

Theme Session L

Stock identification – applications for aquaculture and fisheries management

ICES CM 2007/L:01

To Lump, or to Split? ... maybe the wrong question for stock identification of fishery resources

Steven X. Cadrin, Brian J. Rothschild, and Isaac Wirgin

Stock identification for fishery management typically involves delineation of allopatric groups that have relatively homogeneous vital rates, are essentially self-sustaining and isolated from adjacent groups. However, geographic stock structure of marine populations is seldom so simple, and distinct population processes and fishery effects operate at different spatial scales. Some components of biological production are sensitive to large-scale oceanic and atmospheric factors, as illustrated by recruitment and growth patterns of cod resources throughout the northwest Atlantic. Conversely, population structure is also influenced by small-scale processes that help maintain local spawning groups, as evidenced by fine-scale genetic structure of cod in the Gulf of Maine. The difficulties associated with monitoring and managing fishery resources as allopatric groups suggest that a more pluralistic and operational approach to stock identification may be more appropriate. For example, recognition of small-scale structure and groups with similar growth, maturity and mortality rates are most effective for short-term catch and spawning stock forecasts. At the other extreme, medium- or long-term rebuilding programs should consider large-scale factors that influence regional recruitment dynamics across many distinct spawning groups. The optimal spatial scale for catch monitoring and stock assessment modeling may be more determined by fleet dynamics (e.g., fishing grounds) and require stock composition analysis if fisheries harvest mixed stocks. Consideration of large-scale influences and sympatric population structure may improve the effectiveness of stock assessment and fishery management.

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ICES CM 2007/L:02

Results of biological and genetic studies of *S. mentella* in the open areas of the North East Atlantic

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Scanty knowledge of *S. mentella* population structure in the open North East Atlantic causes great difficulties in NEAFC with management measures for its pelagic fishery. According to ICES, in the Irminger Sea there are three types of *S. mentella*: “oceanic”, “pelagic deep-sea” and “deep-sea” *S. mentella*. Since the mid 1990’s some researchers have argued that the “pelagic deep-sea” type is a stock distinguished from the “oceanic” type. The purpose of the present paper is to study population structure of *S. mentella* in the pelagic Irminger Sea based on biological and genetic studies. It was found that in the 0–500 m and 500–1000 m depth ranges linear and weight growth rates, absolute and relative increments in *S. mentella* were equal. Individuals caught at different depths showed full similarity in the maturity rate by length and age. The genetic analysis showed a steady increase in frequency of occurrence of MEP-2*100 allele with depth. Variation in frequency of the “dominating” MEP-2* allele in *S. mentella* in the Irminger Sea could be explained by a steady (with age increase) move to greater depths and higher survival of individuals-carriers of the “dominating” allele that led to the increase in frequency of occurrence of MEP-2*100 allele. Based on the biological studies it was inferred that the so-called “oceanic” and “pelagic deep-sea” types are distinct age-length groups of *S. mentella*. Genetic data suggested the existence of a genetically single group *S. mentella* varying in time and being in the state of dynamic balance at which intra-population migration of genes prevents the formation of genetically different groups. Vertical variability of some biological and genetic parameters of *S. mentella* in the Irminger Sea is governed by peculiarities of its biology and ecology at different stages of the ontogeny.

Keywords: genetic studies, North East Atlantic, population biology, population structure, *S. mentella*.

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ICES CM 2007/L:03

The use of information on parameters of the life cycle in the management of *S. mentella* fisheries in the Irminger Sea

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Deficient knowledge of biology, ecology and population structure of *Sebastes mentella* (Travin, 1951) has long been the cause of heated discussions among scientists and managers regarding the number of its stocks in the Irminger Sea exploited in the midwater and demersal fisheries. The North East Atlantic Fisheries Commission manages the *S. mentella* fisheries on the basis of management units. In the Irminger Sea two management units were distinguished: "pelagic" and "deep-sea". Classification into management units reflected stages of fisheries development. Scientific grounds for such management option seem to be insufficient because it is not known reliably how much it is correct in view of *S. mentella* biology, ecology and population structure. The purpose of the present paper is identification of *S. mentella* stock in the Irminger Sea based on the research into the main parameters of its life cycle. Peculiarities of reproduction, maturity and growth of *S. mentella* in the pelagic waters and on the slopes, as well as recruitment to the two currently used management units were analyzed.

