

Theme Session K

Small-scale and recreational fisheries surveys, assessment, and management

ICES CM 2008/K:01

Managing coastal-zone fisheries: interactions between small-scale and recreational activities

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Coastal resources are exploited by small-scale fisheries, by definition a low investment fishery, characterized by a large number of small boats that use diverse fishing gears and disembarking ports. This fleet seeks to capture fresh product of high commercial value. On the other hand, marine recreational fishing is also a cause of exploitation of the coastal zone, because angling is a popular activity. Recreational fishing is basically an open access activity, considered different from professional/commercial fisheries because they are not subject to economic market forces. Thus, coastal fishing resources are shared between a regulated professional activity and an open-access recreational activity that overlap for a common resource. Managing these shared resources should take into account the size of the resource, its uses, the corresponding rights, the impacts of each kind of fishing, and the economical benefits generated, as well as the right of the population to fish as a source of healthy food. The problems derived from the management of such fisheries are discussed using Mallorca Island (northwestern Mediterranean) as a case study. In the Mediterranean the fishing management measures commonly applied are based on fishing effort limitation. This management method is not adaptive, is not reviewed periodically, and is based mainly on limiting the number of boats, fishing hours, fishing zones and seasons, and regulating the type of fishing gears and the minimum catch size for some species. This system has failed to prevent the overexploitation of most Mediterranean species, and alternative approaches are needed.

Keywords: small-scale, recreational, coastal resources, management, Mediterranean.

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ICES CM 2008/K:02

Trust and check. An individual approach to small-scale fishery sampling from the Polish brackish lagoons (southern Baltic)

Iwona Psuty

Sampling a small-scale and scattered fishery is difficult to achieve with limited resources. Although self-sampling is a cost-effective method, it is highly dependent on human factors. Experience from the Vistula and Szczecin lagoons (southern Baltic) indicated the utility of length self-sampling done by fishers. It was found that correct samples were dependent on using the correct terms, among which the very concept of “scientific measurement” was understood differently by scientists and fishers. The success of the self-reporting programme for catch composition was strongly linked to a history of cooperation with each of the participating fishers. The main human factor issues revealed by the study were the possibilities of the participants retaining anonymity and reporting only a portion of the actual catches. The best way to eradicate misleading factors was to implement a partial self-reporting programme for catch composition, with additional effort put into directly estimating fykenet numbers and indirectly estimating gillnet numbers. Other positive results have been achieved using methods in which fishers were offered financial incentives to conduct research. In this case, the high-quality long-term dataserries provoked conflict with a segment of the local community.

Keywords: self-sampling, fykenet, Polish coastal fishery, fish measurements.

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Combining telephone and on-site surveys for the estimation of catches and expenditures by recreational fishers: the pilot survey of French recreational fisheries

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In 2006, Ifremer, with the help of the polling institute BVA, implemented a pilot national study of recreational fisheries. The aim of the study was to assess the population involved in this activity, taking into account the diversity of recreational fishing activities, from seafood gathering to offshore angling. This study

was designed to provide first estimates of (i) fishing activity; (ii) catches and landings; and (iii) economic impacts of recreational fishing. The protocol implemented was two-step. First, a telephone survey of French households, based on a sampling frame of the entire French population of people aged 15+, was carried out to assess the population of fishers and give a first general view of the diversity of fishing practices, Information was also collected regarding catches and landings and expenditure at various temporal scales (annual, previous three months, last fishing trip). Second, on-site surveys were carried out to obtain precise measures of catches and expenditure per fishing trip. Sampling schemes for both phases of the survey work were designed such that data collected from telephone and on-site surveys could be combined and used jointly in the estimation of catches and expenditure by fishers at national level. The paper presents the methodology developed and first results obtained based on the joint use of the telephone and on-site survey data. Particular emphasis is placed on the way in which the methodology was designed to allow local observations of catches and expenditure per trip to be extrapolated to the national level.

Keywords: recreational fishing, survey methodology, catches assessment, economic impact.

