

Theme Session E

Marine biodiversity: A fish and fisheries perspective

ICES CM 2007/E:01

Species versus functional diversity in a fish community

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As part of a study of flux of energy and nutrients through the Georges Bank food web, we have estimated the year-to-year changes in fish food requirements for plankton and benthos over four decades, 1963–2002. We compare these with the variations in species abundance; and in abundance of species guilds – piscivores, benthivores and planktivores.

The total food requirement of the fish community for plankton and benthos appears to be related to available production from lower trophic levels and dependent on nutrient supply from deeper water. There is also, a steady decrease over the four decades in the benthos component as a fraction of the total. This may be related to changes in primary production due to oceanographic factors; or to possible reduction in benthos resulting from habitat destruction.

On the other hand, the fish community structure is much more variable on inter-annual to decadal time scales; with large fluctuations in evenness (Shannon Index) and in abundance of the feeding guilds. We consider the evidence for compensation between the species guilds under the functional constraints imposed by different categories of food availability. We discuss the relative roles of fishing in terms of direct removal and of habitat change.

Keywords: functional diversity: productivity: compensation: habitat change.

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ICES CM 2007/E:02

The fish biodiversity of the Kara Bay

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The composition of the fish in the Kara Bay is presented by 21 sea (13) and freshwater (8) species. The marine fish are joined in 11 families, the rest - in 3 families. All fish are parts of 3 sea and 2 freshwater faunistic complexes. What is about marine complex - the most numerous is boreal-atlantic, from freshwater complex the most numerous is arctic-freshwater, which includes 7 species. By the nature of feeding fish of the Kara Bay are euryphages and the planktophages in equal amount (33,3% each). The group of the benthophages is less - 23,8%. To the predators fish (9,6%) belong only two species. By the type of reproduction the main part (81,0%) uses the substratum during the period of spawning. The biggest part from them spawns on sand and gravel bottoms. Few of them spawn on the vegetation, one species (stickleback) builds the nests, one species leucorrhoea is live-bearing. Mentioned above information can be used by preparation of the regional fish cadastre in the Nenets Autonomous Okrug.

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ICES CM 2007/E:03

The Danish fish fauna during the warm Atlantic period (ca. 7,000-3,900 BC): forerunner of future changes?

Inge B. Enghoff, Brian R. MacKenzie, and Einar Eg Nielsen

Vast amounts of fish bone lie preserved in Denmark's soil as remains of prehistoric fishing. Fishing was particularly important during the Atlantic period (ca. 7,000-3,900 BC, i.e., part of the Mesolithic Stone Age). At this time, sea temperature and salinity were higher in waters around Denmark than today. Analyses of more than 100,000 fish bones from various settlements from this period document which fish species were common in coastal Danish waters at this time. This study provides a basis for comparing the fish fauna in the warm Stone Age sea with the tendencies seen and predicted today as a result of rising sea temperatures. One example concerns the anchovy which lived in the Stone Age sea, and has become more numerous in Danish waters since the mid-1990s. Other warm water fishes represented among the Stone Age bone samples

include smoothhound, common stingray, European sea bass (*Dicentrarchus labrax*), black sea bream (*Spondyliosoma cantharus*) and swordfish (*Xiphias gladius*). Surprisingly, Atlantic cod, whose biomass in the Kattegat and eastern Baltic Sea is presently at record low levels, was one of the most frequently caught species in the Danish Stone Age sea. These results demonstrate that major changes to the fish fauna near Denmark will occur as climate changes. However exploitable cod populations can potentially be maintained in waters near Denmark, including the North Sea, but the vulnerability to climate change and the risk of stock collapse will increase at present high fishing mortalities. Article available in Fisheries Research (in press: <http://www.sciencedirect.com/science/journal/01657836>)

Keywords: Atlantic period, Mesolithic, Stone Age, fish fauna, biodiversity, cod, Baltic Sea, Kattegat, North Sea, climate change.

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ICES CM 2007/E:04

Detecting fisheries-induced evolution in natural fish populations

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Ages and sizes at maturity have been seen to decrease in several exploited fish populations. These observed shifts have often been claimed to be evolutionary, but little attention has been paid to the possible impacts of growth on the process of maturation. Recently, the probabilistic reaction norm for the age and size at maturation has become a popular tool for investigating the evolutionary background of observed changes in the process of maturation. Here we developed the mathematical links between the probabilistic reaction norm, growth of individuals and ages and sizes at which individuals actually reach maturity. Our study demonstrates that ages and sizes at maturity may decrease in a population solely due to changes in growth histories. Probabilistic reaction norms can reflect evolutionary shifts in the age and size at maturity alone provided that they can be estimated in a way that is immune to any variation in growth. In practice, this requires detailed information on growth trajectories before and after maturation. Thus, before coming to any conclusions about evolutionary shifts in age and size at maturation, a great deal of attention should be focused on the growth of individuals.

Keywords: adaptation, age at maturity, evolution, exploitation, reaction norm, size at maturity.

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ICES CM 2007/E:05

Shortage of spawning habitats hampers spreading rate of the invasive round goby in southern Baltic Sea?