S. mentella concentrations in the pelagic Irminger Sea as well as along the slopes of Greenland and Iceland were found to be a single whole in view of biology and a part of its extensive population in the North Atlantic. It was revealed that the main reproduction area of *S. mentella* was located in the oceanic pelagic waters above the Reykjanes Ridge slopes. Recruitment to *S. mentella* concentrations along the slopes of Iceland and in the pelagic waters of the open sea was proved to come from the common nursery area on the shelf and in shallow waters of the Greenland slopes. The management scheme currently applied to *S. mentella* fishery in the Irminger Sea based on the two management units was concluded to be scientifically groundless.

Keywords: Irminger Sea, management units, parameters of the life cycle, *S. mentella*, stock identification.

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ICES CM 2007/L:04

Tagging data and its role in stock identification

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In the Gulf of Maine region, Atlantic cod, *Gadus morhua*, are managed as three separate stocks: in US waters, the Gulf of Maine (5Y) and Georges Bank (5Z) stocks and in Canadian waters, the Bay of Fundy stock (4X). The Northeast Regional Cod Tagging Program (NRCTP), a large-scale, international collaborative tagging program, was initiated in 2003 and provided the first region-wide snapshot of cod movements, mixing and growth across all three management areas. These mark-recapture data (114,473 tag releases and >6,500 recaptures) are now being analyzed for stock identification purposes. Two core assumptions when defining a stock are that the stock is self-sustaining and that neighbouring stocks exist in isolation. Migration patterns observed in the current study may substantially violate both assumptions. Analysis of raw and weighted data indicate exchanges between different areas which appear to be related to spawning behaviour, maturation and environmental conditions. Spatial variation in key life-history characteristics (e.g., growth, maturation, natural mortality) is also relevant to attempts at stock identification. The NRCTP provides growth data from ~4,500 individual fish throughout the Gulf of Maine region; spatial variation is seen both within and between stock management areas. The NRCTP demonstrates the role of mark-recapture data in the complex process of stock identification. The geographic scale and quality of data collected during the NRCTP also confirm the value of international, industry-science collaborative research initiatives.

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ICES CM 2007/L:05

Genetic stock structure of Atlantic sea bass (*Dicentrarchus labrax*) and Gilt-head sea bream (*Sparus aurata*) around the British Isles.

Ilaria Coscia, Katja Peijnenburg, Mike Pawson, and Stefano Mariani

The gilt-head sea bream (*Sparus aurata*) and the sea bass (*Dicentrarchus labrax*) have long represented very valuable fisheries and aquaculture resources in the Mediterranean Sea, but over the last decades their populations are increasing in the Atlantic coastal waters throughout north-western Europe. Apart from a

definite differentiation between Atlantic vs. Mediterranean stocks, authors have not yet agreed on finer scale stock structure patterns for the purpose of management, and there still remains a high degree of uncertainty as to the processes underlying the current phase of demographic expansion of existing Atlantic populations.

The Gilt-head Sea Bream is believed to be still at the beginning of this expansion phase. Samples of *Sparus aurata* have been collected from western and southern Ireland, the English Channel and the Bay of Biscay. We present preliminary data for this species, obtained employing mitochondrial and nuclear markers. Sea Bass populations from Britain and Ireland (North Sea, English Channel, Irish Sea, Celtic Sea), as well as more southern samples (Bay of Biscay, Western Mediterranean) have also been screened using a suite of 11 unlinked polymorphic microsatellites and a 434-bp fragment of MtDNA comprising part of the D-Loop. With the use of several statistical approaches, we attempt to disentangle present-day migration phenomena from historical colonisation events, and try to make use of integrated multi-marker information to assess and describe the stock structure of the two species.

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ICES CM 2007/L:06

Evaluation of genetic impact of aquaculture activities on native populations

Terje Svåsand, Donatella Crosetti, Eva García-Vázquez, Eric Verspoo, François Bonhomme, Lorenzo Colombo, Sylvie Lapégué, Gudrun Marteinsdottir, Ingrid Olesen, and Costas Triantaphyllidis

The past ten years, worldwide production of farmed fish has more than doubled, with farming activities now producing half of the fish directly consumed by humans. The potential genetic effects of aquaculture on natural fish populations have aroused a great deal of concern among scientists as well as the general public. The perceived risks are often associated with cultured and native fish, and the adverse effects of ecosystem interactions. Public health issues are also a matter of concern.