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ICES2008/K:04

Developments in using aerial fishing effort surveys to scale up observed harvests

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Recreational fisheries often extend along extensive areas of coastline and are accessed at numerous and scattered points. Because of the scale and complexity of these fisheries, researchers often use indirect approaches to assess recreational harvests and effort, such as telephone diary surveys, where catch data provided by a subset of fishers is taken at face value, with limited corroboration. Indirect harvest estimation methods are no longer favoured in New Zealand, following a critical examination of several national surveys, which concluded that available estimates were of dubious and indeterminable reliability. A shift towards more direct and fishery-independent methods has led to the development of a novel and cost-effective method, which has been used successfully to assess recreational harvests from New Zealand's largest inshore fisheries. The method uses a single flight per day to determine the number of parties fishing from vessels at a fixed point in time. Creel surveys are also conducted concurrently to determine both the day's harvest landed at surveyed ramps, and the number of parties fishing at the time of the overflight. The ratio of the number of parties observed from the air relative to the number of interviewed parties who reported fishing at the time of the overflight is used to scale-up the observed subsample of the fisheries catch for a day. The method is, therefore, a cost-effective adaptation of the conventional aerial-access approach but only requires a single flight per day, and is not reliant on any catch rate estimates. Recent surveys suggest that this approach can provide plausible harvest estimates that are widely accepted.

Keywords: recreational harvest assessment, aerial.

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ICES CM 2008/K:05

Probability-based survey techniques for monitoring catch and effort in the coastal small-scale fisheries in Mozambique

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Catch and effort data form an important, and often the only, source of data for fish stock assessment and management in developing countries. Population parameters and management quantities important for stock assessment are often estimated by fitting production models to standardized series of catch per unit effort (cpue). Such basic information is notoriously hard to obtain for small-scale fisheries because of spatial and temporal variability in effort, the numerous landing sites, and limited access. In this paper we present probability-based survey methods for the monitoring of small-scale fisheries in Mozambique. The multistage access point survey implemented is an on-site intercept design that supports estimation of monthly and annual catch and effort and other key statistics for the coastal fisheries in a geographic area. Estimates of catch and effort from 1997 to 2006, with associated relative standard errors, for beach-seine fisheries in two provinces are used to illustrate the applicability of the methodology. The flexible survey design is now used to monitor small-scale fisheries in all provinces of Mozambique. We also present an alternative method for obtaining approximate estimates of the variance of total catch for a region when the coverage of fishing centres is incomplete. An estimate of the proportion of days each gear is fished by month is first used to adjust effort based on census data on total number of gears. The adjusted effort is then combined with estimates of cpue to estimate the catch. Results suggest that the estimation of effort from a frame survey

alone would introduce substantial bias of variable magnitude because fishing activity depends on weather conditions and socio-economic factors.

Keywords: Multi-stage sampling, artisanal fisheries, fisheries-dependent surveys.

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ICES CM 2008/K:06

Development of a dual-frame methodology for estimating marine recreational fishing effort

Han Lin-Lai and Rob Andrews

Traditional survey methods to collect marine recreational fishing effort data rely on random-digit dialling approaches, sampling from lists of licensed anglers or registered fishing vessels, or census logbook reporting. These methods can suffer from inefficiency, incomplete coverage of target populations, non-response, and/or reporting delays. To address these shortcomings, an alternative design that integrates independent recreational fishing data collection programmes in a dual-frame approach was developed. The methodology borrows strengths from the individual survey components to produce a comprehensive, yet efficient design. We present two applications of the dual-frame methodology. The first application integrates census logbook reporting and list-based sampling to estimate fishing effort on for-hire vessels. The second approach integrates random-digit dial sampling and list-based sampling to estimate fishing effort in shore and private-boat modes.

Keywords: recreational fishing survey dual-frame estimation.

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Application of a telephone–diary methodology to estimate catch and effort in recreational fisheries: examples from Australia

