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14–17 April 2009

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Executive Summary

WKSMRF was established by the ICES Planning Group on Commercial Catches, Discards and Biological Sampling (PGCCDBS), for the purposes of facilitating European countries in the ICES area to develop sampling programmes for recreational fisheries. EU member States are required to establish such programmes for several key species (cod, European seabass, eels, salmon and bluefin tuna according to ICES area) in order to meet the requirements of the EU Data Collection Framework (EC Regulation 199/2008 and EC Decision 2008/949/EC). Recreational fisheries include angling and the use of “commercial type” gears by non-commercial fishermen.

Populations of recreational fishers to be sampled can be very large, often diffusely distributed and in most cases of unknown magnitude. There may be few or no lists such as licenses or vessel registries to identify populations to be randomly sampled. Surveys may require multiple within-year “waves” of telephone surveys or postal questionnaires to estimate numbers of recreational fishers and their patterns of fishing activities, together with sampling trips to access points to interview fishermen directly and determine the numbers, species composition, mean weight, and length composition of their catches.

The Workshop report provides an overview of the current state-of-the art in designing and implementing recreational fisheries surveys. The necessary elements of a survey programme are described, including methods for improving the quality of data such as dual-frame sampling, telephone diaries and aerial overflight surveys. A major issue for recreational fishery surveys is the need to minimize potential sources of bias such as under-coverage of the recreational fishing population, non-response of individuals selected for sampling, and poor recall of fishing trips by respondents.

A thorough review was conducted of the survey methods that have been used to monitor recreational fishing effort and catch. Both off-site and on-site survey contact methods were examined, and the relative strengths and weaknesses of the different approaches were identified and discussed. The off-site contact methods considered included mail, telephone, and door-to-door surveys, as well as trip-record reporting surveys that utilize diaries, logbooks or catch cards. The on-site methods considered included access point, roving, and aerial surveys. The review emphasized the need to develop and utilize sampling frames that provide both complete and efficient coverage of the target population, and it pointed to the potential benefits of using more than one frame in a dual-frame or multi-frame approach. It also highlighted the importance of using probability sampling designs and developing estimation methods that properly account for those sampling designs. A variety of sampling designs were reviewed that are commonly used to enhance sampling efficiency and improve statistical precision. The designs reviewed included simple random sampling, probability-proportional-to-size sampling, stratified random sampling, cluster sampling, and two-stage sampling. The review also looked at a number of the current survey programs in the USA, Australia, New Zealand, and various European countries that combine two or more surveys in a complemented survey design. In many of these programs, different survey methods are used to estimate effort and mean catch per unit of effort, but estimates obtained from both surveys are combined to produce estimates of total catch.

Recreational fishery survey experts from the USA, Australia, New Zealand, and Norway attended the workshop and presented recent innovative approaches that are being used for surveying their national recreational fisheries:

- Han-Lin Lai described a dual-frame telephone survey approach that is being used in the USA to estimate marine recreational fishing effort on private/rental boats, man-made shore structures, and natural shorelines. Special angler list frames developed from angler licenses are being used in conjunction with random-digit-dialling telephone surveys of coastal residential households to provide more efficient sampling of licensed fishing participants and reduce potential coverage biases.
- Jeremy Lyle reported on a telephone-diary approach that has been used in Australia to obtain both effort and catch estimates. This off-site approach is very cost-effective and provides good coverage of catch information for night-time and private access fishing trips that are typically difficult to assess in on-site surveys. The success of this approach relies heavily on the implementation of a comprehensive process for managing respondents that involves highly trained interviewers and sustains both high response rates and low rates of respondent recall error.
- Ralph Townsend related recent difficulties with the fielding of telephone-diary surveys through contractors in New Zealand, and emphasized the importance of detailing survey protocols and implementing adequate oversight of survey administration to help reduce potential non-response and recall biases.
- Jon Helge Vølstad described recent efforts in Norway to survey recreational fishing by developing and sampling from list frames of businesses that rent boats to tourists. The list frames would be used as an indirect way to access tourists to obtain information on their fishing effort and catch. Jon Helge also reported on a Delaware River Survey in the USA that employed both aerial and access point surveys in a complemented design to estimate recreational fishing effort. The addition of an aerial survey approach proved to be a very cost-effective method for improving the precision of effort estimates based solely on the access point approach.

To facilitate an evaluation of appropriate recreational fishery survey schemes in Europe, WKSMRF participants provided relevant information for establishing suitable survey schemes for recreational fisheries in their country. This included information on sampling frames, fishing modes, gears, key species, and primary information needs for stock assessments and effective management of recreational fishing effort and catch. The results of any previous sampling schemes or pilot studies were also summarised. The national reports are included in the overall workshop report. Break-out groups were formed at WKSMRF to develop recommendations for common methodological approaches for surveying marine recreational fishing that could be developed through international collaboration in the Baltic; the North Sea, the North Atlantic (ICES areas IV –VII) and from Biscay to the Mediterranean. The main conclusions from these groups, and from subsequent discussions, are summarised below:

- The primary goal should be to develop methods to accurately estimate the annual recreational harvests for the stocks as required by fishery managers. Secondary goals would include accurate assessments of discards (for catch-per-unit-effort trends or for removals if discard mortality is significant), the size/age structure of removals for each species, and an accurate characterization of both the fishery and its participants. The relative importance of recreational fisheries can only be assessed with accurate accounting of total catches, species compositions, catch values, total fishing effort and total fishing participation. Fishery managers would want to know how

fishing effort is distributed among different modes of fishing, fishing seasons, fishing areas, and target species. It would also be important to understand how fishing trips are distributed between resident and non-resident populations.

- A complemented survey design would be most appropriate for a harmonized regional approach. The preferred design would combine an off-site survey of fishing effort with an on-site survey of mean catch per unit of fishing effort. Either a mail or RDD telephone survey could be used to estimate effort, but a telephone contact method is preferred because it would be less prone to non-response and recall biases and would provide more timely results. It would be desirable to build complete mail and telephone list frames of recreational fishing participants through registration, permits or licensing programs. Given that complete list frames are not currently available, it may still be advantageous to utilize available license lists in dual-frame, or multi-frame survey approaches.
- On-site survey methods are generally preferred for surveys of marine recreational catches. This is especially true if the objective is to monitor catches for regional or restricted fisheries. The access point design was identified as the best approach for estimating mean catch per unit of fishing effort, but a roving method may be preferred if access to fishing is very diffuse or a high proportion of the fishing occurs out of private access sites. On-site surveys could be designed to cover recreational fishing for a wide variety of fishing targets, or they could be designed specifically to intercept trips targeting certain key management species if funds are limited. If funding is short, it may be necessary to use a telephone diary approach like the one used in Australia to estimate mean catch per unit of effort.
- Surveys of fishing on for-hire boats could use a complemented logbook-access survey design. If for-hire boats are registered and required to report their fishing effort and catches in standardized logbooks, then access point surveys could provide the representative sampling needed to validate the self-reported effort and catch data in the logbooks. For such an approach to work, reporting should be mandatory and enforced to assure full compliance and timely reporting.
- There is general agreement that significant investments of financial and labour resources will be needed to ensure that the surveys implemented for monitoring recreational catch and effort are able to meet the precision and spatiotemporal resolution needs for stock assessments and effective fisheries management.
- An important recommendation of the Workshop was the formation of an ICES Planning Group to enable international coordination and quality assurance of recreational fishery surveys within the ICES area.

1 Opening of the Meeting

The WKSMRF meeting took place from 14-17 April 2009, at the Ifremer laboratory in Nantes. The participants at the meeting are listed in Annex 1.

2 Introduction

The EU Data Collection Framework (EC 199/2008) defines recreational fisheries as “non-commercial fishing activities exploiting living aquatic resources for recreation or sport.” A range of other definitions of recreational fishing are given in Pawson *et al.* (2008). The scientific assessments of European marine fish stocks continue to focus on quantifying the mortality associated with commercial fishery removals, and have ignored the impacts of recreational fishery catches. However there are species such as European sea bass and cod which are widely targeted by recreational fishermen and where data from recreational fisheries could potentially improve the assessments. Stocks of cod, bluefin tuna and eels (*Anguilla anguilla*) in European waters are severely depleted, and for such stocks, it is clearly important to be able to quantify all sources of fishery removals that could affect recovery. Such factors are presumably the primary reason for the EU Data Collection Framework requirement to quantify recreational fishery catches of these species.

Prior to the requirements of the EU Data Collection Framework and the preceding Data Collection Regulation, studies of recreational fishing in Europe often focused more on descriptions and socio-economic aspects rather than estimating catch quantities using the types of survey approaches used in the United States and elsewhere (see references in Pawson *et al.* 2008). The EU DCR/DCF requirement for pilot studies to collect the information necessary to establish recreational fishery surveys has resulted in a greater focus on the appropriate methodology for estimating catches, and there have also been surveys of freshwater recreational fisheries in Germany using methods such as telephone-diaries (see Section 12). The ICES Planning Group on Commercial Catches, Discards and Biological Sampling (ICES, 2008) considered that a forum was needed to consider appropriate methodology for European fisheries and to promote harmonisation of approaches between countries as far as possible. WKSMRF was therefore established to address the following Terms of Reference in relation to European recreational fisheries:

- a) Provide a comprehensive description of the marine recreational fisheries in each ICES country including the species/stocks targeted, the potential or known magnitude of recreational catches and effort by geographic area, time period and fishing method, and the definition of appropriate reference populations of recreational fishermen for sampling;
- b) Review the findings of existing studies on recreational fisheries including DCR Pilot Studies and their relevance for sampling schemes in other areas;
- c) Recommend appropriate statistical sampling schemes, protocols, and associated data analysis for estimating recreational fishery removals and length/age compositions, taking account of international experience and recent methodological developments. Review potential for conducting parallel studies to establish comparability of results for different sampling schemes.

The legal framework for collection of recreational fisheries data by EU Member States is given by the EU Data Collection Framework (Council Regulation (EC) No 199/2008 and Council Decision 2008/949/EC). The Council Decision specifies that:

- *For the recreational fisheries targeting the species listed in Appendix IV (1 to 5), Member States shall evaluate the quarterly weight of the catches.*
- *Where relevant, pilot surveys as referred to in Chapter II B (1) shall be carried out to estimate the importance of the recreational fisheries mentioned in point 3(3)(a).*
- *Data related to annual estimates of the catches in volumes must lead to a precision of level 1 (level making it possible to estimate a parameter either with a precision of plus or minus 40 % for a 95 % confidence level or a coefficient of variation (CV) of 20 % used as an approximation).*

Appendix IV of Council Decision 2008/949/EC specifies fleet metiers covered by the DCF, and includes recreational fisheries specified to Level 5 in the matrix (target species assemblage). The species for which recreational fishery data are to be collected in each area are:

- Baltic (ICES Sub Divisions 22-32): Salmon, cod and eels
- North Sea (ICES Div. IV & VIId) and Eastern Arctic (ICES Div. I & II): cod and eels
- North Atlantic (ICES Div. V-XIV): Salmon, seabass and eels
- Mediterranean and Black Sea: bluefin tuna and eels

The recreational fishery data do not have to be collected according to mesh size bands of nets (metier Level 6), but the DCF specifies that data should be collected for “all vessel classes (if any) combined”. The DCF does not specifically mention shore-based (i.e. non-vessel) recreational fishing.

The principal goal of WKSMRF was to provide the factual and methodological framework to allow European countries to develop suitably harmonised sampling and survey schemes to provide the type of information required by the EU Data Collection Framework or other national requirements. The agenda for the meeting (Annex 2) was devised with this goal in mind.

The work plan for the meeting involved the following activities:

- Methodological presentations based on experiences gained in the USA, Australia, New Zealand and Norway;
- Presentations describing national recreational fisheries and existing pilot studies in the European countries represented at the meeting;
- Break-out groups to develop recommendations for sampling schemes and international collaboration in three of the ecoregions shown in Fig. 2.1 (Baltic Sea ecoregion; North Sea and Celtic Seas ecoregion; and the South European Atlantic Shelf and western Mediterranean Sea);
- Plenary sessions to review break-out group outcomes and to conduct other general Workshop business.

The Workshop benefited from taking place after the 2008 ICES Annual Science Conference in which Theme Session K dealt with Small-Scale and Recreational Fisheries Surveys, Assessment, and Management. Two of the Theme Session chairs (Dave Van Voorhees and Jon Helge Vølstad) participated in WKSMRF and the third Theme session chair (Patrick Berthou) contributed valuably to the discussions leading up to WKSMRF. Readers are referred to the ICES website at

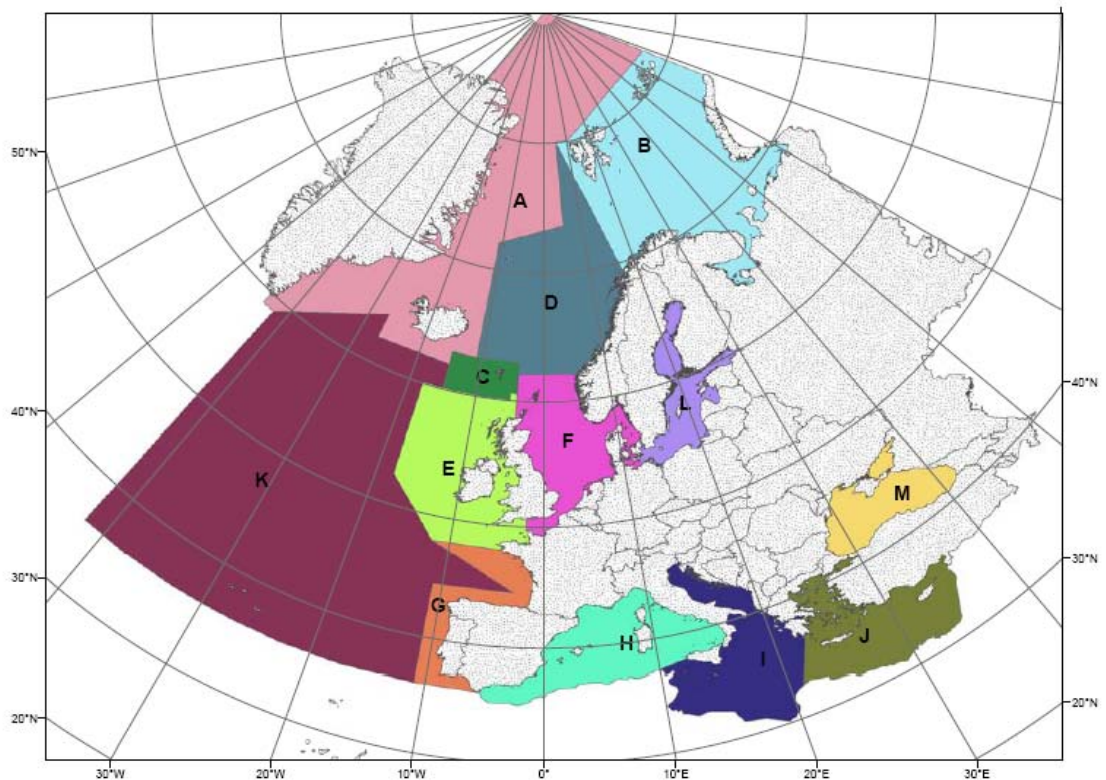
<http://www.ices.dk/products/CMdocs/CM-2008/K/K-2008.pdf> for access to the manuscripts and posters from this theme session.

Throughout this report, references are listed at the end of each section.

References

ICES (2008). Report of the Planning Group on Commercial Catches, Discards and Biological Sampling (PGCCDBS). ICES CM 2008 / ACOM 29.

Pawson, M.G., Tingley, D., Padda, G. and Glenn, H. 2007. Final report of EU contract FISH/2004/011 on "Sport Fisheries" (or Marine Recreational Fisheries in the EU. Prepared for The European Commission Directorate-General for Fisheries.



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Fig 2.1. Ecoregions based on ICES Advice ACFM/ACE report (2004). A: Greenland and Iceland Seas; B: Barents Sea; C: Faroes; D: Norwegian Sea; E: Celtic Seas; F: North Sea; G: South European Atlantic Shelf; H: Western Mediterranean Sea; I: Adriatic-Ionian Seas; J: Aegean-Levantine Seas; K: Oceanic northeast Atlantic; L: Baltic Sea; M: Black Sea. WKSMRF dealt mainly with recreational fisheries in ecoregions D-H and L.

3 Description of marine recreational fisheries in ICES areas, including previous pilot studies and other studies

This section of the report addresses ToRs (a) and (b) (see section 2).

A requirement for WKSMRF participants was to prepare, in advance, a Working Document describing the recreational fisheries occurring in each ICES Division, according to fishing method groupings that could be used for defining the populations for sampling (e.g. shore fishing, private boats, charter boats). Information should be given (where known) on target and by-catch species, spatial and seasonal patterns of fishing, qualitative or quantitative information on catches, fishing effort (e.g. numbers of anglers x number of days spent fishing by method, area and time period), potential for access-point and other forms of direct catch and effort surveys, likely sources of bias, and any other factors relevant to the establishment of statistical survey and sampling schemes to estimate total effort, catches and size compositions. To facilitate this, a pro-forma for key information was provided to facilitate inclusion of consistent information in the Workshop report.

The reports provided by each country are reproduced in Sections 8 – 23. A summary of pilot studies carried out to meet the requirements of the EU Data Collection Regulation up to 2008, and summaries of any other relevant studies, are included in each section. These national reports provide a comprehensive overview of aspects of recreational fisheries throughout Europe that are of relevance for establishing survey and sampling schemes. A previous overview by Pawson *et al* (2007; ref in Section 3) provided general descriptions of the national fisheries but also focused on the socio-economic and environmental impacts of sport fishing as well as management issues including legislation. Pawson's report therefore provides a very useful overview of aspects of recreational fisheries not covered by WKSMRF, together with a comprehensive reference list.

4 Overview of survey methods for marine recreational fisheries (Dave Van Voorhees)

This section addresses ToR (c).

This overview of survey methods is based largely on the reviews of Pollock *et al* (1994) and the U.S. National Research Council of the National Academies (2006). The main reference for the background on statistical survey terminology, probability sampling methods, and potential sources of bias in survey sampling is Sarndal *et al* (1992).

Survey Planning

There are a number of important steps that must be followed to plan a survey. The following step-by-step approach is based largely on important aspects of survey planning identified by Sarndal *et al* (1992):

- 1) Objective: The first step is to specify the objective of the survey.
- 2) Survey Problem: Once you have determined the objective, you must determine an appropriate problem to solve that is amenable to a survey approach.
- 3) Target Population: Next you must specify the target population for study.

- 4) Domains and Parameters of Interest: For the target population, you must specify the domains (or subpopulations) of interest and any unknown population parameters that you need to estimate at the population and/or domain levels. At this point, you should also identify any known auxiliary variables that may be useful in determining an appropriate sampling design.
- 5) Sampling Frame: The next step would be to find or construct appropriate sampling frames that could provide efficient access to all of the elements of the target population.
- 6) Inventory of Available Resources: Once the possible frames have been identified, you must inventory your available resources in terms of budget, staff, data processing, and other equipment.
- 7) Requirements: It will also be important to specify any requirements that need to be met with regards to time schedule or accuracy of survey estimates.
- 8) Data Collection Method: At this point one can specify an appropriate data collection method that can utilize available frames, is affordable, and will meet the specified requirements. Questionnaire construction can proceed once the appropriate contact method is determined.
- 9) Sampling Design: It will be very important to consider the choice of frame and data collection method before specifying a probability sampling design and sample selection mechanism. An appropriate sample size can then be determined based on the design and any specified requirements for the spatiotemporal resolution and statistical precision of estimates.
- 10) Data Processing Methods: With a sampling design in place, it will be important to plan very specifically how data will be processed, audited, and edited. It will also be important to specify any methods to be used for imputation of missing data.
- 11) Estimation Methods: The specific estimation formulas to be used for point estimators and measures of the precision of those point estimators (variance estimators) should be based on the selected sampling design.
- 12) Training: Once data collection, sampling, and estimation methods are specified, you should develop and implement appropriate procedures for the training and supervision of the personnel who will conduct the various survey operations. It is very important to ensure that all of work of fielding the survey is well organized.
- 13) Resource Allocation: Resources must then be optimally allocated among the various survey operations, including between the control and evaluation tasks to be performed.

The focus of this workshop is to determine appropriate target populations, sampling frames, data collection methods, sampling designs, and estimation methods for effective surveys of marine recreational fishing effort and catch. Other important aspects of survey planning should be taken into account before fielding any particular methodological approaches, but those additional considerations are not addressed in this workshop.

To establish some basic terminology, let us consider that we may want to conduct a survey to estimate the total amount of fishing effort by marine recreational fishermen in a particular geographic region. We could define our **target population** to be all recreational fishermen who fish in that region. The **elements** of that population would be individuals who engage in marine recreational fishing. The unknown population **parameter** that we wish to estimate is the total number of fishing trips made by recreational fishermen in the region. Suppose we are also interested in studying three different **domains** of marine recreational fishing – fishing from shore, fishing from private boats, and fishing from charter boats. We will want to partition the data we collect from a representative sample of fishermen so that we can estimate the total number of fishing trips in each of the three different domains.

Sampling Frames

In order to implement a survey to accomplish this objective, we will need to select an appropriate **sampling frame** (Sarndal *et al*, 1992). Suppose that we have a list of all people who participate in recreational fishing that includes valid contact information (e.g., phone number or mailing address) for each person. The list comprises a sampling frame that we can use to select individual fishermen as **frame units**. Using a specified **probability sampling design**, we can then draw a representative sample of units from the frame that will include a number of people who fished in marine waters. We can then use an appropriate **data collection method** to contact each of the individuals who were selected as part of the survey sample and obtain **observations** of the reported number of marine fishing trips they made within a specified time period. Recreational fishing participants who only fish in freshwater streams or lakes will have no marine trips to report, but at least some of those who participate in marine fishing will have marine trips to report. Using a specified **point estimator** formula, we can then use the observations we obtained from the sample to calculate a point estimate of the total number of marine recreational fishing trips made by the people listed in the frame. We can also use a specified formula to estimate the **variance of the point estimator** as a measure of its precision.

Sampling frames can be classified as either **direct** element sampling frames or **indirect** element sampling frames. A **direct frame** provides direct access to the individual elements of the target population. Each sampling unit within the frame corresponds to an individual population element. An **indirect frame** does not provide direct access to the individual elements of the target population. Instead, the indirect frame provides direct access to individual subsets, or **clusters**, of population elements. The individual sampling units within the frame are the clusters, and each cluster may contain one or more individual population elements. A list of individual recreational fishing participants would be a direct frame, but a list of residential households with recreational fishing participants would be an indirect frame. Each household would represent a cluster of one or more recreational fishing participants.

Sampling frames can also be classified as **list frames** or **area frames**. A **list frame** is a list or directory that contains individual frame units that correspond to either individual population elements or clusters of individual population elements. An **area frame** is comprised of a set of geographic subareas or spatial locations that may contain clusters of individual target population elements. Area frames are always indirect frames. A list of individual recreational fishing participants with their telephone numbers and/or mailing addresses would be an example of a **direct list frame**. A list of residential households identified by telephone number and/or mailing address would be an example of an **indirect list frame**. A list of fishing access sites that pro-

vides access to clusters of completed fishing trips would be another example of an **indirect list frame**. A map of states, counties, or provinces could be used as an area frame, and a map of delineated fishing areas could also be used as an area frame. Within each subarea of such a frame, one may gain access to clusters of individual recreational fishing participants or individual fishing trips.

Available sampling frames for use in surveys of a specific target population usually have imperfections. The ideal sampling frame provides direct access to all elements of the target population and does not include any elements that do not belong in the target population. If a frame does not include some elements of the target population, then it suffers from **under-coverage** of the target population. The larger the proportion of the target population that is not included in the frame, the greater the under-coverage of the frame for the population in question.

Under-coverage can result in serious estimator biases and estimation errors if the under-covered elements differ significantly from the elements covered by the frame in the study parameters to be estimated by the survey. If the sampling frame includes elements that are not in the target population, then the frame suffers from **over-coverage**. The greater the over-coverage, the less efficient the frame is in providing access to the individual elements of the target population. In general, the lower the over-coverage of a frame, the more cost-effective it becomes as a survey sampling frame. Another frame imperfection that can potentially cause estimation errors is **duplication**. A given individual target population element may be represented by more than one frame unit, giving it a higher probability than other individual elements of being selected for sampling. If duplicated elements differ from non-duplicated elements with respect to the study parameters of the survey, then frame duplications can cause estimation errors. Of these possible frame imperfections, under-coverage is the most serious because it can result in a very significant estimation bias.

Probability Sampling Methods

There are a number of basic probability sampling designs that can be used to draw a survey sample from a sampling frame, and each design dictates a different specific set of estimation formulas for point estimators and point estimator variances (Sarndal *et al*, 1992). The different possible designs offer advantages and disadvantages that should be considered in the selection of the design to be used for a particular survey.

Simple random sampling is the easiest design to implement and it allows use of the simplest estimators. In this sampling design, every element of the frame has a probability of being selected and their individual selection probabilities are equal. The point estimator of a population total (\hat{t}_π) is a simple formula based on the sum of the sample observations ($\sum_s y_k$), the sample size (n), and the frame size (N) as follows:

$$\hat{t}_\pi = \frac{N}{n} \sum_s y_k .$$

The estimator of point estimator variance ($\hat{V}(\hat{t}_\pi)$) is also a straightforward formula based on the sample variance (S_{ys}^2), the sample size (n), and the frame size (N) as follows:

$$\hat{V}(\hat{t}_\pi) = N^2 \frac{(1 - n/N)}{n} S_{ys}^2 .$$

Unequal probability sampling is more complicated to implement and requires more complicated estimators, but it can be advantageous for increasing the precision of point estimators as measured by reduced point estimator variances. In this type of sampling design, the selection probabilities of individual frame elements are not equal. A special case of unequal probability sampling is called **probability-proportional-to-size (PPS) sampling**. In PPS sampling the selection probability of each frame unit is directly proportional to its known size with respect to a known auxiliary variable. If a known auxiliary variable is likely to be highly correlated with the unknown parameter to be estimated, then PPS sampling based on the known values of that auxiliary variable can lead to significant reductions in point estimator variance, hence more precise point estimators. For example, if you already knew the average fishing avidity of all of the anglers in a given angler list frame, it would be beneficial to use a PPS approach that would base individual angler selection probabilities on their measures of mean avidity. The more avid anglers would have a higher probability of being selected for the sample.

Although the estimator of total fishing effort would be more complex using this approach, the estimation formula for a point estimator (\hat{t}_{pwr}) would be a straightforward calculation based on the observations for each sample element (y_k), the predetermined selection probabilities of those elements (p_k), and the sample size (n) as follows:

$$\hat{t}_{pwr} = \frac{1}{n} \sum_{i=1}^n \frac{y_k}{p_k}.$$

The estimated variance of the point estimator ($\hat{V}(\hat{t}_{pwr})$) would be calculated as follows:

$$\hat{V}(\hat{t}_{pwr}) = \frac{1}{n(n-1)} \left[\sum_{i=1}^n \left(\frac{y_k}{p_k} \right)^2 - \frac{1}{n} \left(\sum_{i=1}^n \frac{y_k}{p_k} \right)^2 \right].$$

Stratified random sampling is another probability sampling design that can be used to reduce the variance of point estimators. In this design, the frame population is divided into subpopulations called strata, and each stratum is sampled independently. If strata are defined such that the elements of each stratum are relatively homogeneous with respect to the parameter of study and most of the frame population variability is due to differences among strata, then stratified sampling can lead to substantial gains in the precision of point estimators of the study parameter. In the stratified design, point estimates and estimates of point estimator variance are calculated separately for each sampled stratum. Because each stratum is sampled independently, both the point estimates and variance estimates can be summed to get total estimates for the frame population. If variability in the unknown study parameter is low within strata, then the stratum estimates of point estimator variance will be relatively low. The sum of the stratum variances would likely be much lower than the point estimator variance that would be obtained without stratification of the frame population. The key inputs for the estimates are the total size of each stratum (N_h), the sample size in each stratum (n_h), the sample mean in each stratum (\bar{y}_{s_h}), and the sample variance within each stratum ($S_{ys_h}^2$).

The point estimator is as follows:

$$\hat{t}_{\pi} = \sum_{k=1}^H N_h \bar{y}_{s_h}.$$

The estimator of point estimator variance ($\hat{V}(\hat{t}_{\pi})$) is as follows:

$$\hat{V}(\hat{t}_{\pi}) = \sum_{k=1}^H N_h^2 \frac{\left(1 - \frac{n_h}{N_h}\right)}{n_h} S_{y_{s_h}}^2.$$

Stratified sampling also offers the flexibility of differentially allocating sample among strata in ways that could further improve the overall precision of parameter estimates. Because the sampling of each stratum essentially comprises a separate survey, it is possible to allocate proportionally more of your total sample size for your study to the strata that have greater variability in the study parameter. In general, a stratified sampling design can lead to precision gains that are comparable to those obtained from a PPS sampling design, but the stratified design is often easier to implement than PPS and its variance estimators are simpler.

To illustrate how a stratified random sampling design might be used to improve the precision of a survey of marine recreational fishing effort, suppose that we are using a list of known marine recreational fishing participants as our sampling frame. If we know the residence location of each person in the frame, we could stratify the frame to distinguish between those who live near the coast and those who live further away from the coast. This would seem to be a reasonable way to define subpopulations of participants who would differ in their mean avidity. We might expect that residents of a defined coastal zone would have higher mean avidity than non-residents of that zone. If this were true, then by creating resident and non-resident strata we might expect to find that there will be much less variability in fishing effort within each stratum than we would find for the total frame population. In such a case, we should expect to get more precise point estimates of total fishing effort using this stratified design than we would get without the stratification. We could also choose to allocate a disproportionate amount of our total survey sample to the resident stratum because we expect to find greater variability in avidity among the people within that stratum. By “optimizing” the allocation of sample among strata in this way, we should expect to get even greater statistical precision than we would get from a proportional allocation.

Cluster sampling is the type of sampling that must be used with indirect frames that identify subsets of target population elements rather than individual elements. In a simple random cluster sampling design, each frame unit represents a cluster of population elements and all clusters have the same probability of being selected. Once a sample of clusters is selected, then all elements within each of those clusters are observed. In other words, each sampled cluster of elements is completely enumerated. For example, we might be using a list of fishing access points as an indirect frame to gain access to anglers who have completed fishing for the day. In this case, the target population is all of the marine angler fishing trips completed within a given time frame (possibly only one day to simplify this example), and the target population elements are completed individual angler fishing days within that time frame. We could select a simple random sample of the listed sites and then visit those sites to intercept and interview all anglers who have completed fishing for the day. We would have to stay long enough to census all anglers who completed fishing at that

site on that day. This would give us a simple random cluster sample where the sampled sites represent completely observed clusters of angler fishing days. The point estimators and estimators of precision are relatively straightforward for simple random cluster sampling, and the estimators are based on the known total number of clusters in the frame (N_I), the number of sampled clusters (n_I), the mean of the totals observed for all elements within the sampled clusters (\bar{t}_s), and the variance of those observed totals among the sampled clusters (S_{ts}^2) as follows:

$$\hat{t}_\pi = N_I \bar{t}_s, \text{ and}$$

$$\hat{V}(\hat{t}_\pi) = N_I^2 \frac{\left(1 - \frac{n_I}{N_I}\right)}{n_I} S_{ts}^2.$$

Much like for direct element sampling, unequal probability cluster sampling or simple stratified cluster sampling designs can be used to obtain gains in the statistical precision of point estimators with more complicated estimation formulas.

Two-stage sampling is similar to cluster sampling, except selected clusters are sub-sampled in this probability sampling design. This design is commonly used when it is not easy to obtain observations from all of the population elements contained within a given unit cluster of an indirect sampling frame.

Suppose we found that it was difficult to intercept and interview all anglers who completed fishing at a given fishing access site that was selected in a given cluster sample, as described in the example provided in the previous paragraph. Some anglers may leave the site while other anglers are being interviewed. We might have to resort to a two-stage sampling design because it is not possible to intercept and interview all anglers at a given site. In such a case, the first stage of sampling would select a sample of sites and each site would represent a cluster of angler fishing days. The second stage of sampling would consist of a simple random sampling of completed angler fishing days within each selected fishing access site. The primary sampling unit would be a fishing site, and the secondary sampling unit would be an angler fishing day. The point estimators and estimators of point estimator variance are considerably more complex for the two-stage simple random sampling design than for the simple random cluster sampling design. Nevertheless, estimation methods can be relatively straightforward if accurate cluster sizes are obtained in the first stage of sampling and combined with observations obtained from the individual elements sampled in the second stage. The point estimator of a population total is based on the number of clusters (N_I), the number of sampled clusters (n_I), the sizes of the sampled clusters (N_i), the means of observations obtained within the sampled clusters (\bar{y}_{s_i}) as follows:

$$\hat{t}_\pi = \frac{N_I}{n_I} \sum_{s_i} N_i \bar{y}_{s_i} = \frac{N_I}{n_I} \sum_{s_i} \hat{t}_{i\pi}.$$

The estimator of the point estimator variance also utilizes the sample variances within ($S_{ys_i}^2$) and among (S_{is}^2) the sample clusters as follows:

$$\hat{V}(\hat{t}_\pi) = N_I^2 \frac{\left(1 - \frac{n_I}{N_I}\right)}{n_I} S_{\hat{t}_{s_I}}^2 + \frac{N_I}{n_I} \sum_{s_I} N_i^2 \frac{\left(1 - \frac{n_i}{N_i}\right)}{n_i} S_{y_{s_I}}^2.$$

More complicated **multi-stage sampling** designs can be used with indirect sampling frame, but the sampling protocols and estimation methods become increasingly more complex as more stages are added to the design.

Estimator Bias, Estimator Precision, and Estimation Errors

An **estimator** is a statistical formula that is used to estimate an unknown population parameter. An estimator is biased if its average value over all possible samples differs from the true value of the parameter that it is designed to estimate. In other words, the **bias of an estimator** for a given population parameter may be measured as the difference between the average estimated value over all possible samples and the true value. The statistical **precision of an estimator** is measured by the inverse of its variance over all possible samples. The **accuracy of an estimator** is measured as a function of both its bias and precision. In general, the accuracy of an estimator is inversely related to its bias and directly related to its precision.

An **estimate** is the calculated value of an estimator based on a single sample. An estimate by itself has no variance and no bias. Only the estimator that produced the estimate can be described as having bias or precision. However, an estimate can have error, and the **error of an estimate** can be measured as its deviation from the true value of the parameter it is intended to match. Of course, a biased estimator will tend to produce erroneous estimates, but an imprecise, unbiased estimator can also produce erroneous estimates. In general, we want to avoid estimation errors by using estimators that are both unbiased and precise.

Sources of Error in Survey Estimates

There are a number of different sources of estimation error of which we must be aware when designing a survey. One obvious source of error is that we usually base our estimate on observations obtained from only one of all possible samples of the target population. Estimation error attributable to the use of only one sample is known as **sampling error**. The more precise the estimator, the lower will be the magnitude of a possible sampling error. Other sources of estimation error are closely related to possible causes of bias in survey estimators and are called **non-sampling errors**. Non-sampling errors can be grouped into two major categories – non-observation errors and observation errors. **Non-observation errors** are errors that result from a failure to obtain data from parts of the target population that differ from the rest of the population with respect to the unknown study parameter. The selected sampling frame may fail to provide access to all elements of the target population, allowing the possibility of an **under-coverage error**. Even if the frame provides complete coverage, the survey may fail to contact or obtain observations for all elements in a selected sample, allowing the possibility of a **non-response error**. **Observation errors** are those that result from failures to accurately observe and record values of the study parameter for population elements that are included in the survey sample. If a survey respondent provides an incorrect value or the survey interviewer records an incorrect value, this could result in a **response error**. If an instrument used for measurements consistently returns an incorrect value, this could result in a **measurement error**. Even if correct values are obtained in responses and measurements, the actual value recorded in a database may not be correct due to a variety of possible **processing errors**. There may be errors in the coding of responses, the key entry of

data, the auditing and editing of entered data, or the imputation of values for missed observations. All of these types of non-sampling errors must be minimized to assure that survey estimators will be relatively unbiased.

Survey Contact Methods

There are a variety of survey contact methods that can be used for surveys of recreational fishery effort or catch. We can group them according to whether the data collection occurs off-site or on-site. **Off-site methods** include mail surveys, telephone surveys, door-to-door surveys, and various types of self-recorded response surveys that involve recording data in diaries, catch cards, or logbooks. **On-site methods** include access point surveys, roving surveys, and aerial surveys. The rest of this overview looks at a variety of possible fishery survey designs that have been based on the different contact methods and discusses the relative strengths and weaknesses of each approach.

Mail Surveys

Mail surveys of recreational fishing have usually targeted populations of anglers or boat captains and have been used to estimate total fishing effort, total catch, or both. Mail surveys utilize either a post office directory frame or a special list of participants as a sampling frame. A **post office directory frame** usually provides the most complete coverage of fishing participants, but it can be very inefficient due to its high level of over-coverage. Usually a large majority of households identified in such an indirect sampling frame do not have residents who participate in recreational fishing. A **special list frame** that is based on fishing licenses or some other kind of registration process that obtains mailing addresses will generally serve as a much more efficient sampling frame. However, specialized lists are often very incomplete, and surveys based strictly on such lists may suffer from substantial under-coverage biases. Licensing or registration programs for recreational fishing participants or boats will often exempt certain participants (elderly, children, teenagers, etc.), and many participants may fail to obtain a license or to register before going fishing.

In addition, registration lists may not be updated frequently. Consequently, mail surveys that utilize special list frames can miss significant numbers of fishing participants who may fish very differently from the ones who are accessible for sampling.

In general, mail surveys are often chosen because they are relatively cheap to run and simple to operate. In addition, a mail survey based on a postal mailing address directory frame can provide more complete coverage of recreational anglers than any telephone survey could because it will provide access to households without telephones. Another advantage of a mail survey approach is that it allows for the development and use of longer, more detailed, questionnaires than could be used with telephone survey approaches. The main potential weakness of mail surveys is that they tend to have much lower response rates than telephone or on-site surveys, so there is potential for a very high non-response bias in the survey estimates. In addition, mail survey questionnaires usually need much more clarification than telephone survey questionnaires, because respondents cannot talk to an interviewer as they record their responses. Response errors can be substantial if questionnaires are not accompanied with clear, specific, easy to read instructions. Mail surveys are also not very suitable if responses are needed within a short time frame, because the turn-around time for responses is much longer than for telephone or on-site approaches.

In order to sufficiently minimize potential weaknesses, most mail surveys now employ Dillman's "Total Design Method" (Dillman, 1978). This approach involves a se-

ries of mailings to decrease non response, the use of detailed instructions to reduce response errors, and the conduct of a follow-up telephone survey with mail non-respondents to obtain a measure of any possible non-response bias. A first mailing to each selected member of the sampling frame includes a cover letter that fully explains the purpose of the survey and the importance of providing a response, a numbered questionnaire with explicit instructions for its completion, and a postage-paid return envelope to facilitate mailing of a response. In some cases, an inducement may be included with this first mailing to encourage cooperation. A follow-up postcard is mailed a week later to remind the recipient to complete the survey. If no response is obtained, a second mailing is sent three weeks after the initial mailing. The second mailing has a new cover letter, another numbered questionnaire with instructions, and a new postage-paid return envelope. If no response is obtained after the second mailing, a third mailing is sent four weeks later by certified mail that includes a new cover letter, another numbered questionnaire with instructions, and a postage-paid return envelope. If no response is obtained after the third mailing, then all remaining non-respondents are included in a sampling frame that is used to conduct a follow-up telephone survey of mail non-respondents. The values of the study parameter obtained from telephone respondents are compared with the values obtained from mail respondents to determine the possible existence of a mail non-response bias and calculate an estimate of the magnitude any such bias. The estimate of the mail non-response bias is then used to correct the mail survey estimate based on mail respondents.

Telephone Surveys

Telephone surveys have been used to target populations of anglers or for-hire boat captains for estimating fishing effort, catch or both. The conduct of a telephone survey depends on the sampling frame that is used. Common approaches either use an indirect list frame of residential households or a special list frame of registered recreational fishing participants. The frame of residential households could be a set of residential telephone numbers that can be accessed through random digit dialling, or it could be a telephone directory that provides direct access to listed telephone numbers for households. Directory frames could be regular directories of telephone company subscribers or enhanced directories maintained by commercial firms.

Random-digit-dialling (RDD) telephone surveys are based on an indirect frame concept, often called the RDD frame, which provides access to all possible telephone numbers, listed and unlisted, for both fishing and non-fishing households. Cell-phone numbers may or may not be included in such surveys, but survey calls to cell-phone numbers are often subject to specific restrictions. In the U.S., telephone surveys may contact cell-phone numbers only if computerized predictive dialling methods are not used. In most countries, telephone numbers are coded in a manner that indicates the geographic location of households or businesses. In the U.S., the first 8 digits of a 10-digit telephone number usually define a block of 100 numbers that are specific to a given geographic zone. The commonly used RDD approach uses a probability sampling method to allocate sampling effort among the different 8-digit-prefix phone blocks contained within the study area. Within any selected block, a random sample of the 100 possible 2-digit suffixes is selected for dialling.

Two different probability sampling methods have been used for RDD – stratified random sampling and two-stage sampling. If 8-digit-prefix phone blocks are already known to be strictly “commercial”, “strictly residential”, or “mixed”, then a stratified sampling design is commonly used. In this case, “commercial” blocks are excluded,

and the RDD sample is distributed evenly among the “residential” and “mixed” 8-digit-prefix strata. The sample allocated to each block is then obtained by randomly selecting possible two-digit suffixes. This stratified design greatly increases the efficiency of the RDD approach by reducing the number of calls to non-residential numbers. If the composition of 8-digit-prefix blocks is not known in advance, then it is more appropriate to use a two-stage sampling approach such as the Witofsky-Waksberg design (Waksberg, 1978). In this approach, the first stage of sampling randomly selects a sample of 8-digit-prefix blocks and the second stage randomly selects one 2-digit suffix for each selected block. Calls are then made to the selected numbers. If the contacted number is “residential”, then an interview is attempted and additional 2-digit suffixes are randomly selected within the same 8-digit block. If the contacted number is “non-residential”, then the 8-digit block is rejected. This method selects 8-digit-prefix blocks as primary sampling units according to a design that simulates a PPS approach. The blocks with the most residential numbers will have the highest probability of being selected for second stage sampling. In general, the Witofsky-Waksberg design is much more efficient than simple RDD sampling because it produces a much larger proportion of useable residential telephone numbers.

The RDD frame can provide very good coverage, but its over-coverage relative to a target population of marine recreational fishing participants can be substantial. The Marine Recreational Fishery Statistics Survey (MRFSS) of the U.S. utilizes an RDD telephone survey that employs a stratified RDD. Even though that survey only targets coastal zone residents, it is still a relatively inefficient approach for surveying marine recreational fishing effort because only 5-10% of the households contacted have residents who went fishing within the prior two months.

A recent review conducted by the National Research Council of the U.S. National Academies of Science (National Research Council of the National Academies, 2006) recommended the use of a **panel survey option** as a means of increasing the efficiency of RDD telephone surveys of recreational fishing effort. One possible approach would be to use an RDD sampling design as a means of recruiting fishing participants for a rotating panel survey. Such a survey design would combine periodic independent sampling (first contacts with recreational fishing households) with longitudinal sampling (re-contacts of those households). The telephone numbers of “fishing households” identified in the RDD sampling for a given two-month wave of the survey would be retained and re-contacted as a panel for a total of 3-6 successive sampling waves. In each wave, a new panel would be started and a previous panel would be terminated.

Three to six overlapping panels would be contacted each wave, and new panels would be rotating in as old panels rotate out over time. The panel design would greatly increase the proportion of contacts with fishing households in each wave, thereby increasing overall sampling efficiency. However, the panel design also presents some disadvantages that should be considered.

Longitudinal sampling is considered to be advantageous for accurately estimating changes in population parameters over successive time periods, but it is considered to be disadvantageous for estimating cumulative totals over successive time periods. Repeated measures on the same individuals allow separation of any effects attributable to individual differences from other possible effects when evaluating the statistical significance of changes from wave to wave. Independent sampling over successive time periods is more advantageous for precisely estimating cumulative population totals, such as the total fishing effort in a given year. This is because the

surveys for successive waves would be totally independent and the estimated variance for a cumulative total of wave-by-wave point estimators would simply be the sum of the estimated variances for each included wave. In longitudinal sampling, the point estimates for successive time periods would not be independent, and the estimated variance for a cumulative total would have to include covariance terms that could be substantial in magnitude. Other possible disadvantages of adding a panel option to RDD surveys include the necessary increases in respondent burden and the possible response errors that could occur if panel participation directly influences angler fishing behaviour. The increased burden could cause panel members to drop out sooner than planned, and panel members might decide to fish more or less than they would have otherwise.

Directory telephone surveys may be based on a **regular directory** of telephone company subscribers or and **enhanced directory** maintained by a commercial firm. Regular directories typically include names, addresses, and telephone numbers for a specific geographic area. A main disadvantage for their use as a sampling frame is that they do not include unlisted numbers. Some commercial firms supplement subscriber lists with additional lists and additional household-specific information obtained from a variety of other sources (e.g., a national census survey). Such directories are usually more complete and are updated more frequently than regular directories. Commercial directories are available in most European countries, but they can also be expensive to purchase. Directory frame sampling for surveys of recreational fishing is usually stratified geographically, allowing the allocation of more sampling to areas with higher levels of recreational fishing participation. In order to include some coverage of households with unlisted telephone numbers, some directory-based surveys have used a method called “add-a-digit” sampling. This approach basically takes a telephone number randomly selected from the directory and adds a constant or randomly selected number (1-9) to get a number that may or may not be already listed in the directory. Although this is advantageous for improving coverage, it is statistically problematic because the probability structure for estimation is complex.

Special list frame telephone surveys may be based on fishing license lists, boat registration lists, and/or fishing club membership lists. In general, such list frames are more direct and more efficient for sampling of fishing participants, but they are often very incomplete. Licensing and registration programs often specify exemptions for some categories of participants due to age, military service, or other characteristics. If license or registration lists are used, participants who qualify for an exemption would be excluded. In addition, any non-exempted participants who choose to fish without a license would also be excluded. If such lists are not updated frequently, they may fail to include many recent registrants and may also include many people who no longer fish. The shorter the time frame for license or registration renewals, the more likely the list will be useful as a survey sampling frame.

Lists based on fishing club memberships are not only usually very incomplete, but they are also likely to have an avidity bias. The ideal frame for a telephone survey of marine recreational fishing would be a complete list of participants. In order to construct and maintain such a list, licensing or registration should be mandatory, should require all participants to provide valid contact information and update it annually, and should effectively enforce compliance with this requirement.

In comparison with other contact methods, telephone surveys have a number of strengths worth noting. Telephone surveys generally provide higher response rates and more timely responses than mail surveys. Response errors are less likely in tele-

phone surveys, because it is usually easier for respondents to understand survey questions when they are able to speak with a well-trained interviewer. Questionnaires and recording of responses can be computerized with telephone surveys. Computer-assisted telephone interviewing (CATI) reduces the chances for respondent errors in answering questions, interviewer errors in administering the complex skip-patterns of a questionnaire, and interviewer errors in coding responses. Recall errors are less likely in telephone surveys than in mail surveys because telephone surveys usually require respondents to report within a shorter, more controlled recall period. Telephone surveys are also safer and much less expensive than on-site surveys.

The relative weaknesses of telephone surveys are mostly associated with their relative costs, possible recall issues, and coverage issues. They are more expensive than mail surveys to implement because they require significant investments in the training and supervision of interviewing staff. Compared to on-site surveys, telephone surveys are much more prone to recall errors, especially in the reporting of catch data. The extent of possible under-coverage bias in telephone surveys varies among the sampling frames used, but such a bias can potentially lead to significant estimation errors. Anglers who live in non-coastal locations, in institutional housing, or in coastal residences without telephones are generally missed by most telephone surveys. Anglers with a cell phone but no landline telephone are also excluded from most RDD and directory frame telephone surveys. Most directory frame telephone surveys also miss anglers with unlisted telephone numbers. Although special telephone survey list frames can be much more efficient to use and may allow access to some of the sectors poorly covered by RDD and directory surveys, registration lists usually provide less complete coverage than the more comprehensive telephone frames. If the missed anglers fish differently than the anglers who are covered, then it is easy to see that any of these under-coverage issues could result in significant estimation biases.

Door-to-Door Surveys

Door-to-door surveys are not often used to monitor recreational fishing activity. The target population for such surveys could be individual recreational fishing participants or for-hire boat captains, but the sampling frame used is usually an indirect frame that provides access to easily mapped locations of individual households. In the absence of a special list of recreational fishing participants, the sampling is usually conducted through a two-stage process that starts with the selection of specified subareas within a study area frame. In the first stage, a sample of subareas is selected. In the second stage, a sample of households is selected within each selected subarea. The selected households are then visited to conduct interviews with household residents. This method can provide good coverage if the enumeration of residential households and identification of their map locations is relatively complete. However, the development of complete household lists can be very labour-intensive and costly. Simple random sampling from special list frames of registered participants is more efficient, but under-coverage may be significant and travel costs can be very high if randomly selected households are widely scattered.

Door-to-door survey methods have been used in the U.S. National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (U.S. Fish and Wildlife Service, 2007) and in the 2000 Australian National Survey of Recreational Fishing (Lyle *et al*, 2002).

The advantages and disadvantages of door-to-door surveys are relatively obvious. A major strength is that response rates are generally much higher with this contact

method than with either mail or telephone surveys. The face-to-face interviews conducted with respondents can have much greater depth and flexibility than with telephone surveys, and potential literacy and language issues are generally less problematic than with either mail or telephone contacts. The obvious disadvantages of door-to-door surveys are that they are very labour intensive, very costly, and logistically very complex. Under-coverage can be a significant source of bias with incomplete special list frames or with a more general area frame approach if household enumeration within subareas is incomplete. The biggest drawback in comparison with on-site face-to-face methods is that the data are self-reported and, therefore, subject to a variety of possible reporting biases.

Diaries

A sample of recreational fishermen or boat captains may be asked to complete a diary of their fishing activity, including data on both fishing effort and catch. This kind of survey approach is considered to be an “off-site” survey method because there is usually no guarantee that the respondent records data during, or even immediately following, the fishing activity. A typical diary is a multi-trip record, and respondents are recruited to report fishing data in the diary over an extended period of time. This approach provides longitudinal sampling, and the recruited respondents report as though they are members of a survey panel. It is important to retain recruits for the duration of the planned panel survey. Initial recruiting may be accomplished by mail or telephone contact using one or more of the possible frames described above. An inducement may be used in some cases to encourage cooperation, and diary response rates are generally higher when inducements are used. Once a fisherman or captain has agreed to participate, a diary package is mailed. The package usually includes a compact, easy to carry booklet with a standard format and specific instructions describing the information desired and how it should be recorded in the booklet. Respondents are usually encouraged to record anecdotal information as needed to promote accurate interpretation of the data they record. The time frame for diary reporting and returns may be the length of a specific fishing season or a full year. A follow-up telephone contact is often made to answer any questions that the respondent may have, and a subsample of respondents may be asked to submit a diary early, possibly after the first three months, to allow checking for quality. Additional follow-up contacts by mail or telephone may be used to encourage better cooperation. In general, there is evidence indicating that response rates increase significantly with the addition of more follow-up contacts. In the Australian National Survey of 2000, diary reporting was facilitated through phone contacts planned immediately after the dates of planned fishing trips reported by the respondent (Lyle *et al*, 2002). A recent pilot study conducted in Germany used a diary approach that relied more on follow-up mail contacts (Arlinghaus, personal communication).

Logbooks

Another survey approach that has often been used to obtain multi-trip records of recreational fishing is to ask a sample of participants to record data on their fishing activities on standard logbook forms. Logbook surveys have been used to collect catch and effort data from charter boat captains, fishing pier operators, or tournament directors. Like diary surveys, logbook surveys implement a form of longitudinal sampling and are usually considered to be “off-site” because data are not always recorded or delivered immediately subsequent to the completion of each fishing trip.

Respondents are typically recruited as members of a respondent panel by mail or telephone contacts, and they are asked to record fishing data on standard logbook

forms which are subsequently mailed to them. Accompanying instructions direct the respondents to record data separately for each fishing trip or fishing day. Specific instructions are provided on standard coding schemes to use for recording values for different categorical variables such as fish species, catch dispositions, fishing methods, gear types, or fishing locations. Training of the recruited respondents can greatly reduce the incidence of possible response errors. To avoid possible under-coverage or non-response biases in logbook surveys, it is important to use appropriate sampling frames and probability sampling methods for recruiting and to retain recruits for the duration of the planned survey. Completed logbook forms are either collected by an agent or they are mailed by respondents at specified time intervals. It may be difficult to get respondents to consistently complete and provide their completed forms in accordance with a requested schedule, so follow-up mail or telephone contacts, or even mandatory reporting requirements, have been used to promote better compliance. The U.S. Southeast Headboat Survey is a logbook survey of headboat captains that attempts to census annual marine recreational fishing effort and catch on headboats from Texas to North Carolina.

Catch Cards

Recreational fishermen or boat captains may be asked to report catch and effort data on a catch card that they can subsequently return either by mail or by hand-delivery to an agent who is located on site. Catch cards are usually single-trip records, not multi-trip records like diaries or logbooks. A catch card is typically a pocket-sized card made out of waterproof paper that is formatted for standard recording of values for catch and effort variables for one day of fishing. The card may be issued to the respondents by mail or by an agent who is located on site. The fisherman or captain fills out the card at the end of a fishing day and either directly returns it to an agent or returns it by mail. Some catch card reporting surveys are mandatory. In such cases, the catch card approach may be used in conjunction with a daily fishing permit and a check station. The fisherman would have to hand over his license to get the permit and would only be able to get his license back by returning a completed catch card. Voluntary catch card programmes are likely to be subject to substantial non-response bias, because the more successful participants are often more likely than the less successful ones to return a completed catch card. Mandatory catch card programs have been used in Washington (U.S.) to track recreational catches of salmon and halibut and in North Carolina (U.S.) to track recreational catches of bluefin tuna.

