Sea and the future of their professions.

Picking fisher's brains about the impact of windfarms

Ref V:04 Time 12:20 (22/09/05)

Offshore wind farms are appearing all around the European coast although there are still some uncertainties about their impacts. Fishers have a wealth of knowledge about the sea and in this study scientists used a technique called cognitive mapping to help draw out English fishers' views and perceptions on the impact of windfarms on their fishing activities and livelihoods. Put simply, cognitive mapping meant listing relevant ideas on the impact of wind farms, grouping them and mapping the inter-relationships, creating an easily understandable digest of fishers' views.

Download full paper: <http://www.ices.dk/products/CMdocs/2005/v/V0405.pdf>

Both these presentations are from a theme session titled "Fishers' perceptions and responses in management implementation" (V). All the abstracts and the timetable for this session can be downloaded here:

<http://www.ices.dk/iceswork/asc/2005/Abstracts/V/V-list.pdf>

<http://www.ices.dk/iceswork/asc/2005/timetables/V.pdf>

Oil spills: do we know enough about their long-term impacts

Ref S:13 Time 13:30 (21/09/05)

Looking at the impact assessments after a number of recent oil spills ("Braer", "Sea Empress", "Erika", "Prestige" and "Tricolor") the answer is no. Scientists found that most impact assessments looked at the short term impacts of oil spills but did not continue long enough to monitor long term impacts. Long term monitoring is often difficult due to lack of pre-oilspill data and the difficulty of separating oil spill effects from the effects of other chemicals/natural changes. A focus on long-term monitoring of the most vulnerable and sensitive components of the ecosystem is suggested.

This presentation is part of a theme session on the impacts of oil pollution on the marine ecosystem. All the abstracts and the timetable for this session can be downloaded here:

<http://www.ices.dk/iceswork/asc/2005/Abstracts/S/S-list.pdf>

<http://www.ices.dk/iceswork/asc/2005/timetables/S.pdf>

Seabird "spies" reveal fish secrets

Ref O:39 Time 14.30 (23/09/05)

Fish tend to congregate in certain hotspot areas. To build up a better understanding of where hotspots are and why they exist, scientists have followed the daily feeding behaviour of fish-eating seabirds.

This presentation is part of a theme session titled: Connecting Physical-Biological Interactions to Recruitment Variability, Ecosystem Dynamics, and the Management of Exploited Stocks. All the abstracts and the timetable can be downloaded at:

<http://www.ices.dk/iceswork/asc/2005/Abstracts/O/Olist.pdf>

<http://www.ices.dk/iceswork/asc/2005/timetables/O.pdf>

High-tech warnings to keep harbour porpoises out of fishing nets

Ref X:02 Time 12:00 (23/09/05)

To help harbour porpoises avoid gillnets near the seabed, scientists have been developing acoustic alarms (pingers). These alarms are attached to nets and make a noise to warn porpoises that a net is in the area. These have so far been successful -

so much so that they will soon become mandatory in many North Sea and Baltic gillnet fisheries.

But scientists were concerned that in heavily fished areas porpoises could be driven away by walls of constantly pinging nets. So to get round this problem they have developed a high-tech pinger that only pings when it picks up the sound of harbour porpoise sonar. Tests in Danish waters have found that the new pinger works well and emits 1-3% of the noise of the always-on, traditional pingers.

All the abstracts from the Theme Session on marine mammal bycatch can be downloaded at <http://www.ices.dk/iceswork/asc/2005/Abstracts/X/X-list.pdf>

The timetable can be downloaded at:

<http://www.ices.dk/iceswork/asc/2005/timetables/X.pdf>

Hake hedge their bets when it comes to spawning

Q:09 Time: 11:50 (21/09/05)

Studies on the northern hake stock have found that they spawn over a long period of more than 6 months. Other fish that spawn over shorter time periods are more at the mercy of poor environmental conditions/food shortages. But hake, by spreading their spawning over more than half the year, hedge their bets that at least some fish will spawn in good conditions. Scientists discuss how, in the long run, this may help hake adapt to climate change.

