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Executive Summary

PGRFS was established by the ICES WKSMRF (Workshop on Marine Recreational Fishing) to discuss and develop common method for recreational fishing survey. EU members 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 Regulations 199/2008 and EC Decision 2008/949/EC).

The first part of the survey was devoted to presentations:

- Harold Levrel reminded the group of the Terms of References for this workshop.
- Dave Van Voorhees presented the conclusions and recommendations of last year's workshop (WKSMRF 2009). The aim was to identify survey method to estimate the annual catch (landings and discards), CPUE and age and size structure. The preferable approach retained was complemented survey design with both off-site survey and on-site survey.
- Harry Strehlow related Recommendation from RCM Baltic 2010 to PGRFS.
- 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. He also presented a method to estimate recall bias comparing two types of surveys.
- Dave Van Voorhees described survey lessons learned in the US as they already have a long experience.
- Each country presented its own context, method, results and improvements.

The recreational fishing can be evaluated at different level. First the population of fisher needs to be identified. Screening surveys and list frame (i.e.: license register) survey appears to be the most successful method. Screening and list frame survey are most of the time done by telephone or by mail. It was adopted that this kind of off-site surveys gives estimation of the recreational fishers' population. Then to evaluate the capture it has been proved that off-site surveys present important recall biases for capture declaration. So to appraise the mean catch rate, the effective method that was pointed out is diaries and logbooks of panel of recreational fishers. Species, details about weight and size are recorded in diaries and give better accuracy about catch. However they need to be validated with on-site sampling such as access point survey, roving, survey and visual survey. The definition of the primary survey unit (PSU) and secondary survey unit (SSU) is a very important part of the sampling, mainly to combine different kind of survey. Furthermore stratification and estimation domain can be different.

To facilitate an evaluation of appropriate recreational fishery survey schemes in Europe, PGRFS participants discussed and established schemes of survey methods for recreational fisheries. The national reports are included in the overall workshop

report. Break-out groups were formed at PGRFS 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 importance of dual-frame approach was underlined. Also combining different survey methods.
- List frame such as recreational fishermen registry helps a lot for survey design. Maybe the EU can incite member countries to have a registration (free but obligatory). The word of “license” should not be used to avoid conflict and refusal from the population.
- At a European scale, common approaches can be implemented to survey national population of recreational fisher following the method recommendations of the PGRFS. But for local scale, contexts can be so different that it influences a lot the method and standardization could be too hard to design.
- The collaboration between ICES countries is very important and a PGRFS meeting is necessary next year. Balearic Island proposed to host it in June 2011.
- Recreational fishing is a non negligible part of resources collection and human impact on environment. In the US the budget to study recreational fishing is now bigger than that for commercial fishing. EU and ICES have to provide support and funding for recreational fishing survey and include it in main species stock assessment.

Maybe the Planning group should become a working group.

1 Opening of the Meeting

The WKSMRF meeting took place from 7-11 June 2010, at the IMR laboratory in Bergen (Norway). The participants at the meeting are listed in Annex 1.

2 Introduction

2.1 European context and target species

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 dif-

ferent 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

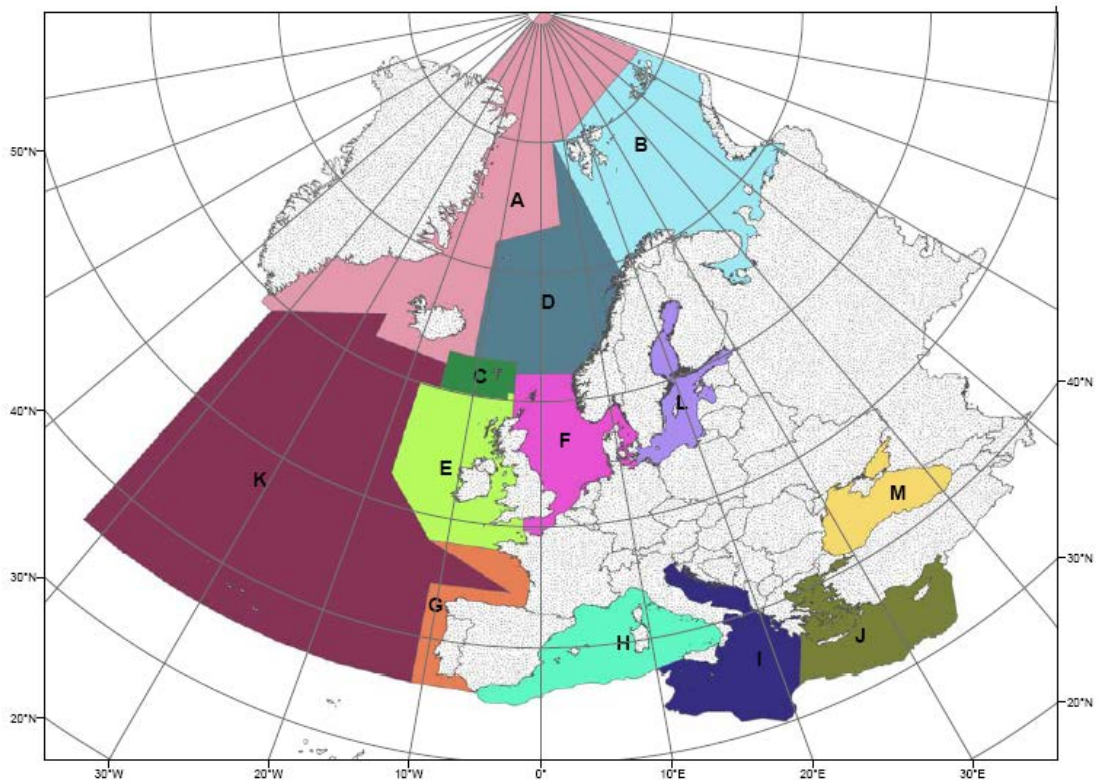
Surveys, Assessment, and Management. Two of the Theme Session chairs (Dave Van Voorhees and Jon Helge Vølstad) participated in WKSMRF and the third Theme session chair (Patrick Berthou) contributed valuably to the discussions leading up to WKSMRF. Readers are referred to the ICES website at <http://www.ices.dk/products/CMdocs/CM-2008/K/K-2008.pdf> 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.

2.2 Terms of reference

Scientific justification of PGRFS:

- The Planning Group is proposed in response to the EC-ICES Memorandum of understanding that requests ICES to provide support for the Data Collection Framework (EC Reg. 199/2008 and EC Decision 2008/949/EC).
- PGRFS is the ICES forum for planning and co-ordination of collection of recreational fishery data for stock assessment purposes
- PGRFS coordinates and initiates the development of methods, and develop and adopt sampling standards and guidelines
- 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 PGRFS shall develop and approve standards for best sampling practices within its remits and for recreational fisheries in the ICES area, in line with the ICES Quality Assurance Framework

Aims of this workshop:

- Review sampling strategies, protocols, and levels to be proposed for implementation within the EU Data Collection Framework
- Develop guidelines for best practices for sampling recreational fisheries
- Develop a common standardized protocol at European scale for comparisons between countries
- Formulate procedures for identifying and quantifying biases in sampling and survey schemes and precision of estimates
- Looking for synergies between countries efforts (tourism fishing for example)
- Looking for synergies between freshwater and saltwater fishing (eels, salmon)
- Agree a workplan for 2011 for further developing and finalising standards and best practices for sampling recreational fisheries
- Recommendations for appropriate Workshops

3 Overview of survey methods for marine recreational fisheries

3.1 U.S. Surveys of Marine Recreational Fishing Lessons Learned (by Dave Van Voorhees)

3.1.1 The Marine Recreational Fishery Statistics Survey

The Marine Recreational Fishery Statistics Survey (MRFSS) that has been conducted by the National Marine Fisheries Service (NMFS) in the U.S. since 1979 has been based on a “complemented surveys” design. The MRFSS includes both a Coastal Household Telephone Survey (CHTS) and an Access Point Angler Intercept Survey (APAIS) in what has been called a “telephone-access design” by Pollock *et al* (1994). The CHTS is used to estimate marine recreational fishing effort by coastal residents. The APAIS is primarily used to estimate the mean catch per unit of effort, but it is also used to estimate fishing effort missed by the CHTS. The estimates from the two surveys are combined to obtain estimates of total marine recreational catch of finfish by species.

The CHTS is a bimonthly survey that is used to estimate the total number of angler fishing days (usually referred to as angler fishing “trips”) for residents of a well-defined coastal zone of the United States. The target population is the total population of marine recreational anglers who live in coastal counties that extend to within 25, 50, or 100 miles of saltwater coastline. The size of the coastal zone that is targeted varies by state and two-month wave. The CHTS selects a sample of residential households within each coastal county by using a standardized random-digit-dialing approach. The RDD sample frame has provided indirect access to all residents of households with landline phones. The primary sampling unit is the household which represents a cluster of permanent residents, and the RDD sampling is stratified by state, county, and two-month wave.

The CHTS collects data on fishing effort from household residents and uses those data as a basis for estimating the total number of angler fishing trips by coastal zone residents with landline phones. When a household is contacted, the telephone interviewer asks the respondent if any permanent resident of the household took a recreational saltwater fishing trip within the last 60 days. If the respondent answers “Yes”, then the interviewer attempts to complete an interview with every household resident who fished in that period. Each interview collects data on the number of days fished in each of four different fishing modes – shore, private/rental boat, charter boat, and headboat (also sometimes called “partyboat” or “open boat”). The data collected by the CHTS have been used to produce separate domain estimates of the number of angler fishing days for the four different fishing modes, but in recent years the CHTS is only used to estimate effort for shore and private/rental boat fishing.

The APAIS is an on-site survey that is used to estimate the mean number of fish caught per angler fishing day. The target population for the APAIS is the population of angler fishing days, and the sampling frame is a spatiotemporal frame that includes all known fishing access sites and all the days on which fishing may occur at those sites. This site-day frame provides indirect access to angler fishing trips ending at any fishing access sites that can be visited by APAIS interviewers. Multi-stage sampling design is used, and the ultimate sampling unit is a completed angler fishing trip. The primary sampling unit (PSU) is a site-day, and the selection probability for each individual site is a function of its estimated level of fishing activity, or “fishing

pressure". Sites are assessed for their fishing pressure in the shore, private boat, and charter boat fishing modes, and higher pressure sites are given a higher probability of being selected in an "unequal probability sampling" design. Within a selected site-day unit, clusters of boat and angler fishing trips are subsampled. In the private and charter boat fishing modes, the secondary sampling unit (SSU) is a boat trip and the tertiary sampling unit (TSU) is an angler trip. In the shore fishing mode, the SSU is an angler trip. The multi-stage sampling is stratified by fishing mode, state, day type, and two-month wave.

The APAIS interviewers intercept and interview as many anglers as possible while on site, and they also record a count of any eligible angler trips for which they are unable to obtain interviews. For each completed angler fishing trip that is intercepted, the APAIS interviewer collects data on the angler's residency location and phone ownership and the species identity and quantity of the angler's catch, and the location of the angler's fishing effort. In addition, the interviewer obtains weight and length measurements on a subsample of the catch that are available for observation. The counts of fish caught are separated into catch types to distinguish catch that is kept or released dead from catch that is released alive.

The APAIS data are used to estimate both mean angler catch rates and the number of angler fishing trips missed by the CHTS. The APAIS catch data are used to estimate mean catch rates for all species and catch types. The angler residency and phone ownership data are used to identify the intercepted trips that were made by residents of households included in the CHTS frame. These data are used to estimate the proportion of angler fishing days attributable to potential CHTS respondents. The inverse of this proportion is used to adjust the CHTS estimate of angler fishing days to account for any fishing by anglers who would not be reached through the CHTS RDD frame. Therefore, the MRFSS estimate of the total number of angler fishing trips is based on data provided by both the CHTS and the APAIS. The mean catch rate estimates are expanded by the estimate of total angler trips to get estimates of total catch by species and catch type.

3.1.2 The For-Hire Survey

In 2000, the NMFS started using a new telephone survey design for monitoring marine recreational fishing effort on charter boats in the Gulf of Mexico. The new Charter Boat Telephone Survey (CBTS) utilized a compiled directory of charter boats and their operators as a sample frame. The CBTS was designed as a weekly survey, and the operators, or owners, of a random sample of boats were selected each week for telephone interviews that collected data on the number of boat fishing trips, numbers of anglers who fished, and boat fishing locations. NMFS worked with the Gulf State Marine Fisheries Commission (GSMFC) and the state fishery agencies in Louisiana, Mississippi, Alabama, and Florida to test the new design in 1997-1999 and found to be much more efficient and less prone to bias than the MRFSS CHTS for estimating fishing effort in the charter boat mode. The CBTS was combined with the MRFSS APAIS in a new "telephone-access" complemented survey design that is now just called the "For-Hire Survey" (FHS).

Another pilot study of this new FHS design was conducted in 2000-2001 by NMFS in collaboration with the Atlantic Coastal Cooperative Statistics Program (ACCSP) and the South Carolina Division of Natural Resources (SCDNR). This study included coverage of headboat fishing effort and catch, compared the FHTS with the mandatory logbook census program run by SCDNR for all for-hire boats, and showed that it provided very similar estimates of total fishing effort and catch by species. Based on

the results of this study, the lack of mandatory census programs in most states, and an endorsement by the ACCSP, NMFS began implementation of the FHS on the Atlantic coast in 2003. In 2001, the new FHS design was also tested and adopted by the state of California and now comprises part of the California Recreational Fishery Survey (CRFS) program under the name "Party-Charter Survey".

In 2003, NMFS began using a new at-sea sampling design to collect catch data for headboat angler fishing trips. Instead of using a site frame, the new Headboat At-Sea Survey uses the same list of boats and boat operators that is used for the FHS telephone survey. Estimates of fishing activity are obtained for each headboat in the list, and headboats are selected with a probability proportional to their estimated activity. Once a boat is selected, the operator is contacted to determine when fishing trips are planned. A specific fishing trip is then randomly selected from the list of planned trips, and an interviewer is assigned to board that trip to collect data from anglers while they are "at sea".

