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ICES CIEM

NEWSLETTER

INSIDE THIS ISSUE:

President's welcome

Dear Colleagues,

These are interesting times for ICES. Our scientific community continues to grow with the last two Annual Science Conferences having record attendance and this year's conference in Maastricht, the Netherlands, promises to be another essential meeting in the marine scientist's calendar. As ICES scientists do their part to provide exciting scientific content for ASCs, working groups, symposia, and ICES advice, the Consultative Committee, MCAP[1] Bureau and Council are all busy trying to keep the ICES organizational structure and organizational practices up with evolving needs for interdisciplinary ecosystem science and scientific advice. Let me comment briefly on some of the important issues that have been addressed or are being considered.

About a year ago, the Consultative Committee initiated a review of expert group and science committee activities, as well as its own activities. As part of the process an open meeting was held among members of the ICES community in March 2006. In general, there seems to be agreement that expert groups are performing well, the role of committees needs to be clarified, and the Consultative Committee needs to spend more time strategically looking toward the future. The Consultative Committee is preparing a proposal to address the problems and opportunities it has identified. Its proposal will be circulated for broad discussion before consideration by the Bureau and Council.

The Advisory side of ICES is also reviewing its structure. Under the leadership of MCAP, important changes have been made in the last few years, such as allowing observers at Advisory Committee meetings, and changing the structure of Advisory Reports to integrate information on fisheries, environment and ecosystems. Currently, MCAP is considering structural changes aimed at making the system even more integrative and flexible so that it can be more responsive to increasingly complex issues for which advice is sought.

The most pressing need for change in the advisory process concerns the timing of assessment advice. At present, ICES gives some of its most critical advice on fisheries shortly after the autumn meeting of the Advisory Committee on Fisheries Management. This leaves very little time for managers to consult and deliberate before making fishery management decisions that are effective from January 1st, about 2 months after the advice was given.

The European Commission has asked ICES to consider options for advancing the time when advice is given so that there is more time for decision making. ICES has committed itself to working with the Commission to address the timing problem without jeopardizing the integrity of the advice. This will probably make it necessary, to some degree, to "de-link" annual cycles for conducting assessments, preparing advice, and making fishery management decisions. Obviously, a large portion of the ICES community has a stake in any changes that might be made, so we will keep you posted on developments.

There are many other issues being addressed and improvements made. For example, ICES has extended its policy that opens up participation in science working groups to now include advisory working groups. The Council has also established a strategic investment fund to give ICES the flexibility to fulfill important needs that are not affordable from regular sources of funds. In addition, ICES has committed funds for this year's ASC, as it did last year, to partially support participation of "new comers" to the ASC. This is a modest, but I believe important, effort to broadening and renewing the ICES scientific community.

Finally, I want to recall that David Griffith completed his 6-year term as General Secretary culminating decades of service to ICES (General Secretary 1999–2005, President 1991–1994, Vice President 1985–1991, and many other roles). However, ICES is fortunate to have yet another extremely talented and dedicated General Secretary, Dr.Gerd Hubold. Before becoming General Secretary on February 1st, Dr. Hubold served ICES as a Delegate and Vice President. He was the first Chair of the Advisory Committee on Fisheries Management. Dr. Hubold was the director of the German Federal Institute for Fisheries in Hamburg. He is a marine ecologist and fisheries scientist who has worked in the North Sea, in the South Atlantic, and in polar ecosystems of the Arctic and Antarctic. The ICES Secretariat is in good hands, and as always, working hard on our behalf. I'm sure we all appreciate their valuable support.

Michael Sissenwine

[1] *Management Committee for the Advisory Process*

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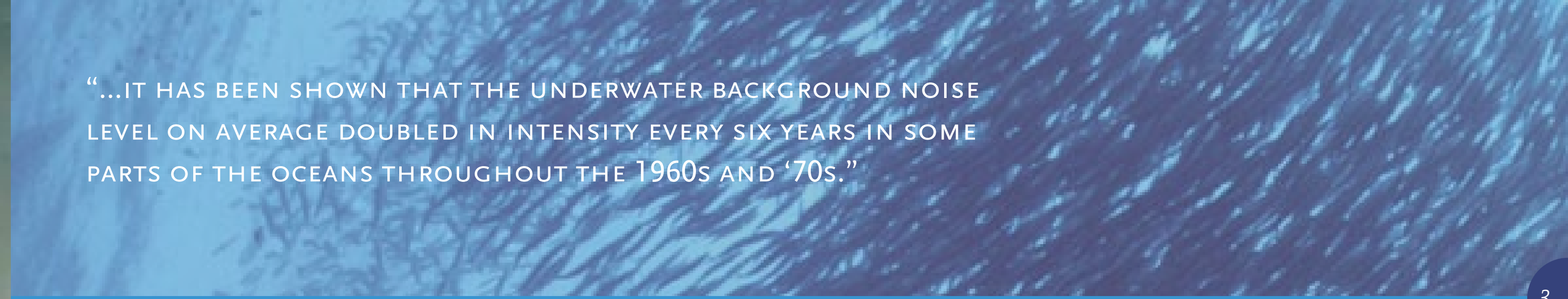


"…It has been shown that the underwater background noise level on average doubled in intensity every six years in some parts of the oceans throughout the 1960s and '70s."

A not so silent underwater world

Sound is the most efficient form of communication underwater and many marine animals use acoustic signals for orientation, communication, and detection of prey and predators. Human activities also create underwater noise; for example, boat traffic and underwater construction work produce intense acoustic noise that can be transmitted over very long distances. Since the late 1800s the debate has raged between scientists, industry, and fishers as to whether human noise may pose a threat to marine organisms. During the last decades the research in this area has expanded, but our knowledge on how marine animals are affected by the increased noise levels is still rather basic.

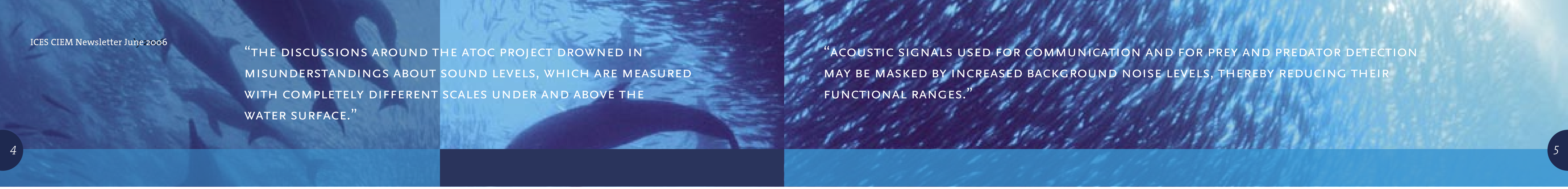
Natural noise
'The silent world' was an expression coined by Jacques Cousteau for the underwater world, based on his experience as a scuba diver rather than from acoustic measurements. In fact, the silent world is actually very noisy; it is just that our hearing works poorly underwater and we can't hear what is going on as waves, rain, sediment movements, earthquakes, and lightning fill the ocean with sound. Marine animals also add to the noise levels. Many animals produce a cacophony of sounds used for communication, orientation, and detection of prey: cod, haddock, and many other fish species produce long sequences of grunts during courtship; baleen whales emit powerful low-frequency sound pulses that can be heard across oceans; and toothed whales produce intense ultrasonic pulses for echolocation when they are hunting squid in the ocean depths. Even at coral reefs there is a constant noise caused by signalling of thousands of snapping shrimps. And on top of the intentional biological sound production, there are also many sounds produced unintentionally by animals while swimming and feeding.

Human noise
But humans also make a lot of noise. Noisy activities include boat traffic, seismic surveys, echo sounders, military sonar, and underwater construction. In fact it has been shown that the underwater background noise level on average doubled in intensity every six years in some parts of the oceans throughout the 1960s and '70s. The increased noise levels seem coupled to a rapid increase in human activities such as shipping. Ever since the introduction of boat engines in the late 1800s both fishers and scientists have been concerned about the possible effects of boat noise on marine animals, and in particular marine mammals which have very sensitive hearing. Among fishes the hearing abilities vary tremendously between species, but many species use sound for communication and probably also for orientation. Fish avoidance reactions from large vessels have been documented at considerable distances. Besides being stressful for the fish, this is relevant both to trawlers catching fish in the wake of powerful and noisy engines, and also to fishery research vessels that risk scaring away or congregating the fish before being able to count or sample them. Such concerns have led to the development of scientific vessels producing significantly reduced noise levels.

"The increased noise levels seem coupled to a rapid increase in human activities such as shipping." Photo by Doug Perrine www.naturepl.com

Besides vessel traffic there are other significant man-made contributors to underwater noise. During seismic prospecting very powerful low-frequency sound pulses are emitted with so-called air guns. These signals penetrate the ocean sea floor and geologists use the return signals to identify gas and oil pockets in the sediments. Such signals have been found to cause damage to the inner ear of some fish species. Also, during a study in the North Atlantic it was found that catches of cod and haddock were significantly reduced in an area exposed to seismic shooting. From studies on marine mammals, behavioural changes have been noted in the migration routes of some baleen whale species. Both for fish and whales, the ecological importance of such impact is not yet clear.

Another source of high-intensity anthropogenic noise is pile driving and other construction work creating low-frequency noise which can travel over long distances underwater. The effects of such activities can be significantly reduced by deploying bubble curtains screening the sounds around the construction site. However, to be efficient the bubble curtain has to be extremely dense, and the gear needed to produce it can therefore be very cumbersome and costly. In order to develop appropriate mitigation methods there is a dire need to understand how pile driving may affect marine wildlife.



Besides these more conventional noise sources, there are other forms of anthropogenic sounds that have gained considerable attention during the past decade. During the 1990s the Acoustic Thermography of the Ocean Climate (ATOC) project was launched to detect temperature changes in the oceans as an early sign of global warming. The ATOC project induced massive protests among many marine mammal scientists, as the water temperature was to be measured by analysing the speed of propagation of very low-frequency sound pulses transmitted from one part of an ocean basin to another one. The discussions around the project drowned in misunderstandings about sound levels, which are measured with completely different scales under and above the water surface. The ATOC source could deliver a sound intensity that appeared to be devastatingly high when directly translated into in-air decibels. However, under water this sound level is comparable to the sound levels produced by singing humpback whales or large ships.

A huge effort was launched to investigate if marine mammals were affected by the ATOC signals. No detrimental effects could be detected. The discussions around ATOC seemed to be hampered by a psychological barrier as the project was supposed to actively produce low-frequency sounds in the ocean. It seems that a considerable amount of the funding used for this could have been better used to study the effects of marine noise sources that are more likely to be a problem for marine life.

Recently there has been an increasing focus on powerful naval active sonar systems used to detect submarines. While standard fish-finders and echosounders generally produce ultrasonic sound that doesn't carry far in the water, military sonar uses more powerful signals of a lower frequency that can travel across large distances. The usage of so-called mid-frequency sonar by the military has been correlated in time with several incidents of strandings of disorientated beaked whales, many of which were suffering from decompression sickness indicating that they had swum to the surface too quickly. One theory is that the sonar panics the whales, but truly understanding what happens is a very challenging task, as beaked whales are commonly found in deep waters and only make rather short breathing pauses at the surface. By attaching acoustic data loggers to the animals with suction cups, scientists hope to be able to study the acoustics and movements of the animals. This information can provide useful insight into any changes in the animal's normal behaviour when exposed to naval sonar or give background information that can be used to develop passive acoustic monitoring methods that could highlight the whereabouts of beaked whales before sonar exercises begin.

Other human sound sources, such as car and train traffic over bridges, airplanes, and ocean-based wind farms, are of much lower intensity than the ones listed above. For ocean-based wind farms an intense research effort is currently ongoing in Northern Europe to map the effects on fish as well as on marine mammals.

"The usage of so-called mid-frequency sonar by the military has been correlated in time with several incidents of strandings of disorientated beaked whales." Photo by Tod Pusser www.naturepl.com

While these noises are too small to have a damaging effect on the hearing organs of marine animals, there are other effects that are much more difficult to study. Acoustic signals used for communication and for prey and predator detection may be masked by increased background noise levels, thereby reducing their functional ranges. It has been shown that city-dwelling blackbirds can compensate for the high urban background noise levels by increasing the pitch and intensity of their song. While marine animals may do the same to reduce the effects of masking, this can naturally only work up to a certain degree of increased background noise levels. Also, many marine species rely on passive acoustic detection of sound sources – an ability that is hampered by increased noise levels.

Hearing damage

Even though the amount and quality of the research performed in this field has escalated considerably during the last decade, our knowledge is still very limited. Hearing damage and behavioural disruption on some species of fish and marine mammals have been observed for some types of sounds, but the overall picture of the responses is far from clear. For example, even though fish are able to regenerate damaged hair cells there will be a period after strong sound exposure where the fish suffers hearing damage. Whether or not this has any significance for the fish's survival we can presently only speculate. For marine mammals there is no evidence that extensive hearing damage is reversible. As many marine mammal species rely on sound for food finding it is likely that damaging their hearing abilities may significantly affect the animals' chances of survival after suffering extensive hearing damage. But how do we quantify such a reduction in survival?

Masking and stress

After physical damage, the other concern over the impact of human sound on marine life is masking and stress, and again this is extremely difficult to measure. If the induced noise levels are modest and below those that may cause damage or significant masking, many species probably rapidly habituate to the noise. For example, many marine animals thrive in noisy areas without seemingly having any large problems. Our knowledge on this is, however, rudimentary at best, and there is likely to be huge differences between species. Also, detrimental effects on some species may easily have gone unnoticed due to a lack of observation effort.

When studying noise effects on animals, measuring the animal response is thus a very delicate matter. There is also a fundamental problem in the way sound levels are measured and how this compares to other studies. Generating results that are useful in practice poses very high demands on the experimental design, instrumentation, and analysis. Before launching larger studies in this field it is important to synthesize existing knowledge on the hearing abilities of the species in question and to obtain appropriate measurements on the properties of the sound source and the sound propagation in the relevant habitat. All this information should ideally be used to formulate relevant hypotheses prior to designing the experiment.

Photo by Doug Perrine. www.naturepl.com

Finally, there is no doubt that there is an immediate need to regulate man-made underwater sound. But before such efforts can really work we need to have a better understanding of how marine animals react to sound. Besides more basic research on how marine animals react to human-induced noise there is a need to critically evaluate and synthesize existing information to make it useful for policy issues. Such work is done within the ICES Study Group on the Effects of Sound in the Marine Environment. The results will be released on the ICES home page and continuously updated as new data is added to the existing ones in this rapidly growing field of study.

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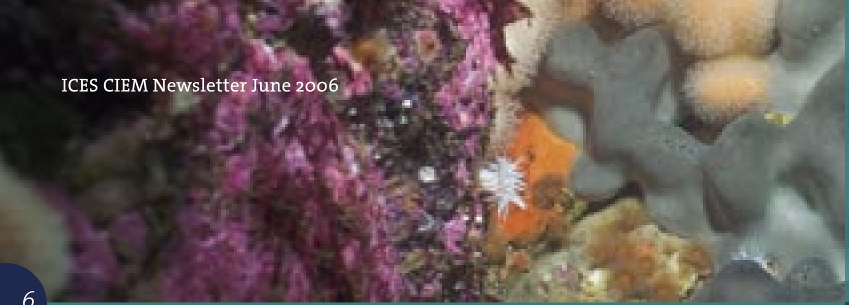
http://www.ices.dk/iceswork/wgdetailace.asp?wg=SGESME



“THE RESEARCH WILL FOCUS ON CORALS, BIOTOPES, THE EFFECT OF OIL AND GAS SPILLS ON BIOTOPES, AND RELATIONSHIPS BETWEEN BIOTOPES AND SEDIMENTS.”