Jeremy M. Lyle

The ongoing provision of reliable information about recreational catch and effort represents a major challenge for researchers and resource managers, both methodologically and in terms of data costs. This is especially so where the spatial scales over which fisheries operate are large. Recognizing the need for cost-effective approaches to provide recreational fishery data, we have developed an off-site methodology that has been applied to assess general fishing and specific (e.g. lobster and abalone) fishing activities. The survey method involves a two-stage process: initial selection of a representative sample of fishers and then repeated contact with respondents throughout the survey period. The primary contact method is by telephone, with fishers initially identified through general population sampling (telephone lists) or sampling of licence frames. Respondents are encouraged to use a simple memory-jogger diary to record key data but they are also contacted frequently by survey interviewers who are responsible for recording the fishing information. Substantial detail is possible, including location, targeting, fishing methods, platform, harvest, and release; information that can be linked to fishers' socio-demographic characteristics. In order to reduce potential recall biases for non-diarized data, the frequency of telephone contact is tailored to match the level of an individual's fishing activity. Response rates represent a key performance measure and have been high (80–95%) for all applications of the method. Nevertheless, the nature and impacts of non-response biases have been examined, providing important insights into the efficacy of this methodology and potential limitations of previous studies in which response rates have been low.

Keywords: recreational fishing, off-site survey methods, telephone survey, diary survey, non-response, recreational catch and effort.

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ICES CM 2008/ K:08

Small-scale fisheries of the Asian Moon Scallop (*Amusium pleuronectes*) in the Brebes Coast, Central Java, Indonesia

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The Asian moon scallop is a pectinid bivalve found on the northern coast of Central Java. It is economically important and the taste is delicious. Brebes Coast is an important landing place for the scallop's small-scale

fishery. Landing of this scallop is the result of bycatch by traditional vessels fishing for prawns, normally from one-day fishing trips. The scallop fishery is an unlimited-entry fishery with no legally defined season, and operates within a four-month period, from December to March, coinciding with the prawn fishery. No minimum shell size has been set and all catch is landed whole and processed on shore by hand, mainly for the export market. Preliminary studies off Brebes Coast were carried out using a GPS on a fishing vessel. The vessel towed three times over 2.5–3 hours at trawling speeds varying between 3 and 4 km h⁻¹. The effort and the catch per unit of effort (cpue) were calculated. Growth was also analysed by regression analysis. It was found that there were four scallop fishery patches off Brebes Coast. The catch between January and March 2008 was over 41 t. The size of the scallops was 43–85 mm and the morphological growth pattern was allometric negative.

Keywords: *Amusium pleuronectes*, Asian moon scallop, small-scale fisheries.

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ICES CM 2008/K:09

Fuel consumption as a proxy for the assessment of nominal effort and variable costs: application to the French West Indies small-scale fleets

Olivier Guyader, Sébastien Demaneche, and Patrick Berthou

The assessment of nominal effort is a key issue for the estimation of total catches. However, in many data-collection systems, total effort is inferred from sampling schemes at landing points or calculated from fishing forms or logbooks, which do not provide accurate information on a vessel's fishing activity. This problem is especially significant in small-scale fleets where fishers' behaviour and related fishing activity are heterogeneous. As fuel consumption by fishers is often subject to tax relief, it is registered by administration and can be used to improve and cross-check nominal effort measures (hours at sea, days at sea). This paper presents a methodology developed, using this type of dataset, for French West Indies fisheries. The protocol implemented was in three steps and used different data sources. First, a statistical analysis of engine power, engine type, and fuel consumption per métier was carried out based on field studies and fleet register information. Second, an algorithm was developed in order to estimate the number of trips and engine hours per vessel from vessel fuel consumption and vessel tank fill-ups, registered by the administration. Third, these estimates were used to provide a first assessment of the fleet landings per species and discuss the use of this information for calculation of revenue and running cost per trip, including fuel costs.

Keywords: fuel consumption, nominal effort, engine power, catches estimates, running costs.

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ICES ASC 2008/K:10

Re-assessing French small-scale fisheries: from fleet activity to economic performance

Fabienne Daurès, Sylvie Van Iseghem, Sébastien Demaneche, Cecile Brigaudeau, Olivier Guyader, Emilie Leblond, and Patrick Berthou

Although the majority of small-scale fisheries are found in developing nations, a considerable number exist in developed nations as well. Small-scale fisheries are strongly represented in all European Union (EU) Member States, 81% and 87% of the EU 25 whole fleet is composed of vessels less than 12 and 15 m long, respectively. In 2000, European regulation established a fishery data collection framework including economic information requirements in order to provide the scientific basis for the implementation of the Common Fisheries Policy. This paper presents the methodology designed to collect the relevant economic data and characterize the status of the French fleets from an economic perspective. Based on a stratified sampling plan including the following of small-scale fleets, data collection by field survey is based on a single questionnaire for all the fleets, whatever the size of the vessel, the gear used, the fishing area or the species targeted. It provides a large dataset including earnings and costs but also capital, employment, fishing activity figures. Statistical analysis through a revenue model gives the basis for a re-assessment of the small-scale fisheries contribution to national production. Economic indicators such as gross added value, rents, and direct employment are derived from the dataset. The significant role of small-scale fisheries in the French fishing sector is established and the use of indicators in bioeconomic analysis is discussed.