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In 1990, the Ponto-Caspian round goby (*Appollonia melanostomus*) was first observed in the Gulf of Gdańsk, Baltic Sea, most likely introduced via ballast water. Despite that the round goby presently is among the dominating species in Gulf of Gdańsk and is found also in other parts of the Baltic Sea, its spread has been slow in comparison with the rapid spread within and among the Laurentian Great Lakes. In this study we hypothesize that shortage of suitable habitats is a main cause to the slow spreading rate of the species in the Baltic Sea. When assessing life history traits of more than 1,000 round gobies along a habitat gradient within Gulf of Gdańsk, sexual maturation, gonad somatic index, growth, and longevity varied in relation to habitat characteristics. Sheltered areas with high temperature and high habitat heterogeneity showed to be most optimal for population growth, selecting for high population turnover rate. In contrast, exposure to the sea, low temperature and lack of vegetation appeared sub-optimal, selecting for low frequency of spawning, high growth rate and large body size. The low reproduction rate observed in sub-optimal habitats, suggests that shortage of suitable reproduction habitats along the open and exposed coasts surrounding Gulf of Gdańsk is one major reason to the relatively slow spread of the species in the Baltic Sea.

Key words: Life history, habitat, non-indigenous species, Baltic sea, *Appollonia* [*Neogobius*] *melanostomus*.

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ICES CM 2007/E:06

Appearance of the ‘visiting’ fish species in the Polish research catches conducted in the southern Baltic (autumn-winter 1976–2004)

Włodzimierz Grygiel and Kordian Trelła

Temporal-spatial variations in the occurrence and catch per unit effort of ‘visiting’ fish species in the near bottom water layers of the southern Baltic Sea (within the Polish EEZ), during autumn-winter seasons of 1976 – 2004 were analysed. The geographical, bathymetric and seasonal distributions of the following visiting fish species: whiting, mackerel, horse mackerel, European anchovy, haddock, common dab, striped seasnail, rock gunnel and serpent blenny, which occur periodically, primarily in the Kołobrzeg-Darłowo fishing ground, were considered. One of the most important factors that contributed to the appearance of these species was the periodic increase of seawater salinity, while in the case of European anchovy, it was the increase of seawater temperature. Fish species listed above were recorded as a by-catch in the Polish research catches carried out within the framework of the Baltic International Trawl Surveys Programme. The results of 2,528 bottom catches made along the nine standard research profiles within the depths ranging from 10 to 110 m were analyzed.

Keywords: visiting fish species; occurrence, CPUE, southern Baltic.

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ICES CM 2007/E:07

Marine Biodiversity – the Remaining Challenges

Jake Rice

The global interest in the conservation of biodiversity has come late to marine systems, but recently there has been substantial momentum in several areas. The Census of Marine Life has been instrumental in promoting an interest in documenting marine biodiversity in areas that have been poorly studied, and in advancing the technologies available for quantifying marine biodiversity. Agencies focused on assessment and recovery of species at risk of extinction have given increased priority to marine species as well. The escalating interest in establishing Marine Protected Areas has protection of marine biodiversity as one of its goals.

The major lag is in working biodiversity considerations into the actual development and implementation of management strategies for fisheries (and other human activities in the sea). The framework for rule-based decision-making in fisheries management could accommodate biodiversity indicators as a source of control rules, but the possibility has not been explored yet. More importantly, if some version of the control rule framework is applicable to bringing biodiversity into rule-based management, then it is necessary to focus on what the rule(s) should be. In particular, current fisheries control rules use the avoidance of reduction in SSB to the point where productivity is impaired as the foundation for the rest of the management strategy. It is essential that experts establish the comparable foundation for making management strategies addressing biodiversity into operational tools, not just concepts. This means addressing two scientific challenges. The first is establishing what changes to biodiversity constitute “serious or irreversible harm” (in the language of the international agreements on conservation of biodiversity). This challenge means operationalizing the links between biodiversity and the resilience of ecosystem structure and function. The second, once the first challenge is met, is to determine appropriate criteria for objectively determining how risk of such serious harm changes with the value of the many indicators of biodiversity. The paper will develop further the rationale behind both of these challenges, and propose a set of tractable research questions, which, if answered, might result in a scientifically sound and practical framework for including biodiversity explicitly in rule-based fisheries management strategies.

Keywords: biodiversity, management strategies, control rules, resilience, reference points.

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ICES CM 2007/E:08

Seasonal and year-to-year variability of ichthyoplankton assemblage diversity indices in the coastal zone of the southeastern Baltic under the influence of spatio-temporal environmental dynamics

E. M. Karasiova and V. M. Ivanovich

The seasonal and year-to-year changes in ichthyoplankton assemblage abundance and species composition are demonstrated based on investigations carried out in the coastal zone of the SE Baltic in 1992–2006. It was shown that depth gradient, bottom substratum variety and seasonal changeability of environment within

the shallow-water zone provided higher ichthyoplankton diversity as compared with the open sea. The larvae of 15 fish species, the reproduction of which takes place by spawning of bottom eggs or carrying them in brood pouch, were the principal ichthyoplankton component. Pelagic eggs and fish larvae, from main spawning taking place in deepwater basins also occurred periodically. On average, the peak species richness and abundance were observed in July. The Shannon's indices of general diversity, Simpson's domination indices and Pielou's equitability indices were calculated to characterize the ichthyoplankton assemblage. It was shown that their values underwent significant inter-annual variability depending on the abundance of dominant species *Pomatoschistus minutus*. Three types of hydrographic situations that determined patterns of larval *P. minutus* spatial distribution and abundance were revealed: 1) prolonged upwelling and cold water penetration from intermediate layer to 10 - 15m depths, 2) alternation of upwelling and down-welling events, 3) prolonged development of down-welling at lack of cold water intrusions. Accordingly, phenomena observed were as: 1) low abundance, minimal species richness, and average values of diversity and domination indices, 2) average levels of abundance and species richness, high diversity index and low domination index, 3) outburst of *P. minutus* abundance, minimal diversity index and high domination index.