Norway’s seabed goes online!

Norwegian waters cover a total of over 2 million km² and yet today our knowledge of the seabed is so limited that, to use an old cliché, we know more about the surface of the moon than about the seabed along our coast! So in 2005, the Norwegian Government allocated NOK 5 million for the first phase of an interdisciplinary programme, MAREANO (Marine Area Database for Norwegian Coasts and Sea Areas), which aims to map and study the seabed in Norwegian waters. The project will initially focus on environmentally sensitive areas of the Barents Sea and was specifically highlighted in the recent Integrated Management Plan for the Barents Sea put forward by the Norwegian Government.

MAREANO will run from 2006 until 2010, with a total cost of around NOK 235 million. It is a very timely project as there are extensive plans for exploitation of oil and gas reserves in Lofoten and the Barents Sea, and sustainable management of the area is highly dependent on improved knowledge of the Arctic ecosystems (Figures 1 & 2).

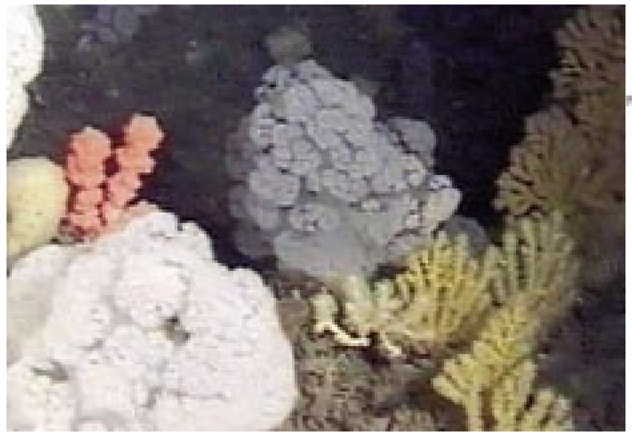


Figure 1. Previous mapping surveys of the seabed by the Norwegian Institute for Marine Research have highlighted the existence of large cold-water coral reefs off the Norwegian coast. The corals are a rich habitat for a number of other species.

Answering questions

Questions that will be answered by MAREANO include: What does the seabed consist of? What is the relationship between the physical environment, species diversity, and biological resources? How are contaminants stored in seabed sediments? Where are the coral reefs located? Where can we find the best natural conditions for aquaculture?

In order to provide answers to these questions, the programme has been divided into three main components: mapping, research, and dissemination.

1. Surveys

Surveys and basic studies of the physical, biological, and chemical environment of the seabed will initially prioritise a number of environmentally sensitive areas of the Barents Sea and the Lofoten area in which offshore petroleum activities are being planned. Future areas to be surveyed will be selected on an annual basis in agreement with the government and relevant user groups.

2. Research

The research will focus on corals, biotopes, the effect of oil and gas spills on biotopes, and relationships between biotopes and sediments.

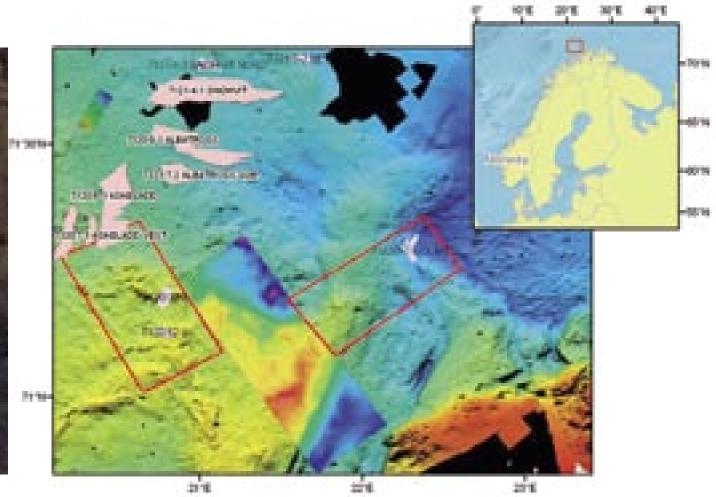


Figure 2. In 2006, MAREANO will map bottom fauna and habitats within the area mapped with a multibeam echosounder in 2005 (middle rectangle with strong colours). The red rectangles on either side have been mapped with multibeam echosounder this spring and will be part of the 2007 programme for fauna and habitat mapping.

By following up seabed mapping with sampling and video recordings of the benthic fauna, one result of the MAREANO research will be the ability to predict occurrences of bottom habitats based on seabed information (e.g. topography and acoustic backscatter) (Figure 3).

A joint effort

MAREANO is a multi-disciplinary programme, bringing together biologists from the Institute of Marine Research and geologists from the Geological Survey of Norway, and the Hydrographic Service. A number of other partners will also participate in the field work and contribute to the MAREANO database.

Financing is provided by the ministries of the Environment, Fisheries and Coastal Affairs, Trade and Industry, and by the Research Council of Norway through the new Marine and Coastal Programme.

The seabed off the Norwegian coast is characterised by deep fjords and shelf areas (deeper than 200 m) and the habitats are complex and not easily documented using only standard sampling gears. That is why a video-platform has been built, with a high-resolution video camera and sensors enabling quantitative estimates of epibenthic megafauna (Figure 4).

In the deeper parts of the Norwegian coast and shelf, coral- and sponge-communities are quite abundant. The distribution of these and other habitats, as well as observed effects of fisheries are all examples of the valuable information that will be obtained by this new equipment (Figure 5).

3. Norway’s seabed goes online

The information gathered through surveys and research will be collated in a database on Norway’s coastal and marine regions. This database will also be open to contributions from external sources of knowledge in the public and private sectors, such as local and regional government bodies and the offshore industry. A pilot version of the online MAREANO database currently covers information on selected topics and a limited interactive map service for parts of the Barents Sea (see www.mareano.no). The service will be developed to cover all of Norway’s coastal and marine regions.

The ultimate aim of MAREANO is to provide a tool that will give users from industry, authorities, research institutes, and the general public, direct access to neutral and reliable knowledge. An example of such knowledge will be charts that combine different types of data to display potential conflicts between vulnerable fish spawning grounds and planned offshore activities in the Barents Sea. Another is the possibility of combining data on types of seabed, currents, and depth in order to identify optimal sites for fish farms in the coastal zone.

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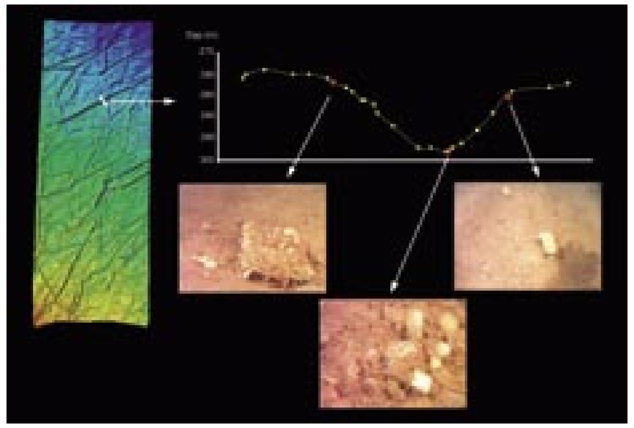
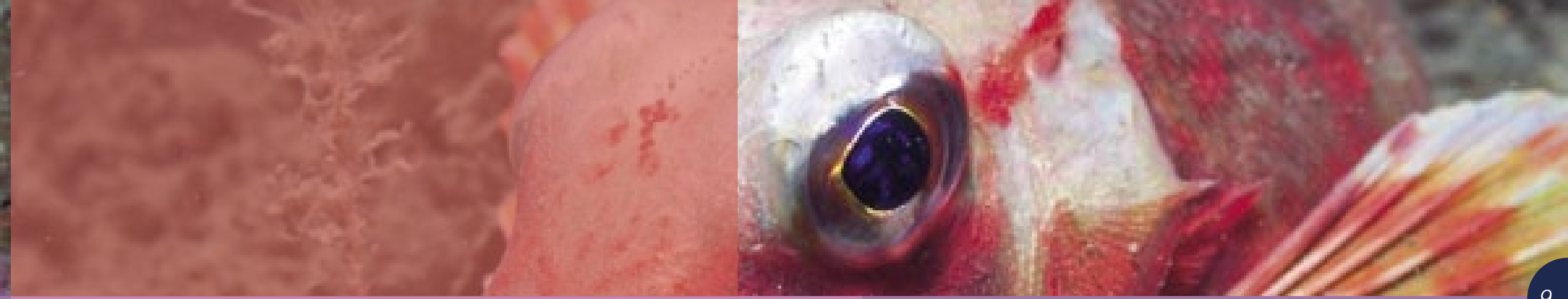


Figure 3. Map made by multibeam echosounder in the Snøhvit area (left). It shows a web of ~15 m deep iceberg furrows. The white line indicates the locations of a transect where observations were made using video. The depth-profile of the transect is shown to the right with photos taken at the sites marked in red beneath. On the sides of the furrow, sponges are common while dense occurrences of brachiopods are found at the bottom.

Figure 4. Video-platform with high resolution video camera and sensors enabling quantitative estimates of seabed substrates and abundance of animals living on the seabed.

Figure 5. Remains of a Lophelia reef that has been heavily trawled, leaving a pile of rubble.



Listening to fish

One afternoon, at the end of winter, I lowered a hydrophone gently to the seabed near the head of a Norwegian fjord. At first I heard only the sounds of waves breaking at the surface. But then I detected a slow drum beat; then another. More and more drum beats occurred, gradually merging into a continuous and ever-louder rumbling sound. At last, I had found haddock spawning in Balsfjord!

Many species of fish make sounds; we do not know precisely how many as very few have ever been examined closely. But we can hear them using hydrophones, which are specialised underwater microphones. Listening to fish can reveal much about their behaviour. More than that, it provides a powerful tool for locating spawning fish, defining fish habitat, and perhaps even estimating fish numbers.

"HADDOCK WERE PERFECT FOR OUR WORK AS THEY ARE AMONGST THE NOISIEST OF FISHES."

I first began listening to fish in the 1960s. My first hydrophone was fashioned from a waterproofed crystal microphone designed to be attached to a guitar. Lowered into an aquarium it immediately detected the clicks and bumps of crustaceans moving about, the scraping sounds from grazing sea urchins, and the knocks, grunts, and drumming sounds of fishes. Later, together with Colin Chapman and other colleagues at the Marine Laboratory in Aberdeen, I began to catalogue these sounds and to examine the behaviour of the vocal fish. Soon we extended our studies from the aquarium into the sea and began a long series of experiments into the sounds and hearing abilities of fish.

Initially, we studied sound production by the haddock *Melanogrammus aeglefinus*. Despite the important fisheries for haddock there had been very few studies of its behaviour. Haddock are quite difficult to keep alive and healthy. When the fish are brought to the surface from the seabed their swim-bladders are often ruptured. They require cold clean water, very low light levels and above all quiet conditions if they are to thrive and show the full range of their behaviour in captivity.

Haddock were perfect for our work as they are amongst the noisiest of fishes. At spawning time, mature males defend small territories in the aquarium. The dominant fish swim in tight circles, uttering a continuous low frequency drumming. As other fish including females approach its territory the male swims up through the water and performs a series of complex displays. The male presents its body to the opposing fish, with a flickering movement of the vertical fins (Figure 1). The drumming sound speeds up until the fish is humming, the pitch rising and falling as the fish performs its dance. With competing males, the activity leads to circling and further displays. With females the activity leads to a close spawning embrace culminating in the release of eggs and sperm.

The sounds are sufficiently loud to be detected at a distance, and the changes in the sounds which accompany the behaviour of the fish make it possible to confirm that courtship and spawning is taking place. With my colleagues Licia Casaretto, Marta Picciulin, and Kjell Olsen we have found spawning concentrations in Balsfjord simply by listening for the sounds. We detected many drumming fish; their numbers increasing as night fell, reaching a crescendo at midnight.

"WE HAVE RECENTLY SHOWN USING WAVELET ANALYSIS THAT THE CALLS FROM INDIVIDUAL MALE HADDOCK ALSO DIFFER FROM ONE ANOTHER – PROVIDING A BASIS FOR MATE SELECTION BY THE FEMALES."

Other members of the cod family also produce sounds. The cod produces short thumps and grunts during courtship, while the pollack or lythe produces a series of sharper 'farting' sounds. In all three species, the sounds are made by the repeated contraction of very fast muscles attached to the swim-bladder. The pattern of contraction varies from species to species, and the acoustic characteristics of the swim-bladder also differ, giving each species its characteristic sounds. We have recently shown using wavelet analysis that the calls from individual male haddock also differ from one another – providing a basis for mate selection by the females.

Other families of fish are also vocal. Some exceptionally interesting studies are being carried out by Sarah Walters and her associates from the Florida State Fisheries Service in Tampa Bay, where it has proved possible to map the distribution of several species of sciaenid fish by means of hydrophone surveys.

"MAPPING KEY SPAWNING HABITAT MAY BE ESPECIALLY VALUABLE FOR THE CONSERVATION OF SOME FISH POPULATIONS."

Listening for the sounds of fish has prompted concern over the exploitation of spawning fish. In the case of the haddock, where large numbers of fish gather together and the courtship behaviour is especially complex, it is possible that dragging a trawl across the seabed will greatly disrupt behaviour and reduces spawning success. Mapping key spawning habitat may be especially valuable for the conservation of some fish populations.