It's a hard life being a cod

Q:20 Time:09:05 (21/09/05)

From the moment it is born until the moment it dies a cod has a hard life finding food and dodging predators. In this paper, the author runs through the obstacles to survival that fish have to go through in their lifetime and discusses why it is not always a certainty that a heavily depleted fish stock will recover.

Download full paper at: <http://www.ices.dk/products/CMdocs/2005/Q/Q0905.pdf>

These two presentations are part of a theme session on advances in reproductive biology. All the abstracts and the timetable can be downloaded at:

<http://www.ices.dk/iceswork/asc/2005/Abstracts/Q/Q-list.pdf>

<http://www.ices.dk/iceswork/asc/2005/timetables/Q.pdf>

ORIGINAL ABSTRACTS OF PRESENTATIONS

ICES CM 2005/AA:20

The role of cod in the ecosystem

Authors: Jason Link, Bjarte Bogstad, Henrik Sparholt, and George Lilly

To help us explore the role of cod in the ecosystem, we reviewed biological interactions between cod and its prey, predators, and competitors within six ecosystems. These six examples are from a broad geographic range: three are cod-capelin (*Mallotus villosus*) systems toward cod's northern limit across the top of the Atlantic (Barents Sea, Iceland, and Newfoundland-Labrador), two are more diverse systems toward the southern end of the species' range on either side of the Atlantic (North Sea and Georges Bank-Gulf of Maine), and one is a species-poor system with an unusual physical and biotic environment (Baltic Sea).

We then attempted a synthesis of the role of cod in these and other ecosystems and speculate on how the role of cod might change in response to a variety of influences, particularly climate change. Our review indicates similarities in feeding across the ecosystems, with cod prey, predators and competitors functionally similar in all six ecosystems. Conversely, our review indicates different magnitudes of the role of cod in an ecosystem, with subsequently different effects of this role on cod populations, on cod prey populations, and on cod predator populations. Due to the direct effects of fishing on cod, it also

appears that the ecological role of cod is diminished relative to historical roles in many cod ecosystems. What remains unclear is how additional climate variability will alter cod stocks, and thus the role of cod in the ecosystem.

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ICES CM 2005/AA:13

The response of Atlantic cod (*Gadus morhua*) to future climate change

Author: Ken Drinkwater

Future CO₂-induced climate change scenarios from Global Circulation Models (GCMs) indicate increasing air temperatures, with the greatest warming in the Arctic and Subarctic. Changes to the wind fields and precipitation patterns are also suggested. These will lead to changes in the temperature and salinity properties of the ocean, as well as the vertical stratification and circulation patterns. Based upon the observed responses of cod to climate variability, the expected responses of cod stocks throughout the North Atlantic to these future climate scenarios are reviewed and discussed. Stocks in the Celtic and Irish Seas are expected to disappear while those in the southern North Sea and Georges Bank will decline. Cod will likely spread northward along the coasts of Greenland and Labrador, occupy larger areas of the Barents Sea and may even extend onto some of the continental shelves of the Arctic Ocean. Growth rates of many of the stocks will increase with increasing temperatures. The effects of climate change on maturity and transport of cod larvae will also be discussed. Since the response of cod to climate changes will depend also on their prey and predators, some speculations on the changes in these will be presented.

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ICES CM 2005/AA:03

The human dimensions: Demographic impacts of fisheries decline

Author: Lawrence C. Hamilton

As marine ecosystems change, under pressure from fisheries and the physical environment, they force changes onshore among fisheries-dependent societies. For smallscale, labor-intensive fisheries the changes might be gradual and not well recorded. The big fisheries declines of the post-trawler era since World War II show a different pattern, however. These ecological events tend to be comparatively abrupt, large-scale, and well-recorded—as have their human dimensions on land. This chapter illustrates a key aspect of the human dimensions in recent fisheries decline—quantitative changes in demographic and other social indicators, where the timing suggests a direct connection to specific fisheries/ecosystem events. Quantitative trends such as outmigration by young adults reflect a broad range of other social changes, some better understood through qualitative case studies. The social indicators approach, in contrast, reveals big changes from afar. It also highlights patterns that have been common across a variety of environments, historical backgrounds, cultures, and management regimes. Examples from Newfoundland, the Faroe Islands, and Greenland show demographic consequences from codfish declines.