Keywords: coastal zone, ichthyoplankton assemblage, biodiversity, distribution patterns.

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ICES CM 2007/E:09

Deep-sea pelagic ichthyonekton diversity in the Atlantic Ocean and the adjacent sector of the Southern Ocean

Heino O. Fock

Species richness of pelagic deep-sea fishes was analysed for 66 stations. For local and regional richness latitudinal gradients were present, asymmetric between North and South Atlantic. Lowest values were indicated for the Antarctic stations. The analysis of local-regional richness relationships indicated that assemblages were saturated. In support of the productivity-diversity hypothesis, a strong hump-shaped relationship to primary production was indicated. Regional effects on local richness were indicated in that a regionalisation in accordance to Merrett's (1987) hypothesis on the effect of seasonal productivity improved the model significantly. For regional richness, historical influences by means of the overlap between tropical and boreal faunas could not be precluded.

Keywords: Atlantic Ocean, nekton, latitudinal species diversity gradients, primary production, deep-sea.

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ICES CM 2007/E:10

Spatial variation in size distribution of two freshwater species, European perch (*Perca fluviatilis* L.) and roach (*Rutilus rutilus* L.), in the shallow coastal area of the NE Baltic Sea

Anu Albert

Patterns of distribution and abundance of different size groups of European perch (*Perca fluviatilis* L.) and roach (*Rutilus rutilus* L.) in the different zones of shallow elongated brackish-water Matsalu Bay (NE Baltic Sea) were investigated. A horizontal salinity gradient from shallow (1 m) freshwater (0-2 ppt) inner part to deeper (3 m) brackish-water (4-6 ppt) outer part occurs in the bay, and therefore provides diverse environmental conditions for various size groups of fish with different habitat optimum. The study revealed the habitat selection pattern to be quite regular over the study period (mid-summer fish monitoring 1995-2006). Perch was abundant all over the bay, whereas larger and older size classes showed preference for shallower and warmer areas of the inner part. On the contrary to perch, both abundance and size of roach increased significantly towards deeper areas of the outermost zone of the bay. The possible reasons and tendencies behind the spatial variability and gradients are discussed.

Keywords: brackish-water, *Perca fluviatilis* L., perch, roach, *Rutilus rutilus* L., size distribution, spatial variation.

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ICES CM 2007/E:11

Impact of 21st century climate change on the Baltic Sea fish community and fisheries

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We use recent regional – scale climate - ocean modelling results to consider how climate change during this century will affect the fish community of the Baltic Sea and fisheries management. Expected climate changes in northern Europe will likely affect both the temperature and salinity of the Baltic, causing it to become warmer and fresher. As an estuarine ecosystem with large horizontal and vertical salinity gradients, biodiversity will be particularly sensitive to changes in salinity. Marine-tolerant species will be disadvantaged and their distributions will partially contract from the Baltic Sea; habitats of freshwater species will likely expand. Although some new species can be expected to immigrate because of an expected increase in sea temperature, only a few of these species will be able to successfully colonize the Baltic because of its low salinity. Fishing fleets which presently target marine species (e. g., cod, herring, sprat, plaice, sole) in the Baltic will likely have to relocate to more marine areas or switch to other species which tolerate decreasing salinities. Fishery management thresholds that trigger reductions in fishing quotas or fishery closures to conserve local populations (e. g., cod, salmon) will have to be re-assessed as the ecological basis on which existing thresholds have been established changes. The Baltic situation illustrates some of the uncertainties and complexities associated with forecasting how fish populations, communities and industries dependent on an estuarine ecosystem might respond to future climate change. (Article available in *Global Change Biology* [in press]).

Keywords: Baltic Sea, climate change, fish, fishing, ecosystems, temperature, salinity, management, estuaries

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ICES CM 2007/E:12

The development of the northern European fishery for north Atlantic bluefin tuna *Thunnus thynnus* during 1900–1950

Brian R. MacKenzie and Ransom A. Myers

North Atlantic bluefin tuna used to migrate to northern European waters (Norwegian Sea, North Sea, Skagerrak, Kattegat, and Øresund) where it supported important commercial and sport fisheries. The species disappeared from the region in the early 1960s and the species is now still extremely rare. The factors which led to the development of the fishery and its subsequent decline remain unclear and poorly documented. This investigation documents the development of the fishery in terms of landings, effort, and gears with focus on the time period from 1900–1950 when landings were increasing. The species was frequently sighted while fishermen were targeting other species (herring, mackerel) and occasionally was caught as bycatch with these and other species. Information from scientifically trained observers demonstrate that tuna schools were common in the North Sea for 2–3 months during the summers of 1923–31. As fishermen realized that the species had market value, new catch methods were developed and employed. Landings rose sharply as did the number of vessels and the capacity of processing facilities for bluefin tuna. Similarly sportfishing increased in popularity in some of these countries and attracted many foreign participants. The increase in landings between 1900–1950 was driven particularly by an increase in fishing effort and technology. We found no evidence that the increase was due to a temperature-related shift in habitat into the region. Our results demonstrate that the species was an important part of the ecosystem at least back to the early 1900s. (Article in press in *Fisheries Research*)

Keywords: bluefin tuna, *Thunnus thynnus*, fishery, North Sea, Norwegian Sea, temperature.