There is a need to strengthen the knowledge base required to assess the genetic impact of aquaculture on the environment. The EU-project Genimpact (Evaluation of genetic impact of aquaculture activities on native populations – An European network, (<http://genimpact.imr.no>), financed by the European Commission, started in November 2005 to review existing knowledge necessary to assess genetic effects of aquaculture on biodiversity, review future research needs, and disseminate this information to a wider public. To achieve this, Genimpact has convened a series of expert workshops on risk assessment and interbreeding and aquaculture ecosystem interactions, and discussed the results with stakeholders. The main findings and conclusions are presented in this paper.

Key words: aquaculture, genetic interaction, monitoring tools.

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ICES CM2007/L:07

The Atlantic Salmon Arc Project (ASAP): A genetically-based tool for stock identification and management of Atlantic salmon (*Salmo salar*) in western Europe

Andrew Griffiths, Gonzalo Machado-Schiaffino, Eileen Dillane, Dylan Bright, Tom Cross, Eva Garcia-Vazquez, and Jamie Stevens

Atlantic salmon (*Salmo salar*) exist in rivers across the North Atlantic, returning to their river of birth with a high degree of accuracy; however, they are in steep decline across their range, particularly at their southern limits. Atlantic salmon from rivers along the western seaboard of Europe migrate along similar routes, along which they have, historically, often been subject to high commercial netting. This ‘mixed stock exploitation’ has the potential to devastate weak and declining stocks where they are indiscriminately exploited. The effect of marine exploitation, and more generally the marine element of the salmon life-cycle, remains the “black-box” of salmon management. To address this problem, ASAP has generated a baseline of genetic information for salmon originating from the largest rivers across the project arc (northern Portugal to northern Scotland). Using a panel of up to 12 common microsatellites, more than 4,000 individual fish from 60 rivers have been genotyped. Techniques for genetic stock identification have been applied and the results from preliminary tests and simulations are extremely encouraging; salmon stocks from different rivers appear to be largely distinct and mixed stock analysis is possible. Samples of known origin (which are not included in the baseline) are being tested, together with samples from commercially net-caught salmon. This research will provide a baseline for the informed management of salmon stocks, both in their natal rivers and in the marine environment. ASAP is a collaborative project supported by the European Union INTERREG IIIB programme.

Keywords: Atlantic salmon, *Salmo salar*, genetic stock identification (GSI), mixed stock analysis (MSA).

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ICES CM 2007/L:08

Examining the loss of genetic variation in Atlantic salmon stocks created for supportive breeding

Gonzalo Machado-Schiaffino, Jose Luis Horreo-Escaldon, Andrew Griffiths, Dylan Bright, Jamie Stevens, and Eva Garcia-Vazquez

Conservation of genetic variability is of priority for hatchery stocks employed to supplement natural populations. Supportive breeding of Atlantic salmon (*Salmo salar*) to enhance wild populations is particularly important at the south of the European distribution (northern Spain). In this region, wild adults are caught every year from local rivers and artificially crossed. The offspring are hatchery reared until juvenile stage, then released in the same river where their parents were caught. In this study we demonstrated that adult breeders chosen for creating hatchery stocks by artificial spawning preserved all genetic variants present in three wild Spanish populations for twelve microsatellite loci (Narcea, Cares and Sella rivers). However, significant losses of genetic variability were found in juveniles released to the native rivers. The cross strategy carried out in hatcheries was evaluated and differences at fidelity of hatchery stocks to native wild genetic patterns were found among them. The role of different causes for genetic variation loss (overuse of some breeders, differential performance of crosses etc) was examined through pedigree analyses.

Keywords: genetic variability, *Salmo salar*, stocking, supportive breeding.

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ICES 2007/L:09

An evaluation of stock management practices for the central Baltic herring (*Clupea harrengus membras*)

Maciej T. Tomczak

In Baltic proper a number of local herring stocks (e.g. South-coast or North-eastern) can be distinguish on the basis of the spawning areas, otolith shape, maturation or growth rate, but have been grouped for assessment and management purposes for different stock-unit. Since year 1990 ICES has been assessing and recommending Total Available Catch (TAC) for one stock-unit compose from SD 25-29;32. This aggregated stock-unit was compromise between actual knowledge of stock structure of Baltic herring, and the ability to separate stock in mixed catches. International Baltic Sea Fisheries Commission was managing Central Baltic herring for almost 20 years, as one Management-unit (SD 22-29;32) without taking into consideration ICES spatial units system, also the recommendation to manage on the basis of the ICES advice was not taken in to account sufficiently.

