

Theme Session L

Bringing collaborative science–industry research data into stock assessment and fishery management: evaluating progress and future options

ICES CM 2009/L:01 Withdrawn

ICES CM 2009/L:02

The Russian experience of collecting industry research data in the Barents Sea demersal fishery

K. V. Drevetnyak, E. A. Shamray, and Yu M. Lepesevich

The Barents Sea is an important demersal fishery area for northwestern Russia and Norway. The key species in the bottom-trawl fishery are cod, haddock, saithe, catfish, Greenland halibut, redfish, etc. The Russian demersal fishery primarily targets cod, which makes up about 70% of the total Russian catch in the Barents Sea. The Russian cod fishery is conducted all year-round in the entire Barents Sea. The lengths and ages of fish caught depend on the season and fishing area. The Russian cod fishery is mainly conducted by large and medium-sized freezing trawlers (over 200 vessels) with production facilities on board and cruise duration exceeding one month, which limits the opportunities to collect data during port calls. Russian trawlers fishing for cod in the Norwegian Economic Zone use 135-mm mesh, while those working in other Barents Sea areas use 125-mm mesh. This also results in differences in length and age composition of catches. With all this in view, PINRO has developed different schemes for collecting biological and industry research data on the Russian cod fishery. This paper gives a detailed description of the schemes used for collecting industry research data on the Russian cod fishery. All types of industry research data are presented and their use for stock assessment and other managerial purposes is discussed.

Keywords: Barents Sea, cod, demersal fishery, industry research data.

Contact author: Konstantin V. Drevetnyak, Knipovich Polar Research Institute of Marine Fisheries and Oceanography (PINRO), 6 Knipovich Street, Murmansk, 183038, Russia [tel: +7 8152 47 22 31, fax: +7 8152 47 33 31, e-mail: drevko@pinro.ru].

ICES CM 2009/L:03

Estimating abundance and biomass of North Sea cod based on surveys with commercial fishing vessels

Kai Wieland, Eva Maria Fenger Pedersen, Hans J. Olesen, Casper Berg, and Jan E. Beyer

A collaborative fishers–biologists project on cod in the northeastern central North Sea was started by the National Institute of Aquatic Resources at the Technical University of Denmark and the Danish Fishermen Association in summer 2006. Three commercial vessels representing different fishing methods participated in the study. The surveys with these vessels, which allowed fishing on rough bottoms and on ship wrecks, provided information on the distribution, abundance, and size composition of North Sea cod in respect to bottom type. These data could be compared with results from the International Bottom Trawl Survey (IBTS). In general, catch rates were higher on rough bottom than on smooth bottom, and large catches were made in areas where the IBTS reported low densities or no cod at all. In particular this was pronounced for cod of older ages in the first quarter surveys. Scaling the commercial catch rates based on the ratio of IBTS indices for the study area and the entire North Sea suggests that the spawning-stock biomass may have increased faster in recent years than the assessment indicates.

Keywords: cod, North Sea, fishery–science collaboration, effect of bottom type on cpue, catchability at age.

Contact author: Kai Wieland, Technical University of Denmark, National Institute of Aquatic Resources, North Sea Center, PO Box 101, 9850 Hirtshals, Denmark [e-mail: kw@dtu.aqua.dk].

ICES CM 2009/L:04

Science-to-management pathways for collaborative and traditional herring stock assessments: using network analysis to track information flow in fishery management