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ICES CM 2007/E:13

Mortality of discards from southeastern Australian estuarine fishing gears: implications for improved resource management

Sebastian S. Uhlmann and Matt K. Broadhurst

In response to concerns over the potential for large unaccounted fishing mortalities to discarded, unwanted organisms (termed bycatch) in commercial estuarine fisheries in New South Wales (NSW), Australia, a research project was initiated to (1) quantify the key factors contributing towards the damage, stress and short-term (< 10 days) mortality of discards, and based on this information, (2) test the utility of a range of operational and post-capture handling modifications that maximise survival. So far, data have been collected for 13 species discarded from four estuarine gears (beach and boat seines, trawls and gill nets) during 38 fishing operations in two estuaries. These data have revealed considerable species- and gear-specific variabilities among impacts; reflecting a range of biological attributes, as well as technical and environmental factors such as the duration of gear deployment and subsequent air exposure of the catch. For example, irrespective of the fishing method, soft-bodied teleosts such as *Gerres subfasciatus* and *Herklotichthys castelnaui* always incurred substantial scale loss and high mortalities (typically between 90 and 100%),

whereas the harder-scaled *Acanthopagrus australis* and *Rhabdosargus sarba*, or crustaceans like *Metapenaeus macleayi* and *Scylla serrata* were more resilient with mortalities typically less than 50%. While sorting catches in water reduced the impacts to a few species, minimizing the duration of gear deployment demonstrated the greatest potential for improving the survival of most discards. Further work is being done to more closely examine the utility of these, as well as other modifications to operational and post-capture handling procedures. It is anticipated that the eventual adoption and legislation of such simple strategies will contribute towards the sustainability of local fisheries.

Keywords: discard mortality, estuarine fisheries, gear deployment, air exposure.

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ICES CM 2007/E:14

The seasonal and inter-annual variability of ichthyoplankton biodiversity in the Gdansk Deep of the Baltic Sea during last decades.

E. M. Karasiova

The assemblage of pelagophilous fishes, which reproduce in the Baltic Sea deeps, has formed under the influence of environmental conditions that extremely limited its species richness. The composition of ichthyoplankton from the Gdansk Deep usually includes eggs of 4 fish species only (cod, sprat, flounder, rockling), co-occurrence of which is observed in spring season. Extremeness of reproduction conditions (low salinity and recurring oxygen deficiency) is one of the main reasons of species composition poorness, which becomes even more pronounced in some seasons with a decrease in frequency and intensity of the North Sea water inflows. Based on AtlantNIRO investigations for 1992–2006, and the analysis of literature data published in previous decades, significant seasonable and decade-to-decade changeability of Shannon's index of general diversity and Simpson's domination index were revealed under the invariable species richness. Over the period greater than 50 years (beginning from late 40s), the index of general diversity exhibited a stable downward tendency, whereas the domination index permanently increased. It was structural reorganization of the pelagophilous fish community, which reproduced in the deeps, that resulted in transition from the polydominant to the monodominant ichthyoplankton assemblage. The influence of abiotic environment on spatial variability of Shannon's index is also shown. The mechanisms that compensate low species saturation, and augment other kinds of the ichthyoplankton assemblage diversity are considered. At present the assemblage structural elements remained as well as a possibility of recurrence to a former state in case of adequate climatic changes.

Keywords: ichthyoplankton, deeps, diversity and domination indices, long-term trends.

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ICES CM 2007/E:15

Biology and conditions of *Alfonsin Beryx splendens* Lowe, 1833 dwelling in the region of the Azores complex of seamounts

Dmitry A. Kozlov

Alfonsin is one of the important fish species in deepwater fishery above the seamounts of the open North Atlantic. The paper is based on the materials of 15 research expeditions carried out in the region of the Azores complex of seamounts on the vessels of AtlantNIRO (Atlantic Research Institute of Marine Fisheries and Oceanography) and Zaprybpromrazvedka (Western Fish Scouting Surveys, Kaliningrad) over the period from 1976 to 2004.

The stability of seamounts biotope may be attributed to water mass volume in the form of the Taylor columns and Hogg cones. Turbulent mixing inside the lens and along its boundaries facilitates both transportation of mineral salts to a photic layer and carrying products of this layer to the mount top and slopes. Due to intensive ingress of biogens to a photosynthesis layer, increased productivity of lower trophic levels is formed inside the lens, which provides higher productivity of consecutive trophic levels in the entire seamount biotope.

Most favourable conditions for alfonsin fishery develop in pre-spawning and spawning periods during meridional transfer of the air and water masses. The fishery situation is extremely variable during winter (feeding) period, which is caused by unstable hydrometeorological conditions. Fishing for alfonsin in the region of the Azores complex of seamounts was conducted above 250-280m depths. According to the data obtained in 1976-2004, there occurred the fish 14 to 52cm in length with the mode of 24-25cm and average

weight of up to 0.5kg. The largest alfonsin occurred during the period from January to March, when the average length of individuals amounted to 25.4cm. Mass spawning of alfonsin takes place in this region from June to September. The beginning of the spawning was recorded in April-May. Judging by food items, alfonsin perform vertical diurnal migrations on the seamounts over the banks.