In this work the results of the current assessment methodology and management practices were compared with outcomes from hypothetical models based on precautionary recommendations from ICES. A number of different population models were constructed to simulate herring stock abundance, recruitment patterns, catch, CPUE, and also to evaluate contrasting ICES management strategies and possible impacts on the central Baltic herring population.

The results show that the management of the central Baltic herring stock according to ICES recommendations would not probably prevent the decrease of biomass, though it would enable faster “stock recovery” and minimize the risk of unsustainable exploitation.

Keywords: Baltic herring, assessment, management, local stock, stock-unit.

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ICES CM 2007/10

Separation of Norwegian coastal cod and Northeast Arctic cod by otolith morphometry

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For stock assessment purposes, Atlantic cod (*Gadus morhua*) from the coastal and offshore regions off northern Norway is usually allocated to Norwegian coastal cod (NCC) and Northeast Arctic cod (NEAC) by internal morphological features of their otoliths. As this classification is subject to individual interpretation, this study investigated an alternative objective approach for the separation of the two cod groups, using otolith shape analysis. Otolith samples from coastal areas along northern Norway and from the Barents Sea

were analysed by univariate shape descriptors and Elliptical Fourier Analysis (EFA). When combining those methods, the classification score was 89% for NCC and 90% for NEAC. When genetic typing data (Pan I marker) were used as reference, the classification scores were reduced to 83% for NCC and 76% for NEAC. These results imply that differences in internal otolith morphology are translated to a large extent into the outer shape, but that those cannot directly be linked to genetic structure. Environmental conditions, however, seem to have a considerable influence on how otolith growth increments and consequently otolith shapes are formed. As the various fjord systems in Norway provide local habitats and as differences within the NCC with regard to genetic structure and life-history parameters had been found in earlier studies, variation of NCC otolith shapes between three coastal regions was also examined. The region classification scores for reader-typed NCC varied between 60% and 81%. Apart from the outer shape analyses, experimental work on the detection of internal (annuli) shapes was carried out and will be presented as work in progress.

Keywords: stock identification; otolith shape analysis; Northeast Atlantic; Norway; Atlantic cod; *Gadus morhua*.

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ICES CM 2007/L:11

The scientific implications of the EU Project WESTHER (Q5RS - 2002 – 01056) to the assessment and management of the herring stocks to the west of the British Isles

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WESTHER's overall goal was to describe the population structure of herring stocks to the west of the British Isles, to enable the production of a set of improved guidelines for the conservation and management of biodiversity and stock preservation by incorporation of the findings into the assessment processes for western herring. Analysis of a multi-disciplinary suite of characters was carried out on herring collected from spawning aggregations, from nursery areas and from adult non-spawning, feeding, aggregations in the study area. The results revealed temporally distinct spawning grounds in the area, with each of them being populated by a group of herring which, in general, have a certain level of site fidelity. There was a clear distinction of many of the different juvenile samples. There was, however, strong evidence that juveniles from separate spawning areas mixed in some of the nursery areas sampled. There was also evidence to suggest mixing of adults from separate spawning components, especially in VIa North. The science, therefore, suggests links between the areas, with fish spawning in different areas mixing, to varying extents, on feeding grounds and, therefore, fish from each spawning aggregation do not remain discrete on their feeding grounds. The results from WESTHER suggest that under the current stock assessment units, two basic assumptions of stock assessment (the stock is a closed unit, and the data used in assessments are representative of the entire stock) are violated. Alternative recommendations for the combination of stocks are discussed with reference to their assessment and management.

Keywords: assessment and management; herring, multi-disciplinary approach, stock components.

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ICES CM 2007/L:12

Using otolith and body shape analysis to distinguish herring stocks to the west of the British Isles.

Emma M.C. Hatfield, Henrik Mosegaard, Soenke Jansen, Jürgen Schlickeisen, and Christopher Zimmermann.