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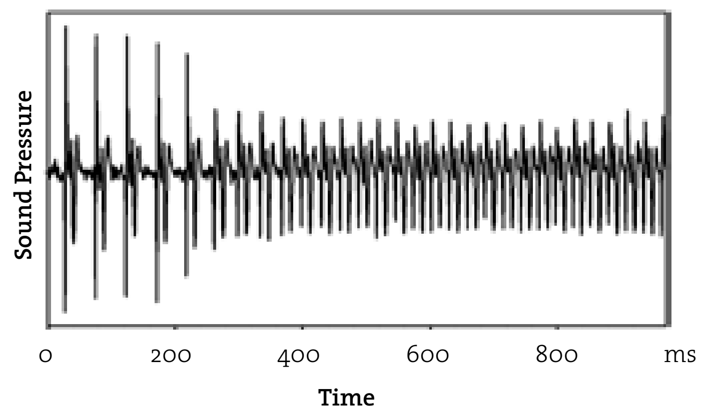
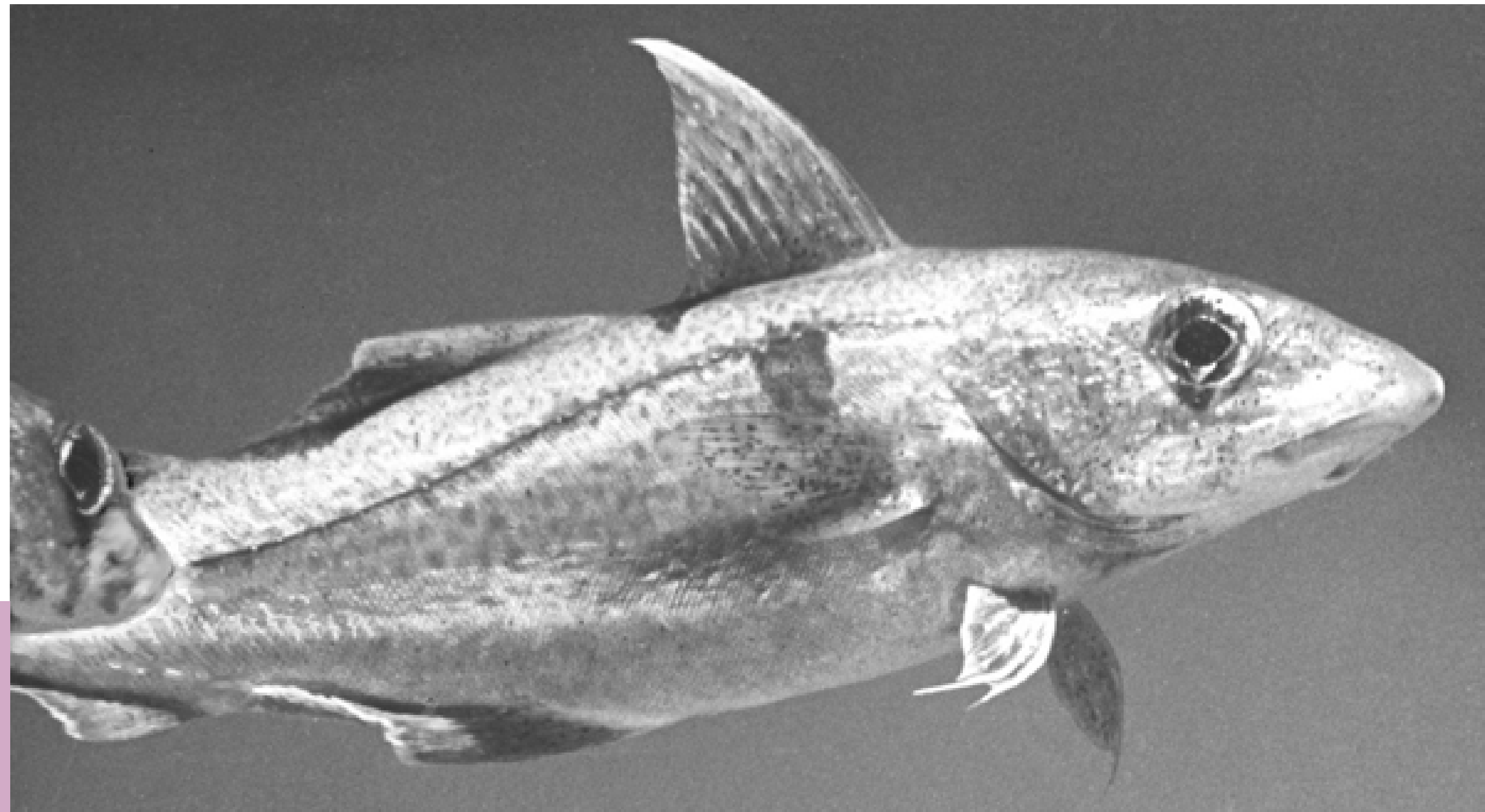


Figure 1. The drumming sounds from the male haddock are composed of low frequency pulses, which speed up as the courtship display proceeds giving a humming sound.



Fertilising the oceans with iron

The ocean, and hence our entire planet, appears blue from outer space because plant life—known as phytoplankton—in its surface layer is generally sparse. The reason for this low phytoplankton biomass over most of the ocean is the lack of nutrients (nitrate and phosphate), particularly in the extensive warm waters of the subtropics. In the coastal waters but also in the open North Atlantic, where nutrient levels are higher, the sea takes on a greener hue because of the presence of millions of tiny phytoplankton. But one thing that has puzzled scientists for many years is why the entire Southern Ocean, the Equatorial and Subarctic oceans in the Pacific have high nutrient levels and yet still remain clear blue and lacking in plant life.

"SCIENTISTS SUSPECTED THAT THE MAGIC INGREDIENT TO GREEN THE SEAS WAS THE SAME MATERIAL USED TO MAKE CARS, SHIPS, AND EVEN FRYING PANS: IRON."

The obvious answer was that the plant life needed something else and scientists suspected that the magic ingredient needed to "green" the seas was the same material used to make cars, ships, and even frying pans: iron. To find out if this was the case a group of scientists set up a series of open-ocean experiments in the Pacific and Southern Oceans where several tonnes of an iron salt were emptied into the surface waters and the scientists then waited to see what would happen. As if by magic the sea was transformed from a clear blue to a murky green in all the experimental areas as phytoplankton used the iron to multiply and bloom. This provided proof that a lack of iron does limit productivity in these oceans.

The idea that iron is a potentially limiting trace element in the sea is by no means new and has been around for many decades. All organisms need iron, but it is only available in seawater for short periods as it is quickly changed (oxidised) to highly insoluble ferric hydroxide (rust) which rapidly sinks to the sea floor. This means that iron is less available for marine life than other essential nutrients. In fact, because of this one would expect iron to be the most important nutrient limiting phytoplankton growth throughout the ocean. But the actual extent of growth limitation due to iron deficiency and the major sources of this element to the ocean are still hot topics in climate research.

There are several reasons why the role of iron is still poorly understood:

1. the concentrations of iron are so low that sample contamination is a serious problem;

2. iron has a strong affinity to a number of organic molecules (called ligands) that keep the element in solution and provide a counterbalance to the insolubility of inorganic iron compounds; and

3. there are great regional differences in the supply of iron. Thus, waters around continental margins are rich in iron (>50 nanogrammes Fe/litre), supplied by run-off, wind-borne dust and leaching from shallow sediments, hence phytoplankton blooms recur seasonally. But iron concentrations rapidly decline offshore where supply comes from either wind-blown dust or from upwelling of deep water. However, the percentage of iron present in dust that can be used by marine life is still subject to debate, as are the deepwater concentrations of this element.

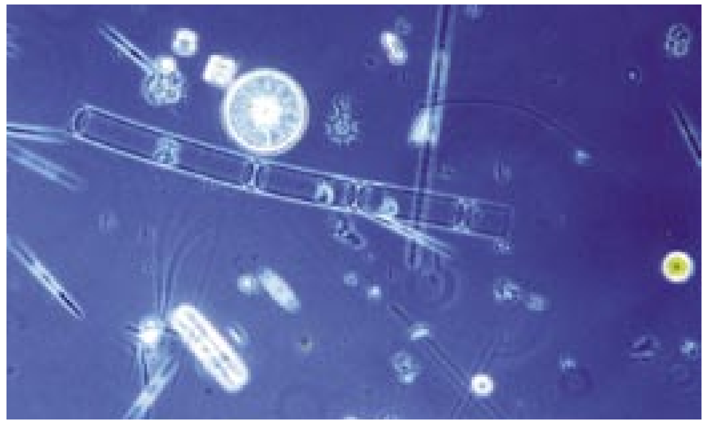
Exceptional plankton blooms in the North Atlantic

Interestingly, the North Atlantic is the only high-latitude open ocean where a regular spring bloom of phytoplankton, which can be seen from space, develops each year until biomass build-up is limited as the available nitrate is used up. Diatoms dominate the biomass of the spring bloom and a significant proportion of their populations sink out of the surface layer in flakes of intact chains that accumulate in fluffy layers on the abyssal sea floor. The vertical "rain" of particles produced in the surface layer by phytoplankton drives the "biological carbon pump" which pulls carbon into the deep sea and sediments. For this, but also other reasons, the North Atlantic is a major sink of atmospheric carbon dioxide in the ocean.

"ONE THING THAT HAS PUZZLED SCIENTISTS FOR MANY YEARS IS WHY THE ENTIRE SOUTHERN OCEAN, THE EQUATORIAL AND SUBARCTIC OCEANS IN THE PACIFIC HAVE HIGH NUTRIENT LEVELS AND YET STILL REMAIN CLEAR BLUE AND LACKING IN PLANTLIFE".

"...WE KNOW THAT THE SPRING DIATOM BLOOM OF THE NORTH ATLANTIC IS EXCEPTIONAL AND PROBABLY FUELLED BY IRON INPUT IN DUST BLOWN OFF THE AFRICAN CONTINENT."

The seasonal cycles of plankton ecology and biogeochemistry characteristic of the ocean margins, but also the North Atlantic have dominated the thinking of plankton ecologists—most of whom were nurtured in the ICES area—until the late 1990s. Now we know that the spring diatom bloom of the North Atlantic is exceptional and probably fuelled by iron input in dust blown off the African continent.



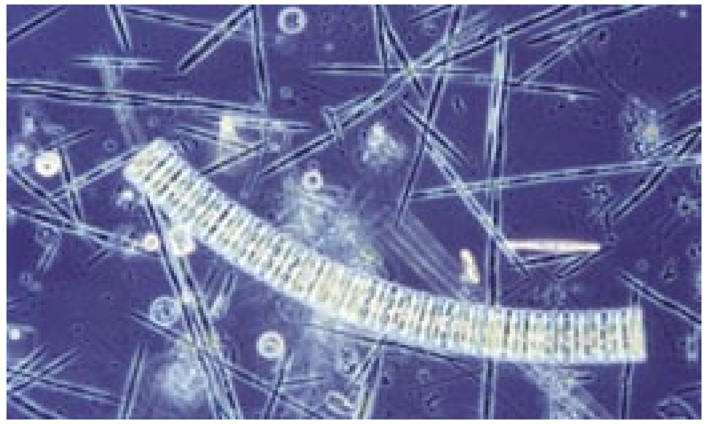


Figure 5. (top) Phytoplankton concentration in seawater outside the area fertilised with iron. (bottom) Phytoplankton concentration in one of the areas artificially fertilised with iron. Photos courtesy of Dr. Philipp Assmy.

Testing the iron effect in the Southern Ocean

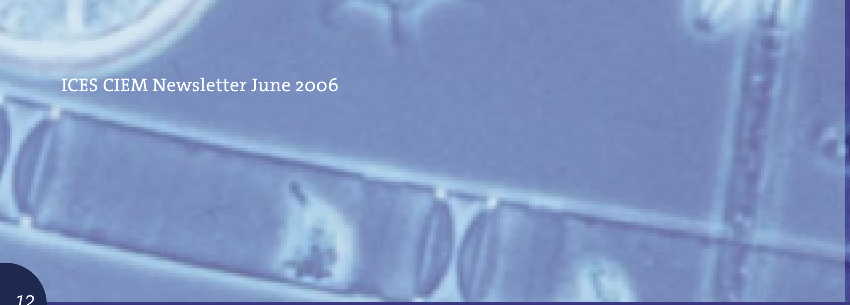
Areas such as the Southern Ocean with high nutrients and low chlorophyll are called HNLC (High Nutrient Low Chlorophyll) areas. The normal type of plankton community in these areas are microscopic phytoplankton called pico- and nano-phytoplankton which dominate. The nine iron fertilization experiments carried out in these oceans have so far shown that adding iron to these waters results in diatom blooms similar to those of the North Atlantic. However, in most cases the fate of these blooms could not be followed because of lack of ship-time or because the fertilized surface patch became disassociated from the water column below it.

To find out what happened to these resulting blooms over a longer time scale I was involved in two experiments that were carried out in the Antarctic in areas of relatively stable water. The first experiment involved releasing iron over a 100 km^2 patch to fertilise the 80-m deep nutrient-rich, mixed layer, bringing iron levels up from the very low values characteristic of HNLC waters, to values typical for productive coastal regions (from 5 to 100 nanogrammes/litre). We achieved this by putting just 6 tonnes of iron sulphate powder into the water; the equivalent of 1 kg per 2 million cubic metres. This figure conveys an impression of the minute amounts of iron required to revive anemic plankton and we used the same iron sulphate powder—a waste product of the titanium industry—that is sold by gardening shops to improve lawns.

In the first experiment a large spring diatom bloom developed in an 80-m deep, mixed water layer and in the presence of exceptionally dense stocks of protozoan and copepod grazers. Indeed our results indicated that the copepods fed selectively on the protozoa, thus relieving grazing pressure on the diatoms. Neither the deep mixed layer nor the heavy grazing pressure prevented large-celled diatoms from building up a high biomass within 3 weeks during which the patch size increased from 100 to 900 km^2 due to horizontal dispersion. The ship had to leave the experimental site while the bloom was still growing.

"WE ACHIEVED THIS BY PUTTING JUST 6 TONNES OF IRON SULPHATE POWDER INTO THE WATER; THE EQUIVALENT OF 1 KG PER 2 MILLION CUBIC METRES."

We had more time for the second experiment which also built up biomass equivalent to a North Sea spring bloom (300 mg chlorophyll/m^2), albeit in a 100-m deep mixed layer and during late Antarctic summer. Twenty-five days after the first iron addition several of the diatom species suffered mass mortality in the surface layer and sank out of it. We were able to record the sinking rate



"It is very likely that adding iron to N. Atlantic waters will also boost growth rates of the plankton although the effect will probably not be quite as dramatic as in the HNLC areas."

of the diatoms which reached the sea floor at a depth of 3,700 m within a week – an extremely fast sinking rate of over 500 m/day. And because of the depth of the nutrient-rich mixed layer only a small fraction of the nutrients, nitrate and phosphate, were actually used by the bloom. However, in an experiment carried out in the calmer North Pacific, the diatom bloom developed in a 10-m deep mixed layer until all the nitrate was consumed within 10 days.

These experiments have unambiguously shown that ocean productivity is limited by iron availability. This applies not only to the phytoplankton but also to other components such as bacteria and zooplankton. It is very likely that adding iron to North Atlantic waters will also boost growth rates of the plankton although the effect will probably not be quite as dramatic as in the HNLC areas. *In situ* experiments have greatly furthered our understanding of how open ocean ecosystems function and how the organisms of the plankton interact with one another and with the environment to drive the biogeochemical cycles of our planet.

Photo by Dr U Bathmann

Kick-starting phytoplankton blooms to fight global warming

Iron fertilisation experiments to kickstart phytoplankton blooms will receive a lot more publicity in the coming years because of their potential to help combat global warming. This is because phytoplankton absorb CO_2 from the atmosphere and convert it to organic carbon. A large-scale iron fertilization of the Southern Ocean could potentially sequester up to 1 gigatonne CO_2/year – equivalent to about 15% of the current anthropogenic annual input to the atmosphere. This deals with much more CO_2 than any other CO_2 reduction strategy and the technique is much less expensive, both in cash and in energy units. Also, although it would mean artificially manipulating a natural process, it is worth noting that the amount of phytoplankton in the sea is never stationary. For instance, during the drier and dustier glacial periods there was far more iron—wind-born dust, etc.—available to enter the Southern Ocean, and thus phytoplankton productivity was much higher there than it is now.

"These experiments have unambiguously shown that ocean productivity is limited by iron availability."

Perhaps, today, we can afford to oppose adopting the idea of manipulating phytoplankton blooms with iron, but in the coming years I feel that we will have no choice and be forced to apply all measures that hold any promise to delay the melting of ice caps such as those of Greenland or the West Antarctic.

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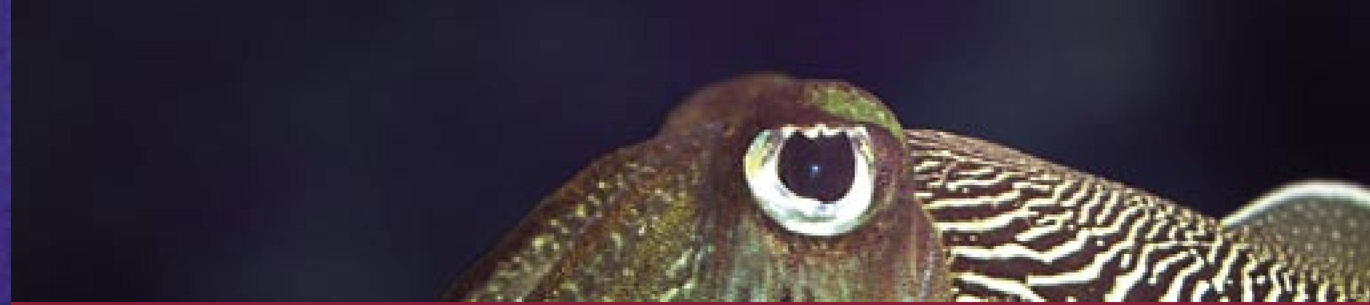


Interview with the new ICES General Secretary, Gerd Hubold

Could you start by telling our readers a bit about your background, before you took over the role of ICES General Secretary in February 2006?