3.1.3 National Research Council Review

In 2004, the NMFS contracted with the National Research Council (NRC) of the U.S. National Academy of Science to conduct a critical review of the MRFSS and the other recreational fishery surveys funded or conducted by the NMFS. The NRC completed its review and published its findings in its *Review of Marine Recreational Fishery Survey Methods* (2006). The NRC identified a number of problems in the sampling and estimation methods used by the current surveys and recommended that NMFS undertake a complete overhaul of the survey designs. The NRC Review also stated that substantial changes may be needed to better address the requirements of stock assessment scientists and fishery managers.

3.1.4 Marine Recreational Information Program

In 2007, the NMFS implemented the Marine Recreational Information Program (MRIP) to evaluate possible biases in the current marine recreational fishery surveys and develop improved sampling and estimation designs for future surveys that would better meet the needs of its primary customers. The MRIP was established as a collaborative effort involving representation from all stakeholders, including survey statisticians, survey managers, stock assessment scientists, fishery managers, and various constituent groups. In addition to addressing the recommendations of the NRC, the MRIP has been specifically addressing new requirements provided by the U.S. Congress in its 2006 reauthorization of the Magnuson-Stevens Fisheries Conservation and Management Act (MSA). The reauthorized MSA required NMFS to implement the 2006 recommendations of the NRC to the maximum extent feasible. In addition, it specifically required NMFS to develop a national registry of marine recreational fishing participants (also an NRC recommendation) and use that registry to implement more efficient sampling in future telephone surveys of recreational fishing. Starting in 2008, the U.S. Congress has approved annual budget increases to help support the work of the MRIP. This has enabled the Program to recruit consultant support from expert survey statisticians who are now supporting a number of ongoing projects that are (1) developing design-unbiased estimation methods for current and past surveys and (2) designing and testing improved sampling and estimation approaches for future surveys of fishing effort and catch. The progress of the MRIP is being reported on the NMFS website at www.st.nmfs.noaa.gov/mrip.

3.1.5 MRIP Progress in Redesigning Surveys

The work of MRIP project teams has identified a number of problems in the MRFSS and the other survey designs currently in use to provide fishing effort and catch estimates. This presentation will focus on the issues currently being investigated for the long-standing MRFSS approach and will briefly summarize the progress that MRIP is making to design and test better alternatives.

3.1.6 Re-Designing Off-Site Surveys of Fishing Effort

There are a number of possible sources of bias in the MRFSS CHTS estimates of angler fishing effort. The RDD household frame of the CHTS is imperfect in a number of ways that could limit the accuracy of its resulting estimates. The MRFSS APAIS data on angler residency indicates that as many as 70-80% of U.S. marine recreational anglers do not live in the coastal counties covered by the CHTS. In addition, only permanent residents of households with landline telephones are included in each coastal county RDD frame. Residents of households with no landline telephone and residents of institutional housing are not covered. Cell-phone only (CPO) households are growing in number in the U.S., as more and more people are switching from landline phones to cell phones as a primary means of communication. Even in landline telephone households, contact rates for telephone surveys have been steadily declining as more and more people with answering machines and caller ID are now screening and refusing to answer calls from unknown sources. An additional concern is the accuracy with which avid anglers are able to recall all of the fishing trips that they made over the past 60 days. It is possible that they may tend to estimate rather than count their individual fishing trips, and estimates could tend to be higher or lower than the actual counts.

The NRC pointed out that a complete registry of fishing participants would provide the ideal sampling frame for future surveys of fishing effort. In January of 2009, the NMFS initiated the National Saltwater Angler Registry (NSAR) Program as a first step toward accomplishing this goal. Under this program, marine recreational anglers who fish in federal waters, or for anadromous species, are required to register with the NMFS unless they are already licensed or registered in a state that is specifically exempted because it meets the minimum requirements for the NSAR and provides its own registry of fishing participants to the NMFS. The NSAR requires the registration of shore and private boat anglers and specifies that a valid telephone and address is needed for each. For the for-hire fishing sector, it requires the registration of all boats that operate as charter boats or headboats, and it specifies that the names, phone numbers, and addresses of all operators and owners must be provided for each boat.

With many states actively seeking exemptions from the federal registry requirement, NMFS hopes that it will be able to develop the NSAR to provide nearly complete coverage of marine recreational anglers fishing in both federal and state waters within the very near future. Many states already had angler licensing and for-hire boat registration programs in place and have received exemptions for their registrants from the federal registry requirement. Within the last three years, several other states have either already implemented or will soon implement new licensing/registration programs that should qualify their fishing participants for a federal registry exemption. It now looks like only two states will not be providing their own registry data to the NSAR by the end of 2011.

MRIP project teams are currently testing alternative off-site survey designs for estimating fishing effort that would utilize the new angler and for-hire boat registries for each state. Such surveys could potentially be both much more efficient and much less prone to bias than the current CHTS. The goal of MRIP is to develop the NSAR to provide valid contact information (telephone and mailing address) for (1) complete lists of anglers participating in shore and private/rental boat fishing and (2) complete lists of participating charter boats and headboats. With complete lists, it would be possible to base the sampling for all future telephone or mail surveys on those list frames. However, complete list frames are not available in any state at this time. Current state licensing and registration programs exempt some participants and it is quite likely that a subset of non-exempted fishing participants have not actually registered. For this reason, current MRIP projects are testing the use of dual-frame sampling for both telephone and mail survey approaches to estimating fishing effort.

3.1.7 Testing of Dual-Frame Surveys

In the states of North Carolina, Louisiana, and Washington, MRIP project teams are currently testing the use of dual-frame telephone surveys that use both an angler list frame derived from a state licensing program and a coastal zone RDD household frame (like the one used by the traditional MRFSS CHTS). In this dual-frame design, sampling from the angler list frame yields a much higher percentage of respondents who actually report having fished within the last 60 days. Sampling with the RDD frame is much less efficient, with only 5-10% of the respondents reporting fishing trips within that time frame. The RDD frame is considered to be necessary as a means of providing coverage of anglers who are either exempted from the license requirement or have been fishing without a license.

Ideally, a survey based on a dual-frame sampling design would match the frames in advance of sampling so that the units in the more specialized and more efficient frame could be removed from the other. This would allow the conduct of side-by-side independent surveys with additive results. In this case, it would seem to be desirable to be able to remove the telephone numbers of state license holders from the RDD household frame. However, it is possible that license holder households could also have residents who fished without a license and license holders may reside in households with more than one telephone (cell and/or landline). Therefore, it is not possible to eliminate possible overlaps in the coverage of the two frames prior to sampling. The questionnaires used for interviews of the respondents contacted through both frames include questions about license possession, license type, landline phone ownership, cell phone ownership, and location of permanent residence. The responses to these questions are used to help define the domain of overlap between the two frames so that separate effort estimates can be obtained for three different subpopulations of anglers – those who can only be reached through the angler list frame, those who can only be reached through the RDD frame, and those who can be reached through both. However, the current pilot studies have found that such data may not always be sufficient for defining the “overlap domain”. Efforts to match phone numbers for the two frames have shown that some anglers in the license list may actually respond that they do not have a license. Also, the current studies are finding that the state license databases often do not have a valid telephone number for every license holder. Some have no phone number entered, and some have an invalid phone number. For this reason, efforts have been made to use mailing addresses to find valid phone numbers for such license holders through reverse lookups. This has helped to

develop better coverage for the list frames, but it has also increased the costs of conducting the list frame sampling.

An MRIP project team has also been testing the feasibility of using a dual-frame mail survey approach for estimating fishing effort in North Carolina (NC). In this survey approach, a list of licensed anglers with their mailing addresses is being used as the angler list frame and the U.S. Post Office's Delivery Sequence File (DSF) is being used as a second address-based sampling (ABS) frame. This method was considered to be promising for a number of reasons. First of all, the ABS frame would most likely provide more complete coverage of non-licensed participants than the RDD frame used in the dual-frame telephone surveys described above. The ABS approach can reach residents of cell-phone only (CPO) households, as well as households without telephones. Secondly, current state licensing programs require anglers to submit a mailing address even when the entry of a phone number may be optional. Also, licensed anglers are more likely to have only one mailing address when they could easily have more than one telephone number. Matching of mailing addresses between an angler list frame and an ABS frame is likely to be much more successful than matching of phone numbers between the list frame and an RDD household frame. Finally, recent studies have shown that mail survey response rates are now in many cases higher than telephone survey response rates. In the early 1990's, telephone surveys were preferred because they almost always obtained higher response rates than mail surveys. However, the downward trend in telephone survey response rates over the last 20 years is now making mail surveys look much more desirable. Also, much work has been done in recent years to develop mail survey designs that can elicit high response rates.

The design of the NC dual-frame mail survey combines a two-phase sampling approach using the ABS frame with a single phase sampling approach that uses the angler list frame. The first phase of the ABS sampling is a "screener" survey that asks a small number of questions needed to identify if any household residents participate in marine recreational fishing. The list of sampled households that are identified as "fishing households" in this screener phase are used along with the license-based angler list frame in a second phase dual-frame mail survey that collects more detailed data on angler fishing trips made within the last 60 days. Preliminary results from this study will be reported at the Joint Statistics Meetings in Vancouver, BC, Canada, during the first week of August, 2010. The results so far are promising because the response rates are higher for the dual-frame mail survey than for the dual-frame telephone survey that is also being tested in NC. Data collected in the ABS portion of the mail survey is also being used to assess possible differences in fishing effort between anglers covered by the CHTS RDD frame and anglers not covered by that frame. This will be important for understanding any possible biases in the CHTS that may have resulted from the inability to cover CPO households which are rapidly increasing in number.

3.1.8 Re-Designing Access Point Angler Intercept Surveys

The NRC and the MRIP have identified a number of possible sources of bias in the MRFSS APAIS estimates of "mean catch per angler trip" (also called "mean catch rate" in this document). The sampling design for the APAIS is very complex and the sampling frame does not provide coverage of all angler fishing trips. However, the MRFSS estimation methods have been based on the assumption that the resulting APAIS sample of angler fishing trips can be treated like a simple random sample of the whole target population. The APAIS only has access to angler fishing trips that

end at public access sites, and the sampling procedures instruct interviewers to avoid tournament fishing sites and only visit sites during peak fishing activity periods. It is quite likely that the fishing targets and mean catch rates of anglers differ between public and private access site trips, between daytime and night time trips, and between tournament and non-tournament trips. Because the selection probabilities of the primary, secondary, and tertiary sampling units have not been taken into account in the estimation process, it is likely that the even the MRFSS estimates of mean catch rates for what is covered have been significantly biased.

The sampling design for the current APAIS was clearly developed to maximize the number of angler fishing trip intercepts (and interviews) obtained with a limited budget. Therefore, interviewers have been instructed to only visit sites during the peak hours of fishing activity, to visit up to two additional "alternate sites" if interviewing at the selected site is not sufficiently productive, and to opportunistically intercept angler trips (and conduct interviews) in alternate fishing modes whenever possible. Unfortunately, these sampling procedures have emphasized the wrong goal for maximizing precision in APAIS estimates, and they make it much more difficult to determine the actual selection probability for each angler fishing trip that is ultimately intercepted. The potential for bias is great because the sampling has been clearly focused toward the collection of data from the most active fishing sites. If fishing targets and/or catch rates actually vary in some consistent manner among sites that differ in fishing activity, then the failure to appropriately weight the collected data could have resulted in biased MRFSS estimates of both mean catch rates and total catch.

In 2008, an MRIP project team supported by expert consultants was formed to develop a design-unbiased estimation method that could be applied to the MRFSS APAIS data. The primary goal for this "APAIS Estimation Team" effort was to develop appropriate weights for each angler trip intercept in the APAIS sample that would account for the complex multi-stage probability sampling design. In 2010, the team completed the development and testing of a new MRIP estimation method that can be applied to the MRFSS APAIS data to provide design-unbiased estimates. The specific changes made in this new estimation approach are briefly described below in later section of this report. A report that describes that method and explains how it would be applied is now being reviewed independently by U.S. Census Bureau staff and two experts who were selected by the American Statistical Association's Survey Research Methods Section. The MRIP expects to receive the peer reviews in the fall of 2010 and plans to implement the new estimation method in early 2011 to produce 2011 APAIS estimates and revise APAIS estimates for 2003-2010.

As the members of the APAIS Estimation Team began to explore how available data could be used to accomplish their immediate objectives, they inevitably began to identify changes that should be made in the sampling design for future access point intercept surveys. This led to the formation of a second MRIP project team in 2009 that began the development of a new APAIS sampling design in 2009. The "APAIS Sampling Design Team" completed development of an initial design and began testing it a North Carolina pilot study in the Fall of 2009. The specific changes made in that new design are briefly described below in a later section of this report. That study is ongoing and is aimed at delivering a recommended design for future access point surveys that could be broadly implemented in one or more regions.

Another MRIP project team was created to design survey methods that could be used to assess the possible biases in the MRFSS APAIS associated with its undercoverage

of private access, nighttime, and tournament fishing trips. The “APAIS Coverage Team” was formed in 2009 to explore alternate surveys designs that would allow the collection of data on all angler trips occurring at both public and private fishing access sites. This Team has recently developed a pilot study for an off-site survey design that will be initiated in early 2011.

3.1.9 New Design–Unbiased Estimation Method for MRFSS APAIS

The APAIS Estimation Team had little difficulty determining the appropriate weighting scheme for the site-day units that were selected as PSUs for each interviewing assignment, but developing appropriate weightings for “alternate site” PSUs, SSUs, and TSUs proved to be more difficult. Sampling procedures have specified that interviewers are allowed to visit up to two adjacent sites with estimated fishing activity in the assigned fishing mode if interviewing productivity is low at the selected site for the assignment. The selection of sites for site-day interviewing assignments in a given fishing mode stratum has always been based on an unequal probability sampling approach that gives higher probability to sites with higher estimates of expected fishing activity. Therefore, these probabilities are known and have always been delivered and stored in “site assignment draw” and “site frame” datasets for each two-month sampling wave. Because the alternate sites visited by interviewers were not selected with known probabilities, it is more difficult to know how to weight data collected at those sites in the estimation process. The APAIS Estimation Team had to develop a means of approximating the selection probabilities for sites as alternate sites that was based on the relative frequency of their selection by interviewers over the many years (1990-2009) of the MRFSS APAIS.