There are a number of strengths and weaknesses common to diary, logbook, and catch card surveys. All three approaches have proved to be useful for tracking time trends or differences between geographic areas in fishing effort and catch. These approaches are commonly used because they are inexpensive and easy to administer. Collected information can be high in quality if the survey is supported with continual public education and cooperative good will. The biggest weakness common to these approaches is that all data are usually self-reported without the direct support of a trained interviewer. A number of factors may contribute to response errors and consistent estimation biases. Anglers or captains may tend to consistently exaggerate their catches, introducing a "prestige bias". Respondents may be likely to make consistent errors in the identification of certain fish species, resulting in a "species ID bias". If length or weight measurements are reported, it is likely that individuals will make consistent errors that could cause measurement biases. In addition, all of these trip-record reporting methods tend to have high non-response rates, especially when reporting is voluntary. Such reporting methods are often subject to significant under-coverage bias because the frames used for recruiting the reporting panels have often

been rather incomplete. In many cases, such reporting programs have found probability sampling to be difficult in the absence of a mandatory reporting requirement.

Participants in the reporting panels for such surveys are often largely self-selected. Complete frames, probability sampling methods, and effective public education are needed to ensure that the recruits for such trip-record reporting programs comprise a representative subset of the target population.

Access Point Surveys

Access Point Surveys utilize an on-site, intercept design to gain access to a target population of shore-fishing trips or boat-fishing trips. In this type of survey, trained interviewers are sent to fishing access points where they intercept recreational fishermen or boat captains immediately after they have completed an individual fishing trip or day of fishing. Interviewers may be sent to boat ramps, marinas, public piers, or small dirt parking lots near popular shoreline fishing spots. In addition, any parking lot that is used routinely by recreational fishermen as a starting and ending point for a day of fishing could be included as a defined access point. The sampling frame for an access-point survey is a spatiotemporal frame that ideally includes all times available for fishing and all points of access to the fishery. Interviewers are assigned for specified times at specified sites where they directly count and intercept fishermen or boat captains as they are coming off the water. Only fishermen or captains who have completed a day of fishing are counted and intercepted for interviews. Interviewers directly observe and count landed fish that the fishermen or captain makes available for inspection, and they may obtain length and weight measurements for a random sample of the inspected fish. Interviewers may also ask questions to obtain values of demographic, economic, or socio-cultural variables for each intercepted respondent. Access point surveys may be used to estimate total fishing effort, mean catch per unit effort, and/or total catch.

The access point survey sampling frame is a multi-dimensional frame of all fishing sites and times. To avoid possible under-coverage bias, it is important that the list of fishing sites be kept current and complete. The list of fishing times should ideally include all dates and time intervals during which fishing can occur. A frame unit is a specific combination of site, date, and time interval, and individual frame units should be selected using probability sampling methods. Time intervals could be specified to create separate daytime and night-time shifts for interviewers, or they could be specified as a set of 4-6 consecutive fixed-time blocks that cover a 24-hour day. To allow for the efficiency and precision gains that may be possible with a PPS sampling approach, it is usually advisable to obtain data that can be used to predict fishing effort or catch within each site/date/time unit of the frame. Separate frames are often developed and maintained for independent access point surveys of different modes of fishing. Separate surveys may be conducted for shore fishing trips, private/rental boat fishing trips, and for-hire boat fishing trips. In such cases, a different spatiotemporal frame and set of frame unit measures of effort (or catch) is needed for each mode of fishing.

The spatiotemporal sampling frame used for access point surveys is an indirect frame and probability sampling of fishermen or boat fishing trips must follow a cluster or multi-stage sampling design. In the first stage of sampling, a site/date/time unit must be selected as the "primary sampling unit" (PSU). Trained interviewers can then be assigned to cover each of the selected PSUs. The interviewer assigned to a given PSU must visit the assigned site on the assigned date to intercept fishermen, or boat, trips during the assigned time interval. If the estimation of mean catch per boat trip, for

example, is the primary survey objective, then the second stage of sampling must intercept all or a representative subset of the boat trips completed at the site during the assigned time interval. If all boat trips are intercepted, then a cluster of boat trips is fully covered within each PSU, and the survey employs a cluster sampling design. If only a subset of boat trips are selected, then a two-stage sampling design is used and boat trips are secondary sampling units (SSUs) that are selected within each PSU.

If the survey is designed to estimate mean catch per angler trip, then the second stage of sampling within the PSU would either intercept all completed angler trips (cluster sampling) or a representative subset of completed angler trips (two-stage sampling). For anglers fishing on boats, the SSU could be a completed boat trip and a third stage of sampling may occur that would select a subset of anglers within each completed boat trip.

The selection of site/date/time PSUs is usually conducted as multi-stage process, and a variety of approaches can be used. Dates and time intervals for interviewing assignments may be selected before sites are selected. Alternatively, sites may be selected before dates or time blocks. Dates are usually selected using a stratified sampling design that distinguishes between day types (weekend versus weekday), months, or weeks that are expected to have different levels of fishing activity. Stratification is advisable when fishing effort is predictably greater on some days than it is on others. Proportionately higher levels of sampling can then be allocated to the temporal strata in which fishing activity is greater, thereby allowing for more precise catch and effort estimators. Dates may be selected without replacement in a first stage of stratified sampling, and a specific time interval for each selected date may be selected in a second stage of PPS sampling where intervals are weighted by their expected activity. Another approach creates time block strata, allocates interviewer assignments among time blocks in a first stage, and then selects a specific date for each assignment within a given time block in a second stage of PPS or stratified sampling. This latter approach would allow the same date to be selected for more than one time block.

Sites for access point survey assignments can be selected through simple random sampling or PPS sampling. In general, access point survey estimators will be most precise when sampling effort can be allocated among sites in at least rough proportion to the number of fishing trips at those sites. Therefore, a PPS approach is usually preferred and good site-specific estimates of fishing effort are needed to support that approach. In some cases it may be advisable to cluster sites, weight the site clusters by total expected fishing effort, and select them through a PPS approach. Interviewers would then be assigned to visit multiple sites within a selected site cluster in a randomly assigned order and according to some predetermined schedule. Visits to multiple sites per day are usually preferred if sites are numerous and varied. However, multiple site sampling protocols may be difficult to implement and estimators can become much more complex with these kinds of approaches.

Access point surveys can be used to estimate total fishing effort. The most common approach is to conduct census counts of completed angler or boat fishing trips for each sampled site/date/time unit and expand those sample counts across the total frame units to estimate the total number of fishing trips. In order to do this properly, it is extremely important to count all marine recreational fishing trips in the mode of fishing being targeted that have ended at the assigned access site during the assigned time interval. If estimates of the total number of angler fishing hours are desired, then interviewed anglers or captains can be asked to report the number of hours that they

fished. Sample estimates of the mean number of hours per trip can then be expanded by the estimated total number of trips to obtain an estimate of total fishing hours. If multiple sites are visited on access point survey assignments, then the lengths of the time intervals covered at each visited site would have to be recorded and used with the actual "time interval counts" in the calculation of total trip estimates.

A more specialized access point survey method for estimating total fishing effort utilizes exit or entrance counts. This approach can be used when an embayment has an observation point from which the comings and goings of boats can be easily seen. An observer with binoculars can be stationed at the observation point to obtain accurate counts of boats exiting the bay or entering the bay over the course of an assigned time block.

Dockside interviews conducted in another access point survey that covers sites within the embayment can be used to estimate the ratio of returning boats that were actually engaged in marine recreational fishing. That ratio can be applied to the exit or entrance counts of total boat trips to estimate the total number of marine recreational boat fishing trips. Although the counts obtained in such surveys can be subject to errors resulting from poor visibility at night or on bad weather days, time-lapse and infrared cameras can be used to facilitate more accuracy.

Access point surveys are commonly used to estimate mean catch per unit effort and may also be used to directly estimate total catch. The main objective is often to estimate a mean catch rate that can be expanded with an independent measure of effort obtained from another survey. Interviewers intercept fishermen or captains who have completed fishing for the day and ask to see any kept fish that the respondent is willing to make available for observation. A well-trained interviewer can directly observe and identify these "available" fish to the species level. The interviewer can also obtain accurate counts of these fish by species and can obtain accurate length and weight measurements on a random subsample of them. The interviewer must rely on the respondent to provide identification and count data on any "unavailable" catch that was either not returned to the dock or not made available for observation. For self-reporting by recreational fishermen, fish may only be identified to the family level if it is likely that the respondent would be unable to provide an accurate species identification. Estimates of mean catch per fishing trip are likely to be more accurate for "observed" fish than for "unobserved" fish. Separate estimates are often made for these two categories of catch and those estimates are usually partitioned to produce domain estimates for retained and released catch by taxonomic category. The domain estimates for the observed and unobserved catches are then summed to get total mean catch rates for retained and released fish.

The access point survey method is the best method to use for estimating mean catch per unit of fishing effort. Estimates are largely based on direct observations of retained fish made by interviewers who are well-trained to identify fish accurately to the species level. There is likely to be much better recall of self-reported data on released catches in this design than in any of the off-site survey designs. The fishing trips that are sampled with the access point design are always completed trips, so no assumptions must be made about the fishing behaviour of an intercepted fisherman or captain after being interviewed. Access point surveys are generally safer than other on-site surveys and they are also more practical for collecting data at night. The access point survey design works best if a great majority of the fishermen use defined public sites to reach the water and few use private docks, private piers, or walk to the water from ad hoc parking spots along a road. This design is not very suitable when

access to fishing is very diffuse. The main disadvantage of this approach relative to off-site surveys is that it is much more costly and labour intensive. In addition, access point surveys are prone to under-coverage bias because it is often difficult to gain access to individuals or boats that complete fishing at private access sites (private shoreline, private docks, private locked marinas, or private boat ramps). For this reason, off-site survey methods may be preferred for estimation of total fishing effort and may be needed to assess possible differences in catch rates between private and public access fishing trips.

The access point survey is a very appropriate design for sampling of angler fishing trips, but it is less suitable as a means of sampling individual anglers because the more avid anglers will always have a greater probability of being intercepted than the less avid ones. This inherent avidity bias must be considered if this method is used as a means of targeting individual participants for surveys of economic and socio-cultural parameters. There are also limits to the amount and level of detail that can be obtained in on-site interviews.

Follow-up mail or telephone interviews may be necessary to obtain more detailed information about angler behaviour and expenditures, especially if information is needed on what the respondent does after the fishing trip is completed.

Roving Surveys

Roving Surveys can be used when access to fishing is very diffuse and an access point survey would not be practical. This type of survey is an on-site intercept design that can be conducted by boat or by foot, and the target population is a population of recreational fishermen or boat fishing trips. The sampling frame is a spatiotemporal frame much like the one used for access point surveys. The only difference is that a sample location is a defined subarea where fishing is actively occurring, not a defined access point that is located between where fishing occurs and where anglers or captains go to return home after a fishing trip. Interviewers are assigned to collect data at specified times within specified subareas. They “rove” around the subarea and intercept fishermen or boat captains while they are actively engaged in the act of fishing. Therefore, a sample of incomplete fishing trips is obtained. Many of the same advantages of access point surveys are obtained because interviewers can directly observe and count any retained fish that are made available by the intercepted fishing participant and interviewers can obtain direct measurements of weight and length data on a random sample of the available fish.

Roving surveys may be used to estimate fishing effort from counts obtained of people or boats that are actively fishing. However, estimates of the number of fishing days per trip, or number of trips, cannot be based entirely on the effort data obtained directly from interviews of fishermen or captains because the roving interviewers only obtain data for incomplete fishing trips. Two types of counting methods are used – instantaneous counts and progressive counts. Instantaneous counts are usually made over a 15-minute interval, and progressive counts may be made over much longer time periods. If only instantaneous counts are used, there are several counts taken on each day of sampling and interviewers alternate between periods of counting and interviewing within the assigned subarea. If progressive counts are used, the sampler is instructed to make a number of successive instantaneous counts at different locations within a sampled subarea. These successive counts are added together to get a total progressive count for the subarea. With the latter approach, it is generally best to get more than one progressive count per day. Progressive counts can be unbiased if the start point and direction of movement among counting locations are randomized.

However, counts may be biased if some fishermen are not easily visible or if some non-fishermen are accidentally included. To estimate the total number of fishing hours per fisherman in a sampled day, the average of the counts obtained for that day is multiplied by the number of hours when fishing can occur. To estimate the total number of fishing days per fisherman, the total number of hours per fisherman must be divided by a measure of the mean length of a fishing day that is obtained from another survey.

Roving surveys may also be used to obtain estimates of total catch, but limiting assumptions must be made about how catch rates (catch per hour) can vary due to trip length. Interviews with fishermen or boat captains must obtain the start time for fishing, the time of the interview, and the counts of fish caught at the time of the interview. An estimate of mean catch per hour is calculated for each species of fish based on the interview data. This mean is expanded by an estimate of the total number of fishing hours for all the fishermen (based on roving survey counts as described above) to get an estimate of the total number of fish caught. This approach assumes that the catch rate at the time of the interview equals the catch rate for the intercepted fisherman's or captain's complete day of fishing. This may not be true if fishermen tend to consistently catch more fish near the beginning or end of a fishing trip.

This estimation method also assumes that the mean catch rates of interviewed fishermen are equal to the mean catch rates of non-interviewed fishermen. In roving surveys, fishermen who take longer fishing trips will consistently have a greater chance of being intercepted than those who take shorter fishing trips. In other words, roving survey sampling of fishing trips is subject to what is called a "length-of-stay bias". If catch rate consistently increases or decreases with increasing trip length, then this sampling bias could result in a significant estimation bias.

Roving surveys offer a number of advantages and disadvantages. These surveys collect good information on catches in areas where access to fishing is dispersed and access point sampling would not be feasible. Direct observations of retained fish are obtained by well-trained interviewers. Because roving interviewers actively seek fishermen and don't have to wait for them to complete fishing and exit through access points, they may actually collect more interviews per hour than access point interviewers would. The main disadvantage to this approach is that interviews are obtained with fishermen before they have completed fishing. This method of sampling may inevitably result in a length-of-stay bias that can lead to erroneous estimates of mean catch per trip or total catch. Because roving surveys are often more complex to plan and conduct than access point surveys, they are also more prone to interviewer errors. There are also issues with safety and equipment maintenance. Conditions are generally not as safe for roving interviewers as they are for access point interviewers, especially at night, and roving interviewers cannot carry or maintain fish measurement instruments as easily.

Practical Considerations for Access Point and Roving Surveys

Both access point and roving surveys require significant investments in survey management to assure high quality data and accurate statistical estimates. Very specific procedures and quality assurance protocols must be developed for on-site sampling. Interviewers must be provided with very detailed instructions and they must be well trained to execute accurate counts, to randomize selection of fishermen or captains for interviews, to conduct interviews properly, to randomize selection of fish for length and weight measurements, and to measure fish accurately with supplied measuring boards and scales. Trained supervisors should monitor interviewer per-

formance on and off site to assure that survey protocols are consistently being followed. If a name and phone number is obtained from each interviewed fisherman or captain, then a sample of interviews can be checked through follow-up telephone interviews to verify that the interview and fish measurements were conducted properly. Additional procedures will be needed to facilitate communications with interviewers and resolve any data issues identified by standardized auditing and editing procedures.

Aerial Surveys

Aerial surveys are on-site surveys of fishing effort, and they cannot be used to estimate catch. This type of survey is particularly useful for counting large numbers of fishermen or boat fishing trips over a large area. The staffing demands are minimal, because only one pilot and one or two observers are needed to conduct the data collection activities. The sampling frame is a spatiotemporal frame, and the spatial part of it is an area frame. For each day of sampling, a subarea is selected and that subarea is swept to make a series of instantaneous counts for different well-defined zones within the selected subarea. An aerial survey of shore fishing effort obtains counts of individuals engaged in fishing. An aerial survey of boat fishing effort obtains counts of individual fishing boats.

Probability sampling is conducted using a spatiotemporal frame. The sampling days are usually selected by stratified random sampling, with separate weekday and weekend strata, and proportionately more sample may be allocated to the busier weekend stratum.

The selection of days may be stratified by month or week to break out a fishing season into successive time intervals. Once a day is selected, then a specific flight time and a specific subarea are selected. Simple random sampling may be used to select both the flight time and the subarea, or a PPS sampling approach may be used in one or both cases if estimates of fishing activity are available for different time intervals and/or subareas.

In order to estimate total fishing effort for a given time interval, the total count obtained for the swept area is expanded by the ratio of the entire area divided by the swept area to get a total count of fishermen or boat trips. There is usually only one time interval count made for each sampled day. The estimated effort for each sampled day is obtained by expanding the total time interval count to the total fishing hours in a typical fishing day. With different time periods being selected and covered on different sampled days, this approach produces daily estimates that can be summed and expanded by the inverse of the fraction of days sampled to provide a total effort estimate for the length of the fishing season that is unbiased.

There are several advantages and disadvantages worth noting for aerial surveys. Aerial surveys must be paired with other surveys that collect catch data if the goal is to provide estimates of total catch. Such surveys can provide efficient coverage of fishing over large areas with a very limited number of personnel. Aerial surveys allow total enumeration of fishing trips on a large spatial scale, and the estimates of fishing effort do not depend on self-reporting. In addition, they can be very helpful for assessing spatiotemporal patterns in the fishery and can be used to evaluate the site or area frames used for on-site surveys. Although staffing demands are low, flights are usually quite expensive and often difficult to schedule. Aerial surveys require a lot more planning than other types of effort surveys. The most difficult challenge is to avoid the potentially large biases that could result if visibility is poor. Accurate counts are difficult to obtain in adverse weather conditions or at night-time. Aerial

surveys of shore angler fishing effort may miss some anglers fishing under the cover of trees or man-made structures. In general, it is usually best to check aerial survey counts against on-site counts obtained by access point or roving surveys.

Dual-Frame Surveys

For any given survey design, it may be advantageous to utilize two or more overlapping sampling frames. An available special list frame, like a list of licensed anglers, may provide direct and efficient access to only a segment of the target population. A second more complete frame, like an RDD frame, may provide better coverage of the target population, but the access is indirect and less efficient. If the two frames are used in concert, they can provide relatively complete coverage with an increased sampling efficiency for at least a subset of the target population. A survey that utilizes two frames like this is called a “dual-frame” survey. If the special list frame includes population elements that are also included in the less efficient, more complete frame, then one can define two different domains for the total frame population – the overlap domain and the non-overlap domain. The overlap domain would be comprised of the members of the incomplete special list frame, and the non-overlap domain would be comprised of the members of the second frame that are not in the special list frame. Both frames would be used for selecting the sample for the survey, but the unknown study parameters would be estimated separately for the two domains and summed to get the population totals. There are a number of possible approaches that can be taken to produce the separate domain estimates. The best approach is to screen all units on the special list frame out of the more complete frame before samples are drawn from each frame. This allows for stratified sampling of the two domains. If such screening is difficult to accomplish because special list frame members are hard to identify in the more complete frame, then it may be possible to identify frame membership and partition estimates based on data collected in the survey interviews.

This approach is more difficult in practice, but the subsequent partitioning of estimates after sampling can allow for the separate estimation of the overlap and non-overlap domains.

Complemented Survey Designs

It is often necessary or desirable to use more than one contact method in combination to achieve the overall study objective of a particular survey project. A survey design that includes two or more contact methods is called a “complemented survey design”. Complemented surveys may be used for several different reasons.

A complemented survey design may be used for the purpose of **bias correction**. If a contact method used for a particular survey is known to have high potential for a particular kind of bias, then a second contact method may be used to obtain a measure that could be used to correct for that kind of bias. The use of a follow-up telephone survey to measure possible differences between respondents and non-respondents to a primary mail survey of recreational fishing effort is a good example of a complemented survey design that provides a bias correction. In this case, the telephone survey is used to measure possible non-response bias in a mail survey because telephone contacts usually result in higher response rates than mail contacts. For the same reason, a door-to-door survey might be used as a follow-up to measure non-response bias in a telephone survey.

A complemented survey design may be used for the purpose of obtaining **additional information** that cannot be easily collected in a primary survey. For example, an an-

gler who is intercepted by an access point survey that collects data on both catch and economic variables may be asked to provide a name and phone number so he/she can be included in a follow-up telephone survey that collects additional economic data. It may not be feasible to ask detailed questions on angler expenditures in an on-site survey interview, and it may be important to get data on the angler's expenditures related to his travel back home. Such information may best be obtained through a follow-up survey.

Large complex surveys may be necessary if different modes of fishing are best surveyed with different contact methods. It may be possible to conduct special list frame telephone surveys for recreational fishing effort on for-hire boats, but it may be necessary to use an RDD household frame or some sort of dual-frame approach for surveys of private boat and shore fishing effort. A complemented survey design for marine recreational fishing might employ an access point survey method for recreational fishing on boats or man-made shore structures and a roving survey method for natural shoreline fishing which tends to have more dispersed access.

Separate effort and catch surveys may be needed in a complemented survey design for marine recreational fishing. The use of different contact methods for estimating effort and mean catch per unit effort is quite common. The Marine Recreational Fishery Statistics Survey in the U.S. has always used an RDD household telephone survey to estimate fishing effort and an access point survey to estimate mean catch per unit effort.

The following sections briefly describe a variety of complemented survey designs that have been used for estimating marine recreational fishing effort and catch. The headers refer to combinations of effort and catch surveys, where the method used primarily to estimate effort is shown before the method used primarily to estimate catch rates. This "effort-catch" terminology was first developed by Pollock *et al* (1994) and is now widely used to broadly categorize alternative complemented survey designs for recreational fishing.

Mail-Mail Design

The mail-mail complemented survey design combines a mail survey to estimate fishing effort with a mail survey to estimate catch or mean catch per unit effort. This is the simplest and least expensive approach to take, and it may be a reasonable approach to use for estimating the total catches of memorable, easily identified trophy species that are caught in small numbers within limited fishing seasons. For more common or hard-to-identify species that are caught in larger numbers over longer time frames, there will be high probabilities of recall and measurement biases with this approach. The Alaska Sportfish Statewide Harvest Survey uses a mail survey that samples from a list of license holders for estimation of both total angler fishing trips and total angler catches by species.

Telephone-Mail Design

A telephone-mail complemented survey design combines a telephone survey method that estimates fishing effort with a mail survey method that estimates catch rates. A recent German pilot study (Arlinghaus, personal communication) utilized a dual-frame telephone survey to contact anglers and collect fishing effort data. Sampling for the telephone survey utilized special lists of license holders, as well as an RDD household frame. A subset of the telephone survey respondents were recruited as a panel to complete catch diaries and return them by mail. Both effort and catch data from the returned diaries were used in the estimation of effort and catch statistics,

and mail response rates were maximized through inducements and a number of follow-up mail contacts using an approach similar to that recommended by Dillman (1978). In addition, a telephone follow-up survey was conducted with mail diary non-respondents to get a measure of mail non-response bias.

Telephone-Telephone Design

A telephone-telephone complemented design relies on telephone contacts for the collection of both fishing effort and catch data. The Australian National Survey design (Lyle *et al*, 2002) utilized a telephone-telephone diary approach in most states. In this case, a regular directory telephone survey was used to contact anglers and collect fishing effort data. This telephone survey served as the primary source of data for fishing effort estimates, but telephone respondents were also recruited for participation in a diary survey that was used to estimate catch rates. Diary participants were sent a diary and detailed instructions on how to identify and record the fish they caught. Frequent telephone contacts with panel members allowed anglers to report the data recorded in their diaries by telephone with a very short recall.

Telephone-Access Design

The most common complemented survey design approach utilizes a telephone survey as the primary mechanism for estimating fishing effort and an access point survey as the means of estimating mean catch per unit effort. The effort and catch rate estimates are combined to estimate total catch. The design of the IFREMER Pilot Survey of Recreational Fishing (Section 12) is a good example of this approach. An RDD household telephone survey was used to estimate the total number of angler fishing trips, and an access point intercept survey was used to estimate mean catch per angler trip. The MRFSS design in the U.S. has used a very similar approach since its inception in 1979. The U.S. Large Pelagics Survey (LPS) uses a special list frame telephone survey of Highly Migratory Species (HMS) Permit holders to estimate the total number of offshore vessel fishing trips directed at large pelagic species. The LPS also employs a specialized access point survey that intercepts vessel trips returning to sites used for offshore fishing. The U.S. For-Hire Survey uses a special list frame telephone survey of for-hire boat operators to estimate total angler fishing trips and an access point intercept survey of angler trips on for-hire boats to estimate mean catch per angler trip.

Access-Access Design

An access-access design utilizes two different access point surveys to estimate effort and catch rates. In the U.S., there are two examples of this approach currently in use. The Washington Ocean Sampling Program (OSP) uses an access point approach to conduct entrance counts that enumerate vessels returning from the ocean to coastal bays that they access through narrow inlets. The entrance counts are combined with vessel intercept data collected by a dockside, access point survey to estimate the total number of vessel fishing trips. The dockside survey is also used for collecting catch data and estimating mean catch per vessel trip. The Oregon Ocean Recreational Boat Survey (ORBS) uses a similar design, but the effort estimates are obtained through access point survey exit counts of vessels rather than entrance counts.

Roving-Access Design

A roving-access design uses an on-site roving survey to estimate fishing effort and an access point survey to estimate catch per unit effort. A U.S. Texas Parks and Wildlife Survey has utilized this kind of design. A roving survey based on instantaneous counts of recreational fishing boats is used to estimate the total number of private

boat fishing trips. An access point survey intercepts completed private boat fishing trips and estimates mean catch per private boat trip.

Aerial-Access Design

An aerial survey that is designed to estimate fishing effort may be combined with an access point survey that is designed to estimate mean catch per unit fishing effort. Total catch is estimated by combining estimates from the two complemented surveys. One example of this type of design is the Canadian Georgia Strait Creel Survey (Hardie *et al*, 1998). In this complemented design, an aerial survey was conducted to estimate both shore angler and private boat fishing trips, and an access point survey was used to estimate mean catch per angler trip. The U.S. Delaware River Survey (Vølstad *et al*, 2002) also utilized both aerial and access point surveys, but effort estimates were obtained from both the aerial and access point surveys. The two methods of estimating effort were compared and evaluated to determine which method or combination of methods offered the most accurate measure. The access point effort estimates were preferred for shore fishing, but aerial and access point estimates were both used in a combined estimator of private boat fishing effort.

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5 International experiences in applying recreational fisheries sampling schemes

5.1 Recreational fisheries in USA – Dual-Frame Methodology: CHTS-ALDS Dual-frame Estimation of Recreational Fishing Effort in North Carolina (Rob Andrews and Han-Lin Lai)

Introduction

In 1981, NOAA Fisheries implemented Marine Recreational Fishery Statistical Survey (MRFSS) to estimate total catch. The MRFSS is a complemented survey design that includes two independent surveys. The Coastal Household Telephone Survey (CHTS) estimates fishing effort (in angler trips), and the Access Point Angler Intercept Survey (APAIS) estimates mean catch rate (in number of fish per angler trip). The estimators from the two surveys are combined to estimate total catch.

The CHTS utilizes a computer-assisted, random-digit-dialling (RDD) approach to contact full-time residential households in coastal counties. The sampling frame of CHTS covers anglers who live in coastal county households with landline telephones. Over the years, response rates have decreased and cell phone users have increased.

In 2006, National Research Council (NRC) reviewed the MRFSS sampling design and estimation methods and pointed to three concerns in the CHTS:

- The (RDD) survey suffers inefficiency due to the low proportion of fishing households among the general population and is biased due to its exclusion of non-residents of coastal counties.
- The use of special list frames of marine recreational anglers that are based on saltwater fishing licenses anglers is not yet feasible as a means of improving offsite sampling methods.
- Most current saltwater fishing license programmes have exemptions based on age, residence, and access points. The lack of a universal sampling frame that includes all marine recreational fishing participants (registered or licensed) is a major impediment to the development of a reliable and accurate survey programme.
- Dual-frame procedures should be used wherever possible to reduce possible biases resulting from undercoverage. For example, if a state has an incomplete list frame based on licenses, the use of an additional sampling frame of the state's residents (e.g., RDD) would reduce the bias. The existence of a complete frame of participants would make a dual frame approach unnecessary.

Following the NRC review, NOAA Fisheries has started to implement a National Angler Registry Program and began to conduct pilot studies to test surveys that utilize dual-frame procedures. Two ongoing pilot studies utilize the databases of saltwater license holders in North Carolina (NC) and Louisiana (LA) as sampling frames for Angler License Directory Surveys (ALDS). Both of these states use electronic license sales and maintain up-to-date databases of license holders.

CHTS

The CHTS utilizes an RDD methodology to select residential households in coastal counties as the sampling units. The sampling procedures and questionnaires are found in the following website:

http://www.st.nmfs.noaa.gov/st1/recreational/Coastal_household_telephone_survey.html

The CHTS is relatively inefficient because only 5-12% of the households contacted actually have residents who participate in marine recreational fishing. To reach a target sample of fishing households, the CHTS sample size must be set 10 to 20 times higher. Also, gradually decreasing response rates and recent increases in cell phone usage are becoming problematic for the CHTS.

In NC and LA where the pilot ALDS is implemented, additional questions about license status are added into the CHTS questionnaires in order to classify "licensed" and "unlicensed" households based on the presence or absence of residents who are license-holders. If any member of household purchases license in the calendar year, the household is classified as a "licensed" household.

ALDS

In NC and LA, the sampling frame for the ALDS is based on angler contact information obtained from an electronic database that contains all license sales. The sampling frame is stratified into state-coastal (residents of designated coastal counties in the state), state-noncoastal (residents of non-coastal counties in the state) and out-of-state (non-residents of the state) anglers. For the sampled licensed anglers who do not provide a telephone number, a Post-Reverse Directory Matching method is applied. This approach uses listed mailing address information to obtain a valid telephone number from a directory of telephone subscribers. The percent of sample size with a valid telephone number has been greater than 80% (unweighted) since 2008.

The questionnaire and data collection procedures of the ALDS are similar to the CHTS, and both are conducted bimonthly to collect fishing effort data for a two-month recall period. The efficiency of the ALDS is reflected by the fact that 40-60% of the respondents reported marine recreational fishing trips. In contrast, only about 10% of households contacted by the CHTS reported marine recreational fishing trips.

However, the ALDS suffers from undercoverage because it does not reach anglers who fished with license exemptions or anglers who fished without a license. The ALDS also suffers further undercoverage because the license databases do not have valid telephone numbers for all license-holders. Telephone numbers are missing for some licenseholders and some listed telephone numbers are invalid. There are additional problems with using the license databases as survey frames. Some listed telephone numbers are cell phone numbers, and some license-holders appear more than once in the database because they hold more than one license.

Dual Frame Methods

Coastal county residential households are the sampling units of CHTS. In contrast, licensed anglers are the sampling units of the ALDS. The dual frame method that is used is flexible enough to allow the CHTS and ALDS to have different sampling units. A "licensed household" is defined as one in which any member of the household has a license. This assumption produces the overlapped CHTS and ALDS frames as shown in Figure 5.1. The subpopulation S_1 includes Non-coastal and Non-residence licensed anglers, S_2 represents Non-licensed households, S_{12} represents

overlap of the Coastal licensed anglers and the Coastal licensed households, S_3 represents the anglers/households in the saltwater fishing population who are not covered by the union of the ALDS and CHTS sampling frames.

The traditional MRFSS uses the single frame *CHTS* estimation method that does not take the information of license status into account. The single frame CHTS method estimates total effort (X) in coastal counties. The fishing effort of non-coastal and non-residence households are estimated by the expansion factors obtained from the MRFSS Access Point Angler Intercept Survey (APAIS). In the APAIS, the interviewees are asked for their residence status. The expansion factor for non-coastal and/or non-resident anglers is calculated by dividing the total number of APAIS interviewees by the number of interviewees who live in non-coastal and/or non-resident households. Although the expansion method is cost effective, it suffers measurement errors, sampling errors, and other potential causes of bias.

Residency	in MRFSS	Licensed	Non-Licensed
Coastal	CHTS (X)	CHTS (X_{12})	CHTS (X_2)
Non-Coastal	APAIS Expansion of X	NA	NA
Non-Resident	APAIS Expansion of X	NA	NA

For the dual frame, domain estimation is applied to the CHTS data by utilizing the information obtained on license status. The estimated fishing efforts for subpopulation S_{12} (coastal licensed households) and subpopulation S_2 (non-licensed households) are denoted by X_{12} and X_2 respectively. However, the expansion factors for the non-coastal and non-resident domains in the dual frame method cannot be estimated accurately and precisely due to the reasons listed above.

The sampling for the ALDS is stratified by location of residence. Therefore, the efforts are estimated for the three strata: Y_{12} in subpopulation S_{12} (coastal-licensed), $Y_3 + Y_4 = Y_1$ in subpopulation S_2 (non-coastal and no-resident licensed). However, the efforts of non-licensed anglers in the three residency strata are estimated using expansion factors estimated by the APAIS.

Residency	Licensed	Non-Licensed
Coastal	ALDS (Y_{12})	APAIS Expansion of Y_{12}
Non-Coastal	ALDS (Y_3)	APAIS Expansion of Y_3
Non-Resident	ALDS (Y_4)	APAIS Expansion of Y_4

The *dual frame method* is to combine the CHTS and ALDS estimates in different subpopulations for the total effort of the target population. The rule of thumb is to take the direct estimates of each subpopulation from single frame ALDS and CHTS to fill in the subpopulations without direct estimates as shown in the table below:

Residency	Licensed	Non-Licensed
Coastal	ALDS (Y_{12}), CHTS (X_{12})	CHTS (X_2)
Non-Coastal	ALDS (Y_3)	APAIS Expansion of Y_3
Non-Resident	ALDS (Y_4)	APAIS Expansion of Y_4

The basic equation for the dual-frame method remains unchanged as that proposed by Hartley (1962, 1974). That is,

$$\hat{Y} = \beta \hat{Y}_{12} + (1 - \beta) \hat{X}_{12} + \hat{Y}_3 + \hat{Y}_4 + \hat{X}_2 + Exp(\hat{Y}_3, \hat{Y}_4)$$

The commonly used method for solving β is to minimize the variance of \hat{Y} . In the other words, this is a minimum variance estimate of \hat{Y} . In this procedure, the subpopulation sizes are assumed to be known.

Figure 5.2 shows that the 95% confidence intervals for alternative point estimates include each of the different point estimates. Therefore, the mean number of trips per angler estimated by the ALDS and CHTS in S12 are not different. This is an indication that the two frames cover the same population.

Figure 5.3 compares the estimated total fishing effort by single frame and dual frame ALDS and CHTS for the North Carolina shore and private/rental boat modes. Again, the 95% confidence interval of the dual-frame estimate includes the two single-frame point estimates.

Discussion

The Dual-frame method is a flexible approach to integrate two surveys. The two surveys can have different sampling frames and units, different sampling designs, different estimation methods, and different purposes. It only requires that sampling units can be linkable so the two frames can be overlapped.

Both the ALDS and the CHTS need to reduce non-response rates and both need to solve the problems caused by cell-phone only and no-phone households or anglers in the future. The ALDS also needs to resolve the quality issues such as license exemptions and missing contact information from license sales.

In summary, the dual-frame method offers promise as an alternative to the traditional single frame method because the combination of two frames provides more complete coverage and increased efficiency of the combined surveys.

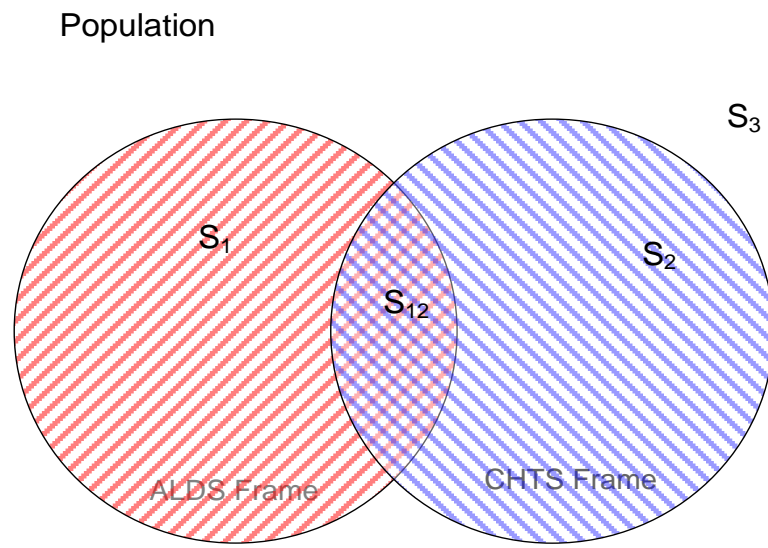
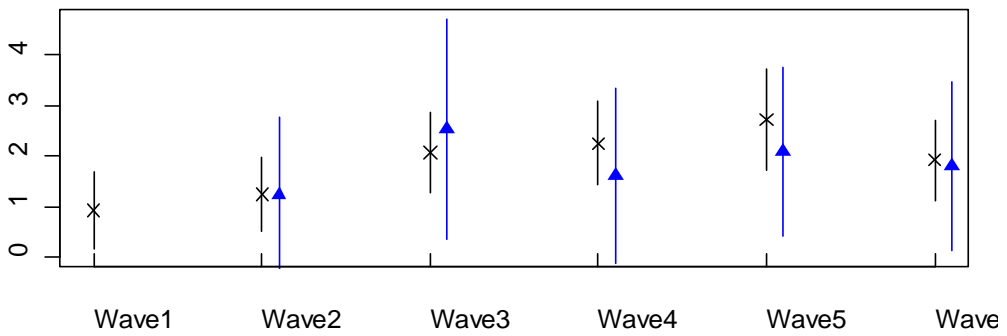


Figure 5.1. Overlay of ALDS and CHTS sampling frame. See texts for more details.

NC Shore Mode Trips/Angler



NC Private/Rental Boat Mode Tri

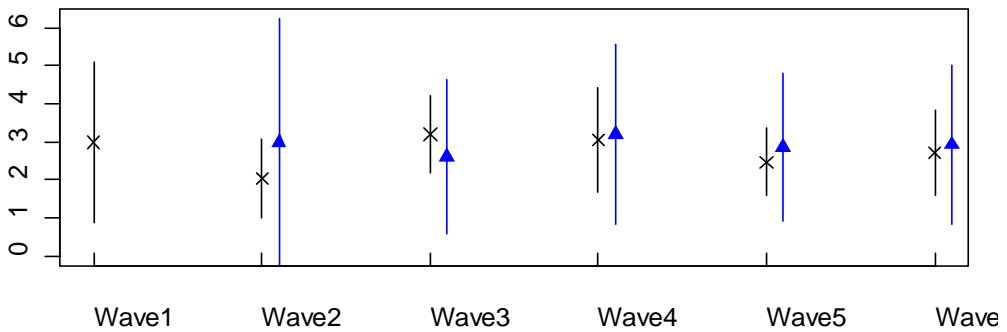


Figure 5.2. Comparisons of the estimated mean trips per angler between CHTS (black colour) and ALDS (blue colour) for the NC shore and private/rental boat modes in the subpopulation S_{12} .

Figure 5.3. Comparisons of the estimated total efforts by single frame and dual frame ALDS and CHTS for the NC shore and private/rental boat modes.

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5.2 Recreational fisheries in USA – Delaware River Survey (Jon Helge Vølstad)

A probability-based aerial survey for effort was combined with an intercept survey of anglers at access points to estimate effort, catch, and harvest of American shad, striped bass, and other species taken by recreational anglers in the Delaware River and upper estuary in 2002 (Vølstad et al. 2006). Sampling of anglers at access points and flights over the river were conducted weekly during the fishing season. Daily flight times were randomly selected; probabilities were proportional to the observed distribution of daily angler effort in a prior aerial-access survey (random count). Additional experimental flights were scheduled to occur at the time of day with expected peak effort (maximum count). Effort estimates derived from these maximum counts were more precise than estimates derived from the random flights, but the maximum-count observations caused bias except when the daily count expansions were based on effort distributions from the concurrent access survey. We maximized the precision and minimized bias in total effort estimates by combining the estimates of boat angler effort and shore angler access. An estimated sevenfold increase in the access survey sampling effort (at nearly five times the cost) would be required to achieve the same precision in the total effort estimate produced by the aerial-access survey. Effective stratification and the use of efficient model-based estimators helped us to achieve the target precision of 20% in relative standard error (RSE) for estimated recreational catch of the target species. A single access survey would have required a 10-fold increase in sampling effort to achieve the same precision in estimated catch of American shad at six times the cost of the complemented surveys.

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5.3 Recreational fisheries in Australia – Application of a telephone-diary methodology to estimate catch and effort in recreational fisheries (Jeremy Lyle)

The telephone-diary methodology was developed in response to the need to provide cost-effective, large scale fishery assessments that can address a broad range of policy issues including resource sharing and allocation, resource assessment and sustainability (Lyle *et al.* 2002). The survey design has been applied in general population and licensed fishing surveys, including the 2000-01 Australian national recreational fishing survey (Henry and Lyle 2003) and several state-wide surveys (e.g. Coleman 1998; Lyle 2000; Lyle *et al.* 2005).

Methodology overview

The methodology is based on a two phase survey design: a screening (telephone) survey followed by a panel (telephone-diary) survey during which fishing activity is monitored over a period of time. The primary objective of the screening survey is to gather profiling information from a representative sample of the target population (resident population or recreational licence holders) and to determine eligibility to participate in the follow-up panel survey. Profiling information typically includes socio-demographics (e.g. age, gender, ethnicity) and prior fishing activity (e.g. types of fishing, activity levels). The screening survey provides the foundation on which subsequent information can be expanded to produce population estimates.

Eligibility to participate in the diary survey is determined by the likelihood to go recreational fishing during the period to be enumerated (typically the following 12 months or fishing season). Respondents (households or licence-holders) who indicate no likelihood to go fishing are thus not eligible to participate in the second phase. In order to account for unexpected fishing by this non-intending fisher group, follow-up interviews may be necessary.

Eligible respondents are encouraged to use a simple diary or 'memory jogger' to record key data for each fishing trip. Data collection is undertaken by brief telephone interviews in which trained interviewers recorded details of any fishing that has occurred since the last contact. The level of fishing activity determines the frequency of such contact but, as a general rule, respondents are called at least once a month even if no fishing is planned. Interviewers are able to immediately clarify ambiguities and ensure completeness of information. This in turn, provides for increased data utility, for example fishing effort can be apportioned between target fisheries, methods, fishing platform, and so on. The underlying design philosophy is thus focussed on minimizing respondent burden whilst maximizing response and data quality.

Sampling frames

The primary difference between general population and licensed fishing surveys is the sampling frame. While there are significant cost and sampling efficiencies associated with a licence-frame, especially if the frame provides complete coverage, there are few such systems in Australia. Exceptions include the licensing of specific fishing activities, such as the taking of rock lobster, in some states. In the absence of a registry of fishers, general fishing surveys, such as the 2000-01 national survey and more recent surveys in several Australian states, have involved sampling from the general population to identify recreational fishers. This has been achieved by random sampling from telephone directories. Random digit dialling also represents an alternative approach to contacting households.

Sampling for general population surveys is based on single stage cluster sampling, with the household representing the primary sampling unit (PSU) and residents within the household the secondary sampling unit (SSU). By contrast, simple random sampling is appropriate for licence frames, the licence holder being the PSU.

Data quality issues

As in any survey seeking to provide unbiased population estimates, the selection of a representative sample is critical. Sample representation or coverage can be addressed in part by calibration against known demographic and/or household characteristics (e.g. population census data) but there are other potential errors associated with sampling and participation in the survey. Such non-sample errors relate to under-coverage, non-response and data reporting quality. While under-coverage remains problematic for all telephone based methodologies (non-phone owning or mobile-only households are not represented), issues of non-response and data quality are addressed within the survey.

Some level of non-response is inevitable in any survey and this can introduce biases since non-respondents tend to differ in their characteristics to respondents. There are several types of non-response that can influence surveys, the most common being refusal to participate and failure to contact the selected person or household (non-contacts). Consistently high response rates have been achieved across all applications of the telephone-diary method:

- screening survey response rates averaging 83% for general population and 89% for licence-based sampling;
- diary uptake rates averaging 90% for general population and 93% for licensed fishing surveys; and
- diary survey completion rates averaging 93% and 96% for general population and licensed fishing surveys, respectively.

By comparison with other off-site survey approaches, these response rates are exceptionally high, and represent an important performance measure for the methodology. Nevertheless, biases arising from non-response have been examined through follow-up surveys and the use of respondent profiling information. For instance, significantly lower fishing participation rates were established for the non-response group in the 2000-01 national survey while completion rates for the diary survey tended to be higher amongst the more avid fishers. If not adjusted, the combined impact of this non-response was to positively bias participation rates and catch and effort estimates. These experiences highlight the importance of minimising non-response in the first instance as well as the need for evaluate and adjust for its impact on parameter estimation.

There are other biases and errors that also have the potential to impact on data quality, particularly when information is self-reported. They include recall bias, exaggeration of catches (prestige bias), rounding of responses to numbers ending in zero or five (digit bias), behavioural shifts, and misidentification of fish species. The survey methodology employs a variety of validation and design elements to address these data quality issues.

Recall bias is a complex issue that is influenced not only by the length of the recall period but by the frequency of participation. The use of the diary in conjunction with frequent contact with respondents represents an important strategy to reduce recall bias effects. By maintaining regular contact, usually within a couple of weeks of any

fishing activity, details of any non-diarised fishing are obtained with minimal concern in relation to recall bias.

By design, reporting accuracy is further optimised by a range of measures that rely on the rapport that exists between the respondent and interviewer. Put simply, the respondent is brought into the survey process in terms of understanding objectives and, for example, that poor or zero catches are common and very important to the study. Limited comparisons have been made between diary and concurrent on-site surveys and have shown good alignment between catch rates and catch frequency distributions.

As diary information is self-reported it is important that respondents correctly identify their catch. To assist with catch identification, respondents are provided with show cards of the main species or species groups, recognising that identification to species may not be feasible in some instances. Identification skills of fishers, in terms of the level of detail required by the diary survey, are typically evaluated through concurrent on-site surveys. Furthermore, recognising problems with estimating fish size and weight, diarists are routinely only required to report catches as numbers. On-site surveys are employed to determine mean lengths and weights, the latter being applied to convert catch numbers into weights.

Summary

The telephone-diary methodology represents a cost-effective means for conducting large-scale, 'big-picture' recreational fishing surveys, having the advantage of collecting all substantive data using a single instrument and avoiding some of the problems with complemented surveys, such as data comparability links. Additional data utility is possible because of the connections between fisher behaviour and their socio-demographic characteristics as well as the inclusion of activities, such as shore-based and night-time fishing, which are often difficult to assess in on-site surveys.

The success of the methodology in achieving high response rates and data reporting quality is ultimately dependent on a comprehensive respondent management process involving highly-trained survey interviewers. In effect, interviewers serve to personalise the survey to match the behaviour of individual respondents, whilst ensuring consistency in data collection. This clearly places considerable responsibilities on the interviewer and thus the processes of interviewer recruitment and training, along with on-going interviewer management, represent critical elements to overall survey success.

Based on experiences in Australia, the telephone-diary methodology appears to have considerable potential in recreational fisheries research, in particular in countries with high telephone ownership rates. However, the increasing trend towards personal mobile telephone ownership is recognised as a challenge in ensuring representative sample coverage for this and any other telephone-based survey methodology.

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5.4 Recreational fisheries in New Zealand: New Zealand experience with recreational catch estimation (Ralph Townsend)

The participation rate in marine recreational fishing in New Zealand is estimated to be 20% to 40%. The estimates are very imprecise because recreational fishers and boats are not licensed and because no survey conducted to date has provided definitive results. Recreational fishers target a wide array of species using many different gear types. Any comprehensive data-gathering programme faces a major challenge to produce reliable estimates for this wide range of recreational activity. For many inshore fisheries, recreational fishing accounts for a significant share (e.g., 20% - 50%) of total fishing mortality. The lack of knowledge about recreational fishing is a significant issue in the management of several major inshore commercial fisheries.

New Zealand ran its first national phone-diary survey in 1996 and then repeated the survey in 2000-2001. The results of these two surveys were not consistent: The 2000-2001 results estimated recreational catches that were often three times the 1996 estimates. For example, in the most important recreational fishery, snapper, the 1996 survey estimated recreational harvest at 2773 tonnes while the 2000-2001 survey produced an estimate of 7885 tonnes. This discrepancy caused the two surveys to be carefully re-examined. The studies had been conducted under external contract to two different firms, and that the contracts inadequately specified some details such as documentation of protocols in survey administration. The lack of such detail made comparison of the two surveys difficult.

The diary component of the two surveys produced similar results with respect to fishing activity and catches per day. These data were also generally consistent with directly observed data from other sources. But the estimated participation rates differed by approximately a factor of three, which drove the differences in estimated harvests. The review of the two studies determined that the 1996 study had an unrealistically high cooperation rate (97.5%), which reflected a flaw in how the 1996 survey accounted for "soft refusals". An external review concluded that the 1996 data were flawed and that the 2000-2001 survey was probably more reliable.

However, scientists, managers, and people associated with recreational fisheries believed that the 1996 estimates were more plausible, while the 2000/2001 estimates

were implausibly large. A consensus assessment was that neither survey was reliable and extreme scepticism has been expressed from stock assessment scientists over whether any self-reported estimation can be trusted.

In retrospect, it seems likely that the 2000/2001 survey failed to adequately adjust for non-response bias. It is also likely that both the 1996 and 2000/2001 surveys suffered from recall bias. In the phone stage of the survey, respondents were asked about their level of activity in the previous 12 months. There is now general recognition that 12-month recall in any kind of survey is likely to produce serious overestimates of the reported activity because of “telescoping”.

The New Zealand experience indicates that any phone-diary survey must address non-response bias and recall bias. That experience also indicates that contracts with external providers, such as survey research firms, must specify survey protocols in detail and must include a requirement to provide extensive documentation on exactly how surveys are administered.

New Zealand has not run a national survey since 2000/2001. New Zealand is currently re-assessing the phone-diary methodology and is tentatively scheduled to run at least a regional phone-diary survey in 2010-2011.

Beginning in 2002, New Zealand worked with NIWA, its largest research provider, to develop a coordinated aerial overflight/boat ramp survey methodology. There seems to be growing agreement that this methodology can yield reliable results in some fisheries. In New Zealand, the set of appropriate fisheries for this methodology is probably trailer boat activity that uses pole-and-line. Fishing activity must also be dense to make aerial overflights cost-effective. Trailer boats use access points that can be directly surveyed for catch composition data and to obtain data on the daily pattern of fishing. Poles are quite visible from aerial overflights, so fishing activity can be separated from other recreational activity. Other fishing gear, such as scuba gear, nets, or traps are difficult to detect. Aerial overflights of shore-based activity are also problematic. New Zealand expects to use aerial overflight/ramp intercept research for significant sectors of several of its most important finfish fisheries, such as snapper and kahawai. But other data sources, probably including national surveys, will be required to cover sectors or fisheries that are poorly estimated by aerial overflight methodology.

5.5 Recreational fisheries in Norway: Tourist recreational fishery in Norway (Jon Helge Vølstad)

The Institute of Marine Research (IMR) in Norway is developing survey methods to provide estimates of total number and weight of commercially important species caught in Norwegian coastal waters by tourists. The research project is part of a 3-year research program supported by the Norwegian Research Council. The goal of the project is to increase our knowledge of the coastal fisheries resources to support sound management advice that help secure sustainable fisheries. IMR conducted a pilot study in 2008 in collaboration with 37 businesses that helped collect data on catches and effort by tourist fishers conducted from rented boats. Recreational fishing from shore by tourists is considered to be negligible compared to fishing from boats. In total we received data on daily fishing effort and catches by species from over 800 log-books provided by tourist fishers. The main project conducted in 2009 has been expanded with data collections from 100 representatively selected businesses out of 400 (selected by stratified random sampling) where tourist fishers will report on their daily fishing effort and catches every 6th week throughout the year. This survey will

provide estimates of catch and effort for the tourist fishery associated with registered businesses (fishers staying at fish camps and cottages rented through portals). The informal sector, comprised by tourist fishers staying in tents, vans, or in privately rented cottages, is not covered at this time. Areal frames may be used in a survey of this informal sector since no list frames (e.g., phone lists, or list of business that provide accommodation to tourist fishers) exist for this sector.

6 Recommendations for European recreational fisheries

Three break-out groups met during WKSMRF to develop recommendations for sampling schemes and international collaboration in the Baltic; the North Sea and North Atlantic (ICES areas IV –VII); and from Biscay to the Mediterranean. These correspond to ICES ecoregions or combinations of ecoregions shown in Fig. 2.1. The groups considered a series of specific questions provided in advance. A summary of the break-out group discussions and conclusions is given in the following Sections 6.1 – 6.3.

6.1 Recreational fisheries in the Baltic and Kattegat

A subgroup chaired by Jon Helge Vølstad discussed objectives, approaches to data collection and anticipated issues for the Baltic Sea recreational fisheries.

Purpose of the data collection. The subgroup agreed that the focus of the data collection should be on removals from the stock, and that data should primarily be collected for the use in fish stock assessments. It was noted that the EU Data Collection Framework requires the collection of removed biomass, while ICES requires numbers at age per quarter. Sampling of numbers at length might be sufficient as length-age relationships for the commercial fishery are well established, and there are no indications that those relationships would differ between the commercial and the recreational fishery for the same area.

While requirements for usual VPA type assessments are clear, the subgroup was uncertain how data should be structured for Bayesian type assessments (which are increasingly used e.g. for Salmon).