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ICES CM 2005/N:07

A preliminary investigation on shelf edge and deepwater fixed net fisheries to the west and north of Great Britain, Ireland, around Rockall and Hatton Bank

Authors: Nils-Roar Hareide, Dominic Rihan, Myles Mulligan, Philip McMullen, Greta Garnes, Maurice Clark, Paul Connolly, Peter Tyndall, Robert Misund, Dag Furevik, Andrew Newton, Kjartan Høydal, Tom Blasdale, and Odd Børre Humborstad

Since the mid-1990s, a fleet of up to 50 vessels have been conducting a gillnet fishery on the continental slopes to the West of the British Isles, North of Shetland, at Rockall and Hatton bank. These vessels, though mostly based in Spain are registered in the UK, Germany, and other countries outside the EU such as Panama. The fishery is conducted in depths between 200 and 1200 meters, with

the main target species being monkfish (200–800 m) and deepwater sharks (800–1200 m). These fisheries are not well documented or understood and they seem to be largely unregulated, with little or no information on catch composition and discards. Vessels currently participating in the fishery are reported to use up to 250 km of gear, and the nets are left fishing unattended and hauled every 3–10 days with trip lengths varying between 4–8 weeks. The amount of fishing gear used in the fisheries, the lengths of the fleets, and the fact that the nets are unattended much of the time, make it very likely that a large quantity of nets are lost, while there is also evidence of illegal dumping of sheet netting. The long soak times in these fisheries result in a high proportion of the catches being unfit for human consumption.

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ICES CM 2005/N:06

North Sea elasmobranchs: distribution, abundance and biodiversity

Authors: Niels Daan, Henk Heessen, and Remment ter Hofstede

Based on data from the International Bottom Trawl Survey (IBTS), an overview is given of the distribution and trends in abundance of the elasmobranchs occurring in the North Sea. In a separate analysis, the information is integrated in fine-scale ($10' \times 10'$) spatial biodiversity indices of the elasmobranch community, by applying a novel method of correcting for differences in sampling effort. The implications for management and conservation are discussed.

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ICES CM 2005/W:04

Marine protected areas as a tool to rebuild both commercial and threatened fish stocks

Author: Ronald Fricke

Marine fish populations have worldwide declined dramatically during the past century. Decades of fisheries management did not successfully reverse this trend. A major decrease is observed in both commercially used and bycatch stocks; some trends are irreversible when present fisheries management regimes continue to be applied. Effective measures for the conservation of marine fishes and their habitats are urgently needed. For the case of the North Sea, tools for conservation and potential management regimes are discussed. It seems inevitable to establish marine protected areas (MPAs) on a larger scale, including core areas without any commercial exploitation. Examples of successful MPAs in other parts of the world, especially in the Great Barrier Reef Marine Park (Queensland, Australia) and the Exmouth Gulf (Western Australia), are presented, and the necessary extent of the sites and legal elements of conservation are discussed.

It is estimated that MPA core areas extending across approximately one third of the area of the North Sea need to be established. The remaining two thirds should be exploited alternately every second year. Such management regime is predicted to increase both commercial and threatened fish stocks, and should in the long term induce improved commercial catches.

A set of MPAs for the North Sea is proposed which would meet the demands of marine fish conservation. The MPAs are suggested to be established under the Oslo Paris Convention (OSPAR) and the EU Habitats Directive; the latter directive should be revised to meet the demands in marine habitats.

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ICES CM 2005/V:12

Harmful blooms of cyanobacteria: A threat to fishermen's livelihood in the Baltic Sea?