In order to appropriately weight individual angler trip intercepts to account for the incomplete sampling of site-day clusters of boats and/or anglers in the secondary or tertiary stages of sampling, it is necessary to have counts of all of the trips that ended at that site on that day. Although counts of missed angler trips have been recorded by interviewers during the time interval when they collected interviews at a site, no counts have been made for missed boat trips during that interval. In addition, no counts are available in the APAIS data for the remainder of the day when the interviewer was not present at the site. Because only angler trip counts are currently obtained, in the boat fishing modes it was necessary to estimate the number of boat trips missed at the secondary stage of sampling from the obtained counts of angler trips and estimates of the mean number of anglers per boat trip that could be derived from the sample data. Because the APAIS sampling design implicitly assumes that the sample of trips intercepted at a site are a representative sample of the trips ending throughout a 24-hour period at the site, it was necessary to develop a weight for each intercept that is based on an expansion of the recorded count for the on-site time period to a 24-hour period. The Team was able to approximate the needed 24-hour counts for the SSUs or TSUs by using the average temporal distribution of mode-specific trips reported in response to the MRFSS CHTS in 1990-2009. The count obtained during the time interval for each site-day visit (PSU) was assumed to represent an average count for a specific slice of the total temporal distribution of trips at that site for a 24-hour period. That count was then expanded to obtain an approximate count for the full day on which the site was visited.

The most difficult challenge for the Team was trying to determine an appropriate scheme for weighting “alternate mode” angler trip intercepts in the estimation process. Because the selection of both primary and alternate sites for any fishing mode stratum would be based on characteristics of those sites in the assigned fishing mode,

it is not clear how the appropriate selection probabilities for opportunistically sampled trips in another fishing mode could be determined. Since the frequency of alternate mode intercepts has been low in the MRFSS APAIS, the Team decided to just exclude them in the new estimation process.

The new design-unbiased estimation method for the MRFSS APAIS is a very important MRIP product. With the use of known site selection probabilities for primary site assignments, approximated site selection probabilities for alternate site visits, and approximated expansions of sample interval counts to 24-hour counts, the new weighted estimation method is not likely to produce biased estimates of mean catch rates as long as possible sources of non-sampling errors are minimized. The complex, multi-stage sampling design is now appropriately taken into account. The application of this new method will produce more accurate estimates of the mean angler catch rates for different fish species for both the current and past MRFSS APAIS. This will allow the immediate production of much more accurate catch estimates for 2003 to the present. As soon as possible, the AAPAIS Estimation Team plans to develop a modified version of this estimation method that can be used to produce design-unbiased MRFSS catch estimates for earlier years when a different method was used for the selection of sites in the primary sampling stage.

3.1.10 Testing of New Sampling Design for Access Point Surveys

The APAIS Sampling Design Team is now testing a new design for access point surveys of marine recreational fishing. The pilot study is being conducted in North Carolina, and it has been designed to eliminate problems identified in the current MRFSS APAIS and to provide a much more complete accounting of sample selection probabilities at every stage of its multi-stage sampling design. In the ongoing pilot study, the new access point sampling design is being compared side-by-side with the MRFSS APAIS that is still being conducted (without alternate mode interviewing). One of the most important differences between this new sampling design and the current MRFSS APAIS sampling design is that it is focused on maximizing the number of site-day assignments (PSUs) rather than maximizing the number of angler trip intercepts (ultimate sampling units). This is largely because the variance of APAIS estimates of mean catch rates depends much more on the number of PSUs than on the numbers of SSUs or TSUs.

The new sampling design selects all sites to be visited prior to the conduct of sampling assignments. Alternate site visits by interviewers and alternate mode interviewing have been eliminated. Sites in the master site list are now clustered prior to sampling into "site cluster units". A given unit may consist of 1, 2, or 3 sites. The clustering of sites is based on both their proximity and their total estimated level of fishing activity. A site with a level of estimated activity that exceeds a certain minimum threshold is not clustered with another site and comprises a one-site unit. Sites with lower levels of estimated activity are clustered one-at-a-time with adjacent sites until the minimum activity threshold is reached or the maximum of three sites is reached. The resulting list of site cluster units is used as the site sampling frame for the selection of site-day assignments. A selected site-day unit specifies 1-3 sites to be visited during an interviewing assignment. For selected 2-site or 3-site clusters, the order in which sites are to be visited is randomized.

The new design now provides coverage of all public access fishing trips. Sampling for a given fishing mode, state, and two-month wave is now stratified by six-hour time block. The sampling of the four time-block strata will be allocated optimally, allowing for heavier sampling of the time blocks when most fishing trips end. With the inclu-

sion of tournament fishing sites in the sampling, this new design now eliminates some of the undercoverage problems of the current MRFSS APAIS, but private access fishing would still need to be covered in another survey.

3.1.11 Testing of Telephone–Diary Survey to Assess Access Point Undercoverage Errors

In order to assess possible bias associated with the undercoverage of the MRFSS APAIS, the APAIS Coverage Team has developed a pilot study that will test the use of the Telephone–Diary Survey design that has been used in recent years as a means of estimating both total fishing effort and total catch for marine recreational fishing in Australia. The study will be conducted in North Carolina where it will use the current dual-frame mail survey as a means of recruiting a panel of marine recreational anglers that will be asked to participate in the pilot study. Each panel recruit will be sent a package that will include a diary, fish guides, and specific instructions on how to record their fishing effort and catch data in the diary. Additional information on how to identify fish species is being developed to include in the initial mailing. Half of the panel recruits will be asked to provide their effort and catch data through periodic telephone contacts with a dedicated telephone interviewer, and the other half will be asked to provide their data through the use of a website reporting tool. The collected data will be used to evaluate differences between various categories of fishing trips that have either been covered or not covered by the current MRFSS APAIS sampling design

3.2 Estimating recall bias in recreational fishing surveys (by Jeremy Lyle, University of Tasmania)

3.2.1 Introduction

Most recreational fishing surveys involve the collection of at least some information after the event, and thus there is potential for recall bias in reporting. Recall bias is a complex issue that is influenced by the length of the recall period and the frequency of participation, such that the longer the recall period the greater the bias, and the greater the activity level (avidity) the greater the bias. In addition to simple exaggeration (inadvertent or deliberate) of activity within the recall period, the phenomenon of telescoping, that is the inclusion of activities that occurred outside of the recall period, can also be a contributing factor.

Off-site recall based surveys have been widely used in recreational fishing surveys to collect information about fishing activity, with surveys typically administered using phone, mail or face-to-face contact. Recall periods of up to 12 months are commonly used in fishing surveys. Such surveys are relatively cheap and easy to administer, since a single contact is used to collect the core information. They are also able to deliver apparently credible information, at the least trends and relativities in activity levels are plausible.

3.2.2 Estimating recall bias

There have been several Australia studies examining the influence of recall bias on estimates of catch and effort (Lyle 2000; Forward and Lyle 2002; Lyle and Morton 2004; Baharthah 2006). The phone-diary approach has been used in each of these studies and results compared with phone-based and/or mail-based surveys in which catch and effort information was collected retrospectively for periods ranging between six and twelve months. The phone-diary method provides detailed informa-

tion about fishing activity collected at the event level (daily activity by method), with particular attention given to achieving high response rates and data quality (including minimising the influence of recall bias) through a comprehensive system of interviewer and respondent management (refer Lyle 2009). Information is collected more or less 'prospectively' through the use of the diary system, whereas in recall surveys information is collected retrospectively at the conclusion of the fishing season/year.

Table 1 provides comparative information for Tasmanian rock lobster and abalone fishery surveys (licensed activities), indicating that the recall-based phone surveys consistently produced significantly higher estimates of catch and effort, in some instances more than double, compared with the phone-diary approach. Interestingly, overall catch rates were similar between methods which may be expected since both fisheries have relatively low daily bag limits imposed. Exceptionally high and comparable response rates (>90%) were achieved for both phone-diary and phone recall surveys, implying that recall bias probably represents the major factor contributing to the discrepancy between estimates. In the surveys conducted in the late 1990s (Lyle 2000), retrospective fishing activity was collected by month and region and, in a relative sense, these data aligned very closely with the spatial and temporal patterns observed from the phone-diary survey. Forward and Lyle (2002) also compared estimates of participation (proportion of licence-holders who fished during the season) and catch (proportion of licence-holders who caught at least one lobster during the season) and established that both the phone-diary and phone-based recall methods provided very similar estimates. This observation tends to confirm that respondents are able to accurately recall whether or not they had fished, and whether or not they had caught something (at least in the context of a discrete fishing season), with recall bias becoming a problem when those who fished and caught something estimate this activity. In the absence of other information, recall based catch and effort information can be useful in profiling fishing activities but absolute estimates of catch and effort need to be treated very cautiously.

Table 1 Phone-based recall estimates relative to phone-diary estimates of catch (numbers) and effort (days fished) and daily catch rate for the Tasmanian rock lobster and abalone fisheries. Recall period is indicated. Based on Lyle 2000; Forward & Lyle 2002; Lyle and Morton 2004. nd not determined

	1996/97	1997/98	2000/01	2002/03
Rock lobster				
Recall period (mo)	6	6	10	10
Effort (relative to diary)	1.7	1.9	1.6	1.4
Catch (relative to diary)	1.2	1.7	1.5	1.3
Catch rate (rel to diary)	nd	nd	1.0	0.9
Abalone				
Recall period (mo)	6	6		12
Effort (relative to diary)	nd	nd	-	2.2
Catch (relative to diary)	2.1	2.1	-	2.2
Catch rate (rel to diary)	nd	nd	-	1.0

Baharthah (2006) compared three survey approaches - phone-diary survey, phone-based recall survey and a mail-based recall survey - to collect catch and information for the Western Australian rock lobster fishery (licensed activity). Phone-based recall

and mail-based recall surveys were administered at the end of an eight month fishing season and respondents were asked to estimate their effort (days fished) and catch of lobsters (numbers). Table 2 provides comparative information for each of the surveys. Consistently high response rates were achieved for both phone surveys, the lowest response rate was achieved for the mail (note, this response rate is comparable to or greater than that achieved in many mail-based fishing surveys). Based on whether respondents (licence-holders) reported fishing for rock lobster during the season, it was evident that the lowest participation rate was estimated for diary participants, although this was not significantly different to the rate determined for the phone-based recall survey. By contrast, a significantly higher proportion of mail respondents reported fishing, implying a bias towards respondents who fished during the season. There was also a marked difference between the proportion of respondents who reported fishing, yet caught no rock lobster for the season, between the mail survey and two phone surveys, implying a bias in the mail survey towards respondents who caught lobster. The net effect of these response biases in the mail survey was for active fishers who caught rock lobster to be more likely to respond than licence holders who did not fish or, if they fished, caught no lobster. Consistency in the proportion of active fishers and those who caught no lobsters during the season for the two phone surveys suggest no obvious reporting biases at the level of fished or not, and caught a lobster or not (similar to Forward and Lyle 2002). When relative estimates of catch and effort were compared with the phone-diary survey, it was evident that both recall based surveys produced significantly higher estimates, the ratios for the phone-based recall surveys being comparable to those determined in the Tasmanian surveys. Significantly higher estimates for the mail-based recall survey compared with the phone-based recall presumably reflect the additional and compounding influence of non-response bias. Interestingly, despite the lower response rate, a substantially larger sample size was available for the mail survey (almost four times that for either of the phone-based surveys) and as a consequence the magnitude of the relative standard errors on catch and effort estimates were less than half those for the phone-diary survey, indicating greater precision in the mail-based estimates. This observation highlights the importance of distinguishing between accuracy and precision, for some researchers and resource managers a relatively precise recall based estimate may be very persuasive.

Table 2 Comparative data for phone-diary (diary), phone recall and mail recall surveys of recreational rock lobster fishing in Western Australia (adapted from Baharthah 2006)

	Diary	Recall	
		Phone	Mail
% response	92*	96+	51 ⁺⁺
% fished	55	62	69
% fishers with nil seasonal catch	13	14	6
Effort (relative to diary)	1.0	1.7	2.6
Catch (relative to diary)	1.0	1.8	2.3

* Response rate based on the proportion of contacts at screening who completed the diary survey for the entire fishing season (actual refusal rate was <5% of net sample)

+ Response rate based on proportion of contacts who responded to the phone survey (actual refusal rate <1% of net sample)

++ Response rate based on proportion of questionnaires returned (excluding non-deliverables).

3.2.3 Conclusions

- Recall periods of several months or greater are likely to result in significant over-estimates of catch and effort.
- Recall based data may be useful in determining relativities rather than absolutes- e.g. relative proportion of catch by method, region or season - and may be useful in tracking trends over time.
- Recall, when confounded with non-response, will tend to compound the bias effect since both biases are likely to act in the same direction.
- Precision is no substitute for accuracy.

References

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4 Schemes of recreational fisheries sampling and survey method

This section of the report provides an outline that was developed by the Planning Group to organize future discussions of options to be considered in designing and implementing effective surveys of recreational fishing participation, effort, and catch. This outline was informed by ideas generated in subgroup discussions (Section 5) and provided the basis for the summary narrative presented in Section 6 of this report.

4.1 Off-site survey method

4.1.1 Screening survey

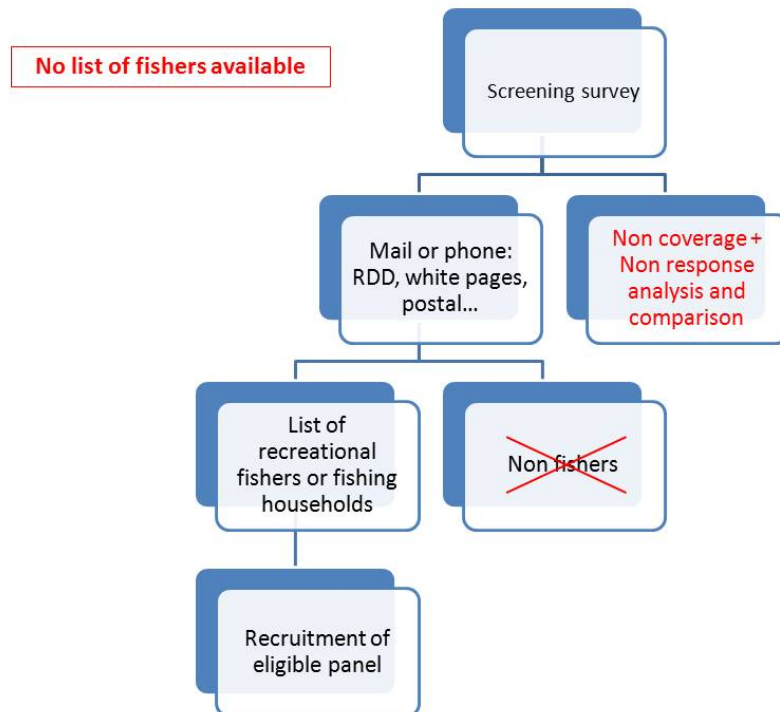


Figure 1: Organisation of survey without list frame

Screening questions:

Short and simple questionnaire

- Have you done recreational fishing on the last 12 months? (exclude commercial, subsistence)
- Are planning fishing in the next 2(?) months? → intention
- Demographic
- Marine/Fresh
- Avidity
- Fishing modes (shore angling, boat, non-angling...)
- Trips aboard
- Willingness to participate to panel (further studies)...