Troy W. Hartley and Christopher Glass

Herring in the Northwest Atlantic are not overfished and overfishing is not occurring. However, concerns for the potential of localized depletion and negative impacts on other fisheries and economic sectors have led to a sequence of management plans and amendments in recent years. Stock assessments have been vital in these management deliberations and there are several sources of herring stock survey data in the Gulf of Maine and Georges Bank, including (i) a government-administered trawl survey and (ii) a collaborative industry–science acoustic survey. A joint US–Canadian technical committee of scientists determines the stock assessment from these data. We first describe the two stock survey approaches, including the outcome of a 2005 external peer review of the collaborative acoustic survey, and examine their use in the assessment process. Second, we use a network analysis methodology to map the communication patterns among participants in the development of a fishery management plan (FMP). Individuals (nodes) and their connections (links) are spatially arranged in a network map based upon the communicative relationship among all individuals. We track the pathways through which traditionally and collaboratively derived stock survey data flow into the FMP decision-making process. We compare the two pathways for their communication efficacy in feeding stock survey information into FMP decision-making, based upon network theory. The resulting map shows participants in the collaborative survey well connected to the fishery management process, but not particularly well connected to the stock assessment committee. Ramifications are discussed.

Keywords: collaborative research, stock assessments, network analysis.

Contact author: Troy Hartley, Virginia Sea Grant Director, Virginia Institute of Marine Science, Gloucester Pt, Virginia 23062, USA [tel: +1 804 684 7248, e-mail: thartley@vims.edu].

ICES CM 2009/L:05

From bust to boom: the success of industry collaboration in US sea scallop research

Catherine E. O’Keefe and Kevin D. E. Stokesbury

Crises in the fishing industry have caused distrust between fishers and fishery scientists. In such crises, fishers and scientists have found ways to work together, resulting in cooperative research programmes. Despite the clear benefits of cooperation, including industry empowerment, transparency of analysis and unbiased results, cooperative research programmes often lack the critical components that make the collected data useful for management decisions. The success of cooperative research hinges on participation from the fishing industry throughout the entirety of the research programme, from project design to data analysis. Furthermore, answerable, scientific questions must be outlined at the start of the research. Finally, data must be collected and analysed in a way that can be translated into management decisions and accepted by regulatory agencies. We have conducted a video survey for Atlantic sea scallops cooperatively with the US scallop fishing industry since 1999. The survey was initiated by the fishing industry as a result of decreased landings and increased regulatory actions with the goal of determining the number of scallops on Georges Bank. Over the last decade, industry participation has grown to include over 300 vessels and 20 shore-based operations. Data and results from the video survey have been included in traditional stock assessments and decision-making processes and have been instrumental in maintaining the success of the area rotation management scheme. This case study outlines the initiation of the survey and examines the success and difficulties associated with bringing cooperative research data into the management arena.

Keywords: cooperative research, sea scallops.

Contact author: Catherine E. O'Keefe, School for Marine Science and Technology, University of Massachusetts, Dartmouth 200 Mill Road, Suite 325 Fairhaven, MA 02719, USA [e-mail: cokeefe@umassd.edu].

ICES CM 2009/L:06

Feeding biology and small-scale geographical distribution of Atlantic cod in the northeastern central North Sea

Maria Kaspersen, Christiane Krog, and Niels G. Andersen

The distribution of Atlantic cod among bottom types was examined by using different types of fishing gear through Danish fishery–science collaboration surveys. Knowledge about potential diurnal shuttling of cod between different bottom types is important for interpretation and statistical assessment of the catch rates. Foraging behaviour is probably one of the most important factors that determines how cod are distributed among habitat (bottom) types outside the spawning season. Stomachs of cod belonging to three size groups were therefore sampled from the commercial vessels during the collaboration surveys, and their contents of prey were subsequently analysed in the laboratory. The main conclusions from these analyses were that: (i) the definition of bottom types by the different types of vessels diverged; (ii) in general, cod did not shuttle between bottom types on a diurnal basis, the exception being that large cod caught on rough bottom forage on smooth bottom; (iii) the diurnal feeding pattern, as inferred from the use of a gastric evacuation model to stomach contents data, differed for cod on smooth and rough bottom; and (iv) the availability of sandeel influenced substantially the distribution of cod between smooth and rough bottom. The implications of these conclusions for interpretation of the catch rates were discussed.

Keywords: fishery–science collaboration; bottom types; dynamics of spatial distribution; diurnal feeding patterns; influence of prey availability.