It was also discussed that a 5-yr time series of recreational fisher's removals would be required before data can regularly be included in fish stock assessments. It might also take that long before the importance of recreational fisher's catches can ultimately be determined, and thus an *a priori* decision on the importance of specific metiers should be avoided. A derogation for sampling those metiers with irrelevant catch will however be required.

Specific issues with the collection of data from recreational fisheries. The subgroup is of the opinion that there are **more customers** to data on recreational fishing than assessment scientists, maybe even different from country to country. Any sensible data collection should try to foresee the needs of these customers, and the collection should not be restricted to the use in assessments if additional data can easily be obtained at the same time. For example, fishery managers will probably ask very soon how a sensible management of recreational fisheries could look like, and effort and CPUE data by type of fishery are most likely required to advise on the usefulness of different measures, such as excluding land-based methods from restrictions as their contribution to the removal of cod is so low. If effort data is recorded (and this might be more important for the management than for the assessment), it should therefore be stratified by method to compare gear efficiencies. An effort management system,

including closed areas or seasons, might be more appropriate in this kind of fishery than a TAC approach. Commercial CPUEs are in most cases not comparable with recreational CPUEs, the latter spent for recreation, the first looking for optimisation/maximising catch rates. There might be exceptions, like the time spent on large charter vessels: charter vessel skippers are clearly optimising for maximum catch to attract more customers in the future, because high CPUEs are a selection criterion for tourists. The cultural and economic value of recreational fishing should be highlighted whenever presenting results of the data collection, as these aspects tend to be marginalised in the public discussion (focussing too much on resource removals). Human behaviour might be even more important here than in commercial fisheries, and economical data should be collected wherever possible – but this collection is not obligatory under the EU-DCF and thus not co-funded.

Possible sampling approaches. For the Baltic Sea, the EU Data Collection Framework obliges member states to collect recreational fisheries' data for the species cod, eel and salmon. Sea trout is considered a candidate species by the Baltic subgroup. The subgroup discussed extensively the different national approaches applied to a data collection in the past, and considered it necessary to harmonise protocols and documentations as much as possible, at least on a regional scale. To foster this, a table listing the national peculiarities of the recreational fisheries for cod and eel has been produced (Table 6.1), and more information for salmon is given in a list below.

While the usability of data will benefit from a harmonisation, some specifics (in terms of structure of the recreational fishery and possible approaches to sampling) will most likely not allow for a completely singular approach. Harmonisation should ensure however that even data collected with different approaches can be combined and used in the assessment. A proper documentation, also of possible errors/types of errors, and an agreed simple quality flag system could help to combine data from different sources.

For the different **levels of disaggregation**, the group agreed that the “metier” concept widely used in sampling commercial fisheries should apply. The 1st level of disaggregation should be “species”, the 2nd “management area”, the 3rd “Nation” and the 4th “fishery/method/gear type”.

The bias in collected data appears to be more critical than the precision highlighted in the DCF. Especially, the recall bias may be important to consider also when trying to reduce sampling costs (compromise between more frequent surveys with a shorter recall period vs. fewer surveys with a longer recall period).

Sampling for cod:

Six nations are involved in recreational fishing for cod (Norway, Sweden, Denmark, Germany, Poland and Lithuania), three different stocks are targeted in the Baltic (Eastern Baltic, Western Baltic, Kattegat), plus three stocks in Norwegian waters (North Sea, Norwegian coastal, Northeast Arctic). Only the management areas for Norwegian coastal and Northeast Arctic cod overlap. All nations have the same basic problem with incomplete or non-existing registries for anglers and vessels. If vessel lists are available, there is often no indication if these are used for fishing. For all nations angling is the most important method for recreational fishers targeting cod, all other methods are negligible. Considerable differences between nations exist in terms of:

- The importance of residents (high e.g. in Germany) vs. tourist fishers (high e.g. in Norway);

- The fraction of recreational fishers compared to total resident population (high in most Scandinavian countries, low in e.g. Germany);
- The importance of sea-based methods vs. land-based methods;
- The accessibility of individual anglers or angling sites;
- The seasonality of the recreational fishery.

The group agreed that sampling for recreational fisher's cod catch needs to be adapted to the specifics outlined above, so no general approach would be possible. However, as initial approach, a telephone and/or mail random sample survey on all residents is preferred, with a short recall period. This would only be impossible for Germany (as the fraction anglers/residents is just too low) and would not be required for Poland (as the fishing effort in terms of man-days spent fishing at sea is exactly known). Response rates appear to be a major issue in offsite surveys, a carefully designed questionnaire will certainly help, as will incentives for returning questionnaires. Intercept (roving or access point surveys) appear to be the best choice for catch and biological information. Aerial surveys appear to deliver a cost effective and fast estimate of the effort for sea-based angling methods (e.g. number of vessels), however, land-based anglers will probably be missed in those areas with a certain minimum flight altitude (usually 2000 ft in Western Europe). It is recommended to combine survey methods for a reasonable coverage, and to estimate the performance of the different methods (if there is an overlap of data collected by different methods).

The group acknowledged that survey effort has to be reasonable and balanced, especially as the marginal cost for sampling is not yet analysed, but at the same time inter-annual variation should not be missed by spending a huge effort only once in 3-5 yrs, as this variation is crucial for the stock assessment. Sampling of a statistically valid subset of recreational fishers in the years between years with complete survey coverage might help to detect this variation.

Regulations imposed on recreational fishers in the initial phase of the data collection might affect the choice of different survey approaches. For example, if bag limits were introduced, it appears likely that fishers optimise their catch towards larger fish, which would increase the discard rate. In that case, access point surveys would be of limited use if they fail to collect accurate discard data.

The group briefly discussed how better regulations could support the data collection, and agreed that a nationwide issuing of fishing permits (not necessarily combined with a fee or duty) along with an up-to-date address database held by authorities would certainly ease the estimation of the number of anglers and setting up an appropriate survey strategy. This option is, however, considered at present not enforceable in most countries. It appears more realistic that charter vessel owners were obliged to provide logbooks or were even treated in a similar manner to commercial fishing vessels.

Sampling for eel:

The situation appears less complex for eel in the Baltic than for cod. Only four nations permit eel catches in marine recreational fisheries (Finland, Latvia, Denmark, Germany). Those fisheries targeting eel are fully regulated in Latvia, Denmark and Germany, which means licenses are required and addresses of those fishers are available. For Finland, catches of eel are included in the nationwide recreational fishing survey, which provided an estimate of the eel catch for the first time in 2008. All other nations plan specific surveys within this year, most likely telephone surveys of a randomly

chosen subset of recreational fishers, which should not be problematic as the total numbers of fishers targeting eel is comparatively small.

Sampling for salmon:

To provide an overview of the countries where the fishery is important, each country provided a preliminary, unofficial guess on the magnitude of the marine Baltic salmon catches taken within their respective country (numbers): Denmark \approx 3000, Finland \approx 6000, Sweden \approx 12000, Latvia = minor, Poland \approx none, Germany =minor catch (ICES CM 2008/ACOM:05). The Swedish and Danish trolling catches cover a fishery where fishermen from several countries participate (see Table below). This mixed tourist/resident fishery generated a discussion on a common best sampling procedure.

FISHERY	FISHERY IN	NATIONALITIES INVOLVED IN THE FISHERY	SUGGESTED (ONGOING) SAMPLING
Trolling	Sweden	Sweden, Denmark, Germany	On site access point sampling
	Denmark	Denmark, Germany, Poland	On site access point sampling
	Finland	Finland	National survey
Gill net	Sweden	Sweden	?
	Finland	Finland	National survey
	Latvia	Latvia	National catch statistics
Trap net	Finland	Finland	National survey
	Sweden	Sweden	Estimated from commercial catches

Specifics of the recreational salmon fishery:

- a) *Trolling:* The trolling fishery taking place in Sweden occurs during the spring/summer but peaks in May. It takes place in the Hanö bay from a limited number of harbours, Simrishamn harbour being by far the most important. The Danish fishery takes place at the same time as the Swedish on the island of Bornholm and from a limited number of harbours, providing the same conditions for sampling as in the Swedish fishery.

Access point surveys are considered to be the most efficient method to sample this fishery. It is a fishery restricted in time, geographical coverage and number of access points providing good conditions for this type of sampling. On-site sampling will in addition have the benefit that tourist fishermen can be reached (language problems are likely to occur). The group agreed that the effort sampling unit should be boats, but that the number of fishermen on board each boat should also be estimated. Catch in numbers and mass should be estimated and the fish retained or released should be noted as well.

The **Finnish** fishery does not have the same geographical delimitation as seen in the Danish and Swedish fishery, and it takes place during the summer. It is a sea trout/salmon mixed fishery. Since the fishery is not restricted to a small number of harbours an access point approach is considered inappropriate. Instead it was suggested to rely on the ongoing national Finnish telephone and mail survey. This means that the sampling unit provided by Finland is a household and the total estimate is salmon catch in weight. Catch in numbers can be estimated using the age composition in the commercial catch. The salmon catch can be estimated per household per year.

- b) *Non-angling fishery (trapnets and gillnets)*: Finland expects to estimate the non-angling captures through their national survey. For the Swedish fishery the gillnet fishery was believed to be of minor importance. The trap net fishery in Sweden is at present estimated from the commercial catches, but raising the commercial fishery catches from the same geographical area and gear.

General considerations:

The group expects that the share of Baltic salmon taken in the recreational fishery will increase in the future due to increasing restrictions imposed on the commercial fishery.

Other species, especially sea trout and maybe pike, should be incorporated into the sampling procedure where this can be done without much additional sampling effort.

As river catches are likely to constitute a significant amount of the recreational catches it is recommended to include and monitor these in parallel to the marine catches. A common sampling procedure would be advantageous.

Table 6.1 National characteristics of recreational fisheries for cod and eels in the Baltic.

Parameter(s)	Finland	Estonia	Latvia	Lithuania	Sweden	Poland	Denmark	Germany	Norway
COD									
Metiers, structure of the recreational marine fishery for cod									
A. angling	yes, but very little catch at present (<0.5 t/a), regularly monitored	no info	yes		most important in the Sound area (SD23)	boat angling only	most important, also North Sea	most important (85% of removals)	yes, residents AND tourists
1. small vessels		no info		yes, departing from harbour or shore, catch comparable to charter vessels	yes	yes, number of participants counted daily	yes	yes, dispersed, highest share of removals	private for residents and tourists, small charter mostly for tourists
2. bigger vessels (charter)		no info		yes, one-day-trips, defined starting point (only one seagoing harbour!)	yes	yes, number of participants counted daily	yes	yes, from harbours, 2nd highest share of removals	very few larger charter vessels
3. land-based methods		no info			few	none (assumed)	few	yes, dispersed, highest share of effort, but 15% of removals	yes, residents and tourists
B. non-angling	incl.	no info	yes, fishers have to fill in logbooks, catch is counted against commercial Quota	none	mostly gillnets, very close to the shore, mostly in the south	none	yes, all areas		
Available lists as basis for surveys									
A. Anglers	no info	no info	no	no	no	no (but # of fishers leaving port registered daily by maritime office)	no (but # of annual permits available)	no (but # of annual permits available - incl. inland; # of sea fishing permits in one federal state)	no
B. Private vessels	no info	no info	yes (but except angling)	no	no	yes	no	yes, but incomplete and no indication for fishing activity	incomplete (voluntary)
C. Bigger/charter vessels	no info	no info	yes (but except angling)	yes	no	yes	yes, but no indication for fishing activity (registered as passenger vessels)	yes, but no indication for fishing activity (registered as passenger vessels)	no
Present and future sampling of recreational fisheries									
A. sampling of anglers	Fishing (all gears) followed-up by a nationwide recreational fishery survey (mail+tel), target population all households, basically complete coverage	no info	no survey so far, but vessel activity completely reported	at present survey on selected vessel owners,	surveys (mail, telephone) random sample on residents (logbooks possible for length frequencies, so far voluntarily), flyover surveys possible	no phone or mail surveys conducted to approach individual anglers,	193 k Angler paying annual licenses (about 1/3 of the estimated numbers of active anglers, based on random telephone survey, but asking "are you a sports fisherman?"), addresses available for 170 k anglers, 60 k registered at the east coast (incl. inland fisheries). Telephone survey to estimate total active population fishing for cod is possible, dual survey with more detailed interviews of licence holders	no common approach to get hold of numbers of fishers fishing for cod – easiest in state of MV along with fishing permit, but everything is anonymous. License with recorded address would help, or incentives to provide addresses voluntarily. Mail survey with likely biased results. Telephone survey on randomly selected residents too expensive (number of anglers compared to number of residents is very small)/	separate approach for tourist and resident fisheries: tourists to access thru businesses renting cottages or vessels or equipment to them. Might miss those who rented from private owners. Seems to be an important fraction of total removals, if not dominating. Residents use own cottages/vessels – phone surveys in waves might work here (but miss tourists), provided the recall period is short enough. Aerial surveys might provide a solution.
B. sampling of small vessels	see A	no info		ideas to implement daily licensing scheme for individual anglers fishing on cod/no sampling at present, but onsite roving surveys possible/no sampling at present, but on-site access point surveys possible (only one sea harbour)	no specific program, onsite surveys possible for length and weight (access point surveys in the sound SD 23)/	onboard observers on fishing vessels, small or large, incl. biol. data collection, can easily be raised because number of fishing trips and number of participants per trip is exactly known from maritime office. Seems only a problem if land-based methods are more important than assumed.	small private vessels spread widely, roving onsite survey possible	roving survey for land-based methods and small vessels	roving surveys on small vessels might be possible for selected stocks, like North Sea, certainly not feasible in Northern Norway. Dual frame approach with boat list and aerial surveys (AUS approach with subset filling in detailed catch logs)
C. sampling of bigger charter vessels	see A	no info			onsite access point survey possible for charter vessels. Possible problem: Access to tourists.		charter boats: discussion on special registry for fishing charter vessels incl. AIS or even VMS. Access point surveys in harbours are possible, but large number of harbours.	access point surveys for charter vessels (now with onboard observers) – looks like GER put much effort in catch and CPUE sampling but comparatively little in effort sampling	some of the few charter vessels are included in tourist surveys, captains filling in logbooks. Land-based methods are a problem, intercept not possible (but very little cod catch from these methods).
EEL									
	no register, fishery is open (static): will be surveyed with nationwide recreational fishery survey	no info	all from vessels, fishery is fully regulated	no eel catch, and prohibited in recreational fishery	all fisheries for eel prohibited	only inland eel fishing	catches in recreational fisheries, small boats, non-angling methods, fully registered fishers	catches in recreational fisheries, small boats, non-angling methods, fully registered fishers: will apply telephone survey in near future	all fisheries for eel prohibited

6.2 Recreational fisheries in the North Sea and in the North Atlantic ICES Areas IV-VII.

Minimum statistics, resolution (temporal and spatial), species and sampling units

Objective - Identify the minimum statistics needed by all partners in each region, in terms of the baseline needs for a general regional marine recreational fishery survey program. How often are updates needed? Are statistics needed minimally at an annual, quarterly, or monthly level of temporal resolution? Are statistics needed at the angler level, boat level, or at both levels?

The DCF specifies bass, cod, salmon, eels in the area considered here so these are minimum requirements. However, the EC may wish to include other species in future, therefore where possible programmes should include (or be flexible enough to include) other stocks considered 'important' or under heavy exploitation pressure. *For stocks/fisheries considered as not significant for assessment purposes catch and effort might not be required but more general information might be wanted.*

The DCF requires catch data and the end point usage of the data is stock assessment, so size/age distribution data are also required if the selectivity of recreational fisheries differs from commercial fleets used in the assessments (although this is not a current requirement of the DCF). It was pointed out that CPUE varies more widely between recreational fishers than between commercial fishers, so aggregate CPUE may not be reliable as an abundance index.

A quarterly temporal scale is specified by the DCF, but annual numbers (by size/age) and total weight are likely to be required as assessment inputs, and the DCF specifies precision for catch weights on an annual scale.

The DCF specifies species to be sampled by major sea areas (e.g. North Sea and Western Waters), however, if the data are to be used in stock assessments then they need to be at the scale of stock units which may be smaller and it may be useful to have them at the scale of significant fisheries or ICES divisions.

The basic sampling unit is the fishing trip, this could relate to anglers (e.g. shore fishing), but boats (a cluster of similar anglers) could also be the sampled unit (charter or private vessels), especially if/when lists are available for this sub-population and a different (more efficient) sampling methodology might be possible. Socio-economics might require data at the fisherman level.

Given these minimum requirements it was also noted that some national governments may have wider data requirements and that the sampling programmes put in place should where possible be sufficiently flexible to accommodate the collection of additional data or complement other data collection programmes.

Domains

Objective - Determine the common domains of interest for marine recreational fishing among partners in each region.

It was considered important that the sampling method be able to capture the different entities of marine recreational fishing (MRF). These include the different fishing platforms for angling and non-angling methods (Tables 6.2 and 6.3). However, by analogy with the DCF usage for sampling commercial fleets where the focus is on important fleets only, it was considered that minor métiers may not need to be sampled for length composition.

Table 6.2. North Sea cod recreational metiers by country

Country	Angling		Non-angling		
	Shore	Boat	Gill net	Trap	Longline
NO	x	x	x	x	x
EN	x	x	?		?
IR	-	-	-	-	-
NL	x	x	?		?
BE	x	x	x		
FR	x	x	x		
DK	-	X	-	-	-

Table 6.3. Western Waters bass recreational metiers by country

Bass WW Country	Angling		Non-angling		
	Shore	Boat	Gill net	Spear	Longline
NO	-	-	-	-	-
EN	x	x	x	x?	x?
IR	x	x	?	?	x?
NL	-	-	-	-	-
BE		x			
FR	x	x	x	x	x

x: active metier

?: uncertain

x?: possibly minor metier

Tourist fisheries were discussed at some length. Some countries may largely receive tourist fishers while others largely donate them. Within-country tourist fishing also takes place. The definition for tourist anglers used in the Norwegian study was people renting accommodation and hiring a boat for fishing. This does capture 'in country' tourist angling, but does not capture shore angling (not widely practiced in Norway) or tourist angling where boats are trailed (or live aboard boats cruised) to the fishing location or where accommodation is not paid for.

It is possible to sample the population of tourist anglers in their 'home' country with respect to historic catch and effort, but it was pointed out that if these make up a very small proportion of the population then large sample sizes would be required or else variances would be very high. However, in the US a matrix of tourist anglers by 'home' and 'host' state is produced from the national survey. Catch details (length/size composition) of tourist catches would (need to) be captured in the host country, by on-site sampling. It was pointed out that in Norway some charter vessels, only recorded the total weight of the catch.

Sampling frames

Objective - Identify particular kinds of sampling frames that could be used in combination by all partners to assure complete coverage of all sub sectors of marine recreational fishing.

A frame that covers the whole (or majority of the) population, e.g. postal or telephone directory, would be needed to sample from to estimate participation levels, possible use of dual frames to obtain complete coverage with 2 incomplete lists.

List frames were considered advantageous and the suggestion that governments could consider producing a national register of fishermen (and private fisherman boats) was suggested (this is being implemented in the US), although it was noted that this can take time and might be politically difficult and resisted by both anglers and/or governments. It was pointed out that the costs of obtaining data without a register (or licence) to provide a list frame is probably several € per fisherman and in the absence of efficient sampling frames (offered by lists) there is a risk of implementing programmes that consistently obtain poor quality data at moderate cost, rather than opting for a very expensive programme that may provide data of better quality.

Table 6.4 provides details of the availability of list frames for different types of angling vessels.

Table 6.4. Availability of list frames for Angling boat types

Country	Small			Large (20 + people)		
	Private	Charter		Private	Charter	Canoe
		No captain	Captain			
NO	L/n	L/n	n	L/n	L/n	-
EN	n	?	L	-	-	n
IR	n	?	L	n	L	n
NL	n	?	L	-	L	-
BE	n	n	n	-	L	-
FR	n	-	L	n	-	n
DK	L/n	-	-	-	L	-

L: list (potentially) available

n: no list available for population

L/n: partial lists possible

?: uncertain

-: not thought to exist

There was some discussion on the influence of including poorly sampled data for minor sub-populations and what affect this might have on combined variances. Bayesian approaches may help to ameliorate this problem if prior information is available. It was suggested that expert advice might be needed for aspects such as this (small area estimation).

Specialised (more efficient) frames

Objective - Identify types of more specialized frames that could be used by all or most partners to more efficiently survey particular sub-sectors of the fishery, such as shore fishing, private/rental boat fishing, charter boat fishing, and/or a specific tourist fishery.

Specialist list frames might include angling federations and clubs or entry lists for tournaments, registers of boats and tourists. It is important to note that these are sub-populations that may behave in a different manner to other fishers. Lists of federations and clubs would be a useful starting point. Registers of boats may be possible for some countries but not for others. Lists are thought to be available in most (or all) countries for charter vessels (Table 6.4) and these could provide a more efficient frame for sampling this sub-population of the population.

France carried out national telephone surveys initially and then plan to develop 'panel frames' for different sub-populations.

Surveys need to be carried out in waves (1-2 months duration) to reduce recall bias and these could also pick up season trends in activity and catch. It is useful to ask questions about catch and effort in the last month or last trip and also at a longer time scale (e.g. over the last year). The collection of data on two time scales may help to identify and characterise recall bias.

Catch, landings, discards and discard mortality

Objective - Identify the catch statistics required, differentiating the needs and priorities for survey estimates of total catch, total landings, total discards, and/or total discard mortality.

On-site sampling and self reporting schemes were considered as two main options in this section.

Landings (harvest) quantification was considered to be the main priority for sampling, but some additional information should be obtained on discard rates and potential discard mortality rates. If/where discarding is thought to be significant then more effort and possibly pilot studies would be needed to quantify it and to investigate discard mortality.

Discard information would be needed for inclusion in fishery removals for stock assessment if discard mortality is significant, and total discards (live and dead) would be needed for CPUE indices if required. However, obtaining information on size frequencies might be problematic. Total (or average) weight might be an option, or reason for discarding might be broadly indicative of size.

For charter vessels it may be possible to give the skipper (or business owner) responsibility for reporting and to support (validate) this with some on-site sampling on the vessels. Self sampling schemes could also be extended to cover private boats and shore angling. In France, intercept sampling of shore and boat anglers was used and was able to provide some information on discard rates as well as landings. However, without intrusive onsite sampling it is difficult to validate discard estimates or to obtain size structures information on discards. The use of a reference fleet may be an option, but whether it is representative of more general discarding practice is an issue. Comparison of discarding practices within similar groupings might be used to check for consistency of discard data. High-grading may occur where bag-limits are introduced.

Competition results may provide a source of data on species composition and size distribution, but need to be treated as a sub-population since the targeting of fish is different from more general fishing.

For length sampling the use of waterproof paper measuring boards that can be marked (by puncture or pencil) and returned to provide length frequency information for all fish of a given species and trip was suggested. Good training is essential for self-sampling of length frequency if bias is to be avoided. The US experience was that it was better to sample numbers independently from length frequency.

Recommendations for common survey contact methods

Objective - Draft recommendations for possible common survey contact methods (mail, telephone, on-site, etc.) for common surveys of fishing effort, catch, and/or catch per unit effort that would utilize similar sampling frames.

Telephone or postal surveys were considered as the main methods for carrying out initial surveys to establish the extent of the total population where no licence or

registration exists. Landlines may be regionally structured, but may not achieve total coverage. Mobile phones numbers are not regionally structured and also may not achieve total coverage. In the US cold calling mobile phones is prohibited.

Postal surveys should achieve complete coverage but are slower and response rate may be low. It was suggested that a postal survey might be useful initially to compile lists of anglers and non-responses could be followed up by telephone interviews. However, in France an initial telephone survey was thought to be the most efficient way to survey.

There was uncertainty as to whether or not 'No Call' registers applied to (non-sales) surveys. Telephone surveys were thought to be slightly more expensive, but achieved better response rates. Government statistics offices should have information on these issues and also expertise in survey approaches. It would be useful to collaborate to draw on this or other professional advice for survey design.

The baseline (national) survey should quantify the population and provide information on activity levels by strata. Information obtained might include: how many people, by different groups (modes [platform, species, angling/non-angling], regions, resident and tourist), how often they fished and level of catch (short and long-term). The coastal zone was considered as 30km in the French study, but this might vary with country, region and transport infrastructure. Other stratification considerations relate to weekend / weekday / holiday and day/night differences in activity. Asking directly about zero catch trips could also provide useful information. Stratification by habitat type was considered to introduce additional complication and fishers may change habitat during a fishing trip. In the US large scale differences are not considered in the national survey, but on-site sampling takes natural or man-made structures into account (as domains).

Opportunistic sampling of vessels from different strata had caused problems in analysis in the US. It may be better to combine strata and consider sub-groups as domains that can be broken out post hoc. This would also apply to fishers operating in different ways (e.g. shore and boat), where the sampling unit is the trip, not the angler.

Asking for short-term information on effort (and catch) provides information on seasonality, but surveys would need to be carried out in waves to obtain this throughout the year in a consistent way. Under-sampling might be an issue here if activity levels were relatively low. Asking about seasonal patterns of activity could provide useful information.

France would suggest a methodology based on a dual monitoring system:

- A random-digit-dialing telephone survey with an over-sampling of coastal zones (planned for 2009) can be used to build a reference frame for recreational fishing regarding the DCF species for each fishing zone (in addition to the previous national telephone surveys carried out between 2006 and 2008).
- A panel survey (planned for 2009/2010) of recreational fishers regarding the DCF species for each fishing zone (on-site survey and logbook).

It was pointed out that defining too many strata upfront could result in very complex sampling programmes and multistage sampling is very complicated to analyse as well as introducing the potential for under-sampling strata and resultant high variance. Minimising strata and subsequently breaking out information by domains,

where sufficient sampling was available was another approach. Carrying out a pilot study in one region was suggested.

Pragmatic and 'deluxe' options

Objective - Identify the "deluxe" version to keep in mind as a future possibility (if unlimited resources were available), but identify the versions that are more practical given current available resources.

It was suggested that an EU project would be a useful vehicle to develop collaborative approaches between countries that would improve consistency and could usefully be used to develop automated (electronic) data capture methods where these are appropriate. It was also considered that an annual ICES planning or working group might provide a forum for collaboration and data assembly at a regional scale. Again this would help to improve consistency and aid in the provision of expertise and knowledge dissemination. A harmonised approach might also be helpful in presenting the programme to anglers in different countries.

A complete register of all recreational fishing would be considered very advantageous and result in more efficient and cost effective sampling programmes. However, very complex systems with many categories may become difficult to sample effectively. A register would not capture tourist anglers, whereas a licence system would. Licensing would also potentially permit a requirement for reporting.

The register could include the basic information required for stratification (e.g. gender, age, residence, annual effort, tourist fishing activity etc.).

GPS or VMS systems for monitoring activity by charter vessels were considered advantageous and could provide additional safety for users. Aerial surveys might also provide useful additional information regarding angler activity, but have difficulties in identifying and assigning individuals to metier and could be expensive for countries with long coastlines.

Non-angling activity is difficult to monitor, but requiring contact details on buoys might provide a means to monitor this type of activity.

Cost of programmes depends on publicity and incentives. Paper logbooks cheap, but have high data input costs. Electronic data capture (for example a web site) may reduce data input costs and restrict entries to standard information and formats, but software may not be widely available and they may also select against certain sections (e.g. older people). Reports based on this type of information may be interesting and useful in engaging fishers. Individual reports to contributing anglers may be useful as well as general summaries. Some such systems operate through SMS including reminders and data submission.

6.3 Recreational fisheries from Biscay to the Mediterranean

The subgroup for the zone Bay of Biscay – Mediterranean Sea, was composed of Spain, Italy and France.

Regarding the lack of basic information in Italy and Spain, it has been suggested that **a first step could be to develop a national reference frame on recreational fishing in order to have a first picture of this activity in these countries.** Such a reference frame has been recently carried out in France with a first national pilot study.

This first frame should be built from a randomly digit dialing (RDD) or maybe from a mailing system in Spain (where there is a regional license system). The minimum in-

formation required to provide a first picture of recreational fishing in these countries is: place of residence (inland/coastal), frequency of activity (regular/occasional, seasonal/throughout the year), mode of fishing (spearfishing, shore angling, boat angling, others), target species (fish, crustaceous, shellfish, cephalopods), place of fishing (country of origin/other country). This dataset should permit the basic indicators to be estimated, specifically: numbers and socio-demographic profile of recreational fishers, total effort, total harvest, economic impact of this activity (in terms of expenditure), main target species. Furthermore, the dataset could be used to provide a baseline to calibrate more specific sampling, to identify potential bias regarding the entire population of recreational fishers and to possibly estimate bias corrections.

In a second step, it could be possible to carry out more accurate surveys focused on target species and based on the “metier” concept. The sampling frame should then be based on: “group of species”, “gears”, “season” and “coastal area of fishing”. To launch these new surveys, it is required to over-sample some specific strata through a filtering RDD (for example: only seabass fishing). In addition, it is suggested to build a representative panel of this stratum for collecting more robust information on sensitive parameters that are difficult to calibrate such as the weight or the number of catches.

The subgroup underlined three core points to keep in mind: quality of survey is largely dependent on the funding invested into these new programmes; publicity/communication based on incomplete or biased dataset can be a source of inefficiency in a complex political context regarding the recreational fishing issue; it can be difficult to compare commercial and recreational fishing parameters if they are not built from comparable methodology.

6.4 Summary / commonalities

The three break-out groups developed a number of similar recommendations regarding the possible collaborative development of harmonized regional approaches for surveying marine recreational fishery catch and effort. There was general agreement that the primary goal should be to develop methods that could accurately estimate annual recreational catches of important fish stocks with a specific emphasis on determining both total catches and total removals. Secondary goals would include accurate assessments of the size/age structure of removals for each species, as well as accurate characterization of both the fishery and its participants. Fishery managers would most likely want to know how fishing effort is distributed among different modes of fishing, fishing seasons, fishing areas, and target species. It would also be important to have accurate demographic information on recreational fishery participants so managers can understand how fishing trips made in each country are distributed between resident and non-resident populations. In addition, it may be important to develop an approach that would support accurate assessments of both the economic impacts and economic values of recreational fishing.

Survey approaches could be developed to estimate total catches of a wide variety of recreational fishing targets, but the most important ones are currently the species listed in the EU data Collection Framework for each region (see Section 3).

There was general agreement among the break-out groups on how different domains of study should be defined for fishing effort and catch estimates. All agree that it would be best to distinguish between shore, private/rental boat, and for-hire boat fishing modes for angling. It would also be desirable to obtain separate statistics for angling and non-angling recreational fishing activities. It is recognized that it will be

important to cover both resident and non-resident (or “tourist”) fishing participants within each country, and it would be desirable to partition estimates of effort and catch between those demographic categories. The groups agree that common survey approaches should also be designed to allow any further breakouts of effort and catch that may be desired within a given region or country.

The three groups considered possible sampling frames and contact methods that could possibly be used for a unified regional approach. All three agreed that a complemented survey design would be most appropriate. The preferred design appears to one that would combine an off-site survey of fishing effort with an on-site survey of mean catch per unit of fishing effort. The off-site contact method should be used in association with a comprehensive household sampling frame to survey fishing participation and effort. Either a mail or RDD telephone survey approach could be used, but a telephone contact method seems to be preferred because it would be less prone to non-response and recall biases and would provide more timely results. It is generally recognized that a mail survey frame of household postal addresses would be more complete than a telephone RDD frame of households. If a telephone approach were developed, it may prove to be worthwhile to conduct a side-by-side pilot study that would compare the telephone and mail approaches, assess differences in their coverage, and measure any telephone RDD frame under-coverage bias. Although recreational fishing households may be a small proportion of the total household population, sampling for a general RDD telephone survey could be stratified geographically and sampling could be optimally allocated among strata to maximize efficiency and statistical precision. A temporal stratification of the telephone survey into quarterly, bimonthly, or monthly sampling waves would shorten recall periods and potentially reduce possible reporting errors.

All groups agreed that it would be desirable to build complete mail and telephone list frames of recreational fishing participants through registration, permitting, or licensing programs. Given that it would not be possible to develop complete list frames in the near future, the groups recognized that it would be advantageous to utilize existing incomplete list frames wherever possible to increase telephone survey sampling efficiency. A dual-frame or multiple-frame approach could be used that would include the use of special lists of permit-holders, license-holders, or other kinds of fishing registrants. It may also be necessary to include other kinds of indirect list frames that would provide access to the non-resident fishing population that is not included in the RDD or mail household frame. In general, it is recognized that coverage would be improved, and possible under-coverage biases reduced, if a multiple-frame approach is utilized.

The break-out group for the Bay of Biscay to Mediterranean area noted that a unified RDD telephone survey approach could also be used to recruit participants for follow-up panel surveys that would focus on more detailed characterization of specific segments of the recreational fishing population. A general telephone survey approach could also be used to recruit panel membership for follow-up catch diaries.

On-site survey methods are generally preferred for surveys of marine recreational catches. The access point design is the best approach for estimating mean catch per unit of fishing effort, but a roving method may be needed if access to fishing is very diffuse or a high proportion of the fishing occurs out of private access sites. On-site surveys could be designed to cover recreational fishing for a wide variety of fishing targets, or they could be designed specifically to intercept trips targeting certain key management species if funds are limited. To utilize either on-site approach, it will be

necessary to develop and maintain complete spatiotemporal frames for sampling, and it will be desirable to characterize the fishing activity levels for all access sites or subareas to allow more efficient PPS sampling. The ultimate sampling units for on-site sampling should be individual angler fishing trips for the shore mode and individual boat fishing trips for the private/rental boat and for-hire boat modes. If angler-specific information is needed to meet secondary goals of the survey, it may also be desirable to collect data from a random subset of the anglers who fished on each sampled boat fishing trip.

Due to the relatively high costs of on-site surveys, it may be necessary to use off-site methods for estimating mean catch rates when funds are limited. In addition, it may not be possible to reach all fishing trips through an on-site approach. Night-time fishing or fishing out of private access sites may be missed, and it may be necessary to utilize off-site surveys to estimate catch rates for those types of trips. The telephone diary approach used in Australia may prove to be the best off-site approach for this purpose because it emphasizes the need for reducing the possibility of significant non-response and recall biases.

At least two of the three groups recognized that surveys of fishing on for-hire boats could use a complemented logbook-access survey design. If for-hire boats are registered and required to report their fishing effort and catches in standardized logbooks, then access point surveys could provide the representative sampling needed to validate the self-reported effort and catch data in the logbooks. For such an approach to work, it would be important to make reporting mandatory and provide adequate enforcement to assure full compliance and timely reporting. Released catch data reported in logbooks would best be validated by at-sea observations of angler catches and discards, hence a separate observer survey may also be needed.

All three break-out groups recognized the potential advantage of developing a unified approach. It is important to develop an overall survey plan that will ensure that the effort and catch statistics obtained for different countries are directly comparable. The use of different survey methods in neighbouring countries can potentially be problematic, because different methods are likely to be subject to different biases that may be difficult to measure. If the same methods are used across countries, then the resulting statistics are likely to be more directly comparable. The common method may still be subject to certain biases, but those biases would likely be similar across countries. It was also noted by one group that it is necessary to collect data in a way that ensures comparability with commercial fishing statistics. This follows from a point emphasized during WKSMRF, that the data collection schemes need to be developed with due regard to the form of data and associated statistics required by end users, for example ICES stock assessment Working Groups.

There is general agreement that significant investments of financial and labour resources will be needed to ensure that the surveys implemented for monitoring recreational catch and effort are able to meet the precision and spatiotemporal resolution needs for stock assessments and effective fisheries management. Off-site survey methods are generally much cheaper to run than on-site surveys, but they are much more prone to response and measurements errors when they are used to collect catch data and estimate catches by species. Investments in on-site surveys may be needed if precise monitoring of removals relative to management targets is desired for certain species or if precise measures of recreational takes are needed to make meaningful comparisons with commercial takes.

7 Descriptions of National Recreational Fisheries and pilot studies

The following sections includes descriptions of national recreational fisheries provided by national experts at WKSMRF and colleagues, focusing on information of importance for establishing appropriate survey schemes, including the identification of populations, domains and sampling frames as described in Section 3. The reports used a “pro forma” circulated in advance of the meeting, in order to have a consistent approach between countries and to encourage the workshop participants to think in terms of the elements required for designing sampling schemes.

A number of the tables include a ranking system to rank from most important (e.g. largest participation of fishermen = 1) to least important (smallest participation). Two or more rows may have equal ranking. Ranking could be based on existing surveys, or anecdotal information. Hence it is for guidance only and not necessarily definitive.

The general summaries of target species etc. given in Tables 1 & 2 in each submission are of necessity over-simplified in most cases but are again included for general guidance.

7.1 Belgium

Belgium Preliminary Description of national marine recreational fisheries

7.1.1 General overview of national recreational fisheries

In Belgium the recreational fishery is split up in inland and marine recreational fisheries, where inland recreational fisheries are under the control of the section “*Bos en Groen*” (“Forest and Green”) of the department of *Leefmilieu* (Environment). Any research/implementation of regulation/control on freshwater fisheries is thus done by the section “*Bos en Groen*”.

Because of time constraints and specifications by the European Commission on recreational fisheries (Belgium needs to sample recreational fisheries for cod), this document will only consider marine recreational fisheries.

The marine recreational fishery in Belgium is regulated by European Regulations and National legislation. The regulation depends on the type of fishery. Municipal authorities can have specific regulations for certain metiers, these are applicable to the shore of the municipality and is controlled upon by the local police. These regulations are not dealt with in this general overview.

In Belgium, marine recreational fishing mainly comprises the following types of activities:

- Recreational fishing for brown shrimp (*Crangon crangon*) with small towed fishing gear in the Belgian territorial waters.
- Sea-angling from vessels (privately owned or chartered).
- Beach-fishing with static gears.
- Wade-fishing for brown shrimp with small towed nets in the surf zone.

Cod (*Gadus morhua*) is the only species in Annex XI of the Data Collection Regulation (Commission Regulation No. 1581-2004) requiring investigation in the Belgian context.

A Pilot study on the recreational fisheries in the waters under Belgian jurisdiction was carried out in 2006. A few questionnaires on recreational fisheries in general

(both inland and offshore fisheries) have been carried out in the past but they have not yet been standardized and were mainly conducted by Angler organisations.

7.1.2 Detailed description of national recreational fisheries

7.1.2.1 Categories of recreational fishing

Angling at sea (Non-automated)

- a) On the beach or from permanent structures on the shore:

According to §11, section 2, Chapter II "Politie- en scheepvaartreglement voor de Belgische territoriale zee, de havens en de stranden van de Belgische kust" (Regulation of the Police and navigation for the Belgian territorial Sea, harbours and beaches on the Belgian Coast), Royal Warrant of August 4th 1981, Sea angling at sea and from permanent structures on the shore is allowed as long as it doesn't impede (commercial) navigation.

- b) On a vessel:

The vessels cannot carry any other type of fishing gear than that applicable to the non-automated sea angling (Article 5 of the Royal Warrant of August 14th 1989). These fishing activities are prohibited between 22:00-05:00. Chartered vessels need to have a "zeebrief" (certificate of registry). This is a permit issued by the Flemish/Belgian authorities only when certain measures (c.f. need to have the capacity for at least 12 passengers and crew) are met on a yearly basis. In Ostend (the section that issues certificates of registry for the Belgian coastal harbours is located in this town, vessels from harbours like Antwerp, would need to apply for one in Antwerp, etc) only 4 ships have this permit: Marcella II (<http://www.marcella.be/>), Bounty I, Bounty II (www.bounty-sportfishing.be) and Albatros (www.albatros-seafishing.com). However, the regulation among these certificates is slightly vague so that quite a lot of vessels apply for another permit although they should apply for a certificate of registry according to the activities carried out on the chartered vessel, and are thus able to evade stricter regulations.

Wade fishing (mainly for shrimps)

No technical limitations, only MLS and the obligation to stay within 3 miles of the coast.

Passive on the beach

Minimum mesh size, mesh size measurement (use of a calliper), MLS. In some municipalities, nets need to be tagged so that they can be identified

- a) Flat" nets that get dug in.
- b) Ankerkuilen, Karten netten, fykes
- c) Trammel nets

Recreational vessels equipped with trawling

Only within 3 miles off the coast for those that have no certificate of registry, for the owners or users of these vessels, it is not allowed to fish on and to carry on the vessel, species for which, according to EU regulation, TAC or quota are applicable. The net types allowed are specified only for shrimps. Use of sieve net

from Dec to May. By catch needs to be thrown overboard immediately. It is forbidden to use twin trawl and/or flapper.

a) Vessels smaller than 8m

Bottom trawlers, but only on 1 side and with restrictions in size of the nets.

b) Vessels larger than 8m

Bordennet, but only on 1 side.

Sport-diving

Do occasionally fish with spear, mainly on flatfish. Most likely to be divers with their own boat, are not restricted by anything.

On-shore shellfish picking

Second to none according to conversations I had with some recreational sea fishermen.

7.1.2.2 Geographic delineations

Will it be necessary to produce statistics for separate geographic regions? If this takes different ICES areas into account, then yes, otherwise, the Belgian coast is only small (67km) and does not comprise very differing geographic regions. Some sea-anglers would go on trips for a couple of days, this would mainly be to the English coast, to fish on Rays and catfish/dogshark.

7.1.2.3 Water bodies

Main species of interest in regards to the DCF in Belgian waters are marine fishes. We focus on these for the moment being. Fishing in freshwater or lakes is controlled by the section "*Bos en Groen*" of the department of *Leefmilieu*. Eels would thus be a species that should be discussed in cooperation with them or might even completely fall into their working area.

Water body type	Ranking
Freshwater rivers or lakes	<i>Bos en Groen</i>
River estuaries	3
Enclosed bays, sea loughs, lagoons, fiords, sounds	2
Open sea: inshore (e.g. shore out to <20m depth)	1
Open sea: Offshore demersal (e.g. > 20m depth)	1
Open sea: Offshore pelagic and Oceanic	3
Other (specify)	-

7.1.2.4 Platforms for fishing

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	3
Beaches	4
Rocky shorelines	NA.
Private boats	1
Rental boats	2
Charter or Guide boats (<i>for-hire boats where passengers pay as a group to hire the vessel and the services of the captain and crew in advance of the trip</i>)	2

Head, Party, or Open boats (<i>for-hire boats where passengers pay as individuals for space on the boat and can "walk on" just prior to the trip</i>)	2
Other boats	-
Other (specify)	-

Is it important to distinguish between shore fishing from man-made structures and shore fishing from natural shorelines when establishing sampling strata or estimation domains? We have very little natural shoreline that is suitable for angling, so most angling would be performed from man-made structures. Fishing on the beach with nets would be on the normal natural shoreline. Apparently, where this type of fishery is static, arguments of "ownership" of parts of beach are common.

Is it important to distinguish between different types of boat angling defined by size/capacity of boat, experience of crew, and capability of passengers? Of course, the more experience the crew or the fishermen have, the better their knowledge of location of shipwrecks and/or other places with a high concentration of the targeted fish. The bigger size/capacity of the boat, the larger the allowed catch. And the more capable the passengers, the more fish they will be able to catch in a shorter amount of time.

The pilot study that was conducted on sea-angling for cod revealed quite big differences in the amounts of cod caught by different boat sizes/capacity, experience of crew and capability of passengers. Vessels with many people on board reported the highest numbers of cod catches varying in weight from 0 to 110 kg per vessel. Those vessels that reported having fished on shipwrecks were semi-professional charter vessels with paying passengers. However, by personal communication, I have heard from several people that a lot of recreational fishermen fish on shipwrecks.

How important is it to distinguish between different types of access points for boat fishing (marinas, launch ramps, private docks, etc.)? I would personally think that there are not a lot of private docks along the Belgian coast, so for Belgium the access points for boats would be harbours.

Are some locations more accessible than others for sampling? Differences for sampling between locations will mostly depend on the level of cooperation from the fishermen.

7.1.2.5 Target species or species groups

The target species on the shore depends of the season. Sole for example, is one of the flatfish that spawn along the shore whereas they spend the rest of the year in deeper water. Therefore, in the months that soles are spawning along the shore, there will be more good-sized, adult soles caught from the shore.

- a) A single species is targeted and consistently forms the majority of the catch: Crangon crangon fishing, mainly on the beach and shore <20m of depth.
- b) A small number of species is targeted and consistently form the majority of the catch (e.g. boat angling for large sharks): cod, plaice and sole (Typical flatfish in Belgian waters)
- c) The fishermen may adapt fishing gear, bait, area, time of day etc. in an unpredictable way, and could land a variety of co-occurring species (e.g. boat fishing for mixed demersal species such as cod, pollack, conger, flatfish, skates, small sharks) Not applicable for fishermen on boats, they are not allowed to have different types of fishing gear with them, both angling and non-angling. On shore anglers would not be restricted in this way.

7.1.2.6 Fishing gears used

Gear type	Ranking
Rod and line, or hand-lines	1
Long-lines	NA
Dip net or A-frame (push net?)	NA
Cast net	NA
Gill net	2
Seine	3
Trawl	3
Pot	NA
Trap	NA
Spear	5
Hand	4

To what extent should these be distinguished when designing sampling and estimation approaches? Quite important when the differences between fishing gear target different species.

7.1.2.7 Seasonality

If any seasonality would exist it would be the same over the different types of fishing/water body/platform and would mainly be dependent on holidays. On average, the respondents of the questionnaire conducted for "Results of a pilot study on the recreational cod fisheries in the waters under Belgian jurisdiction" declared to go out angling during 9 months on twelve. The majority makes angling trips during 10-12 months of the year.

7.1.2.8 Tournament fishing

The Vlaamse Vereniging voor Hengelsport Verbonden (VVHV, a consortium of Flemish angler's associations) had about 2000 sea-anglers amongst its members in 2006. This organisation has World and European championships on its calendar. No more information at the minute.

7.1.2.9 Management regulations and other schemes affecting recreational fisheries

The nature reserve in Knokke-Heist is a closed area for all types of fishing.

There are no different regulations for residents and non-residents.

As long as the quota on regulated species is not yet met, fishing in the areas specified for Belgium is allowed.

Minimum Landing Sizes are applicable to all recreational fisheries

Below the low tide level, the use of passive fishing gear is prohibited (trammel nets, set nets, fixed gillnets en drift nets).

Fishing during the night (22:00-05:00) is prohibited.

There is no limit on the amount of fishing days for Recreational fishermen.

The catches are not allowed to be sold or commercialised in any other way (Article 5 of the Royal Warrant of August 14th 1989).

Types of fishing not allowed:

- Use of explosives

- Use of tranquilisers or poisons
- Electric fishing

Recreational fishing for cod is prohibited with both towed and static gear.

- Regulations of season lengths or closed areas:* closure of the cod fisheries (and others) also apply to the Recreational fishers. No limit in season length.
- Regulations of bag limits:* total catches are limited to 20kg of cod plus sea bass per day per angler per seatrip, of this max 15kg can be cod. The fish can be gutted, but needs to be landed in whole.
- Regulations of size limits:* have to respect the minimum landing sizes for commercial landings, for a few species the minimum landing sizes are more strict for the recreational fisheries.
- Regulations of fishing effort (e.g., numbers of traps, gill nets, etc.)* The vessels may not carry other types of fishing gear than those meant for non-automated angling. There is no limit on the amount of fishing days for Recreational fishers.
- Fishing license requirements:* No requirements! Chartered boats are subject to certain requirements/regular control.
- Protected species regulations:* Cod (*Gadus morhua*), seabass, sole, whiting and mackerel
- Voluntary catch-and-release schemes:* none.

7.1.3 Possible sampling frames

Area frames and list frames: no information supplied.

7.1.4 Available statistics

Statistic	Data sets available, and where/how archived
Number of resident anglers	Results of a pilot study on the recreational cod fisheries in the waters under Belgian jurisdiction: about 2000 people. EAA-questionnaire
Number of visiting anglers	No Information available
Number of resident vessels	No Information available
Number of visiting vessels	No Information available
Fishing effort: Angler days	Results of a pilot study on the recreational cod fisheries in the waters under Belgian jurisdiction: 20 days per angler during
Fishing effort: Vessel days	No Information available
Quantity of catch by species or species group, retained for consumption	Results of a pilot study on the recreational cod fisheries in the waters under Belgian jurisdiction: 5 kg cod per trip per angler
Quantity of catch by species or species group, used for bait	No Information available
Quantity of catch by species or species group, that is released	No Information available

7.1.5 Previous survey methods

DCR Pilot studies

A pilot study was carried out on the recreational cod fisheries in the waters under Belgian jurisdiction. Oostende, February 2007. Ministry of the Flemish Community, Sea fisheries Service (Oostende Belgium), ILVO-Fisheries (Oostende, Belgium)

This pilot study was a mail survey done in 2006. The questionnaires were sent to angler's associations and individual sea-anglers. The fishery targeted was thus angling for cod on vessels in Belgian territorial waters. The pilot study only covered Flanders, the Brussels and Walloon area were not considered in this study. This questionnaire had responses from 15 out of 50 questionnaires sent and there the Flemish Sea-angling population is estimated to be about 2000 people, this study is not sufficiently representative to base a full scale recreational survey on. Belgium plans to start a program on researching recreational fisheries as soon as possible. The WKSMRF in April in Nantes has given a lot of information that needs to be considered in further studies, it also seemed best that any studies on recreational fisheries in Belgium be conducted in accordance to those in the neighbouring countries also fishing on cod and sea bass in the North-Atlantic sea. (The conclusion from the Pilot study: cod catches by recreational fishers in the Belgian coastal waters amount to 100-200 tons annually. However, considering the annual nature of the questions in the survey, the population size and the response rate in this study, high grading is likely.)

Other studies

A local angler's association, VVHV, has done some questionnaires which were distributed among their members and other visitors of the Angling Expo 2003 (<http://www.vvhv.be/dossiers/hengelsportenquete03.pdf>, in Dutch) and 2007 (<http://www.vvhv.be/dossiers/Hengelsportenquete%202007.doc>, in Dutch), these questionnaires were also put online.

This angler's association does these surveys once every 2 years, but only the results from 2003 and 2007 are found on the internet. Under the target population are all visitors of the exposition, which thus includes Walloon and foreign fishermen. These surveys target anglers both on freshwater as on the sea and are therefore difficult to use specifically for sea recreational fisheries research. In 2007, 1842 questionnaires were obtained and the total Flemish angling population is estimated to be at least 165000, this means about 1.1% of Flemish anglers participated in the survey.

Other recreational fisher's associations also undertake surveys (frequency unknown), results from these were however not (yet) obtained. The studies by these recreational fisher's associations don't seem to be representative as a basis for designing a full-scale recreational fishing survey and associated sampling, but the experience these organisations have built up over the years and their direct link with the recreational sea fishermen is very valuable and should be kept in mind while designing surveys and sampling schemes.

In all studies for which the results are available, the occasional recreational fishermen which only make up to 10 fishing trips a year are under sampled.

7.1.6 Primary Customers for the data, and intended uses

Use the table below to indicate the types of data required by the primary customers to whom statistics must be provided, and the intended uses.

		Customers for data					
		European Commission	National government	Stock assessment scientists	Academic researchers	Fishing industry	General public
Type of data	1 Participation	ACD	ACD	ABCD	A	A	A
	2 Fishing effort	ACD	ACD	ABCD	A	A	A
	3 Total catch (retained/released) by species	ACD	ACD	ABCD	A	A	A
	4 Catch per unit effort by species	ACD	ACD	ABCD	A	A	-
	5 Size/age distribution of catch	ACD	ACD	ABCD	A	A	A
	6 Socio-economic data	ACD	ACD	A	A	A	A
	Key species (give list)	Cod and seabass	Cod, seabass	Cod and seabass	Cod and seabass	Cod and seabass	Cod and seabass

Key: A: General monitoring of trends; B: Stock assessment; C: Monitoring of annual statistics relative to annual management targets for specific species; D: In-season monitoring of cumulative statistics relative to annual management targets for specific species; E: other (specify) able 1: Summary of national recreational fisheries: angling

Table 1: Summary of national recreational fisheries: angling

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
Estuaries and enclosed bays; Open sea: Inshore (e.g.shore to <20m depth); Open sea: Inshore / Offshore demersal	Beaches	Mainly plaice, sole (<i>Bass, cod, rays, whiting, sea trout, mackerel, flounders, grey mullet, bream (black & gilthead)?</i>)	Rod and line (bait or artificial lure)	S (more during holidays)	MLS	C	Partial	None
	Man-made structures	Mainly plaice, sole (<i>Bass, flatfish, rays, cod, whiting, mackerel, conger</i>)	Rod and line (bait or artificial lure)	S (more during holidays)	MLS A (Naturereserve in Knokke-Heist, Havendam van Zeebrugge and some municipalities).	B	Partial	None
	Private / Charter/ for-hire boats	Plaice, sole, cod, sea bass, rays, whiting	Rod and line; handlines (bait or artificial lure)	S (more during holidays)	MLS	A	Partial	Low

^{1,2,3,4,5}: See below Table 2 for codes to enter

Table 2: Summary of national recreational fisheries: non-angling

Water body	Platform	Main species targeted	Gear used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for sampling ⁴	Robustness of Available Data/ Statistics ⁵
Estuaries and semi-enclosed bays or sea loughs	Beaches	Brown shrimp	Wade fishing		MLS, stay within 3 miles of the coast	No information	No information	No information
		Cockles, mussels,	Hand picking		No information	No information	No information	No information
		?	Flat nets that get dug in		Minimal mesh size: 70mm, measurement of mesh size with calliper and diagonally from knot to knot, MLS	NA at the moment, should be possible to find out	No information	No information
		?	Ankerkuilen of kartennetten, fuiken (fykes)		Minimal mesh size: 70mm, measurement of mesh size with calliper and diagonally from knot to knot, MLS	NA at the moment, should be possible to find out	No information	No information
		?	Trammel nets		Minimal mesh size: 90mm, measurement of mesh size with calliper and diagonally from knot to knot, MLS, Forbidden below low tide level. In 2008 it was forbidden to use multiple layered warrelnetten, everywhere. Each net can be max 50m long en 80 cm high. Each fisher is allowed a max of 2 nets. March-April-May: only 1 net per fisherman. Harvest necessary at least once in 24 hrs.	NA at the moment, should be possible to find out	No information	No information
Open sea: Inshore (e.g. shore to <20m depth):	Recreational vessels equipped for trawling	Brown shrimp	Nets for fishing on brown shrimp		Only within 3 miles off the coast for those that have no certificate of registry, for the owners or users of these vessels, it is not allowed to fish on and to carry on the vessel, species for which, according to EU regulation, TAC or quota are applicable. The net types allowed are those specified only for shrimps. Use of <i>zee flap</i> from Dec to May. By catch needs to be thrown overboard immediately. Mesh size: 16-31mm needs <i>zee flap</i> with mesh size 70mm, measurement of mesh size with calliper and diagonally from knot to knot Restrictions for net depending on size of ship.	No information	No information	No information
	Private boats	flatfish	Spear		None	No information	No information	No information

¹ Y =Year-round fishery, S =Seasonal fishery (provide separate information on active months and peak periods); P = Pulse fishery (provide separate information to specify months when fishery is most likely to be present)

² MLS (=minimum landing size); BL (=bag limits); S (=closed seasons); A (= closed areas); P (=protected species regulations); VCR (= voluntary catch and release)

³ A: relatively large numbers; B: Intermediate; C: Relatively small numbers; D: very small numbers N/A: No information available

⁴ Full (= fully accessible); Partial (= only partly accessible); <Partial (= less accessible than "Partial"); None (not accessible); N/A: no information

⁵ High (high level of statistical precision); Medium (medium level of statistical precision); Low (low level of statistical precision); None (no data or statistics available)

Table 3: National availability of lists and sampling frames for carrying out surveys of the general public to collect information on participation in different forms of recreational fishing.