Keywords: data collection, sampling schemes, economic data, indicator, revenue model, small-scale fisheries.

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ICES ASC 2008/K:11**The Fisheries Information System of Ifremer—a multidisciplinary monitoring network and an integrated approach for the assessment of French fisheries, including small-scale fisheries**

Fabienne Daurès, Emilie Leblond, Patrick Berthou, Christian Dintheer, Claude Merrien, Alain Tétard, Joël Vigneau, and Patrick Lespagnol

Since 2000, Ifremer has been developing a Fisheries Information System (FIS) in close collaboration with the DPMA (Director of Fisheries and Aquaculture of the French Ministry of Agriculture and Fisheries). The FIS aims to build an operational and multidisciplinary monitoring network for scientific purposes, allowing a comprehensive view of fishery systems including their biological, technical, environmental, and economic components. The objectives of the FIS are (i) to provide specifications and methodologies for the collection, storage, and processing of fisheries data, with the aim of harmonizing all these procedures on a national scale, (ii) to improve data management systems and access to data for a wider public, and (iii) to produce and distribute relevant datasets, indicators, and synthesis, for understanding and evaluation, including bioeconomic diagnostics of fisheries, and assessment of the short- and long-term impacts of fishery management scenario and measures. The FIS covers all the French fisheries, including overseas territories and small-scale fisheries, for which data are often hardly available or missing. Two-thirds of the French vessels are less than 12 m long. The challenge was to establish a statistical and integrated approach supporting bio-ecological and economic issues. A wide range types of data, including acoustic surveys, biological *in situ* observations, environmental observations, as well as fishing statistics (landings and efforts) and economic data, are managed in a single data management system, based on an integrated relational database with geographical facilities.

Keywords: information system, fisheries, fishing fleet, indicators, integrated database, small-scale.

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ICES ASC 2008/K:12**From fleet census to sampling schemes: an original collection of data on fishing activity for the assessment of the French fisheries**

Patrick Berthou, Fabienne Daures, Emilie Leblond, Claude Merrien, Sébastien Demaneche, Olivier Guyader, and Patrick Lespagnol

The development of a fishery ecosystem approach implies the improvement of integrated analyses of fisheries by considering biological as well as socio-economic dimensions, and thus improvement of the data available about the fleet structure, evolution, and activity. Since 2000, Ifremer has been developing a Fisheries Information System (FIS), a multidisciplinary monitoring network allowing an integrated and comprehensive view of fishery systems including biological, technical, environmental, and economic components. The FIS covers all the French fisheries, including the often neglected small-scale fisheries. One of the unique features of the FIS lies in the fleet-monitoring procedure—a comprehensive collection of annual activity calendars designed to characterize the inactivity or activity of the vessels each month of the year and, in the latter case, the métiers practised (use of a gear to target one or several species) and the main fishing areas. This survey covers all the fleets and provides minimum but exhaustive information on the vessels. It is particularly instructive for the small-scale fisheries, where catches and effort data are often incomplete. Furthermore, this exhaustive data allows stratification of the fleet and thus provides the basis for (i) the implementation of sampling schemes to estimate catches, landings, discards, or economic performance of the different fleets and (ii) the development of a fleet–métier matrix, giving the possibility of identifying at any one time the structure of the whole fleet, the métier polyvalence of the vessels, and the allocation of fishing effort on the different fishing resources.

Keywords: fleet, métier, fishing activity, small-scale fisheries, sampling schemes.