Contact author: Maria Kaspersen, Technical University of Denmark, National Institute of Aquatic Resources, Charlottenlund Castle, DK-2920 Charlottenlund, Denmark [e-mail: muk@dtu.aqua.dk].

ICES CM 2009/L:07

Cognitive maps from on-board observers as a tool for fishery management

L. Wise, A. G. Murta, J. P. Carvalho, P. Abreu, A. C. Fernandes, A. L. Ferreira, E. Henriques, D. Silva, G. Pestana, and J. Tomé

The concept of marine resource management could be seen as equivalent to controlling the predatory action of humans over marine ecosystems. One would have thought that human behaviour with regard to fishing activities would be much easier to model and predict than the behaviour of other top predators in the ecosystem. However, examination of the published scientific literature still reveals many methodological shortcomings and knowledge gaps in this subject. A realistic model of the decision-making process for fishers would be a valuable tool to predict the options that the fishers can take as a response to certain factors, such as management measures, fluctuations in fish price, or changes in fish abundance. In this presentation we describe a novel framework to model the decisions of skippers in response to a wide range of variables. This approach uses qualitative information collected by on-board observers through informal conversations with skippers during navigation time and in between fishing operations. That information is then used to build cognitive maps to describe the decision-making process of a skipper or a group of skippers, which are useful tools to demonstrate which variables are important for the skippers and the way in which those variables are related. At a later stage, these cognitive maps will be implemented as qualitative dynamic models using a modelling approach based on fuzzy rules, which will allow simulation of the skippers' decisions in different scenarios.

Keywords: cognitive maps, fleet dynamics, qualitative information, on-board observations, fuzzy modelling.

Contact author: L. Wise; IPIMAR, Av. Brasília, 1449-006 Lisboa, Portugal [tel: +351 213027000, e-mail: lwise@ipimar.pt].

ICES CM 2009/L:08

Preliminary results of an exploratory fishery targeting *Dissostichus eleginoides* and *Macrourus* sp. on the high seas of the Southwest Atlantic

J. M. Portela, S. Goetz, M. Laporta, J. L. del Río, R. Vilela, G. J. Pierce, and M. B. Santos

A pilot exploratory fishing survey was carried out from November 2007 to April 2008 on the high seas of the Southwest Atlantic by a Spanish bottom longliner targeting toothfish (*Dissostichus eleginoides*) and, secondarily, grenadier (*Macrourus* sp.) with scientific coordination by the Spanish Institute of Oceanography (IEO) and in close collaboration with the ship's owner. The main objectives of the pilot were to explore the advantages and disadvantages of a new gear design aimed at reducing depredation by cetaceans and to investigate its use by a commercial fleet, as well as to analyse interactions of fishing activities with marine mammals, seabirds, and vulnerable marine ecosystems (VMEs) and assess the viability of a commercial fishery for the above-mentioned target species. Results will inform future fishery and conservation management decisions for this area. Fishery and biological data were collected by a scientific observer on board the vessel. We present preliminary results from this exploratory survey. The highest concentrations of *Dissostichus eleginoides* were found south of parallel 53°S between 1000 and 1600 m depth. There were no incidental catches of seabirds or cetaceans in the experimental fishing gear and depredation by sperm whales appeared to be reduced. We also include an analysis of the interactions with VMEs and comparison with results from a series of five research cruises carried out by the IEO during the same period and in the same area.

Keywords: exploratory fishing survey, bottom-longline, Southwest Atlantic, catch, effort, cpue.

Contact author: Julio Portela, Instituto Español de Oceanografía (IEO), PO Box 1552, 36200, Vigo, Spain [e-mail: julio.portela@vi.ieo.es].