Seasonal fisheries for herring take place in many different areas around the coast to the west of the British Isles (Scotland, Ireland, northwest England, the Isle of Man and Wales). Currently these putative herring stocks are assessed separately as four stocks. Spawning site fidelity and the degree of mixing outside of the spawning season is unknown. Past decisions to separate areas and create new stocks were based on fishing patterns and the exploitation by different fleets, not biology. These new stocks were then assessed and often managed separately. Body and otolith shape were analysed as part of the multidisciplinary EU-project WESTHER (Q5RS - 2002 – 01056) from spawning aggregations and putative mixed adult feeding aggregations to determine both the extent of population structuring and levels of mixing. High classification success of spawning aggregations for both methods provides evidence of population structuring by spawning time and spawning sites, indicating a high degree of natal fidelity. Evidence suggests significant migration and mixing of herring that originate from different spawning areas, especially to and from feeding grounds and by repeat spawners to spawning grounds.

Keywords: herring, morphometrics; stock components.

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ICES CM 2007/L:13

The use of parasitological data in population studies of the commercial pelagic fishes from the Central-East Atlantic

O.A. Shukhgalter and G.N. Rodjuk

The purpose of the paper is assessment of possible use of parasitological data for investigation of population structure of commercial pelagic fish species of the Central-East Atlantic (CEA). Frozen samples of three commercial fish species (*Sardina pilchardus*, *Trachurus trachurus* and *Scomber japonicus*), a total of 1402 specimens, collected from the neritic area of the North African coast (32–17°N) and from the Azores Archipelago banks (the Great Meteor Bank, the Hyeres Bank and the Irving Bank) were examined using the total parasitological dissection method. Geographical variability of parasite fauna in the neritic areas of North Morocco (32–26°N), South Morocco (26–20°N), and Mauritania (20–17°N), which correspond to three natural latitudinal zones with different neritic ichthyocenosis was studied (Domanevsky, 1998). Three variants of parasitological data analyses were used: 1) analysis of ontogenetic dynamics of infestation of the fish from discriminated areas; 2) analysis of geographical variability of the parasite composition using the set theory method; 3) analysis of mean abundance indices of parasites-tags dispersion (Mackenzie, 2002).

All above variants of parasitological data analyses can be used in complex investigations for distinguishing the intraspecific groups of sardine, horse-mackerel and chub mackerel from the CEA. However it should be mentioned that the use of these variants for different fish species had different effect.

Keywords: chub mackerel, horse mackerel, parasite, population, sardine, tag.

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ICES CM 2007/L:14

Application of SNP's (Single Nucleotide Polymorphisms) for genetic stock identification in Atlantic cod (*Gadus morhua* L.)

Einar Eg Nielsen, Jakob Hemmer Hansen, Thomas Moen, and Dorte Meldrup

Microsatellites are at present the preferred genetic markers for Genetic Stock Identification (GSI) in fisheries management due to their high levels of variability and associated high discriminatory power. However, lately, Single Nucleotide Polymorphisms (SNP's), which are single base substitutions found in both coding and non-coding regions of the genome, have started to replace microsatellites. Although SNP markers have been limited by sampling difficulties, number of available loci and levels of polymorphism, the higher reproducibility and transferability among labs for SNP's offer some advantages compared to microsatellites; in particular in relation to establishing common databases. We here present preliminary results from the application of a panel of more than 50 SNP's to major European populations of Atlantic cod. We contrast levels of population divergence and power for Individual Assignment (IA) with previous results obtained from the same populations based on microsatellites.

Keywords: Atlantic cod, population genetics, SNP's, individual assignment.

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ICES CM 2007/L:15

Spatial stock structure of common whelk (*Buccinum undatum*) in Irish waters inferred through a multidisciplinary approach

Katja Peijnenburg, Alice Antoniacomi, David Weetman, and Stefano Mariani

A description of the patterns of spatial stock structure in exploited marine species is often best obtained when more than one single method is applied. Genetic methods often fail to detect any significant patterns of differentiation at fine spatial scales, whereas phenotypic techniques can potentially yield a misleading picture as a result of the strong influence of the environment on morphological variation.

Here we present the results of an investigation on the stock structure of the commercially exploited marine gastropod *Buccinum undatum*, using both genetic (microsatellites) and phenotypic (shell geometric morphometrics) descriptors. We conducted the analysis at two hierarchical spatial levels (around Ireland and within the central Irish Sea) and detected significant differences using both approaches. By integrating

ordination techniques with multivariate correlation methods, we interpret and discuss our findings with the aim to provide a synthetic view of whelk stock structure that can be useful to the management of the fishery.

Keywords: microsatellites, geometric morphometry, stock identification, migration.