As long as I can think back, for me there was no doubt that I wanted to be a biologist, and work on fishes and their environment. After school I went to Cologne University for courses in biology, and from 1972 to Kiel University, where a specialization in fisheries biology was offered. My scientific work started at Kiel in the mid-1970s with a study on growth changes of North Sea herring (published in ICES Rapp. Proc. Verb. in 1978), which was guided by Prof. Gotthilf Hempel (ICES President 1979–1982). Under his direction I went to Brazil in 1977 and worked for three years in a marine research project on the life cycle of anchovy with several Brazilian Universities and the Hydrographic Institute in Rio de Janeiro.

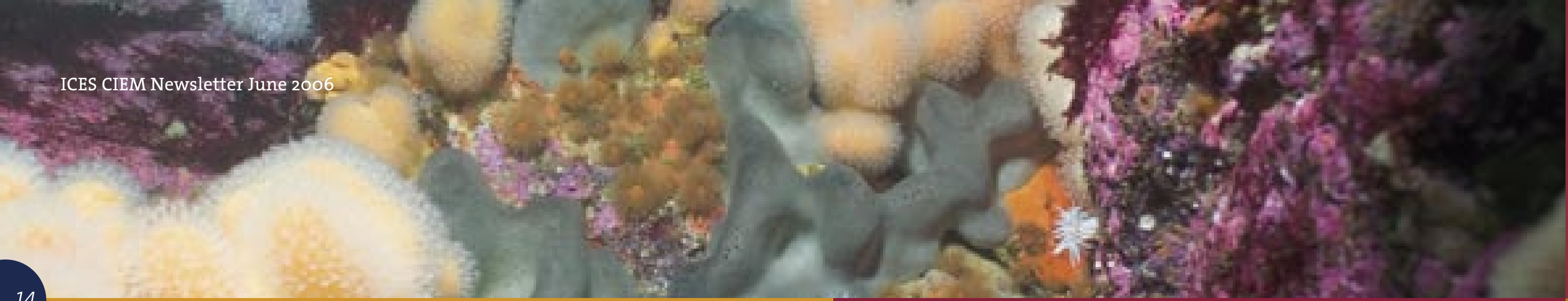
Later in 1982, I joined the newly established German Antarctic research programme and worked for almost ten years on the ecology of fishes in the high Antarctic ecosystem of the Weddell Sea, complemented by some work in the Arctic. I left Gotthilf Hempel´s group in 1991 and became director of the German Federal Fisheries Institute in Hamburg, where I also was elected director general of the research center, until the end of 2005. This German institution is one of the dedicated ICES member institutions, and in my capacity as a director, I served as German Delegate to the ICES Council from the late 1990 onwards, taking up some functions such as Chair of MCAP, member of Finance Committee, and ICES Vice President 2004/5.

ICES has been coordinating and promoting marine science for over a century – why do you think the organization has stood the test of time?

Part of the answer to this can be drawn from my own experience working with ICES. My early work on herring was set up and conducted within the ICES scientific framework, and in particular driven by the 1975 Aarhus Symposium on "Long-term changes in the North Sea". This conference set the stage for the following decades of research on "changes" in marine ecosystems, and ICES had from the beginning taken the lead in such studies in the North Atlantic. The ICES approach brought together results and participation from all components of the research community. Young academics were given a chance to present their science and discuss with the old hands, and become a member of the ICES family. And we learnt an important message about our science: bring it into a larger international and multidisciplinary context and make it relevant for society by being useful for the use and protection of marine ecosystems.

Research vessels line Copenhagen harbour to celebrate ICES Centenary in 2002

"...We learnt an important message about our science: bring it into a larger, international and multidisciplinary context and make it relevant for society by being useful for the use and protection of the marine ecosystems"



"It is the ecosystems that have to be better understood and preserved to allow the species to thrive, and provide a sustainable harvest of marine production to mankind."

For me it has always been clear that ICES is the umbrella for interdisciplinary marine research in the North Atlantic, and that this umbrella adds value to the single research groups by coordinating, channelling, quality checking, and transforming individual science into more relevant cooperative research and advice, relevant for management and society.

The two pillars – science and advice – have been the foundation of the ICES idea since its inception in 1902, and they are now the backbone of the ICES Strategic Plan. It is this unique combination of client-related advisory function and high quality science which keeps ICES relevant now, and into the future.

What do you think the priorities and challenges are going to be for ICES over the next ten years?

We are witnessing a dramatic intensification of the use of the oceans, which carries the risk of local disruption, overexploitation, and damage to the marine ecosystems. To curb the negative effects of human activities, and develop a vision for the future of the oceans, maritime policies have become more and more science-dependent.

Surprisingly, the scientific basis on which managers and politicians have to rely has not been growing according to this demand in some of the most important fields. Instead it has been eroded over the past years. In my view there are two key reasons: the first is reduced funding of long-term research programmes which produce the necessary data for the predictive models that tell us about the future of the oceans under increasing human exploitation; the second problem is increasing pressure which is laid on those scientists who carry the responsibility for the applied science and advisory process. The latter argument has only recently come to our attention through an analysis conducted under an EU-funded research project showing how scientists involved in the advisory process see themselves, their job satisfaction, their future, also in relation to their colleagues from the "pure" science area – their view is not very optimistic!

ICES, as the responsible international organization with the role of coordinating and producing science and practical advice has to do its utmost to make sure that the human basis for our important work does not disappear over the next years – we must invest in young scientists, increase our engagement in education and training, and refine our coordination of the scientific process by providing the best infrastructure to our scientists, in logistics, databases, publication channels, and personal attention on their day-to-day needs to make the international cooperative work in our work groups as efficient as possible.

Another challenge, closely linked to this is the maintenance of scientific excellence and independence in situations, where stakeholder groups want to influence the scientific process for their respective goals. We need to strike a balance between the necessary openness and transparency, and the integrity and independence of the scientific process.

How is ICES responding to the change in focus from single-species to ecosystem-based management of fisheries?

Traditionally, fisheries advice was requested for single stocks of fishes in predetermined sea areas. Accordingly, the models used were shaped for this purpose. On the scientific side of ICES however, multispecies and ecosystem studies have been conducted over many years for the sake of knowledge-gaining on the studied systems.

Now that management is beginning to take these aspects on board, and with the increasing attention to fisheries in an ecosystem context, other scientific input is requested by the marine managers. ICES can draw on its long-standing ecosystem experience in many of its member institutes and university groups and develop the new models better than most players around. However, the experience we have also makes it clear from the beginning that these new demands will not be met simply by a few months or years of additional research. Complex marine ecosystems will not be easy to model.

What do you think is the key to better management of fish stocks?

Better data is crucial. After some one hundred years of fisheries science we now have a rather sophisticated theoretical basis for reliable fish stock models. Unfortunately, we cannot use these models to their full potential as we only have a few coherent, long-term data-series on key fish stock and environmental parameters.

Even today, the quality of some fisheries data is poor and corrupts the scientific analysis. As a compensation, data from scientific surveys have to be used, but these are limited by diminishing funding of fishery research vessels and surveys. This means that advice on fish stocks still has wide error margins, thus complicating management decisions.

Complete statistics on catches, bycatches, and discards (not just on landings) and financial support to international scientific surveys and the related science institutions could definitely improve the advice on which management is based. A better compliance with the established TAC and quota would improve the effects of management decisions, which today often fail due to excessive catches.

Which marine species do you find most fascinating, and why?

Every single species is the result of a billion years of evolution on earth – and each is unique and fascinating. As an ecologist I am most intrigued by the sophisticated cohabitation of organisms and their environment. It is the ecosystems that have to be better understood and preserved to allow the species to thrive, and provide a sustainable harvest of marine production to mankind.

What has been the most memorable moment of your career as a marine scientist?

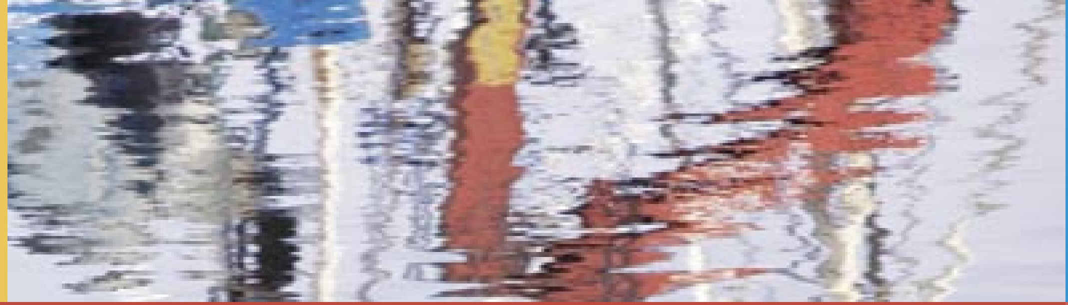
When starting to work in Antarctica, our default hypothesis, as humans, was that the species living under those harsh conditions would have a difficult life coping with their icy environment (in winter, 80% of the Weddell Sea is sea-ice covered). At closer scrutiny, however, it turned out that the opposite was true. In the million-year-old Antarctic marine system, organisms have adapted so perfectly that they do in fact lead a very comfortable life with low temperatures and the ice, and the main threat to them is actually if the ice disappears too early in the season. Weddell seals and Emperor penguins need a stable sea ice cover to bring up their young, Antarctic krill survives much better if the sea is ice-covered, and many fishes use the ice as a substrate for spawning. To me, this was an example of how wrong we can be if we try to interprete marine ecosystems from our human/terrestrial point of view.

What hobbies/interests do you enjoy when you are not in the office?

My point of rest and recovery is my family, my old house in Kiel, and the garden. Gardening is a good way to spend time with nature and you can learn a lot about ecology if you do it properly. Another activity I like is hiking through forests and along beaches, or biking in nature. For the cold season I keep an aquarium with African cichlids and I try to find some time to read books and listen to my old record collection of rock, jazz and Brazilian popular music.

"...data from scientific surveys have to be used, but these are limited by diminishing funding of fishery research vessels and surveys." Photo courtesy of the Marine Institute, Ireland

Top photos by Paul Kay www.marinewildlife.co.uk



Developing science for fisheries management in a changing climate

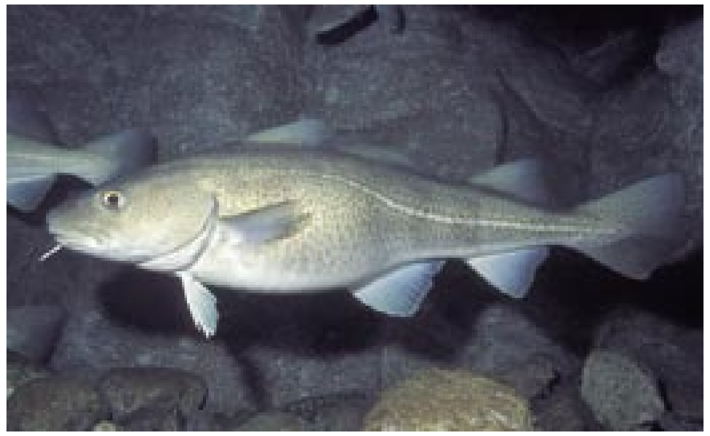
The increasing evidence that the climate is changing has meant that there is now widespread public acceptance that human activities have set in place a series of far-ranging environmental changes. It has been acknowledged that these changes, which include warmer sea temperatures, could be influencing the distribution of temperate fish species and affecting the recovery of fish such as North Sea cod. And it has even been suggested that because fisheries management has traditionally assumed that the environment is in a steady state, the 'fisheries crisis' has in fact been partly driven by the changing climate because stock predictions may not have adequately considered climate change.

Whatever the viewpoint, there is certainly a pressing need to examine the extent to which natural drivers, such as climate, and human impacts (including increasing background levels of contaminants and fishing) interact to influence fish population dynamics. With EU-funding under the Framework 6 Programme we hope to improve our understanding of these processes with a new project: Incorporating Extrinsic Drivers into Fisheries Management (IN EX FISH). The project aims to increase the responsiveness of fisheries management to a range of human and non-human effects on the marine environment. Future fisheries management will require this understanding of all the main influences, human and natural, on fish populations, particularly when attempts are made to rebuild fish stocks.

"IN EX FISH aims to increase the responsiveness of fisheries management to a range of human and non-human effects on the marine environment."

Why it came about

Many of the IN EX FISH team were previously involved in the development of a European Fisheries Ecosystem Plan (EFEP) (www.efep.org). The EFEP consultation with stakeholders—fishers and their representatives, regulators, social and biological scientists, ENGOs, and local government officials—voiced the opinion that climate effects were important drivers affecting commercial fish and other aspects of the ecosystem, including plankton productivity.



"Furthermore, fishers complained that they were hit by regulations because it was easier to impose restrictions on them than to investigate other possible contributory factors to stock decline and ecosystem deterioration."

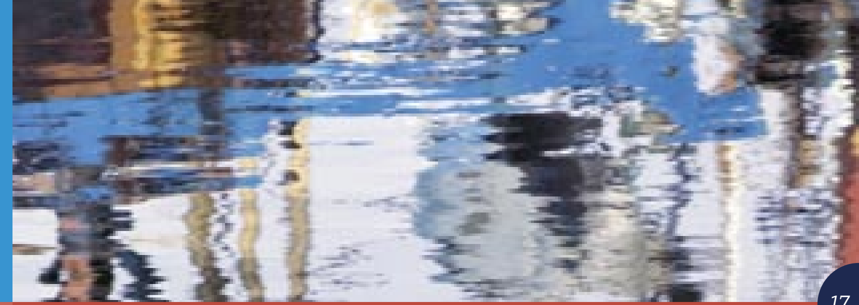
Furthermore, fishers complained that they were hit by regulations because it was easier to impose restrictions on them than to investigate other possible contributory factors to stock decline and ecosystem deterioration. IN EX FISH responds to these concerns by addressing the science of fish stock dynamics.

How we're going to do it

Fish populations can be altered in a number of ways, for example they can decrease if individuals of a particular size of a species are targeted, as this affects predator and prey dynamics. Fishing, however, is not the sole driver of changes to marine life – pollution can affect populations, for example, by affecting the reproduction rate of individuals.

Photos by PaulKay www.marinewildlife.co.uk

"FISHING, HOWEVER, IS NOT THE SOLE DRIVER OF CHANGES TO MARINE LIFE — POLLUTION CAN AFFECT POPULATIONS, FOR EXAMPLE, BY AFFECTING THE REPRODUCTION RATE OF INDIVIDUALS."



Part of the problem is that there is no single, tidy solution to addressing the issue of considering the many drivers that affect fish populations. In addition, different drivers have different effects and drivers do not operate in isolation.

The first phase is to identify which drivers and combinations of drivers are the most important. There are different ways of doing this and the project will therefore employ a range of advanced statistical procedures to examine which factors operate and when their effect is exerted during the annual cycle. This will be done for a number of key species/stocks in each region. This is challenging science and will draw on a variety of survey data sets and modelling systems.

Once the most important drivers are selected, work will begin on deciding which metrics (or "yardsticks") could be used in a management framework.

This information will feed into the next phase focusing on developing management plans sensitive to a selection of drivers in four case study areas:

- The Northeast Atlantic (comprising the North Sea regional advisory council (RAC) area; ICES Area VIa and Icelandic Seas);
- the Baltic Sea RAC area, the West Iberian Sea (within the southwestern RAC area); and
- the Mediterranean Sea RAC area.