Keywords: Alfonsin, Azores, biology, conditions of dwelling, seamounts.

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ICES CM 2007/E:16

Molecular methods for assessing temporal adaptive changes in fish populations; a case study employing historical analysis of Pan I in cod (*Gadus morhua*)

Einar Eg Nielsen, Brian R. MacKenzie, Eydfinn Magnussen, and Dorte Meldrup

We investigated temporal genetic differentiation at the Pan I locus in four cod populations from the southeastern part of the species distribution: the Baltic Sea, the North Sea, the Faeroe Plateau and the Faeroe Bank. Historical otolith collections enabled investigation of allele frequency variation over time periods up to 69 years employing Pan I primers specifically designed for partially degraded DNA. Small and non-significant temporal changes in Pan I allele frequencies were observed in the four populations. Simultaneous microsatellite analysis revealed similar temporal genetic stability with temporal F_{st} 's ranging from 0 – 0.006 suggesting limited demographic changes. Sea surface temperature (SST), which has been suggested as the primary driver for the geographical distribution of Pan I alleles in cod, showed no long-term trend although temperature has increased since the mid-1990s. Our study demonstrates that populations in the southeastern part of the species range has been characterized by very high frequencies of the Pan IA allele for many decades.

Keywords: Atlantic cod, population genetics, archived samples, Pan I, temperature.

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ICES CM 2007/E:17

Fisheries-induced selection as a driver of biodiversity change in exploited populations

Mikko Heino and Ulf Dieckmann

Today, fishing is the dominant source of mortality in most commercially exploited fish stocks. Life-history theory predicts that changes in mortality regime cause selection on life-history traits. In particular, increased mortality can strongly favour earlier maturation. Indeed, commercially exploited fish stocks often show trends towards earlier maturation. However, earlier maturation may also simply reflect phenotypic plasticity – triggered, for example, by improved individual growth when stock abundance is diminished. Until recently, the difficulties involved in disentangling plastic and evolutionary components of life-history changes have hindered understanding the nature of phenotypic maturity changes. Introduction of probabilistic reaction norms for age and size at maturation have helped to combat this problem: by estimating maturation reaction norms, one can control for growth-related phenotypic plasticity and changes in mortality. A suite of methods for estimating these reaction norms is now available. Addressing different types of data, these methods have been applied to at least 18 stocks, representing nine different species of marine and freshwater fish. All but two of these case studies suggest that a significant evolutionary component has contributed to the observed trends in age and size at maturation. Remarkably, this component is often detectable at time scales as short as a couple of decades.

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ICES CM2007/E:18

Linking the diversity of fish assemblages to habitat structure: A study on Dogger Bank (North Sea)

Anne F. Sell, Ingrid Kröncke, and Siegfried Ehrlich

A research cruise on Dogger Bank in the central North Sea was conducted to investigate the influence of habitat properties on the diversity of bottom fish assemblages. In April/May 2006, 35 stations across the bank were sampled for a combined analysis of the bank's topography, hydrography, benthic communities and fish

assemblages. The composition of benthic epifauna was obtained from a 2-m fine-mesh beam trawl, the fish assemblages through a standardized GOV bottom trawl as used during the International Bottom Trawl Survey. Diversity indices of fish and their variability are considered in relation to differences in the physical and biological structure of the local habitats. In addition, preferences in realized fish habitats of individual species are characterized.

Keywords: Fish assemblages, biodiversity, habitat structure, benthos.

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ICES CM 2007/E:19

Functional diversity: a study on the Bay of Biscay nursery habitats

Anik Brind'Amour

Grouping species according to their biological (i.e. morphological, behavioral, and physiological) traits represents a decisive step in assessing the functional diversity of a community. As functional diversity represents a good measure of ecosystem resilience and resistance, it is thought that groups of functional traits may thus be used to develop indicators to assess community responses to natural and human perturbations. The present study aims at (i) testing the use of groups of functional traits as an alternative to the taxonomic-based approach to develop indicators of nurseries states, and (ii) assessing the relationship between species and functional diversity to measure the functional redundancy in nursery fish communities. Groups of functional traits were determined at six coastal nurseries located in the Bay of Biscay. This was done using a three-matrix approach (species*sites, species*traits, sites*environment) allowing direct assessment of the relationship between groups of functional traits and the environment. Functional diversity was estimated using recently developed continuous indices. Analyses were conducted on data collected yearly between 2000 and 2004. Preliminary results indicate a latitudinal gradient in species composition and number of functional groups of traits across the nurseries. Complementary analyses are being conducted to contrast this result with functional diversity analyses and to investigate whether the causes may be anthropogenic or due to natural variability.

Keywords: anthropogenic pressures, Bay of Biscay, environmental variability, coastal nurseries, fish community, fourth-corner method, functional diversity, RLQ analyses.