4.1.2 List frame survey

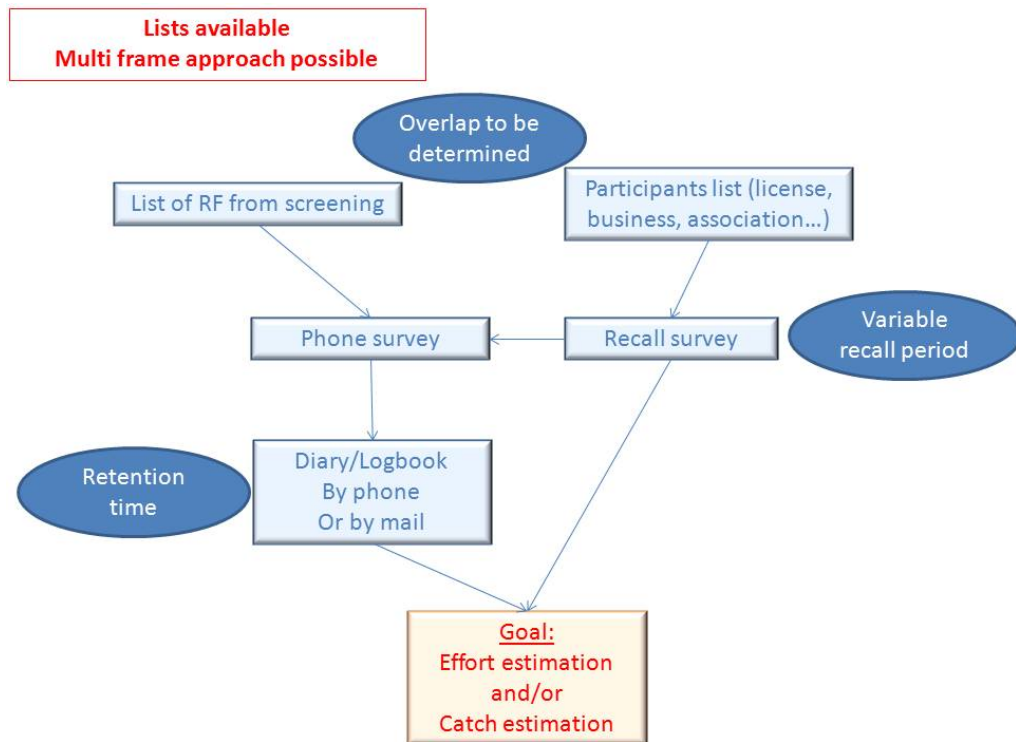


Figure 2: Organisation of survey with list frame

Data elements for off-site survey:

- Effort
 - Location (inside or outside of country)
 - Time fishing (in day or hour...)
 - Mode of fishing
 - Gear type
 - (Primary target species)
- Catches
 - Kept and discards (released alive, dead...)
 - Length
 - Weight

4.2 On-site survey method

4.2.1 General approach

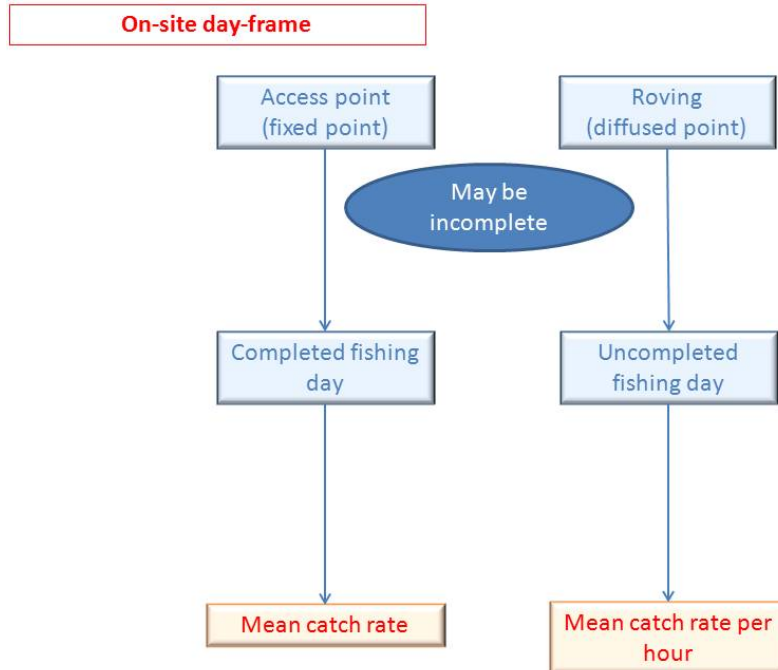


Figure 3: Organisation of on-site survey

Data elements for on-site survey

- Demographic (residency...)
- Mode of fishing
 - Shore (angler level)
 - Boat (boat level)
- Fishing time (in hours...)
- Avidity
- Primary target species
- Catches
 - Kept and discards (released alive, dead...)
 - Length
 - Weight

4.2.2 Particular case: visual survey

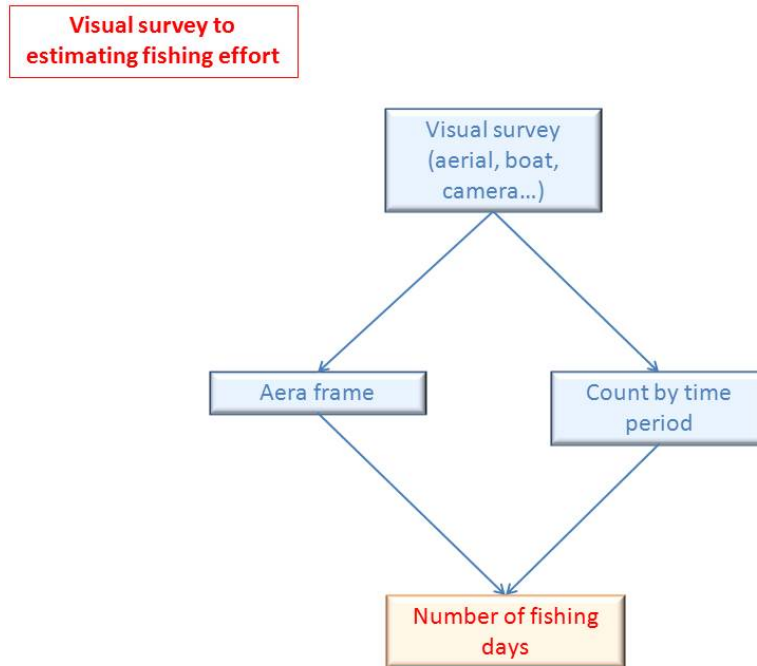


Figure 4: Organisation of visual survey

Data elements for visual survey

- Boat, person, gear (buoys, traps, nets...)
 - Fishing vs non fishing
 - Type of boats
- Position
- Time

4.3 Remarks

Some terms needs to have a common definition in European context:

- Recreational fishing
- Tourism fishing
- Release/Discard

5 Compilation of subgroup reflections

The participants divided into three subgroups to identify issues that we would need to address in designing and conducting surveys of recreational fisheries that would produce reliable estimates of total catch for important fish stocks.

5.1 Sub group 1

The first subgroup decided that the primary objective of the PGRFS should be to develop methods that can be used to accurately estimate recreational fishery catches of cod, seabass, eel, salmon, and tuna. The following issues were identified by the subgroup:

- For any given species stock (e.g., Baltic cod), it may be desirable to implement one regional survey approach that would cover the whole range of the stock and produce a direct estimate of the total catch of the stock.
- It should also be possible to implement two or more separate surveys that produce catch estimates for different non-overlapping geographic areas within the range of the stock and then sum those estimates to get an estimate of the total catch of the stock.
- It should also be possible to produce total estimates of fishing effort and/or catch by residents of a particular country by combining the estimates produced from two different surveys. For example, one survey conducted in the Netherlands could be used to estimate total catch of cod by Dutch residents in Dutch waters, and other surveys conducted in other countries (e.g., Norway) could produce estimates of total catch by Dutch tourists while travelling abroad. The estimates from the separate surveys could be summed to estimate total catch of cod by Dutch residents.
- It would be desirable to establish requirements for the frequency (annual, quarterly, monthly, etc.) and relative precision of catch estimate updates.
- It would also be important to define the subpopulations for which separate catch estimates are needed and then decide the extent to which these subpopulations can be sampled independently as separate strata. If subpopulations cannot be easily stratified for separate sampling, then it may be necessary to produce separate domain estimates for those subpopulations without stratifying the sampling. For example, estimates for subpopulations defined by different métiers (see page 51 WKS MRF) may best be provided by domain estimation if it is not easy to know how to separately sample them as strata.

5.1.1 Large scale national Screening Survey:

The subgroup recognizes that one possible approach for conducting a National survey of recreational fishing would use an off-site survey (by phone, mail, or internet contact method) to target either the entire resident population or a population of known fishing participants who have registered by obtaining a license or permit. The following issues were identified:

- The entire resident population could be accessed through a comprehensive survey of households that would collect data from permanent household residents who engaged in recreational fishing.

- Lists of probable fishing participants and their contact information (mailing address, phone number, and/or e-mail address) could be created through licensing or permitting efforts or by contacting fishing clubs.
- A National survey should attempt to measure the proportions of the population surveyed that (1) participated in non-commercial or recreational fishing, (2) fished in marine waters, (3) fished in fresh waters, and (4) used different particular fishing gears. In addition, the survey should measure the fishing avidity of participants and the proportions of fishing trips made in both the country of residence and in any foreign countries.
- It would be important to measure the levels of non-response due to non-contacts or refusals and evaluate any possible non-response biases.
- Any on-site surveys of recreational fishing trips should collect data on the country of residence of intercepted fishing participants so that it would be possible to estimate resident/non-resident ratios.
- The frequency of the survey needs to be determined. Should it be conducted every year, every 2 years, or less frequently?
- It would be important to compare surveys based on lists of known participants with broad coverage surveys that screen the total population to find fishing participants.

5.1.2 Catch/effort:

5.1.2.1 Offsite Recall Survey

The length of the recall period should be optimized to minimize possible recall biases.

- If measures of recall bias can be obtained through periodic surveys (every year or every few years), then it may be possible to adjust survey estimates each year to correct for such biases.
- Pilot studies should test different recall periods, such as those currently used in Finland, Sweden, and Denmark.
- Netherlands should determine if the fishing behaviour recorded in database TNSNIPO does not deviate from the fishing behaviour of the general Dutch population.

5.1.2.2 Offsite Diary/Logbook Survey

It will be important to determine how often it would be necessary to conduct a detailed survey that generates very precise estimates of total catch by species. It may be possible to conduct less detailed surveys in between that generate indices that can be used to track annual trends. This may be necessary if the detailed surveys are very expensive and resources are limited.

- Depending on how data will be used by fishery managers and/or stock assessment scientists, it may, or may not, be important to target specific levels of statistical precision or a specific frequency of updates to cumulative catch estimates. Decisions may be needed on how to balance possible trade-offs between statistical precision and the frequency of statistical updates.
- A rotating panel design for an off-site diary or logbook survey approach may be more costly, but it may also provide greater statistical precision in the resulting catch estimates.

5.1.2.3 Foreign fishing trips:

It should be important in any offsite survey to ensure that participants are able to record or report their fishing trips and catches outside of their home country.

- If every country quantifies the amount of fish caught by their residents while fishing in other countries on holiday, then a country like Norway may not need to survey its tourists but could collect tourist fishing information from the surveys conducted in other countries.
- Surveys of residents in each country should at least collect out-of-country fishing data so that comparisons can be made between a given country's estimates of tourist fishing catch and the sums of estimates obtained for residents of the other countries when fishing abroad.

5.1.2.4 Onsite Surveys:

It may not be feasible at this time for most European countries to conduct onsite surveys like the U.S. currently conducts to estimate catch rates. Such surveys are very expensive to implement successfully, and resources for most European countries are currently inadequate.

- *Ad hoc* onsite sampling might be useful for validating catch data obtained in logbook reports.
- Some validation may be needed to adequately correct self-reported data on the season, location, avidity of fishing, species composition of catch, and numbers of fish caught.
- Onsite data can be used to validate the species identification of fish in off-site surveys that rely totally on identifications based on fisher observations or observations of pictures taken by fishers.
- Onsite surveys should collect information on the fisher's country, county/province, and city location of residence.
- Catch data should be obtained from vessel operators or anglers who have completed fishing for the day.
- Landed fish should be sampled to obtain length frequency data, species composition, and biological samples.
- It would also be important to ask fisher if he/she could be contacted by landline phone, mobile phone, or e-mail. One could also ask the fisher to provide contact information (mailing address, e-mail address, or phone numbers) that could be used for follow-up offsite surveys (mail or phone).

5.1.3 Other issues

It will be important to include both the landed catch and some fraction of the catch released at sea in estimates of total fishing mortality.

- Landed catch would include catch that is kept to be eaten, used for bait, and/or used for other purposes
- Released catch would include catch released dead or alive, but some fraction of the catch released alive may be subject to a lower probability of survival that depends on how they were caught or handled prior to release.

5.2 Sub group 2

The second subgroup decided that the primary objective of the PGRFS should be to develop methods that help to meet the DCF goal to support management of fish stocks.