Authors: Jari-Pekka Pääkkönen, Miina Karjalainen, Maiju Lehtiniemi, Jonna Engström-Öst, and Markku Viitasalo

Harmful algal blooms of hepatotoxic cyanobacteria, *Nodularia spumigena*, are common between July and September in the Baltic Sea. In optimal weather conditions, as in the summers of 1997 and 2002, massive blooms may occur in most regions of the Baltic Sea, covering thousands of square kilometers. *N. spumigena* has been shown to cause various deleterious effects on Baltic organisms, including Baltic fish. The blooms may also interfere with normal fishing practises, such as using nets and trawls, and cause a decline in fishermen's summertime incomes. However, the influence of blue-green algae on Baltic fisheries has not previously been studied. As a part of a larger research project investigating ecological and socioeconomic effects of the Baltic cyanobacteria, a questionnaire was sent to

professional fishermen on the Finnish coastline. The fishermen were asked: (1) if and how algal blooms have affected their fishing methods, catch, and revenue, (2) which areas and fish species they consider to be affected, and (3) where do they get the information about the blooms, and how do they modify their fishing practises during blooms. The results to be presented reveal area-, species-, and gearspecific effects of blue-greens, and suggest that blooms of cyanobacteria may pose a severe threat to Baltic summertime fisheries. In general, fishermen were very concerned about the current state of the Baltic Sea, and the future of their own profession.

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ICES CM 2005/V:04

Mind games: Cognitive mapping of fishers' knowledge and perceptions on the impacts of wind farms on fisheries

Authors: Steven Mackinson, Robert Brown, Jeroen van der Kooij, Hazel Curtis, Mike Myers, and Ross Leach

The development of offshore wind farms around the coasts of England and Wales could make a significant contribution to securing energy supplies for future generations. However, while knowledge of wind farm impacts is developing all the time, there are still some uncertainties about the impacts of wind farms on the environment and specific industries whose activities may be affected by their development. Cognitive mapping was used as a tool in the dialogue between fishers and researchers in a study that investigates the socio-economic impacts and opportunities arising from wind farm developments.

Cognitive mapping helped fishers to express their knowledge and perceptions of impacts in a structured way that facilitated a comprehensive and transparent understanding of the issues and concerns of fishers. Specific consideration of possible options to minimise the impacts of developments during construction and operation phases highlight the thought process behind fishers' adaptation to management actions.

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ICES CM 2005/S:13

Assessing the long-term impact of oil spills: an examination of recent incidents

Authors: Robin Law, Carole Kelly, Patrick Roose, Jacek Tronczynski, Lucía Viñas, and Lynda Webster

Following major oil spill incidents there is a considerable focus on environmental impact assessment, particularly in the short term. These can arise both as a result of toxic impacts (toxicity and bioaccumulation) and physical impacts (smothering and sediment contamination). There may also be impacts as a result of remedial activities, for instance to sand-dune systems caused by heavy vehicle traffic. Different ecosystems also have varying recovery rates. Long-term impacts can be more difficult to assess, particularly against a background of natural variability and change which would occur in the absence of a spill. We plan to investigate the impact assessments made following a number of recent incidents ("Braer", "Sea Empress", "Erika", "Prestige", and "Tricolor") and to try to assess whether the current framework of environmental risk assessment and toxicology is adequate to address the issues of long-term impacts of oil spills.

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ICES CM 2005/O:39

Hotspots: Marine top predator foraging habitat predicted from a detailed understanding of temporal and spatial oceanographic processes

Authors: B. E. Scott, J. Sharples, O. Ross, and K. Camphuysen

Any fisherman can tell you there are 'hotspots' or areas where high densities of fish are likely to be found again and again. What makes these regions so predictive and interesting to fish and higher order predators? In a multidisciplinary EU study (IMPRESS) investigating the foraging habitat of seabirds with both field investigations and a use of long-term data, we found that seabird foraging patterns provided vital clues as to what particular physical aspects of the marine ecosystem are critical to defining 'hotspots' (regions where there are critical ecosystem linkages between the trophic layers). With spatially targeted at-sea observations of fish-eating seabirds we were able to identify causal links with daily bird foraging behaviour and regionally and temporally specific physical characteristics.

Using a 1-D bio-physical model parameterised with site-specific data, we produced a 30-year time-series to characterise several temporal and spatial components of the annual primary production within the study area. The combination of our short- and long-term temporal investigations and our detailed spatial investigations provides insights into physical and biological reasons for the spatial connectivity of ecosystems.