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ICES CM 2007/E:21

Indicators of size diversity in the eastern Bering Sea

J. Boldt, S. Bartkiw, P. Livingston, G. Walters, and G. Hoff

Biodiversity in marine ecosystems can be affected by changes in anthropogenic pressures, such as fishing. The ICES working group on "Ecosystem Effects of Fishing Activities" has provided ideas for developing ecosystem management indicators that measure system-wide biodiversity properties that might change due to fishing. The variation in size diversity and dominant species in a community are measures of biodiversity that have been found to be relatively explanatory of system-wide, fishing-induced changes. Using the size spectrum of a community, time trends in the relationship between the numbers and sizes of individuals in the community can be evaluated. One possible effect of fishing is a decrease in the abundance of larger individuals over time and thereby a skewed size distribution towards smaller individuals in the community. Also the dominance of a set of species can be different in an exploited versus an unexploited ecosystem. Changes in the size structure and dominant species within an ecosystem have the potential to alter predator-prey relationships and food webs in the community. The eastern Bering Sea ecosystem is one of the most productive ecosystems in U.S. coastal waters, supporting valuable commercial and subsistence fisheries as well as large populations of seabirds and marine mammals. Commercially exploited species include walleye pollock, flatfish, salmon, and crab. Ecosystem information, size diversity, and k-dominance curves were used to determine the level of influence commercial fisheries have had on the eastern Bering Sea ecosystem (both target and non-target fish species) and how that compares to other exploited systems.

Keywords: biodiversity, size spectrum, k-dominance, eastern Bering Sea, fishing effects, ecosystem.

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ICES CM 2007/E:22**Damaging action of trawl fishing on youngers and non-target fishes as a factor of decrease biodiversity of fish communities**

M. Dolgikh, Yu. Gerasimov, and O. Lapshin

The influence of net gear (active and passive) on some model species (sardelle, bleak, roach, bream and perch) with different type of scales was investigated in aquarium and real conditions on Rybinskoe waterpool which hasn't got great depths (maximum 18 meters) and vertical gradient of temperature in summer period. So we had a good chance to evaluate direct influence of injuring from trawling for follow surviving of young and non-target fishes. The level of injuring of different species from the contact with gear and in the process of escaping was determined. Our study indicated that species with easy-deciduous scales to obtain the fatal injuries usually in the codend. We conducted the swimming ability of fishes with various degree of scale injuries and resistance of such fishes to impact of predator. To estimate the survival and the consequences of traumatized fishes. Even at the equal influence, the youngers and non-target species have a different tolerance to damage from the gear and other fishes in catch and different ability to rehabilitation after the damage. If the pressure of fisheries is permanent, even in case to use the trawls with special selectivity devises, the species with easy-deciduous scales suffer in larger degree from human activities, so their comparative quantity is become smaller. This might be a cause of reduction numbers of such species or total disappearance, in other words to decrease the biodiversity of fish communities.

Keywords: biodiversity, injury, survival.

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ICES CM 2007/E:23**Fisheries-induced life history changes in herring**

Katja Enberg and Mikko Heino

Fishing changes not only the population abundance of the target species, but also its population dynamics and life-history traits. A number of studies have shown that life history traits related to the timing of maturation respond quickly to fishing mortality. Because changes in such life-history traits feed back into population dynamics and, consequently, may also affect the yield and thus profitability of a fishery, we need better understand the factors that hasten or hinder such changes.

In this study we compare how fisheries have affected the maturation process of two ecologically and economically important herring (*Clupea harengus*) stocks: the Norwegian spring spawning (NSSH) and the North Sea (NSH) herring. These stocks differ in a very important way: harvest they are exposed to leads to different assumptions of the direction of fisheries-induced adaptive life-history changes. The harvest of NSSH targets mainly mature individuals, and it has been shown that the changes in maturation of NSSH are relatively weak despite the extremely high fishing mortality associated with the collapse on 1960's. This is in accordance with predictions from life history theory: fisheries targeting mature individuals are expected to have a weak selection for later maturation. On the contrary, the harvest of North Sea herring targets both mature and immature individuals, Life-history they predicts that under this kind of mortality regime fisheries can be expected to induce an adaptive decrease in the age at maturation.

The results will provide guidance for evolutionarily enlightened management strategies, particularly with respect to fisheries targeting mature and immature individuals differently.

Keywords: Fisheries-induced change, herring, Norwegian spring spawning, North Sea, *Clupea harengus*, life history

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ICES CM 2007/E:24**Fish data from the Continuous Plankton Recorder survey**

J. A. Lindley, N. C. Halliday, and D. P. Stevens

The CPR survey has been sampling plankton in the North Sea since 1931. However the identification of the larval and juvenile fish taken in the survey has not been a part of the routine analysis of the samples. Specialist analysis of the fish was carried out between 1948 and the early 1980s but the data were available as

hard copy only. As part of MarBEF, data on >60 taxa from 1948 to 1972 have been entered on a database which is now linked to EUROBIS to show the biogeographical information and the data are available for general research. Examples of the data are shown. These data provide a background on the variability of fish stocks before the recent period of rapid warming and in some cases before significant fisheries developed. Data for subsequent years will be made available as possible and work is now underway to bring the analysis up to date. This will provide time series over six decades.

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ICES CM 2007/E:25

MarFish: Causes and consequences of changing marine biodiversity, a fish and fisheries perspective.