5.2.1 CDF context

To put survey design requirements in the appropriate CDF context, the following considerations are important:

- The minimum requirements should be to estimate:
 - numbers of fish caught and landed by species,
 - length distributions of fish landed by species, and
 - number of fish caught and released at sea by species.
- The units of fishing effort should be standardized.
 - Should effort be measured in terms of individual fishing trips, hours, or days ?
 - Should effort be measured at the level of a fishing vessel or a fishing person ?
 - Should effort be measured by gear type ?

5.2.2 Screening Surveys

To conduct a screening survey that would contact and identify fishing participants from whom fishing data can be collected, the following issues must be considered:

- What sorts of list frames are available that could provide efficient access to fishing participants?
- Should the survey be designed to contact households or individual persons?
 - What sort of measures would be needed to ensure the confidentiality of any information provided by respondents?
 - A survey designed to sample from a list of known fishing participants could be biased if the list frame is incomplete.
- A broad national survey would ensure more complete coverage but it may also be very inefficient.
 - What sort of measures would be needed to ensure the confidentiality of any information provided by respondents?
 - A list of mailing addresses could be used for an address-based sampling (ABS) mail survey that would provide relatively complete coverage of residential households, including those without phones and those with only mobile phones.
 - A broad coverage survey may only be needed every five years to provide a general picture of fishing effort.
 - A broad coverage survey may be used as a means of screening participants and recruiting them for a follow-up panel survey that could collect more detailed data on fishing effort and/or catch.

- It would be important to establish certain basic definitions:
 - It would be necessary to distinguish between fresh and salt waters. You may need to collect data on fishing in both kinds of waters in order to be sure that you accurately survey catch and effort in one or the other type of waters.
 - It would also be necessary to distinguish between fishing activities that occur within the specific boundaries of the country of residence and fishing activities that occur within the corresponding boundaries of other countries. It would be desirable to collect data on both in any survey of one country's residents.
 - It would be useful to categorize trips by target species. One must decide which species are the most important to consider in defining trip types. Although it would be helpful to estimate fishing effort and catch for different trip type domains, one would want to limit the number of trip types so that effective sample sizes for each type would be sufficient to ensure a reasonable level of statistical precision.

5.2.3 Panel Surveys

Panel surveys could be used to collect both fishing effort and catch data. Panels of fishing participants could be recruited from a screening survey and asked to respond periodically by mail or phone to report information on their fishing activities. In designing panel surveys, the following issues must be considered:

- Target species – It would be necessary to focus the panel survey on collecting quality data on catch DCF species and fishing effort directed at DCF species
- Methods – Certain design features should be considered.
 - Rotating panel design – A rotating panel survey design could be used to maximize retention of panel members (reducing possible non-response bias) and ensure that more than one panel is surveyed (increasing effective sample size).
 - Diary survey – A diary survey approach could be used to improve the recall accuracy of panel members. Each panelist would be sent a diary to use for recording their fishing activities, and then they would be asked to periodically report data on those activities.
 - Telephone response – Reports could be made in response to a periodic phone calls by a highly skilled interviewer.
 - On-line response – Reports could be made by entering data directly to a well-designed web reporting system.
 - Periodic verification – It would be necessary to frequently check with panelists to be sure that they are accurately recording and reporting their activities in a timely manner.

5.2.4 General recommendations

The subgroup feels that the following points should be addressed in any country's data collection program:

- Cooperation between freshwater and saltwater communities is essential.
- A European database on foreign tourist fishing should be created. If each country attempted to estimate the amount of fishing trips made by their residents in other countries, it would be easier to monitor the impacts of tourist fishing relative to fishing by residents.
- It would be desirable to pursue getting additional funding from DCF to support the further development of improved European surveys of recreational fishing

5.3 Sub group 3

5.3.1 Introduction

The third subgroup discussed the need to learn more about how to design and implement successful sampling surveys. The following general issues were identified:

- Sampling survey methods are not well known among fisheries scientists.
 - A complete census survey of recreational fishing would be impractical, if not impossible.
 - “We are talking about sampling.” Therefore, it is important to understand how to get a representative sample of the target populations of fishers or fishing trips.
- It should be a goal to develop guidelines, or “best practices”, for sampling surveys of recreational fishing. This should go beyond just establishing minimal protocols and should identify an array of alternative survey designs that would be effective, including those that may be too expensive to implement at current funding levels.

5.3.2 Survey methods

5.3.2.1 Preliminary study

There is a certain amount of homework that one must do before designing a survey:

- It is important to identify frames of addresses or phone numbers that could be used to gain access to fishing participants.
 - Each frame should be tested for its completeness and reliability.
 - Determine for each frame how you will define the primary sampling unit. Will it be a household, a business, a person, or a fishing location?

5.3.2.2 First step = identify and define population of the recreational fishermen

The first step should be to identify the target population. If the target population is the population of recreational fishing participants, then the following considerations should be made:

- Screening survey – If there is not a complete list of known fishing participants available, it would be desirable to conduct a screening survey that samples from a broad coverage frame like a comprehensive frame of residential households.
 - A probability-based sample could be drawn to conduct screening by phone (random digit dialing or phone directories) or by mail (post office delivery sequence file).

- A screening survey can always be useful because available list frames are usually incomplete and would not provide access to all participants by itself.
- Recall period – A short recall period would be preferred to minimize possible recall errors.
- Survey frequency – It may not be necessary to conduct a survey every year. Perhaps every 2 or 5 years would be sufficient.
- Temporal stratification – The temporal stratification of the survey should probably be at least quarterly.
- Results – The survey should collect the minimal data needed to define and profile the fishing population.
- Variables – For the screener, it is most important to just determine if the person contacted fished or not. The questionnaire should be kept as short as possible to ensure high response rates.
- Sample size – If the target population is a very small fraction of the frame population, then a very large sample size may be needed to get a sufficiently large sample of fishing participants.
- Stratification – It will be important to consider if there is a need to stratify sampling with respect to fishing mode, time period (bi-monthly, monthly, weekly, etc.), or target species (trip type).
- List frame survey – If possible it would be a good idea to conduct list frame surveys for some segments of the fishing population.
 - The list frame could be a list of businesses with mailing address or telephone information. The businesses could be providing customers with access to fishing.
 - The list frame could provide direct or indirect access to residents or non-resident tourists.
 - One should determine what kinds of lists are available. Are any recreational fishing participants required to have a license, and do they have to provide their name, address, and phone number when they register for the license? Lists of fishing club members or boat registration lists may also prove to be useful sampling frames.
 - Even with a licensing program, there are people who may fish without a license. Therefore, license lists will probably be incomplete.
- Conclusion – The following ideas were discussed:
 - A brief screening survey with a broad coverage sample frame should be cheaper than a detailed survey conducted with the same frame. Therefore, it is probably best to use a screener survey only as a means of recruiting fishing participants for a more detailed follow-up survey (as described in the “second step” below).
 - It would be best to use a dual frame, or multi-frame, approach so that you can test the coverage of your list frame by making comparisons between fishing participants that occur in both frames and those that appear only in one or the other.

- Bias reduction – The use of more than one frame can reduce the biases that could result from the undercoverage of any one list frame.

5.3.2.3 Second step = catch and effort details

A screening survey can be followed by a more detailed survey of the fishing participants identified in the screening process. The detailed questions included in such a second stage of sampling should really depend on the situation and should be adapted to the fishing mode, the specific targets of fishing, and the fishery management context.

5.3.2.4 Key issues in sampling and estimation

The sampling and estimation objectives of a survey are not always easy to link effectively. It will be important to consider the following key issues:

- One must define the unit of measure for fishing effort, as well as the subpopulations for which domain estimates are needed. Should effort be measured in terms of boat trips or angler trips? What trip types, or metiers, are important for defining different subpopulations or domains?
- We must be careful not to subdivide the target population into too many domains, or we will have very small effective sample sizes and statistical estimates at the domain level will not be sufficiently precise.
- It is very important to define the primary sampling unit before determining an appropriate stratification scheme for sampling.
- Sampling should not be stratified unless subpopulations can be easily defined and identified prior to the sampling stage.
- Data collected during the sampling process can be used to define separate domains for estimation that are not separated at the sampling stage. For example, fishing trip types that are defined in terms of species targeted, fishing methods, or fishing gear types may not be easily separable at the sampling stage and should be used to define estimation domains, not to define sampling strata.
- Based on the defined strata for which you can control sample sizes, you should allocate the sampling effort to optimize the precision of estimates of total fishing effort (or total catch of certain species). This may mean allocating a disproportionate share of the sample to strata in which the variabilities of effort (or catch) are greatest.
- Small subpopulations of fishing trips, such as those defined by the use of specialized fishing gears (e.g. spearfishing) are always going to be difficult to capture in a general survey. Precise domain estimates of fishing effort or catch for such rare subpopulations would require very large sample sizes that would be very expensive to obtain.
- A screener survey may help to identify sampling strata in which the rare subpopulation is more common. Sampling could then be optimally allocated among strata to improve the precision of domain estimates for the relatively rare component.
- Fishery managers will generally prefer an overall survey approach that monitors all recreational fishing while prioritizing the collection of information on key species.

- One important objective is to produce estimates of CPUE by species in addition to estimates of total catch. Stock assessment scientists will want to use a measure of directed effort and a directed CPUE to assess relative abundance of the targeted fish stock.
- Two independent surveys can be used to produce an estimate of total catch. One survey can be focused on estimating total fishing effort, while a second survey can be focused on estimating a measure of the average catch per unit of effort. The product of those independent estimates can be used to estimate of total catch.

5.3.3 Additional remarks

Here are some additional comments from the third subgroup:

- EU n°949/2008 (DCF species) defines the EU requirements:
 - Minimal precision requirement = 40% standard error
 - Estimates must be produced quarterly
- Commercial fishing assessment has some of the same problems as exist for recreational fishing assessment.
 - Methods have been defined on a case by case basis
 - Several years of workshops have been needed to develop the methods currently in use.
 - Domain estimators have been developed that are based on metier.
 - Much work was needed to define the base metiers in terms of fishing modes, geography, and gear.

5.3.4 Recommendations

The third subgroup recommended the following:

- A survey is much easier if an existing frame with comprehensive coverage of fishing participants is available.
- The ideal survey frame would be a complete registry of recreational fishermen. Registries could be compiled from licensing or permitting programs that charge a fee (sufficient to cover the costs of the licensing system) or from a free registration process.
- ICES and EU could support a collaborative effort among countries that would provide well-coordinated regional survey programs that produce reliable recreational catch statistics for managed fish stocks. Teamwork among ICES and EU partners would be beneficial for all because some countries have more experience in designing and implementing surveys than others. Sharing of ideas would facilitate more rapid development and testing of innovative approaches by all partners.
- It should be a high priority to enlist the help of experts in survey statistics as consultants who could assist in the development and evaluation of a variety of possible survey designs that could be used by one or more partners.

6 Recommendations for European recreational fisheries

6.1 Recommended framework for recreational fishery surveys

The Planning Group worked collaboratively to develop a recommended approach to conducting surveys of marine recreational fishing that would provide complete coverage of fishing participants and provide total catch statistics for important fish stocks that are unbiased and sufficiently precise for use in stock assessments and fisheries management. The intent was to identify alternative sampling frames, contact methods, and complemented survey designs that should be considered and evaluated for implementation by all ICES partners. The goal was to develop a set of best practices that could be utilized in the development of a data collection framework that would maximize the comparability of resulting fish stock catch statistics among neighbouring countries. The cooperative development of such a framework would also help to ensure that there is an accurate accounting of fishing effort and catch for each country that includes the contributions of both residents and tourists travelling from other countries. This cooperative effort represents an important step toward coordinating the planning of ICES members to jointly evaluate, test, and implement survey methods that could provide a more unified approach for cost-effective monitoring of the recreational catches of shared fish stocks.

6.1.1 Off-Site Survey Methods

The most efficient and cost-effective way to survey recreational fishing would be to (1) register all fishing participants; (2) develop a complete database with their names, mailing addresses, and phone numbers, and (3) utilize that database as a sampling frame for either mail or telephone surveys. The registration of participants could be accomplished through the implementation of a governmental fishing license or permit program that would collect a valid name, address, and telephone number for each participant. Most ICES members do not have registration programs in place that can provide a complete, direct sampling frame of all participants. In addition, most of the mandatory registration programs in place either exclude some participants from the registration requirement or lack the level of enforcement needed to ensure that all participants actually register. Therefore, it is very important to identify and evaluate alternative sampling frames that can be used now to gain either direct or indirect access to all recreational fishing participants. Some ICES members are currently using complete lists of residential mailing addresses for mail surveys of recreational fishing by their residents. Other ICES members have utilized random-digit-dialling (RDD) or directory-based telephone surveys that provide access to a majority of their resident fishing population. Surveys based on such broad-coverage household frames can be used for a "screening survey" that would obtain a representative sample of households whose residents participate in recreational fishing. A detailed survey of recreational fishing activities could then be conducted with such a screened sample of residences without any significant concern for non-sampling errors related to insufficient coverage.

6.1.1.1 Screening Survey Methods

The Planning Group recommends that mailing address, RDD, and telephone directory frames be compared and evaluated to determine which provides the most complete coverage for effective screening of resident recreational fishers in each country. In addition, it is important to test possible mail and telephone survey approaches and

compare them in terms of their expected response rates. In the United States, the U.S. Post Office's delivery sequence file (DSF) provides more complete coverage of resident fishing participants than either RDD or "white-pages" telephone directory frames because it can reach residences without telephones, as well as residences without landline telephones. A current U.S. pilot study is also showing that mail surveys based on the DSF frame can potentially produce response rates equal to or greater than those obtained by current RDD telephone surveys of recreational fishing. Telephone survey response rates have been steadily declining in most countries with the rise in use of answering machines, the increasing use of caller ID to screen calls, and the increase in the prevalence of cell-phone-only households. Such comparison studies are needed in European countries to determine the best approach to use for a screening survey that could successfully reach a representative distribution of recreational fishing households or recreational fishers.