ICES CM 2009/L:09

Progress and future of using CTD loggers in collaborative swept-area surveys of *Loligo gahi* in the Falkland Islands: spatial distribution and biomass estimations

Ignacio Payá, Vlad Laptikhovsky, and Alexander Arkhipkin

Collaborative swept-area surveys are routinely done to estimate the *Loligo* biomass just before the start of each fishing seasons. The surveys are done using commercial vessels, which do not have oceanographic equipment to collect oceanographic data. However, during July 2008 and February 2009 surveys data-storage tags (DST) that record conductivity, temperature, and depth (CTD) were attached to the net. This study demonstrates the difficulties and the use of the oceanographic data collected by DST-CTD in our understanding of *Loligo* distribution and in estimation of its biomass. The data collected were compared with historical records of oceanographic samples routinely taken with a proper CTD along fixed transects. With good precision but limited accuracy the DST-CTD was post-calibrated using a proper CTD. The DST-CTD and the proper CTD were simultaneously deployed in different localities (river, harbour, and open coast) that covered a wide range of salinities and temperatures. The geostatistic analysis demonstrated that *Loligo* spatial distribution, bottom temperature, and bottom salinity were correlated. *Loligo* distribution was restricted by the extension of the upper part of the transient zone between coastal and Subantarctic waters. The geostatistic biomass estimation was improved by incorporating in the spatial model a *Loligo* density trend correlated with bottom temperature. The use of DST-CTD in future surveys and in commercial vessels during the fishing seasons is discussed, with special emphasis on the understanding of *Loligo* spatial distribution and interannual variability of the timing of immigration to the fishing grounds.

Keywords: CTD loggers, commercial vessel, swept-area, geostatistic, *Loligo* distribution, *Loligo* biomass.

Contact author: Ignacio Payá, Fisheries Department, Falkland Islands Government, PO Box 598, Stanley, Falkland Islands [tel: +500 27260, fax: + 500 27265, e-mail: ipaya@fisheries.gov.fk].

ICES CM 2009/L:10

Review of industry-based acoustic observation programme for blue grenadier and influence on management advice

R. J. Kloser, T. Ryan, G. Geen, G. Patchell, L. Scott, and G. Tuck

An industry-based acoustic observation programme was developed and applied on the small austral winter spawning blue grenadier fishery from 2002. Blue grenadier has the highest TAC among the Australian South East Fishery and as a result of highly variable recruitment and stock size uncertainty a cost-effective acoustic monitoring programme was initiated by fishers in 2002. Since 2002 the development of industry-based acoustic methods resulted in the transition from development to uptake in 2006 with “routine” surveying. During this time an incentive-based management approach was introduced by allocation of research quota to assist in the long-term implementation and delivery of the biomass indicator. The survey design of the acoustic method differed significantly from traditional approaches where fishers were tasked with recording a maximum biomass throughout the spawning season. The advantage of this approach was the ability to harness the greater spatial and temporal coverage of the fishing vessels compared with traditional and higher cost research vessel-based voyages. A weakness of the approach is ongoing uncertainty about survey designs, acoustic parameters, and coverage. We provide an overview of the cooperative programme, the strengths and weaknesses of how the acoustic method has been applied and used in assessment models with associated estimates of uncertainty and influence on management advice. Ongoing refinements and extraction of alternative biomass and ecological indicators from the acoustic, biological, and physical data collected are also discussed.

Keywords: blue grenadier, acoustics, biomass, stock assessment.

Contact author: R. J. Kloser, CSIRO MAR, PO Box 1538, Hobart 7001, Australia [fax. +61 3 62325000, e-mail: rudy.kloser@csiro.au].