Brian R. MacKenzie and Pascal Lorance

MarFish is a subproject of the EU Network of Excellence MarBEF (Marine Biodiversity and Ecosystem Functioning) and contains 18 participating fisheries and marine institutes from the Mediterranean Sea to the Norwegian Sea. The subproject is investigating the causes and consequences of changes in marine fish biodiversity in European seas. Project objectives are: (1) Detect and identify mechanisms of large-scale and long-term change in biodiversity of fish and other exploited species (e. g., scallops, lobsters); (2) Predict consequences of changes in biodiversity of fish and other exploited communities on ecosystem functioning and human societies. The main activities of the project are networking and scientific research. Networking activities include workshops, training courses, development of a fish biodiversity consensus document for policy makers and a web-based mechanism to facilitate foreign student and research participation on fisheries research cruises. Research activities include analyses which quantify changes in intra- and inter-specific fish biodiversity, changes in distribution/ranges of species and changes in functional roles of species within ecosystems. Examples of some of these activities will be presented in the presentation. Additional information is available at <http://www.marbef.org/projects/marfish/index.php>.

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ICES CM 2007/E:26 **Withdrawn**

ICES CM 2007/E:27 **Poster**

The life history of smelts (*Osmerus Eperlanus* Linnaeus, 1758) in the system "the Northern Dvina river – the White Sea

Alexander P. Novoselov and Igor I. Studyonov

The European smelt is wide spreaded in water systems of the White Sea and the Barents Sea. The smelt is half-migratorius fish and doesn't make long migrations in the White Sea system. Usually we can meet this fish in summer period in coastal parts, where young fish feed by plankton and adult fish are active predators. They eat their young and young of other fish species. The range of length is not too big – about 20-30 sm. The maximum age is 9 years. Smelts reach their sexual maturity in age of 3-4 years and rather seldom – in age of 2 years. Smelts migrate in the Northern Dvina river for spawning in early spring and don't go upstream too long – only several kilometers. In large rivers, spawning usually occurs 2-30 km upstream from mouth. The spawning places are presented by sand-gravel soil in depth about 2-4 m. The temperature of water is 3-8°C in the spawning period. Smelts have fecundity in range from 8 to 55 thousand eggs. Period of incubation is not long – 7-10 days. Larva's are in the upper layers of water and grow very quickly. The catch of smelts is very short by time – 1-3 weeks and is conducted only during spawning migration period. Maximal volume of catch in the last 10 years – about 10 tons.

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ICES CM 2007/E:29 Poster

Investigation of Blood Serum Osmo-ionregulation in Great sturgeon (*Huso huso*) Cultured in Brackish Water

Tahere Bagheri and Ali Akbar Hedayati,

In recent year use of brackish water as a new subject for commercial rearing (meat and caviar) in Great sturgeon have increase, so investigation of osmotic and ionic regulation in this new culture medium for examination and compare with other convention medium is very important. This study carried out with use of 74 numbers of 4–5 years old Great sturgeon cultured in brackish water pools in BAFGH-Iran. Blood sampling was performed in caudal vein every three month and plasma was frozen until future analyses. Osmotic pressure was determined by digital osmometer, Glucose with Authoanalyser, calcium and magnesium with spectrophotometer and sodium and potassium with filmphotometer. Among blood profiles, calcium had inverted significant correlation with osmolarity. In addition, salinity of water had strong inverted significant correlation with osmolarity that means with increase of calcium and salinity, the osmolarity will be decrease. Other ionic parameter and cortisol had non-statistical inverted correlation. Eventually definite salinity is important and effective factor for osmo-ionregulation in sturgeons, and with increase of salinity, this mechanism will be increase. Cortisol is a key hormone for adaptive to brackish water. Development of osmoregulatory cell is depended to age (little in young). Tolerance of Great sturgeon to brackish water is better than other sturgeon. Osmolarity of this fish do not change in brackish water that is for good adaptation and show that brackish water is a suitable medium for culture of Great sturgeon.

Keywords: Osmo-ionregulation, Osmolarity, Great sturgeon, Brackish water.

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ICES CM 2007/E:30 Poster

Round goby (*Neogobius melanostomus* Pallas, 1811) ‘semi-domestic’ species in the Gulf of Gdansk (the southern Baltic; 1993–2004)

Włodzimierz Grygiel

The geographical, bathymetric and seasonal (autumn-winter 1993 – 2004) variations in the occurrence and the catch per unit effort of round goby in the near bottom water layers of the Gdansk Basin were analysed. The above-mentioned new, invasive in the Baltic Sea taxa, since December 1993 has began to appear very often also in the r/v “Baltica” control catches, primarily in the Puck Bay, at the depth of 50-60 m. Round goby was recorded as a by-catch in the Polish research catches carried out within the framework of the Baltic International Trawl Surveys Programme. The results of 2,528 bottom catches made along the nine standard research profiles within the depths ranging from 10 to 110 m were analyzed.

Keywords: round goby, occurrence, CPUE, Gulf of Gdansk.

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ICES/CM 2007/E:31 Poster

Spatial and temporal dynamics of the demersal fish community in the Barents Sea

Andrey V. Dolgov

The species composition and structure of the Barents Sea fish community is considered. Based on data from the Russian research surveys during 1998-2006 some types of the fish communities were revealed related to different environmental parameters (geographical position, water temperature, habitat depth). The northern Barents Sea fish community consists mainly of arctic species though mainly boreal species dominate in the southern Barents Sea. Deepwater community on the continental shelf slope was represented by limited number of species including Greenland halibut, onion-eye grenadier, deepwater redfish, Arctic skate as the most abundant species. Other species (like Atlantic spiny lumpsucker, shorthorn sculpin, Arctic staghorn sculpin) were more common only in shallow water communities. Some inter-annual changes related to water temperature were observed in the Barents Sea fish community. Due to water temperature increasing the portion of arctic species decreased and the portion of mainly boreal species increased.