Screener Survey Questions

If a list frame of recreational fishing participants is not available, the Planning Group recommends the use of a screening survey to identify a subset of contacted households, or household residents, who could then be used as a representative sample for a follow-up survey that would obtain more detailed information on recreational fishing activities. Even if a list of registered participants is available, the planning group recommends that a screening survey should be used to obtain representative sampling of participants who did not register or did not provide valid contact information. The screener questionnaire should be designed to maximize response rates and obtain a minimum of information needed to identify the eligibility of the respondent or household for the more detailed follow-up survey. The Planning Group developed a minimum list of questions for the recommended screener survey, recognizing that the actual questions would be best developed with the help of consultant experts in questionnaire design. The recommended list of minimum questions is as follows:

1. [Recreational fishing participation – last 12 months] Have you, or anyone in your household, gone (practiced) recreational fishing within the last 12 months?
 - a. [Freshwater fishing participation – last 12 months] Was any of this recreational fishing in freshwater?
 - i. [Freshwater fishing avidity – last 12 months] On how many days did you go recreational fishing in fresh water?
 1. [Freshwater fishing avidity – home country] How many of these fishing days were in your country of residence?
 2. [Freshwater fishing avidity – another country] How many of these fishing days were in another country?
 - a. [Other countries – freshwater fishing] (If greater than zero) In what other countries did you go recreational fishing in fresh water?
 - b. [Marine fishing participation – last 12 months] Was any of this recreational fishing in marine waters?

- i. [Marine fishing avidity – last 12 months] On how many days did you go recreational fishing in marine waters?
 1. [Marine fishing avidity – home country] How many of these fishing days were in your country of residence?
 2. [Marine fishing avidity – another country] How many of these fishing days were in another country?
 - a. [Other countries – marine fishing] (If greater than zero) In what other countries did you go recreational fishing in marine waters?
2. [Recreational fishing participation – next X months] Are you, or anyone in your household, planning to go (practice) recreational fishing in the next __ months?
 - a. [Freshwater fishing participation – next X months] Are you planning to go recreational fishing in fresh water?
 - b. [Marine fishing participation – next X months] Are you planning to go recreational fishing in marine waters?
3. [Demographic questions]
4. [Willingness to participate in follow-up detailed surveys] Would you mind if we contacted you again to ask you more questions about your fishing activities?

The data collected in the screening survey could be used to estimate both the proportion of residential households that participated in marine recreational fishing and the mean number of marine recreational participants that resided in each participating household during the last 12 months. These estimates could then be used in conjunction with available census data on the number of residential households to obtain an estimate of the total number of country residents who participated in marine recreational fishing.

6.1.1.2 Specialized List Frames and Multi-Frame Methods

It may also be possible to gain access to recreational fishing participants through more specialized list frames. Direct list frames of fishers, or fishing vessel operators, could be constructed from fishing license programs, fishing permit programs, or fishing club memberships. If such list frames can be obtained, they can be used in conjunction with a screening survey sample to conduct a multi-frame detailed survey of recreational fishing. The use of such direct list frames can potentially improve the efficiency and cost-effectiveness of a detailed survey, but overlaps between such lists and the general frame that was used for the screening survey must be determined to avoid possible double-counting in the estimation process.

The general screening survey approach described above would only provide access to the resident population in a given country. To provide coverage of non-resident “tourist” fishers, it may be necessary to construct indirect list frames of businesses that rent waterfront properties and/or fishing boats to recreational fishing participants from other countries. If such lists can be developed, they could potentially be used for separate specialized surveys of tourist fishing. Norway has recently conducted a survey of its tourist fishery using an approach like this. The Planning Group

recommends evaluation and testing of alternative list frames that could provide access to non-resident fishing participants in each country.

6.1.1.3 Detailed Survey Methods

Once a sample of recreational fishing households, or recreational fishers, has been identified through a screening survey, it is then possible to use that sample for a more detailed survey of recreational fishing activities. Such a detailed survey approach could be conducted either by mail or by telephone and it could be conducted as a one-time survey, as a panel survey with repeated contacts of the same respondents over several successive time periods, or as a series of independent surveys with different screening survey samples. The Planning Group recommends that pilot studies be designed to test and compare these alternative approaches in terms of their potential non-response and recall biases and their cost-effectiveness for delivering desired levels of statistical precision for annual estimates of fishing effort and/or catch. It is important to identify the relative advantages and disadvantages of different complemented survey designs that would combine a screening survey with one or more follow-up detailed surveys of fishing effort and/or catch.

One-Time Surveys

One possible approach would be to take the screened sample of recreational fishing households and re-contact them in a one-time mail, or telephone, survey to collect data on their fishing effort and/or catch. If a one-time survey approach is to be considered, it would be important to evaluate different recall periods in terms of the potential for response biases. Studies in Australia and the U.S. have showed that one-time surveys with a 12-month recall period can significantly over-estimate total recreational fishing effort. Shorter recall periods should be tested to determine how accuracy would improve as a function of period length. The Planning Group feels strongly that recall periods shorter than 12 months are needed, and recommends that all partners need to consider the alternatives of conducting a panel survey with a screened sample or conducting a series of independent detailed surveys with different screening survey samples. It would also be important to evaluate separately the recall periods needed for accurate reporting of fishing effort (number of days fished) and catch (numbers of fish caught by species). Shorter recall periods will probably be needed for accurate reporting of catches.

Series of Independent Surveys

A series of independent detailed surveys could either be conducted in conjunction with one broad coverage screening survey or as follow-up surveys to a number of independent screening surveys. For example, if a 2-month recall survey was found to provide sufficient response accuracy, one could split a screening survey sample into six different subsamples that would be used for six successive detailed surveys that would cover a 12-month time frame for recreational fishing. Alternatively, a new screening survey could be conducted every two months to generate a new screening sample for use in a detailed 2-month recall survey. Six successive screener-detail sequences could then provide the full coverage of a 12-month time frame.

Panel Surveys

A panel survey approach could use the screening survey as the means for recruiting one or more panels of respondent households, or household residents, that could then be re-contacted over three or more successive time periods to collect fishing ef-

fort and/or catch data using the preferred recall period. One panel could be recruited and retained for a full year, or more than one panel could be recruited so that each is only asked to report for a shorter time frame. For example, with a two-month recall period, two different panels could be recruited from the base screening survey, one could be contacted for the first three successive periods, and the other could be contacted for the second three periods to provide full-year coverage. Panels could also be constructed to be overlapping in some sort of rotating panel design. The optimal panel design should minimize potential biases due to non-response (caused by panelists dropping out) and changes in respondent behaviour while maximizing the effective sample size used for estimating total 12-month fishing effort and/or catch.

Panel surveys could either be designed to have set periodic reporting times or they could be designed to utilize a diary, or logbook, as a recall aid with contact intervals varying in relation to fishing avidity. The telephone-diary approach used in Australia is an example of the latter approach. In that survey design, the panellists are asked to keep diaries of their fishing trips in which they record the type and location of their fishing trips, as well as their catches of different fish species. They are periodically contacted by telephone to report their recent fishing trips and catch, but the more avid anglers are contacted more frequently than the less avid anglers to improve their recall accuracy. The Planning Group recommends consideration of diary-based panel surveys as a means of improving recall accuracy, and it also recommends assessment of the relative advantages and disadvantages of using telephone, mail, or website reporting as the method for collecting either fishing effort or catch data from diary panellists.

Diary-Based Panel Surveys

Panel surveys that utilize diaries and avidity-based contact rates provide a very cost-effective means of collecting both fishing effort and catch data. If panels are recruited from screening surveys that have relatively complete coverage of resident participants, then such surveys have the added advantage of providing coverage of fishing trips made from both public and private access sites. Fishing trips from private property, private docks, or private marinas cannot typically be intercepted by on-site surveys of catch, and they may have mean catch rates or species compositions that are quite different from public access fishing trips. The Planning Group recommends the evaluation of such surveys as a means of estimating both effort and catch in countries that cannot afford to conduct on-site access point or roving surveys. In addition, the Group recommends consideration of diary-based surveys as a means of evaluating differences between private and public access fishing trips in countries that can afford to conduct on-site surveys of catch at public access fishing sites.

Detailed Survey Questions for Fishing Effort Data

The Planning Group recommends that a detailed survey of fishing effort should collect a certain minimum number of data elements. The detailed survey questionnaire should be designed to maximize response rates and obtain a minimum of information needed to effectively estimate total marine recreational fishing effort. The following questions represent a minimum list to be used, recognizing that the actual questions would be best developed with the help of consultant experts in questionnaire design. The questions are as follows:

1. Did you go recreational fishing within the last __ days?
 - a. How many days did you go recreational fishing?

- i. How many of those days were spent fishing in fresh water?
 1. How many of those days of freshwater recreational fishing were in your home country?
 2. How many of those days of freshwater recreational fishing were in another country?
 - ii. How many of those days were spent fishing in marine waters?
 1. How many of those days of marine recreational fishing were in your home country?
 2. How many of those days of marine recreational fishing were in another country?
2. Starting with your most recent day of marine recreational fishing, I would like to ask the following questions:
- a. On what date did that marine recreational fishing occur?
 - i. Did your fishing on that date end at a site located within your own country or within another country?
 1. [If other country] Within what country did your fishing trip end?
 - ii. Did you fish from a private boat, rental boat, charter boat, or headboat on that date?
 1. How many hours did you spend fishing on the [private boat, rental boat, charter boat, or headboat]?
 2. What type of gear did you use for most of your boat fishing on that day?
 3. What species was your primary fishing target on that day of boat fishing?
 - iii. Did you fish from the shore on that date?
 1. If so, did you fish from a pier, dock, jetty, breakwater, bridge, causeway, beach, bank, etc.?
 2. How many hours did you spend fishing from shore on that day?
 3. What type of gear did you use for most of your shore fishing on that day?
 4. What species was your primary fishing target on that day of shore fishing?

Detailed Survey Questions for Catch Data

If catch data is to be collected on a detailed off-site survey, then the following minimum questions should be asked for each profiled day of fishing in a given boat or shore mode:

1. How many species of fish did you catch on that day of fishing?

- a. Name the different species that you caught.
2. [For each species] How many fish of that species did you catch?
 - a. How many of those caught fish did you keep?
 - b. How many of those caught fish did you release (or discard)?

If a diary-based method is used for collecting catch data, then it would also be desirable to attempt to get the diary panelists to obtain and record length and weight measurements of at least a random sample of their kept fish so they can report those measurements when interviewed by phone or when they mail in their diary. If there is a need for estimating the total weight of catch, then the reported weight measurements for each species could be used to estimate a mean weight of the fish caught of that species. Such data would best be collected through an on-site survey approach, but it may be possible to train diary panelists to collect and provide accurate weight measurements for the fish they caught. If length distribution information is needed, it may also be possible to train panel members to collect accurate length measurements.

6.1.2 On-Site Survey Methods

The Planning Group recommends some combination of on-site and off-site approaches for surveying and estimating mean catch rates by species. On-site surveys of recreational fishing trips should always be used in conjunction with a complement of off-site, or on-site, surveys of fishing effort that provide complete coverage of all recreational fishing effort within a given country. On-site survey methods obtain the most accurate data on the catches of recreational fishers, but the spatiotemporal sampling frames used for such surveys do not typically provide access to fishing on private property, from private docks, and from private marine or ramps. On-site methods should be employed whenever there are adequate resources available to support them, but it will usually be necessary to conduct off-site surveys of catch that allow some comparison of mean catch rates and species compositions between trips that can be covered on site and trips like private access (or night fishing trips) that cannot be covered easily on site. A diary-based panel survey approach should be considered as a possible means for performing the necessary assessment of such differences. Depending on the availability of resources, an on-site or off-site survey method may be used as the primary means of estimating mean catch rates. If resources are sufficient, an on-site method should be used to estimate mean catch rates at publicly accessible sites, and an off-site diary-based survey should be used to estimate any necessary adjustments that would be needed to account for fishing at non-public sites. If resources are limited, an off-site diary-based survey method could provide the primary means of estimating mean catch rates as long as some on-site sampling with trained interviewers can be conducted to validate the self-reported off-site data.

6.1.2.1 Access Point Surveys vs. Roving Surveys

The design of an on-site survey of recreational fishing catches should be determined by the manner in which recreational anglers gain access to fishing locations. If access to recreational fishing locations is relatively restricted and anglers typically exit through predictable, fixed points when they have finished fishing for the day, then an Access Point Survey design should be used. If access to fishing locations is relatively diffuse and anglers typically exit through a variety of unpredictable routes, then a Roving Survey design should be used. Access Point Surveys are more desirable than Roving Surveys because they always intercept and interview anglers who have fin-

ished fishing for the day and are consequently not susceptible to a "length of stay" bias. The objective of an Access Point Survey should be to estimate the mean catch rate as the mean number of fish caught per one completed angler day of fishing. This mean catch rate can be expanded by an estimate of the number of angler fishing days at public access sites to get an estimate of total catch at those sites. In the Roving Survey design, the objective would be to estimate a mean catch per angler hour of fishing. That mean rate can be expanded by an independent off-site survey estimate of the mean number of hours per angler fishing day to get the mean catch per angler fishing day. Expansion of that mean catch rate by the estimated number of angler fishing days can produce an unbiased estimate of total catch.

On-Site Data Elements

On-site surveys should obtain data on a certain minimum number of data elements. It is important to obtain basic demographic information (age and gender) about the intercepted recreational fisherman, as well as his/her location of residence (country, county/province). Because the primary site-day sampling units for these surveys are usually selected through unequal probability sampling that is based on estimates of expected fishing activity, it is important to use the selection probabilities to weight data in the estimation process. In addition, on-site sampling with such a design is typically a multi-stage cluster sampling process. Therefore, it is also critical to obtain and use accurate counts of subsampled clusters of fishing boats, anglers, or angler catches in the estimation process. Other critical data include the mode of fishing (shore, private/rental boat, charter boat, or head boat) for the completed angler fishing day, the number of fishing hours, the primary gear, and the primary (and possibly secondary) target species. The interview should obtain some data on the angler's relative avidity by asking for his/her number of recreational fishing days in a prior time period of set length. The catch data to be collected should include the species of fish, the number of fish caught of that species, the number of fish kept, and the number of fish released (or discarded). In addition, the interviewers should attempt to obtain length and weight measurements on a random sample of the kept fish that the angler is willing to make available.