ICES CM 2009/L:11

North Sea GOV groundgear bag trails

Brian Harley and Sven Kupschus

The UK fishing industry has argued that the international bottom-trawl survey carried out in English waters on the “Cefas Endeavour” is not representative of the numbers of fish, especially cod, in the North Sea. They are particularly concerned with the set-up of the groundgear. During two periods in 2008 catch rate comparisons were made between a commercial fishing boat and those achieved by the “Cefas Endeavour” GOV gear. The rate of escape of the main commercial species from the standard GOV trawl was assessed by fitting additional nets behind the groundgear. The aim was to determine not only the escape rate, but also the factors, if any, that influenced escape. Standard GOV catch rates for **cod** were 15% of those of the commercial vessel, with an average of just 17% escaping under the net. This suggests that ground contact of the gear and the net itself is not a problem, but rather that it is the sweeps, bridles, and the resulting towing angle. Patterns of abundance across areas were consistent within season with those found by the commercial vessel fishing the same habitat. During the September survey, an average of 25% of cod would escape underneath the standard GOV gear at low densities. This decreased to just ~15% at greater abundance, indicating that the relationship between abundance on the grounds and catch is not linear, as assumed by the assessment. GOV catch rates for plaice were much lower than commercial rates (29%), even when the portion escaping under the net was included (39%). Unlike cod the large difference in catch rates was obvious during both periods of sampling, which is at least consistent with the idea that plaice are less affected by water clarity and depend more on tactile stimuli. This outcome will not distort the assessments, but it might be possible to decrease uncertainty with larger catches of older fish.

Keywords: none

Contact author: Brian Harley, CEFAS Lowestoft Laboratory, Pakefield Road, Lowestoft, Suffolk NR33 0HT, UK [tel: +44 1502 524254, fax +44 1502 513865, e-mail: brian.harley@cefass.co.uk]

ICES CM 2009/L:12 Poster

Deriving blue ling abundance indices from industry haul-by-haul data

Pascal Lorange, Lionel Pawlowski, and Verena M. Trenkel

A database of tally books, from skippers' own logbooks, provided by the French deep-water fishing industry to the west of the British Isles was used to estimate blue ling landings per unit of effort (LPUEs). It covered the years 1992–2008, with more data in 2000–2007. For each haul, landings by species, tow duration, depth, and location were reported. Compared with EU logbooks, this database is on a haul-by-haul basis instead of being aggregated by fishing subtrips combining hauls from the same day, ICES rectangle, and gear. Moreover, it includes depth, which is a major factor for catch rates in deep-water fisheries. LPUEs were estimated from generalized additive models (GAMs), with depth, engine power, statistical rectangle, and year as explanatory variables. Owing to the distribution of catch rates, LPUEs were separated into two variables: proportion of tows producing some blue ling catch (positive tows) and LPUEs of positive tows. In a second step, the two variables were combined. In order to investigate how to reliably track stock trends, LPUEs were estimated for different subsets including or not the spawning season, when blue ling aggregates, or considering tows where blue ling was only a bycatch. The results based on the tally books indicated that blue ling LPUEs have been mainly stable over the past decade, in contrast to those based on EU logbooks. Thus, haul-by-haul data are useful for deep-water fishery assessment.

Keywords: *Molva dypterygia*, abundance indices, fishing strategy.

Contact author: Pascal Lorange, Ifremer, rue de l'Île d'Yeu, BP 21105, 44311 Nantes Cedex 03, France [e-mail: pascal.lorange@ifremer.fr].

ICES CM 2009/L:13 Withdrawn

ICES CM 2009/L:14 Poster

Estimating a catchability coefficient for a commercial fishing vessel

Hans J. Olesen, Kai Wieland, Uffe H. Thygesen, and Jan E. Beyer

A collaborative fishers–scientists project was established with the aim of estimating abundance and distribution of Atlantic cod (*Gadus morhua*) in a part of the northeastern central North Sea using surveys with three commercial fishing vessels. Such surveys give estimates of the fish density but do not necessarily reflect the true density as the catchability is affected by many factors. The catchability coefficient is a prerequisite in order to relate catches or fishing mortalities to actual biomass abundance estimates. In this study a catchability coefficient for a flyshooter participating in the project was estimated from an experiment in which the same area was fished repeatedly (consecutive tows approximately 2 h apart). So far, five experiments of this type have been carried out, each comprising two to six tows. In three of the experiments the original fishing spot was visited again after 1 or 2 days. All the experiments were accomplished during summertime, in fine weather conditions, and on different bottom types (coarse sand, gravel, and stone bottoms). Initial cod catches varied considerably among experiments, but, in general, the catch rates declined exponentially. Standardization by setting the catch per unit of effort (cpue) in the first tow equal to 1 allows the fitting of an asymptotic function to the pooled dataset of cumulative catch rates. In doing so, a catchability coefficient of 0.4 was obtained, and the result of the regression analysis was highly significant.