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ICES CM 2008/K:13**The status and management of thornback ray (*Raja clavata*) in the southwestern North Sea**

Gary J. Burt, Louise P. N. Cox, Jim R. Ellis, Dave W. Kulka and Andrew I. L. Payne

The thornback ray (*Raja clavata*) is the dominant skate species in the southern North Sea, and the stock also extends into the eastern English Channel. This particular stock is an important bycatch and target species for inshore fisheries in the Greater Thames Estuary. Preliminary assessments used survey data collected during the International Bottom Trawl Survey (IBTS), and indicated that the distribution and abundance of

thornback ray had declined markedly in the North Sea as a whole. In recent years, it has become apparent that some of the IBTS data were compromised by confusion between thornback ray and thorny skate (*Amblyraja radiata*), although recent studies still indicate a decline in the distribution of thornback ray. Despite this longer term decline in geographical extent, survey catches in the southwestern North Sea have increased in recent years. Given concern over the status of the stock, and subsequent management measures brought in during 2007, a one-year Fishery Science Partnership (FSP) project was initiated to collect further data on this stock, using commercial, inshore vessels. The main aims of the survey were to examine discard survival of skates caught in gillnet, longline, and trawl fisheries, the size and species compositions of skates in the area, and other biological information. These data, including all tag return data collected to date, are presented and contrasted with data collected during annual stock monitoring surveys (using beam trawl and GOV trawl), and young fish surveys (also undertaken on inshore vessels in the same area). The benefits of dedicated inshore surveys in this area are discussed.

Keywords: discard survival, skates, Rajidae, North Sea.

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ICES CM 2008/K:14

A new approach to estimate catches and fishing effort of small-scale fisheries by sampling fishing trips on-site

Sébastien Demaneche, Claude Merrien, Olivier Guyader, Emilie Leblond, Fabienne Daures, and Patrick Berthou

Small-scale fisheries are commonly little understood as a consequence of a crucial lack of data. This is also true for European fisheries, where vessels less than 12 m represent almost 75% of the total fleet. This paper details a methodology developed to estimate catches and fishing effort of small-scale vessels by sampling fishing trips on-site. The benefits of using auxiliary census data, the annual activity calendars collected by the Fisheries Information System (FIS), to improve the precision of the estimates are evaluated. Sampling schemes to estimate catches and fishing effort need to take account of the variability resulting from different categories of vessels, métiers, zones, and seasonality. To meet this objective, the methodology used here aims to optimize the sampling effort's allocation according to the diversity of métiers and the intensity of activity in each harbour. Different methods for the extrapolation of catch and effort data have been tested on the basis of the métiers and on the typologies of fleets. The results obtained are presented and their accuracy discussed. For Réunion Island, our estimation by sampling is compared with the declared fishing forms.

Keywords: catches and fishing effort estimation, sampling schemes, extrapolation, annual activity calendars.

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ICES CM 2008/K:15

Species characterization of gurnard landings in north of Portugal

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Available ICES statistics concerning gurnards are not accurate because they are often not sorted by species when they are landed, usually ending up classified under one generic category of "gurnards". For example, France has only reported "tub gurnard" (*Chelidonichthys lucernus*) since 1983 and Denmark, the Netherlands, and Portugal since 2000. It is clear that statistics are incomplete for most years in ICES Divisions, and when statistics exist they are mainly available for all species of gurnards combined and not for a particular gurnard. To address this problem, gurnard landings were observed in trawler (2007) and artisanal fleets (March–July 2007) in Matosinhos, Portugal. Lack of correspondence between the common names given at the auction market ("Ruivo" and "Cabra-Cabaço") and the scientific names of the various species also complicates landing statistics. The proportion with which the various gurnard species occurred in landings was calculated and these results were compared with the official data and available bibliography. In both fleets the most abundant species were *Chelidonichthys lucernus*, *Aspitrigla cuculus*, and *C. obscurus*. Other commercial species, such as *Eutrigla gurnardus*, *Trigla lyra*, and *C. lastoviza*, occurred in residual amounts. The common designations these species were given at auction reflect the mean size of the individuals in the box sampled rather than the scientific names. Thus the database on the official classification does not seem to be of any scientific or statistic use for fishery assessment of these species and further studies are required for gurnards.

Keywords: gurnards, fishery assessment, fish stocks, sampling and statistics.