On-Site Visual Surveys of Effort

In some areas, it may be possible to conduct on-site visual surveys of recreational fishing effort that utilize an area frame for sampling. For example, an aerial survey may be very practical and cost-effective as a means of estimating total recreational fishing effort on boats in areas where all actively fishing boats are easily visible from a plane. On-site boat-based surveys can obtain visual observations of stationary gears (nets, pots, etc.) that can be used to estimate total fishing effort in certain specialized recreational fisheries. It may also be possible to enlist the assistance of government fishing inspectors to conduct visual surveys of the numbers of standing gears or anglers observed along the coast. The Planning Group recommends the use of such on-site visual methods as a means of validating off-site survey estimates of fishing effort. In such aerial or boat-based surveys, the sampling unit could be a boat, person, or gear, and it will be important to observe and record location, time of day, and whether or not fishing gears are actively engaged. Estimates would have to be based on counts obtained within sampled areas and time intervals and the appropriate expansion of those counts to obtain the total number of boat, angler, or gear fishing days.

6.2 Term of references for the next meeting

The terms of reference for the next **Planning Group on Recreational Fisheries Surveys** are the following:

- a) Define common definitions and terminology and create a glossary about surveys of recreational fishing.
- b) Identify methods to evaluate and compare potential for recall, nonresponse and undercoverage biases in alternative survey designs.
 - Develop guidelines for survey design and analysis methods for the estimation of recreational fishing effort and catch totals, including the estimation of totals for subpopulations defined by geography (country of fishing access or water body of fishing), residency status (country resident or tourist), or mode of fishing (shore, private boat, or for-hire boat). Guidelines for minimizing possible biases
 - Guidelines for maximizing precision
 - Guidelines for analyzing cost-effectiveness and for optimizing survey designs under limited budgets
- c) Consider alternative designs for surveys of fishing participation, effort, and catch, and assess their utility relative to their potential for minimizing bias, maximizing precision, and controlling costs.
- d) Examine how best to utilize alternative survey designs to provide needed segmentation of estimated population totals into different metiers through either sample stratification or domain estimation.
- e) Develop a communications and education strategy that will promote a greater stakeholder involvement, participation, and support.
- f) Define the needs for expert statistical consultant support and develop a plan for acquiring and directing that support to facilitate collaborative development of optimal survey designs.
- g) Motivate regional cooperation (stock estimates)
- h) Plan future collaborations among European countries in the development of compatible survey designs that will provide unbiased and reliable recreational fishery catch statistics for shared fish stocks (milestone for 2013)

The next meeting of the PGRFS is planned for the Balearic Islands in June 2011.

7 International experiences in applying recreational fisheries sampling schemes

7.1 Belgium

7.2 Denmark

Abstract

In order to estimate cod and eel catches in the Danish recreational fishery an interview survey was in 2009 planned by DTU Aqua in cooperation with Statistic Denmark. Recreational fishing was separated into anglers (with rod and reel) and passive gear fishing (fyke – and gill-nets). In 2009 a total of 196,000 anglers and 34,000 passive gear fishermen had issued the compulsory license. Based on the interviews it was estimated that 23% and 28% of all anglers and passive gear fishermen fished without license, although with a lower effort than fishermen with an annual license. In total, it was estimated that close to a 100 t eel and 20 t cod were caught in fykenets, with the main catches lying in the period August–October. Eel caught by anglers was assumed to be insignificant. The estimated cod catches in the gillnet fishery amounted to 212 t with the main catches in February–April. In this investigation, anglers were estimated to fish close to 900 t cod with the Sound being the area with highest reported catches. Here, recreational fishing accounted for 12% of the total landings. Present interview survey indicates that approximately 4.5% of the total Danish cod catches and approximately 18 % of the total eel catches are taken by recreational fishing.

7.2.1 Introduction

7.2.1.1 Monitoring of recreational fishing

Denmark is obliged to design and implement monitoring of the recreational fishery. This is a consequence of the EU Council regulation No. 199/2008, concerning the establishment of a Community framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the Common Fisheries Policy. Denmark has to monitor the catches (in weight) of the following species: eel (*Anguilla anguilla*); cod (*Gadus morhua*) and Baltic salmon (*Salmo salar*) on a quarterly basis. This task was introduced in 2009 in all member states of the EU. However, as most member states have their own regulation on recreational fishing, the design of the monitoring differs between member states. For many countries, sampling catches in recreational fishing is a new activity. In a number of cases, pilot studies have been carried out in the past, but in many institutes there is no expertise in sampling these fishing types. For these reasons, derogations have been requested for sampling recreational fisheries in a number of National Programs, waiting for guidelines on the methodology available or to be developed from the ICES Workshop on Sampling Methods for Recreational Fisheries (WKSMMRF). This report from the workshop held at IFREMER, Nantes March 2009, gives a comprehensive summary of the national recreational fisheries in the various countries.

7.2.1.2 Method approach

In September 2009 Statistic Denmark and DTU Aqua developed a concept for a combined telephone and internet survey for the Danish recreational fishery. To estimate the seasonal and annual fluctuations in the catches the survey are intended to be conducted on a quarterly basis during the next years. This rapport provides results from the analyses of data from the first survey conducted in the period October to Decem-

ber 2009. The survey did not include the catches of Baltic salmon, since it was judged to be a fishery not suited for the sampling approach used in present survey.

The interview survey presented in this report was separated into two different phases with their own questionnaires and group of respondents: 1) The Omnibus and 2) License holders.

7.2.1.3 Recreational fishing in Denmark

Approximately 5.5 million people reside in Denmark; 2.5 million on the mainland and the rest on islands (source: Statistic Denmark, www.dst.dk). The coastline of Denmark is 7013 km long and no citizen lives more than 50 km from the nearest coast. Therefore, recreational fishing in marine waters is an important national outdoor leisure activity. In 1997, 16.5% of the Danish public considered themselves anglers and 12.5 % claimed to have been fishing within the last year (Bohn and Roth, 1997). Further, it was found that 25% fished in streams, 30 % in lakes, 27% in put & take ponds, but the majority, 73%, answered marine waters. An economic validation of the recreational fishery underlines the importance of recreational fishery in Denmark, as it was found that Danish willingness to pay for fishing is among the highest in Nordic countries (Roth *et al.*, 2001; Toivonen *et al.*, 2004).

Recreational fishing in Danish coastal waters differs from what is observed in many other countries, especially outside of Europe, in the sense that two major and very different categories of fishing can be identified. The first one is referred to as passive gear fishing throughout this rapport. This is carried out using stationary gear such as gillnets and fykenets. The second category of leisure fishing in saltwater is angling.

Table 1. Number of annual angler- and passive gear licenses issued during 1999 to 2009. In 2004 no data are available. In 2009 17,800 week licenses and 22,200 day licenses was issued.

	1999	2000	2001	2002	2003	2005	2006	2007	2008	2009
Anglers	150526	151529	156769	150925	152534	160942	156474	160664	160186	156000*
Passive gear	33575	31709	33715	33888	33516	33430	34277	33787	35221	34000*

* Approximate numbers

Anglers - domestic as well as tourists - between 18 and 65 years of age have to purchase a license costing DKr. 140 for one year, DKr. 100 for one week and DKr. 35 for one day. All passive gear fishers have to pay a license costing DKr. 275 per year and you are not allowed to fish before the age of 12. The license is personal and non-transferable. Legal reasons for angling without a license are: 1) persons younger than 18 years of age, 2) persons older than 65 years, 3) Private landowners fishing in their own waters, 4) exclusively put & take fishers.

7.2.1.3.1 Passive gear fishing

This fishery is also referred to as "household", "non-angling", "hobby" or "amateur" fishing and is a fishery carried out with passive gear, such as fykenets and gillnets. For the last 10 years there has on average been 33,700 licenses issued per year (Table 1). The average age of fishermen that has issued a license for this particular type of fishery is 54.2 years and males dominate (Fig. 1). This category of fishing resembles commercial fishery in the sense that the gear used are similar, but differs by the fact that it is leisure based and it is illegal to sell the catch. There are restrictions to the effort as it is only allowed to fish with a maximum of either 3 gillnets plus 3 fykenets or a total of 6 fykenets. The maximum length of gillnets are 45 m and they are not allowed to be closer than a 100 m from the coastline; a restriction mainly set up to

protect sea trout (*Salmo trutta*). Further there are several closed areas such as the area around river mouths. The gear are typically deployed from a small boat with a very limited activity radius, which in practice makes this type of fishing more or less stationary. The main target species are eel caught in fykenets and flounder (*Pleuronectes flesus*) caught in gillnets (Sparrevohn *et al.*, 2009). 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 also practiced but eel-trawl is now prohibited and long-line catches are limited. Cod are caught both with gillnets and fykenets in the passive gear recreational fishery. The catches are mainly restricted to certain areas (Sparrevohn *et al.*, 2009).

7.2.1.3.2 Angling

Angling in saltwater are carried out in waders along the coastline, from man-made structures such as piers, bridges or with boats as a platform. It is a very popular outdoor leisure activity practiced by 73% of all fishermen that has fished within the last 12 months (Bohn and Roth, 1997). The average age of angling fishermen with a license is 46.1 year, however people younger than 18 and older than 65 years do not need a license (Fig. 1), thus the true average age of angling fishermen is most probably higher. For the last 10 years there has on average been issued 155,600 annually license (Table 1). Estimated weekly license issued for 2009 are 17.800 and 22.200 for daily license. There are no restrictions, e.g. bag-limit, to the angling fishery in saltwater besides those that apply to fishing in general, i.e. closed areas, minimum size etc. The only exception is that trolling closer than 100 m from the coastline is prohibited. The main target species in saltwater is seatrout, but garfish (*Belone belone*) and cod are also regularly caught as well as salmon and various flatfish species (Rasmussen and Geertz-Hansen, 2001).

In saltwater Baltic salmon are almost exclusively caught by angling from medium sized (15-25 ft) boats around the island of Bornholm, during the spring/early summer and October/November. Down rigging is the dominant fishing strategy.

Cod are by anglers caught in the Sound, the North Sea, Kattegat, inner Danish waters and western/eastern Baltic. Platforms used for the fishery range from beach fishery with rod and reel using casting lures to deepwater jigging from chartered boats many miles offshore. There is also a substantial fishery on wrecks. An angling fishery on board private boats is also very popular and probably accounts for a substantial part of the total cod catches, at least locally.

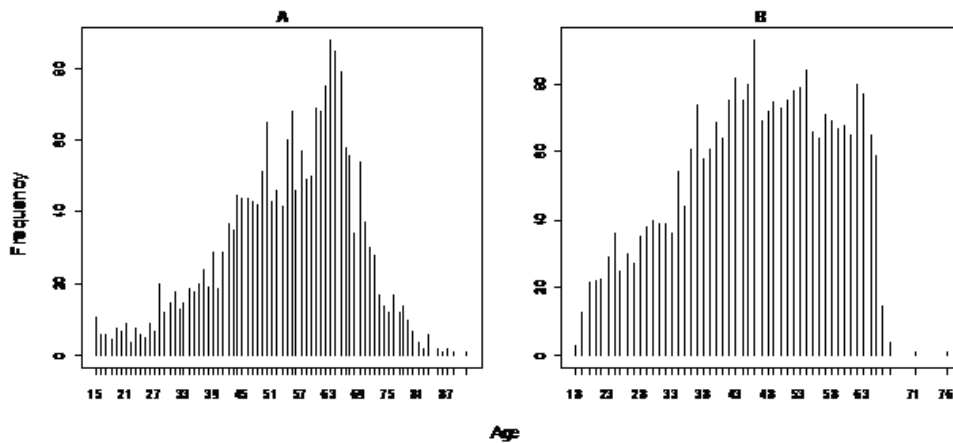


Fig. 1. Age frequency of fishermen holding a license to carry out passive gear (A) fishing or angling (B).

7.2.2 Methods

Two questionnaires, the “Omnibus” and the “License”, were developed by Statistic Denmark and DTU Aqua for a combined telephone and internet survey. The interviews were conducted by Statistic Denmark who holds the expertise on this form of investigations. The questionnaire was tested on a subgroup of fishermen with license, to optimize the process and change questions that potentially could lead to bias. DTU Aqua was responsible for the following data processing.

7.2.2.1 The Omnibus interview

In 2009 three telephone interview rounds were conducted in October, November and December. The Omnibus is a regular monthly interview conducted by Statistic Denmark to gather a variety of information, such as political views etc. The recreational fishery questions were only a minor part of this interview. Respondents were selected by telephoning a random non-mobile number. The interview was conducted with that person within the household who last had a birthday. Only citizens between 16 and 74 were included. A total of 958, 957 and 968 were interviewed and answered in the three months. The first objective was: 1) to estimate the population size of anglers and passive gear fishermen and 2) to estimate the population size that fished illegally – which in this rapport only covers people fishing without a valid license.

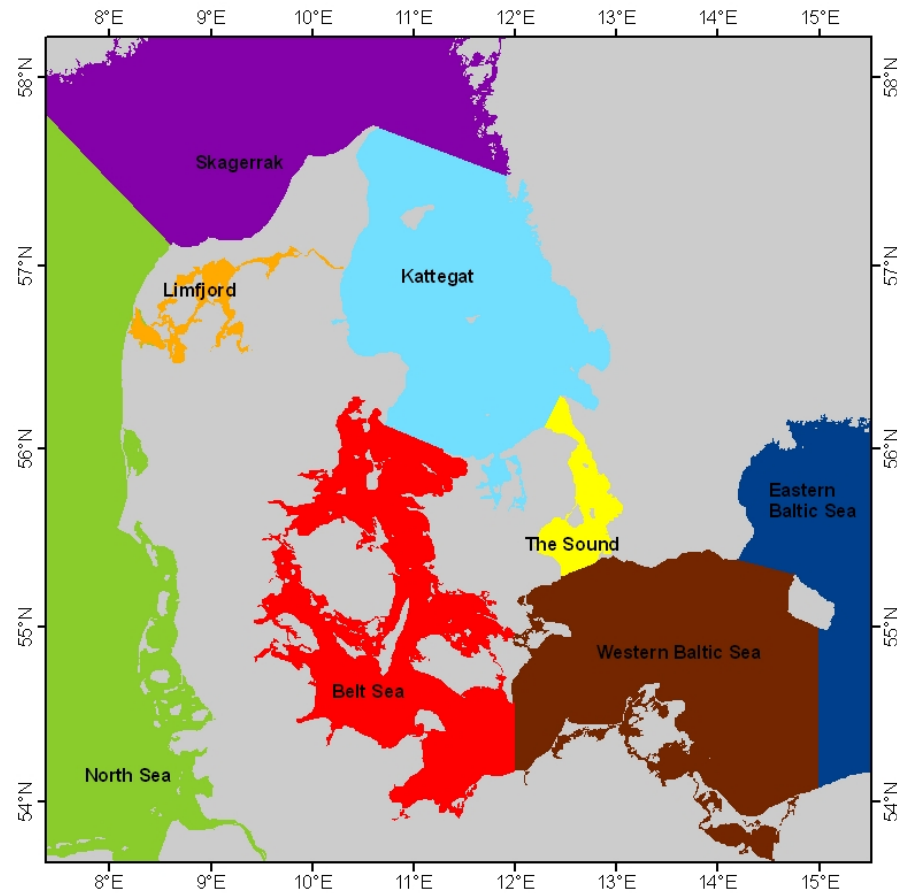


Fig. 2. Area definition used in the interview survey. Green: North Sea, purple: Skagerrak, light blue: Kattegat, orange: Limfjord, yellow: the Sound, red: Belt Sea, brown: western Baltic Sea and blue; eastern Baltic Sea.