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ICES CM 2005/X:02

Testing a pinger activated by porpoise sonar

Authors: G. Desportes, L. R. Poulsen, A. Amundin, F. Larsen, A. Bjørge, J. H. Rye, L. Buholzer, N. Eriksen, I. Eskesen, S. Ingversen, T. B. Jepsen, L. Kindt-Larsen, N. K. Petersen, and C. Vanman

Acoustic alarms (pingers) have proven to be an efficient mitigation method to porpoise bycatch, and will become progressively mandatory in gillnet fisheries in the North Sea and part of the Baltic Sea from June 2005. This study tested an interactive pinger prototype, which only emits a displacement sound when triggered by porpoise sonar. It was conducted in 2002–2005 on freeranging porpoises at Fyns Hoved, Denmark. Surface positions of the porpoises were obtained with a digital theodolite from a 20-m high cliff. Sub-project 1 tested the displacement effect of a single device; subproject 2 investigated the behaviour of porpoises around an array of 4 pingers in a simulated gillnet situation. Only data within a 400-m range of the pingers were analysed (based on theoretical auditory detection range and precision of tracking). The displacement efficiency was evaluated through the overall movement pattern, the median of the minimum approach distances to the pinger (MAD), and the comparison of several parameters between the dives where a displacement sound was emitted (S-dives) with dives during Baseline conditions (B-dives). In both sub-projects the porpoises were significantly displaced from the near vicinity of the active pinger compared to the baseline, but not expelled from an excessively large area (MAD: (sub-project 1: 114 m); (subproject 2: 75 m)). A significant effect in dive-parameters of the S-dives compared to B-dives disappeared in the subsequent or second dive after the S-dive. In addition the sound emission from the interactive pinger was equivalent to 1–3% of the sound emissions from traditional pingers.

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ICES CM 2005/Q:09

A bet hedging strategy for hake enables maximum viable egg production

Authors: Aisling Lannin, E. Rogan, and P. Connolly

In recent years the management of the northern hake stock has been dominated by uncertainty over the state of the stock, recruitment success, and the need for EU recovery plans. There are important spawning and nursery areas for northern hake off the south west of Ireland in the ‘biologically sensitive area’ established by the EU in 2003. The reproductive biology of hake was investigated in this area by tracking maturity stages in the population and oocyte stage abundance in individual ovaries using histological techniques. The results indicated pre-spawning and post-spawning stages present in the population over a prolonged period of 6 months. Furthermore, a variety of mature oocyte stages were present in ovaries of similar maturities over the entire year. Hake display a protracted spawning season with the asynchronous spawning pattern representing an individual level response that feeds into an overall stock response. The protracted spawning season coupled with the asynchronous mechanism underpin the quantity and quality of egg production in the hake stock. Hake employ a ‘reproductive bet hedging strategy’, spreading reproductive effort over time to protect eggs and larvae against adverse environmental conditions and food availability. Against the backdrop of climate change, this strategy may ensure a higher probability of spawning success and lead to a ‘greater recruitment stability’ in the stock.

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ICES CM 2005/Q:20

Reproduction to recruitment to recovery? Significance of parental effects to marine fish stocks

E. A. Trippel

The declines in population sizes of cod (*Gadus morhua*) and of many other fish species in the North Atlantic and Baltic Sea are of large concern to the economies of coastal communities that rely upon their productivity and sustainability. The rebuilding of these stocks is dependent on recruitment, which in turn is partly dependent on successful reproduction. This paper outlines possible pathways and processes that an 'individual' encounters as it is generated by its parents and passes from larva to juvenile to adult. The fish life cycle, and in particular the new knowledge gained recently about spawning, gametes, and early life stages will be appraised in light of the threats encountered and the capacity of individuals to overcome them as a function of parental phenotype and genotype. Successfully rebuilding a depleted population is not a certainty and can be seriously hampered by compensatory mechanisms. Favourable parental, larval, and juvenile environmental conditions may be a necessity to rebuild stocks near historical low levels.

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