Site	Type of lists	Sampling frames	Availability		
Off-site	Mailing-address directories	Postal household frame	N/A		
		Registry-based angler frames	Angler licences	none	
			Angler permits	none	
			Other angler registries		
		Registry based vessel operator frames	Vessel licenses	Exhaustive	
			Vessel permits	partial	
			Other vessel registries		
		Telephone directories	Random-digit-dialing household frame		N/A
			Phonebook household frame		N/A
	Registry-based angler frames		Angler licences	none	
			Angler permits	none	
			Other angler registries		
	Registry based vessel operator frames		Vessel licenses	Exhaustive	
Vessel permits			partial		
Other vessel registries					
On-site	Site or access point lists (points of departure or return for fishing trips)	Public access sites	none		
		Private access sites	none		

7.2 Denmark

7.2.1 General overview of national recreational fisheries

The majority of recreational fishermen are occasional rod and reel anglers using private boats, fishing from piers or using waders along the Danish coasts. According to a recent poll (Gallup, 2008) there are around 650 000 occasional fishermen, which can be divided into 1) anglers using rod and reel for fishing and 2) non-anglers using fixed gears such as gillnets and fykenets. Neither of these two groups of fishermen is allowed to sell their catches. Before recreational fishing - angling as well as non-angling - can be carried out legally, a permit has to be purchased. Only fishery from "put and take" lakes is exempted from fishing licenses. Angler fishermen - domestic as well as tourists - between 18 and 65 years pay a license of DKr. 140 for one year, DKr. 100 for one week and DKr 35 for one day. All recreational fishermen above 12 years of age using gillnet or fykenets has to pay a license costing DKr 275 per year. The licenses are personal and cannot be handed over to others.

In 2005 a total of 33.600 recreational fishermen bought a license for fishing with fixed gears, such as gillnet or fykenet (trap-nets). This fishery is typically carried out along the coast, generally using small boats to get to their gear. The vast majority of people carrying out this type of fishery are males and many are retired. In 2005 the total numbers license issued to anglers was 193 000.

A survey conducted by Bohn & Roth (1997) showed that around 13% of all recreational fishermen were members of an association. In Denmark there are several associations for recreational fishermen, with three dominant associations active in advisory committees to the government. These are the Sports Fishermen's Association, the Danish Amateur Fishermen's Association and the Danish Recreational Fishermen's Organization.

7.2.2 Detailed description of national recreational fisheries

7.2.2.1 Categories of recreational fishing

Species of main interest caught in the Danish recreational fisheries are: eel (*Anguilla anguilla*), cod (*Gadus morhua*) and Baltic salmon (*Salmo salar*).

- Eel are almost exclusively caught in the non-angling fishery using fykenets and only in the Baltic/Kattegat area,
- Cod are caught both in angling and non-angling recreational fishery. Cod are caught in both in the Baltic/Kattegat area and the North Sea,
- Baltic salmon are almost exclusively caught by the angling fishery in saltwater from medium sized (15-25 ft) boats around the coast of the Island of Bornholm.

Eel (Non-angling):

Eel is the single most important species for the non-angling recreational fishery and is exclusively caught using fykenets. It is a traditional fishery that has been practiced for centuries in the coastal areas. Earlier a recreational fishery using eel-trawl and long-lines was practiced but eel-trawl is now prohibited and long-line catches are limited.

Cod (Non-angling):

Cod are caught both with gillnets and fykenets in the non-angling recreational fishery. The catches are at present time estimated to be quite moderate and restricted to certain areas of the inner Danish waters, i.e. the Kattegat/Baltic area.

Cod (Angling)

The angling fishery for cod is rather complex on both a spatial and temporal scale. It is carried out throughout the entire year but with varying intensity and in different areas. Cod are caught in the North Sea, Kattegat, the inner Danish waters, western and eastern Baltic. Platforms used for the fishery range from beach fishery with rod and reel using casting lures to offshore jigging on chartered boats many miles offshore. An angling fishery onboard private boat is also very popular and is likely to have a substantial effect on the catches.

Baltic salmon (Angling)

A spring/early summer fishery is carried out from medium sized private boats. Down rigging is the dominating fishing strategy. The sampling of the catches is relatively easy, since the fishery is more or less restricted to the island of Bornholm where a limited number of harbors are present.

7.2.2.2 Geographic delineations**Eel (Non-angling):**

Eel are caught throughout most of coastal areas of the inner Danish waters. There is a high spatial variation, which should be taken into account in determining CPUE and effort. At present the available CPUE data covers almost the entire Danish waters where eel are caught, hence monitoring the effort should be done on a similar spatial resolution in order to be able to combine the data.

Cod (Non-angling):

Cod CPUE shows large variation on both a temporal and spatial scale. As for eel no quantitative information on the effort is available at present. For non-angling catches the CPUE of cod is available on both a spatial and temporal scale. For the angling fishery the sampling scheme should be set up to account for the high season/area influence on the CPUE and effort.

Cod (Angling)

Cod are caught in all Danish waters, from many miles offshore in the North Sea through the inner Danish waters and into the eastern Baltic. The main catches are believed to be taken onboard boats (chartered, hired and private), but some pier and coastal fishing for cod is also known to take place.

Baltic salmon (Angling)

Angling caught salmon in saltwater almost exclusively takes place in waters adjacent to Bornholm and a reliable estimate of the total catch is at present available.

7.2.2.3 Water bodies

Eel (Non-angling)

Water body type	Ranking
Freshwater rivers or lakes	N/A (prohibited)
River estuaries	1
Enclosed bays, sea loughs, lagoons, fiords, sounds	1
Open sea: inshore (e.g. shore out to <20m depth)	2
Open sea: Offshore demersal (e.g. > 20m depth)	3
Open sea: Offshore pelagic and Oceanic	3
Other (specify)	

Cod(Non-angling)

Water body type	Ranking
Freshwater rivers or lakes	None
River estuaries	2
Enclosed bays, sea loughs, lagoons, fiords, sounds	1
Open sea: inshore (e.g. shore out to <20m depth)	1
Open sea: Offshore demersal (e.g. > 20m depth)	2
Open sea: Offshore pelagic and Oceanic	3
Other (specify)	

Cod (Angling)

Water body type	Ranking
Freshwater rivers or lakes	None
River estuaries	2
Enclosed bays, sea loughs, lagoons, fiords, sounds	1
Open sea: inshore (e.g. shore out to <20m depth)	1
Open sea: Offshore demersal (e.g. > 20m depth)	1
Open sea: Offshore pelagic and Oceanic	2
Other (specify)	

Salmon (Angling)

Water body type	Ranking
Freshwater rivers or lakes	None
River estuaries	3
Enclosed bays, sea loughs, lagoons, fiords, sounds	3
Open sea: inshore (e.g. shore out to <20m depth)	1
Open sea: Offshore demersal (e.g. > 20m depth)	2
Open sea: Offshore pelagic and Oceanic	1
Other (specify)	

7.2.2.4 Platforms for fishing

Eel (Non-angling)

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	3
Beaches	2
Rocky shorelines	3
Private boats	1
Rental boats	3
Charter or Guide boats	3
Head, Party, or Open boats	3
Other boats	3
Other (specify)	

Cod (Non-angling)

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	2
Beaches	2
Rocky shorelines	2
Private boats	1
Rental boats	2
Charter or Guide boats	2
Head, Party, or Open boats	2
Other boats	2
Other (specify)	

Cod (Angling)

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	4
Beaches	4
Rocky shorelines	4
Private boats	2
Rental boats	3
Charter or Guide boats	3
Head, Party, or Open boats	1
Other boats	
Other (specify)	

Salmon (Angling)

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	3
Beaches	3
Rocky shorelines	3
Private boats	1
Rental boats	2
Charter or Guide boats	4
Head, Party, or Open boats	4
Other boats	
Other (specify)	

7.2.2.5 Target species or species groups

See tables 1 and 2.

7.2.2.6 Fishing gears used

Gear type	Ranking
Rod and line, or hand-lines	1
Long-lines	2
Dip net or A-frame (push net?)	2
Cast net	3
Gill net	1
Seine	
Trawl	
Pot	2
Trap	1
Spear	3
Hand	
Others (specify)	

Boat angling should be divided into two categories: trolling and jigging/bait fishing.

7.2.2.7 Seasonality

Seasonality of especially the angling fishery has to be taken into considerations. One example is the angling cod fishery with takes place onboard chartered boats during the winter month in the Sound targeting large spawning females. During the summer a fraction of these boats stays within the Sound while others switch to fishing cod on wrecks in the North Sea or even in the Baltic Sea, i.e. east of Bornholm. During the winter month the charter boats fish along with a large number of smaller sized private boats, which temporal/spatial fishing pattern is even more complex and unknown.

For both the cod and eel non-angling fishery the seasonality differences in CPUE are known whereas the effort change with season has to be investigated further. Special emphasis on how to include the contribution of “summerhouse” fishers on the total catch has to be considered.

7.2.2.8 Tournament fishing

Not important to take into account in the Danish Recreational fishery even though there is a rather large down rigging competition on Bornholm every spring. A competition that might be useful as an access point when sampling this fishery.

7.2.2.9 Management regulations and other schemes affecting recreational fisheries

Fishing with gillnets closer than 100 meters from the low water line is prohibited. Fykenet fishery is closed during the period from the 10th of May to the 31st of July as a part of the Danish eel recovery plan. Angling closer to 75 meters from fixed gear is prohibited.

Regulations on size limits will influence what the fishermen retain and what is discarded at the fishing site. Sampling at access points may therefore underestimate catches as discards would not be included unless these can be reliably self-reported.

7.2.3 Possible sampling frames

Since a permit is obligatory in order to carry out a legal fishery an off-site telephone and/or mail survey seems like a sensible and realistic approach. Together with the purchasing of the permit information such as name and address are registered. For 2005 only 200 out of 33.000 non angling permits lacked this information. This figure was a bit higher for the angling fishery where 24.000 out of 193.000 missed information, probably as a result of more tourists contributing to the angling fishery than to the non-angling. These tourist fishers could probably contribute to a large fraction of the catch in the angling salmon catches and potentially in the cod fishery. Therefore an on-site access point approaches to these two particular fisheries should be considered.

7.2.3.1 Area frames

Eel and cod in the non-angling fishery are caught throughout most of the coastal areas in the inner Danish waters. CPUE does differ between areas but this is a problem of minor concern if the telephone/mail approach is applied. There is one exception, namely the summerhouse fishers, which should receive specially attention in order to set up a proper sampling program. If access point surveys are used as part of estimating the angling fraction of fish caught, area frames should be developed. A factor complicating this is that the fishery varies substantially according to season.

7.2.3.2 List frames

Eel (Non-angling):

Eel recreational fisheries are primarily conducted by non-angling fisheries using traps. These are spread out throughout the entire country. Through the licenses, which are mandatory, lists are available covering all non-anglers. In Denmark this list comprises around 33 000 fishermen. One would have to distinguish between trap and gill-net fishers among the non-angler list to identify the proportion fishing for eel with traps.

Cod (Non-angling):

Cod CPUE shows large variation on both a temporal and spatial scale. Cod are mostly caught in gillnet fishery as trap catches of cod are insignificant. CPUE of cod is available on both a spatial and temporal scale. A list of 33000 recreational fishermen who need li-

cences to fish is available, but one would need to distinguish the proportion fishing with gill nets for cod.

Cod (Angling):

A list of commercial charter boats is available and a diary approach could be implemented in order to monitor this fishery. The magnitude of private boats and their fishery pattern are unknown. A telephone survey might be an option combined with information from harbours.

Baltic salmon (Angling)

Angling caught salmon in saltwater almost exclusively takes place in waters adjacent to Bornholm from a limited number of harbours. It is therefore relatively easy to sample access points for CPUE, catch and any other information on this fishery.

7.2.4 Available statistics

Statistic	Data sets available, and where/how archived
Number of resident anglers	Yes, through licenses.
Number of visiting anglers	Yes, through day or week licenses
Number of resident vessels	No
Number of visiting vessels	No
Fishing effort: Angler days	No
Fishing effort: Vessel days	No
Quantity of catch by species or species group, retained for consumption	No
Quantity of catch by species or species group, used for bait	No
Quantity of catch by species or species group, that is released	No
Other statistics (specify)	CPUE for all species caught by non-anglers with gillnets or traps with a good spatial and temporal coverage. Since 2002. Length of species caught (including discards) but subject to gear selectivity.

7.2.5 Previous survey methods

7.2.5.1 Current methods

Non-angling catch registration based on voluntary self-reporting by “key” fishermen using standard gillnets or traps distributed throughout Denmark.

7.2.5.2 Previous methods

Bohn J & Roth E. 1997. Survey on angling in Denmark 1997 – results and comments. In: Toivonen, A.-L. & Tuunainen, P. (Eds.). Socioeconomics of Recreational Fishery. TemaNord 604, Copenhagen: Nordic Council of Ministers, pp. 79-88.

Roth, E., Toivonen A.-L., Navrud, S., Bengtsson, B., Gudbergsson G., Tuunainen P., Appelblad, H., Weissglas G. 2001. Methodological, conceptual and sampling practices in surveying recreational fishery in Nordic countries – experiences of a valuation survey. Fisheries management and Ecology 8: 355-367.

Toivonen et al. 2004. The economic value of recreational fisheries in Nordic countries. *Fisheries Management and Ecology* 11; 1-14.

Pilot survey on the recreational fishery in the Sound (ICES sub division 23). This was based on interviews with all identified Danish charter vessels that provided information on catch and effort. Small boat angling was sampled through access points covering harbors in the sound to estimate number and types of boats and phone interviews with angling clubs in the region to get an estimate of member effort and catches.

7.2.6 Primary Customers for the data, and intended uses

		Customers for data					
		European Commission	National government	Stock assessment scientists	Academic researchers	Fishing industry	General public
Type of data	1 Participation		X				
	2 Fishing effort	X	x	x	x	x	X
	3 Total catch (retained/released) by species	X	x	x	x	x	x
	4 Catch per unit effort by species	X	x	x	x	x	
	5 Size/age distribution of catch	X	x	x	x		
	6 Socio-economic data		x		x	X	
	Key species (give list)	Cod Eel Salmon					

Table 1: Summary of national recreational fisheries: angling

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
Estuaries and enclosed bays or sea loughs	Beaches	Sea trout, garfish	Rod and line (bait or artificial lure)	S	MLS except for garfish A,S	A	<Partial	None
	Man-made structures	Flatfish, garfish	Rod and line (bait or artificial lure)	S	MLS except for garfish A,S	B	Partial	None
	Private / Charter/ for-hire boats	Sea trout	Rod and line; handlines (bait or artificial lure; trolling)	S	MLS A,S	B	<Partial	None
Open sea: Inshore (e.g.shore to <20m depth):	Rocky shores	sea trout	Rod and line (bait or artificial lure)	S	MLS S	B	<Partial	None
	Man-made structures	Flatfish, cod, mackerel, garfish	Rod and line (bait or artificial lure)	S	MLS, S	B	Partial	None
	Beaches	Flatfish, cod, sea trout, garfish	Rod and line (bait or artificial lure)	S	MLS S	B	Partial	None

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
	Private /charter / for hire boats	Cod, salmon, flatfish, sea trout	Rod and line; handlines (bait or artificial lure; trolling)	S	MLS, S, A	A	Partial	Medium
Open sea: Offshore demersal (e.g. 20m+ depth):	Private /charter / for hire boats	Cod, salmon	Rod and line (bait or artificial lure)	S	MLS, A	B	Partial	Medium
Open sea: Offshore pelagic and Oceanic:	Charter / for hire boats							

^{1,2,3,4,5}: See below Table 2 for codes to enter

Table 2: Summary of national recreational fisheries: non-angling

Water body	Platform	Main species targeted	Gear used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for sampling ⁴	Robustness of Available Data/Statistics ⁵
Estuaries and semi-enclosed bays or sea loughs	Beaches	Eel, eelpout, flatfish, shrimps	Trapnets/fykenets, pushnets	S	MLS, S (eel, flatfish)	C	<Partial	Low
	Rocky shores							
	Private boats	Cod, sea trout, flatfish, eel, eelpout	Various nets & traps	S	MLS, S, A	A	High	High
Open sea: Inshore (e.g. shore to <20m depth):	Beaches							
	Rocky shores							
	Private boats	Cod, sea trout, flatfish, eel, eelpout	Various nets & traps	S	MLS, S, A	A	High	High

¹ Y =Year-round fishery, S =Seasonal fishery (provide separate information on active months and peak periods); P = Pulse fishery (provide separate information to specify months when fishery is most likely to be present)

² MLS (=minimum landing size); BL (=bag limits); S (=closed seasons); A (= closed areas); P (=protected species regulations); VCR (= voluntary catch and release)

³ A: relatively large numbers; B: Intermediate; C: Relatively small numbers; D: very small numbers N/A: No information available.

⁴ Full (= fully accessible); Partial (= only partly accessible); <Partial (= less accessible than "Partial"); None (not accessible); N/A: no information

⁵ High (high level of statistical precision); Medium (medium level of statistical precision); Low (low level of statistical precision); None (no data or statistics available)

Table 3: National availability of lists and sampling frames for carrying out surveys of the general public to collect information on participation in different forms of recreational fishing.

Site	Type of lists	Sampling frames	Availability	
Off-site	Mailing-address directories	Postal household frame		
		Registry-based angler frames	Angler licences	Yes
			Angler permits	
			Other angler registries	1
		Registry based vessel operator frames	Vessel licenses	Angling club boats registered
			Vessel permits	
	Other vessel registries			
	Telephone directories	Random-digit-dialing household frame		partial
		Phonebook household frame		partial
		Registry-based angler frames	Angler licences	Yes
			Angler permits	
			Other angler registries	
		Registry based vessel operator frames	Vessel licenses	Through angler clubs
	Vessel permits			
Other vessel registries				
On-site	Site or access point lists (points of departure or return for fishing trips)	Public access sites	Partial	
		Private access sites	n/a	

7.3 Finland

7.3.1 General overview of national recreational fisheries

In 2006, there were over 1.8 million recreational fishermen in about one million households in Finland. About 230 000 fishermen participated in fishing only by rowing or steering boat. The proportion of recreational fishermen was 35 per cent. Forty-seven per cent of men and 25 per cent of women engaged in fishing. Fishing was the most or almost the most, important hobby for 76 000 fishermen.

The number of fishermen has slightly decreased from about two million persons in 2000 to about 1.8 million persons in 2006. The fishermen's proportion of population has decreased in age groups under 10 years and 18-44 years. In other age groups the proportions has been stable.

The total catch amounted to 42 million kg, of which 75 per cent was taken in inland waters. Perch and pike made up over half of the catch. The crayfish catch was 6.8 million pieces. Compared to 2004 the crayfish catch was over two times bigger in 2006. The proportion of signal crayfish catch was already 76 per cent of the total catch. The estimate for

crayfish catch is very unreliable because crayfish catch is taken by only a few households and the catches have great variation.

Fifty-five per cent of the total fish catch was taken with gill nets, fish traps and trap nets; 43 per cent was taken with rod and line. The catch of half of the fishing households did not exceed 9 kg (median). The average catch per fishing household was 41 kg. Of the fishing households, 9 % did not catch fish at all.

The value of the fish catch was EUR 56 million estimated according to the prices paid to professional fishermen. The value of crayfish catch was EUR 17 million estimated using prices collected from wholesalers. The catch values are rough estimates, because recreational fishermen rarely sell their catch. Most of the fish catch is used in fishermen’s own households or it is given free of charge to relatives and neighbours. Also the crayfish catch is used mostly in fishermen’s households or enterprises. One part of catch is sold for example to restaurants, other households etc. Small crayfishes are also sold for stocking in lakes and rivers. Concerning grayfish the prices are collected from wholesalers, so the used prices present the most valuable part of catch.

7.3.2 Detailed description of national recreational fisheries

7.3.2.1 Categories of recreational fishing

The most common tackle was the hook and line, which was used by 63 per cent of fishermen. The spinning rod was used by 45 per cent of fishermen. In last years the proportion of fishermen using hook and line has slightly decreased, whereas the proportion of fishermen using spinning rod has increased. The jig was used by one in three fishermen, the gill net by one in four and trolling gear by one in five fishermen.

7.3.2.2 Geographic delineations

The division of fishing areas follows the Fishing Industry Units of the Employment and Economic Development Centres (in practise provinces). Another division follows the provincial division in the inland water area. In the sea area the subareas were divided also by the boundaries of Uusimaa – Varsinais-Suomi, Varsinais-Suomi – Satakunta and Ostrobothnia – Central Ostrobothnia regions. The division is about the same as the International Council for Exploration of the Sea (ICES) division in the sea area.

The fishing days were allocated to the statistical areas by gear type. Catches were reported as ungutted weight and were allocated by species to the statistical areas according to the most important fishing area for the species.

7.3.2.3 Water bodies

Water body type	Ranking
Freshwater rivers or lakes	1
River estuaries	
Enclosed bays, sea loughs, lagoons, fiords, sounds	
Open sea: inshore (e.g. shore out to <20m depth)	
Open sea: Offshore demersal (e.g. > 20m depth)	
Open sea: Offshore pelagic and Oceanic	

Other (specify) Sea area as a whole	2
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7.3.2.4 Platforms for fishing

Division not possible to do because fishermen in the sea areas are spread to the whole coast and the archipelago and go for fishing primarily using their own shore.

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	NA
Beaches	NA
Rocky shorelines	NA
Private boats	1
Rental boats	NA
Charter or Guide boats (<i>for-hire boats where passengers pay as a group to hire the vessel and the services of the captain and crew in advance of the trip</i>)	NA
Head, Party, or Open boats (<i>for-hire boats where passengers pay as individuals for space on the boat and can "walk on" just prior to the trip</i>)	NA
Other boats	NA
Other (specify) whole shoreline and in winter ice cover	2

7.3.2.5 Target species or species groups

In sea area all species are considered as mixed. Strata cannot be defined by species.

7.3.2.6 Fishing gears used

Gear type	Ranking
Rod and line, or hand-lines	2
Long-lines	
Dip net or A-frame (push net?)	
Cast net	
Gill net	1
Seine	
Trawl	
Pot	
Trap	
Spear	
Hand	
Others (specify)	

We don't have information of gears beforehand to be considered for strata.

7.3.2.7 Seasonality

No information collected. Some gears refer to winter fishing.

7.3.2.8 Tournament fishing

Not considered separately.

7.3.2.9 Management regulations and other schemes affecting recreational fisheries

Fishing regulated by fishing law (allowed gears) and by regional regulations (seasonal and technical limits, protected areas etc.).

7.3.3 Possible sampling frames

The only possible sampling frame to cover all fishing is the population register. License registers possible in some rivers.

7.3.4 Available statistics

Statistic	Data sets available, and where/how archived
Number of resident anglers	Official statistics available
Number of visiting anglers	
Number of resident vessels	
Number of visiting vessels	
Fishing effort: Angler days	Official statistics available
Fishing effort: Vessel days	
Quantity of catch by species or species group, retained for consumption	Official statistics available
Quantity of catch by species or species group, used for bait	
Quantity of catch by species or species group, that is released	
Other statistics (specify)	Much

7.3.5 Previous survey methods

The following is a list of reports detailing recreational fishery pilot studies in Finland.

DCR Pilot studies

Commission Regulation (EC) No 1639/2001

Report of pilot survey of Recreational Fishing in Finland Revised version 11.03.2004 Finnish Game and Fisheries Research Institute

References:

Kekäläinen, K. Nonresponse and sampling unit problem in recreational fishing surveys. (In Finnish). "Kala- ja riistaraportteja", nro 256. Finnish Game and Fisheries Research Institute. 2002.

Fishing Finland 2001. (In Finnish). " Kala- ja riistaraportteja", nro 266. Finnish Game and Fisheries Research Institute. 2003.

Vapaa-ajankalastus 2000 - Fritidsfiske 2000 - Recreational Fishing 2000. Riista- ja kalatalouden tutkimuslaitos. Vilt- och fiskeriforskningsinstitutet. Finnish Game and Fisheries Research Institute. SVT Maa-, metsä- ja kalatalous - Jord- och skogsbruk samt fiske - Agriculture, Forestry and Fishery 2002:54. 29 s.

Vapaa-ajankalastus 1998 - Fritidsfiske 1998 - Recreational Fishing 1998. Riista- ja kalatalouden tutkimuslaitos. Vilt- och fiskeriforskningsinstitutet. Finnish Game and Fisheries Research Institute. SVT Maa-, metsä- ja kalatalous - Jord- och skogsbruk samt fiske - Agriculture, Forestry and Fishery 2000:1. 27 s.

Commission Regulation (EC) No 1581/2004

The report of the pilot survey of recreational Cod fishing in Finland 4.9.2007. Finnish Game and Fisheries Research Institute

References:

Moilanen, P., Ahvonen, A. and Kekäläinen, K. Data Analysis of Recreational Fishing Survey in Finland: Do non-respondents go for fishing? In: Proceedings. European Conference on Quality and Methodology in Official Statistics (Q2004). Federal Statistical Office Germany. Wiesbaden. October 2004.

Vapaa-ajankalastus 1998 - Fritidsfiske 1998 - Recreational Fishing 1998. Riista- ja kalatalouden tutkimuslaitos. Vilt- och fiskeriforskningsinstitutet. Finnish Game and Fisheries Research Institute. SVT Maa-, metsä- ja kalatalous - Jord- och skogsbruk samt fiske - Agriculture, Forestry and Fishery 2000:1. 27 s.

Vapaa-ajankalastus 2000 - Fritidsfiske 2000 - Recreational Fishing 2000. Riista- ja kalatalouden tutkimuslaitos. Vilt- och fiskeriforskningsinstitutet. Finnish Game and Fisheries Research Institute. SVT Maa-, metsä- ja kalatalous - Jord- och skogsbruk samt fiske - Agriculture, Forestry and Fishery 2002:54. 29 p.

Vapaa-ajankalastus 2002 - Fritidsfiske 2002 - Recreational Fishing 2002. Riista- ja kalatalouden tutkimuslaitos. Vilt- och fiskeriforskningsinstitutet. Finnish Game and Fisheries Research Institute. SVT Maa-, metsä- ja kalatalous - Jord- och skogsbruk samt fiske - Agriculture, Forestry and Fishery 2004:51. 32 p.

Vapaa-ajankalastus 2004 - Fritidsfiske 2004 - Recreational Fishing 2004. Riista- ja kalatalouden tutkimuslaitos. Vilt- och fiskeriforskningsinstitutet. Finnish Game and Fisheries Research Institute. SVT Maa-, metsä- ja kalatalous - Jord- och skogsbruk samt fiske - Agriculture, Forestry and Fishery 2005:62. 50 p.

Other studies

Moilanen, P., Ahvonen, A. and Kekäläinen, K. Data Analysis of Recreational Fishing Survey in Finland: Do non-respondents go for fishing? In: Proceedings. European Conference on Quality and Methodology in Official Statistics (Q2004). Federal Statistical Office Germany. Wiesbaden. October 2004.

Vapaa-ajankalastus 2006 - Fritidsfiske 2006 - Recreational Fishing 2006. Riista- ja kalatalouden tutkimuslaitos. Vilt- och fiskeriforskningsinstitutet. Finnish Game and Fisheries Research Institute. SVT Maa-, metsä- ja kalatalous - Jord- och skogsbruk samt fiske - Agriculture, Forestry and Fishery 2007:7. 57 p.

7.3.6 Primary Customers for the data, and intended uses

Use the table below to indicate the types of data required by the primary customers to whom statistics must be provided, and the intended uses.

		Customers for data					
		European Commission	National government	Stock assessment scientists	Academic researchers	Fishing industry	General public
Type of data	1 Participation	?	A		A		A
	2 Fishing effort	?	A		A		
	3 Total catch (retained/released) by species	?	A	B	A		A
	4 Catch per unit effort by species						
	5 Size/age distribution of catch						
	6 Socio-economic data	?	A		A		A
	Key species (give list)	?	A		A		

Key: A: General monitoring of trends; B: Stock assessment; C: Monitoring of annual statistics relative to annual management targets for specific species; D: In-season monitoring of cumulative statistics relative to annual management targets for specific species; E: other (specify

7.4 France

7.4.1 General overview of national recreational fisheries

2.45 millions of sea recreational fishers (+/- 0.15 millions) practice this activity in France (mainland) according to a recent study based on a sample of approximately 15 000 people. Catches estimations for fish would represent between 20 000T and 30 000T, for shellfish 3100T (+/-1200), for crustaceous 1600T (+/-900) and for cephalopods 495T (+/-600T). The main fished species are Seabass (G2 in DCR), Mackerel (G1 in DCR) and Seabream (G1 and G2 in DCR). They represent between 40 and 67% of total catches (source : first results from pilot survey of recreational fishing in France).

7.4.2 Detailed description of national recreational fisheries

7.4.2.1 Categories of recreational fishing

The latest French study on recreational fisheries take into account 5 categories: On shore Shellfish picking, Angling from shore, Fisheries activities from boat (except scuba diving), Scuba diving from shore, Scuba diving from boat.

7.4.2.2 Geographic delineations

From a biological point of view, it would be necessary to separate at least statistics in three groups: Mediterranean Sea, Atlantic Sea and Channel. For example the survey protocol used for on-site survey was based on the following sampling plan (numbers are numbers of interviews):

	Summer	Autumn	Winter	Spring	Total
English Channel					
Seashell gathering by food	40	50	40	20	150
Boat fishing	50	40	40	50	180
Sea shore fishing	50	30	70	40	190
Total English Channel	140	120	150	110	520
Atlantic Ocean					
Seashell gathering by food	70	30	40	40	180
Boat fishing	80	40	70	30	220
Sea shore fishing	60	30	60	30	180
Total Atlantic Ocean	210	100	170	100	580
Mediterranean Sea					
Seashell gathering by food	20	20	0	20	20
Boat fishing	30	50	40	40	110
Sea shore fishing	40	20	60	20	190
Spear fishing from shore	20		0		60
Spear fishing with a boat	20		0		20
Total Mediterranean Sea	130	90	100	80	400
TOTAL	480	310	420	290	1500

Sampling and estimation methods must take those geographic boundaries in order to be able to consider in the future CIEM zone (VIIId, VIIe, VIIh, VIIIa, VIIIb and GFCM GSA), and the stocks really targeted by the fishers. At present statistics available by Geographic delineations are (2005):

Number and profile of the recreational fishers, sex, age, region, profession, number of outings and catch estimations by fishing modes, catches for main species, expenditure estimations, nature of the conflicts between commercial and recreational fishers, typology of recreational fishers (based on number of outings per season, fishing mode, fishing zone, residence zone, group of species, boat owning), opinion about several regulation systems. However, because the pilot-study had as a main goal to estimate recreational fishing activities at the national scale, these statistics are not really adapted, nor robust enough, to estimate the parameters mentioned above at a sub-regional ICES zone level. It is why it is now necessary to launch a new survey at these scales.

7.4.2.3 Water bodies

At present the following five water bodies have been studied.

- *On shore Shellfish gathering*: 71% (percentage of recreational fisherman)
- *Angling from shore*: 33%
- *Fishing activities from boat (except spearfishing)*: 25%

- *Spearfishers from shore: 5%*
- *Spearfishers from boat: 2%*

The results led to a total higher than 100% because the same fisherman can practice several modes of fishing.

Water body type	Ranking
Open sea: inshore (e.g. shore out to <20m depth)	1
Open sea: Offshore demersal (e.g. > 20m depth)	2
Freshwater rivers or lakes	N/A
River estuaries	N/A
Enclosed bays, sea loughs, lagoons, fiords, sounds	N/A
Open sea: Offshore pelagic and Oceanic	N/A
Other (specify)	

7.4.2.4 Platforms for fishing

Harvesting by foot (beaches and rocky shorelines): 71 % of recreational fishers

Angling from shore (beaches and rocky shorelines): 33 % of recreational fishers

Angling from boat: 25 % of recreational fishers

Spearfishing from shore: 5 % of recreational fishers

Spearfishing from boat: 2 % of recreational fishers

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	N/A
Beaches	N/A
Rocky shorelines	N/A
Private boats	N/A
Rental boats	N/A
Charter or Guide boats (<i>for-hire boats where passengers pay as a group to hire the vessel and the services of the captain and crew in advance of the trip</i>)	N/A
Head, Party, or Open boats (<i>for-hire boats where passengers pay as individuals for space on the boat and can "walk on" just prior to the trip</i>)	N/A
Other boats	N/A
Other (specify)	N/A

7.4.2.5 Target species or species groups

Main species in catches in France mainland (from most to least important) associated to fisherman groups:

Seabass	<i>dicentrarchus labrax</i>	Angling from shore, Fishing activities from boat, Spearfishing from shore Spearfishing from boat
Seabream	<i>sparidae</i>	Angling from shore, Fisheries activities from boat, Spearfishing from shore Spearfishing from boat
Mackerel	<i>Scomber scombrus</i>	Angling from shore, Fisheries activities from boat, Spearfishing from shore Spearfishing from boat
Clam	<i>Ruditapes</i>	On shore Shellfish gathering
Cockle	<i>Cerastoderma</i>	On shore Shellfish gathering
White bream	<i>Diplodus</i>	Angling from shore, Fisheries activities from boat, Spearfishing from shore Spearfishing from boat
Oyster	<i>oysters</i>	On shore Shellfish gathering
Mussel	<i>mytilus</i>	On shore Shellfish gathering
Common prawn	<i>Crangon</i> <i>Palaemon</i>	On shore Shellfish gathering , Fishing activities from boat
Velvet swimcrab	<i>Necora puber</i>	On shore Shellfish gathering , Fishing activities from boat
Grey mullet	<i>Mugilidés</i>	Angling from shore, Spearfishing from shore , Spearfishing from boat
Sole	<i>Solea vulgaris</i>	Angling from shore, Fishing activities from boat, Spearfishing from shore Spearfishing from boat
Cuttlefish	<i>Sepia officinalis.</i>	Angling from shore, Fishing activities from boat, Spearfishing from shore Spearfishing from boat
Sand smelts	<i>Atherinidés</i>	
Pollack	<i>zPollachius pollachius</i>	Angling from shore, Fishing activities from boat, Spearfishing from shore Spearfishing from boat
Cod	<i>Gadus morhua</i>	Angling from shore, Fishing activities from boat
Squid	<i>Loligo sp.</i>	Angling from shore, Fishing activities from boat
Limpet	<i>Patella vulgata</i>	On shore Shellfish gathering
Meagre	<i>Argyrosomus regius</i>	Angling from shore, Fishing activities from boat, Spearfishing from shore Spearfishing from boat
Warty venus	<i>Venus verrucosa</i>	On shore Shellfish gathering
Pout	<i>Trisopterus luscus</i>	Angling from shore, Fishing activities from boat, Spearfishing from shore Spearfishing from boat

Large pelagic fish (including Tunas)	<i>Thunnus thunnus</i> , <i>Thunnus alalunga</i> , <i>Auxis</i> , <i>Sarda</i> , <i>Seriola</i> , <i>Coryphaena</i>	Fishing activities from boat, Scuba diving from shore, Spearfishing from boat
Periwinkle	<i>Littorina littorea</i>	On shore Shellfish gathering
Whiting	<i>Merlangus merlangius</i>	Fishing activities from boat
Skipjack tuna	<i>Katsuwonus pelamis</i>	Angling from shore, Fishing activities from boat, Spearfishing from shore Spearfishing from boat
Atlantic bonito	<i>Sarda sarda</i>	Angling from shore, Fishing activities from boat, Spearfishing from shore Spearfishing from boat
Gilthead	<i>sparus aurata</i>	Angling from shore, Fishing activities from boat, Spearfishing from shore Spearfishing from boat
Plaice	<i>Pleuronectes platessa</i>	Angling from shore, Fishing activities from boat, Spearfishing from shore Spearfishing from boat

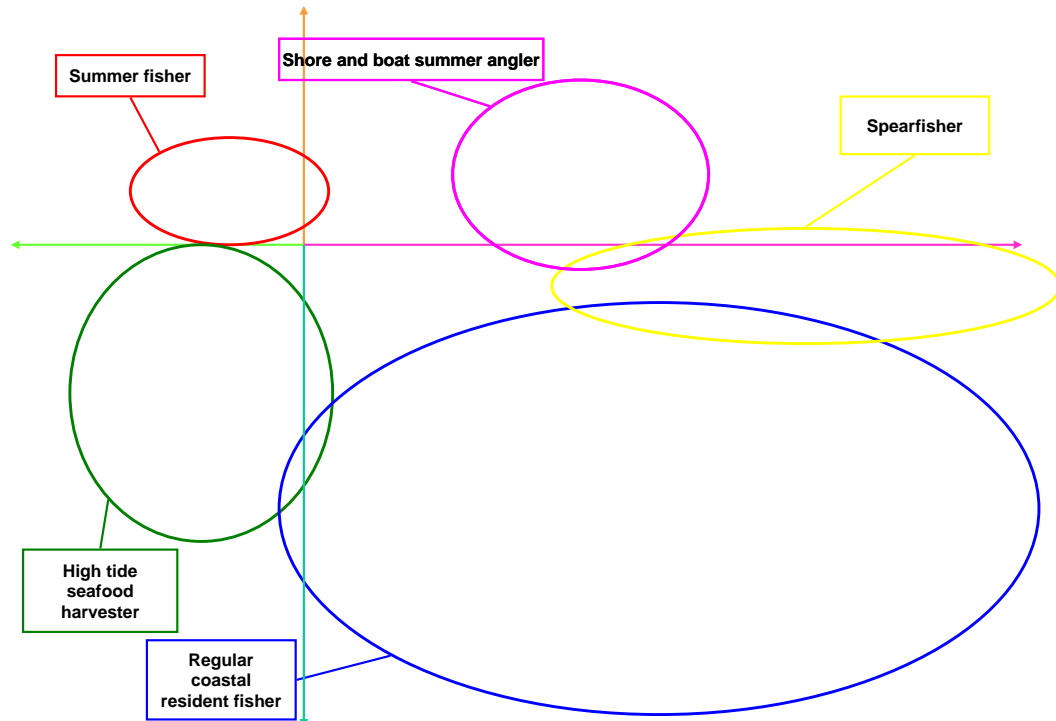
7.4.2.6 Fishing gears used

Main fishing gears used in France mainland (from most to least important):

Fishing gears	Water bodies	Ranking
Fishing rod	Angling from shore, Fishing activities from boat (except spearfishing)	1
Handlines, Line with hand, trolling lines	Angling from shore, Fishing activities from boat (except spearfishing)	2
Hand (with and without tools)	On shore Shellfish gathering	3
Hand dredgers, rakes	On shore Shellfish gathering	4
Spear	Spearfishing from shore, Spearfishing from boat	5
Landing net	On shore Shellfish gathering	6
Other		7
Set trammels and gillnets	Angling from shore, Fishing activities from boat (except spearfishing)	8
Pots	Angling from shore, Fishing activities from boat (except spearfishing)	9
N/A		10
Three-pronged fish spear	On shore Shellfish gathering	11
Drifting and set longlines	Angling from shore, Fishing activities from boat (except spearfishing)	12

7.4.2.7 Seasonality

Fishermen behaviours could be also characterized in terms of intensities of fishing by the annual number of trips (regular vs occasional) and by the level of equipment implemented, of seasonality (summer vs all along the year), of main geographical areas of practice. Some typologies could be established showing some reference groups of fishermen (see figure). Seasonality (vertical axis) and level of equipment (horizontal axis) for the fishing effort in each category explain the main part of the registered behaviours.



7.4.2.8 Tournament fishing

Fishing categories implied in tournament. (No knowledge on a potential significant factor to consider in designing sampling schemes).

- Angling from shore
- Fisheries activities from boat (except scuba diving): angling
- Spearfishing from shore
- Spearfishing from boat

7.4.2.9 Management regulations and other schemes affecting recreational fisheries*a) Regulations of season lengths or closed areas: Local areas*

No regulations of season or closed area for recreational fishing, except for specific marine protected areas and for specific shellfishes. Also sometimes for health reasons for shellfish.

b) Regulations of bag limits: depend of species

Bags limits for shellfishes depending on areas

c) Regulations of size limits

EU regulations for fish and some national size limits depend on the area (see example below)

d) Regulations of fishing effort (e.g., numbers of traps, gill nets, etc.)

Some regulations of fishing effort depending on the area (see example below). Some regulations on the gears allowed for specific target species (for example hooks are banned for groupers in the French part of the Mediterranean Sea).

e) Fishing license requirements

No fishing licence in marine waters. Spearfishers must be registered. License is mandatory for fishing in inland waters.

*f) Protected species regulations**g) Voluntary catch-and-release schemes*

No Schemes regarding catch and release.

Management regulations depend on the area of recreational fishing. Below is an example in Brittany.

2006



Tailles **MINIMALES** de capture des **POISSONS, COQUILLAGES, CRUSTACES, CEPHALOPODES** et **ECHINODERMES** applicables

à la

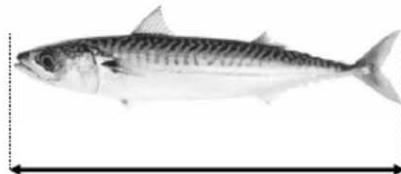
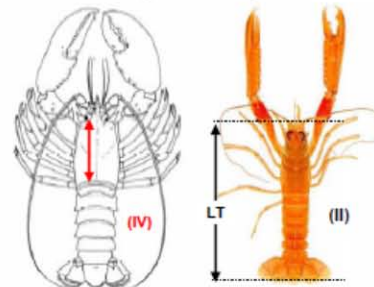
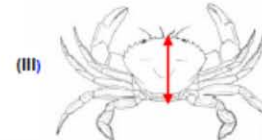
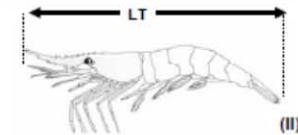
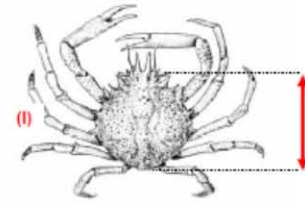
PÊCHE DE LOISIRdans le Département du **FINISTÈRE**

Règlement communautaire 850/98 du Conseil du 30 mars 1998

Décret n°90-618 du 11/07/1990 modifié, et Arrêté du 21/12/1999 relatifs à l'exercice de la Pêche de loisir

Délibérations du Comité Régional des Pêches Maritimes (CRPMEM)

POISSONS (*)	Tailles minimales (cm)	
	au NORD du 48 ^e parallèle	au SUD du 48 ^e parallèle
ALOÏSE (<i>Alosa alosa</i>)		30
BAR (<i>Dicentrarchus labrax</i>)		36
BARBUE (<i>Scophthalmus rhombus</i>)		30
CABILLAUD (<i>Gadus morhua</i>)		35
CARDINE (<i>Lepidorhombus spp</i>)		20
CETEAU (<i>Dicologlossa cuneata</i>)		15
CHINCHARD (<i>Trachurus trachurus</i>)		15
CONGRE (<i>Conger conger</i>)		58
DORADE grise (<i>Spondyliosoma cantharus</i>)		23
DORADE ROSE (<i>Pagellus bogaraveo</i>)		25
DORADE royale (<i>Sparus aurata</i>)		19
EGLEFIN (<i>Melanogrammus aeglefinus</i>)		30
FLET (<i>Platichthys flesus</i>)		25
HARENG (<i>Clupea harengus</i>)		20
LAMPROÏE marine (<i>Petromyzon marinus</i>)		27
LIEU jaune (<i>Pollachius pollachius</i>)		30
LIEU noir (<i>Pollachius virens</i>)		35
LIMANDE (<i>Limanda limanda</i>)	15	23
LIMANDE- SOLE (<i>Microstomus kitt</i>)		25
MAQUEREAU (<i>Scomber scombrus</i>)		20
MARBRE (<i>Lithognathus mormyrus</i>)		23
MERLAN (<i>Merlangius merlangus</i>)		27
MERLU (<i>Merluccius merluccius</i>)	30	27
MULET (<i>Mugil spp</i>)		20
PLIE (<i>Pleuronectes platessa</i>)		25
PLIE grise (<i>Glyptocephalus cynoglossus</i>)		28
ROUGET BARBET (<i>mullus spp</i>)		15
SAR (<i>Diplodus sargus</i>)		23
SARDINE (<i>Sardina pilchardus</i>)		11
SAUMON (<i>Salmo salar</i>)		50
SOLE (<i>Solea solea</i>)		24
TRUITE de mer (<i>Salmo trutta</i>)	23	25
TURBOT (<i>Psetta maxima</i>)		30



(*) = La taille des poissons se mesure :
du bout du museau à l'extrémité de la nageoire caudale

ATTENTION ! : La pêche à la palangre sur l'estran est interdite du 1er juin au 15 septembre

ATTENTION !
Pêche
à la
civelle
INTERDITE

(arrêté DRAM
n°25/2005
du 24/01/2005)



ATTENTION!
Casiers à crabes
INTERDITS
en
Rade de Brest
du
15 octobre
au
15 mars

IMPORTANT :
les casiers
à parfoir
ne
sont pas
autorisés
en
Bretagne



(VIII)



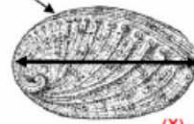
(VII)



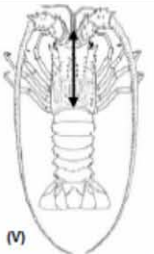
(IX)

Prélèvement limité à
15 coquilles par jour
et par pêcheur en
plongée sur
les gisements Brest/
Camaret/Morlaix
pendant la campagne
coquillière
(limitations horaires)

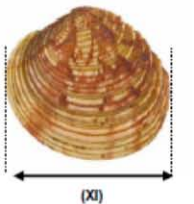
Prélèvement limité à
20 ormeaux par jour et par
pêcheur
Pêche **INTERDITE** du
15 juin au 31 août.
Pêche sous-marine et
usage du tuba **INTERDITS**
(en plongée et/ou
avec appui au sol)



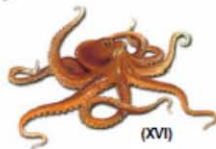
(X)



(V)



(XI)



(XVI)

RAPPEL :
Prélèvements de la pêche de loisir
limités à la consommation personnelle.
**Vente rigoureusement
INTERDITE**

CRUSTACES	Tailles minimales (cm)	
	au NORD du 48è parallèle	au SUD du 48è parallèle
ARAIGNEE de mer (<i>Maja squinado</i>) (I)	12 cm (et 500 gr mini)	
CREVETTE grise (<i>Crangon crangon</i>) (II)	3	
CREVETTE bouquet (<i>Palaemon serratus</i>) (II)	3	
ETRILLE (<i>Necora puber</i>) (III)	5	
HOMARD (<i>Homarus gammarus</i>) (IV)	8,7	
LANGOUSTE rouge ou rose (<i>Palinurus spp</i>) (V)	9,5	
LANGOUSTINE (<i>Nephrops norvegicus</i>) (II)	9 (II)	
TOURTEAU (<i>Cancer pagurus</i>) (VI)	14	13
POUCE-PIED (<i>Mitella pollicipes</i>)	(VII)	

- (I) : Longueur totale mesurée entre les rostrès jusqu'à la bordure postérieure de la carapace
- ATTENTION!** Prélèvement limité à 8 araignées par personne et par jour en pêche sous-marine
- Pêche fermée annuellement sur certains secteurs. Se renseigner auprès des A.M. locales
- (II) : Longueur totale de l'animal (LT) (Dimensions CIEM VIII, a,b,d,e.- Arrêté du 21 septembre 2005)
- (III) : Longueur totale de la carapace dans sa plus PETITE dimension
- (IV) : Longueur de la carapace mesurée de l'arrière des orbites jusqu'à la bordure distale du céphalothorax
- (V) : Longueur de la carapace mesurée de la pointe du rostre à la bordure distale du céphalothorax
- (VI) : Longueur totale de la carapace dans sa plus GRANDE dimension
- (VII) : Pêche **AUTORISEE** du 16/01 au 14/03, et du 16/09 au 14/11. (3 kilos par personne et par jour)
- (Quartier du Gulfinec : du 01/02 au 31/03 et du 30/05 au 30/11 (5 kg/pers/jour - Arrêté du 2 janvier 2006)
- ATTENTION!** Interdiction de pêche sur certains secteurs. Se renseigner auprès des A.M. locales

COQUILLAGES	Tailles minimales (cm)	
	au NORD du 48è parallèle	au SUD du 48è parallèle
BÛLOT ou BUCCIN (<i>Buccinum undatum</i>) (VIII)	4,5	
CLAM (<i>Mercenaria mercenaria</i>)	4,5	
CLOVISSE (<i>Venerupis pullastra</i>)	3,8	
COQUE (<i>Cerastoderma edule</i>)	3	
COQUILLE St Jacques (<i>Pecten maximus</i>)	10,2 (IX)	
COUTEAU (<i>Ensis spp + Solen spp</i>)	10	
HÛITRE creuse (<i>Crassostrea gigas</i>)	30 gr/pièce	
HÛITRE plate (<i>Ostrea edulis</i>)	5	
MOULE (<i>Mytilus edulis</i>)	4	
ORMEAU (<i>Haliotis tuberculata</i>)	8/9 (X)	8
PALOURDE (<i>Ruditapes decussatus + R. philippinarum</i>)	4	
PETONCLE blanc (<i>Aequipecten opercularis</i>)	4	
PETONCLE noir (<i>Chlamys varia</i>)	3,5	
PRAIRE (<i>Venus verrucosa</i>)	4 (XI)	4
TELLINE (<i>Donax trunculus + Donax vittatus</i>)	2,5	
VENUS (<i>Spisula spp.</i>)	2,8 (XII)	
VERNIS (<i>Callista chione</i>)	6/7 (XIII)	



(XII)



(XII)

- (IX) : 10,5 cm sur le gisement Brest-Camaret
- (X) : 9 cm au nord du Cap de la Chèvre
- (XI) : 4,3 cm sur le gisement Brest-Camaret
- (XII) : Gisement des Glénan **uniquement**
- (XIII) : 7cm sur le gisement des Glénan

ECHINODERMES	
OURSIN violet (<i>Paracentrotus lividus</i>)	5 (XIV)
OURSIN granuleux (<i>Sphaerechinus granularis</i>)	8 (XV)

- (XIV) : 5,5 cm (sans les piquants) en Baie de Douarnenez
- (XV) : Gisement Concarneau - les Glénan **uniquement**



(XV)



(XIV)

Pêche **INTERDITE**
du 16 avril au 14 octobre au
nord de l'anse de Kervigen
(commune de
Plodiern) jusqu'à
la limite de la Normandie

CEPHALOPODES	
POULPE (<i>Octopus vulgaris</i>) (XVI)	750 gr

7.4.3 Possible sampling frames

A two step national study has been carried out (2006-2008) under a steering committee with the Ministry in charge of fisheries IFREMER and some other scientific institutes an institute specialized in opinion polling and statistics (BVA), representatives of Recreational Fishing associations, and of the Industry (commercial fishermen).

First stage: national survey by telephone in order to estimate the population of recreational fishers in France.

Second stage: on-site survey in order to estimate some parameters such as catches and expenditures.