The case study areas are broadly arranged around Regional Advisory Council (RAC) areas in EU waters since RACs provide a framework for linking stakeholders at the regional and local level with the European Commission and the Member States concerned. They enable the fishing sector to work more closely with scientists and provide a forum for the fishing industry to enter a dialogue and to work with other interested parties on identifying options regarding the management of specific fisheries.

The areas in themselves vary, from the open oceanic regime (Icelandic waters) to the relatively enclosed, shallow inland sea (typified by the Baltic area). The use of carefully selected areas allows contrasts and comparisons to be explored. The enclosed nature of the Baltic and Mediterranean means that both may be more liable to show impacts from chemical contaminants than the open, oceanic Icelandic and Iberian regions, with the North Sea being intermediate. The oceanic regime in the Icelandic and Iberian regions and northern North Sea may result in strong climatic drivers operating here, thus contrasting with the more terrestrially influenced climates in the Baltic, Mediterranean, and southern North Sea.

By developing these contrasts and comparisons, the project will be able to assess the relative importance of the different drivers, and consider the extent to which a single model of drivers operates (with different parameter values) or whether there are more fundamental differences in system dynamics that a management regime would need to take account of.

The results from the case studies will be discussed with stakeholders at a series of workshops to determine the acceptability of the management tools, metrics, and methods required to support the tools developed.

Ultimately, a suite of management tools will be developed, incorporating metrics and reference levels which can be integrated into the European fisheries management processes.

These will be for the studied, existing, exploited stocks on geographic scales. But through the identification of commonalities, extrapolative mechanisms for use in data-poor situations and emerging management scenarios (offering potential management options through best-use of existing available information) will be also developed.

Developing management tools which are more sensitive to the wide range of drivers which affect fish populations addresses both an important stakeholder concern and will in the end provide more responsive methods to manage fisheries in a more sustainable way.

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"AFTER ASSESSING THE LEVEL OF INTERACTION BETWEEN FISHERIES AND THE NATURE CONSERVATION INTERESTS AND OBJECTIVES, THE PROJECT WILL DEVELOP MANAGEMENT PROPOSALS."

Managing fisheries in Marine Protected Areas

While most people like to eat fish, the process of catching them has a number of impacts on marine ecosystems. These include the obvious removal of biomass when fish are taken from the sea, discarding of unwanted bycatch, and damage by fishing gear such as bottom trawls. Moreover, fisheries are thought to have major impacts on the function of marine ecosystems in heavily-fished areas, for instance by causing shifts towards smaller fast-growing fish species as bigger fish are rapidly caught and removed from the ecosystem.

One promising approach to reduce the impact of fishing on marine ecosystems is the idea of establishing networks of Marine Protected Areas (MPAs) at local, regional and global levels. In European waters the main way this is being achieved is through two types of protected areas: Special Protected Areas (SPAs) for birds which are put in place through the Birds Directive (79/409/EEC); and Special Areas of Conservation for habitats and species, which are put in place through the Habitats Directive (92/43/EEC).

Implementation of both Directives is a legal obligation on EU Member States and provides major elements in the protection of the marine environment in European waters. Both types of protected areas will form a European network of MPAs within the so-called NATURA 2000 network, which includes both marine and terrestrial protected areas. The aim is to complete designations of the SPAs and SACs by 2008 in order to finish the marine NATURA 2000 network by 2012.

While the primary aims of the NATURA 2000 network are to protect threatened, endangered and/or declining species and habitats, the Marine Protected Areas created through the network are also expected to have positive effects on overexploited fish stocks. For instance closed areas are not new concepts in fisheries management: on the contrary they are approved management tools to improve fish stock productivity and/or to protect local fisheries. Their target, however, is to optimize fisheries yields, and thus they are different from the targets of nature conservation. However, benefits for both the marine environment and the fisheries can be expected if both targets can be successfully harmonized in fishery management plans.

NATURA 2000 in German waters

In May 2004 Germany nominated ten NATURA 2000 areas in the offshore areas of its EEZ in the North Sea and Baltic Sea to EU (see Figure 1). Germany is the first EU Member State with a complete set of marine NATURA 2000 nominations. The nominated MPAs within the German EEZ account for 31.5% of the total offshore German marine area.

In February 2006, ICES started a new project entitled "Environmentally Sound Fishery Management in Protected Areas" to develop fisheries management plans for each of the ten German NATURA 2000 areas. The project is funded by the German Federal Agency for Nature Conservation (BfN) and will run for three years with the first project workshop taking place in April 2006.

A harbour porpoise - one of the species protected in the German Natura 2000 areas. Photo by Florian Graner www.naturepl.com

For each of the ten designated German MPAs the central questions to be answered are:

1. to what extent do the fishing activities in the MPA represent a significant interference with the NATURA 2000 concept and objectives;
2. to what extent do the fisheries activities need to be regulated; and
3. how can the regulations be balanced with the requirements of NATURA 2000 and the fisheries.

The answers to these questions will be based on existing and, where appropriate, newly collected data – in particular from cooperation with fishers and the fishing industry. The project intends to significantly improve the data used for evaluation of the potential conflicts between fisheries and nature conservation interests in German waters and will require an analysis of the fishing activities of all fishing vessels operating in (and around) the MPAs.

After assessing the level of interaction between fisheries and the nature conservation interests and objectives, the project will develop management proposals. A key part of these proposals may be concrete recommendations for fisheries management measures such as the spatial and temporal regulation of the fishery (e.g., no-take zones), the introduction of sustainable fishing methods that better comply with ecosystem requirements, and other management measures (e.g., banning discards) to ensure that activities within the NATURA 2000 areas are being conducted in an ecologically sound and sustainable way.

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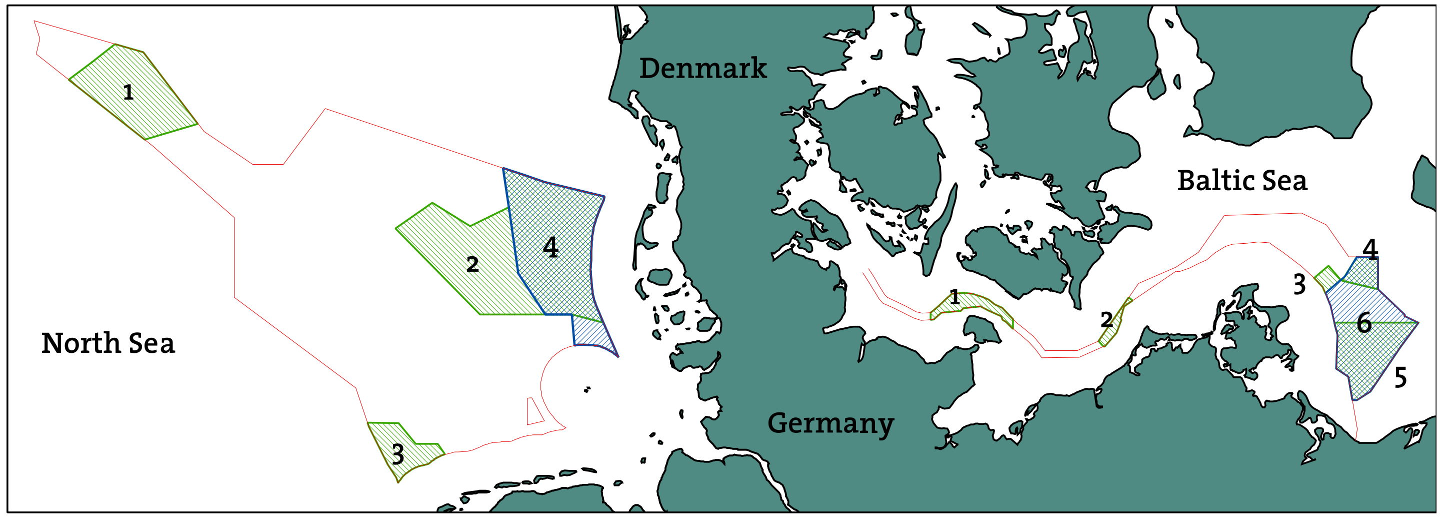
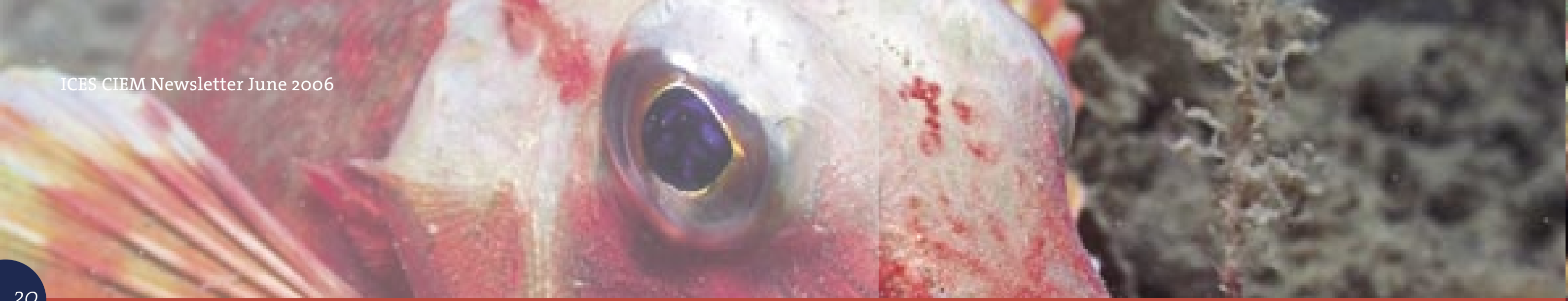
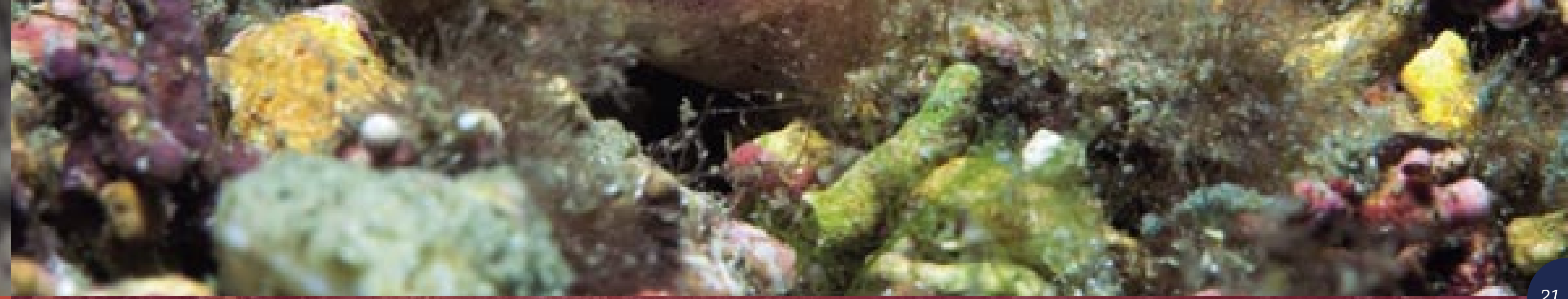


Figure 1. *The ten nominated NATURA 2000 sites in German EEZ. There are eight proposed Sites of Community Importance (pSCIs) (green areas in Figure 1) - three in the North Sea and five in the Baltic Sea. In addition there are two Special Protected Areas (SPA) (blue areas in figure) – one in the North Sea and one in the Baltic Sea. For more information see:* www.habitatmare.de

North Sea *(habitats and species to be protected): 1* – Doggerbank *(sandbank, Harbour porpoise, Harbour seal); 2* – Sylt Outer Reef *(sandbank, reef, Harbour porpoise, Harbour seal, Grey seal, Lamprey, Twaite shad); 3* – Borkum Reef Ground *(sandbank, reef, Harbour porpoise, Harbour seal, Grey seal, Twaite shad; 4* – Eastern German Bight SPA *(Seabirds: Red-throated diver, Black-throated diver, Northern gannet, Little gull, Common gull, Lesser black-backed gull, Great black-backed gull, Kittiwake, Sandwich tern, Common tern, Arctic tern, Guillemot, Great Crested Grebe, Fulmar, Common scoter, Black-headed gull, Herring gull, Razorbill).*

Baltic Sea *(habitats and species to be protected): 1* – Fehmarn Belt *(sandbank, reef, Harbour porpoise, Harbour seal); 2* – Kadet Trench *(reef, Harbour porpoise); 3* – Adler Ground *(sandbank, reef, Harbour porpoise, Grey seal); 4* – Western Rønne Bank *(reef, Harbour porpoise); 5* – Pommeranian Bay with Odra Bank *(sandbank, Harbour porpoise, Sturgeon, Twaite shad); 6* – Pommeranian Bay SPA *(Seabirds: Red-throated diver, Black-throated diver, Red-necked grebe, Slavonian grebe, Common eider, Long-tailed duck, Common scoter, Velvet scoter, Little gull, Black guillemot, Great Crested Grebe, Herring gull, Common gull, Lesser black-backed gull, Great black-backed gull, Black-headed gull, Great Cormorant, Guillemot, Razorbill).*





Understanding 'Essential Fish Habitat'

Essential Fish Habitat (EFH) is a term used to describe the habitats that a fish needs during its life. These include spawning grounds, nursery areas, feeding grounds, migration routes, and habitats that provide shelter from predators. The term was coined in the US when the Magnuson-Stevens Fishery Conservation and Management Act was amended in 1996 and suddenly required fisheries managers to consider the implications of fishing activities (and the consequences of management actions) on 'Essential Fish Habitat' or EFH.

The interaction between fish that spend all or part of their lives in freshwater and their habitat is well understood, although issues of the appropriate spatial and temporal scales for effective management remain a current challenge. However, the Magnuson-Stevens Act brought into sharp focus the extent of the gaps in our current knowledge of the habitat requirements of all but the most well-studied marine fishes, particularly the adult stages.

The juveniles of most species tend to inhabit inshore shallow waters and estuaries and it is relatively straightforward to protect this life-stage through the exclusion of some or all fishing activities. The distribution of adult stages is relatively well-known through fishery-independent trawl surveys. However, the coarse scale at which these surveys are conducted means that they provide only an indication of where fish occur in highest abundance/biomass, and offer only an incomplete insight into the large-scale (>100 km) environmental gradients that determine such distributions (temperature, depth, salinity, etc.). Within these large-scale areas, the direct effects of fishing activities on seabed habitat are patchy in line with the distribution of fishing effort. Hence, if we are to understand how fishing might affect EFH, it is necessary to understand how fish use habitats at an appropriate scale. This has lead to a number of recent studies both in North America and Europe, although they have been restricted in the number of species studied.

"ESSENTIAL FISH HABITAT (EFH) IS A TERM USED TO DESCRIBE THE HABITATS THAT A FISH NEEDS DURING ITS LIFE"

So what insights have we gained to date? Experimental studies of Atlantic cod and Pacific halibut juveniles reveal a strong behavioural preference for habitats with an emergent geological or biological structure (e.g. hydroids, soft corals, stones, cobbles). The option to hide from predators appears to be important for many fish in their juvenile stage, and for cod this observation has been reported in at least four different studies. For some species, e.g. whiting the close association with structured habitat is lost at a threshold size when schooling behaviour becomes a more effective anti-predator strategy.

"THE OPTION TO HIDE FROM PREDATORS APPEARS TO BE IMPORTANT FOR MANY FISH IN THEIR JUVENILE STAGE, AND FOR COD THIS OBSERVATION HAS BEEN REPORTED IN AT LEAST FOUR DIFFERENT STUDIES."

For other fishes, however, habitat structure assumes a different role. For example silver hake use sand-wave structures as cover from which to ambush approaching prey. Parameters such as sediment grain size critically determine burial ability for some juvenile flatfishes and rays. Thus for marine demersal (bottom-living) species, the link between habitat-type and occurrence seems to be strong for the juvenile life stages.