Keywords: environmental parameters, arctic, boreal and deepwater fish species, interannual changes, water temperature.

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ICES CM 2007/E:33 Poster

Time series analysis of flatfish landings in the Portuguese coast

Célia M. Teixeira and Henrique N. Cabral

Time series analysis was applied to annual landings data of flatfishes (*Pleuronectiformes*) commercial fishery in the Portuguese coast, between 1927 and 2005. Common trends in the time series of several groups of species were evaluated for a shorter period (1992 to 2005) based on monthly estimates of landings. Both time series revealed trends and seasonal patterns were also detected in the 1992-2005 monthly data time series. Long-term changes in the flatfish landings were related to fishing effort and fisheries regulations historic records. The overall trend in the exploitation of these resources and aspects related to fisheries management efficiency are discussed.

Keywords: time series, flatfish landings, seasonality, fisheries, Portugal.

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ICES CM 2007/E:34 Poster

Historical variation on total catch and discard CPUES and bottom trawl survey abundances in the Northern Spanish Shelf: are they related?

N. Pérez, A. Serrano, J. Santos, and F. Velasco

Patterns of variation of total catch and discards of the Northern Atlantic Spanish shelf otter trawl fishery in the last two decades are analysed. These patterns are compared with the species abundance indices data series obtained from oceanographic bottom otter trawl surveys. Environmental data series are also used with the aim to explain and link total catch variability, discards and survey abundance indices. Shifts in the abundance and discard rate of vulnerable and sensitive species are specifically analysed with the aim of to develop a set of trawling impact indicators.

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ICES CM 2007/E:35 Poster

Trophic level of Portuguese fisheries landings during the period 1970–2005

Filipa Baeta, Maria José Costa, and Henrique Cabral

Fishing activities can alter the structure of marine food webs by the selective removal of some species. The changes in the marine food webs off the Portuguese coast were evaluated based on estimates of the annual mean trophic level and Fishing Is Balanced index (FIB) of marine fisheries landings for the period between 1970 and 2005. The relationship between price and trophic level was also examined, through the Relative Price Index (RPI). Mean trophic level showed a decreasing trend, which reflects changes in marine food webs structure. The relative importance of large piscivorous fishes has decreased compared to small invertebrates' feeders and planktivorous fishes, which dominate landings. FIB index also showed a downward trend and negative values, which may be associated with unbalanced fisheries. Fish species with higher trophic level have become relatively more expensive than species of lower trophic level. Considering that the contribution of low trophic levels to landings has increased, their prices were forced to decrease. It is likely that the persistency of present trends will compromise the sustainability of fisheries, both concerning preys and their predators. Changes in management measures adopted for each of the fishery resources can affect the whole trophic web.

Keywords: landings, trophic level, FIB, RPI, fishing down the food web, Portugal.

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ICES CM 2007/E:36 Poster

Ichthyofauna investigations in the mezopelagial of the Gulf Stream zone and in the North Atlantic current system related to that zone (species composition and distribution peculiarities, zoogeographic analysis)

Efim I. Kukuev and Dmitry A. Kozlov

This paper is based on the results of processed collection of mezopelagic fish caught during a series of scientific expeditions undertaken for investigation of the area in the North Atlantic in the Gulf Stream zone between 70-40°W and 37-45°N as well as in the area along the North-Atlantic Current between 40-57°N and the Irminger Current to 60N°and 40°W. A total of 15000 fish specimens were examined. The annotated list of fish species caught in epi- and mezopelagial of the Gulf Stream zone and related currents, including over 150 species out of 120 genera belonging to 54 families, was made based on the processed material. The study of the regularity of mezopelagic fish distribution depending on the character and structure of the Gulf Stream waters and related currents at the time of the material collection was another important stage of our investigation. With this end in view, we analyzed the species composition of the fish caught at 107 stations of 20 complex transects made between Cape Hatteras and Flemish Cap Bank, which crossed different locations from the continental slope waters to the Sargasso Sea. As a result, we obtained a picture showing a clear-cut dependence of the ichthyofauna composition on the water structure. The species and groups of species, indicators of warm and cold waters, were singled out. The zoogeographical analysis of the ichthyofauna at all the stations of investigated transects was a significant moment in our work. We traced the changes in the zoogeographical structure of mezo-pelagic ichthyofauna while moving from the continental slope across the Gulf Stream current towards the Sargasso Sea, and from the subtropics along the North-Atlantic Current to Rockall Bank and the Irminger Sea.

Keywords: faunistic composition, frontal zone, mezopelagial, mezopelagic fish, water structure zoogeographical, structure.

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ICES CM 2007/E:37 Poster

Age estimation, growth, maturity of the Dealfish *Trachipterus articus*

H. M.McCormick and G. Power

This paper summarises the preliminary results from the ageing and maturity of Dealfish, *Trachipterus articus* caught in fishery surveys in the NE Atlantic. In recent years there has been a significant increase in the numbers of these fish observed in the catches from Acoustic surveys with relative little knowledge of their basic biology.

Keywords: otolith, reproduction, NE Atlantic.

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