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ICES CM 2008/K:16

Assessment of the Mediterranean swordfish based on Italian harpoon fisheries data

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The Mediterranean Sea has a long history of exploitation. Today most of its stocks are overexploited, with large predators at extremely low levels of population abundance. For the Mediterranean swordfish (*Xiphias gladius*), historical and recent population abundance figures are quite uncertain owing to the lack of standardized fishery data. Catch statistics are available from few countries, even though the species is targeted by a large international longline fleet. In the Strait of Messina, swordfish is also the target of a traditional small-scale harpoon fishery, whose catch and effort data have been available since 1976 in a systematic fashion. By using generalized linear models (GLM) and their extensions, we analysed catches registered in harpoon fishers' logbooks to detect long-term trends of swordfish population abundance. Data were available in different formats, from daily catches with information on fishing position, date, time, fishing vessel, and observation on tidal currents, to aggregated annual landings. Accordingly, we carried out multiple analyses with different probabilistic strategies within the GLM framework. Both aggregated and more detailed data were able to show a significant decline of swordfish in the last 30 years. Nonetheless, there is evidence of a recent recovery. We will discuss causes and implications of the observed patterns, and the importance of small-scale fisheries to detect dynamics of fish populations in the absence of conventional data.

Keywords: swordfish, harpoon fishery, GLM, Mediterranean se, small-scale fishery, assessment.

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ICES CM 2008/K:17

Enhancing sustainability in marine recreational fisheries: a stakeholder-driven process for evaluating angling practices and management options for king mackerel in the US

Michael Wilberg, Thomas Ihde, Thomas Miller, and David Secor

Despite the increasing importance of marine recreational fisheries, management goals and objectives have not changed from a focus on managing for commercially important objectives such as maximum or optimum sustainable yield. In addition, recreational fishery stakeholders in several prominent US fisheries have been frustrated by a perceived lack of inclusion of recreational views in fishery management decisions. Our objective was to provide a forum for representatives of stakeholder groups to explore the consequences of policy alternatives, which could then be used in the management of recreational fisheries. We developed a stakeholder-driven process that allowed stakeholders to evaluate how well alternative options could achieve their goals through development of a simulation model over the course of three workshops. The first application of this collaborative process was to the king mackerel (*Scomberomorus cavalla*) fishery off the southeast coast of the USA. The workshops centred on developing objectives for the fishery, performance measures to gauge whether objectives were reached, and options that could be used to reach the objectives. Goals identified by stakeholders included traditional and non-traditional goals such as maintaining high and stable catches and retaining the ability to catch large fish, and options included both voluntary changes in fishing practices (e.g. adoption of techniques that reduce catch and release mortality) and mandatory regulations (e.g. size limits or bag limits). Through an iterative process, stakeholders assisted in developing a model to allow them to compare how well the options they wanted to consider met their vision for a quality fishery.

Keywords: decision analysis, *Scomberomorus cavalla*, recreational fisheries management.

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ICES CM 2008/K:18

Self-sampling as a method for collecting assessment data from a small-scale fishery—Norwegian gillnetting for anglerfish

Otte Bjelland and Irene Huse

Since autumn 2005, a programme for collecting data on catch composition, length distributions, and effort have been established through the Coastal Reference Fleet (CRF)—a self-sampling programme. This is a network of contracted 9- to 15-m-long vessels where the crew are educated and paid to provide samples from their own fishery. During the early 1990s a directed fishery for anglerfish developed rapidly along the Norwegian coast. One-man vessels operating near their homeports, using large-meshed gillnets, comprise the

main fleet landing anglerfish in the areas north of 62°N. The anglerfish stock north of 62°N has never been assessed quantitatively. It is not covered by any groundfish survey and no mandatory logbook schemes for the coastal fishing vessels exist. The landings are registered in a central system of sale slips. The temporal and spatial dynamics of the fishery based on sales information and the CRF as a method of collecting data on catch and effort are described here. The representativeness of the data collected by the CRF is discussed. The usefulness of such data in future assessments and management of the anglerfish along the Norwegian coast and the need for improvements are evaluated.

Keywords: anglerfish, assessment data, small-scale fisheries, self-sampling.