"...IF WE ARE TO UNDERSTAND HOW FISHING MIGHT AFFECT EFH, IT IS NECESSARY TO UNDERSTAND HOW FISH USE HABITATS AT AN APPROPRIATE SCALE."

As fish increase in size, the risk of predation declines as does the dependence upon habitat as a refuge. Post-juvenile demersal species such as whiting spend less time near the seabed and their preference for certain habitat substrata can be reversed. In temperate seas, the adults of many species appear to be habitat generalists capable of feeding on a wide variety of prey-types across a range of habitats. In other words, habitat specificity seems to decline with age and size.

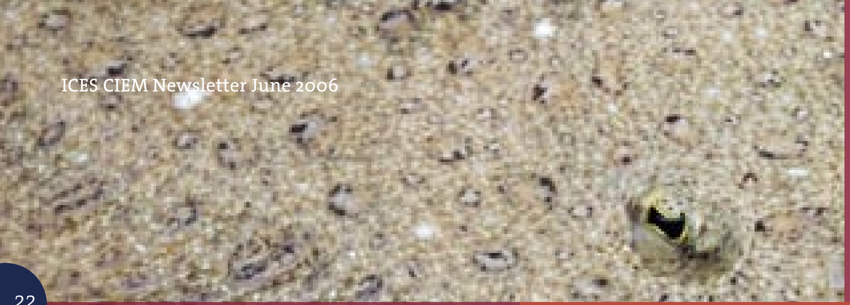
Nevertheless, fish aggregate in habitats that have a high carrying capacity and production. Clues to the whereabouts of such areas can be found if we look for stable patterns in fish distribution across time. This approach, in addition to modelling of the distribution of biomass and production of potential benthic biota would provide a predictive basis for focusing our studies on areas that are potentially important due to their high carrying capacity.

The quality of fish habitat varies at both a regional and local scale. Some regions (>100 km) are more productive than others, due to the influence of underlying geology and prevailing environmental stressors (wind and current stress) and variation in phytoplankton production. Within these regions, habitat quality varies considerably (< 10 km) according to seabed topography and coastal discharges.

It is at the smaller scale that management measures are likely to occur with respect to controlling activities that might adversely affect fish habitat (e.g. aggregate extraction, dredge spoil dumping). However, identifying exactly which of a number of environmentally distinct habitats is the key habitat for a particular fish species is highly problematic. This relates to the means by which we typically sample fish. The use of towed fishing gear as a sampling tool seems straightforward enough, but even a 15-minute tow can traverse three very distinct habitats. How can one tell at which point the fish in the codend were sampled? Direct means of observation such as ROVs (Remotely Operated Vehicles) overcome this problem, but their use is constrained by currents and water clarity. Our own attempts to disentangle the habitat requirements of adult plaice have used a combination of visual and remote sampling techniques. These studies indicate that the best feeding habitats for plaice are created by a mosaic of habitat types, some of which provide rich feeding areas while others provide shelter while the fish remain inactive.

Photos by PaulKay www.marinewildlife.co.uk

"AS FISH INCREASE IN SIZE, THE RISK OF PREDATION DECLINES AS DOES THE DEPENDENCE UPON HABITAT AS A REFUGE."



"In temperate seas, the adults of many species appear to be habitat generalists capable of feeding on a wide variety of prey-types across a range of habitats."

At a broad scale, our knowledge of the distribution and spatial extent of nursery and spawning areas is reasonably accurate and probably sufficient for the purposes of management. However, our understanding of the temporal variation in habitat use and the extent over which temporal species range make it a challenging task to identify precisely the linkage between individual species and specific habitat characteristics. Ultimately, limiting the negative effects of fishing activities can be achieved through reductions in effort and re-building stocks. This still leaves the issue of site-by-site considerations of other potentially habitat modifying activities such as aggregate extraction, land-reclamation, and spoil discharge. Much remains to be learned about the habitat requirements of marine fish, but it is a task we will need to confront to provide appropriate advice if we are to adopt an ecosystem approach to management.

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Monitoring sea conditions with the help of lobster fishermen

Every year lobster fishermen put out millions of lobster traps all over the Gulf of Maine (GoM) and southern New England Shelf. Because the traps spend long periods in the water they are ideally placed to monitor sea conditions and, thanks to the help of more than 100 lobstermen along the New England coast (Figure 1) that is exactly what the traps are now doing. eMOLT (Environmental Monitors on Lobster Traps) is a ground-breaking new project between fishers, scientists, and students, who have joined together to monitor the physical environment of the Gulf of Maine and the Southern New England shelf.

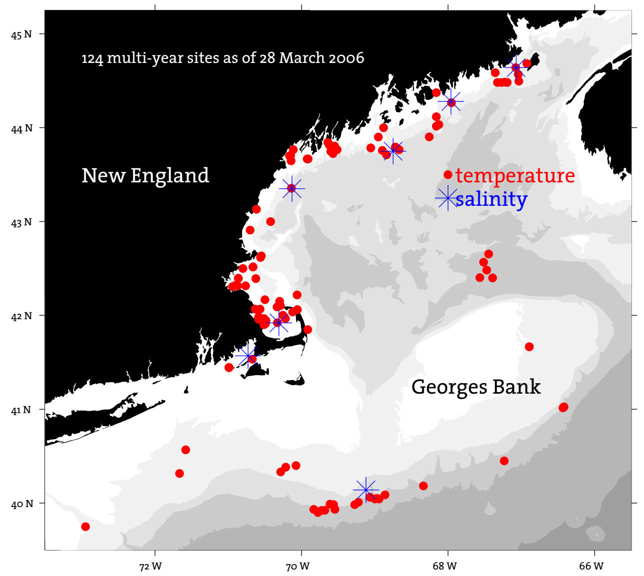


Figure 1. Multi-year bottom-temperature (red) and one-year salinity (blue) sites maintained by lobstermen where each lobsterman typically deploys one or two sensors.

The project has focused on putting low-cost instruments on lobster traps to record variables such as temperature and salinity and deploying GPS instruments in the sea to record current strength. Since the project began in 2001, the lobstermen have now provided over two million hourly-records of temperature (Figure 2), 80 000 hourly records of salinity, and 50 000 hourly satellite drifter fixes. While the project is focusing on lobster science (the need to document background conditions and how these relate to lobster populations), the database is also accessible to the general public and the recently-formed GoM Ocean Data Partnership in the form of web-served products and raw data (see www.emolt.org and/or www.northeastconsortium.org)

About eMolt

eMOLT was funded by a series of cooperative research grants from Northeast Consortium (2001–2005). The eMOLT partners currently include all the major lobstermen associations in New England (Maine, Massachusetts, Downeast, and Atlantic Offshore), a NOAA scientist from the Northeast Fisheries Science Center, the Gulf of Maine Lobster Foundation, and the Marine Science Department at the Southern Maine Community College (SMCC). The eMOLT philosophy is that local fishermen already spend their days at sea, have the best knowledge of their local waters, and have the biggest stake in preserving coastal marine resources.

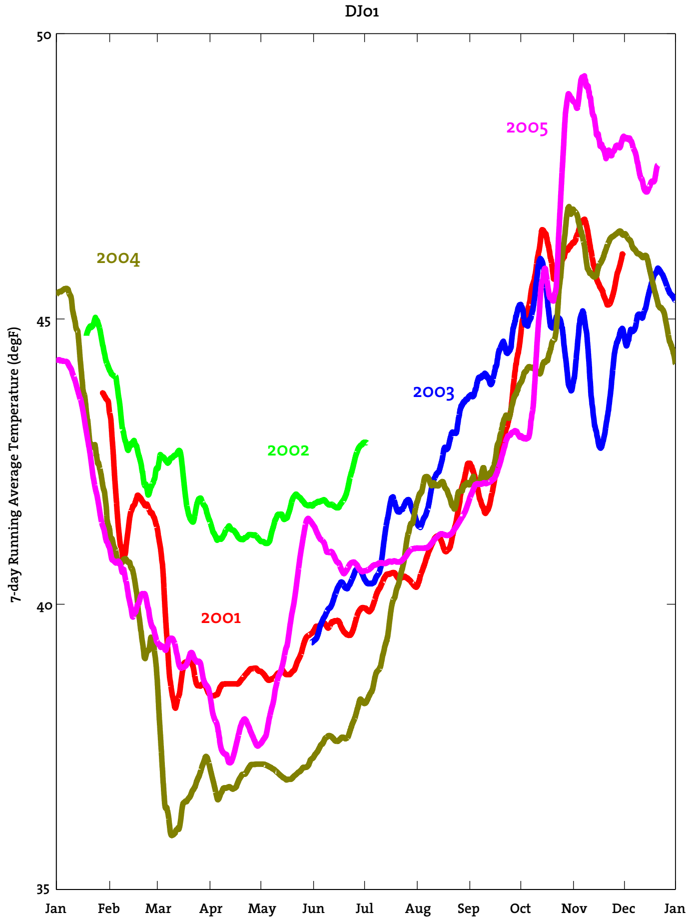
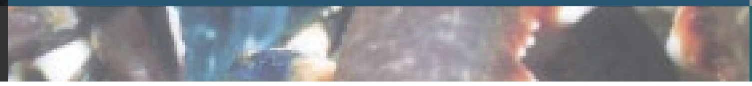


Figure 2. Example of one lobsterman's multi-year, bottom-temperature record.

"The objective of eMOLT is now to extend the existing multi-year time-series as well as the monitoring capabilities for many years to come."



In a quest to minimize the cost of instruments eMOLT set up a partnership with Southern Maine Community College students and local engineers in the private sector to develop low-cost monitoring devices – also likely to be of interest to the wider oceanographic community. The first is a GPS drifter which costs more than 50% less than the conventional units and works with the GLOBALSTAR low-orbiting satellite system. These units have already logged more than 50 thousand kilometers of ocean (Figure 3) and are now being used by several other research groups. Another new device is a "real-time" bottom temperature sensor (attached to lobster traps) that wirelessly transmits data to a shipboard system as it is hauled on deck. While the drifters are fully operational, the wireless temperature sensors are still under development.

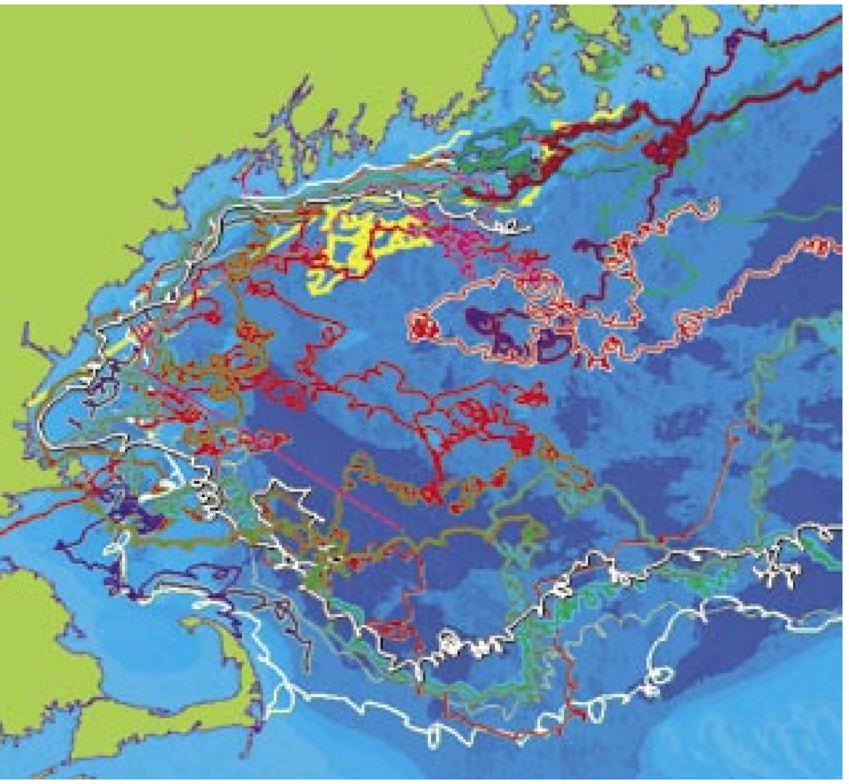


Figure 3. eMOLT drifter tracks in the Gulf of Maine deployed to monitor potential drift of lobster larvae and harmful algal blooms.

It is expected that the primary users of eMOLT data, aside from the lobstermen themselves, will be local ocean circulation modelers. The need for data for their numerical simulations is becoming more and more obvious. The complex, time-varying nature of the Gulf of Maine system calls for incorporating as much data as possible in order to generate realistic current flow fields. The goal is to supplement the data supplied by the Gulf of Maine Ocean Observing System (GoMOOS) by providing modelers with an extensive array of bottom observations as well as Lagrangian drifter tracks with the hope that these numerical models will someday help us to better understand lobster larvae drift and the fate of any particles for that matter — such as Harmful Algal Blooms — along the coast. The data may also help us to better understand the mechanisms that govern both the short-term and long-term variability of the GoM ecosystem and the future question is, can we generate realistic, time-varying, 3-d simulations of these changes?

The objective of eMOLT is now to extend the existing multi-year time-series (Figure 2) as well as the monitoring capabilities for many years to come. Integration with other long-term operational systems in the region such as the GoMOOS and Nova Scotia's Fishermen and Scientist Research Society (FSRS) is also underway.

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Top photo by Paul Kay www.marinewildlife.co.uk

Fishing for cephalopods

Squid, octopus and cuttlefish – the cephalopods – currently make up an unusually low proportion of fishery landings in the Northeast Atlantic region as compared to most other regions of the world, suggesting that they are either unusually scarce here or that they represent an under-exploited fishery resource. Another reason for interest in these species is that cephalopods can move in when fish are overexploited (so-called ecological replacement). The poor state of many traditional fish stocks has inevitably led to focus on alternative resources – and cephalopods are prime candidates. In Britain, for example, where squid have generally been little regarded, the last 3–4 years have seen a marked expansion in small-scale squid fishing. We need to ensure that cephalopods are fished in a sustainable way, taking into account their very different biology and ecology.

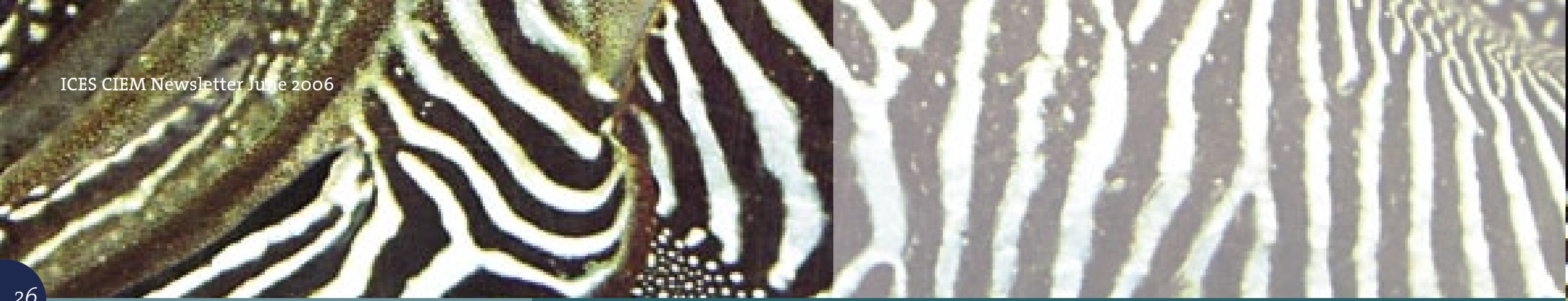
"We need to ensure that cephalopods are fished in a sustainable way, taking into account their very different biology and ecology."