First stage 2006-2007: National telephone survey

- Seasonality: 5 waves of interviews
- A total of 15 085 households were interviewed in France mainland
- Over sampling of coastal zones
- Main goal: have a reference frame for recreational fishing and a first estimation of recreational fisher population

	France mainland		
	Survey date	Number of interviews	Reference period
	TEST STAGE		
WAVE 1	5 to 11 April 2006	2061 households interviewed	January, February and March 2006
	STUDY STAGE		
WAVE 2	15 to 24 June 2006	3003 households	April and May 2006
WAVE 3	September 2006	5012 households	June, July and August 2006
WAVE 4	November 2006	3003 households	September and October 2006
WAVE 5	January 2007	2006 households	November and December 2006

Second stage 2007-2008: on-site survey

- Pilot study on cod recreational fishing for DCR 2006-07
- 1500 interviews directly at fishing access sites
 - from August 2007 to July 2008
 - in all France mainland
- Sampling plan based on information from telephone survey
 - Statistical unit = fishing trip
 - Sampling plan: data of telephone survey give us a reference frame
 - Number of outings: % per façade, per season, per fishing mode
 - Under sampling of shellfish gathering and over sampling of winter
- Main goal: accurate information regarding catches and expenditures

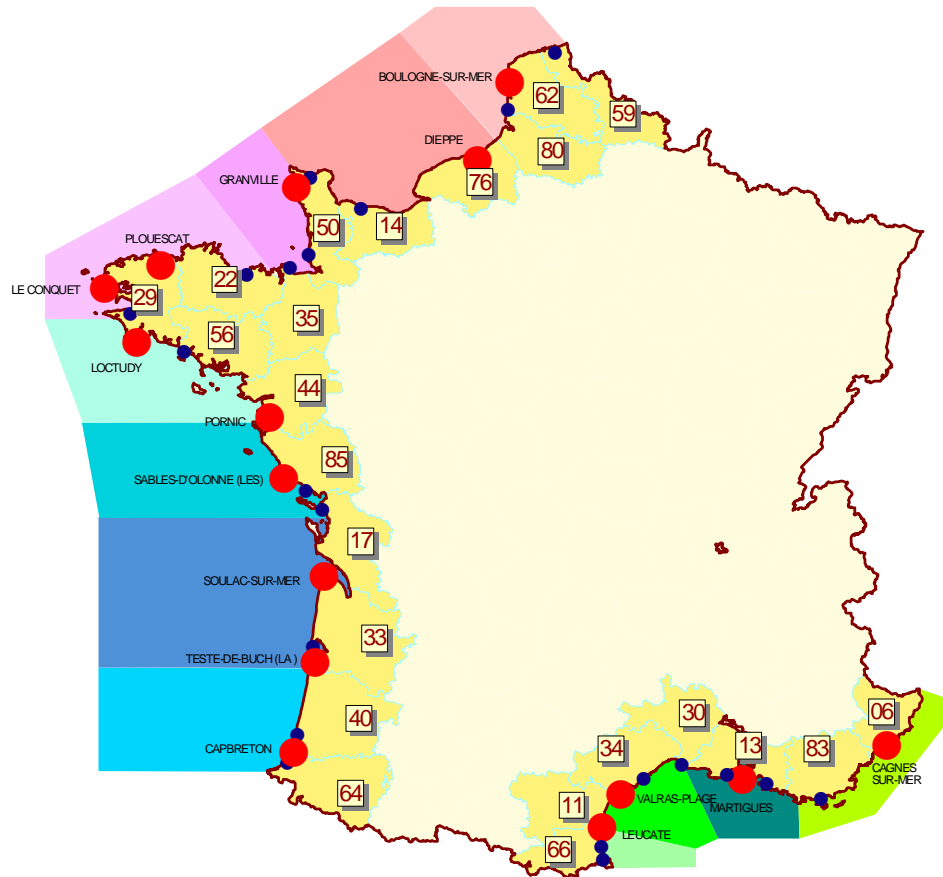
	Summer	Autumn	Winter	Spring	Total
<u>English Channel</u>					
Seashell gathering by food	40	50	40	20	150
Boat fishing	50	40	40	50	180
Sea shore fishing	50	30	70	40	190
Total English Channel	140	120	150	110	520
<u>Atlantic Ocean</u>					
Seashell gathering by food	70	30	40	40	180
Boat fishing	80	40	70	30	220
Sea shore fishing	60	30	60	30	180
Total Atlantic Ocean	210	100	170	100	580
<u>Mediterranean Sea</u>					
Seashell gathering by food	20	20	0	20	20
Boat fishing	30	50	40	40	110
Sea shore fishing	40	20	60	20	190
Spear fishing from shore	20		0		60
Spear fishing with a boat	20		0		20
Total Mediterranean Sea	130	90	100	80	400
TOTAL	480	310	420	290	1500

7.4.3.1 Area frames

- a) Geographic areas defined by country and state or province boundaries
- b) Geographic areas defined by other easily identified management boundaries

The survey protocol for on-site survey choose sites according to expert (administration, scientists, fishing club) and their repartition by façade, by fishing mode and by season.

Geographic distribution of sampling effort for the on-site survey



7.4.3.2 List frames

Table 3: National availability of lists and sampling frames for carrying out surveys of the general public to collect information on participation in different forms of recreational fishing.

Site	Type of lists	Sampling frames	Availability	
Off-site	Mailing-address directories	Postal household frame		
		Registry-based angler frames	Angler licences	none
			Angler permits	none
			Other angler registries	none
		Registry based vessel operator frames	Vessel licenses	none
			Vessel permits	none
			Other vessel registries	none
	Telephone directories	Random-digit-dialing household frame	exhaustive	
		Phonebook household frame	?	
		Registry-based angler frames	Angler licences	partial
			Angler permits	none
			Other angler registries	none
		Registry based vessel operator frames	Vessel licenses	none
			Vessel permits	none
Other vessel registries	none			
On-site	Site or access point lists (points of departure or return for fishing trips)	Public access sites	partial	
		Private access sites	partial	

7.4.4 Available statistics (France mainland):

Statistic	Data sets available, and where/how archived
Number of resident recreational fishers	2.45 millions (estimation +/- 0.15 millions)
Number of visiting anglers	
Number of resident vessels	335 000
Number of visiting vessels	
Fishing effort: Recreational fishing days	2.45 millions X 12.77 outings = 31.286 millions
Fishing effort: Vessel days	
Quantity of catch by species or species group, retained for consumption	FISH: 24 500T (+/-4600T); SHELLS: 3100T (+/-1200); CRUSTACEANS: 1600T (+/-900), CEPHALOPODS: 495T (+/-600)
Quantity of catch by species or species group, used for bait	N/A
Quantity of catch by species or species group, that is released	N/A
Other statistics (specify)	Weight/fisherman/year; catches for main species, expenditures relating to the travel expenditures, housing, food, equipment, boat; Economic impact of recreational and commercial fishing on French economy

Other statistics

Weight/fisherman/year: 10 kg of fishes, 1.3 kg of shellfish, 0.7 kg of crustaceans and 0.2 kg of cephalopods

Catches for main species:

Fishes: Seabass 5 600 t. (+/-2 000) (19 % of total catches) ; mackerel 3 600 t. (+/-1 600) (12% of total catches) ; pollack 3 500 t. (+/- 2 500) ; seabream 2 000 t. (+/- 960); white bream 840 (+/- 160). The five most important species represent a total catches of 15 540 t.

Crustaceans: edible crab + spider crab + common prawn 1 600 t. (+/-900)

Shellfishes: oyster 1 200 t. (+/-1000); clams 600 t. (+/-400); cockles 490 t. (+/-300); mussels 460 t. (+/-300).

Expenditures relating to the travel expenditures, housing, food, equipment, boat

Expenditures related to outing: 1 milliard (+/- 0.4) EUR

Expenditures related to equipment: 435 millions EUR

Expenditures related to boat: 341 millions EUR

Relative economic impact of recreational and commercial fishing on French economy

2005	Recreational fishing	Commercial fishing
Demographic weight	Practisings: 2 550 000	Full time employment: 11 937
Economic weight (expenditure)	Expenditure: between 1 000 and 2 000 millions	Intermediate consumption: 404 millions
Well-being	Savings due to capture (around 500 millions) + non market benefits	Added value: 689 millions
Social and cultural weight	Highly variable	High

7.4.5 Previous survey methods

7.4.5.1 Current methods

See above

7.4.6 Primary Customers for the data, and intended uses

Use the table below to indicate the types of data required by the primary customers to whom statistics must be provided, and the intended uses.

		Customers for data					
		European Commission	National government	Stock assessment scientists	Academic researchers	Fishing industry	General public
Type of data	1 Participation	A	A	A	A	A E	A E
	2 Fishing effort	B C	A B C	A B C	A B C	A E	A E
	3 Total catch (retained/released) by species	B C	A B C	A B C	A B C	A E	A E
	4 Catch per unit effort by species	B C	A B C	A B C	A B C	A E	A E
	5 Size/age distribution of catch	B	B	A B	A B		
	6 Socio-economic data	A	A E	A	A E	A E	A E
	Key species (give list)	DCF	Sea bass, shellfish, blue fin tuna	G1 and G2 species	Local context, opportunistic	Sea bass	

For each relevant cell in rows 1 – 6, enter one or more of the following codes to indicate how the statistics are, or would be, used to support the needs of the primary customers:

- A: General monitoring of trends
- B: Stock assessment evaluation
- C: Monitoring of annual statistics relative to annual management targets for specific species
- D: In-season monitoring of cumulative statistics relative to annual management targets for specific species
- E: other (specify)

7.5 Germany

ICES Workshop on Marine Recreational Fisheries Proforma Germany

collated by Norbert Schultz, Christopher Zimmermann, vTI-OSF (version 24.04.2009)

7.5.1 General overview of national recreational fisheries

About 3.3 million of anglers (range of estimated interval 2.6 – 4.1 mill.) are estimated to be active in Germany (Arlinghaus, 2004), roughly 4 % of the German citizens. About 920,000 anglers are organized in two large societies. 110,000 – 150,000 anglers are fishing annually in the German coastal waters of the Baltic Sea.

Recreational fishermen using commercial gears (further called “leisure fishers”) and fishing from the German Baltic coast are estimated to be about 1.200 persons. For the North Sea coast of Schleswig-Holstein, about 1.000 leisure fishers registered.

Recreational fishers are obliged to obtain an angling license in all German federal states. Applicants have to pass an exam, the license is valid for a lifetime and does not distinguish between inland (freshwater) and marine fishing. State authorities may keep lists of license holders, but these lists are not up-to-date, and they are so far not available for science. In almost all federal states of Germany recreational fishermen are obliged to pay an annual fishery duty. In 2004 about 1,430,000 fishery duties were paid (Brämick, 2005). Addresses of those having paid the annual duty are usually not kept. In two coastal states, non-resident anglers can acquire a tourist license, which is valid for a limited time.

The DCF 2009 – 2013 requires to sample recreational fisher’s catches of cod, salmon and eel for all nations with commercial catch of these species.

Cod is the main target fish of anglers in marine waters of Germany. The German pilot study for cod catches of the recreational fishery, conducted for 2004-2006, demonstrated that cod landings taken from anglers operating from the German Baltic coast amounted between 26 % and 73 % of landings of the German commercial fishery from the same area (Sub-Divisions 22 + 24). While landings of the leisure fishers are low, it became clear that the catch of the recreational fishery is important for the stock assessment and development.

Salmon is, as is sea trout, the target species of a relatively small group of anglers: the trolling fishers. A pilot study conducted in 2003 showed that salmon landings of German recreational fishers are low and without importance for the stock. However, there is apparently a salmon trolling fishery in the waters of the isle of Rügen developing in the last two years, which will be monitored.

Eel is the main target species of leisure fishers. For 2009/10, a pilot study is planned to estimate the landings of eel in the German marine coastal waters of the Baltic and North Sea obtained from these fisheries. Arlinghaus and Dorow (2009) estimated that the landings of eel from the anglers in Mecklenburg-Western Pomerania exceed the landings of the commercial fishery in this federal state.

7.5.2 Detailed description of national recreational fisheries

7.5.2.1 Categories of recreational fishing

In Germany, recreational fishermen can be divided into two groups: **anglers, using rods** for fishing, and **leisure fishermen** which are allowed to fish with limited numbers and sizes of **passive commercial gears** like gillnets, longlines, eel pots or traps. Different sampling strategies were applied for the data collection from the two groups.

Anglers can again be divided into those fishing from the beach or from piers and jetties, (surf fishing, angling whilst wading), and offshore fishing (angling from small boats, from larger charter vessels (“cutters”), or trolling). In addition, there are two fisheries characterized by the target fish and specialized angling methods with very low by-catch of other species: the fishery on herring and garfish.

Neither non-commercial subsistence fishing nor shellfish picking or spear-fishing exist in German waters.

7.5.2.2 Geographic delineations

a) Baltic Sea

The German Baltic coast is entirely situated at ICES Sub-Divisions 22 and 24. Landings are not separated between these Sub-Divisions.

Mail surveys to estimate the angling effort are conducted separately for the federal states of Schleswig-Holstein (SH) and Mecklenburg-Western Pomerania (MV) to account for the different fishery legislations in the two countries, causing different conditions for data collection.

In the on-site sampling system (creel survey) to collect CPUE data for cod (landings per angling day) interior coastal waters (estuaries, lagoons) are not sampled: Because of the lower salinity of these waters cod is very rarely caught and the target species are mostly pike, pikeperch and perch. A comparison of the CPUE data from marine waters of Schleswig-Holstein and Mecklenburg-Western Pomerania showed significant differences between both regions. The numbers of cod landed were raised separately for these federal states to account for the differences in CPUE and the different approach for the collection of effort data.

In a future sampling system to collect CPUE data for eel, interior coastal waters will have to be included.

b) North Sea

For the North Sea it is necessary to separate the outer coastal waters and open sea from the Wadden Sea and the tideways. In these areas recreational fishers target different species and use different methods for fishing.

7.5.2.3 Water bodies

a) Baltic Sea

In the German Baltic Sea, two distinct water bodies are fished by recreational fishers:

- The outer coastal waters and open sea with a salinity of >10. In these waters marine fish like cod, flounder, plaice, sea trout and salmon are the main target species of the recreational fishery.
- The interior coastal waters with a reduced salinity. In these waters freshwater fish species like pike, pikeperch and perch are the main target species of the recreational fishery.

Some fish species like herring and garfish are targeted in both water bodies.

Water body type	Ranking
Outer coastal waters and open sea (fishing from boats and cutters)	1
Outer coastal waters (fishing from the beach and jetties)	2
Interior coastal waters (estuaries, lagoons)	3

b) North Sea

For the North Sea it is at present not possible to rank the different water bodies because the data basis is insufficient. Future research activities could separate the following water bodies:

Water body type	Ranking
Open sea (for fishing from boats and large charter vessels)	N/A
Outer coastal waters (fishing from the beach)	N/A
Wadden Sea	N/A
Tideways	N/A

7.5.2.4 Platforms for fishing

a) Baltic Sea (ranking according to importance for fishing effort)

Platform	Ranking
Private boats	1
Beaches	2
Large charter vessels ("angling cutters", mostly larger former commercial fishing vessels transformed into passenger vessels where passengers pay for trips individually with the intention to fish during the trip)	3
Man-made structures (piers, jetties, bridges)	4
Smaller charter or guide boats	5
Belly-boats, rubber boats	6

b) North Sea

Rough estimation due to the very limited data basis in this area.

Platform	Ranking
Man-made structures (piers, jetties, bridges)	1
Beaches	2
Large charter vessels ("angling cutters", mostly larger former commercial fishing vessels transformed into passenger vessels where passengers pay for trips individually with the intention to fish during the trip)	3
Private boats	4
Smaller charter or guide boats	5

7.5.2.5 Target species or species groups

See table 1 and 2.

7.5.2.6 Fishing gears used

a) Baltic Sea

Gear type	Ranking
Rod and line	1
Gill net	2
Eel pots	3
Long-lines	4
Dip net or A-frame	5

Rod and line is by far the most important gear type. It is used in different ways and can be separated by fishing methods and/or platforms, e. g. surf fishing from the beach or man-made structures, angling whilst wading off the beach, angling from small boats or cutters (artificial lures or natural bait fishing), trolling from a boat. In addition, there are two

special fishing methods with rod and line for herring and garfish. **Gill nets** can be separated by target species like herring, flounder, pike perch, cod and sea trout. The main target species of the **long-line** fishery is eel. Dip nets or A-frames are mainly used for catching bait.

b) North Sea

Gear type	Ranking
Rod and line	1
Gill net	N/A
Eel pots	N/A
Long-lines	N/A
Dip net or A-frame	N/A

Data is insufficient to estimate the importance of fishing gear other than rod and line.

7.5.2.7 Seasonality

See table 1 and 2.

7.5.2.8 Tournament fishing

a) Baltic Sea

Three types of tournament fishing are conducted in German waters:

- Beach fishing, main target species cod and flounder,
- Fishing from a cutter, jigging or fishing with natural baits, main target species cod, flounder and whiting,
- Fishing from smaller boats, trolling, jigging or fishing with natural baits, main target species cod, flounder, sea trout, salmon.

The large tournaments cannot be used for the collection of regular CPUE data because highly specialized anglers participate in these tournaments, and their CPUE is likely to be higher than the one of the “mean” angler. However, length compositions of the landings can be used.

b) North Sea

Data for tournament fishing in the German North Sea is insufficient.

7.5.2.9 Management regulations and other schemes affecting recreational fisheries

See table 1 and 2.

A permanent fishing license is regularly required to fish in German waters which is valid for a lifetime once the fisher has passed an exam. In Schleswig-Holstein and Mecklenburg-Western Pomerania non-residents can buy a limited "tourist license" without passing an exam. An annual duty has to be paid by active license holders in most German federal states. In Mecklenburg-Western Pomerania, an additional special permit has to be acquired for recreational fishing in marine waters.

7.5.3 Possible sampling frames

7.5.3.1 Area frames

a) Baltic Sea

There are two area frames which are used for sampling:

- The federal states Mecklenburg-Western Pomerania and Schleswig-Holstein have partially different legislations and regulations for the recreational fishery. E. g. in Mecklenburg-Vorpommern anglers have to buy a permission to fish in the coastal waters of MV, while such a permission is not required in Schleswig-Holstein.
- For a sensible sampling, outer coastal waters and open sea should be separated from the interior coastal waters. Because of the different salinity in both water bodies there are different target species in both areas.

b) North Sea

There are two area frames which can and should be used for sampling:

- The federal states Niedersachsen and Schleswig-Holstein have partially different legislations and regulations for the recreational fishery.
- For a sensible sampling, outer coastal waters and the open sea should be separated from the Wadden Sea and the Tideways. In these areas different species are targetted and partially different methods are used for fishing.

7.5.3.2 List frames

See Table 3.

7.5.4 Available statistics

Statistic	Data sets available, and where/how archived
Number of resident anglers	Yes, estimated from survey, OSF ¹ database
Number of visiting anglers	Yes, estimated from survey, OSF ¹ database
Number of resident vessels	Partial, trade offices of municipalities
Number of visiting vessels	Not available
Fishing effort: Angler days	Yes, estimated from survey, OSF ¹ database
Fishing effort: Vessel days	Partially available, estimated from survey, OSF ¹ database
Quantity of catch by species, retained for consumption	Cod, partially Flounder, Sea trout, Herring
Quantity of catch by species or species group, used for bait	Not available
Quantity of catch by species or species group, that is released	Not available
Quantity of catch by species and fishing methods, retained for consumption	Cod, partially Flounder, Sea trout, Herring

¹ vTI – Institute of Baltic Sea Fisheries (Institut für Ostseefischerei)

7.5.5 Previous survey methods

DCR Pilot Study on cod catch in the recreational fishery, 2004-2006

All European member states with commercial cod catch were obliged by the Commission to conduct a pilot study on recreational fisher's cod catch during 2004 through 2006, in support of the data collection regulation (Regulation EC No 1581/2004, 7th appendix XI (section E) para.3). The final reports were made available to the Commission in spring 2007 and evaluated by SGRN in July. Approach and effort spent on the collection of data from the recreational fishery as well as the level of detail provided and the estimated removals by sport fishers were very different between the nations.

Germany put 72 man-months effort into the sampling. The study focussed on cod angling in the Baltic, as non-systematic investigations yielded very little angler catch of cod and effort from the German North Sea coast. Telephone interviews with 10% of the non-angling recreational fishers with potential cod catch (using commercial fishery methods) in one of the three federal states with a marine coastline supported the perception that their catch is negligible.

The sampling of anglers fishing for cod in the Baltic followed a four-step approach: Total number of recreational fishers operating at the German Baltic coast, their effort and main target species by angling method, and origin of anglers (to determine residents vs. tourists) were determined by means of two mail surveys (67000 questionnaire sent out, together with sea angling permits (in one federal state) or by using the angler unions (in the second federal state with a Baltic coastline). The return rate was 4-7%, with the higher figure including anglers replying that they were not active at the Baltic coast in that year. Recall bias was addressed by asking anglers to indicate whether their effort in the last year was based on records or only estimated. As "estimated" effort was significantly

higher than “recorded” effort, all following calculations were kept separate, resulting in a range for all results.

CPUE (daily cod catch numbers) was obtained by on-site interrogations (351 samples, 4000 fishers interviewed, roving survey for land-based methods, access point survey for vessels), sites and dates were randomly selected. Length distributions were recorded during angling events (146 samples with 2500 fishers participating, 14000 fish measured), and the raised length distributions converted into biomass using quarterly length-mass relationships established for the commercial fishery in the same area. Additional means for data collection were explored or used for the validation of data. Effort data was only collected once over the three years period (and assumed to be constant), while all other data was collected and raised annually.

The results demonstrate that 113-147,000 persons were fishing 880-1,500,000 days annually on the Baltic (without herring fishery and inner coastal waters). CPUEs ranged between 0.1 and 10.5 cod per day, depending on angling method and year. 2-5 Mill. cod were caught annually, which translates into 1,900-5,200 t total cod removals by the recreational fishery, again depending on year and assumption on effort (recorded/assumed). This represents roughly 50% of the commercial German catch of cod from the same area. Catch proved to be highly variable between years (60% higher in 2005 than in 2006), in spite of the assumed constant effort, possibly caused by a stronger incoming yearclass and increased accessibility of juveniles to the nearshore anglers. Effort was distributed evenly over the land-based and sea-based methods, but the majority of catches were taken by anglers in small boats (one half), followed by large charter vessels (29-37%). Catch from land-based methods amounted to only 15-17% (*Fig 1*).

Additional investigations (separate interrogation of highly specialised sea anglers) indicated that it is unlikely that the number of anglers and effort exerted is largely overestimated because of a biased participation of anglers specifically interested in sea angling.

Routine sampling of cod catch following the pilot study

The same approach chosen for the pilot study was continued, with a number of improvements however. On-site length sampling started in 2007; observers were placed on large charter vessels for the determination of length, mass and potential discards since 2008. Four part-time interviewers were employed (one by sub-region of the German Baltic coast) to increase the effort in on-site surveys (roving surveys for land-based methods, access point and onboard surveys for sea-based methods). A second effort mail survey was launched in early 2009, asking for effort of recreational anglers in the federal state of Mecklenburg-Western Pommern in 2008. As in 2005, the questionnaires were distributed with sea angling permits which are obligatory in this state. An information campaign involving all recreational fishing organisations was launched at the same time.

Other surveys on the German marine recreational fishery

Since the finalisation of the report, two additional large-scale studies have been performed on this topic, one conducted by the Institut für Gewässerkunde und Binnenfischerei Berlin (Arlinghaus et al.), one by one of the two large German Angling federations.

The first focussed on eel fisheries in the federal state of Mecklenburg-Vorpommern, and is not yet fully published (see <http://lfamv.de/index.php?/content/view/full/6392> for a

description of the method and eel related results [in German]). The authors used a combined telephone, diary and on-site sampling scheme. Estimates of cod catches by the recreational fishery were as high as those obtained by the DCR pilot study, data are also available for herring and garfish.

The second study was based on a mail (and later telephone) survey exclusively among members and sub-organisations of the German angling association “Verband Deutscher Sportfischer” (Mohnert et al 2009, see <http://www.vdsf.de/documents/vdsf-weissbuechlein-dorsch.pdf> [in German]). It asked for recorded effort and catch of marine fish from the Baltic, and presented results for cod for 2006 and 2007. While number of anglers fishing for cod in the Baltic, total effort and mean mass of caught fish was very close to that derived from the DCR study, catch per angler per day was only half, resulting in total removals of about 1200-1300 t of cod per year for the whole German recreational Baltic fishery. The study is not yet finally evaluated, and some of the assumptions for raising remain unclear.

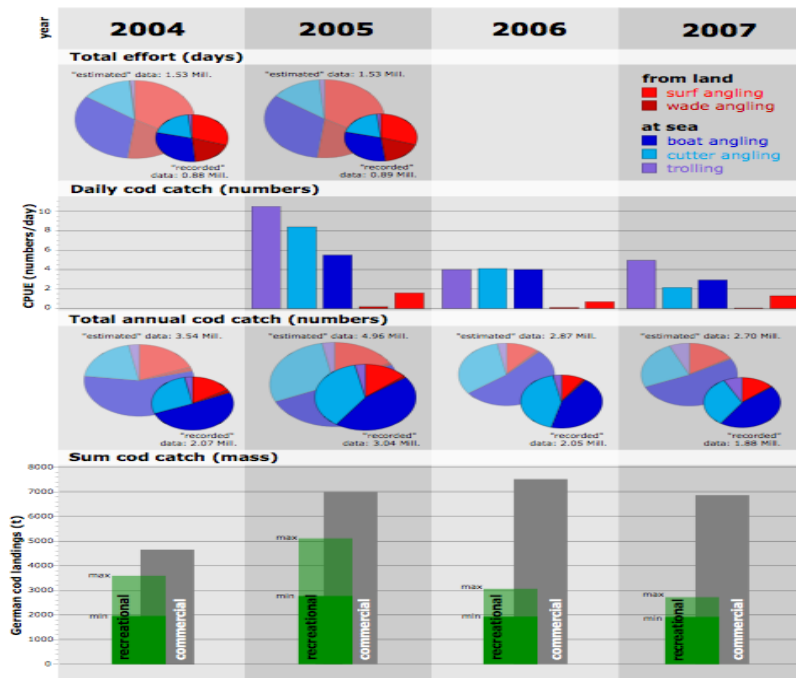


Fig. 1: German DCF Recreational fishers sampling of cod catch 2004-2007: Results

7.5.5.1 Current methods*Baltic Sea*

- a) Mail survey to collect information on the effort (angling days) of the anglers separated by method.
- b) On-site-survey to collect information on CPUE of anglers (catch per angling day), place and date of sampling randomly selected.
- c) Different methods to collect information on the length composition of the cod catches:
 - on angling cutters by observers of the Institute of Baltic Sea Fisheries,
 - self-sampling by anglers on small boats,
 - self-sampling from large-scale angling events in cooperation with angling associations.
- d) Census and interviews of randomly selected leisure fishers in Mecklenburg-Vorpommern.

North Sea

None

7.5.5.2 Previous methods

- a) Baltic Sea
 - See above (with the exception of length sampling, which has previously been derived from angling events only)
- b) North Sea
 - Owners and captains of commercial angling cutters, representatives of fishery administrations, angling associations, anglers and tourism agencies, have been interviewed, either personally or by telephone.

7.5.6 Primary Customers for the data, and intended uses

		Customers for data					
		European Commission	National government	Stock assessment scientists	Academic researchers	Fishing industry	General public
Type of data	1 Participation	A, B, C	A, B, C	A, B, C	A		A
	2 Fishing effort	A, B, C	A, B, C	A, B, C	A		A
	3 Total catch (retained/released) by species	A, B, C	A, B, C	A, B, C	A		A
	4 Catch per unit effort by species			A, B, C	A		
	5 Size/age distribution of catch			A, B, C	A		
	6 Socio-economic data	N/A	N/A	N/A	N/A	N/A	N/A
	Key species (give list)	Cod, Eel	Cod, Eel	Cod	Cod, Eel		Cod, Eel

Key: A: General monitoring of trends; B: Stock assessment; C: Monitoring of annual statistics relative to annual management targets for specific species; D: In-season monitoring of cumulative statistics relative to annual management targets for specific species; E: other (specify)

Table 1: Summary of national recreational fisheries: angling

Baltic Sea

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
Outer coastal waters and open sea (for fishing from boats and charter vessels)	Private boats	Cod, sea trout, salmon, garfish,	Rod and line / Natural baits and artificial lures, jigging, trolling,	Cod: Y, Sea trout: S, Salmon: S, Garfish: S,	Cod: MLS, VCR; Sea trout: MLS, BL, ^S , VCR; Salmon: MLS, BL, S ^o , VCR; Garfish: no;	Cod: A Sea trout: B Herring: A Salmon: D Garfish: C Mackerel: D	Cod: Partial; Sea trout: < Partial; Herring: Partial; Salmon: < Partial; Garfish: Partial; Mackerel: Partial	Cod: Medium; Sea trout: Low; Herring: Low; Salmon: Low; Garfish: None; Mackerel: None
		flounder	Natural baits	Flounder: Y	Flounder: MLS partial, VCR	Flounder: A	Flounder: Partial	Flounder: Low
		herring, mackerel	paternoster	Herring: S; Mackerel: S	Herring: no; Mackerel: no	Herring: A; Mackerel: D	Herring: Partial; Mackerel: Partial	Herring: Low; Mackerel: None
	Larger charter vessels	Cod,	Rod and line / Natural baits and artificial lures, jigging,	Cod: Y,	Cod: MLS, VCR;	Cod: A	Cod: Partial	Cod: Medium
		flounder	Natural baits	Flounder: Y	Flounder: MLS partial, VCR	Flounder: A	Flounder: Partial	Flounder: Low
		herring, mackerel	paternoster	Herring: S; Mackerel: S	Herring: no; Mackerel: no	Herring: A; Mackerel: D	Herring: Partial; Mackerel: Partial	Herring: Low; Mackerel: None
	Charter or guide boats	See private boats	See private boats	See private boats	See private boats	See private boats	See private boats	See private boats
	Belly or rubber boats	See private boats	See private boats	See private boats	See private boats	See private boats	See private boats	See private boats
	Outer coastal waters	Beaches	Cod, sea trout,	Rod and line / Natural baits and	Cod: Y; Sea trout: S;	Cod: MLS, VCR; Sea trout: MLS,	Cod: A;	Cod: Partial;

		garfish,	artificial lures, jigging,	Garfish: S	S ⁶ , VCR; Flounder: MLS partial, VCR; Garfish: no;	Sea trout: B; Garfish: B;	Sea trout: < Partial; Garfish: Partial	Sea trout: Low; Garfish: None
		flounder	Natural baits	Flounder: Y	Flounder: MLS partial, VCR	Flounder: A	Flounder: Partial	Flounder: Low
	Man- made struc- tures	Cod, sea trout, garfish,	Rod and line / Natural baits and artificial lures, jigging,	Cod: Y; Sea trout: S; Garfish: S	Cod: MLS, VCR; Sea trout: MLS, S ⁶ , VCR; Garfish: no;	Cod: A; Sea trout: B; Garfish: A	Cod: Partial; Sea trout: < Partial; Garfish: Partial	Cod: Medium; Sea trout: Low; Garfish: None
		flounder	Natural baits	Flounder: Y	Flounder: MLS partial, VCR	Flounder: A	Flounder: Partial	Flounder: Low
		herring, mackerel	paternoster	Herring: S; Mackerel: S	Herring: no; Mackerel: no	Herring: A; Mackerel: D	Herring: Partial; Mackerel: Partial	Herring: Low; Mackerel: None
Interior coastal waters	Private boats	Pike, Perch, Pikeperch, Garfish	Rod and line / Natural baits and artificial lures, jigging,	Pike: S; Perch: Y; Pikeperch: S; Garfish: S	Pike: MLS, S, VCR; Perch: MLS; Pikeperch: MLS, S, VCR; Garfish: no	Pike: A; Perch: A; Pikeperch: B; Garfish: B	Pike: N/A; Perch: N/A; Pikeperch: N/A; Garfish: N/A	Pike: no; Perch: no; Pikeperch: no; Garfish: no
		Herring	paternoster	Herring: S	Herring: no	Herring: A	Herring: Partial	Herring: Low
	Beaches	See private boats	See private boats	See private boats	See private boats	See private boats	See private boats	See private boats
	Man- made structures	See private boats	See private boats	See private boats	See private boats	See private boats	See private boats	See private boats
	Charter or guide boats	See private boats	See private boats	See private boats	See private boats	See private boats	See private boats	See private boats
	Belly- boat, rubber boat	See private boats	See private boats	See private boats	See private boats	See private boats	See private boats	See private boats

North Sea

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
Open sea (for fishing from boats and charter vessels)	Larger charter vessels	Cod	Rod and line / Natural baits and artificial lures, jigging,	Cod: Y	Cod: MLS, VCR	Cod: C	Cod: < partial	Cod: none
		Mackerel, Herring	paternoster	Mackerel: S; Herring: S	Mackerel: MLS; Herring: MLS	Mackerel: C; Herring: C	Mackerel: < partial; Herring: < partial	Mackerel: none; Herring: none
	Private boats	Cod, Sea trout	Rod and line / Natural baits and artificial lures, jigging, trolling,	Cod: Y; Sea trout: S	Cod: MLS, VCR; Sea trout: MLS, S ⁶	Cod: C; Sea trout: N/A	Cod: < partial; Sea trout: < partial	Cod: none; Sea trout: none
		Mackerel, Herring	paternoster	Mackerel: S; Herring: S	Mackerel: MLS; Herring: MLS	Mackerel: C; Herring: C	Mackerel: < partial; Herring: < partial	Mackerel: none; Herring: none
	Charter or guide boats	See private boats	See private boats	See private boats	See private boats	See private boats	See private boats	See private boats
Outside coastal waters (fishing from the beach)	Beaches	Plaice, Flounder, Sole	Rod and line / Natural baits	Plaice: Y; Flounder: Y; Sole: Y	Plaice: MLS; S; Flounder: MLS, S; Sole: MLS	Plaice: N/A; Flounder: N/A; Sole: N/A	Plaice: < partial; Flounder: < partial; Sole: < partial	Plaice: none; Flounder: none; Sole: none
		Sea bass, Garfish,	Rod and line / Natural baits and artificial lures, jigging,	Sea bass: S; Garfish: S	Sea bass: MLS; Garfish: No	Sea bass: C; Garfish: B	Sea bass: < partial; Garfish: < partial	Sea bass: none; Garfish: none
	Man-made	Plaice, Flounder,	Rod and line / Natural baits	Plaice: Y; Flounder: Y;	Plaice: MLS; S; Flounder: MLS, S;	Plaice: N/A; Flounder:	Plaice: < partial; Flounder: < partial;	Plaice: none; Flounder:

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
	structures	Sole		Sole: Y	Sole: MLS	N/A; Sole: N/A	Sole: < partial	none; Sole: none
		Sea bass, Garfish,	Rod and line / Natural baits and artificial lures, jigging,	Sea bass: S; Garfish: S	Sea bass: MLS; Garfish: No	Sea bass: C; Garfish: B	Sea bass: < partial; Garfish: < partial	Sea bass: none; Garfish: none
		Mackerel, Herring	paternoster	Mackerel: S; Herring: S	Mackerel: MLS; Herring: MLS	Mackerel: C; Herring: C	Mackerel: < partial; Herring: < partial	Mackerel: none; Herring: none
Wadden Sea	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tideways		Plaice, Flounder, Sole	Rod and line / Natural baits	Plaice: Y; Flounder: Y; Sole: Y	Plaice: MLS. S; Flounder: MLS, S; Sole: MLS	Plaice: N/A; Flounder: N/A; Sole: N/A	Plaice: < partial; Flounder: < partial; Sole: < partial	Plaice: none; Flounder: none; Sole: none
		Garfish,	Rod and line / Natural baits and artificial lures, jigging,	Garfish: S	Garfish: No	Garfish: B	Garfish: < partial	Garfish: none

¹ Y =Year-round fishery, S =Seasonal fishery (provide separate information on active months and peak periods); P = Pulse fishery (provide separate information to specify months when fishery is most likely to be present)

² MLS (=minimum landing size); BL (=bag limits); S (=closed seasons); A (= closed areas); P (=protected species regulations); VCR (= voluntary catch and release)

³ A: relatively large numbers; B: Intermediate; C: Relatively small numbers; D: very small numbers N/A: No information available.

⁴ Full (= fully accessible); Partial (= only partly accessible); <Partial (= less accessible than "Partial"); None (not accessible); N/A: no information

⁵ High (high level of statistical precision); Medium (medium level of statistical precision); Low (low level of statistical precision); None (no data or statistics available)

⁶... in the federal state of Schleswig-Holstein it is not allowed to land fishes in spawning colour

Table 2: Summary of national recreational fisheries: non-angling

Baltic Sea

Water body	Platform	Main species targeted	Gear used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for sampling ⁴	Robustness of Available Data/Statistics ⁵
Outer coastal waters	Private boats	Flounder, Herring, Cod, Sea trout	Gill net	Flounder: S Herring: S Cod: S Sea trout: S	Flounder: MLS partial, VCR; Herring: no; Cod: MLS; Sea trout: MLS, S ⁶ ;	Flounder: C; Herring: C; Cod: C; Sea trout: C	Flounder: < partial; Herring: < partial; Cod: < partial; Sea trout: < partial	Flounder: None; Herring: None; Cod: Low; Sea trout: None
		Cod, Eel	Longlines, eel pots (only eel), traps,	Cod: S; Eel: S	Cod: MLS; Eel: MLS	Cod: C; Eel: C	Cod: < partial; Eel: < partial	Cod: None; Eel: None
Interior coastal waters	Private boats	Pikeperch, Perch, Flounder	Gill net	Pikeperch: S; Perch: S; Flounder: S	Pikeperch: MLS, BL, S; Perch: MLS; Flounder: MLS partial	Pikeperch: C; Perch: C; Flounder: C	Pikeperch: < partial Perch: < partial Flounder: < partial	Pikeperch: None Perch: None Flounder: None
		Pikeperch, Eel	Longlines, eel pots (only eel), traps,	Pikeperch: S Eel: S	Pikeperch: MLS, BL, S Eel: MLS	Pikeperch: C Eel: C	Pikeperch: < partial Eel: < partial	Pikeperch: None Eel: None

North Sea

Water body	Platform	Main species targeted	Gear used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for sampling ⁴	Robustness of Available Data/Statistics ⁵
Open sea	Private boats	Plaice, Sole, Shrimp	Beam trawl	Plaice: S Sole: S Shrimp: S	Plaice: MLS, S Sole: MLS, Shrimp: none	Plaice: N/A Sole: N/A Shrimp: N/A	Plaice: < partial Sole: < partial Shrimp:	Plaice: None Sole: None Shrimp: None
		Eel	Trap	Eel: S	Eel: MLS	Eel: N/A	Eel: < partial	Eel: None
	Man-made structures	N/A	Dip-Net	N/A	N/A	N/A	N/A	None

¹ Y =Year-round fishery, S =Seasonal fishery (provide separate information on active months and peak periods); P = Pulse fishery (provide separate information to specify months when fishery is most likely to be present)

² MLS (=minimum landing size); BL (=bag limits); S (=closed seasons); A (= closed areas); P (=protected species regulations); VCR (= voluntary catch and release)

³ A: relatively large numbers; B: Intermediate; C: Relatively small numbers; D: very small numbers N/A: No information available.

⁴ Full (= fully accessible); Partial (= only partly accessible); <Partial (= less accessible than "Partial"); None (not accessible); N/A: no information

⁵ High (high level of statistical precision); Medium (medium level of statistical precision); Low (low level of statistical precision); None (no data or statistics available)

Table 3: National availability of lists and sampling frames for carrying out surveys of the general public to collect information on participation in different forms of recreational fishing.

Site	Type of lists	Sampling frames	Availability	
Off-site	Mailing-address directories	Postal household frame	partial	
		Registry-based angler frames	Recreational fishers licenses	partial
			Angler permits	partial
			Other angler registries	partial
		Registry based vessel operator frames	Vessel licenses	partial
			Other vessel registries	partial
	Telephone directories	Random-digit-dialing household frame	partial	
		Phonebook household frame	partial	
		Registry-based angler frames	Angler licences	none
			Angler permits	none
			Other angler registries	partial
		Registry based vessel operator frames	Vessel licenses	partial
			Vessel permits	none
	Other vessel registries		partial	
On-site	Site or access point lists (points of departure or return for fishing trips)	Public access sites	partial	
		Private access sites	none	

7.6 Ireland

7.6.1 General overview of national recreational fisheries

There is no mandatory requirement in Ireland to obtain a licence to undertake recreational fishing, with the exception of salmon and sea trout. Therefore, there is very little national data regarding recreational fisheries and their associated levels of participation. No attempt has been made to estimate the number of recreational fishing days per year to date.

The Central Fisheries Board along with seven other regional boards is responsible for the conservation, management, development and promotion of inland fisheries and sea angling in Ireland. Sea angling occurs on all coasts, however shore angling is most popular from Galway in the west around the south coast to Dublin in the east. Inshore angling from self drive boats up to 6 metres (20 feet) in length, traditionally based on the eastern and southern coasts, is the fastest growing branch of marine sport fishing in Ireland and is becoming more popular in other coastal areas. Offshore or deep sea angling is usually done from purpose built charter vessels of 9metres and over and consists of trolling, bottom fishing, wreck fishing, and drift fishing for shark.

Data is lacking on other non-angling methods/gear types used.

A number of species sampled under the Data Collection Regulation are caught by recreational fisheries using angling or non-angling gears i.e. Cod (*Gadus morhua*), Sea bass (*Dicentrarchus labrax*), Red gurnard (*Aspitrigla cuculus*), Grey gurnard (*Eutrigla gurnardus*),

Conger Eel (*Conger conger*), Ling (*Molva molva*), Pollack (*Pollachius pollachius*), Turbot (*Psetta maxima*), Blond ray (*Raja brachyuran*), Thornback ray (*Raja clavata*), Cuckoo ray (*Raja naevus*), other rays and skates, Salmon (*Salmo salar*), Mackerel (*Scomber scombrus*), Edible crab (*Cancer pagarus*), Lobster (*Homarus gammarus*), Crawfish (*Palinurus elephas*) and Spider crab (*Maja brachydactyla*).

In Ireland all vessels carrying passengers for reward are required by law to register with the Marine Survey Office (MSO) at the Department of Transport in relation to the safety of vessels at sea. This register includes information on the capacity of the vessels and combined with information from a voluntary logbook scheme for angling vessels undertaken by the Central Fisheries Board, this sector of recreational angling is being monitored. However, the data from the logbook scheme is currently being collated by the Central Fisheries Board and will not be available in time for this workshop.

In 2006 a pilot study was carried out by the Marine Institute in conjunction with the Central Fisheries Board on angler caught cod. Club participation was low and returns were poor. No report has been published from this study.

7.6.2 Detailed description of national recreational fisheries

7.6.2.1 Categories of recreational fishing

Recreational angling comprises of freshwater and sea angling from both the shore and boats. Currently non-commercial subsistence or leisure fishing (using various pots, traps, nets), hand gathering and spear fishing etc. does occur but there is no available data on this category and no efforts have been made to quantify the effort involved. There is a bye-law in place prohibiting taking shellfish while scuba diving.

7.6.2.2 Geographic delineations

n/a

7.6.2.3 Water bodies

Recreational angling takes place from the shore surrounding freshwater rivers or lakes, river estuaries and enclosed bays, sea loughs, lagoons, fjords and sounds. Angling from boats also occurs in these areas along with the open sea areas. The majority of non-angling recreational fisheries are likely to occur in river estuaries, enclosed bays, sea loughs, lagoons, fjords, sounds and within the inshore area (out to <20m depth).

Water body type	Ranking
Freshwater rivers or lakes	1 (anecdotal)
River estuaries	1 (anecdotal)
Enclosed bays, sea loughs, lagoons, fjords, sounds	1 (anecdotal)
Open sea: inshore (e.g. shore out to <20m depth)	2 (anecdotal)
Open sea: Offshore demersal (e.g. > 20m depth)	2 (anecdotal)
Open sea: Offshore pelagic and Oceanic	3 (anecdotal)
Other (specify)	N/A

7.6.2.4 Platforms for fishing

The only data available on shore based angling platforms would be localised for certain rivers and from tournaments where the local fisheries boards would be involved. The main category of boat used would be charter or guide boats.

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	1
Beaches	1
Rocky shorelines	1
Private boats	2
Rental boats	N/A
Charter or Guide boats (<i>for-hire boats where passengers pay as a group to hire the vessel and the services of the captain and crew in advance of the trip</i>)	2
Head, Party, or Open boats (<i>for-hire boats where passengers pay as individuals for space on the boat and can "walk on" just prior to the trip</i>)	N/A
Other boats	N/A
Other (specify)	

7.6.2.5 Target species or species groups

Overall boat angling would be the most likely platform used to target specific species, i.e. shark fishing. Otherwise species availability will be spatially and seasonally dependent. Fishermen do adapt fishing gear, bait, area, time of day to target species, however by-catch of species within the same locality with similar life-cycles is likely.

7.6.2.6 Fishing gears used

Gear type	Ranking
Rod and line, or hand-lines	1
Long-lines	N/A
Dip net or A-frame (push net?)	N/A
Cast net	N/A
Gill net	N/A
Seine	N/A
Trawl	N/A
Pot	2 (anecdotal)
Trap	N/A
Spear	3 (anecdotal)
Hand	2 (anecdotal)
Others (specify)	

7.6.2.7 Seasonality

Recreational fisheries in Ireland with the exception of inland shore based activities would be largely dependent on weather and holiday periods. Boat based fishing would also be dependent on the season, due to weather conditions. Certain fisheries would be seasonal due to the availability of the fish species.

7.6.2.8 Tournament fishing

In Ireland tournament fishing consists predominantly of angling and the tournaments are organized by localised and regional groups with a few national tournaments taking place. Due to the fact that the majority of tournaments are locally organized by specific clubs data on participation or catch is not readily available.

7.6.2.9 Management regulations and other schemes affecting recreational fisheries

REGULATIONS	MEASURE	LEGISLATIVE BODY	SPECIES
Season lengths or closed areas	15 th May - 15 th June	Ireland	Seabass
Bag Limit		Ireland	Salmon, Sea trout, Seabass
Size limit	MLS	EU	Cod, Sea bass, Conger Eel, Ling, Pollack, Mackerel, Lobster, Crawfish, Spider crab and Edible crab
	MLS	Ireland	Seabass, Spider crab
Fishing Effort	N/A		
Fishing license		Ireland	Salmon & Sea trout
Protected species	N/A		
Catch and release schemes			

7.6.3 Possible sampling frames

7.6.3.1 Area frames

Areas are defined by the seven regional fishery boards. Spatial distributions of fish species should be considered.

7.6.3.2 List frames (see Table 3)

7.6.4 Available statistics

Statistic	Data sets available, and where/how archived
Number of resident anglers	N/A
Number of visiting anglers	Partial (from charter vessel logbook scheme & tournaments)
Number of resident vessels	Department of Transport registered vessels
Number of visiting vessels	N/A
Fishing effort: Angler days	N/A
Fishing effort: Vessel days	Partial (from charter vessel logbook scheme)
Quantity of catch by species or species group, retained for consumption	Partial (from cod census forms)
Quantity of catch by species or species group, used for bait	N/A
Quantity of catch by species or species group, that is released	N/A
Other statistics (specify)	

7.6.5 Previous survey methods

DCR Pilot studies

The Marine Institute is undertaking a study in conjunction with the Central Fisheries Board on recreational charter vessels. A voluntary angler logbook scheme (catch rates, species composition, environmental condition, nationality of anglers) was set up in the early 1980s. In recent years approximately 80% of registered angling vessels around the coast of Ireland have taken part in this scheme. The data recorded to date is currently being collated and results should be available in late 2009. This scheme is ongoing providing up to date data on angler caught fish from charter vessels around the Irish coast.

Other studies

In 2003 a national survey was carried out on the water-based leisure activities of Ireland. The objective of the study was to provide a broad indication of participation levels in water-based leisure activities by Irish residents and the expenditures involved. Participation in freshwater and sea angling from both boat and shore were surveyed. It was found that 218,000 participated in angling; 74,100 in sea angling from the shore and 53,000 in sea angling from boats. Total number of overnight trips was also estimated during this survey. Sea anglers fishing from the shore were estimated to undertake 19,000 over-night trips per year and 20,300 trips from boats.

A study (2006) was initiated by the Marine Institute in conjunction with the Central Fisheries Board on angler caught cod. A census card (name of club/angler/boat, location of fishing, shore or boat fishing, catch effort, size of fish, number of counted fish during competitions, number of anglers fishing, etc.) was distributed by the Central Fisheries Board to various clubs and angling charter boats around Ireland. Data was collected in 2006 and 2007 however returns were poor for both years as participation in the study was low.

7.6.6 Primary Customers for the data, and intended uses

		Customers for data					
		European Commission	National government	Stock assessment scientists	Academic researchers	Fishing industry	General public
Type of data	1 Participation		A	A		A	A
	2 Fishing effort	A	A, B, C, D	A, B, C, D		A, C	A
	3 Total catch (retained/released) by species		A, B, C, D	A, B, C, D		A, B, C	A
	4 Catch per unit effort by species	A	A, B, C, D	A, B, C, D	A	A, B, C	A
	5 Size/age distribution of catch	A	A, B, C, D	A, B, C, D	A, C, D	A	A, C
	6 Socio-economic data		A			A	A
	Key species (give list)	Cod, seabass, salmon, other TAC species	Cod, seabass, salmon, other TAC species and shellfish	Cod, seabass, salmon, other TAC species and shellfish	All	Cod, salmon, other TAC species and shellfish	All

Key: A: General monitoring of trends; B: Stock assessment; C: Monitoring of annual statistics relative to annual management targets for specific species; D: In-season monitoring of cumulative statistics relative to annual management targets for specific species; E: other (specify)

Table 1: Summary of national recreational fisheries: angling

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
Estuaries and enclosed bays or sea loughs	Beaches	Bass, cod, rays, whiting, sea trout, mackerel, flounders, plaice, sole, salmon, grey mullet, eels, bream (black & gilthead)	Rod and line (bait or artificial lure)	S	MLS, (bass) BL, salmonids & bass (S), P	N/A	Partial	Low
	Man-made structures	Bass, flatfish, rays, cod, whiting, mackerel, conger eel	Rod and line (bait or artificial lure)	S	MLS, (bass) BL	N/A	Partial	Low – N/A
	Private / Charter/ for-hire boats	Cod, bass, rays, whiting, mackerel, tope, smoothhounds, bream (black and gilthead)	Rod and line; handlines (bait or artificial lure; trolling)	S	MLS (bass), VCR (tope)	C	Partial	Medium
Open sea: Inshore (e.g. shore to <20m depth):	Rocky shores	Pollack, mackerel, wrasse, bass, rays, conger eel, dogfish, small sharks, cod, black bream	Rod and line (bait or artificial lure)	S	MLS, VCR	N/A	<Partial (“<Partial” indicates less accessible than “Partial”)	Low – None
	Man-made structures	Bass, flatfish, rays, pollack, cod, whiting, mackerel, small sharks, conger eel, black bream	Rod and line (bait or artificial lure)	S	MLS, VCR	N/A	<Partial	Low - None

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
	Beaches	Bass, flatfish, rays, cod, whiting, small sharks, black bream	Rod and line (bait or artificial lure)	S	MLS, VCR	N/A	<Partial	Low - None
	Private /charter / for hire boats	Cod, pollack, whiting, conger eel, rays, flatfish, small sharks, small mixed demersal, bass, mackerel, black bream	Rod and line; handlines (bait or artificial lure; trolling)	S	MLS, VCR	C	<Partial	Medium
Open sea: Offshore demersal (e.g. 20m+ depth):	Private /charter / for hire boats	Cod, pollack, ling, whiting, conger eel, skates (rays?), small sharks (hounds), large flatfish (turbot), (black bream), monkfish	Rod and line (bait or artificial lure)	S	VCR (shark, monkfish)	C	Partial	Medium
Open sea: Offshore pelagic and Oceanic:	Charter / for hire boats	Large sharks, (tuna)	Rod and line (bait or lure)	S	MLS, VCR	C	<Partial	Medium

^{1,2,3,4,5}: See below Table 2 for codes to enter

Table 2: Summary of national recreational fisheries: non-angling

Water body	Platform	Main species targeted	Gear used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for sampling ⁴	Robustness of Available Data/Statistics ⁵
Estuaries and semi-enclosed bays or sea loughs	Beaches	Bass, cod, sea trout, salmon, grey mullet, sand eels, eels	Seine nets	S	MLS, S (salmonids), BL	N/A	<Partial	Low - None
		Cockles, mussels, periwinkles	Hand picking	S	MLS (cockles)	N/A	<Partial	None
	Beaches and rocky shores	Shrimps	Push or dip nets	S		N/A	<Partial	None
	Private boats	Bass, cod, sea trout, salmon, flatfish, grey mullet, eels	Various nets & traps	S	MLS	N/A	<Partial	None
Open sea: Inshore (e.g. shore to <20m depth):	Beaches	Bass, flatfish, grey mullet, sand eels	Seine nets	S	MLS, BL	N/A	<Partial	None
	Rocky shores	Prawns	Dip netting	S		N/A	<Partial	None
	Private boats	Crabs, lobsters	Pots and traps	S	MLS, BL	N/A	<Partial	Low - None
		Grey mullet, flatfish, rays, cod, gurnards, red mullet	Enmeshing nets	S	MLS	N/A	<Partial	None
		Cod, flatfish, rays, (bass)	Long lines	S	MLS	D	<Partial	None
		Shrimps	Shrimp trawl	S		D	<Partial	None
		Herring	Drift net	S	MLS	D	<Partial	None
Flatfish	Trawl	S	MLS	D	<Partial	None		

Footnotes:

¹ Y =Year-round fishery, S =Seasonal fishery (provide separate information on active months and peak periods); P = Pulse fishery (provide separate information to specify months when fishery is most likely to be present)

² MLS (=minimum landing size); BL (=bag limits); S (=closed seasons); A (= closed areas); P (=protected species regulations); VCR (= voluntary catch and release)

³ A: relatively large numbers; B: Intermediate; C: Relatively small numbers; D: very small numbers N/A: No information available .

⁴ Full (= fully accessible); Partial (= only partly accessible); <Partial (= less accessible than "Partial"); None (not accessible); N/A: no information

⁵ High (high level of statistical precision); Medium (medium level of statistical precision); Low (low level of statistical precision); None (no data or statistics available)

Table 3: National availability of lists and sampling frames for carrying out surveys of the general public to collect information on participation in different forms of recreational fishing.