Keywords: catchability coefficient; Atlantic cod; flyshooter.

Contact author: Kai Wieland, Technical University of Denmark, National Institute of Aquatic Resources, North Sea Science Park, PO Box 101, 9850 Hirtshals, Denmark [e-mail: kw@dtu.aqua.dk].

ICES CM 2009/L:15 Poster

The REX project: a collaborative fishers–scientists project on the geographical distribution of Atlantic cod in the northeastern part of the central North Sea

Jan E. Beyer, Kai Wieland, Hans J. Olesen, Eva Maria Fenger Pedersen, Niels G. Andersen, Maria Kaspersen, Tamme Bolt, Kenneth Nielsen, Tonny Nees, and Kurt Madsen

The basic idea of this cooperative fishers–scientists project was to explore the distribution of Atlantic cod on different geographical scales. For this purpose, three types of commercial fishing gear were applied to cover different bottom habitats in a number of surveys, and the fishers' knowledge of the habitats and the overall distribution of cod were implemented. In addition to the three commercial vessels, trawler, gillnetter and flyshooter, the research vessel MS "Dana" together with a few minor ships were used for data collection. The variations in catch per unit of effort (cpue) data were analysed statistically by inclusion of a number of physical and biological explanatory variables. To acquire a mechanistic understanding of some of the observed data variation, the behaviour of cod was examined through analyses of the contents of sampled cod stomachs and by acoustics transmitters and data-storage tags mounted on individual cod.

Keywords: cooperative fishers–scientists approach, commercial vessels, geographical distribution of Atlantic cod, behaviour of Atlantic cod.

Contact author: Jan E. Beyer, Technical University of Denmark, National Institute of Aquatic Resources, Charlottenlund Castle, DK-2920 Charlottenlund, Denmark [e-mail: jeb@aqua.dtu.dk].

ICES CM 2009/L:16 Poster

Electronic catch registration on board commercial fishing vessels for scientific and commercial use

Agnes C. Gundersen, Jesper Boje, Einar Hjørleifsson, Jan Erik Dyb, and Kristin Helle

In assessment and management of marine fish resources, representative data of statistically good quality describing the actual catch are lacking for many fisheries. Even for the most studied fisheries in the North Atlantic, the uncertainty regarding what is actually caught has implications for the management. Fish stock assessments often rely on samples from; research vessels, landed catches, or collaboration with commercial vessels. This means that samples at sea often are taken from shorter periods than the actual fishing period and also with different gear modifications. It may be questioned how representative those data are of the landed catch. Data provided by the commercial fleet are usually restricted to total length. Biological sampling in distant waters is a challenge because of the logistics and high costs. The use of electronic scales on board commercial fishing vessels opens up opportunities for new approaches to data collection. In recent years electronic scales measuring individual fish weights on deck have been connected to GPS for combination with information on fishing location and depth (developed by Maritech AS and Møreforskning and used by a Norwegian longliner). Such data collection will meet the challenges of obtaining more representative fishery data in distant waters, provides for continuous sampling throughout the fishing period, and could contribute to increased data acquisition for use in assessments. This paper presents the state of the art as well as the prospect of using electronic scales along with some considerations about the use of such data in assessments.

Keywords: electronic scales, electronic catch registration, longlines, trawl.

Contact author: Agnes C. Gundersen, Møreforskning Marin, PO Box 5075, Larsgården, NO 6021 Ålesund, Norway [tel: +47 70 11 16 00 (21), e-mail: agnes@mfaa.no].