Compared to most fish, cephalopods are short-lived: the common European squid (*Loligo forbesi* and *Loligo vulgaris*) live only for around 18 months and even the giant squid is thought to reach no more than 3 years old. To reach adult size in such a short time, cephalopods have very high growth rates and most are voracious predators. They are also among the most advanced invertebrates, with complex behaviour patterns. Octopuses in particular appear to be highly intelligent. Cephalopods are able to change their body coloration at will, both for camouflage and to communicate with each other.

To take stock of the current state of knowledge of European cephalopods, scientists from 21 marine institutes in 7 European countries recently completed an EU-funded project CEPHSTOCK. CEPHSTOCK had its roots in a series of European research projects on cephalopod biology and fisheries during the 1990s, for which the underlying rationale was that cephalopods had currently unrealised fishery potential in European waters. The CEPHSTOCK project had a number of broad aims, including:

1. Disseminating unpublished research results accumulated over the previous decade;
2. Synthesising the biological and fishery data that may be needed to assess cephalopod stocks and manage them in a sustainable way;
3. Reviewing relevant stock assessment methods and management options; and
4. Highlighting knowledge gaps and identifying research priorities.

The geographical focus encompassed the NE Atlantic and Mediterranean and, to a lesser extent, European fishery interests in other waters, such as the Saharan Bank and the SW Atlantic. The project, which ended in 2005, has confirmed many of our existing ideas about cephalopods as well as revealing a number of new insights.



Cephalopods and the environment

As short-lived species, cephalopods are generally believed to be highly sensitive to environmental changes and many cephalopod fisheries are characterised by sharp year-to-year changes in catches. Relationships with environmental conditions are of two main types: those affecting cephalopod distribution and those affecting biological processes such as spawning, embryonic increment, hatching, growth, recruitment, maturation, and migration. Sea temperature, productivity-enhancing ocean processes (e.g. upwelling) and current systems (e.g. the Gulf Stream) all appear to play important roles in cephalopod lives – the timing and intensity of these processes act as environmental triggers that affect the various life stages of cephalopods.

"ENVIRONMENTAL VARIATION MAY ALSO STRESS CEPHALOPOD IMMUNE SYSTEMS, LEAVING THEM MORE PRONE TO DISEASES."

Meso-scale (10–100 km) oceanographic features may be important centres of abundance, especially in pelagic squid. Characterization of environmental relationships should permit modelling "Essential Habitat", a topic currently being followed up in the EU-funded project EnviEFH. There is the prospect of exploiting such relationships in GIS-based dynamic mapping tools available to fishery managers and fishers.

Cephalopods and climate change

Cephalopod stocks may prove to be particularly susceptible to certain aspects of climate change. Research in the SW Atlantic has highlighted links between squid recruitment success, seawater temperatures and the El Niño Southern Oscillation, while several studies in the NE Atlantic indicate links between the North Atlantic Oscillation and the timing of life-cycle events, as well as effects on distribution and abundance. The sensitivity of cephalopod growth patterns and abundance to environmental conditions suggests that they may be strongly affected by climate change. Environmental variation may also stress cephalopod immune systems, leaving them more prone to diseases. In captivity, cephalopods are known to be affected by various diseases and parasites but there are few reports available on viral, bacterial or fungal diseases in wild stocks of cephalopods.

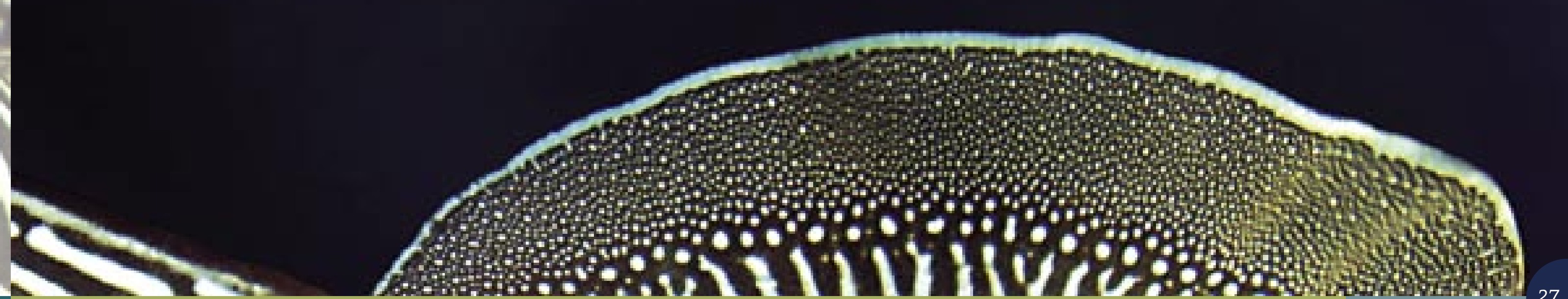
A further effect of climate change is rising CO_2 absorption in seawater which lowers ocean pH. As highlighted during Peter Brewer's open lecture at the 2004 ICES conference in Vigo, Spain, this may be a particular problem for certain oceanic squid of the family Ommastrephidae that are characterised by a high metabolic rate and extremely pH-sensitive blood oxygen transport. A lower pH in the oceans may mean that these species cannot get enough oxygen around their bodies; this is not only bad news for these species but also for the many animals that rely on them for food, including seabirds and marine mammals.

Cephalopod aquaculture

Many cephalopod species have the potential for large-scale culture for human consumption. Among their most attractive characteristics in this respect are a short life cycle, rapid growth (up to 13% of body weight per day) and high food conversion rates (up to 43%). However, to be able to culture cephalopods we need to be able to feed them and this is not easy as they require live prey of an appropriate type and size during their initial life stages. Once a critical size has been reached, it becomes possible to feed the animals on dead prey, considerably reducing maintenance difficulties and cultivation costs.

Among cephalopods, cuttlefish have attracted the most attention of aquaculturists over the years. One example is the National Resource Center for Cephalopods (NRCC, Galveston, Texas, USA), which has achieved production of cuttlefish on a relatively large scale – up to 2000 individuals annually in the last 20 years. NRCC focuses on producing good quality animals for research: production has not yet reached the necessary scale to change the market focus.

"AMONG THEIR MOST ATTRACTIVE CHARACTERISTICS IN THIS RESPECT ARE A SHORT LIFE-CYCLE, RAPID GROWTH (UP TO 13% OF BODY WEIGHT PER DAY) AND HIGH FOOD CONVERSION RATES (UP TO 43%)."



Another cephalopod species that has received a lot of attention from aquaculturists is the common octopus (*Octopus vulgaris*). For a long time now, efforts have been made to artificially complete the common octopus' reproductive cycle in captivity and thus ensure the first step towards the economically viable production of this species – one of the most valued fishery products in southern Europe. While this is still work in progress, a more established form of culture is to take small octopus and feed them up in sea cages. Spain, and in particular Galicia, has led world commercial production of this kind, by licensing companies to collect small specimens of *Octopus vulgaris* and selling them for a higher profit after an ongrowth stage lasting 4 months, during which the animals are fed on commercially discarded fish and crustaceans.

Assessing cephalopod stocks

Papers presented at ICES theme sessions and, in particular, at conferences organised by the Cephalopod International Advisory Council (CIAC), have highlighted the existence of two schools of thought about cephalopod fisheries, which can be crudely characterised as:
(1) squid are not fish; and
(2) oh yes they are!

Some general points can be made in support of both views. As short-lived species with notoriously variable age-length relationships, cephalopods are generally unsuited to the typical VPA[1]-type models used to assess the status of fish stocks. On the other hand, by focusing at a monthly scale, instead of an annual scale, traditional fish stock assessment methods such as cohort analysis can – and have been – applied successfully to cephalopods.

In other parts of the world, both "production" and "depletion" models are used to assess stocks, with some success, and depletion models have also been applied on a preliminary basis to cephalopod fisheries in British and French waters. Overall though, it is clear that species whose abundance fluctuates markedly due to lack of older age classes (to act as a buffer), and that are extremely susceptible to environmental changes, are particularly unsuited to management using quotas. Instead, effort-based management (coupled with real-time assessment) has, in general, served the Falkland Islands squid fishery well. The CEPHSTOCK project reviewed stock assessment methods and fishery management options for cephalopods and highlighted the need for management to be adaptive – and adaptable to the diversity of European cephalopod fisheries.

[1] *Virtual Population Analysis*

Photo courtesy of Form & Zumholz

Photos by Paul Kay
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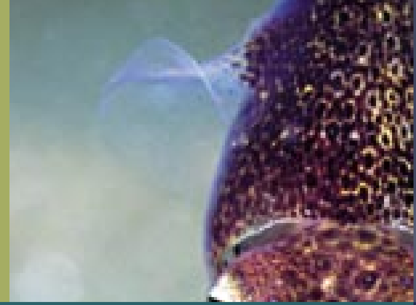

Cephalopod fisheries: poor data collection

The implementation of stock assessment models relies on appropriate stock identification and consistent data collection programmes. Perhaps the most important problem at present is that few European countries collect detailed data on cephalopod fisheries. From 2002, cephalopod sampling became part of the regular official data collection under National Sampling Programmes at a basic level (minimum sampling). However, given the short lifespan of these species, sampling should be intensified to at least a monthly level and a larger number of samples should be considered as minimum. Furthermore, sampling of cephalopods is not part of the core data collection programme of all European countries. The CEPHSTOCK project concluded that, in many national statistical schemes, substantial improvement in sampling is feasible, very often without entailing a comparable rise in costs.

Stock status and trends

For all groups of cephalopods, substantial year-to-year variation in abundance is observed, and different sources of data (e.g. surveys and landings) do not always agree – meaning that trends in abundance can be difficult to identify. In Spanish Mediterranean waters, for instance, surveys suggest that cuttlefish and octopus are currently increasing, but these trends are not evident in the commercial catch data.

Stock assessments have been carried out in Northern European waters for common squid (*Loligo forbesi* and *Loligo vulgaris*) and the cuttlefish (*Sepia officinalis*). Overall, strong seasonality in landings was observed for these species. In the English Channel, squid and cuttlefish do not show strong overexploitation and fishing pressure seems to depend upon annual abundance of these species: in years of high abundance, squid are targeted more than in years of lower abundance.

A promising future for cephalopod fisheries?

If significant expansion of targeted cephalopod fishing does now occur, the timing is arguably good, since much relevant knowledge is available and adoption of the "ecosystem approach" has provided renewed focus on sustainability and the need to fully integrate fishers into the management process. Some important knowledge gaps have been identified, including cephalopod immune function and the prevalence of disease in cephalopods. We also still need information on detailed movement patterns of most fished squid species: to some extent these can be reconstructed from catch data, but monitoring of directed fishing may give us a much better idea of recruitment, feeding, and spawning areas.

Authors: Graham Pierce, Vasilis Valavanis, João Pereira, Marina Santurtun, Jean-Paul Robin, Shelagh Malham

Factbox – CEPHSTOCK Project outputs

The project has produced two journal special issues, arising from an ICES theme session on cephalopod biology and fisheries in 2004 and a dedicated project workshop on assessment methods, also held in 2004:
Payne, A.G., Agnew, D.J., and Pierce, G.J. (Guest Editors), 2006. Trends and Assessment of Cephalopod Fisheries: Proceedings of the CEPHSTOCK Cephalopod Assessment Workshop. *Fisheries Research* 78 (1)
Pierce, G.J., Portela, J.M., and Robin, J.-P. (Guest Editors), 2005. Environmental effects on cephalopod life history and fisheries. *Aquatic Living Resources* 18 (4).

In conjunction with ICES WGCEPH, CEPHSTOCK project participants plan to write a report on cephalopod fisheries for the ICES Cooperative Research Report series and prepare a "guide" to existing cephalopods of fishery importance in European waters. The guide will provide brief summaries of current knowledge. An outlet for this is still being sought.

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Useful websites:

http://www.abdn.ac.uk/eurosquid/cephstock
http://www.thecephalopodpage.org/
http://tolweb.org/tree?group=Cephalopoda&contgroup=Mollusca

"IF SIGNIFICANT EXPANSION OF TARGETED CEPHALOPOD FISHING DOES NOW OCCUR, THE TIMING IS ARGUABLY GOOD..."

BULLETIN BOARD

ICES Working Groups on the Web

If you want to know something about the Northeast Atlantic marine ecosystem then it is more than likely that there is an ICES Working Group that could help. ICES has more than 100 Working Groups that cover subjects ranging from marine chemistry to fish to marine mammals and seabirds. The Working Group reports can be accessed through: http://www.ices.dk/iceswork/workinggroups.asp

"Environmental and Ecosystem Histories in the Northwest Atlantic – What Influences Living Marine Resources?"

This symposium is being held in conjunction with the 28th Annual Meeting of NAFO during 13–15 September 2006 in Dartmouth, NS, Canada. For more information please see: http://www.nafo.int/science/frames/res2006.html

Climate change and fish stocks

Find out everything you ever wanted to know about the influence of climate change on North Atlantic fish stocks with the recently published ICES Journal of Marine Science Symposium Edition (Vol. 62, no. 7, October 2005). Download papers at http://www.sciencedirect.com/

ICES/GLOBEC Symposium: Herring – Linking Biology, Ecology and Status of Populations in the Context of Changing Environments

This symposium will be held in the SAS Radisson Hotel, Galway, Ireland, 26–28 August 2008.

The Theme Sessions will include:
Herring in the middle – the trophic and ecological interactions and impacts of herring;
Managing Change – management and exploitation of herring in a dynamic environment, within the context of long-term change;
Variable Production – particularly the role of reproduction, recruitment, and life history strategies;
Population Integrity – the rigidity of stocks and the drivers of migration;
Counting herring – qualitative and quantitative estimation of herring and its application.

For more information please see:
www.LinkingHerring.com

linking herring galway 2008

The Seventh International Symposium on Fish Immunology

This symposium is being organised by the Nordic Society for Fish Immunology (NOFFI), and will be held in June 2007 at the University of Stirling, Scotland.

This event is held every three years and as with previous meetings, scientists from around the world are invited to attend to discuss recent advances in fish immunology. For more information please see: http://www.noffi.org/scotland2007

Restore America's Estuaries': 3rd National Conference on Coastal and Estuarine Habitat Restoration

This conference will take place at the Hilton Riverside Hotel in New Orleans, Louisiana, 9–13 December 2006.
For more information please see http://www.estuaries.org/conference

Marine Climate Change Impacts Encyclopedia goes online

Find out about the impacts of climate change on marine ecosystems with a new web portal at http://www.sahfos.org/climate%20encyclopaedia/index2.html.

ICES Data Strategy, Systems & Services

In October 2005, the ICES Council approved the first ever ICES Data Strategy. The Council also approved a new Data Policy to replace the policy of 1994. Ultimately, the Strategy and Policy will ensure value-adding systems and services for the ICES community.

ICES Data Policy conforms to the IOC Oceanographic Data Exchange Policy, and promotes open and free access to data (see http://www.ices.dk/datacentre/datapolicy.asp), while the Data Strategy defines 3 main goals to fulfil ICES mission (see http://www.ices.dk/reports/Bureau/2005/BWGDDP/Del.04.02.pdf).

The policy and strategy are products of the BWGDDP (Bureau Working Group on Data Development Project, see http://www.ices.dk/iceswork/wgdetailacfm.asp?wg=BWGDDP).

The Data Centre encourages constructive, direct contact with users. Users are invited to participate in all phases of system development from initial conception through final testing. A User Survey conducted at the 2005 ASC is also helping to guide improvements in data systems and services. Data Centre staff are available to participate in relevant expert group meetings.