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ICES CM 2007/L:16 Withdrawn

ICES CM 2007/L:17

Identification of Atlantic salmon (*Salmo salar*) parr from different rivers in the Trondheimsfjord area by geochemical signatures of otoliths

Peder Fiske, Nils Arne Hvidsten, and Syverin Lierhagen

Our initial results suggest that salmon parr from different rivers could be differentiated based on the composition of trace elements in their otoliths. However, we could not classify new samples taken at a different time to the correct rivers using the discriminant functions based on the first sample.

This suggest that there are year to year variation in the chemical composition of the otoliths, and that if the method should be used to identify salmon of unknown origin one would need year specific samples from the possible rivers of origin.

The usefulness of the method to identify salmon from mixed-stock fisheries to the river of origin therefore seems limited.

Keywords: otolith chemical composition, Atlantic salmon, parr.

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ICES CM 2007/L:18 Poster

An interdisciplinary assessment of winter flounder stock structure

Greg DeCelles and Steve Cadrin

Stock structure and management of winter flounder (*Pseudopleuronectes americanus*) was evaluated throughout geographic range of this species in the Northwest Atlantic Ocean. Information on genetics, morphology, meristics, hydrodynamic modeling, life history traits, applied mark experiments and environmental signals was reviewed. Winter flounder in the U.S. waters are currently managed as three separate stocks; Georges Bank, Gulf of Maine and Southern New England/Mid-Atlantic. Estuarine spawning, which likely plays an important role in reproductive isolation and population structure, appears to be obligate in southern New England, non-existent on Georges Bank and variable in the Gulf of Maine. Despite evidence for reproductively isolated estuarine groups, information from tagging studies, meristic analysis, and life history studies suggest extensive mixing, thereby supporting the current U.S. management regimen. In Canadian waters, winter flounder are managed as three units which correspond to NAFO areas 4X (Western Scotian Shelf), 4VW (Eastern Scotian Shelf) and 4T (Gulf of St. Lawrence). Genetic analysis and parasite markers indicate that these populations are distinct from one another. However, similar studies between inshore and offshore winter flounder within division 4X suggest little interchange between these groups. Several distinct winter flounder stocks probably also exist within the 4T management area. Stock assessment and fishery management would likely benefit from stock composition analysis of mixed-stock fisheries of both U.S. and Canadian fishery resources.

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ICES CM 2007/L:19 Poster

Fish stocks of large lake systems of northern Russia and their rational use (Case Vashutkini lakes)

Gennadi Dvoryankin and Vadim Timofeev

By virtue of various social and economic reasons the fishery volume in the lakes of northern Russia has decreased six-fold over the past 15 years. Now there is a serious need for restoration of the fish facilities in the internal reservoirs of the region. In northern conditions one of the ways of increasing freshwater fish

production is the trade development of large reservoirs and lake systems located near the large industrial centers. Researches which have been carried out during 2004–06 years have shown that Vashutkini lakes are very prospective for the industrial fishery. This largest lake system of Bolshezemelskaya tundra is located in the northeast of the Arkhangelsk region near the city of Vorkuta. It consists of 7 comparatively large lakes with the area 6.20 km² and set of small reservoirs. In 50–60's years of the last century 60–70 tons of fish have been extracted annually from Vashutkini lakes. However, during the last twenty years fish resources of these reservoirs basically haven't been used. Vashutkini lakes can be important for fishery due to the prevalence of the valuable kinds in stocks. From the information we have, the relative number of the white-fish and umber is about 60–70 % of the total fish stock. The population of the basic fish kinds is in good condition, and their stocks make it possible to restore the industrial fishery of the white-fish, pelyad, umber and pike. The total possible fish yield on Vashutkini lakes can reach 100 tons, comprising the white-fish - 30 tons, umber - 15 tons, pelyad - 15 tons, pike - 30 tons and 10 tons of the perch and roach.

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ICES CM 2007/L:20 Poster**Fish stock management for especially protected natural territories (case Kenozerskij national park)**

Gennadii Dvoryankin and Sergei Kulida

Kenozerskij national park is a unique natural, historical and cultural complex located in the southwest of Arkhangelsk region. In 2004 it was included into UNESCO's World Network of Biosphere Reserves. One of the important tasks of this national park is the maintenance of the traditional fishery and supplying local population with fish products. In Kenozerskij park there are about three hundred lakes with the total area over 200 km², which makes 14,4 % of park's total territory. Over 80 tons of fishes is extracted annually from those lakes. The most productive is Lekshmozero lake. From 40 up to 60 % of total national park's catch volume is extracted from this 54 km² large reservoir. Continuous monitoring of conditions of industrial fish species is conducted on the lake with the purpose of rational fish stock management. Special attention is given to the biggest in the Arkhangelsk region freshwater population of vendace - *Coregonus albula* (L.). Based on the results of researches, the annual catch quota of this valuable fish has been increased three times up to 20–25 tons, which allowed to completely provide local residents with high-quality albuminous food. Another important task is the control over the lake ecology. In 1996 a mass suffocation of fish has occurred on Lekshmozero as a result of the concurrence of several adverse factors - 35 tons of vendace were lost. The industrial fishery has been restored only after two years.