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Extracting fish movement information using landings and effort information from the small-scale *Argyrosomus regius* fishery in Portugal

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The life history patterns of several valuable marine fish exploited by small-scale artisanal fleets remain unknown or unstudied worldwide. This situation frequently develops where fishery-independent information is not available and fishery-dependent data are considered data-poor. One such data-poor situation occurs when only short time-series of (generally) noisy landing data are available and information on fish occurrence and seasonality is to be determined. The meagre (*Argyrosomus regius*) is the largest sciaenid in European waters and a valuable resource for small-scale local fleets of the Portuguese, Spanish, and French Atlantic coasts. However, fishery-independent data for it are very limited and its migration patterns remain largely unknown across its geographical range. We make use of a set of time-series techniques (periodogram analysis, generalized non-linear harmonic regression, and seasonal-trend decomposition based on loess) and use them to analyse several five-year datasets of monthly landings of meagre from Portuguese waters, demonstrating how information on periodicity and seasonality of the landings can be statistically inferred even from such scarce data. We combine these analyses with analysis of fishing effort exerted on the species, including an identification of the months of bycatch and target effort, and find evidence that the meagre performs movements in the Portuguese coast, migrating along the west coast in autumn/winter. Our results indicate that through the use of these statistical techniques relevant biological information can be extracted even from short data-poor situations involving noisy small-scale artisanal fleet landing information.

Keywords: small-scale artisanal fisheries, fishery landings, time-series analysis, fishing effort, target effort, meagre.

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For-hire survey of marine recreational fishing in the Gulf of Mexico

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Fishery catch and effort statistics are fundamental for assessing the influence of fishing on any stock of fish. The United States National Marine Fisheries Service of the National Oceanic and Atmospheric Administration (NOAA Fisheries) has statutory authority to conduct surveys of marine recreational fishing to obtain this information. The For-Hire Survey (FHS) specifically gathers information on fishing effort (number of angler trips) and catch by marine recreational anglers fishing on for-hire (charter boat and headboat) vessels. The FHS consists of two independent, yet complementary surveys: a vessel-directory telephone survey to assess fishing effort, and an access-point intercept survey to assess catch per unit of effort. Data from the two surveys are combined to estimate total fishing effort and catch by species. The telephone survey portion of the FHS has been conducted for the Gulf of Mexico in Florida, Alabama, Mississippi, and Louisiana from 1997 to the present. Trip-level information obtained includes the number of anglers, the hours fished, the area (or water body) fished, the time of day of the fishing trip, and the state and county where the trip landed. Telephone surveys are conducted weekly and effort estimates are produced for each survey week. Aggregated bimonthly effort estimates are used to produce catch and harvest estimates of all finfish species encountered by the access point intercept survey. This survey approach is more efficient and produces more credible estimates of effort than the Coastal Household Telephone Survey, which employs a random digit dialling protocol for contacting recreational anglers residing in the coastal zone.

Keywords: recreational fishing, surveys, Gulf of Mexico.

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The Marine Recreational Fishery Statistics Survey—complex sampling and possible estimation biases

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The Marine Recreational Fishery Statistics Survey (MRFSS) of the US National Marine Fisheries Service (NMFS) has been used to monitor fishing effort and catch since 1979. The MRFSS complemented surveys design includes a random digit dialling telephone survey to estimate fishing effort (number of angler fishing trips) and a stratified access point survey to separately estimate catch rate (number of fish caught per angler trip) by species for shore, private/rental boat, and for-hire boat fishing. Total catch of a given species is estimated as the product of total estimated effort and the estimated catch rate for that species. Because the telephone survey is restricted to a band of coastal counties, the access point survey collects residence and phone ownership data that are used to estimate appropriate effort corrections. The access point survey is based on a complex sampling design that includes probability-proportional-to-size sampling, as well as multistage cluster sampling. Methods used for the estimation of catch rates have ignored this complexity, assuming simple random sampling. Estimation methods also assume access point sampling is representative for all fishing sites and periods, but telephone survey data indicate that private access and night-time fishing trips have been underrepresented. In collaboration with stakeholders, NMFS has initiated studies to revise the MRFSS estimation methods and evaluate potential biases that may have resulted from simplifying estimation assumptions. The results of these studies will inform decisions on how to improve sampling and estimation methods for future access point surveys.

Keywords: marine recreational fisheries, household telephone survey, access point survey, sampling design, effort estimation, catch estimation.