Workshop: Oxygen minimum systems in the ocean: distribution, diversity and dynamics

This workshop will be held at the Hotel el Araucano in Concepción, Chile, 24–26 October 2006 and is a collaboration between the Faculty of Natural and Oceanographic Sciences, the Department of Oceanography, and the Center for Oceanographic Research in the eastern South Pacific (FONDAP-COPAS) of the University of Concepción. The workshop will coincide with the 2006 SCOR (Scientific Committee on Oceanic Research) General Meeting.

The Workshop will bring together scientists and students from many countries into one meeting covering the following areas of oceanography related to oxygen minimum zones and oxygen-deficient waters: physical and chemical oceanography, biogeochemistry, ocean-atmosphere interactions, biology, biodiversity, ecology, paleoceanography, and anthropogenic influences.

For more information please contact the organizer: Dr. Víctor A. Gallardo (vagallar@udec.cl; vgallardo@coreocean.org).

Remotest ICES Working Group ever?

Deep in the Norwegian Arctic circle, tucked away near the Norwegian-Russian-Finnish border lies the small community of Svanvik (69°N 30°E). It is here that the Svanhovd Environmental Centre provided the setting for the 2006 WKHAD (Workshop on Biological Reference Points for Northeast Arctic Haddock) meeting, chaired by Knut Korsbrekke. If this wasn't the remotest setting for a working group meeting ever, it was surely the most northern, equaled only by the 2003 SGBRP (Study Group on Biological Reference Points for Northeast Arctic Cod) meeting at the same location. The unusual location made a welcome change to the anonymous hotels typically used for meetings.

After all, there can't be many working groups where the magical Northern lights glimmer in the evening, and you can enjoy a sweat in a sauna before cooling off in the snow and experiencing outside temperatures of –28°C (a record low for an ICES working group?). The exotic location was appreciated by all participants at the meeting although the sharp decrease in temperature was most keenly felt by the Spanish participant Dorleta Garica from AZTI. Thankfully, the food was as good as the company, with hearty fish stews and reindeer hearts keeping people warm and cloud berries providing local flavour.

On behalf of the workshop, Finlay Scott

Working inside in comfort while outside temperatures show a character-building –28°C.

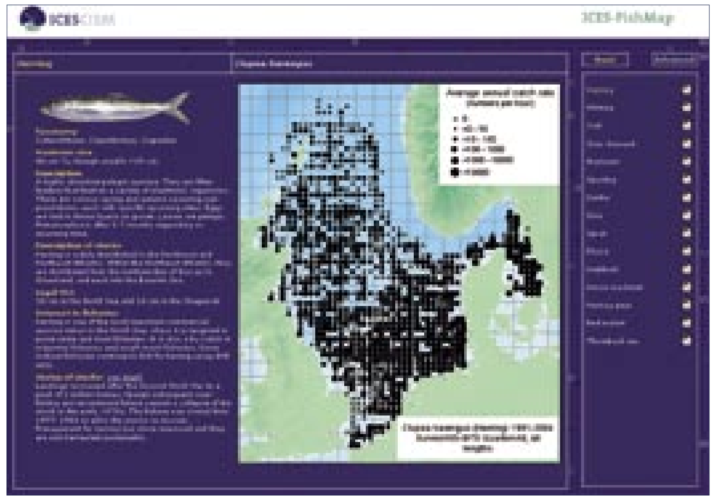
Probably the most northern setting for an ICES Working Group ever!

The Journey to PICES: Scientific Cooperation in the North Pacific, by Sara Tjossem
This new book gives an in-depth look at the process of creating the North Pacific Marine Science Organization which is the equivalent of ICES in the Pacific Ocean. For more information please see: http://www.uaf.edu/seagrant/bookstore/pubs/AK-SG-05-04.html

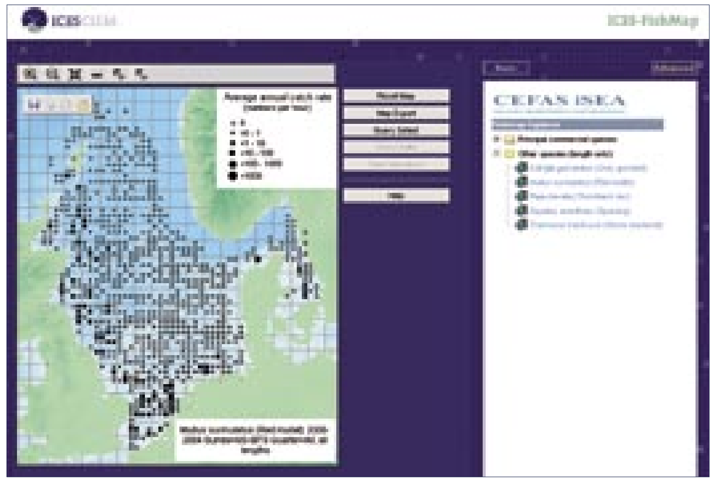
Belgian research vessel RV Belgica goes online
Since January 2004, the track of the RV Belgica has been online at http://www.mumm.ac.be/EN/Monitoring/Belgica/odas.php. Using a new, interactive web tool the user can dynamically draw maps and access some of the data measured continuously on board by the vessel's oceanographic data acquisition system (ODAS). For each point on the ship track, the user has direct access to measurements of sea surface temperature, salinity, wind speed/direction, solar radiation and depth. Information about each cruise is provided, together with links to files of interest, while GIS overlays, such as standard monitoring stations or dredging and dumping sites can be added. The ODAS data is also available in table or graph form.

GIS News: National EEZ boundaries go online
Dr. Edward Vanden Berghe and Mr. Pieter Deckers of the Flanders Marine Datacentre (in Ostend) have digitized all public information on national EEZ boundaries, and created a set of GIS-compatible shapefiles for use in various mapping projects. The shapefiles can be downloaded at www.vliz.be/vmdcdata/marbound.
The database is available for downloading, or it can be browsed in an IMS-style geointerface. Please take the time to read the interesting notes on the development of the files.

ICES FishMap pulls in the visitors
ICES FishMap is an interactive atlas of 15 North Sea fish that accesses thousands of records from research vessel surveys in the North Sea (1983–2004). It has two sections: a basic screen which shows distribution maps and pdf information about each fish; and an advanced section that lets you make your own maps. Try making maps for red mullet in the North Sea 1983–87 and 2000–2004 and look at the difference! http://www.ices.dk/marineworld/ices-fishmap.asp



ICES Fish Map - Basic window



ICES Fish Map - Advanced window

Is the North Sea getting warmer for fish stocks?
ICES and EuroGOOS are running a joint project NORSEPP – the North Sea Pilot Project. NORSEPP focuses on oceanography and fish stocks, and the aim is to promote the use of operational oceanography for biological applications such as fish stock assessments.

The latest report for the last 6 months of 2005 is available at http://www.ices.dk/marineworld/NORSEPP3and4qtr2005.pdf.

Reports from the 1st and 2nd quarters of 2005 are available at http://www.ices.dk/marineworld/norsepp.asp.

BULLETIN BOARD

ICES Annual Science Conference in the Netherlands 2006

This year the ICES ASC will be in Maastricht, the Netherlands, 19–23 September 2006. Committee meetings will take place 17–26 September 2006.

Theme sessions will cover the following:

- Harmful Algae Bloom Dynamics: Validation of model predictions (possibilities and limitations) and status on coupled physical-biological process knowledge
- Large-scale changes in the migration of small pelagic fish and the factors modulating such changes (Co-sponsored by PICES)
- Climatic variability in the ICES area – 2000–2005 in relation to previous decades: physical and biological consequences
- Census of Marine Life: Community and species biodiversity in marine benthic habitats from the coastal zone to the deep sea
- Operational oceanography (Co-sponsored by PICES)
- What plankton are fish really eating? Species and diets, availability, and dependency
- Human health risks and marine environmental quality
- Evolutionary effects of exploitation on living marine resources
- Quantifying, summarizing, and integrating total uncertainty in fisheries resource surveys
- Is there more to eels than SLIME?
- Discarding: quantities, causes, and consequences
- Marine mammals, seabirds, and fisheries: ecosystem effects and advice provision
- Environmental and fisheries data management, access, and integration
- Technologies for monitoring fishing activities and observing catch
- Spatio-temporal characteristics of fish populations in relation to environmental forcing functions as a component of ecosystem-based assessment: effects on catchability
- Integrated assessments in support of regional seas ecosystem advice – beyond quality status reporting
- Use of data storage tags to reveal aspects of fish behaviour important for fisheries management
- ICES advice in a changing world!

For more information on the conference please see http://www.ices.dk/iceswork/asc/2006/index.asp

A new standard instrument for the scientific measurement of the mesh size of fishing nets

After 44 years the ICES mesh gauge has been replaced by the OMEGA gauge as the standard instrument for the scientific measurement of the mesh size of fishing nets. The replacement was recommended by the Fisheries Technology Committee (FTC) at the 2005 ICES Annual Science Conference in Aberdeen and confirmed by the ICES Council in October 2005.

The new mesh gauge, presented in the ICES Newsletter last September, uses state-of-the-art technology to measure and record mesh openings. The measurement results are completely free of human influence. As part of the OMEGA project, a research project in the frame of the European Fifth Framework Programme (http://www.dvz.be/omega), the new instrument was extensively tested and compared with existing mesh gauges in the laboratory, at sea, at the harbours, and in the netting industry.

Detailed instructions for the use of the new standard gauge are given in ICES Cooperative Research Report No. 279 "Protocol for the Use of an Objective Mesh Gauge for Scientific Purposes" (www.ices.dk/pubs/crr/crr279/crr279.pdf).

"Implementing the Ecosystem Approach to Fisheries" Conference
The aims of the conference are to review concepts and address implementation issues related to applying the ecosystem approach to fisheries, to exchange experiences made and constraints encountered so far, and to identify strategies and best practices that will facilitate further implementation in practical fisheries management. The conference will take place at the Radisson SAS Royal Hotel Bryggen, Bergen, Norway, 26–28 September 2006. For more information please see http://cieaf.imr.no/

IRD/IMARPE/FAO/ICES/PICES Symposium on "The Humboldt Current System: Climate, ocean dynamics, ecosystem processes, and fisheries"
This symposium will be held in Lima, Peru, 27 November–1 December 2006. For more information please see: http://irdal.ird.fr/hcs-conference.imarpe.fao.ird.php3

International Symposium on Integrated Coastal Zone Management
This symposium will be held in Arendal, Norway, 11–14 June 2007. For more information please see: http://www.imr.no/iczm/

ICES-PICES Symposium on "Marine Bioinvasions"
This symposium will be held at the Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts 15–18 May 2007. For more information please see http://web.mit.edu/seagrant

ICES Symposium 2006 on "Fishing Technology in the 21st Century"
This five-day symposium will take place in Boston, Massachusetts, USA (30 October–3 November 2006). The symposium will focus on the theme of integrating commercial fishing and ecosystem conservations.

- Ecosystem sensitive approaches to fishing: reconciling fisheries with conservation through improvements in fishing technology.
- Current status of mobile and static sampling gears used in resource surveys.
- Fishers' responses to management measures and their socio-economic effects.
- Stakeholder forum: Integrating fishers' knowledge with science and stakeholder needs – the future of fisheries management?

For more information please go to: http://www.ices2006boston.com/

ICES/PICES/GLOBEC Symposium "The 4th International Zooplankton Production Symposium"
This symposium will be held in Hiroshima, Japan from 28 May–1 June 2007. For more information please see: http://www.pices.int/meetings/international_symposia/2007_symposia/4th_Zooplankton/4th_Zoopl.aspx

ICES Data Centre – InterCatch
InterCatch is a web-based system for handling fish stock assessment data. National fish stock catches are uploaded to InterCatch. Stock coordinators then allocate sampled catches to unsampled catches, aggregate to international catch and download the aggregated catch data which, in turn, is used as input to fish stock assessment models.

ICES developed InterCatch in collaboration with DIFRES with support from the Norwegian Ministry of Fisheries and Coastal Affairs. Several assessment experts and stock coordinators have contributed invaluable knowledge, ideas and hard work to design and test InterCatch.

InterCatch was developed building upon existing DIFRES and ICES software to ensure efficient development and robust programs.

ICES Data Centre, DATRAS
Our DATabase of TRAwl Surveys, DATRAS, will be enhanced in 2006–2007. The upgrade will include new facilities for calculation of mean weight-at-age and maturity ogive and, for variance, estimations of indices. Data checking will be extended, and the web front-end will be improved. This upgrade is made possible by a grant from the EU with matching funds from ICES.

The first deliverable from the project is variance of all the indices calculated by DATRAS. These will be compiled into a report by 1 November 2006. The method for the variance estimation was defined and described during a workshop held in ICES in May 2006. A report from that workshop is available on request from Lena Larsen lena@ices.dk.

ICES STAFF NEWS

The ICES ship welcomed a new captain, Gerd Hubold, on board 1 February 2006, and on 10 February the ICES crew gave a memorable farewell party to the outgoing captain, David de G. Griffith.

Welcome to the following new staff members:

Søren Anker Pedersen (Denmark), who took up employment on 1 February 2006 on an initially one-year contract (expected to be renewed to a total of three years) as Project Coordinator for the German Bundesamt für Naturschutz (Federal Agency for Nature Protection) project on "Developing Fisheries Management Concepts of Marine Projected Areas". Søren is married and has two daughters aged 10 and 15, and has already been recruited to the well established ICES choir.

Søren Anker Pedersen

Michael Drew (UK) joined the Secretariat on a four-year contract as Administrative Programmer on 1 February 2006 and he has already settled in well with the Data Group. Mike and his fiancée have a 1-year-old daughter.

Mike Drew

And goodbye to:

Janus Larsen – After 6 years in ICES Janus decided to leave us and take up a position at the Danish Hydraulic Institute. Fortunately he seems to be doing well, so though he is missed by many in the Secretariat it is a consolation to know that he is thriving in his new environment.

Neil Fletcher has relinquished his post as Communications Officer, effective from 30 August 2006. Neil is leaving to do a PhD for the next three years and will be moving to Lesvos, Greece with his family during the summer. Neil will be missed among staff, not least for his positive attitude and friendly character. We wish him the best of luck!

A few round birthdays:

Bodil Chemnitz, our Master Spider in the Web – or Webmaster – claims to have turned 40 in October. This will come as a shock even to geriatricians.

Jørgen Nørrevang Jensen, Environmental Specialist, and **Søren Lund**, Connoisseur of special environments, had a joint celebration in January to mark their admittance into the fifties club, henceforth called the Roaring 50s. – Roar!

And some other news:

Keith Brander (ICES/GLOBEC Coordinator) reduced his working hours to 60% starting 1 May 2006 to take into account the reduced funding of the ICES/GLOBEC Office in 2006.

Congratulations to **Hans Lassen** (Head of Advisory Programme) and Hans Mose (Programmer) who have both had their contracts extended for another four years (2006–2010).

Julie Gillin (Data Center Manager) will take unpaid leave for family reasons from 26 June–25 September 2006.

By Inger Lützhøft

ICES Newsletter editor signs off

As this is the last ICES Newsletter that I will be editing I just wanted to add a huge thank you to all the people who helped to produce it over the past 5 years. In particular, this includes the sterling team of proof readers – Søren "the dash man" Lund, David Griffith, Michala Ovens, and Henrik Sparholt. I also want to thank Solveig Lund and Henrik Larsen – and anyone else who has helped – for doing such an efficient job of sending out 3000 newsletters to addresses all over the world. And finally a big thanks to all the people who have written articles for the newsletter. The aim over the past five years has been to produce a newsletter that contains interesting, readable articles and hopefully we have gone some way to achieving that. Best wishes, Neil Fletcher (Nfletcher1@gmail.com).

Photo by Paul Kay www.marinewildlife.co.uk