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ICES CM 2007/L:21 Poster**Population genetic studies in Northeastern Atlantic minke whales**

M. Berube, H. Skaug, L. Andersen, T. Haug, and N. Øien

Minke whales are the most abundance species of baleen whales in the North Atlantic. As part of current management of minke whales in Norwegian and adjacent waters, a DNA-register have been established. The register ensures that samples (muscle tissues) are taken of each animal caught under the Norwegian catch quota, and that a DNA-profile is established and stored in a database from each individual whale. Previous studies have indicated that genetic population substructure exists within the North Atlantic, but sample sizes were limited. We present an analysis based on mtDNA and 10 microsatellites from the 4500 individuals that currently constitute the DNA-register. Information about population structure is important input to the management procedure applied for North Atlantic minke whales.

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ICES CM2007/L:22 Poster**Differentiation of western (*Gadus morhua* L.) and eastern (*Gadus morhua callarias*) Baltic Sea cod stock by means of stable isotope ratios in otoliths**

Barbara Deutsch, Katrin Paul, Ulrich Berth, Martina Bleil, and Rainer Oeberst

The existence of two different cod stocks in the Baltic Sea is an accepted concept since many years. The assignment of individual cod to one of the stocks is only based on the location of its capture and does not incorporate the different intensity of the mixing of both stocks in the different ICES subdivisions. Uncertainty of the assignment of individuals influences different aspects of the stock assessment. In 2005 the

International Baltic Sea Fisheries Commission started to manage the two stocks separately, and methods to identify the origin of individual fish becomes important.

A small pilot study, carried out in 2005 tested the application of stable isotope measurements in cod otoliths and muscles as a tool to distinguish between both cod stocks. The results of the study, although carried out with a limited number of individuals (total 20 fish) captured in the western Baltic Sea (ICES SD 22) and the Bornholm Basin (ICES SD 25), showed significant differences in the $\delta^{18}\text{O}$ values of the otoliths. Moreover, significant differences were found in the $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values of muscles between fishes from both regions. Similar investigations were carried out on otoliths of 220 spawning individuals with comparable length from the western Baltic Sea (ICES SD 22) Arkona Basin (ICES SD 24) and Bornholm Basin (ICES SD 25).

Keywords: stock identification, stable isotopes, $\delta^{18}\text{O}$, $\delta^{13}\text{C}$, Baltic Sea, cod, otoliths.

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ICESCM 2007/L:23 Poster**Age and growth of bluemouth, *Helicolenus dactylopterus* (Delaroche, 1809), in the Portuguese continental coast: a contribute to the stock identification**

Vera Sequeira, Ana Neves, Ivone Figueiredo, and Leonel S. Gordo

Helicolenus dactylopterus was studied from bottom trawl demersal surveys (540 specimens) and commercial landings (207 individuals) carried out between 2005 and 2007 along the Portuguese continental coast. For each individual, the total length (TL), weight (TW), and sex were recorded. Otoliths were extracted and both the radius and the distance of each ring to the nucleus were measured for 299 otoliths. Age was assigned using whole otolith readings. Marginal increment analysis suggested that a single annulus was formed each year. The fish length range was between 5 to 38 cm for the individuals captured in the surveys and between 19 to 37 cm for the individuals obtained from the commercial landings, which corresponded to a estimated age between 0 and 25 years old and 12 and 28 years old, respectively. The otoliths showed the typical teleost fish pattern with alternated opaque and hyaline rings, but with a complex ring pattern in the central area. The von Bertalanffy growth equations were determined for the two groups of individuals and for both sexes, and the growth parameters were compared. Comparisons with other studies carried on the Portuguese EEZ are discussed.

Keywords: *Helicolenus dactylopterus*; age; growth; otoliths; stock identification; Portugal.