Site	Type of lists	Sampling frames	Availability	
Off-site	Mailing-address directories	Postal household frame		
		Registry-based angler frames	Angler licences	none, except salmonids
			Angler permits	none
			Other angler registries	Partial e.g. angling clubs
		Registry based vessel operator frames	Vessel licenses	partial (charter vessel register)
			Vessel permits	none
			Other vessel registries	none
		Telephone directories	Random-digit-dialing household frame	partial
			Phonebook household frame	none
	Registry-based angler frames		Angler licences	none
			Angler permits	none
			Other angler registries	Partial (salmonid licences & angling clubs)
	Registry based vessel operator frames		Vessel licenses	partial (charter vessel register)
			Vessel permits	none
			Other vessel registries	none
On-site	Site or access point lists (points of departure or return for fishing trips)		Public access sites	Partial – information on angling websites & through fishery boards
		Private access sites	N/A	

7.7 Italy

7.7.1 General overview of national recreational fisheries

Sport fishing doesn't find an organic and homogeneous arrangement in the Italian domestic legal order in force. No complete law provides rules for this activity that, therefore, has fragmentary regulations full of gaps. The domestic law on the sport fishing is included in the wider context of fishing, which has its fundamental nucleus in the Law no. 963/1965 (*O. J.*, 14 August 1965, nr. 203). Article 7 of this establishes the distinction among the professional, scientific and sport fishing.

No provision enforces the fishing licence for those involved in sport fishing at sea: the Ministerial Decree of 26 July 1995 asks for the licence only to practise professional fishing.

A different legal framework is provided for bluefin tuna fishery; the Total Allowable Catch (TAC) of *Thunnus thynnus* within the Italian fishery is shared among longline, seine and recreational fishery, as well as *trap* and UNCL (quotas earmarked for possible compensations). The sport fishermen of bluefin tuna are required to register on a list of the Directorate-General of Fisheries and Aquaculture. According to the list a total of 1826 sport fishermen presented formal request to obtain a bluefin tuna catch quota. From the 1st May to the 30th September, their activity is restricted to a weekly total catch of one single tunny per vessel.

7.7.2 Detailed description of national recreational fisheries

7.7.2.1 Categories of recreational fishing

If we want to classify the different kinds of Italian recreational fishing, we can consider fishing by: nets (lift-net and cast-net), hooks and lines, long-lines and traps, underwater fishing. As approximate estimate recreational/sport fishermen in Italy are about 2 millions, including the occasionals: most of them are anglers. During summertime all categories are strongly present all along the coastline.

7.7.2.2 Geographic delineations

There are no important differences in recreational fisheries among the various Italian marine areas, neither for the number of fishermen nor for catch and effort evaluation.

7.7.2.3 Water bodies

All categories of recreational fisheries upon indicated are present along Italian seas. Recreational/sport fishing in freshwaters (rivers and lakes) are easily evaluated because they are regulated by specific annual licenses. The real data collection problem is related to recreational fishing at sea.

Water body type	Ranking
Freshwater rivers or lakes	1
River estuaries	2
Enclosed bays, sea loughs, lagoons, fiords, sounds	3
Open sea: inshore (e.g. shore out to <20m depth)	1
Open sea: Offshore demersal (e.g. >20m depth)	
Open sea: Offshore pelagic and Oceanic	3
Other (specify)	

7.7.2.4 Platforms for fishing

Most of the recreational fishing activities are conducted from beaches or from natural and man-made rocky structures. Quite important is the fishing from private boats, mainly used for drifting and towing lines and as base for underwater fishing.

For data collection is not so important to distinguish among different types of land-based angling or among different type of boats (excluding big-game).

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	1
Beaches	1
Rocky shorelines	3
Private boats	2
Rental boats	
Charter or Guide boats (<i>for-hire boats where passengers pay as a group to hire the vessel and the services of the captain and crew in advance of the trip</i>)	
Head, Party, or Open boats (<i>for-hire boats where passengers pay as individuals for space on the boat and can "walk on" just prior to the trip</i>)	4
Other boats	
Other (specify)	

7.7.2.5 Target species or species groups

Using some specific gears (hand picking and traps) target species are only a couple (mussel and clams, lobsters and prawns). In the big-game fishing target species are only large pelagics (tunas, mackerels, swordfish etc.) and sharks. Most of recreational/sport fishing in Italy is included in the situation described. All demersal inshore species are the target of angling fishing at sea.

7.7.2.6 Fishing gears used

In the following scheme are indicated the fishing gears mainly used by Italian recreational fisheries. It could be important to separate rod /hand line fishing into three categories: from shores (any kind), from boats inshore, and from boats offshore. They have quite different target species, with limited overlapping.

Gear type	Ranking
Rod and line, or hand-lines	1
Long-lines	2
Dip net or A-frame (push net?)	
Cast net	5
Gill net	
Seine	
Trawl	
Pot	
Trap	4
Lift net	3
Skin diving	1

7.7.2.7 Seasonality

The seasonality is referred only to fishing of large pelagics: some species are limited by rules (tuna) and all are regulated by the passage periods of target species. During the summertime the number of recreationals increases strongly. The total quantity of catches of all species increases as well.

7.7.2.8 Tournament fishing

Tournament fishing at sea are mainly linked with competitions organized by Associations of big-game, surfcasting, drifting or skin diving. Data from competitions are the only actually available for non-professional fishing.

7.7.2.9 Management regulations and other schemes affecting recreational fisheries

Regulations of season lengths or closed areas

Seasonal limits are present mainly in freshwater fishing. The only seasonal limits at sea are coming from international regulations:

Bluefin tuna	forbidden from 15 October to 15 June (according to ICCAT)
Swordfish	forbidden from 15 October to 30 November (according to ICCAT)
Lobster	forbidden from 1 January to 30 April
Spiny lobster	forbidden from 1 January to 30 April

Underwater fishing forbidden from sunset to dawn in any season

Area limits are defined for environmental protection or fisherman safety:

Forbidden in core zones of Marine Protected Areas

Less than 500 metres from professional fishing units

Underwater fishing: distance less than 500 metres from beaches
 distance less than 100 metres from professional fishing units
 distance less than 100 metres from anchored ships

Regulations of bag limits

Catch limits by law for recreational fisheries are the following:

Max 5 kg/fisherman/day or 1 specimen if heavier

Max 3 kg mussels /fisherman/day

Max 50 sea urchins/fisherman/day

Only 1 grouper/fisherman/day

Regulations of size limits

Minimum size limits (TL) in the Italian law are the following:

Atlantic bonito	25 cm
Little tunny	30 cm
Albacore tuna	40 cm
Swordfish	140 cm
Grey mullets	20 cm
Mussels	5 cm
Oysters	6 cm
Sea urchins	7 cm

Size limits are defined for all species included in Annex III reg. CE 1967/2006 (Mediterranean fisheries).

Catch of ovigenous female of lobsters and spiny lobsters are forbidden at any length (reg 1967/2996)

According to ICCAT regulations Bluefin tuna minimum size is 30 kg or 115 cm.

Regulations of fishing effort (e.g., numbers of traps, gill nets, etc.)

Italian law foresees for recreational fisheries the following permitted gears and limits:

Lift-net	6 metre/side
Cast-net	16 metre perimeter
Rod (max 3 hooks)	max 5/angler
Drift-line	max 6 hooks/line
Long-line	max 200 hooks/boat
Trap	max 2 traps/boat
Underwater fishing	no scuba, no light

Fishing license requirements

Italian law defines:

Sport fishing is all non-professional and non-scientific fishing activity.

Sport fishing is divided into agonistic and recreational fishing

Fishing is agonistic only during competitions organized by Associations and authorized by competent Authorities.

All other are recreational fishing.

Licenses

Fishing license required for inland waters (freshwaters and brackish waters)
 Non professional fishing at sea is regulated by law but don't require a license
 Only tuna fishing needs a specific registered permission
 Sport fishing is conducted in specific frame rules defined by each association

Protected species regulations

Regulation prohibits catches of protected species.

- Marine mammals
- Sea turtles
- Date mussels
- Corals

Voluntary catch-and-release schemes

Catch and release practice is voluntary for recreationals, compulsory in most of sport fishing competitions, fostered by many fishing associations.

7.7.3 Possible sampling frames

n/a

Available statistics

Statistic	Data sets available, and where/how archived
Number of resident anglers	
Number of visiting anglers	
Number of resident vessels	
Number of visiting vessels	
Fishing effort: Angler days	
Fishing effort: Vessel days	
Quantity of catch by species or species group, retained for consumption	
Quantity of catch by species or species group, used for bait	
Quantity of catch by species or species group, that is released	
Other statistics (specify)	

7.7.4 Current survey methods

Collection of data from recreational fisheries will cover bluefin tuna and eels

Recreational fisheries of bluefin tuna

Data collection on recreational and sport fisheries of bluefin tuna in 2009 and 2010 will follow the methodologies suggested by the pilot study previously carried out within the 2004 National Program. Applied methodologies will assure the estimate of total catches and total fleet, as well as biological information on length composition of catches.

The main basis of the data collection program is the overall census of recreational and sport fisheries that will cover all the Italian coast line and islands. The census will take place in the last two months of each year and it will require about 30 days of activity.

Tournaments of sport fishery will be monitored directly through collaboration with the national clubs (FIPSAS, EFSA, Big Game Italia) that are committed to providing all the data on the tournaments organised by them. Recreational and sport fisheries will also be monitored in one port for each coast side where this type of fishery is practised.

Logbooks will be distributed to local fishermen and direct controls will be carried out periodically in order to verify the reliability of log books.

Official declarations of blue fin tuna catches will also be monitored through an analysis of declarations delivered to the port authorities.

Recreational fisheries of eels

Information on recreational fisheries of eels is quite scarce at the moment. In 2009 a pilot study will be carried out to identify the importance of recreational fishery compared with the commercial one, as provided by EC Decision [paragraph B1 (metier related variable), 3 (sampling strategy), 3 (recreational fishery), b]. The pilot survey will also collect information on the general context of the eels recreational fisheries (marine or inland, fishermen population, types of fishing, seasonality). On the basis of the Italian management plan for eel recovery and on the results of the pilot survey of 2009, in 2010 a routine data collection will be set up.

Data quality

For the bluefin tuna population and sampling schemes are described in previous paragraph. As required by the regulation, data related to annual estimates of the catches in volumes will lead to a precision of level 1. Data on capacity will be collected exhaustively. Continuity and consistency of the series collected is assured by the methodology applied that will be the same as in previous programs. For the eels a pilot study will be implemented in 2009. A statistical survey will start in 2010 and only from this year precision levels will be calculated.

7.7.5 Primary Customers for the data, and intended uses

		Customers for data					
		European Commission	National government	Stock assessment scientists	Academic researchers	Fishing industry	General public
Type of data	1 Participation	A	A	A			
	2 Fishing effort	A	A	A			
	3 Total catch (retained/released) by species	A	A	A			
	4 Catch per unit effort by species						
	5 Size/age distribution of catch						
	6 Socio-economic data	A	A				
	Key species (give list)						

Key: A: General monitoring of trends; B: Stock assessment; C: Monitoring of annual statistics relative to annual management targets for specific species; D: In-season monitoring of cumulative statistics relative to annual management targets for specific species; E: other (specify)

Table 1: Summary of national recreational fisheries: angling

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
Estuaries and enclosed bays or sea loughs	Beaches	Bass, rays, sole, grey mullet, bream	Rod and line (bait or artificial lure)	Y	MLS BL	A	<Partial	none
	Man-made structures	Bass, flatfish, , conger eel bream	Rod and line (bait or artificial lure)	Y	MLS BL	A	<Partial	none
	Private / Charter/ for-hire boats	Bass, rays, sole, grey mullet, bream	Rod and line; handlines (bait or artificial lure; trolling)	Y	MLS BL	B	<Partial	none
Open sea: Inshore (e.g.shore to <20m depth):	Rocky shores	Bass, flatfish, , conger eel bream, grey mullet	Rod and line (bait or artificial lure)	Y	MLS, BL	B	<Partial	none
	Man-made structures	Bass, flatfish, , conger, bream, grey mullet	Rod and line (bait or artificial lure)	Y	MLS, BL	A	<Partial	none
	Beaches	Bass, flatfish, rays, bream, grey mullet, red mullet	Rod and line (bait or artificial lure)	Y	MLS, BL	A	<Partial	none
	Private /charter / for hire boats	conger, rays, flatfish, small mixed demersal, bass, bream	Rod and line; handlines (bait or artificial lure; trolling)	Y	MLS, BL	B	<Partial	None
Open sea: Offshore pelagic and Oceanic:	Charter / for hire boats	sharks, tunas, albacore, horse mackarel, swordfish	Rod and line (bait or lure)	S	MLS, VCR BL, P	C	<Partial	Medium

^{1,2,3,4,5}: See below Table 2 for codes to enter

Table 2: Summary of national recreational fisheries: non-angling

Water body	Platform	Main species targeted	Gear used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for sampling ⁴	Robustness of Available Data/Statistics ⁵
Estuaries and semi-enclosed bays or sea loughs	Beaches	Bass, , grey mullet, red mullet	cast nets	Y	MLS, BL	C	<Partial	none
		clams, mussels,	Hand picking,	S	MLS, BL	B	<Partial	None
	Private boats	Bass, grey mullet, bream	Long line	Y	MLS, BL	C	<Partial	None
Open sea: Inshore (e.g. shore to <20m depth):	Beaches	Bass, flatfish, grey mullet,	cast nets	Y	MLS, BL	C	<Partial	None
	Rocky shores	Prawns, lobsters	traps	Y	MLS. BL	C	<Partial	None
	Private boats	Cattlefish. octopus, lobsters	Pots and traps	S	MLS, BL	B	<Partial	none
		Bass, grey mullet, flatfish, rays, cod, gurnards, red mullet	Long lines	Y	MLS, BL	C	<Partial	None

Footnotes:

¹ Y =Year-round fishery, S =Seasonal fishery (provide separate information on active months and peak periods); P = Pulse fishery (provide separate information to specify months when fishery is most likely to be present)

² MLS (=minimum landing size); BL (=bag limits); S (=closed seasons); A (= closed areas); P (=protected species regulations); VCR (= voluntary catch and release)

³ A: relatively large numbers; B: Intermediate; C: Relatively small numbers; D: very small numbers N/A: No information available.

⁴ Full (= fully accessible); Partial (= only partly accessible); <Partial (= less accessible than "Partial"); None (not accessible); N/A: no information

⁵ High (high level of statistical precision); Medium (medium level of statistical precision); Low (low level of statistical precision); None (no data or statistics available)

Table 3: National availability of lists and sampling frames for carrying out surveys of the general public to collect information on participation in different forms of recreational fishing.

Site	Type of lists	Sampling frames	Availability	
Off-site	Mailing-address directories	Postal household frame		
		Registry-based angler frames	Angler licences	none
			Angler permits	none
			Other angler registries	none
		Registry based vessel operator frames	Vessel licenses	partial
			Vessel permits	none
			Other vessel registries	none
		Telephone directories	Random-digit-dialing household frame	partial
			Phonebook household frame	partial
	Registry-based angler frames		Angler licences	none
			Angler permits	none
			Other angler registries	partial
	Registry based vessel operator frames		Vessel licenses	none
			Vessel permits	none
Other vessel registries		none		
On-site	Site or access point lists (points of departure or return for fishing trips)	Public access sites	partial	
		Private access sites	none	

7.8 Latvia

7.8.1 General overview of national recreational fisheries

Latvia's fisheries legislation uses the following definitions:

Amateur fishing – angling and underwater hunting – activities performed for the purposes of recreation or sport in order to catch fish with angling equipment without the right to sell or place on the market fish acquired fishing; **Industrial fishing** – activities for the purpose of catching fish, utilising industrial fishing gear;

Commercial fishing – industrial fishing whereby a fisherman has the right to utilise a fishing limit (number, type of industrial fishing gear and volume of catch), which exceeds the limits specified for personal consumption specified in the relevant industrial fishing regulations, with the right to sell or place on the market fish acquired fishing; and

Fishing for personal consumption – industrial fishing whereby a fisherman has the right to utilise a fishing limit (number, type of industrial fishing gear and volume of catch), which is indicated in the relevant industrial fishing regulations without the right to sell or place on the market fish acquired fishing.

Latvia's legislation divides fisheries into following categories: industrial fishing and amateur fishing (angling and underwater hunting). A part of industrial fishing- fishing for

personal consumption (fisherman has the rights to use the industrial fishing gear without the rights to sell or place on the market fish acquired fishing)- belongs to recreational fisheries too.

Accordingly two main categories of recreational fishermen’s exist in all types of Latvia waters- anglers and fishermen fished for personal consumption (better explanation would be non- commercial).

The number of anglers in Latvia is evaluated from “anglers card” purchasers to be 100000- 120000. The Latvia Anglers association considers the number of anglers to be about 200000 or 4- 8% of the population.

The number of fishermen fishing for personal consumption can be evaluated from ICIS (country fisheries dbase). In total 832 leaseholders were registered in this data base in 2008.

In this report we will use the following terminology:

Angler- person using angling equipment (different kinds of rods) without the rights to sell or place on the market fish acquired fishing. Underwater hunters according to legislation belong to the category anglers.

Non- anglers or non- commercial fishermen- persons (fishermen) using the commercial fisheries gear (gillnets, fyke- nets, anchored bottom longlines) without the rights to sell or place on the market fish acquired from fishing.

Coastal waters- coastal waters up to 20m depth.

7.8.2 Detailed description of national recreational fisheries

Category	Area	Number of participants	Landings (t)
Anglers	Inland waters+ ICES sub.div. 26, 28 coastal waters	100000- 120000	Estimated to be about 4500 t~ approx.25% from this in coastal waters
Non- anglers	ICES sub.div. 26, 28 coastal waters	832	120

The share of angler’s catch is about 4500 t in inland and coastal waters together. In total catch of 120 t reported in non- commercial fisheries for personal consumption in coastal waters (ICES sub.div, 26 and 28). That put together about 6% from the total Latvia’s catch in Baltic Sea basin.

At present data collection from recreational fisheries is not include in National DCR.

Species reported in angler’s and non- commercial fisheries in coastal waters (by rank of importance)

Category	Target species	Other species
Anglers	Flounder, perch, herring	At least different 10
Non- anglers	Herring, flounder, perch, sea trout	31 fish species reported in logbooks all together

7.8.2.1 Categories of recreational fishing

The Latvia's legislation determines that:

Anglers use the angling tackle- different rods, spins, non- anglers- industrial fishing gears- nets, fyke- nets and anchored long- lines.

Angler's activities are managed by Regulations of Angling. Non- anglers are subject to regulations regarding Commercial Fishing in Inland Waters and regulations regarding Commercial Fishing in Territorial Waters and Economic Zone Waters. In Latvia underwater hunting and crayfish catching are also regulated by Regulations of Angling. Both categories have not rights to utilise the catch in market.

Angling is managed by catch- bag limit (daily limit), non- commercial fishing by effort-number (fyke- nets, trap- nets) or length (gill nets, trammelnets) of gear.

In general several groups of anglers and non- commercial fishermen would be defined regarding target species/gears used:

Anglers:

- i. Flounder angling from beaches/jetties- all year around angling of flounder by bottom road using natural bait- shrimp, meat of fish;
- ii. Herring angling from jetties- spring time spawning herring angling by road from jetties using artificial bait;
- iii. Perch angling in the gulf of Riga- summer angling by road from small private boats using natural bait, mostly worms.
- iv. Underwater hunting- no information available.

Non- commercial anglers- all year around fisheries targeting different species in different seasons. The target species depends from gear used and season:

- i. Herring and smelt fishing in early spring- spring using the small mesh size gillnets;
- ii. Mixed fisheries all around year using gillnets with mesh size >40 mm from knot to knot;
- iii. Eel and flounder fishing by bottom longlines using natural bait (summer months).

Category	Gear	Number of participants
Anglers	Different type roads	25000- 30000
Underwater hunters	Spearguns, scuba is not allowed	n.a.
Non- anglers	Gillnets, fyke- nets, bottom longlines	~800

7.8.2.2 Geographic delineations

There are some difference between catch composition in non- commercial fisheries operating in the coastal waters of Gulf of Riga (ICES sub. div.28.5) and Baltic Main Basin (ICES sub.div.28, 26).

Catch composition (in t) in non- commercial fisheries (year 2008)

Species	Sub.div.26	Sub.div.28 (Main Baltic)	Sub.div.28 (Gulf of Riga)
Burbot	0,03	0,05	0
Perch	0,23	1,07	6,83
Salmon	0,34	0,39	1,41
Flatfish	2,04	7,94	11,25
Herring	1,23	1	42,77
Whitefish	0,03	0,27	1,2
Seatrout	0,07	1,24	2,07
Pikeperch	0,06	0,06	1
Eel	0,03	0,01	0,14

Data on angler's catches is not available.

7.8.2.3 Water bodies

The largest number of anglers operate in the inland waters. Approximately a quarter of angling effort is carried out in coastal waters mainly inshore. Non- commercial fishermen operate in the coastal waters according to legislation- inshore in depths less than 20m.

Water body type	Ranking
Freshwater rivers or lakes	1
River estuaries	?
Enclosed bays, sea loughs, lagoons, fiords, sounds	
Open sea: inshore (e.g. shore out to <20m depth)	2
Open sea: Offshore demersal (e.g. > 20m depth)	Small scale, data na
Open sea: Offshore pelagic and Oceanic	
Other (specify)	

7.8.2.4 Platforms for fishing

The more popular types of angling are flatfish angling from the sandy beaches and jetties. Small row- boats or boats with outboard engine are used for perch angling in the Gulf of Riga. Non- anglers used different types of own boats for operating with tackle. Ice- fishing is carried out in the Gulf of Riga in separate winters and should be considered as a separate platform.

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	2
Beaches	1
Rocky shorelines	
Private boats	3
Rental boats	
Charter or Guide boats (<i>for-hire boats where passengers pay as a group to hire the vessel and the services of the captain and crew in advance of the trip</i>)	
Head, Party, or Open boats (<i>for-hire boats where passengers pay as individuals for space on the boat and can "walk on" just prior to the trip</i>)	
Other boats	
Other (specify)- ice fishing in the Gulf of Riga*	4

*- in medium hard and hard winters

7.8.2.5 Target species or species groups

Target species in angling and non- commercial fisheries in Latvia

ICES sub- div.	Geogr. area	Target species	Bycatch
28.5	Gulf of Riga	Single species- perch and herring	At least 6- 8 species
26, 28	Main Baltic	Flounder	At least 6- 8 species

7.8.2.6 Fishing gears used

Non- commercial fishermen use different types of professional gear. Anglers use different types of rods. Different natural baits are usually used- shrimp, worms, piece of fish meat.

Gear type	Ranking
Rod and line, or hand-lines (anglers)	1
Bottom long-lines (n- c fishermens)	4*
Dip net or A-frame (push net?)	
Cast net	
Gill net (n- c fishermens)	2
Seine	
Trawl	
Pot	
Trap	
Spear (underwater hunters)	?
Hand	
Fyke- net (n- c fishermens)	3

*- allowed only in coastal waters

7.8.2.7 Seasonality

In Latvia, ecological and climatic conditions result in seasonal angling and non- commercial fishing activities. Angling and non- commercial fishing is more active in spring and summer.

Seasonality of non- commercial fisheries in Latvia's coastal waters

Month	Catch (t)
1	0,8
2	1,5
3	4,4
4	9,8
5	34,2
6	25,7
7	14,1
8	7,0
9	14,3
10	1,9
11	2,4
12	3,8

Anglers data is not available, but probably variations of catch by season would be with same shape.

7.8.2.8 Tournament fishing

No significant tournament fishing occurs in coastal waters of Latvia.

7.8.2.9 Management regulations and other schemes affecting recreational fisheries

	Angling	Non- angling
<i>Regulations of season lengths or closed areas</i>	No	yes
<i>Regulations of bag limits</i>	yes	no
<i>Regulations of size limits</i>	yes	yes
<i>Regulations of fishing effort (e.g., numbers of traps, gill nets, etc.)</i>	Partially, number of hooks used in angling are regulated	Yes, limited by number of gear- only one gill net or 1 fyke- net or longline with 100 hooks allowed per person
<i>Fishing license requirements</i>	yes*	Yes, same as for commercial fishermens
<i>Protected species regulations</i>	yes	yes
<i>Voluntary catch-and-release schemes</i>	yes	yes

***- Anglers card is obligate**

Angling: Angling in Latvia is subject to a fee. Every person between 16- 65 must buy the "Anglers card". No closed areas and seasons for angling occur in the coastal waters. For most species, bag and size limits exist. A fishing license is obligatory in special places.

Non- commercial fishing: Effort is limited by number of gear and closed seasons. For most species size limits exist.

7.8.3 Possible sampling frames

In Latvia, sampling in non- commercial fisheries and angling is not planned because the share of recreational fisheries in Latvia is too small and does not achieve the DCR requirements.

7.8.4 Available statistics

Consistency of angler's data (effort, catch composition and other data) should be verified or used with care.

Statistic	Data sets available, and where/how archived
Number of resident anglers	Estimated
Number of visiting anglers	No
Number of resident vessels	Partially
Number of visiting vessels	No
Fishing effort: Angler days	Estimated
Fishing effort: Vessel days	No
Quantity of catch by species or species group, retained for consumption	Yes
Quantity of catch by species or species group, used for bait	No
Quantity of catch by species or species group, that is released	No
Other statistics (specify)	

7.8.5 Previous survey methods

There are no previous data on recreational fisheries.

Current methods

Anglers' activities were estimated by inquiry in 2007. Category "fisheries for personal consumption" was formulated in legislation from 2005, accordingly this category of Fishermen fishing for personal- consumption are registered in same way as commercial fishermen, and all daily catch and catch operations must filled in the monthly logbooks.

7.8.6 Primary Customers for the data, and intended uses

		Customers for data					
		European Commission	National government	Stock assessment scientists	Academic researchers	Fishing industry	General public
Type of data	1 Participation		A	B			
	2 Fishing effort		A	B			
	3 Total catch (retained/released) by species		A,C	A			A
	4 Catch per unit effort by species		A	A			
	5 Size/age distribution of catch		A	B			A
	6 Socio-economic data		A				
	Key species (give list)		Flatfish, perch, cod, herring	Flatfish, perch, cod, herring			Flatfish, perch, cod, herring

For each relevant cell in rows 1 – 6, enter one or more of the following codes to indicate how the statistics are, or would be, used to support the needs of the primary customers:

- A: General monitoring of trends
- B: Stock assessment
- C: Monitoring of annual statistics relative to annual management targets for specific species
- D: In-season monitoring of cumulative statistics relative to annual management targets for specific species
- E: Other (specify)

Table 1: Summary of national recreational fisheries: angling

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
Open sea: Inshore (e.g. shore to <20m depth):	Beaches	Flounder	Rod and line- mostly bait	Y, S	MLS, BL	A	N/A	L
	Man-made structures	Flounder, herring	Rod and line (bait or artificial lure)	Y, S	MLS, BL	A	N/A	L
	Private boats	Perch	Rod and line; (bait or artificial lure)	S	MLS, BL	A	N/A	L

^{1,2,3,4,5}: See below Table 2 for codes to enter

Table 2: Summary of national recreational fisheries: non-angling

Water body	Platform	Main species targeted	Gear used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for sampling ⁴	Robustness of Available Data/Statistics ⁵
	Private boats	Herring	Gillnets	S	Include in total TAC system, MLS	A	N/A	Medium
		Flounder, perch, pikeperch, sea trout	Gillnets	S	MLS, S, A, P	A	N/A	Medium
		Flounder, eel	Long lines	S	MLS, A	B	N/A	Medium

¹ Y =Year-round fishery, S =Seasonal fishery (provide separate information on active months and peak periods); P = Pulse fishery (provide separate information to specify months when fishery is most likely to be present)

² MLS (=minimum landing size); BL (=bag limits); S (=closed seasons); A (= closed areas); P (=protected species regulations); VCR (= voluntary catch and release)

³ A: relatively large numbers; B: Intermediate; C: Relatively small numbers; D: very small numbers N/A: No information available.

⁴ Full (= fully accessible); Partial (= only partly accessible); <Partial (= less accessible than "Partial"); None (not accessible); N/A: no information

⁵ High (high level of statistical precision); Medium (medium level of statistical precision); Low (low level of statistical precision); None (no data or statistics available)

Table 3: National availability of lists and sampling frames for carrying out surveys of the general public to collect information on participation in different forms of recreational fishing.

Site	Type of lists	Sampling frames	Availability	
Off-site	Mailing-address directories	Postal household frame		
		Registry-based angler frames	Angler licences	none
			Angler permits	none
			Other angler registries	partial
		Registry based vessel operator frames	Vessel licenses	partial
			Vessel permits	partial
			Other vessel registries	partial
		Telephone directories	Random-digit-dialing household frame	none
			Phonebook household frame	none
	Registry-based angler frames		Angler licences	none
			Angler permits	none
			Other angler registries	partial
	Registry based vessel operator frames		Vessel licenses	partial
			Vessel permits	none
Other vessel registries			none	
On-site	Site or access point lists (points of departure or return for fishing trips)		Public access sites	partial
		Private access sites	Sea coast is public in Latvia	

7.9 Lithuania

7.9.1 General overview of Lithuanian recreational fisheries in Baltic sea.

Target species for recreational or leisure fishery in Lithuanian exclusive economic zone is cod and Baltic herring. Cod fishery with rod and line has been developing very rapidly for approximately 6 recent years. That is confirmed by the data on number of vessels exploited in recreational fishing and the number of anglers participating in cod at sea angling trips. According to very preliminary estimation number of cod anglers in Lithuania has increased from 12 100 in 2006 until 22 400 in 2008. Catches increased from 36 t until 88 t respectively. Pilot study was prepared and submitted to SGRN in 2006.

Recreational fishing for salmon takes place in freshwater rivers but open sea angling in Lithuanian waters does not occur. We do not have any registered data about eel recreational fishery in the sea.

Baltic herring recreational fishery from sea gate mole in April and May is very attractive but we think that data collecting is not easy.

7.9.2 Detailed description of national recreational fisheries

7.9.2.1 Categories of recreational fishing

Cod recreational fishing is mainly carried out by anglers in open sea offshore waters (>20m) angling with fishing rods equipped with artificial lure aboard of head/charter boats. It is well known however, that head boats are more frequently used. These boats can accommodate not more than 12 anglers Also very popular and particularly in summer season cod angling in open sea near-shore waters (<20m) conducted by small boats without board engines with 2-3 anglers aboard. We not have any data about other fishing methods for recreational cod fishery.

In the open sea recreational fishing in Lithuania cod is the only target species. It is relatively easy fished on the bottom, even by non-experienced angler.

The only fishing gear used is fishing rod equipped with artificial bait (pilker).

Cod recreational fishing is conducted all year-round with peak of activity between May-October. Cod near-shore angling season conducted with small boats is much shorter due to safety reasons (June-August). In terms of the days of the week, weekend is most popular.

We do not have an obligation to discard cod smaller than 38 cm in recreational fishery, the only regulation we use - bag limit – 7,5 kg per day. No seasonal restrictions are applied for recreational fishing for cod

Not special fishing licenses are required.

7.9.3 List frames

It is not a requirement to be a member of any angling club or association.

There is association of vessels for chartering. In these vessels captain has special book where anglers must write name, family name, home address and signature for responsibility of safety behaviour in vessel during recreational fishery trip.

7.9.4 Available statistics

Statistic	Data sets available, and where/how archived
Number of resident anglers	Not
Number of visiting anglers	
Number of resident vessels	Number of vessels are available from Maritime Offices but not separately for resident and visiting vessels.
Number of visiting vessels	
Fishing effort: Angler days	Data available from charter vessels
Fishing effort: Vessel days	Data available from charter vessels.
Quantity of catch by species or species group, retained for consumption	NA
Quantity of catch by species or species group, used for bait	None
Quantity of catch by species or species group, that is released	NA
Other statistics (specify)	

Data on number of small boats without board engines for two or three anglers not collected. Only it was estimated that sometimes, exceptionally in summer season number of small boats can reach 60 units in all coastal zone of Lithuania.

Data (length and weight of each fish caught) was collected by optional sampling on board of charter vessels in harbour after returning from recreational fishing trip.

Table 1: Summary of Lithuanian recreational fisheries:

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
Open sea: Inshore (e.g. shore to <20m depth):	Man-made structures Mole	Baltic herring	Rod and line (bait or artificial lure)	S	BL (10 kg)	A	Partial	Medium
Open sea: Offshore demersal (e.g. 20m+ depth):	Private /charter / for hire boats	Cod,	Rod and line (bait or artificial lure)	Y	BL (6,5 kg)	A 2006 -12100 2007 - 16600 2008 - 22400	<Partial	Medium 2006 - 36 t 2007 - 54 t 2008 - 88 t

¹ Y =Year-round fishery, S =Seasonal fishery (provide separate information on active months and peak periods); P = Pulse fishery (provide separate information to specify months when fishery is most likely to be present)

² MLS (=minimum landing size); BL (=bag limits); S (=closed seasons); A (= closed areas); P (=protected species regulations); VCR (= voluntary catch and release)

³ A: relatively large numbers; B: Intermediate; C: Relatively small numbers; D: very small numbers N/A: No information available

⁴ Full (= fully accessible); Partial (= only partly accessible); <Partial (= less accessible than "Partial"); None (not accessible); N/A: no information

⁵ High (high level of statistical precision); Medium (medium level of statistical precision); Low (low level of statistical precision); None (no data or statistics available)

7.10 Netherlands

7.10.1 General overview of national recreational fisheries

Information on the number of persons angling at sea in the Netherlands was obtained from a study by TNS NIPO in 2003 (4.673 households questioned), 2004 (11.540 households questioned) and 2006 (~30.000), conducted for the Dutch anglers organization “Sportvisserij Nederland” (NIPO 2003, 2004b; NIPO 2006 in Vriese et al., 2007). TNS NIPO estimated a total of 425.000 and 450.000 anglers fishing at sea for all species combined in 2003 and 2004 respectively, while for 2006 a total of 650.000 anglers fished at sea. No estimates were available for anglers targeting different species.

For non angling recreational fisheries, a licence is needed for some areas along the Dutch coast (Waddensea, Eems, Dollard, Oosterschelde, Westerschelde) to fish with nets and fykes on a recreational basis. However for the Dutch coast between Den Helder and The Hague, no license is needed. Data on the number of fishers are not available for this area. In the Waddensea, Eems and Dollard there were 436 licenses in 2007, while in the Delta (including Oosterschelde and Westerschelde) there were 563 licenses. About 80% of the licenses are used (Jansen et al., 2008).

7.10.2 Detailed description of national recreational fisheries

7.10.2.1 Categories of recreational fishing

7.10.2.2 Geographic delineations

None

7.10.2.3 Water bodies

Water body type	Ranking
Freshwater rivers or lakes	1
River estuaries	1
Open sea: inshore (e.g. shore out to <20m depth)	2
Open sea: Offshore demersal (e.g. > 20m depth)	3

7.10.2.4 Platforms for fishing

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	1
Beaches	2
Rocky shorelines	4
Private boats	3
Rental boats	1
Charter or Guide boats (<i>for-hire boats where passengers pay as a group to hire the vessel and the services of the captain and crew in advance of the trip</i>)	4

7.10.2.5 Target species or species groups

Roundfish (cod, whiting). A popular method for catching cod is fishing near ship wrecks from either commercial or small vessels with pilkers or paternosters baited with e.g. worms or pieces of fish which are jigged from the bottom. Whiting can be caught as by-catch. From the shore, cod and whiting are caught with a more passive way of angling. A paternoster or a side line connected to the main line is connected to a piece of (anchored) lead, which is used for casting and keeping the bait to the bottom. The paternosters and side lines can be rigged in multiple different ways, depending on the preference of the angler.

Flatfish (sole, plaice, dab, flounder). Flatfish is fished for from the shore (beach) or from boats near shore. A lead weight with a paternoster or with one or multiple side lines, baited with lugworms or other worms, is usually used.

Schooling fish (mackerel, herring). Mackerel are fished for from commercial vessels or can be caught from shore during the summer, while fishing for herring is more during spring. Usually a paternoster with 3 to 6/7 hooks are used, which are rigged with white or coloured feathers for mackerel (Figure 2.5, left) or shiny plastic strips or reflective nylon threads for herring (Figure 2.5, right). Because mackerel and herring live in large schools, catches of several fish during one cast usually occur.

Sea bass. Sea bass are targeted from the shore (piers) or from boats using different kinds of lures such as small swim- or crankbaits, surface lures, spoons or soft baits such as shads. They can also be targeted using a float and a hook baited with e.g. crab, or using a lead weight and a side line with a baited hook.

Mullet. Mulletts can be found around structure such as piers or weirs and are usually targeted from the shore, using a float and a hook baited with e.g. bread, shrimps or worms. Also a floating piece a bread is used.

Garfish. Garfish is usually swimming below the surface and are targeted with e.g. small spoons, but also with small trips of fish on a hook, which is connected to a special float. This float has a weight on the bottom and is constructed for casting.

Salmonids (salmon and sea-trout). Salmonids are usually bycatch species in both salt and fresh water angling for e.g. sea bass in salt water or pike and pikeperch in fresh water. However in some areas they can be targeted directly.

Eel. In salt water, eel is usually a bycatch species but are targeted in some areas. Usually a lead weight with one or multiple side lines, baited with lugworms, other worms or small species of fish is usually used. In fresh water, eel is targeted using a lead weight with a side line, baited with worms, cheese or small pieces of fish.

7.10.2.6 Fishing gears used

Gear type	Ranking
Rod and line, or hand-lines	1
Sniggling	4
Fykes	2
Gill net	2
Long-lines	3

7.10.2.7 Seasonality

N/A

7.10.2.8 Tournament fishing

Unknown

7.10.2.9 Management regulations and other schemes affecting recreational fisheries

For angling at sea, there is no license system. There is a minimum landing size for most species, but no bag limit.

For non angling recreational fisheries, a licence is needed for some areas along the Dutch coast (Waddensea, Eems, Dollard, Oosterschelde, Westerschelde) to fish with nets and fykes on a recreational basis. However for the Dutch coast between Den Helder and The Hague, no license is needed. Data on the number of fishers are not available for this area. In the Waddensea, Eems and Dollard there were 436 licenses in 2007, while in the Delta (including Oosterschelde and Westerschelde) there were 563 licenses. About 80% of the licenses are used (Jansen et al., 2008). In the Waddensea about 41% of the fishers use fykes (fuiken), 50% use gillnets (staand want) and 9% longline (hoekwant), while in the Delta 70% use fykes, 26% use gillnets and 4% use longline. Most fykes are set for one tide, most gill nets and long lines for one day.

Fykes (fuiken). A fyke exist of two or more rings (in coastal areas restricted to a maximum diameter of 75 cm) with one or two wings (coastal areas restricted to 15 m wide and a maximum height of 75 cm). The first ring must have a net of maximum 14 cm mesh to protect seals and birds from drowning. In the Dutch coastal waters where fykes are allowed (Westerschelde, Oosterschelde, Waddenzee, Eems, Dollard), a maximum of two fykes are allowed.

Gillnets (staand want). A gillnet is a net with a weighted bottom line and a top line with floats, and a single or multifilament net between these lines, which is not moved by man power or tidal power. In the Dutch coastal waters where staand want is allowed (Westerschelde, Waddenzee, Eems), the maximum length is 30 meter.

Longline (hoekwant). A "hoekwant" is a long main line with side lines with baited hooks. A "hoekwant" is usually set for one tide. In the Dutch coastal waters where a hoekwant is allowed (Westerschelde, Oosterschelde, Waddenzee, Eems), the maximum length is 30 meter.

7.10.3 Possible sampling frames

7.10.3.1 Area frames

7.10.3.2 List frames

Since there is no license system for angling at sea, questionnaires (with possible high bias) or a random telephone household frame could be used. For other recreational angling, some licenses are obliged, but not for all areas. See also chapter 2.9 and table 3. Direct interviewing can take place all along the Dutch coast.

7.10.4 Available statistics

Statistic	Data sets available, and where/how archived
Number of resident anglers	TNS NIPO, questionnaire
Number of visiting anglers	-
Number of resident vessels	-
Number of visiting vessels	-
Fishing effort: Angler days	TNS NIPO, questionnaire
Fishing effort: Vessel days	-
Quantity of catch by species or species group, retained for consumption	Partially (see 4.1.2)
Quantity of catch by species or species group, used for bait	-
Quantity of catch by species or species group, that is released	Partially (see 4.1.2)
Other statistics (specify)	-

7.10.5 Previous survey methods

7.10.5.1 Current methods

None

7.10.5.2 Previous methods

In 2006 and 2007, a pilot survey was carried out for the catches of cod by recreational fisheries in the Netherlands (Van Keeken et al., 2006; Van Keeken et al., 2007) through an internet questionnaire.

An estimate on eel catches in the Netherlands was made for recreational fishermen (Vriese et al., 2007) and commercial fishermen (Dekker et al., 2008). The estimates by recreational fishermen were based on questionnaires.

An inventory on data available on the bycatches of salmonids in the Dutch fisheries was made by Jansen et al. (2008), which included estimates of catches of salmon and sea trout in recreational fisheries. Both estimates of salmon catches for anglers and fishers with fykes and gillnets were retrieved through questionnaires.

Dekker, W., C. Deerenberg & H. Jansen. 2008. Duurzaam beheer van de aal in Nederland: onderbouwing van een beheersplan. Wageningen IMARES Rapport C041/08. Pp. 99.

Jansen, H.M., H.V. Winter, I. Tulp, T. Bult, R. Van Hal, J. Bosveld & R. Vonk. 2008. Bijvangst van salmoniden en overige trekvis vanuit een populatieperspectief. Wageningen IMARES Rapport C039/08. Pp. 55.

Van Keeken, O., A. Dijkman Dulkes & P. Groot. 2006. Resultaten vragenlijst recreatieve kabeljauwvisserij. Wageningen IMARES report C045/06. Pp. 18.

Van Keeken, O., A. Dijkman Dulkes & P. Groot. 2007. Pilot study: Catches of North Sea cod by recreational fishermen in the Netherlands. CVO report 07.002. Pp. 28.

Vriese, F.T., J. Klein Breteler (VIVION), M.J. Kroes & I.L.Y. Spierts. 2007. Beheer van de aal in Nederland. Bouwstenen voor een beheersplan. Visadvies Rapport VA2007_01. Pp. 174.

Table 1: National availability of lists and sampling frames for carrying out surveys of the general public to collect information on participation in different forms of recreational fishing.

Site	Type of lists	Sampling frames	Availability	
Off-site	Mailing-address directories	Postal household frame	-	
		Registry-based angler frames	Angler licences	NA
			Angler permits	NA
			Other angler registries	partial
		Registry based vessel operator frames	Vessel licenses	Partial
			Vessel permits	None
			Other vessel registries	Partial
		Telephone directories	Random-digit-dialing household frame	None
			Phonebook household frame	None
	Registry-based angler frames		Angler licences	None
			Angler permits	None
			Other angler registries	None
	Registry based vessel operator frames		Vessel licenses	None
			Vessel permits	None
Other vessel registries		None		
On-site	Site or access point lists (points of departure or return for fishing trips)	Public access sites	Partial	
		Private access sites	None	

7.11 Norway

7.11.1 General overview of national recreational fisheries

Recreational fishing is a popular in Norway. A phone survey from 2003 indicates that 42 % of the population over 15 years of age fished in the sea that year. In addition an unknown number of overseas tourists visit Norway to go fishing every year. Fishing effort is dominated by Rod and reel, and hand lines. However, over 10 % of the respondent in the 2003 phone survey answered that they fished with gill net, traps, pots and long lines. These gears may account for a substantial portion of the catch of cod and other demersal species. Cod, mackerel and haddock dominate the reported catches. Even though recreational fishing is a very popular activity in Norway, and it is expected that this sector might have a significant impact on the coastal cod populations, no studies are undertaken except the above mentioned phone survey from 2003. There is a need to develop reliable survey methods to increase the knowledge of recreational fishing in order to give sound scientific advice. The Institute of Marine Research is now conducting a few studies aiming at providing estimates of catch and effort in the tourist fishing and recreational fisheries. However, much work is needed to develop methods to obtain reliable data on catch and effort in the recreational fishery in Norwegian coastal waters.

7.11.2 Detailed description of national recreational fisheries

7.11.2.1 Categories of recreational fishing

We can divide recreational fishing into following groups:

- Tourist fishers
 - Residents
 - Non-residents
- Anglers/sport fishers
 - Boat
 - Land
- Standing gear (only residents)
 - For personal consumption
 - For sale
- Diving, spear fishing
- Hand gathering

7.11.2.2 Geographic delineations

n/a

7.11.2.3 Water bodies

The information on catches and effort in recreational fisheries in Norway is limited, but data from some prior studies and from commercial fisheries show regional differences in fishing effort and species composition of the catches. For cod there are several sub-populations, and the coastal cod have an unknown number of subpopulations differing in life history traits.

Preliminary data from a tourist fishing survey conducted by IMR and former phone surveys indicate that catch per unit effort decreases from north to south, where Northern Norway has the highest CPUE and Skagerrak has the lowest CPUE. A high proportion of the recreational fisheries in Norway are conducted from private boats. Recreational fishing boats mainly operate in fjords, inshore and offshore. Fishing from charterboats or from the shore is considered to account for a smaller component of the catches.

Water body type	Ranking
Freshwater rivers or lakes	2
River estuaries	5
Enclosed bays, sea loughs, lagoons, fiords, sounds	1
Open sea: inshore (Inside the outer skerries)	1
Open sea: Offshore demersal (e.g. Open ocean, outside outer skerries)	3
Open sea: Offshore pelagic and Oceanic	4
Other (specify)	

7.11.2.4 Platforms for fishing

The list is based on phone survey and professional judgment by the reporters

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	4
Beaches	6
Rocky shorelines	2
Private boats	1
Rental boats	3
Charter or Guide boats (<i>for-hire boats where passengers pay as a group to hire the vessel and the services of the captain and crew in advance of the trip</i>)	5
Head, Party, or Open boats (<i>for-hire boats where passengers pay as individuals for space on the boat and can "walk on" just prior to the trip</i>)	-
Other boats	-
Other (specify)	

NB: These data are partially based on a phone survey from 2003, and the reporters' personal experience

There is no need to distinguish between shore fishing from man-made structures and shore fishing from natural shorelines when establishing sampling strata or estimation domains. Is it important to distinguish between different types of boat angling defined by size/capacity of boat, experience of crew, and capability of passengers? Experience level should be investigated and accounted for. Boats are used differently, where some types of boats are more often used for fishing than others. A pilot survey should investigate types of boats used for fishing.

Few large marinas exist in Norway. Trailer boats are seldom used. Boats are scattered around on private properties and smaller marinas in combination with a few larger marinas. There is a difference between tourist fishing and regular recreational fishing. Tourist fishing is more often localized to marinas and/or fish camps.

7.11.2.5 Target species or species groups

Cod is the most important target species in recreational fishing. In western Norway ling and tusk is targeted by many recreational fishers. Sea trout and sea bass are often directly targeted in southern Norway, and specialised fishing for halibut and wolffish occurs in some areas. Pelagic hand line fishing for mackerel is common in southern Norway.

7.11.2.6 Fishing gears used

Used of different gears were investigated by Hallentvedt and Wullf (2003):

Rod: Approx. 65 % of fishers

Handline: Approx. 40 % of fishers

Gillnet: Approx. 10 % of fishers

Longline: Approx. 4 % of fishers

Pots and traps: Approx. 2 % of fishers

Tourist fishers (non-resident) are only allowed to use rod and hand line

Gear type	Ranking
Rod and line, or hand-lines	1
Long-lines	3
Dip net or A-frame (push net?)	
Cast net	
Gill net	2
Seine	
Trawl	
Pot	2
Trap	2
Spear	4
Hand	5
Others (specify)	

It is important to separate gill nets and traps in the when estimating CPUE. Pots are often used in fishing for crayfish (Norway lobster), crabs, and European lobster. Gill nets and traps catch crabs, European lobster (illegal) and a diversity of fish species. The lack of data in Norwegian recreational fisheries is immense. Main aim should be to define categories of 1. Rod/hand line, 2. Gill nets, 3. Lobster pots, 4. Regular pots, 5. Norwegian lobster pots, 5. Long lines, 6. Eel pots, 7. Cod traps.

7.11.2.7 Seasonality

The recreational fishing effort is highest in the summer months (May- August). However, recreational fishing occurs year round. Lobster is the only species that is regulated through season (Oct-Nov). Tourist fishing has the highest activity level from April to September. It is a lack of data regarding seasonality of fishing activity.

7.11.2.8 Tournament fishing

Catch per Unit Effort in tournament fishing decreases from north to south. In Finnmark county it was estimated that mean catch per person per hour were 31,8 kilo (ref.), while in the Oslo fjord the CPUE were 0,6. The competitions differ in rules, where some competitions are based on size of catch while others are based on number of species (and their size) etc.

7.11.2.9 Management regulations and other schemes affecting recreational fisheries

Given in Tables 1 & 2

7.11.3 Possible sampling frames

Boat ramp and marina surveys have limited use in Norway since the boats are widely dispersed along the coast, often located on private properties and smaller marinas, and since access to the sea generally is unlimited. In 2008, on-site roving surveys (boat to boat interviews) were tested out in southern Norway interviewing fishers while they were fishing. The interviews were successful, where the interviewer was able to measure the fish caught and interview about time of fishing, gear etc. However, as a national strategy this might be difficult. The study area has a relatively high population density with short distance between fishers. In other parts of the country, the distance between recreational

fishing boats are expected to be longer and more costly and time consuming to conduct interviews. A new project is in the planning and funding stage, aiming to get access to the recreational boat register in order to collaborate with recreational fishers to get CPUE data. Phone surveys should be used to gather effort data. Internet report has been successful for salmon fishing in rivers (including SMS-reports). This is mandatory for fishing in rivers. Internet and SMS reports should be tested out in marine fisheries as well as part of a pilot study. Reporting by business owners through internet portal in the tourist fishery has been tested out, but reporting rates were very low. Basically, envelopes with pre paid stamps showed to be more efficient.

7.11.3.1 Area frames

Area frames is probably not the appropriate method for recreational fishing surveys on a national scale for most sectors, but could be useful for sampling tourist fishers that rent private accommodation, or that stay in tents or vans. Area frames may also be used on smaller scale as part of a dual frame survey.

7.11.3.2 List frames

Table 3

7.11.4 Available statistics

Statistic	Data sets available, and where/how archived
Number of resident anglers	Phone survey 2003, Hallenstvedt and Wullf, Norwegian Fisheries College/University of Tromsø. In Norwegian Statistics Norway. Some published at www.ssb.no
Number of visiting anglers	Hallenstvedt and Wullf http://home.samf.norut.no/frank/Fisketurisme/relevante%20dokumenter/TuristfiskeinntektCapGemini%202003%20oktober.pdf
Number of resident vessels	Volunteer register for recreational vessels: www.redningsselskapet.no/sbr
Number of visiting vessels	None
Fishing effort: Angler days	Phone survey 2003, Hallenstvedt and Wullf, Norwegian Fisheries College/University of Tromsø. In Norwegian
Fishing effort: Vessel days	None
Quantity of catch by species or species group, retained for consumption	Phone survey 2003, Hallenstvedt and Wullf, Norwegian Fisheries College/University of Tromsø. In Norwegian
Quantity of catch by species or species group, used for bait	None
Quantity of catch by species or species group, that is released	None
Other statistics (specify)	Lobster catches in recreational fisheries (unpublished) CPUE for a smaller region of Norway (unpublished) CPUE tourist fishing (unpublished) All these are studies which are undertaken at the moment by IMR

7.11.5 Previous survey methods

7.11.5.1 Current methods

IMR is now conducting three studies aiming at a higher accuracy than previous studies.

- i) Tourist fishing: Collaboration with 400 tourist fishing destinations collecting CPUE and E data. Probability based sampling of businesses and time periods combined with catch diaries (self-reporting)
- ii) Recreational fishing for lobster: Transect studies undertaken to count buoys (Effort estimates). Recreational fishers in a voluntarily program writing catch diaries (CPUE). Covering 170 km coastline of southern Norway
- iii) Estimating CPUE in recreational fisheries by boat and phone interviews covering a 100 km coastline in southern Norway. Roving survey boat to boat interview. Demographic, activity and biological data sampling.

7.11.5.2 Previous methods

Few surveys in Norway have been conducted. All previous surveys have been based on off-site sampling (phone).

7.11.6 Primary Customers for the data, and intended uses

		Customers for data					
		European Commission	National government	Stock assessment scientists	Academic researchers	Fishing industry	General public
Type of data	1 Participation						
	2 Fishing effort		A	A			
	3 Total catch (retained/released) by species	C, D	A, B, C, D	A, B, C, D	D	C	
	4 Catch per unit effort by species		A, B	B			
	5 Size/age distribution of catch			B	E		
	6 Socio-economic data				E		
	Key species (give list)						

Key: A: General monitoring of trends; B: Stock assessment; C: Monitoring of annual statistics relative to annual management targets for specific species; D: In-season monitoring of cumulative statistics relative to annual management targets for specific species; E: other (specify)

Table 1: Summary of national recreational fisheries: angling

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴
Estuaries and enclosed bays or sea loughs	Negligible estuaries and enclosed bays						
Open sea: Inshore (e.g.inside outer skerries):	Rocky shores	Sea trout, sea bass, cod, pollack, mackerel, wrasse, saithe	Rod and line	Y		B	<Partial
	Man-made structures	Sea trout, sea bass, cod, pollack, mackerel, flatfish, saithe	Rod and line	Y		A	Partial
	Beaches	Sea bass, flatfish, sea trout	Rod and line	Y		D	<Partial
	Private /charter / for hire boats	Pollack, mackerel, cod, ling, halibut, tusk, wolffish, flatfish, haddock, whiting,	Rod and line; handlines (bait or artificial lure; trolling), net, pots, trap	Y	None for rod and line. Pots, nets and traps regulated (#/meters)	A	Partial
Open sea: Offshore demersal (outside outer skerries):	Private /charter / for hire boats	Cod, pollack, ling, angler fish, wolffish, tusk, halibut,	Rod and line; handlines (bait or artificial lure; trolling),		MLS	A	<Partial
Open sea: Offshore pelagic and Oceanic:	Charter / for hire boats	Mackerel	Rod and line (bait or lure)	S	MLS, VCR	B	<Partial

^{1,2,3,4}: See below Table 2 for codes to enter

Table 2: Example summary of national recreational fisheries: non-angling

Water body	Platform	Main species targeted	Gear used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for sampling ⁴
Estuaries and semi-enclosed bays or sea loughs							
Open sea: Inshore (e.g. shore to <20m depth):	Rocky shores	Crabs, various fish, mussels and clams	Hand, snorkelling, diving (spear)	Y		C	N/A
	Private boats	Crabs, lobsters, Norway lobster, eel	Pots and traps Nets: crab	S Lobster: oct-nov Crabs: Y/S	MLS, S, A (lobster),	B	Partial (lobster) N/A crab
		Cod, ling, tusk, wolfish, angel fish, halibut, haddock, pollack, flatfish	Gillnets, traps	Y		A	<Partial
		Cod, halibut, tusk, ling, wolfish	Long lines	Y		D	<Partial

¹ Y =Year-round fishery, S=Seasonal fishery (provide separate information on active months and peak periods); P = Pulse fishery (provide separate information to specify months when fishery is most likely to be present)

² MLS (=minimum landing size); BL (=bag limits); S (=closed seasons); A (= closed areas); P (=protected species regulations); VCR (= voluntary catch and release)

³ A: relatively large numbers; B: Intermediate; C: Relatively small numbers; D: very small numbers N/A: No information available .