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Large pelagics survey: methodology, data uses, and statistical issues

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The National Marine Fisheries Service is responsible for monitoring and managing US marine fishery resources. Large pelagic species (e.g. tuna, billfish, swordfish, and sharks) that are caught in offshore oceanic waters are of particular management interest as these species support socially and economically important recreational and commercial fisheries. The collection of catch and effort information on large pelagics also fulfils US obligations to the International Commission for the Conservation of Atlantic Tunas (ICCAT). The Large Pelagics Survey (LPS) is specifically designed to collect information on recreational fishing directed at large pelagics. Offshore trips targeting large pelagics typically make up a relatively small proportion of all recreational fishing trips. Using this specialized survey design allows for higher levels of sampling large pelagic trips, which ultimately improves estimates of catch and effort for large pelagics. The LPS includes two independent complementary surveys, which provide the effort and average catch per trip estimates needed to estimate total catch by species. The Large Pelagics Telephone Survey (LPTS) collects fishing effort information directly from captains holding the federal permits required to fish for large pelagics. Data from the phone survey are used to estimate the total number of boat trips on which anglers fished for large pelagics. The Large Pelagics Intercept Survey (LPIS) is a dockside survey of private and charter boat captains that is primarily designed to collect detailed catch data. The dockside survey is also used to apply a correction factor for vessels not on the phone survey sampling frame.

Keywords: large pelagic, survey, recreational.

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How much cod is removed from the western Baltic Sea by recreational fishers?

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A German pilot study conducted over three years under the framework of the EU data collection regulation was set up to find out the number of cod removed from the western Baltic Sea by recreational fishers. As recreational fishers are not obliged to record their catch officially, a four-step approach was applied to collect the data: (i) effort data (days at sea) was obtained from 65 000 questionnaires sent to angling licence holders or those organized in local and regional federations; (ii) anglers were randomly sampled for their catch (by

means of on-site interviews); (iii) length distributions were obtained from angling events; and (iv) all this information was translated into biomass by means of length–age and length–mass relationships from the commercial fishery. Our results demonstrate that annually more than 100 000 anglers are fishing off the German Baltic coast, spending 800 000 to 1.5 million days at sea (depending on the year, raising method, and data source, marked by the anglers as “estimated” or “recorded”), and removing 1.9–5.0 million cod annually, which translates into 1900–5100 t biomass. Compared with the catch of commercial fishers, this amount is not only significant (30–50%) but also very variable between years. These recreational catches therefore have to be taken into account in future stock assessments and management.

Keywords: recreational fishery, angler survey.

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Survey sampling on a shoestring: effective methods to monitor catch and effort in Norway’s coastal tourist fishery

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Tourist fishing has become an increasingly important part of the Norwegian travel industry. At present there are no precise statistics on the fishing effort throughout the year by tourists along the coast; neither are there statistics on the quantity of fish or the species caught. Estimates of total catch for commercially important species, including total catch for the tourist fishery, are necessary to support effective management towards sustainable fisheries, and can help to reduce conflict among stakeholders within the coastal zone. In particular, abundance in some coastal cod stocks has declined to levels that put sustainable fisheries at risk. Atlantic cod is one of Norway’s most important species economically, and is highly valued in both commercial and tourist fisheries. The tourist fishery may account for a significant portion of the fishing mortality of local stocks. Conducting a survey of the tourist fishery is made difficult by Norway’s intricate coastline, extending over 80 000 km, the diverse assortment of fishing activities, and the lack of a comprehensive sampling frame. No licence is required for tourists fishing in Norway’s coastal waters. The lack of a tracking tool means that foreign fishers cannot be contacted to conduct a random telephone interview survey. Furthermore, no complete registry of businesses catering to tourist fishers exists. In this study, we evaluate the use of a probability-based sampling survey of tourist businesses and time-blocks, combined with self-reporting of catch and effort by tourist fishers through logbooks. We present results from a pilot study conducted during spring and summer of 2008 in collaboration with 50 businesses along the coast. Preliminary results from a companion project, conducted in collaboration with the Norwegian Coastguard, are used to assess coverage of the tourist fishers through a sampling frame based on known businesses that cater for them. Data on daily catch and effort from the pilot study, combined with information on sampling coverage, are used to develop cost-effective methods to survey the tourist fishery throughout Norway.

Keywords: recreational fisheries survey, multi-stage sampling, access-point survey.

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