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ICES CM 2007/L:24 Poster**Comparative study of introduced populations of Red king crab (*Paralithodes camtschaticus*) in Barents Sea and two native populations in Pacific**

Daria A. Zelenina, A. A. Volkov, N. S. Mogue, and V. I. Sokolov

Red king crab (*Paralithodes camtschaticus*) was introduced to the Barents Sea in the 1960s. Mature crabs in the coastal Russian water have been observed since the middle of 1970s. At present time, red king crabs occur along the coast from the Hammerfest (Northern Norway) to the Voronka region of the White Sea (north-east coast of Kola peninsula). Crabs from four sample sites from Barents Sea (Varangerfjord, Teriberka, Dolgaya Bay, and Drozdovka Bay) were compared with each other and with two reference native populations from Kamchatka region and Primorye (Russian Pacific). The samples were screened for five microsatellite loci and the sequence of COI was determined for some of individuals. Most of the samples were under Hardy-Weinberg equilibrium and no linkage between loci was observed. The average number of the microsatellite alleles per loci and mtDNA haplotypes distribution were quite similar in all populations and no reduction of genetic variation due to founder effect was observed. The results of Fisher's exact test allowed to suppose some genetic differentiation of crabs from Varangerfjord with the rest of the Barents Sea sites studied and with the Pacific populations. No significant difference among three other Barents Sea and Pacific populations was detected. Further investigations of introduced red king crab using more microsatellite loci and probably some other molecular markers could be very useful for understanding of the genetic processes taking place in alien species in new environment.

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ICES CM 2007/L:25 Poster

Population genetic structure of grey seals (*Halichoerus grypus*) : Diversity, differentiation and prospects for genetic population assignment with special reference to Norwegian waters

Anne Kirstine Frie, Madjid Delghandi, and Torild Johansen

Population structure of grey seal breeding colonies in Norway (n=300), Northwest Russia (n=40) and Scotland (n=100) is currently being investigated based on Mt-DNA control region sequencing and fragment analysis (8 microsatellite primers) applied to biopsies from live sampled pups. In addition, mixed adult/pup samples from Iceland (n=80), the Baltic Sea (n=50) and Canada (n=50) are included in the study, which thus spans the distributional limits of the main grey seal concentrations worldwide.

In line with previous observations of a high degree of female philopatry in grey seals, preliminary results from Mt-DNA analyses show highly significant differentiation of 3 breeding populations along the Norwegian coastline. Both juvenile and adult grey seals are, however, capable of undertaking long distance migrations and mixing of non breeding animals from different populations has been documented by tagging studies. We analyse the grey seal sequence and microsatellite data with respect to genetic diversity and population differentiation and evaluate the potential for genetic assignment of native population to grey seals sampled out of the breeding season with particular focus on Norwegian waters. Depending on geographical resolution, assignment tests may be a valuable tool for assessing degrees of population intermixing in grey seals and for estimating population specific parameters such as hunting and bycatch mortality.

Keywords: grey seals, population structure, population assignment.

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ICES CM 2007/L:26 Poster

First approach to the fishing effort estimation of the rays and skates Portuguese mixed-fishery

Bárbara Serra-Pereira, I. Figueiredo, I. Farias, A. Neves, T. Moura, and L. S. Gordo

Rays and skates in Portuguese continental waters are essentially caught by multi-species fishery. A large number of commercial species, mostly benthic, are landed by artisanal vessels operating mainly with trammel nets, and/or gillnets, longline and pots. The combination of gears and the targeted species vary along the year. Apart from the heterogeneous fishery, the main problem to the management of rays and skates are the combine landings, which include almost all the landed species on a single commercial category. The first goal of this work is to make the identification and description of the fishing segments that compose the mixed-fishery with positive landings of rays and skates. The second aim is to make a first approach to the estimation of the fishing mortality imposed by a given quantity of nominal fishing effort on rays and skates capture, based on the number of fishing hours or the number of effort units (i.e. length of nets or number of hooks). The information was obtained from inquiries to the fisherman's community of Peniche, the landing port with highest landings of these species. The inquiries were focused on individual fishing trips with information on gears (type, units, size, fishing hours and targeted species) and fishing ground (location, depth and bottom type). Additionally landings composition, landed length frequency and weight of each rays and skates species were obtained. The fishing segments were identified based on landings composition and characterized according to fishing gear, fishing ground, season and species composition.

Keywords: rays and skates, mixed-fisheries, métiers, effort, Portugal.

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