⁴ Full (= fully accessible); Partial (= only partly accessible); <Partial (= less accessible than "Partial"); None (not accessible); N/A: no information

Table 3: National availability of lists and sampling frames for carrying out surveys of the general public to collect information on participation in different forms of recreational fishing.

Site	Type of lists	Sampling frames	Availability	
Off-site	Mailing-address directories	Postal household frame	Exhaustive	
		Registry-based angler frames	Angler licences	None
			Angler permits	None
			Other angler registries	None
		Registry based vessel operator frames	Vessel licenses (voluntarily)	Partial
			Vessel permits	None
	Other vessel registries		None	
	Telephone directories	Random-digit-dialing household frame	Exhaustive	
		Phonebook household frame	Exhaustive	
		Registry-based angler frames	Angler licences	Exhaustive
			Angler permits	None
			Other angler registries	None
		Registry based vessel operator frames	Vessel licenses	Partial
	Vessel permits		None	
Other vessel registries	None			
On-site	Site or access point lists (points of departure or return for fishing trips)	Public access sites	Partial	
		Private access sites	Partial	

7.12 Poland

7.12.1 General overview of national recreational fisheries

In Appendix IV of the Commission Decision (2008/949/EC) adopting a multiannual Community programme for the collection, management and use of data in the fisheries sector, three species (cod, salmon and eel) require investigations in Polish recreational fisheries. Eel recreational fishing is planned to be investigated as a pilot study in 2010 following Council Regulation 1100/2007 adopting Eel Management Plan (EMP) to be prepared by all Member States for implementation from 1 July 2009.

Recreational fishing for salmon takes place in freshwater rivers but open sea angling in Polish waters does not occur.

However, recreational fishing for cod, which is carried out with fishing rods only, has been developing very rapidly for approximately 10 recent years. Its role in Polish marine angling is the dominating one and still increasing. That is confirmed by the data on number of vessels exploited in recreational fishing and the number of anglers participating in cod at sea angling trips as registered by Maritime Offices along the Polish coast. According to that source of data, number of cod anglers in Poland has slightly exceeded 110 000 persons in 2007. Roughly estimated total catch of cod in 2007 using a simple approach (product of number of anglers recorded by Maritime Offices and the average mass of cod fished by angler during on-board observed trips) amounted to 437 tonnes (4% of Polish cod limit).

The first results of Polish cod recreational fisheries investigations carried out in the Baltic in 2005 were presented in a pilot study report submitted to SGRN for evaluation (available on WKRSM share point).

Anecdotal information and articles presented in angling magazines show that recreational fishing from beaches, in lagoons and in bays, for other species than cod is slowly developing. It is worth to mention angling for garfish (1-2 weeks period in May during spawning time in Puck Bay), angling for perch, pike-perch (in two lagoons – Vistula and Szczecin, on-site interviews under way, not elaborated) and angling for flounder (from beaches - short period during autumn). The above-mentioned recreational fisheries are in all cases carried out with fishing rods and aboard of charter boats. Since there is at present no quantifiable data available on these fisheries therefore information regarding cod recreational fisheries will be presented in the following sections of the proforma.

7.12.2 Detailed description of national recreational fisheries

7.12.2.1 Categories of recreational fishing

Cod recreational fishing is mainly carried out by anglers in open sea offshore waters (>20m) angling with fishing rods equipped with artificial lure aboard of head/charter boats. On a very low scale there is also cod angling in open sea near-shore waters (<20m) conducted aboard of small carrying 2-3 anglers aboard. Fishing rod is also the only “gear” used.

Non-angling activity has not been detected as yet.

7.12.2.2 Geographic delineations

Two Baltic cod stocks are identified (western – ICES Sub-divisions 22-24 and eastern – ICES Sub-divisions 25-32), separately assessed and managed. Angling on western cod stock however is at present very limited because of fishing harbours location relatively distant from cod fishing grounds and therefore no separate statistics is at present collected for that area.

7.12.2.3 Water bodies

Cod angling is mainly carried out in open sea waters, most frequently within a depth range of 20-50 m. Fishing in shallow waters (<20m) of definitely minor importance, probably results in smaller size of cod, although to date it has not been investigated biologically since cod angling aboard of smaller head/charter began 2 years ago and is still conducted on a very limited scale (in terms of time, area and number of anglers involved).

Water body type	Ranking
Freshwater rivers or lakes	NA
River estuaries	NA
Enclosed bays, sea loughs, lagoons, fiords, sounds	NA
Open sea: inshore (e.g. shore out to <20m depth)	2
Open sea: Offshore demersal (e.g. >20m depth)	1
Open sea: Offshore pelagic and Oceanic	NA
Other (specify)	NA

7.12.2.4 Platforms for fishing

Charter boats are the only platforms used in cod recreational open sea offshore waters while charter and private boats are used in inshore waters. Larger boats (above 10 m, which definitely prevail in numbers and in number of anglers to accommodate) are used in on-board observer programme aimed at estimating cod catches at sea, including collection of data on age and length structure of the catch.

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	
Beaches	
Rocky shorelines	
Private boats	2
Rental boats	
Charter or Guide boats (<i>for-hire boats where passengers pay as a group to hire the vessel and the services of the captain and crew in advance of the trip</i>)	1
Head, Party, or Open boats (<i>for-hire boats where passengers pay as individuals for space on the boat and can "walk on" just prior to the trip</i>)	
Other boats	
Other (specify)	

7.12.2.5 Target species or species groups

In the open sea recreational fishing in Poland, cod is the only target species. Biological samplings aboard of angling boats indicate that almost 100% of the total catch (in terms of mass) is cod. Very few specimens of by-catch are occasionally found (herring, flounder, fourbeard rockling) during angling trips.

7.12.2.6 Fishing gears used

Nowadays, the only fishing gear used is fishing rod equipped with artificial lure (pilker).

Gear type	Ranking
Rod and line, or hand-lines	1
Long-lines	
Dip net or A-frame (push net?)	
Cast net	
Gill net	
Seine	
Trawl	

Gear type	Ranking
Pot	
Trap	
Spear	
Hand	
Others (specify)	

7.12.2.7 Seasonality

Cod offshore recreational fishing is conducted all year-round with a peak of activity between May-October. Cod inshore angling season conducted with small boats is much shorter due to safety reasons (June-August). In terms of the days of the week, it is weekend when the most anglers take part in fishing trips.

7.12.2.8 Tournament fishing

Tournament fishing for cod has become more popular in recent years. The results of championships are always presented publicly.

7.12.2.9 Management regulations and other schemes affecting recreational fisheries

For cod size limit is 38 cm and bag limit is 7 fish per day. Undersized fish must be discarded. No seasonal restrictions are applied for recreational fishing for cod, although commercial fishermen must respect summer ban for cod (July-August). There are regulations concerning number of hooks attached to artificial lure of the fishing rod. Fishing licenses are required. They are issued for individual persons or for the boat owner who needs to specify how many anglers his vessel can accommodate. Licenses are issued for two weeks period or one year.

Anglers are not required to evidence their cod catch. There are no regulations in terms of fishing effort.

7.12.3 Possible sampling frames

7.12.3.1 Area frames

Polish waters within ICES Sub-divisions 25-32 is the most important area for recreational fishing. Information on number of fishing trips and number of anglers aboard is provided by Maritime Offices.

7.12.3.2 List frames

There is no requirement to be a member of any angling association if fishing recreationally for cod. Therefore there is no ready to use database registry of anglers available. There is a register of fishing licenses issued by Fishing Inspection Offices. Licenses are issued for individual persons or for the boat owners for two weeks period or one year (name and address is obligatory). Since most frequently licenses are issued for boat owner who needs to specify how many anglers aboard the boat can carry, therefore in that case no information regarding anglers is available. Many of cod anglers are tourists who came for vacation at the seaside. The lack of register does not allow for distinguishing between visiting or resident anglers.

Maritime Offices data is only precise in terms of boat owners addresses but anglers' addresses are not recorded. To-date we have never interviewed individual persons directly or by any technical means.

A list of participants during fishing tournaments is always available, prepared by the organizers.

7.12.4 Available statistics

Statistic	Data sets available, and where/how archived
Number of resident anglers	Number of anglers is available from Maritime Offices but not separately for resident and visiting anglers.
Number of visiting anglers	
Number of resident vessels	Number of vessels is available from Maritime Offices but not separately for resident and visiting vessels.
Number of visiting vessels	
Fishing effort: Angler days	Data available from Maritime Offices.
Fishing effort: Vessel days	Data available from Maritime Offices.
Quantity of catch by species or species group, retained for consumption	NA
Quantity of catch by species or species group, used for bait	None
Quantity of catch by species or species group, that is released	NA
Other statistics (specify)	

7.12.5 Previous survey methods

DCR Pilot studies

Pilot study on Polish cod recreational fisheries was conducted in 2005. Survey method applied differed considerably from the methods commonly used in recreational fisheries investigations. Data used in the survey originated from Maritime Offices' records (1999-2005) on number of angling trips and number of anglers on-board of each fishing trip. In parallel, data on magnitude of the catch and biological data on cod (length, weight, age) were collected during randomly selected on-board observer trips.

Results of total cod catch taken during on-board observer trips were raised by number of angling trips registered by Maritime Offices in order to estimate total weight of cod angled in recreational fisheries in 2005 (similar method is used to estimate discards level in commercial fisheries). For comparison purpose also raising by number of anglers was applied.

The study revealed a very rapid increase in number of anglers and angling trips in the period 1999-2005. Cod catches taken by recreational fisheries estimated in Polish waters amounted to 225 tonnes. It became also evident that the number of vessels involved in recreational fisheries increased considerably and that there was a great variety of types of vessels (vessels withdrawn from commercial fishery, yachts, tugs, rescue vessels, pilot boats etc) involved in cod angling in Poland.

The same method as described is continued yearly to monitor the development of cod recreational fishery but as a follow up of WKSMRF Workshop in Nantes it is intended to launch in parallel other methods (of-site and on-site interviews).

Other studies

None carried out.

7.12.6 Primary Customers for the data, and intended uses

		Customers for data					
		European Commission	National government	Stock assessment scientists	Academic researchers	Fishing industry	General public
Type of data	1 Participation		A			A	A
	2 Fishing effort		A			A	A
	3 Total catch (retained/released) by species	B		A, B		A	
	4 Catch per unit effort by species						
	5 Size/age distribution of catch	B		B		A	
	6 Socio-economic data						
	Key species (give list)	Cod (eastern Baltic stock)	Cod (eastern Baltic stock)	Cod (eastern Baltic stock)		Cod (eastern Baltic stock)	Cod (eastern Baltic stock)

Key: A: General monitoring of trends; B: Stock assessment; C: Monitoring of annual statistics relative to annual management targets for specific species; D: In-season monitoring of cumulative statistics relative to annual management targets for specific species; E: other (specify)

Table 1: Summary of Polish national recreational fisheries: angling.**(Refers to cod recreational fishing only)**

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
Open Sea: Inshore (e.g. shore to <20m depth)	Charter/private boats	Cod	Fishing rod (artificial lure)	S (June-August)	MLS, BL, P	D	<Partial	Medium
Open sea: Offshore demersal (e.g. 20m+ depth):	Charter boats	Cod	Fishing rod (artificial lure)	Y	MLS, BL, P	A	<Full	High

1,2,3,4,5:

¹ Y =Year-round fishery, S =Seasonal fishery (provide separate information on active months and peak periods); P = Pulse fishery (provide separate information to specify months when fishery is most likely to be present)

² MLS (=minimum landing size); BL (=bag limits); S (=closed seasons); A (= closed areas); P (=protected species regulations); VCR (= voluntary catch and release)

³ A: relatively large numbers; B: Intermediate; C: Relatively small numbers; D: very small numbers N/A: No information available

⁴ Full (= fully accessible); Partial (= only partly accessible); <Partial (= less accessible than "Partial"); None (not accessible); N/A: no information

⁵ High (high level of statistical precision); Medium (medium level of statistical precision); Low (low level of statistical precision); None (no data or statistics available)

Table 2: Polish national recreational fisheries: non-angling**(Cod non-angling activities do not occur in Polish waters)**

Table 3: National availability of lists and sampling frames for carrying out surveys of the general public to collect information on participation in different forms of recreational fishing.

Site	Type of lists	Sampling frames	Availability	
Off-site	Mailing-address directories	Postal household frame		
		Registry-based angler frames	Angler licences	partial
			Angler permits	none
			Other angler registries	partial
		Registry based vessel operator frames	Vessel licenses	partial
			Vessel permits	none
			Other vessel registries	partial
		Telephone directories	Random-digit-dialing household frame	none
			Phonebook household frame	none
	Registry-based angler frames		Angler licences	none
			Angler permits	none
			Other angler registries	none
	Registry based vessel operator frames		Vessel licenses	none
			Vessel permits	none
Other vessel registries		none		
On-site	Site or access point lists (points of departure or return for fishing trips)	Public access sites	partial	
		Private access sites	partial	

7.13 Spain - Basque Country (Atlantic area)

7.13.1 General overview of national recreational fisheries

In the Basque Country (Spain), a license is required for recreational fisheries, which is given by the Basque Government. There are two types of licenses, marine recreational license with validity for 5 years and spear fishing license with validity for 1 year. There are some requirements to obtain these licenses. One is to be older than sixteen years old. If the activity is practiced from a boat, the boat has to be registered in a concrete recreational vessel census with its main characteristics.

Rod and line or hand-lines are the gears used by the fishermen with marine recreational license because these are the only gears allowed.

Many important commercial species are catch, from sedentary species to the migratory ones as the tunids. Some of them have a recovery plan as the bluefin tuna and hake.

Another special license is given for the glass eel fishery. This is a very traditional fishery although there was not any managing plan for the fishery until 2001. In 2003, a new regulation for glass eel fisheries was issued. It stated that there must be only a license per person and fishing basin and it is obligatory to fill in the Daily Catches report with data regarding catches and effort. In December 2008 a management plan for the recovery of the European eel in the Basque Country was presented.

The importance of the recreational fisheries in the last years is evident in the Basque Country (Spain). Although there is a regulation for the recreational fisheries, not accurate data is available and a study is needed to know the real dimension of this fishery in biological and socio-economical terms.

7.13.2 Detailed description of national recreational fisheries

7.13.2.1 Categories of recreational fishing

Angling is the most important activity from both the shore and boats. Rod and line or hand lines are the gear used.

There is also an important seasonal non angling recreational fishery. This is the glass eel fishery, a traditional fishery in the Basque Country. It affects to zones associated to river mouths, including beaches, estuaries and river banks. Sieve and hoe are the gear used and it is practiced from shore and private boats.

Spear fishing and the harvest of some invertebrates are also practiced but the importance of these activities is minor.

7.13.2.2 Geographic delineations

n/a

7.13.2.3 Water bodies

Three water bodies have to be take into account as the main important in relational with the categories mentioned above.

Enclosed bays and sea loughs are used by shore anglers. The effort is bigger in summer due to the non-residents' activity, although during all the year residents anglers are quite constant.

The three open sea water bodies are exploited by the fishers from boats. Inshore <20 m depth and offshore demersal > 20 m effort is similar during all the year. The difference use of each one depends on the target species. However, there is a very important and seasonal fishery which target species are the migratory ones, the tunids. In this case the offshore pelagic water body is exploited by the fishers. Summer is the period of this kind of fishery in the Spanish Atlantic waters.

In the case of the glass eel fishery river estuaries support all the effort in this seasonal fishery.

Water body type	Ranking
Freshwater rivers or lakes	
River estuaries	2
Enclosed bays, sea loughs, lagoons, fiords, sounds	1
Open sea: inshore (e.g. shore out to <20m depth)	1
Open sea: Offshore demersal (e.g. > 20m depth)	1
Open sea: Offshore pelagic and Oceanic	1
Other (specify)	

7.13.2.4 Platforms for fishing

Man-made structures such as piers, docks and natural shorelines as rocky shorelines are the most important platforms for shore angling. Beaches are less important although some activity exists.

Private boats are the usual ones in both angling and non-angling fisheries. There is a special census of boats for recreational activity. The owners are obliged to register these boats with their main characteristics.

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	1
Beaches	3
Rocky shorelines	2
Private boats	1
Rental boats	N/A
Charter or Guide boats (<i>for-hire boats where passengers pay as a group to hire the vessel and the services of the captain and crew in advance of the trip</i>)	N/A
Head, Party, or Open boats (<i>for-hire boats where passengers pay as individuals for space on the boat and can "walk on" just prior to the trip</i>)	N/A
Other boats	
Other (specify)	

7.13.2.5 Target species or species groups

There is a wide range of target species in our recreational fisheries. Some of them are sedentary and fished during all the year. Others, although their catches are possible during the year they are more seasonal. Finally we have the migratory species.

Among sedentary species are pots, cuckoo wrasses, sparids, serranids, hake and others. More seasonal target species are the seabass from April to December, squids from May to December, mackerel from April to May and the horse-mackerel in autumn. Finally in summer there are migratory species where the tunids are the most important in boat angling, and in winter the glass eels.

Except from the tunids which are fished in offshore pelagic waters, the rest of the species could be fished from all the platforms described before.

7.13.2.6 Fishing gears used

Rod and line, or hand-lines are the most important gears in angling fisheries. This occurs because in the Basque Country (Spain) only these gears are allowed for recreational fisheries. The rest of the gears are denominated as professionals and their use is forbidden.

Many different modalities are used among these gears. Probably the bait fishing is the most used for both, shore and boat angling. Depending on fishers and target species, trolling and jigging are also very common for boat angling. One example is the tunids fishery where trolling is very used. Another case is the cephalopods where squid jigs are very common for their catch.

For non angling gears, sieve and hoe is used in the glass eel fishery. Less important are the spear and the hand harvest.

Gear type	Ranking
Rod and line, or hand-lines	1
Long-lines	
Dip net or A-frame (push net?)	
Cast net	
Gill net	
Seine	
Trawl	
Pot	
Trap	
Spear	3
Hand	4
Others (specify) Sieve and hoe	2

7.13.2.7 Seasonality

There are two clear *Seasonal fisheries* where all the effort is concentrated on those months:

- Tunids fishery in summer between May and September
- Glass eel fishery from November to February

There are some fisheries that although the target species could be catch during all the year, there are some months when fishery is more present: *Pulse fishery*. These are the seabass fishery when most of the effort is from April to December, squids fishery from May to December, mackerel fishery from April to May and horse-mackerel in autumn.

The rest of the fisheries have to be considered *Year-round* fishery. In the Basque Country (Spain) the weather is a limitation factor for recreational fisheries. So in winter the effort is lower comparing with the rest of the seasons. Otherwise, between spring and summer there is an important effort increase. In these seasons it is also important the non residents fishers presence.

7.13.2.8 Tournament fishing

Some tournament fishing exits during all the year in the Basque Country (Spain). Many of them are in summer and tunids are the target species. There is partial information of these kinds of tournaments.

7.13.2.9 Management regulations and other schemes affecting recreational fisheries

There are some management regulations for the inshore waters where the Basque Government is the relevant authority. For the offshore waters the Spanish Government is the relevant authority. The regulations do not differ too much between them but there could be some minor modifications.

The most important regulations are:

- 1) **MLS:** There is a Real Decret 560/1995 where there is a list of species with their MLS.
- 2) **Gear type:** Only rod and line, or hand-lines are allowed for sea fishing.
- 3) **Effort:** 6 hooks per license and gear.
- 4) **Total catches:** 5 kg per day and license. If fishing is from a boat, 5 kg per license and a maximum of 25 kg per boat.
- 5) **Exceptional regulations:** For some species, a different regulation is applied. It is the case of hake and big pelagic as tunids and sword fishes. The maximum catch is of 5 individuals per license and day with a maximum of 20 individuals per boat. For these species a landing declaration have to be submitted to the authorities.

7.13.3 Possible sampling frames

n/a

7.13.4 Available statistics

Below we provide some data for glass eel fishery in the first table and some data for angling and spear fishing in the second one.

Statistic	Data sets available, and where/how archived
Number of resident licenses	347 / Basque Government
Number of visiting licenses	
Number of resident vessels	48 / Basque Government
Number of visiting vessels	
Fishing effort: Fishermen hours	46,1 / Basque Government
Fishing effort: Vessel fishing hours/fisher	19,9 / Basque Government
Quantity of catch by species or species group, retained for consumption	773,4 / Basque Government
Quantity of catch by species or species group, used for bait	
Quantity of catch by species or species group, that is released	
Other statistics (specify)	

Statistic	Data sets available, and where/how archived
Number of resident anglers licenses	61087 / Basque Government
Number of visiting anglers	
Number of resident registered vessels	4063 / Basque Government
Number of Spear fishing licenses	1815 / Basque Government
Fishing effort: Angler days	
Fishing effort: Vessel days	
Quantity of catch by species or species group, retained for consumption	
Quantity of catch by species or species group, used for bait	
Quantity of catch by species or species group, that is released	
Other statistics (specify)	

7.13.5 Previous survey methods

Tuna tagging using recreational fishermen in Basque country (Spain)

The project started in 2001 as an attempt to involve recreational fishermen in the scientific world and use it as a platform for obtain catch and effort data.

The project included an agreement with the fishermen associations to establish a tag and release trophy during its tournaments and a training course on tagging for new skippers every year. AZTI also give them technical support and tags.

Target species is albacore (*Thunnus alalunga*) wich more than 98% of the taggings. Some other species tagged has been blue fin tuna (*Thunnus thynnus*) and Skipjack (*Katsuwonus*

pelamis). The tuna fisheries in Gulf of Biscay is a seasonal fisheries (June-October) and the presence of both professional and recreational fishermen are simultaneous in time but not in space so that commercial fisheries for albacore occur in far waters.

Despite start in a very modest way, during last years has increased his relevance both in tag put and in number of boats involved.

The table shows the data for this action since 2001

	2001	2002	2003	2004	2005	2006	2007
Tags	10	81	378	213	493	2621	310
Recoveries (0)	-	1	1	10	44	11	7
Recovery rate (1)		1,2%	3,5%	3,0%	8,9% (2)	0,4%	N/A
Boats participants	2	6	13	11	20	47	26

(0) number of recoveries of the year but not necessarily tagged in this year

(1) recovery number over number of tags in the year

(2) searching for an explanation for this high value

The recovery rates obtains shows lower figures than scientist tagging surveys except for 2005 witch shows an abnormal height value. No explanation has been found for this. The average length of tagged individuals is around 50 cm. and they spend 241 days between its tagging and its recapture. The average distance since tag point and recovery location is 245 km.

During the latest years, skipper had started to tag not only during the tournaments but also during their recreational trips; witch was one of the aims of the project.

Pilot study on recreational fleet- Basque country (Spain)

A three year project (2009-2011) will be carried out by AZTI Tecnalia focus on the recreational fleet (list 7 of the National Fleet Census) based on Basque ports.

The main objectives of the project are:

- Update, as far as possible, the census, so that the variation on this fleet is more quick than the updating of the census
- Provide a useful segmentation of this fleet based on its fishery activity:
 - o Sail boats
 - Not fishing
 - Fishing
 - Frequency
 - o Gear....
 - o Motor boats
 - Not fishing
 - Fishing
 - Frequency
 - o Gear....
- To implement a sampling methodology which allow us to estimate the fishing activity, catches, effort, spatial distribution, etc.

- To identify major fishing areas for this fleet and to analyze possible use conflicts with other fleets (mainly artisanal fleets)
- To evaluate the socioeconomic impact of recreational fishery in the surrounding areas.

Studies on recreational eel fishery- Basque country (Spain)

AZTI-Tecnalia has an agreement since 2001 with the Basque Government that has been now extended until 2010. This agreement includes the following items:

- In 2001 took part in the launch of glass eel fisheries monitoring plan that resulted in a new regulation for glass eel fisheries in 2003.
- Since the 2003-2004 season until now, the Basque Government deals the licences in September and after the fishing season compiles the Daily Catches Reports and delivers them to AZTI who creates the catches data base. The fisherman has to fill in the following table in the Daily Catches Reports

Day	Beginning of fishing	River or beach	Gear	End of fishing	Capture (gr)	Remarks

- AZTI-Tecnalia has taken part in the drawing-up of the eel management plan for the Basque Country in 2008. This plan includes measures to restrict the fishing pressure and a research plan in which AZTI will determine the mortality caused by fishery and the annual estuary and fluvial recruitment.

Additionally, AZTI-Tecnalia took part in the INTERREG INDICANG project (2004-2007), the aim of the project was to set up networks to measure the abundance and the colonization of the European eel at a scale covering the central part of its distribution area. Thanks to this project, estuary and fluvial recruitment had been determined in the Oria river basin in 2004, 2005, and 2006. The indicators proposed in this project had been included in the research plan of the eel management plan of the Basque Country and thus will be utilized in the monitoring of the status of the eel.

Glass eels

Although the glass eel fishery was very traditional, there was not any managing plan for the glass eels until 2003, when the Basque Government, with the advice of AZTI, launched a fisheries monitoring plan.

Since the 2003-2004 seasons, the Basque Government collects the information regarding number of licences, catches, and effort and charges AZTI to analyse this information, which has been published in the ICES/EIFAC reports since 2004 (ICES 2004, 2005, 2006, 2007, 2008). In addition, in the Oria river, the recruitment of glass eel has been studied since 2005, and the biometrics of glass eel had been measured (Castellanos et al. 2007, 2008a, 2008 b).

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7.13.6 Primary Customers for the data, and intended uses

Glass eel

		Customers for data					
		European Commission	National government	Stock assessment scientists	Academic researchers	Fishing industry	General public
Type of data	1 Participation	A,B,C	A,B,C	A,B,C			
	2 Fishing effort	A,B,C	A,B,C	A,B,C			
	3 Total catch (retained/released) by species	A,B,C	A,B,C	A,B,C			
	4 Catch per unit effort by species	A,B,C	A,B,C	A,B,C			
	5 Size/age distribution of catch						
	6 Socio-economic data						
	Key species (give list)						

Key: A: General monitoring of trends; B: Stock assessment; C: Monitoring of annual statistics relative to annual management targets for specific species; D: In-season monitoring of cumulative statistics relative to annual management targets for specific species; E: other (specify)

Table 1: Summary of national recreational fisheries: angling

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
Enclosed bays and sea loughs	Man-made structures and natural shorelines	Wide range of species (squids, serranids, sea bass, conger, sparids)	Rod and line or hand-lines	Y and P depending on the target species	MLS,	A	N/A	N/A
Open sea: inshore (e.g. shore out to <20m depth)	Private boatst	Wide range of species: Squids, Mackerel, Horse mackerel, Sea bass	Rod and line or hand-lines	Y and P depending on the target species	MLS	B	N/A	N/A
Open sea: Offshore demersal (e.g. > 20m depth)	Private boats	Wide range of specie: Hake, Conger, Sparids, Serranids, Pots	Rod and line or hand-lines	Y and P depending on the target species	MLS	B	N/A	N/A
Open sea: Offshore pelagic and Oceanic	Private boats	Migratory species such as tunids	Rod and line or hand-lines (trolling)	S (May to September)	MLS, P	B	<Partial	Medium

Table 2: Summary of national recreational fisheries: non-angling

Non-angling in glass eel fishery

Water body	Platform	Main species targeted	Gear used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for sampling ⁴	Robustness of Available Data/Statistics ⁵
Estuarine and Rivers	Beaches, River mouths, and River banks	Glass eel	Sieve and hoe	S	S,A	C	Full	Medium

¹ Y =Year-round fishery, S =Seasonal fishery (provide separate information on active months and peak periods); P = Pulse fishery (provide separate information to specify months when fishery is most likely to be present)

² MLS (=minimum landing size); BL (=bag limits); S (=closed seasons); A (= closed areas); P (=protected species regulations); VCR (= voluntary catch and release)

³ A: relatively large numbers; B: Intermediate; C: Relatively small numbers; D: very small numbers N/A: No information available.

⁴ Full (= fully accessible); Partial (= only partly accessible); <Partial (= less accessible than "Partial"); None (not accessible); N/A: no information

⁵ High (high level of statistical precision); Medium (medium level of statistical precision); Low (low level of statistical precision); None (no data or statistics available)

7.14 Spain - Balearic Islands (NW Mediterranean)

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7.14.1 General overview of the Balearic Islands recreational fisheries

This report focuses only in the recreational fisheries of the Balearic Islands because generalization at the scale of Spanish Mediterranean is problematic due to the large amount of regional specificities.

Recreational fishing is one of the islands' main leisure activities, with around 10% of the population participating (population of the Balearic Islands around 1 million people). Anglers tend to be middle class (most anglers own a small boat moored at marinas or use ramps), middle-aged males (90% male, mean age 46.2 years). The most popular fishing method is from a boat (62.9%), followed by fishing from shore (32.4%) and spearfishing (3.6%). The mean time for a fishing trip is around 3.5 h d⁻¹. Typically, anglers use more than one type of gear (mean 1.27). The frequency of fishing is 4 to 6 times per month, mainly on holidays and weekends, increasing in summer (Morales-Nin, 2005).

The activity has a sizeable impact on the coastal fauna, with diverse catches of at least 1209.25 t year⁻¹ (i.e., about 615 000 fishing outings year⁻¹). Thus, the amount of carbon extracted annually is at least 137 kg C km² year⁻¹, and the recreational fishery removes about 31% of production at the trophic level 4. Although these are gross estimates and more detailed studies of the effects of recreational fishing are needed, it is unquestionable that there exists an important impact on coastal fish communities (Morales-Nin, 2005).

Sport fishing activity is important also, with a large number of tournaments and other competitive activities. Fishing requires a specific fishing permit with 2 yr duration for angling and 1 yr for spearfishing, thus the annual number of licenses may be used as indicator of the fishing pressure. The evolution of the number of permits for fishing shows a high increase along time with a rise from the 11367 permits on 2000 to 24933 in 2006, the mean annual increase was 2261 licenses for fishing from shore or from a boat. The evolution of the spear fishing licenses was more reduced from 810 to 1417 from 2000 to 2006, with a mean increase of 100 licenses per year (unpublished data from *Direcció General de Pesca*, DGPBG, from the Balearic Government). DGPBG is the authority who manages this local fishery, including the promulgation and vigilance of specific local norms, which are based in the general policy rules of the Spanish Government and the European Community.

Finally, another relevant characteristic of the recreational fishery at the Balearic Islands is that it is largely multispecific.

Figure: evolution of the number of licenses between 2000 and 2007. (unpublished data from Direcció General de Pesca, DGPBG, from the Balearic Government)

7.14.2 Detailed description of national recreational fisheries

7.14.2.1 Categories of recreational fishing

There are three main groups of angling categories; 1) Boat angling (62.9%), shore angling (32.4%) and spear fishing (3.6%) (Morales-Nin. Et al., 2005). However, a lot of different sub-modalities can be differentiated within these main groups:

1) Boat angling

1.1 Big game (trolling and feeding) (tunas, marlins and swordfish)

1.1 Coastal boat angling

1.1.1 Hook-and-line

- a) "Roquer". This is the most popular for low and medium experienced anglers and tournaments (*Coris julis*, *Serranus scriba* and *Diplodus annularis*)
- b) "Platform hook-and-line". This is probably the most important for biomass extracted (*Serranus cabrilla* and Sea breams).
- c) Hook-and-line for the razor fish is a category with very high participation and with an extreme spatial-temporal pattern (sandy bottoms and seasonal closure of the fishery) (*Xyrichthys novacula*, *Bothus podas*, *Trachinus sp.*). This species has high commercial value.
- d) Electric reel at range of depths from 150m to 600 m (*Pagellus bogavareo*, *Epinephelus caninus*).

1.1.2 Jigging, relatively new but low yield. It focuses in species with very high commercial interest (*Seriola durmerili*, *Dentex dentex*).

1.1.3 Trolling (surface trolling and deep trolling) (*Trachurus sp.*, *Lichia amia*, *Auxis rochei*, *Seriola durmerili*, *Dentex dentex*).

1.1.4 Squid, nocturnal and with a very high participation (two main groups of modalities; hand-and-line and trolling). There is a possible competitive interaction with the artisanal (commercial low-scale) fishery.

1.1.5 “Popping” fishing for octopus (low participation from boat)

2) Shore angling

2.1 Sandy bottoms

2.1.1 Night fishing for sea breams (*Sparus aurata*, *Lithognathus mormyrus*, *Trachynotus ovatus*).

2.1.2 Live bait fishing (large coastal predators, *Lichia amia*, *Dycentrarchus labrax* o *Pomatomus saltatrix*).

2.1.3 Traditional “puu” fishing (fishing for small sea breams with small amphipods and other crustaceans [commonly known as “puu”] that must be collected by the angler from the remains of *Posidonia oceanica*).

2.2 Rocky bottoms

2.2.1 “Roquer”. The most popular (*C. julis*, *S.scriba* and *D.annularis*)

2.1.2 Night fishing for Sea breams and conger

2.1.3 Traditional “puu” fishing.

2.1.4 Feeding for sea breams and mullets

2.3 Harbors and fishing piers

2.3.1 Feeding for sea breams and mullets

2.3.2 “Popping” fishing for octopus (high participation from shore)

2.3.3 Fishing for sea bream (*S. aurata* and *D. sargus*)

2.3.4 Spinning (barracuda, *D. labrax* and large carangids)

3) Spear fishing

In spite of experiencing smaller increase than other categories, spearfishing is viewed as the main potential competitor by the artisanal fleet. There exists an unmeasured illegal landing of very high commercial value species that are directly sold to restaurants.

Tournaments data on catch and effort evolution of spear fishing since 1975 have been used as a tool to study the temporal evolution of littoral fishery resources (Coll et al., 2004). Competition spear fishing affected over 30 species, among which the most abundant were *Diplodus sargus*, *Symphodus tinca*, *Labrus merula* and Mugilidae. It is remarkable that there is a clear decreasing trend over time for the mean CPUE. *Epinephelus marginatus* is a key species in the evolution of CPUE, since individuals weighing more than 4 kg diminished drastically after 1987 (Coll et al., 2004).

4) Others minor modalities; Fly fishing, freshwater fishing (carp and pike, there are only two lakes in the Balearic Islands, no rivers), sepia fishing.

7.14.2.2 Geographic delineations

By definition the coastal zone is limited to 12 nm off the coast, and the coastal fleet as those vessels spending more than 75% of their time in the coastal zone.

In the Balearic Islands there are a series of protected areas (MPAs) and a National Park where fishing is limited. Protected areas represent 21% of this coastal domain. In these MPAs, recreational and small scale commercial fishing is allowed with some additional restrictions and with closed areas.

7.14.2.3 Water bodies

Water body type	Ranking
Freshwater rivers or lakes	N/A
River estuaries	-
Enclosed bays, sea loughs, lagoons, fiords, sounds	1-2
Open sea: inshore (e.g. shore out to <20m depth)	1-2
Open sea: Offshore demersal (e.g. > 20m depth)	3
Open sea: Offshore pelagic and Oceanic	4
Other (specify)	

The term “enclosed bays” is equivocal for us. So, we selected 1-2 for referring to inshore hook-and-line fishing.

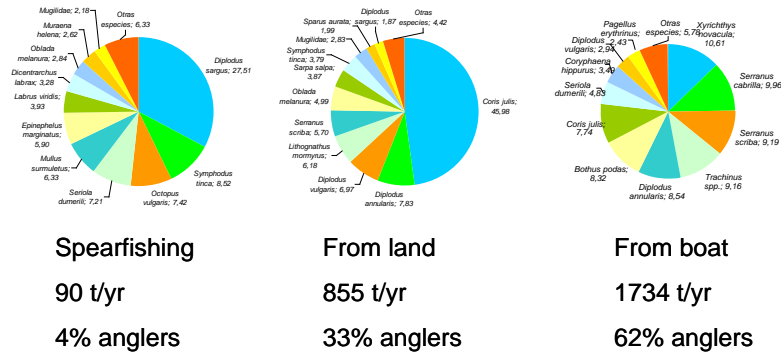
7.14.2.4 Platforms for fishing

N/A is showed for no information available and (-) for no presence of this platform

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	4
Beaches	3
Rocky shorelines	2
Private boats	1
Rental boats	N/A
Charter or Guide boats (<i>for-hire boats where passengers pay as a group to hire the vessel and the services of the captain and crew in advance of the trip</i>)	5
Head, Party, or Open boats (<i>for-hire boats where passengers pay as individuals for space on the boat and can “walk on” just prior to the trip</i>)	6
Other boats	
Other (specify)	

7.14.2.5 Target species or species groups

One of the main characteristics of recreational fishery at the Balearic Island, and possibly at all the Spanish Mediterranean is the large number of target species. The catches made from boats constituted the largest number of species (54 species), followed by fishing from shore (43 species), with spearfishing (29 species) being the most selective method. Despite the high diversity, effort was concentrated on 32 species, depending on the different fishing methods (see table below). *Serranus cabrilla*, *Serranus scriba*, *Coris julis*, *Symphodus tinca*, *Diplodus annularis*, *Diplodus vulgaris*, *Diplodus sargus*, and *Octopus vulgaris* are the most abundant species in the catches. The two species with closed seasons, *Xyrichtys novacula* and *Seriola dumerili*, are also among the most frequently caught.



Recreational fishery is multispecific (Morlaes-Nin, 2005)

Taxon	Boat	Shore	Spear
Apogonidae			
<i>Apogon imberbis</i>	X	X	
Balistidae			
<i>Balistes carolinensis*</i>	XX		X
Belonidae			
<i>Belone belone</i>	XX		
Blenniidae			
<i>Blennius</i> spp.	X	X	
Bothidae			
<i>Bothus podas</i>	XXX	X	
Carangidae			
<i>Lichia amia</i>	X	XX	X
<i>Seriola dumerili*</i>	XXX	X	XXX
<i>Trachurus</i> spp.*	XX		
Congridae			
<i>Ariosoma balearicum</i>		XX	
<i>Conger conger*</i>		XX	XX
Coryphaenidae			
<i>Coryphaena hippurus*</i>	XXX		
Dactylopteridae			
<i>Dactylopterus volitans</i>	XX	X	X
Labridae			
<i>Coris julis</i>	XXX	XXX	
<i>Labrus viridis*</i>	X	XX	XXX
<i>Symphodus ocellatus</i>	X	XX	
<i>Symphodus tinca*</i>	XX	XX	XX
<i>Thalassoma pavo</i>	X	XX	
<i>Xyrichtys novacula*</i>	XXX		
Loliginidae			
<i>Loligo</i> spp.*	XX	X	
Moronidae			
<i>Dicentrarchus labrax*</i>	X	XX	XXX
Mugilidae		XXX	XXX
Mullidae			
<i>Mullus surmuletus*</i>	X	XX	XX
Muraenidae			
<i>Muraena helena*</i>	X	XX	XXX
Octopodidae			
<i>Octopus vulgaris*</i>	XX	XX	XXX
Pomacentridae			
<i>Chromis chromis</i>	X	X	
Rajidae			
<i>Raja</i> spp.*	X	X	X
Sciaenidae			
<i>Sciaena umbra*</i>	X	X	XXX
<i>Umbrina cirrosa</i>		XX	XX
Scombridae			
<i>Auxis rochei*</i>	XXX		
<i>Sarda sarda*</i>	XX		
<i>Scomber japonicus*</i>	XX		
<i>Thunnus alalunga*</i>	XXX		
<i>Thunnus thynnus*</i>	XXX		
Scorpaenidae			
<i>Helicolenus dactylopterus*</i>	XX		

Taxon	Boat	Shore	Spear
<i>Scorpaena porcus</i> *	X	X	XX
<i>Scorpaena scrofa</i> *	XX	X	XX
Scyliorhinidae			
<i>Scyliorhinus canicula</i> *	X		
Sepiidae			
<i>Sepia officinalis</i> *	XX	XX	XX
Serranidae			
<i>Epinephelus marginatus</i> *	X	XX	XXX
<i>Serranus cabrilla</i> *	XXX	XXX	
<i>Serranus scriba</i> *	XXX	XXX	
Synodontidae			
<i>Synodus saurus</i>	XXX	X	
Sparidae			
<i>Boops boops</i> *	XX	XX	
<i>Dentex dentex</i> *	XX	X	XX
<i>Diplodus annularis</i> *	XXX	XXX	
<i>Diplodus puntazzo</i> *	X	XX	XX
<i>Diplodus sargus</i> *	XX	XXX	XXX
<i>Diplodus vulgaris</i> *	XXX	XXX	XX
<i>Lithognathus mormyrus</i> *	XX	XXX	XX
<i>Oblada melanura</i> *	XX	XXX	X
<i>Pagellus acarne</i> *	XX	X	
<i>Pagellus bogareveo</i> *	XX	X	
<i>Pagellus erythrinus</i> *	XX	X	
<i>Pagrus pagrus</i> *	XX	X	
<i>Sarpa salpa</i>	X	XXX	XX
<i>Sparus aurata</i> *	X	XXX	XX
<i>SpondylIOSoma cantharus</i> *	XX	X	X
Sphyraenidae			
<i>Sphyraena</i> spp.*	XXX		X
Trachinidae			
<i>Trachinus</i> spp.*	XXX	X	X

Taxa caught by recreational fishing off Majorca. Frequency of appearance is qualitative (X: seldom, XX: regularly, XXX: very often). Asterisks indicate species also exploited by the commercial fishery. Extracted from Morales-Nin et al (2005)

7.14.2.6 Fishing gears used

Gear type	Ranking
Rod and line, or hand-lines	1
Long-lines	Not allowed
Dip net or A-frame (push net?)	Not allowed
Cast net	Not allowed
Gill net	Not allowed
Seine	Not allowed
Trawl	Not allowed
Pot	Not allowed
Trap	Not allowed
Spear	3
Hand	2
Others (specify)	

7.14.2.7 Seasonality

The recreational fishery in the Balearic Islands is highly seasonal, mainly the consequence of seasonal variability in abundance of the key target species and variations in the fishing methods used depending on weather conditions and leisure time available. There are some species with seasonal closures (see management section).

7.14.2.8 Tournament fishing

Sport fishing is a very important activity in the Balearic Island, both from boat, shore and spear fishing. For years, sport anglers have collaborated with the scientist and managers to promote sustainable fishing in the entire recreational community. There are an important number of research programs involving the samples obtained in tournaments. The data obtained can be useful to assess the recreational fishery.

There are a lot of additional regulations for the tournaments (most of them promoted by the local sport associations themselves) such as minimum legal sizes, minimum hook size, or the recent promotion of the no dead angling tournaments (catch-and-release). In our experience, local sport associations are or can be very important stakeholder for collaborating in fisheries research programs (tagging programs, volunteers, experimental angling...).

7.14.2.9 Management regulations and other schemes affecting recreational fisheries

The recreational fishery is open; there is not a limitation on the access. Although an individual non transferable permit is necessary, there are no limitations on their total number. Moreover the permit cost is very cheap. Therefore the management is based on conservation measures.

MPAs, Cabrera National Park and closed zones represent nearly 63.500 Ha of protected coastal zone with 16.500 Ha totally closed to any fishery. Recreational fishing in the partially protected areas of MPAs is allowed with additional rules. Management plans are specific for each MPA but it is common to limit recreational fishing to certain days per week. Effectiveness of protection is also greatly dependent on the specific MPA. For example, Palma Bay MPA and Cabrera National Park has very effective surveillance, and

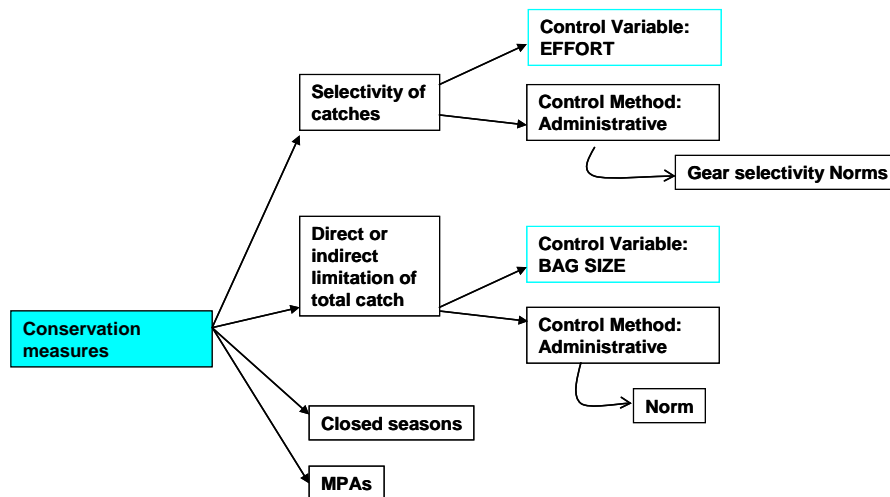
not only the specific limitations but also the general rules for open access areas are reasonably respected. In general, recreational fishers accept well the existence of MPAs.

In addition to MPAs, the conservation measures are the selectivity of the catches, the limitation of the individual bags and closed seasons for razor fish (*Xirichthys novacula*) and for amberjack juveniles (*Seriola dumerilii*). Up to 31 species are protected with minimum lengths; catches under this length have to be returned to sea. The maximum bag allowed depends on the species, in general is 5 kg/angler day plus one fish. For cephalopods and razor fish there is a number of items limitation (10 cephalopods, 50 razor fish) without over passing the 5 kg bag limit.

With a number of exceptions, the only allowed gear is the hook line. Some small traditional hand nets are also allowed in restricted areas. The relevance of hand nets is anecdotic. The gears used by the commercial fishery are banned. There are limitations of the number of rods (2 maximum), hooks in line (6 maximum), and jigging lures for cephalopods (6 maximum) for each fishermen. Spearfishing has to be done without the aid of aqua lungs, torpedoes etc., and using only mechanical traction guns. There are no regulation on time spend fishing, except for spear fishing that cannot operate at night.

Other use regulations are based on avoiding the competition with the commercial fishery, namely fishing with lights at night is forbidden, a minimum distance of 250 m from any commercial fishing gear has to be maintained; or for other stakeholders security (not fishing on beaches during the day either onshore or by boat). Also fishing inside harbors and marinas is restricted.

Recently, the promotion of catch-and-release and the stipulation of minimum legal hook sizes have become popular among angler associations and managers. It is remarkable that the *Direcció General de Pesca del Govern Balear* tries to convince the recreational fishers of the usefulness of the management rules before imposing them.



General scheme of the currently implemented regulation measures

7.14.3 Possible sampling frames

7.14.3.1 Area frames

In Spain, the management responsibility of the recreational fisheries relies on the regional governments (*Gobiernos Autónomos*). Legislation and interest on recreational fishery largely differ between regions. Therefore, it is very difficult or even impossible to maintain a sampling program of recreational activities at the whole state level.

The case of the Balearic Island is probably special. The *Direcció General de Pesca del Govern Balear* recognizes the socioeconomic value of recreational fishery and promotes its regulation and sustainable management. In addition, recreational fishing is a consolidated research line at the IMEDEA scientific research institute. Finally, angler associations are aimed to promote enhancement of the quality of the resources, thus are prone to collaborate in scientific projects.

Therefore, here we present data and suggest sampling strategies focusing only at such regional scale that could not be of general application.

7.14.4 Available statistics

Statistic	Data sets available, and where/how archived
Number of resident anglers	Demographic Statistical from Spanish department
Number of visiting anglers	Tourism department from Spanish department
Number of resident vessels	Harbor department from Spanish department
Number of visiting vessels	Harbor department from Spanish department
Fishing effort: Angler days	Morales-Nin et al (2005) and other research paper published. Project CONFLICT (2009-2011)
Fishing effort: Vessel days	Morales-Nin et al (2005) and other research paper published. Project CONFLICT (2009-2011)
Quantity of catch by species or species group, retained for consumption	Morales-Nin et al (2005) and other research paper published. Project CONFLICT (2009-2011)
Quantity of catch by species or species group, used for bait	Morales-Nin et al (2005) and other research paper published. Project CONFLICT (2009-2011)
Quantity of catch by species or species group, that is released	Morales-Nin et al (2005) and other research paper published. Project CONFLICT (2009-2011)
Other statistics (specify)	

7.14.5 Previous survey methods

Different kinds of information acquisition were used and evaluated in the previous recreational research project done by our research group (SUMA'T and ROQUER). These methodologies are actually applied in different work-packages of the new project CONFLICT:

- 1) The first kind of information is generated from the fishing licenses. Data about social aspects such as spatial and temporal patterns or age and sex participation can be accessible also.
- 2) A multiple approach based on a telephone survey, on-site and mail personal interviews, voluntary logbooks, and records from recreational fishing competitions was used

for more reliable assessments of the actual numbers of recreational anglers and their habits, fishing effort and yields

2.1) Telephone survey randomly selected

2.2) Face-to-face interviews personally surveyed people observed fishing or returning from a day of fishing at harbours or along the shore, according to a stratified spatiotemporal design. Anglers Interview during the most active times of day, early morning and midday at harbours, and marinas, boat shows and mid-morning along the shore.

2.3) Mail surveys

2.4) Volunteer recreational anglers fishing logbooks

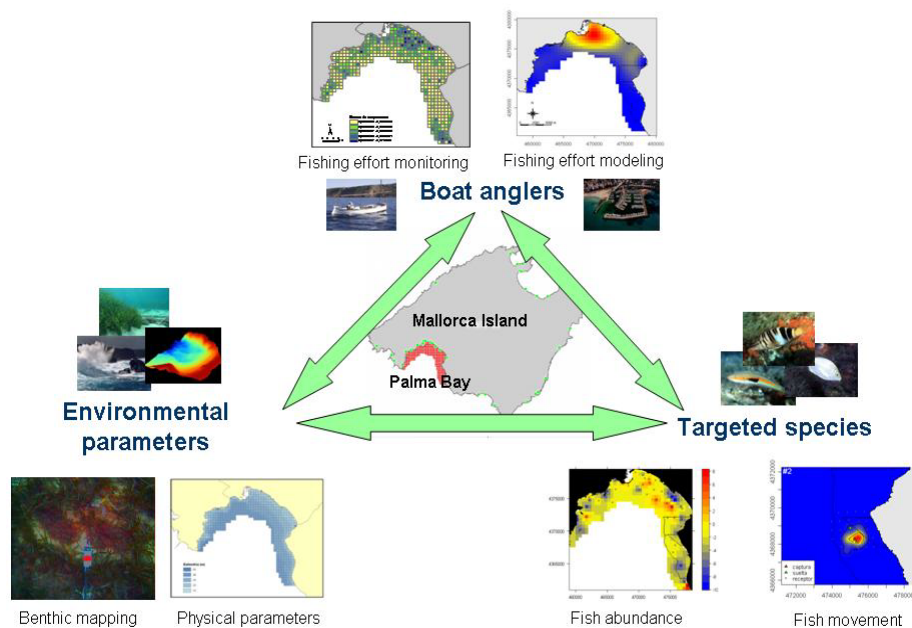
2.5) Monitoring recreational fishing tournaments. From 1998 to 2009, the Fishing GD has monitored the recreational fishing tournaments held on Majorca Island, recording the duration, number of participants, and catch by number and weight for each species, along with the size (total length, TL) of all fish caught or of a representative sample of the catch.

3) Direct estimates.

SUMA'T project was the pioneer research project of recreational fishing at the Balearic Islands. This project demonstrated that telephone surveys and interviews can be imprecise and may suffer important uncertainties due to the attitude of the anglers. We do not propose to abandon this type of survey but it is important to realize that there is a need for validating the data on fishing effort and CPUE obtained from interviews.

SUMA'T project evaluated a number of on-site methods for estimating fishing effort. Namely, aerial flights, Coastguard surveys, IMEDEA boat survey, boat outings from marinas and shore survey. All of them have pros and contras but in our opinion surveys from a boat made by IMEDEA (i.e., the final users of the information) have the best ratio between cost and quality of the information obtained.

We also realized that there is a need for a more holistic approach that takes into account not only the fishers but also the environmental scenario and the target species. The current sampling program we are developing is based in the following scheme:



Concerning fishing form boat (the most important), the basic survey of fishing effort consists in weekly-monthly on boat surveys of the entire scenario. The position and characteristics (e.g., boat size, number of anglers) of each boat are recorded. One hundred of these sampling trips are available at this moment for the most popular modality (Roquer), but it is expected to continue this monitoring program during some years. Long-term monitoring (at the decadal scale) is not possible at IMEDEA.

These on-site surveys represent partial samples of the fishing effort. Thus, the key point is to be able to build a robust statistical model for predicting fishing effort (i.e., fishing journeys per day) at the entire scenario with a spatial precision of 0.25 km². The putative predictive variables included in the model cover three main categories: Spatial variables (bathymetry, type of bottom, distance to the harbour/marina, distance to some MPA...), temporal variables (weather related variables) and resource-related variables (target species abundance).

Proper management and analyses of all these data implies to develop a geographic information system (GIS). Note that the aim is not only to describe the spatio-temporal patterns of fishing effort but also to understand the reasons (when and where) anglers go to fish and thus, to be able to predict fishing effort at the scale of the entire scenario.

The sampling program of fishing effort is completed with a sampling program aimed to estimate CPUE. Experimental fishing is completed for the main fishing modalities, covering the entire spatial scenario and all the seasons. This spatio-temporal precision imposes to limit the extent of the scenario. At this moment we are limiting the sampling effort (fishing effort and CPUE) to the Palma Bay only.

Note also that this scheme puts much attention in the effects of recreational fishing on the biology of fishes. Accurate description of biological objectives (aging, population dynamics) surpasses the objectives of the current ICES workshop, but we should realize that fisher's satisfaction depends, for example, on the size of the captures.

7.14.6 Primary Customers for the data, and intended uses

		Customers for data					
		European Commission	National government	Stock assessment scientists	Academic researchers	Fishing industry	General public
Type of data	1 Participation	A	A		A,C		
	2 Fishing effort	A	A		A,C		
	3 Total catch (retained/released) by species	A	A		A,C		
	4 Catch per unit effort by species	A	A		A,C		
	5 Size/age distribution of catch	A	A		A,C		
	6 Socio-economic data	A	A		A,C		
	Key species (give list)						

Key: A: General monitoring of trends; B: Stock assessment; C: Monitoring of annual statistics relative to annual management targets for specific species; D: In-season monitoring of cumulative statistics relative to annual management targets for specific species; E: other (specify)

Table 1: Summary of national recreational fisheries: angling (ONLY THE MOST IMPORTANT SUB-MODALITIES ARE LISTED.)

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
Estuaries and enclosed bays or sea loughs								
Open sea: Inshore (shore to <30m depth): BAYS INCLUDED	Rocky shores and private boats	Roquer (see above)	Rod and line (bait)	S	MLS, BL,A	A	<Partial	Low
	Man-made structures					D		
	Beaches (Night fishing for sea breams)	<i>Lithognathus mormyrus</i> , <i>Sparus aurata</i>	Rod and line (bait)	S	MLS, BL,A	B-C	<Partial	Low
	Private boats	<i>Xyrichthys novacula</i>	Rod and line (bait)	S	MLS, BL,A,S	A	<Partial	Low
	Private boats	squid	Hand line (lure)	S	MLS, BL,A	B	<Partial	Low
Open sea: Offshore demersal (>30m depth):	Private boats	Platform hook-and-line (<i>Serranus cabrilla</i> and Sea breams)	Rod and line (bait)	S	MLS, BL,A	A	<Partial	Low

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
Open sea: Offshore pelagic and Oceanic:	Private boats	Trolling (<i>Trachurus sp</i> , <i>Lichia amia</i> , <i>Auxis rochei</i> , <i>Seriola durmerili</i> , <i>Dentex dentex</i>)	Rod and line (lure)	S	MLS, BL,A,S (for some species)	B	<Partial	Low
	Charter / private boats	Big game (tunas, marlins and swordfish)	Rod and line (bait or lure)	S		C	<Partial	Low

^{1,2,3,4,5:} See below Table 2 for codes to enter

¹ Y =Year-round fishery, S =Seasonal fishery (provide separate information on active months and peak periods); P = Pulse fishery (provide separate information to specify months when fishery is most likely to be present)

² MLS (=minimum landing size); BL (=bag limits); S (=closed seasons); A (= closed areas); P (=protected species regulations); VCR (= voluntary catch and release)

³ A: relatively large numbers; B: Intermediate; C: Relatively small numbers; D: very small numbers N/A: No information available.

⁴ Full (= fully accessible); Partial (= only partly accessible); <Partial (= less accessible than "Partial"); None (not accessible); N/A: no information

⁵ High (high level of statistical precision); Medium (medium level of statistical precision); Low (low level of statistical precision); None (no data or statistics available)

Table 2: Example summary of national recreational fisheries: **non-angling**

We omitted this table because the only relevant non-angling modality is spearfishing.

Table 3: Regional availability of lists and sampling frames for carrying out surveys of the general public to collect information on participation in different forms of recreational fishing.

Site	Type of lists	Sampling frames	Availability	
Off-site	Mailing-address directories	Postal household frame	Partial	
		Registry-based angler frames	Angler licences	none
			Angler permits	none
			Other angler registries	partial
		Registry based vessel operator frames	Vessel licenses	partial
			Vessel permits	none
			Other vessel registries	partial
		Telephone directories	Random-digit-dialing household frame	partial
			Phonebook household frame	partial
	Registry-based angler frames		Angler licences	none
			Angler permits	none
			Other angler registries	partial
	Registry based vessel operator frames		Vessel licenses	partial
			Vessel permits	none
Other vessel registries		partial		
On-site	Site or access point lists (points of departure or return for fishing trips)	Public access sites	partial	
		Private access sites	partial	

7.15 Sweden

General overview of national recreational fisheries

There is no mandatory requirement in Sweden to collect data regarding recreational fisheries. Approximately 1 million citizens (from 2008 interview study) will at some time during the year practice recreational fisheries in some form. The total catch in tons of fish is approximately equally distributed between marine and inland recreational fisheries. The Swedish recreational fisheries are spread out along a very long coastline and over ten thousand lakes are subject to recreational fisheries. This contributes strongly to the problem of estimating the impact of the recreational fisheries on fish stocks. The problems of accuracy and precision in all previous Swedish studies should not be underestimated. A few interview studies regarding the recreational fisheries in general (both inland and offshore fisheries) have been carried out during recent years but they have not yet been standardized. There were rather large differences in results between the 2005 and 2008 studies due to their setup. A new and somewhat differently planned study will be carried during 2009. It will be possible to adapt that study to future DCR requirements.

This means that it is difficult, or pointless, to answer some of the questions in this proforma and some of the questions asked have never been addressed in Swedish studies. Therefore, we will here mainly report results regarding cod and salmon (as recreational fisheries on these two species may affect TAC available for the commercial fisheries) and we will bring to the attention the difficulties that we are aware of so far. An unpublished mark and recapture study of cod in the Skagerrak, the Kattegat, and the Sound during 2003-2005 gave much lower estimates of the importance of the recreational fisheries compared to the above mentioned interview studies. The estimates of recreational fisheries on salmon that are reported here are made independently of the more general interview studies mentioned above. A DCR Pilot study was carried out in 2002-03 regarding salmon fishery. This study gave an overview of the present state of most recreational salmon fishery at sea, along coasts and in rivers, without providing precision estimates (Anon. 2003).

7.15.1 Detailed description of national recreational fisheries

7.15.1.1 Categories of recreational fishing

In Sweden recreational fishing is divided into two categories; one is fishing using equipment where the fisherman cannot control the number of fish taken (nets, traps etc) and the second is "hand held gear".

7.15.1.2 Geographic delineations

For cod: Skagerrak, Kattegat, Western Baltic including the Sound, Eastern Baltic (remaining part of the Baltic Sea).

For salmon: Offshore and coastal regions in Baltic Main Basin, offshore and coastal regions in Gulf of Bothnia, rivers in Main Basin and Gulf of Bothnia.

7.15.1.3 Water bodies

(No accurate details available from Sweden)

7.15.1.4 Platforms for fishing

(No accurate details available from Sweden)

7.15.1.5 Target species or species groups

(Only some general information given here)

Angling in the Sound target cod (using private boats or charter boats)

Angling in salmon rivers target salmon and sea trout and in some rivers also grayling.

Offshore trolling in south Baltic targets salmon and sea trout.

7.15.1.6 Fishing gears used

Estimated for all recreational fishermen, not only salmon and cod, as one group.

Gear type	Ranking
Rod and line, or hand-lines	1
Long-lines	
Dip net or A-frame (push net?)	
Cast net	
Gill net	2
Seine	
Trawl	
Pot	3
Trap	4
Spear	
Hand	
Others (specify)	

For salmon a natural division is “all angling” in one area/river.

Traps would only be important for lobster (only traps are allowed).

7.15.1.7 Seasonality

Cod is fished year round and the major fishery on cod is in the Sound. Salmon is fished by trolling in spring and autumn in offshore areas, in coastal regions in spring-summer and in rivers in summer.

7.15.1.8 Tournament fishing

Tournament fishing for cod is arranged annually in the Sound.

For salmon competitions/tournaments take place in offshore trolling particularly in the spring and for river fishery there is at least one tournament in summertime covering the two largest salmon rivers. In particular the offshore trolling has already been used to provide addresses and other input for questionnaires.

7.15.1.9 Management regulations and other schemes affecting recreational fisheries

Seasonal restrictions (mainly during the spawning period) for cod fishing occur locally in order to protect local cod populations. Size limit is 35 cm and bag limit is 3 fish per day in some areas.

Offshore salmonid trolling is so far not restricted, coastal recreational trapnet fishery may be affected by regional restrictions close to wild salmon rivers. In rivers there are seasonal restrictions as well as sometimes also bag limits. In addition in some areas/rivers there are bans on landing of wild salmon (not adipose fin clipped) while reared ones are landed (management decision in 2005 to have adipose fin removed on all reared smolts released into the wild). Minimum landing sizes are applied but normally almost all fish exceed this limit.

Regulations of season lengths or closed areas

Salmon: This has some effect in the early part of the season in some rivers

Regulations of bag limits

Cod: unknown effect.

Salmon: has rarely any effect on salmon fishery.

Regulations of size limits

Cod: unknown effect.

Salmon: may have some effect in offshore trolling. Little effect in coastal fishery or river fisheries.

Regulations of fishing effort (e.g., numbers of traps, gill nets, etc.)

Cod: 180 m net length, seasonal and depth regulations for nets may occur locally.

Salmon: in the coastal fishery with trap nets, seals have caused heavy damage. This has caused commercial fishermen to switch to subsidized seal-safe gear. Recreational fishermen are not subsidized and are thus leaving this fishery. In some salmon rivers an upper limit on number of fishermen.

Fishing license requirements

Cod: No license requirement

Salmon: In coastal fishery with trap-nets many preferred areas close to or even in rivers are for licensed fishermen.

Protected species regulations

Cod: some protected areas

Salmon: All wild salmon rivers have restrictions on fishery close to river mouth and also in rivers.

Voluntary catch-and-release schemes

Salmon: This has been implemented to various degrees in different rivers, but it is on rapid increase.

7.15.2 Possible sampling frames

7.15.2.1 Area frames

Cod: The Sound is the most important area for recreational fishing. It is also an easily identified area and it is also used by the Danes and foreign tourists.

Salmon: Southern Baltic for trolling, all salmon rivers, spread from south Sweden to the Finnish-Swedish border.

Individual salmon rivers or even individual fishery within areas covered by individual fishery rights owners in rivers.

7.15.2.2 List frames

Salmon: Tournaments do normally have lists. This is mainly applicable for offshore trolling. Fishing licenses for rivers are sold by local Fisheries Management Organizations. An increasing share of these have made it mandatory to provide name and address of fishermen. But the implementation of this rule is often relaxed.

7.15.3 Available statistics

Below we provide a new table that suits the cod and salmon data available in Sweden.

Total allowable catch (TAC) and estimates of Swedish recreational catch of cod (RC, for 2006 only) from an interview study.
Estimates of recreational catch of salmon from annual or periodic surveys directed towards salmon fisheries.

(Cod TAC and RC in tons and salmon TAC in numbers and RC in tons)

Species and ICES areas	TAC 2006	RC 2006 "nets" ¹	RC 2006 "angling" ¹	RC 2006 Total	Total RC 2006 % of TAC
Cod ²					0
Cod E Baltic, 25-32	49200	49	3	52	
Cod W Baltic, 22+24 ³		21	101	122	
Sound, 23 ³		86	437	523	2
Cod W Baltic total, 22-24	28 400	107	538	645	4
Cod Kattegat, 21	850	3	29	32	5
Cod Skagerrak, 20 ⁴	3 300	12	152	164	
Salmon ^{5,6}					0
Baltic, coast and sea 22-29		333	333	666	2
Gulf of Bothnia, coast and sea 30-31		7029		7029	2
Baltic Sea, 22-31 ⁵	460000	7362	333	7695	3
Rivers, 22-31		8049	4180	12229	4
Baltic Sea, including rivers, 22-31		15411	4513	19924	

TAC data come from ICES and the RC estimates for cod come from an interview study reported by the Swedish Board of Fisheries.:
2008: Fritidsfiske och fritidsbaserad verksamhet (in Swedish, no English abstract). This report will be presented and available during
the meeting in Nantes 2009. For salmon estimates of recreational catches are collected by directed surveys towards salmon
fisheries. Collection take place for rivers, coastal areas and the sea.

Comments

1. "Nets and angling": In Sweden recreational fishing is divided into two categories; one is fishing using equipment where the fisherman cannot control the number of fish taken (nets, traps etc) and the second is with any kind of hand held gear.
2. An unpublished mark and recapture study of cod in the Skagerrak, the Kattegat, and the Sound during 2003-2005 gave much lower estimates of the impact of recreational fishery compared to the estimates for 2006 by the interview study (Svedäng, H.: Mark and recapture experiments as a way of validating the relative importance of leisure fishing. Swedish Board of Fisheries, henrik.svedang@fiskeriverket.se. This unpublished report is submitted to the WKSMRF meeting in 2009.
3. W Baltic is divided here into W Baltic (excluding the Sound) and the Sound. Note the high RC (437 ton) in the Sound.
4. The 2006 Skagerrak TAC (3300 ton) is part of the much higher TAC for the North Sea that includes the Skagerrak. % of RC to North Sea TAC is therefore much lower than 5 %.
5. Salmon TAC covers catch in coastal and offshore areas, river catch not included in TAC. Regarding DCR regulations, EU requires addition of freshwater catch for calculation of proportion of share of recreational to total catch.

Statistic	Data sets available, and where/how archived
Number of resident anglers	2008 interview study, Swedish Board of Fisheries
Number of visiting anglers	
Number of resident vessels	
Number of visiting vessels	
Fishing effort: Angler days	2008 interview study, Swedish Board of Fisheries
Fishing effort: Vessel days	2008 interview study, Swedish Board of Fisheries
Quantity of catch by species or species group, retained for consumption	2008 interview study, Swedish Board of Fisheries.
Quantity of catch by species or species group, used for bait	
Quantity of catch by species or species group, that is released	
Other statistics (specify)	Salmon: Statistics is collected annually for all salmon rivers. Periodic studies are made of offshore trolling fishery, Estimates for recreational trapnet fishery collected annually

7.15.4 Previous survey methods

DCR Pilot studies

In 2002-03 a DCR pilot study was carried out of the recreational salmon fishery in the Baltic. The study consisted of three parts:

- a) A summary was made of the existing system for collection of catch statistics in rivers. As there is a number of different kinds of fisheries and many kinds of organisations, no uniform method is available.
- b) There is a coastal recreational trapnet fishery in Sweden and an inventory was made of the total number of trapnets operated by commercial and recreational fishermen from the borderline Sweden/Finland and to the archipelago of Stockholm. This inventory gave a basis for comparing the catch of commercial fishermen and those by recreational fishermen in the same area.
- c) A pilot study of the trolling salmon fishery in southern Baltic. This was carried out by studies at the largest trolling port in the area, Simrishamn, questionnaires sent out to trolling fishermen and inventories of trolling fishing boats in ports along the coasts of several counties in south Sweden.

Detailed results of the studies are available only in Swedish reports, but a summary is provided in English.

Anon. 2003. Game and recreational salmon fishery in Sweden. Swedish Board of Fisheries, Institute of Marine Research.

Current methods

The 2009 interview study by the Swedish Board of Fisheries is carried out in collaboration with the Swedish Statistical Agency (SCB). The study includes all recreational fisheries in Sweden including inland waters, rivers, and off shore fishing (brackish and marine waters). Target population includes all citizens of Sweden between 16 and 74 yrs of age. The study is divided into two parts. In part one 10 000 people receive a letter asking if they have done recreational fishing during the previous yr. Two more letters are sent to non-responding persons and a non-response study is carried out (telephone interviews with 600 persons). In part two a more comprehensive questionnaire is sent to those who actually did recreational fishing. Again two more letters are sent to non-responding persons and a non response study (600 persons) is carried out (telephone interviews). This study may be carried out every second year and changes in the questionnaire for TAC species can be made in future studies.

Salmon: The compilation of river statistics is difficult due to the varying degree of organization and different kinds of fisheries occurring in different rivers. In addition the varying size of the rivers gives rise to a need for variable approaches. In almost all rivers angling is covered by data from individual fishery rights owners, but the quality of this statistics is very variable. In most cases there is a requirement of fishermen to report their catch, but this rule is enforced to a variable degree. Data on other kind of fisheries (seine, net, trap-nets in rivers) are normally collected via questionnaires from authorities to individual fishermen. Offshore trolling has been studied by questionnaires, complemented by data from statistics from major ports. Even though the quality of data in some cases is of high quality, no statistical methods have been used to estimate the precision and accuracy of the data.

Previous methods

Interview studies were carried earlier out but their set up has been changed for 2009 (see above). Details for earlier studies are therefore omitted here.

A mark and recapture study was carried out 2003-2005 in the Skagerrak, the Kattegat and the Sound. The study attempted to validate earlier interview estimates of the recreational cod catches by the Swedish Board of Fisheries on the Swedish west coast (Sub-Divisions 20, 21, 23). The validation method is based on the recapture of 318 tagged cod (41 % recaptured out of 771 tagged cod) by both recreational and professional fishers. While the earlier studies interview estimates indicated that the recreational cod catch in the Sound could well be higher than the commercial landings from the same area, the mark-recapture analysis arrived at much lower (11 times lower) values. As already mentioned in the general overview, the problems of accuracy and precision in all previous Swedish studies should not be underestimated.

For salmon similar methods have been in used for a number of years and there is a need to corroborate the precision and accuracy of the data collected. Furthermore data need to be broadened to not only cover retained catch but also catch and release and fishing effort.

7.15.5 Primary Customers for the data, and intended uses

Cod (C) and Salmon (S)

		Customers for data					
		European Commission	National government	Stock assessment scientists	Academic researchers	Fishing industry	General public
Type of data	1 Participation		A (C)				A (C)
	2 Fishing effort		A (C)				A (C)
	3 Total catch (retained/released) by species	B(S)		A(S),B(S)			
	4 Catch per unit effort by species		A (C)				A (C)
	5 Size/age distribution of catch	B(S)		B(S)			
	6 Socio-economic data						
	Key species (give list)						

Table 1. Summary of national recreational fisheries for salmon only.

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴	Robustness of Available Data/Statistics ⁵
Rivers	Shore, private and rental boat	Salmon, sea trout	Rod and line	S	MLS, BL, S, A, P,	B	Partial	Low-High
Open sea	Private or rental boat	Salmon, sea trout	Trolling	S	MLS	C	<Partial	Medium

Table 2: Summary of national recreational fisheries: non-angling regarding salmon. Non-angling in salmon rivers, gear seine nets, trapnets, traps targeting whitefish and salmonids. Coastal trapnet fishery targeting whitefish and salmonids.

Water body	Platform	Main species targeted	Gear used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for sampling ⁴	Robustness of Available Data/Statistics ⁵
Rivers	Shore, private boats,	Salmon, sea trout, whitefish	Seine nets, traps, gill net	S	MLS, BL, S, A, P,	C	<Partial	Medium
Coast	Shores, private boats	Salmon, whitefish, sea trout	Trapnet	S	MLS, BL, S, A, P	C	<Partial	Medium

Table 3: In Sweden there is no general applicable database. When doing national surveys of the fishery, the national registration is used as a base for selection of individuals to include in the survey. There are datasets covering parts of the recreational fishery. These datasets are often restricted to certain areas/harbours. This comment would be to explain that we have difficulties in filling in the table. As far as we know for salmon we have some data based on angler licenses, either as mailing list directories or telephone directories. On site we have some public access sites with partial data.

7.16 United Kingdom (England)

7.16.1 General overview of national recreational fisheries

Marine recreational fishing (MRF) is considered to consist of all non-commercial fisheries that are also not undertaken for predominantly subsistence purposes (Pawson *et al.*, 2007). Angling is the capture of fish using hooks and recreational sea angling the activity of attempting to catch marine fish by using hooks and line, in particular in conjunction with a fishing rod, and without sale of the fish caught. We define recreational sea angling (RSA) as the activity of catching or attempting to catch sea fish by rod and line, pole or hand-held line, for non-commercial purposes; recreational anglers do not sell the fish they catch.

In the UK, the public has a right to fish in tidal waters, except where exclusive rights have been acquired or the public's common law rights have been restricted by Parliament and at present no license is required for recreational sea fishing. However, a licence is required to catch salmon or migratory sea trout in England and Wales (Pawson *et al.*, 2007). Recreational angling forms the largest sector of the recreational fisheries with the number of participants estimated to be in the region of 1.5 million and 1.1 million households containing at least 1 person who went sea angling in the last year (Drew, 2004). However, MRF is also carried out using a number of other methods, although the level of participation in these activities has not been quantified to any extent.

The DCR specifies that cod and bass recreational fisheries must be sampled in the North Sea and Western Waters, respectively in addition salmon and eels. Both of cod and bass are important recreational sea angling (RSA) species and cod is subject to management plans in a number of sea areas. Other species under management plans that feature to a lesser extent in angling catches, but which are also taken in recreational fisheries using angling and/or non-angling gears include sole (VIIe under management plan), plaice, herring, mackerel, the latter noted as the most frequently taken species by UK anglers in a survey conducted by NFSA (now part of Angling Trust).

7.16.2 Detailed description of national recreational fisheries

7.16.2.1 Categories of recreational fishing

Recreational sea angling

RSA forms the largest component of UK (E & W) MRF with 1.1 million households (1.5 million individuals) estimated to contain at least one member who had been sea angling in the past year and a total of 12.7 million angler days of activity. These figures, derived from the household survey, indicated a mean number of days fished per annum per household of 11.3, with 24% fishing only once per year, while figures derived from angler interview surveys produced much higher estimates of the mean number of days fished per annum (23 - 78, depending on fishing platform and survey method).

The authors note that these may be affected by avidity bias, but do not comment on recall bias which can be substantial (a factor of 3 has been reported in the South Pacific. RSA participation has been broken down by fishing platform with shore anglers contributing 54%, private boats 23% and charter boats 22% of participants (Drew, 2004). A similar breakdown of days fished (and proportion of catch retained) results in shore contributing 65% (32%), private boats 25% (39%) and charter boats 9% (38%).

Other marine recreational fishing

These metiers are essentially different from angling in that gears other than (attended) hook and line are employed. There have been few if any significant efforts to quantify the extent of non-angling MRF in the UK. Can be categorised by the gears used into the following fisheries (see also Tables 1 & 2):

a) Diving, snorkelling and spear fishing

Largely targeting macrocrustaceans and bivalves (e.g. scallops), flatfish and opportunistically other whitefish. The level of participation is unknown, thought to be low relative to angling, but possibly significant for some species. Visibility of water column is important and temperature may also influence participation levels.

b) Pot fishing

Targeting macro-crustaceans (lobsters and crabs), this sector is recognised in local SFC legislation as in many areas the number of crabs or lobsters that can be taken is restricted and, in some cases, the number of pots that can be deployed by unregistered fishermen is also limited. The level of activity is not quantified, but potentially significant.

c) Net (enmeshing and encircling) fishing

This metier can be locally popular, including in some cases by tourists, although legislative controls, which may not be particularly widely published, may deter some potential participants. It includes bottom and surface set nets (fixed and/or drift) targeting flat and roundfish and potentially macrocrustaceans, as well as occasional seining including sand eel seining, which may be practiced by RSA as a method of capturing bait. There are likely to be regional variations in level and types of activity, possibly dependent on local conditions and species availability. The number of participants is likely to be low relative angling.

d) Long-lining

This metier is likely to have a relatively low participation, as it is quite labour intensive, but it is traditional in some parts of the country and activity might be expected to increase if controls on netting were increased. A range of whitefish species (flat and round) may be targeted.

e) Trawling

This metier is very limited for recreational use as it generally requires reasonably roomy and powerful boats and there is substantial legislation (technical measures), not widely publicised, which may deter some people from trawling recreationally. Nonetheless, there is likely to be some very limited targeting of whitefish and beam-trawling for shrimps in areas where they are abundant. Participation is thought to be very low.

f) Dip netting (including drop netting)

Primarily targeting species such as *Palaemon sp.* and possibly *Crangon sp.*, but drop netting could be used to take some larger crustaceans and possibly fish. This metier may have quite substantial numbers of participants in some areas.

g) Hand gathering

This fishery consists mainly of molluscan gathering (e.g. cockles, mussels, winkles) and potentially some macro-crustaceans, including crabs and lobsters in certain areas. Crabs (mainly green crabs *Carcinus maenus*, but also velvet crabs, *Necora puber*, edible crabs *Cancer pagurus* and other species)

and molluscs (mussels, razor clams) may also be collected as bait for angling.

h) Bait digging

It is not clear whether this falls within a fisheries remit, but the digging of annelid worms for angling (or long-lining) bait could have substantial participation in some areas, including some commercial activity.

7.16.2.2 Geographical delineations

The DCR specifies regional differences for sampling cod and bass in the UK. Regionally stratified sampling will be necessary to take account of stock structures and differences in species availability and seasonality. These are likely to be reflected in local fishing practices. Catch and effort data are therefore likely to vary between regions dependent on species abundance and capture approaches.

7.16.2.3 Water bodies

The potential importance (rank) of various water bodies based on a consideration of angler participation (with regards to marine species) is given in the table below.

Water body type	Ranking
Freshwater rivers or lakes	NA
River estuaries	2 (NI – anecdote)
Semi-enclosed bays, sea loughs, lagoons, fiords, sounds	2 (NI – anecdote)
Open sea: Near-shore coastal (e.g. <20m depth)	1 (NI – anecdote)
Open sea: Offshore demersal (e.g. > 20m depth)	4 (NI – anecdote)
Open sea: Offshore pelagic and Oceanic	5 (NI – anecdote)
Other (specify)	

NA: not applicable

NI: no information

Anecdote: preliminary estimate based on anecdote only

The separation of river estuaries from semi enclosed bays, sea loughs in this classification does not seem entirely warranted, as they have many of similar features, notably relatively sheltered waters. Further, the definition of semi-enclosed needs to be precise so the distinction between this and relatively sheltered coastal waters is clear.

Most MRF is likely to take place from the shore or in near-shore coastal waters. Semi-enclosed waters may be particularly attractive because they offer shelter and relative safety, but the overall extent of estuarine and semi-enclosed waters is likely to be less than open coastal waters, hence these have been ranked second.

Different water bodies may contain different species assemblages, which could influence catch rates. However, this is likely to be at a very local population level and may not be reflective of trends in the stock.

7.16.2.4 Platforms for fishing

The potential importance (rank) of various fishing platforms based on a consideration of angler participation (with regards to marine species) is given in the table below. The distinction between charter and head boats is less clear in the UK than in North America. In the UK Charter boats may permit additional individual anglers to join a pre-booked party if this is agreed upon, or build up charters from a number of indi-

vidual bookings. Nonetheless there are also 'fishing trip' boats that are more analogous to head boats.

Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	1 (NI - anecdote)
Beaches	1 (NI - anecdote)
Rocky shorelines	4 (NI - anecdote)
Private boats	3 (NI - anecdote)
Rental boats	7 (NI - anecdote)
Charter or Guide boats (<i>for-hire boats where passengers pay as a group to hire the vessel and the services of the captain and crew in advance of the trip</i>)	4 (NI - anecdote)
Head, Party, or Open boats (<i>for-hire boats where passengers pay as individuals for space on the boat and can "walk on" just prior to the trip</i>)	6 (NI - anecdote)
Other boats (e.g. merchant ships at anchor)	8 (NI - anecdote)
Other (specify)	

Man-made structures often permit access to deep water relatively close in, either through the structures extending to naturally deep water (breakwaters and piers) or through dredging of harbours and they also often provide relatively easy access. They may be very popular venues. Some rock marks may offer similar advantages of deep water close in, but they are more likely to be relatively remote and difficult to access. Man-made structures offer advantages for angling, but also tend to be busy and anglers who fish them may enjoy the social aspect of fishing 'in a crowd', whereas rock marks, although possibly offering similar advantages in terms of depth, are likely to be less accessible. Many harbours are sited in estuary mouths, where the inner side of a breakwater may provide access to a significantly different habitat to the outside. The latter may be more similar to natural rock marks. The social aspect of angling is also an important part of the experience for those competing in tournaments and on charter vessels.

The distinction between private boats, charter and head boats is important and may capture a significant amount of fishing power. Charter boats tend to be larger, more powerful, skippered and crewed by experts, and targeting more specifically (size and species) and attracting more expert anglers than head boats, which will tend to operate more seasonally and target smaller and more easily caught fish. Private boats encompass a huge range of vessel size (canoe, rowing boat, outboard powered boats, large motor cruisers) and expertise from those who may fish occasionally for easily caught species like mackerel to specialist anglers targeting very specifically. In general terms most private angling boats are unlikely to be as efficient as charter vessels, which are operating professionally.

Capturing fishing power of smaller private boats may be more difficult since this may vary widely depending on the method used and the particular target species sought (i.e. the metier). For static gears the amount of gear in the water may be informative, but gear design and soak times also have influence.

For angling boats, the number of 'crew', ability of the vessel to handle poor weather and electronics aboard are all likely to contribute to increased fishing power.

Harbours and launch sites may influence fishing activity, as boats moored in harbours or marinas where 'step aboard' access is available allow much more instant access to fishing and less need for planning. However, modern boats and trailers can also be launched and retrieved relatively easily, providing tide and weather conditions at the launch site are suitable. Location of the access point relative to fishing

grounds is a further consideration, with some locations very close to fishing grounds and others requiring some considerable steaming time and cost to reach the fishing grounds. Intercepting boat anglers at harbours and launch sites is likely to be difficult and costly.

7.16.2.5 Target species or groups

Species availability and targeting will be regionally and seasonally variable. Fishing platform may also influence species availability and targeting. For example, boat fishing may extend the seasonal availability of some species and may provide opportunities to target larger fish of the same species or different species. See tables 1 & 2.

In the North Sea, RSA targets relatively fewer species than in the English Channel, and it may be possible to define metiers according to target species. However, some anglers may fish generally, without serious target, and some anglers may start a trip targeting one species, but change gear to widen the possibilities if the first target is not forthcoming. Similarly different trips by the same angler may target different species, and ground and/or target species may be changed during a single trip.

For metiers based around gears other than rod and line, the level of species targeting may also vary. In general there will be one or two main target species, but additional 'bonus' by-catch may be very welcome and sometimes possibly targeted to some extent. Some metiers may be very precisely targeted, e.g. collecting bivalves such as cockles or mussels.

Examples of some well-defined metiers are included in tables 1 & 2.

7.16.2.6 Fishing gears

The table below summarises the possible importance of different gears for MRF in the UK.

Gear type	Ranking
Rod and line, or hand-lines	1
Long-lines	5 (NI - anecdote)
Dip net or A-frame (push net?)	2 (NI - anecdote)
Cast net	8 (NI - anecdote)
Gill net	5 (NI - anecdote)
Seine	7 (NI - anecdote)
Trawl	8 (NI - anecdote)
Pot	3 (NI - anecdote)
Trap	8 (NI - anecdote)
Spear	4 (NI - anecdote)
Hand	3 (NI - anecdote)
Others (specify)	

Several of these are likely to be used by relatively very few participants (e.g. trawls, cast nets and traps), while at the other extreme as already noted RSA has an estimated 1.5 million participants.

It would be possible to define angling at a higher resolution by gear and there are differences in catch composition, selectivity and catchability associated with the use of different gears. However, these systematic differences may be masked by wide differences in individual catch and selectivity rates. Given the present situation of data paucity, it may be that sampling at a lower level of gear aggregations does not add significantly to the overall statistics. However, depending on the cost of the data

collection programme this may be a consideration. A pilot scale logbook scheme does specify gear types for angling, and we also included question on this in a recent questionnaire survey of RSA carried out for Natural England (report not yet available in the public domain).

There are also numerous subtleties to the other gears specified in the table above, for example pots could be subdivided into various types, with parlour pots likely to have higher catch rates and longer soak times. However, individual 'hobby' fishermen may fish a variety of different designs of pots and therefore sampling of their catch at a very precise gear specification would be difficult.

Gill nets includes, tangle nets and trammels and can be fished on the surface or on the bottom, fished static or drifted and have different selectivity characteristics dependent on hanging ratios. However, obtaining such a vast array of technical information in addition to target and ground characteristics could result in numerous very individual metiers with broadly similar overall characteristics. Given that these metiers are likely to be relatively small relative to RSA a fairly high level of aggregation seems sensible and practical if these are to be included in any sampling scheme.

7.16.2.7 Seasonality

In practice most year-round fisheries have seasonal variations due to fish availability, weather and holiday periods. The species specific resolution of the metier will determine how much seasonality needs to be taken into account for sampling. For example a cod, bass or bream fishery would be seasonal when considering each species, but if considered as part of an inshore mixed demersal fishery, the activities of the fishery would be more prolonged as fishing switches between species according to availability. Seasonality also varies according to the platform – shore fishing for cod and whiting is predominantly from autumn through to spring, but the species are available to boat anglers at other times of year.

The table below provides a very provisional indication of species seasonality for a few of the key species in the UK, with the main season highlighted in bold.

Winter	Spring	Summer	Autumn
Cod	Cod		Cod
		Bass	Bass
Whiting			Whiting
Flounder	Flounder	Flounder	Flounder
	Black (& gilthead) bream	Black (& gilthead) bream	
	Rays		

7.16.2.8 Tournament fishing

In the UK, tournament fishing is largely the preserve of angling, although there are some spear fishing competitions. The British Spearfishing Association (BSA) Championship involves 40 to 60 divers on a regular basis and takes place over 6 or 7 competitions throughout the country, from early May to September (BSA, 2009).

Angling competitions take many forms, including:

- Highest aggregate weight,
- Largest individual fish,
- Single species competitions,
- Species hunts (points awarded for each different species caught),
- Specimen awards (season long club run schemes for the largest fish by species), and
- Catch and release (fish may be measured rather than weighed).

Tournaments may be shore based or boat based, including both private boats and charter boats. Many charter vessels encourage informal competitions for members of their parties.

7.16.2.9 Management regulations for key species

Management of fisheries in the UK occurs at three levels; EU, UK national and UK local. There is a range of measures that may be applied and which may be species specific (e.g. minimum landing size, MLS, depend on species composition (e.g. minimum mesh size, MMS) or may be generic. The table below illustrates some of these measures and the species (not exhaustive) to which they apply. Measures are only repeated at a lower level in the legislative hierarchy if they exceed the higher authority measure.

Measure type	Measure	Legislative body	Species
Size limit	MLS	EU	Bass, coalfish, cod, haddock, mackerel, plaice, pollack, sole, whiting, lobster, edible crab, spider crab, velvet crab, crawfish, scallop, queen scallop, various clams
	MLS		Edible crab, spider crab, crawfish
	MLS	UK local	Bass, brill, conger eel, dab, flounder, grey mullet, skates and rays, turbot, lobster, edible crab, cockles, mussels
	Max LS	EU	Porbeagle shark, spurdog
MMS	Towed	EU	Bass, black bream, gilthead bream, brill coalfish, cod, conger eel, dab, dogfish (LS and GS), flounder, haddock, mackerel, grey mullet, red mullet, plaice, pollack, pout, skates and rays, sole, turbot, whiting
	Fixed	EU	Bass, coalfish, cod, dab, dogfish (LS and GS), flounder, haddock, mackerel, grey mullet, red mullet,

Measure type	Measure	Legislative body	Species
			plaice, pollack, sole, whiting
Catch and release	No take	EU	Common skate, undulate ray
	No take (recreational)	UK national	Tope
	No take	UK local	Tope
	Voluntary (required for NMC competitions)	National mullet club	Grey mullet
	Voluntary	Species of lower culinary value or threatened conservation status	Dogfish, smoothhounds, skates and rays, wrasse and others
Spatial and seasonal controls	Closure to certain vessel and gears specifications	EU	Plaice, mackerel, cod (Trevoise Closure)
	No fishing for bass from a boat	UK national	Bass
	No use of sand eels for bait in specified area	UK national	Bass
Bag limits		UK local	Lobsters and crabs
Gear limits	Pot limits for unregistered fishermen	UK local	Lobsters and crabs

7.16.3 Possible sampling frames

7.16.3.1 Area frames

Sampling frames will need to be spatially disaggregated because:

- a) UK has devolved administrations with fisheries responsibilities (Scotland, Wales, Northern Ireland, England)
- b) DCR specifies regional sea area breakdowns for cod (North Sea) and bass (Western Waters).
- c) Regional distributions of other fish species will need to be taken into account.
- d) EU/ICES stock assessment and fishery management areas are specified regionally, so information on recreational catches intended for assessment and management utility will need to be similarly structured. Presence of ICES management plans for various species (e.g. sole VIIe) may require information at a relatively fine spatial (regional) scale

7.16.3.2 List frames

see table 3.

7.16.4 Available statistics

Statistic	Data sets available, and where/how archived
Number of resident anglers	Drew, 2004
Number of visiting anglers	None
Number of resident vessels	Defra has data on Charter vessels from previous consultations
Number of visiting vessels	
Fishing effort: Angler days	Drew, 2004; Cappell & Lawrence, 2006.
Fishing effort: Vessel days	Drew, 2004; Cappell & Lawrence, 2006.
Quantity of catch by species or species group, retained for consumption	Drew, 2004; Cappell & Lawrence, 2006.
Quantity of catch by species or species group, used for bait	None
Quantity of catch by species or species group, that is released	Drew, 2004; Cappell & Lawrence, 2006; NMC, 2006
Other statistics (specify)	

7.16.5 Survey methods

DCR Pilot studies

A pilot study carried out by the Countryside Council for Wales to look at an approach to recording recreational sea angling activity on the North Wales coast during the winter of 2007/08, has been put forward by the UK as a DCR pilot study. It explored the principles upon which a methodology for recording RSA activity could be based. The following text is reproduced from the Executive Summary of the report (Goudge *et al*, 2009).

Pilot data collection methods were trialled to investigate RSA activity and catch in North Wales during the winter season between December 2007 and March 2008. The aim of the project was "To trial methods in North Wales to: gather accurate information on recreational angling activity; collate anecdotal evidence of change and assess methods of gathering catch data from anglers". An important output of the study was to investigate the feasibility of RSA surveys and to contribute towards establishing 'best practice' for future surveys both in Wales and elsewhere in the UK.

In total, 50 surveys were undertaken at 37 popular locations in three regions of North Wales (North East Wales, Anglesey and the Llyn Peninsula). Over 150 anglers contributed to the surveys and 124 of these were categorised into one of the following groups using their sea angling frequency and experience: 'Top Match' 'Match', 'Day', 'Club', 'Casual' and 'Novice'.

Angling behaviour, species targeted, species caught and angler perception all differed between angler group and this highlights the danger of 'clumping' anglers together during analysis of catch or making assumptions or extrapolating information (i.e. catch) from broad averages of all anglers. It was clear from the results of this study that RSA data must be divided by angler experience and behavioural groups to avoid certain angler types biasing the results, and that the correct classification of these groups is crucial.

Cod and Bass were expressed to be the species most targeted by the anglers questioned, however out of more than 650 fish recorded by anglers and surveyors, only two cod were caught and recorded during the current survey. In relation to the survival of released fish, the majority of anglers believed that more than 90% of the fish

returned to the sea survived, and this figure decreased with greater angler experience.

It was concluded that a combination of profiling questionnaires, angler recording schemes and direct surveyor observations are a good means of sampling RSA activity within a region. Valuable trends in recreational sea fishery populations may also be recorded by the collection of 'catch and release' match cards (where competitors verify each other's catch), but these alone would not provide the full RSA picture and could bias the data. Using a combination of these methods, angler's catch and trends in numbers and sizes of fish caught in a certain area can be estimated. It must be noted that variability in catch due to angler experience, season, time of day, weather, location and state of the tide will all result in different results, so will depend upon when, where and from whom, catch is measured.

The RSA winter pilot study will be used to refine future surveys and ensure objectives are realistic and achievable. Methodologies will be adapted and further tested within the same area and during the summer months, when an increased number of anglers will be fishing and also a wider variety of species are likely to be caught. Results of the following summer survey and also the method evaluations, conclusions and recommendations drawn from both winter and summer surveys will be published separately in the following two reports: 3. North Wales Recreational Sea Angler (RSA) pilot surveys: Summer results July to

October 2008. 4. North Wales Recreational Sea Angler (RSA) pilot surveys: Discussion of the pilot methodologies and recommendations for future surveys.

Current methods

- 1) Cefas has an angler logbook scheme (catch rates, species composition, discarding rates, bait usage, environmental condition, etc.) implemented as part of a Defra funded R & D project. Scheme has just been launched and take up is currently very low, in the light of suspicion from anglers over article 47 and other recent management experiences.
- 2) Cefas recently carried out limited angler questionnaire surveys by off-site interview, postal return and internet/email to obtain data on angler behaviour, catch rates and attitudes towards MCZs. This was under contract to Natural England, who have rights to the report which is not yet in the public domain.
- 3) Cefas is investigating the use of historic angling datasets to provide historic abundance indices. Currently relatively few data have been assembled or evaluated, but specimen records are generally difficult to analyse, because effort data are usually unavailable and extremes of fish size distribution are recorded. Fishing match results may provide some information on species composition and angler catch per effort, but are often not fully recorded (not all anglers bother to weigh in if their catch is low) and match anglers are likely to target fish in a different way to other anglers and recreational fishers.

7.16.5.1 Previous methods

Previous methods have involved interview and postal surveys combined with omnibus surveys and choice experiments (Drew, 2004; Cappell & Lawrence, 2006). Work has also been carried out (on bass) by Cemare in collaboration with Cefas (then DFR) during the 1980s/90s.

The Drew (2004) report on the economic contribution of sea angling in England and Wales estimated that there are around 1.1 million sea anglers in England and Wales (2% of the total population), who fish from beaches, harbours, piers, and from boats both close to shore and offshore over wrecks. An Omnibus survey was carried out, sampling 10,200 households in England and Wales to identify the sea angler population and their activities. An additional 383 member of (30) angling clubs and 514 sea anglers on angling trips in 12 regional locations provided information on types of angling activity, number of visits, expenditure and consumer surplus. Four case studies produced descriptive information on the characteristics of sea angling, its economic contribution, trends and factors limiting development of the sector. Finally, a business survey was carried out with 162 tackle shops, charter skippers and boat equipment suppliers.

7.16.6 Primary Customers for the data, and intended uses

The table below details the expected usage of data by different customers. Note the table above does not include local management agencies, which might also be potential customers.

		Customers for data					
		European Commission	National government	Stock assessment scientists	Academic researchers	Fishing industry	General public
Type of data	1 Participation	B-D	A, C, D	A-D	A-D	C, D	A
	2 Fishing effort	B-D	A, C, D	A-D	A-D	C, D	A
	3 Total catch (retained/released) by species	B-D	A, C, D	A-D	A-D	C, D	A
	4 Catch per unit effort by species	A	A	A, B	A, B		A
	5 Size/age distribution of catch	A, B, C	A, C, D	A, B, C	A, B, C		A
	6 Socio-economic data	A, C, D	A, C, D	A, C, D	A, C, D	C, D	A
	Key species (give list)	Cod (IV), bass(VII), salmon(VII) eels (IV & VII), TAC spp.	Cod, bass, TAC and shellfish spp	Cod, bass, TAC and shellfish spp	Any	Cod, bass, TAC and shellfish spp	Any

Key: A: General monitoring of trends; B: Stock assessment; C: Monitoring of annual statistics relative to annual management targets for specific species; D: In-season monitoring of cumulative statistics relative to annual management targets for specific species; E: other (specify)

7.16.7 References

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Table 1: Summary of national recreational fisheries: angling

Water body	Platform	Main species targeted	Gear / methods used	Seasonal patterns ¹	Regional patterns	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for biological sampling ⁴
Estuaries and semi-enclosed bays or sea lochs	Beaches	Bass, cod, rays, whiting, sea trout, mackerel, flounders, plaice, sole, salmon, grey mullet, eels, bream (black & gilthead)	Rod and line (bait or artificial lure)	S	R	MLS salmonids (S) VC&R (grey mullet), spatial controls (bass)	A	P
	Man-made structures	Bass, flatfish, rays, cod, whiting, mackerel, conger eel	Rod and line (bait or artificial lure)	S	R	MLS, spatial controls (bass)	A	P
	Private / Charter/ for-hire boats	Cod, bass, rays, whiting, mackerel, tope, smoothhounds, bream (black and gilthead)	Rod and line; handlines (bait or artificial lure; trolling)	S	R	MLS Tope, common skate, undulate ray – C&R spatial controls (bass), smoothhounds effectively VC&R	B	P <P for C&R
Open sea: Near-shore coastal (e.g. <20m depth):	Rocky shores	Pollack, mackerel, wrasse, bass, rays, conger eel, dogfish, small sharks, cod, black bream	Rod and line (bait or artificial lure)	S	R	MLS, Tope, common skate, undulate ray – C&R, VC&R	B	<P
	Man-made structures	Bass, flatfish, rays, pollack, cod, whiting, mackerel, small sharks, conger eel, black bream	Rod and line (bait or artificial lure)	S	R	MLS, Tope, common skate, undulate ray – C&R, VC&R	A	P
	Beaches	Bass, flatfish, rays, cod, whiting, small sharks, black bream	Rod and line (bait or artificial lure)	S	R	MLS, Tope, common skate, undulate ray – C&R, VC&R	A	P
	Private /charter / for hire boats	Cod, pollack, whiting, conger eel, rays, flatfish, small sharks, small mixed demersal, bass, mackerel, black bream	Rod and line; handlines (bait or artificial lure; trolling)	S	R	MLS, Tope, common skate, undulate ray – C&R, VC&R	B	<P
Open sea: Offshore demersal (e.g. 20m+ depth):	Private /charter / for hire boats	Cod, pollack, ling, whiting, conger eel, skates (rays?), small sharks (hounds), large flatfish (turbot), (black bream)	Rod and line (bait or artificial lure)	S	R	MLS, MaxLS (porbeagle shark & spurdog), VC&R	B	<P
Open sea: Offshore pelagic and Oceanic:	Charter / for hire boats	Large sharks, (tuna)	Rod and line (bait or lure)	S	R	MLS, MaxLS (porbeagle shark & spurdog), VC&R	C	<P

^{1,2,3,4}: See below Table 2 for codes to enter

Table 2: Summary of national recreational fisheries: non-angling

Water body	Platform	Main species targeted	Gear used	Seasonal patterns ¹	Management regulations affecting fishery ²	Index of relative number of participants ³	Accessibility for sampling ⁴
Estuaries and semi-enclosed bays or sea loughs	Beaches	Bass, cod, sea trout, salmon, grey mullet, sand eels, eels	Seine nets	S	MLS, S (salmonids), MMS	C	<P
		Cockles, mussels,	Hand picking	S	MLS, S	B	P
	Beaches and rocky shores	Shrimps	Push or dip nets	S		C	<P
	Private boats	Bass, cod, sea trout, salmon, flatfish, grey mullet, eels	Various nets & traps	S	MLS, MMS, spatial controls (bass)	C	<P
Open sea: Near-shore coastal (e.g. <20m depth):	Beaches	Bass, flatfish, grey mullet, sand eels	Seine nets	S	MLS, spatial controls (bass)	C	<P
	Rocky shores	Prawns	Dip netting	S		C	<P
	Private boats	Crabs, lobsters	Pots and traps	S	MLS, BL	B	<P
		Bass, grey mullet, flatfish, rays, cod, gurnards, red mullet	Enmeshing nets	S	MLS, spatial controls (bass)	C	<P
		Cod, flatfish, rays, (bass)	Long lines	S	MLS, spatial controls (bass)	C	<P
		Shrimps	Shrimp trawl	S		<C	<P
		Herring	Drift net	S	MLS, MMS	<C	<P
Flatfish	Trawl	S	MLS, MMS	<C	<P		

¹ Y =Year-round fishery, S =Seasonal fishery (specify active months and peak periods); P = Pulse fishery (specify months when fishery is most likely to be present)

² MLS (=minimum landing size); BL (=bag limits); S (=closed seasons)

³ A: relatively large numbers; B: Intermediate; C: Relatively small numbers; N/A: No information available.

⁴ FULL (= fully accessible); PARTIAL (= only partly accessible); NONE (not accessible); N/A: no information

Table 3: National availability of lists and sampling frames for carrying out surveys of the general public to collect information on participation in different forms of recreational fishing.

Site	Type of lists	Sampling frames	Availability	
Off-site	Mailing-address directories	Postal household frame	Exhaustive	
		Registry-based angler frames	Angler licences	None, except salmonids
			Angler permits	None
			Other angler registries	Partial e.g. angling federations
		Registry based vessel operator frames	Vessel licenses	None,
			Vessel permits	None
			Other vessel registries	charter vessels may be listed by local authorities
		Telephone directories	Random-digit-dialing household frame	Partial
			Phonebook household frame	Partial
	Registry-based angler frames		Angler licences	None
			Angler permits	None
			Other angler registries	Partial e.g. angling federations
	Registry based vessel operator frames		Vessel licenses	None
			Vessel permits	None
Other vessel registries			None	
On-site	Site or access point lists (points of departure or return for fishing trips)	Public access sites	N/A (partial - guides to launch sites, maps, local government offices/harbour masters)	
		Private access sites	N/A	

Annex 1: List of participants

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Annex 2: Agenda

ICES Workshop on Sampling Methods for Recreational Fisheries

Dates: 14 – 17 April 2007

Venue: IFREMER, Rue de l'Île d'Yeu, BP 21105, 44311 Nantes Cedex 3

Chairs: Dave Van Voorhees (NOAA, US) and Mike Armstrong (Cefas, UK)

DRAFT AGENDA

14 April: Start time 10:00. Finish 18:00

Introduction: Welcomes and introductions; information regarding venue, organization of meeting and preparation of meeting report; finalization of agenda

Morning plenary session: 1) Overview by Dave Van Voorhees on possible survey methods for monitoring different types of recreational fisheries, and specific examples where certain methods have been successfully employed. 2) A number of invited presentations by experts will describe the experiences gained in setting up current national survey programs, including in the US, that employ suitable sets of sampling frames, sampling designs, and estimation methods to monitor a diverse array of recreational fishery types.

Afternoon plenary session: Individual presentations by each country, using the *pro-forma* completed prior to the meeting as a framework. Participants will describe their recreational fisheries and statistical monitoring needs, summarize any statistical information obtained from prior surveys, and specify the availabilities of possible off-site or on-site survey sampling frames. After each presentation the group can briefly discuss the suitability of different frames, contact methods, and/or survey designs.

3 Report drafting; updating of pro-formas if necessary

16 April: Start time 09:00 Finish 18:00

Morning plenary: 1) Review of break-out groups recommendations: The breakout groups will present brief reports of their recommendations to the larger group. Subsequent group discussion will look for commonalities and opportunities for multinational, or cross-regional, approaches that might potentially be standardized in some way to maximize comparability of resulting statistics. 2) Go through draft sections of report completed so far.

Continued report drafting: The specific recommendations for each national fishery will be appended to the national *pro-forma* information, and a summary of the country-by-country recommendations will be completed for inclusion in the main body of the report.

17 April: Start time 09:30 Finish around lunchtime

Morning plenary: Agree remaining drafts of report sections. Agree work plan and deadlines for any remaining work

Annex 3: Recommendations

Recommendation	For follow up by:
1. Formation of an ICES Planning Group for Recreational Fisheries Surveys (PGRFS) (See proposed ToR's below)	ACOM

Proposal for planning group on recreational fisheries surveys:

A **Planning Group on Recreational Fisheries Surveys** [PGRFS] (Co-Chairs Harold Levrel (France) and Mike Armstrong (UK)) will be held in [venue], [date], to:

- a) Develop guidelines for best practices for sampling recreational fisheries, and formulate procedures for identifying and quantifying biases in sampling and survey schemes and precision of estimates, for inclusion in the ICES Quality Assurance framework.
- b) Review sampling strategies, protocols, and levels to be proposed for implementation within the EU Data Collection Framework and national centres responsible for sampling recreational fisheries;
- c) Agree a workplan for 2011 for further developing and finalising standards and best practices for sampling recreational fisheries, including recommendations for appropriate Workshops;

PGRFS will report for the attention of ACOM by XXXX

Supporting Information

PRIORITY:

SCIENTIFIC JUSTIFICATION AND RELATION TO ACTION PLAN:

The Planning Group and any associated workshops are proposed in response to the EC-ICES MoU that requests ICES to provide support for the Data Collection Framework (EC Reg. 199/2008 and EC Decision 2008/949/EC). PGRFS will be complementary to PGCCDBS and PGMED and will be the ICES forum for planning and co-ordination of collection of recreational fishery data for stock assessment purposes. Building on the outcomes of the PGCCDBS Workshop on Sampling Methods for Recreational Fisheries (WKSMRF) in 2009, it will coordinate and initiate the development of methods, and develop and adopt sampling standards and guidelines. Many activities in this group will be closely linked to the activities of the EU Data Collection Framework (DCF), and DG MARE should be a member of PGRFS to ensure proper coordination with the DCF activities. Stock assessment requires data covering the total removal from the fish stocks and the PG will serve as a forum for coordination with non-EU member countries where appropriate. The PG shall develop and approve standards for best sampling practices within its remit and for recreational fisheries in the ICES area, in line with the ICES Quality Assurance Framework. The implementation of these practices will be discussed regionally and implemented nationally. The PG will coordinate initiatives for workshops and other activities to address specific problems. The success of the workshops will require a substantial amount of preparatory work in the laboratories. This preparatory work will be the responsibility of the national laboratories. ICES will be informed that this work is included in the national annual DCF work plans.

RESOURCE REQUIREMENTS:

PARTICIPANTS:

SECRETARIAT FACILITIES:

FINANCIAL:

LINKAGES TO ADVISORY COMMITTEES: ACOM