Therefore fishermen not holding a license were asked for their reason. There are several legal exemptions from holding the compensatory license for angling fishing (, see section 1.3). Passive gear fishers do not have any legal excuse for not holding a license when fishing in saltwater.

Furthermore respondents were asked for information on effort in fishing days to be able to estimate if people fishing without a license are doing it with same effort as people with a license. These questions would provide the needed information for calculating the fraction of illegal fishermen and the effort they fished with. Respondents were also asked about their fishing pattern outside Denmark, such as countries they had visited for fishing.

7.2.2.2 The License interview

The second interview phase was based on people that had a valid annual license at the time of the interview. It was possible to contact persons holding a license directly as names and social security numbers are available. A detailed questionnaire was answered either on web or in a telephone interview. This interview provided detailed information on the fishing carried out and the catches taken. The respondent was ex-

explicitly told only to report those catches that were actually taken, which means that the results in the present rapport does not include discards, undersized fish, or fish that for other reasons were released.

To estimate catches by managing areas the respondents were asked which areas and quarters they had been fishing. The operational areas in this investigation were; North Sea, Skagerrak, Kattegat, the Sound, Belt Sea, Limfjord and Eastern and Western Baltic Sea (Fig. 2).

7.2.2.3 Estimating catches in Danish recreational fishing

The total catch of cod and eel in the Danish recreational fishery can be calculated from the information gathered in interview phase 2 where the respondents provide information on their catches. These values can then be extrapolated to the entire population of fishermen (license holders and illegal fishers). Illegal fishermen are assumed to show a different effort pattern and therefore it is corrected with the estimated effort fished by illegal fishermen found in interview phase 1. The following equation was used,

$$T_{aq} = \left(\frac{C_{aq}}{r} \cdot p_y + \frac{C_{aq}}{r} \cdot p_w \cdot \frac{E_w}{E_y} + \frac{C_{aq}}{r} \cdot p_d \cdot \frac{E_d}{E_y} \right) + \left(\frac{C_{aq}}{r} \cdot i \cdot (p_y + p_w + p_d) \cdot \frac{E_i}{E_y} \right)$$

where (T_{aq}) is the total catch of either cod or eel per quarter (q) and area (a). T_{aq} is the sum of the catches in the legal fishing (first bracket) and the catches in the illegal fishery (left bracket). C is the total catch reported from the interview, p is the number of license issued (in 2009 around 34.000 were estimated to fish with passive gear and 156.000 as anglers with annual license (y), 17,800 with a weekly license (w) and 22,200 with a daily (d) license, Table 1), r is the number of respondents participated in the license interviews (1585 in the passive gear interview and 1929 in the angling interview). E_i is the average fishing effort of the population that fish illegally, E is the average effort of the population that hold a license and i is the fraction that fish illegally. The estimates can be found in Table 7. For those holding a day license the effort was set to 1 and for those holding a weekly license the effort was set to 3 days.

In the license interview the respondent had the opportunity to report their catches in either kilo or numbers, hence it was necessary to find an average weight in order to change the catches reported in numbers to kilo. The average size of eel and cod above minimum landing size caught in the passive fishery was found from Sparrevojn *et al.* (2009). Eel larger than the minimum landing size caught in fykenets was set to 47.1 cm corresponding to a weight 188 gram. Cod caught in fykenets above the minimum size was set to 39.0 cm corresponding to 540 gram and cod caught in gillnets was set to 47.6 cm, which corresponds to 975 gram.

In the angling fishery the average weight of cod is more imprecise; however we have used a value of 1.5 kg per fish. This number was derived by dividing the catch of cod reported in kg with the catch of cod reported in numbers, resulting in an average weight of 1.6 kg for those cod caught by anglers with an angler license. For those anglers that fished with a passive gear license the average cod weight was found to be 1.7 kg. Since both estimates are very questionable a rounded value of 1.5 kg was chosen.

7.2.3 Results

7.2.3.1 Omnibus interview

During three interview rounds in October, November and December a total of 2883 persons were interviewed. When asked whether they had fished within the last twelve months, respectively 13, 16 and 14 % confirmed. Approximately 10 % of these were fishing with passive gear, 90 % were anglers and 0.1% fishing commercially.

7.2.3.1.1 Illegal fishing

The margin between respondents that claimed to have a valid license and the actual number of license issued was very small. In 2009 the number of annual license issued was 156,000; weekly license was 17,800 and daily 22,200, summing to a total of 196,000, which is close to the estimated 201,000-239,000 persons that claimed to have had a valid license. For both groups of recreational fishermen approximately half had a license and half did not. Excluding the group that did not hold a license for valid reasons, 23% of all anglers were estimated to fish illegally (Table 2). For the passive gear fishermen, the number of people not holding a license is larger and on average for the three months of our omnibus investigation 28% fished illegally. However, this level fluctuates highly between months and since fewer persons are available in this group, interpretations from this data should be dealt with caution. Further there appeared to be a bias in separating between anglers and passive gear fishery in the first two months since some of the passive gear fishers gave meaningless answers to why they did not hold a license. For example, several respondents answered that they only fished in put & take, an answer that does not make any sense, since a fishery with gillnets or fykenets in put & take lakes does not exist. The problem was recognized and it was emphasized that respondents should have a clear understanding of the difference between anglers and passive gear fishery. In this investigation we have used the average for the three months to up-scale the illegal fishery. However, we have planned to continue the Omnibus survey in 2010 to confirm the level of illegal fishery for both anglers and fishing with passive gear.

Table 2. Table 2A shows the numbers of respondents in the Omnibus in October-December 2009. In table 2B the numbers were scaled up to actual population size of person between 16 and 74.

A			Do you fish?	Do you have a license?				
Respondents			Yes	Yes	No	No-legal	No-illegal	% illegal
Dec	968	Angling	116	58	58	30	28	24.1
		Passive gear	9	7	2	0	2	22.2
Nov	957	Angling	132	69	63	33	30	22.7
		Passive gear	17	8	9	2	7	41.2
Oct	958	Angling	119	59	60	34	26	21.8
		Passive gear	14	8	6	3	3	21.4
B			Do you fish?	Do you have a license?				
Scaled to total population			Yes	Yes	No	No-legal	No-illegal	% illegal
Dec	3,356,206	Angling	402,190	201,095	201,095	104,015	97,080	24.1
		Passive gear	31,204	24,270	6,934	0	6,934	22.2
Nov	3,318,067	Angling	457,664	239,234	218,431	114,416	104,015	22.7
		Passive gear	58,942	27,737	31,204	6,934	24,270	41.2
Oct	3,321,534	Angling	412,591	204,562	208,029	117,883	90,146	21.8
		Passive gear	48,540	27,737	20,803	10,401	10,401	21.4

7.2.3.1.2 Effort

It was expected that that effort between fishermen holding a license and fishermen without was different. This was investigated in the two latest omnibus where the respondents were asked about their fishing pattern and effort. Results indicate that for anglers fishing illegally, the effort was approximately 1/3 compared to anglers fishing with license. For passive gear fishers the effort for people without a license was approximately half compared to fishermen fishing with a license (Table 3).

Table 3. The average days fished for anglers and non-anglers that fished with either a license or illegally.

	Angling		Passive gear	
	With license	Illegally	With license	Illegally
November	8.5	2.2	24.0	10.7
December	9.9	4.2	25.4	16.5

7.2.3.1.3 Fishing in other countries

In the omnibus interview the respondents were asked about fishing habits in other countries. The percentage that fished in other countries was 2.8, 2.1 and 3.3 % of all interviewed. Sweden and Norway were by far the most important countries visited (Table 4). On average approximately 60 % reported one trip to other countries but some reported as many as 12.

Table 4: Respondents that fished in other countries. Total numbers of respondents are: 958, 957 and 968 in the October, November and December omnibus interview round, respectively.

	October	November	December
Sweden	11	7	16
Norway	9	3	6
Faroe Island	3	2	0
Greenland	1	0	2
Rest of Europe	4	3	7
Rest of the world	3	6	5
Respondents that fished outside of Denmark	28	20	32

7.2.3.2 License interview

For both anglers and passive gear fishing, the fraction of respondents was higher than 70 % and with a higher number that responded via the internet than over telephone (Table 5).

Table 5. The numbers and percentage of respondents that replied via internet and telephone survey.

	Passive gear		Anglers	
	Numbers	%	Numbers	%
Respondent:	1,585	75.08	1,929	70.81
via internet	959	45.43	1,129	41.45
via telephone	626	29.65	800	29.37

7.2.3.2.1 Passive gear fishers

A total of 2,111 persons were contacted and 1,585 volunteered to participate in the interview. 959 answered via the internet and 625 via the telephone survey (Table 5). Only 61% of the passive gear fishers answered that they had actually been fishing within the last 12 months. The respondents were asked to give their catches and fishing pattern on a three month interval with the last three months August, September and October first.

The passive gear fishermen participating in the survey were split into 4 groups; 1) catching cod with gillnets 2) catching cod with fykenets or 3) catching eel with fykenets, 4) angling cod on their passive gear license.

A total of 167 fished exclusively with fykenets, 500 fished exclusively with gillnets and 281 fished with both types of gear. Out of the 1585 that had a valid license eels and cod had been caught and kept in fykenets by 23 % and 6 %, respectively. Indicating that fykenet is targeting eels and cod is only caught as a by-catch. Cod was caught and kept by 12% of those fishing with gillnets.

After completing questions about passive gear fishing and catches, the respondent was asked whether he/she also fished with rod, i.e. angled. To that 62% confirmed. This high number led us to analyze the fishery of this group separately from the rest of the anglers. A Fishery referred to as "angling with a license for passive gear".

7.2.3.2.2 Anglers

Of the 1,929 anglers that participated in the interview only 73 % had actually been fishing within the last 12 months, although they had a valid license. Cod was caught and kept by 16%. The majority, 87%, that caught cod did it from boats, 63% from tour boats and the rest from some kind of smaller boat.

Close to 15% of anglers fished in more than one area and the main part of those that operated in more areas did it from tour boats (73%).

To estimate the total catch in kg a conversion key between numbers and weight were used, 1/3 of all respondents answered in kg and 2/3 answered in numbers.

7.2.3.3 Calculating cod and eel catches in the Danish recreational fishery

Table 6. All values used in equation 1 except for the average catches which can be found in table 7 or annex 1A to 1E.

	License (p)	Respondent (r)	Effort illegal (E _i)	Effort license (E _p)	Pct. illegal (i)
Passive gear	34,000	1,585	13.6	24.7	28.3
Angling	156,000	1,929	3.2	9.2	22.9

7.2.3.3.1 Passive gear –cod in gillnets

Of the persons interviewed 12% (184 persons) had caught cod in gillnet fishing within the last year. A total of 8.6 tons cod were caught by these fishermen. Up-scaling to total amount of cod caught in the legal and illegal gillnet fishery this corresponds to 212 t in the recreational gillnet fishing. The largest part of the cod was captured in the period February to April, were 38 % of the total catches was caught. The period with the lowest catches were in the summer (May-July) were only 8% of the total cod catches in gillnets were taken (Table 7).

Table 7. Cod and eel catches reported from recreational fishing in this study.

Month	Cod in gillnets		Cod in fykenet		Eel in fykenets		Cod angling (angling license)		Cod angling (passive gear license)	
	kg	%	Kg	%	kg	%	kg	%	kg	%
Aug-Oct	2,285	27	631	81	3,065	79	1,901	26	3,168	35
May-July	712	8	17	2	300	8	1,570	22	2,453	27
Feb- April	3,263	38	74	10	395	10	1,890	26	2,117	23
Nov-Jan	2,299	27	59	7	132	3	1,898	26	1,333	15

7.2.3.3.2 Passive gear – cod in fykenets

Of the persons interviewed 6% (96 persons) had caught cod in their fykenets within the last year. Less than 1 ton (777kg) cod were caught by these fishermen. Up-scaling to total amount of cod caught in the legal fykenet fishery this corresponds to 17 t and 19 t if the illegal fishery is included. The main part of the cod catches (81%) were taken the period August to October. As was the case in the gillnet fishery the period with lowest catches were in May-July.

7.2.3.3.3 Passive gear – eel in fykenets

Of the persons interviewed 23% (362 persons) had caught eel fishing with fykenets within the last year. Just less than 4 t eels were caught by these fishermen. Up-scaling to total amount of eel caught in the legal fykenet fishery this correspond to 86 t and 99 tons if up-scaled to included the illegal fishery as well.

7.2.3.3.4 Angling with a passive gear license – cod

Fishermen holding a license for passive gear have automatically a license to fish with rod as well. A separate interview was therefore conducted on this group as we expected the fishing pattern in this group to differ from that in the general group of anglers. In this group a total of 244 persons caught cod within the last year and the areas they fished in differed compared to the group only fishing with rod. Skagerrak and the North Sea were the most important areas where 50% of all persons had fished, in the Sound it was 10%.

In our investigation this group fished close to 9 tons cod, corresponding to 225 t cod when up-scaling to include all with a license and the illegal fishery as well (annex 1E). In the period from August to October 35% was caught and only 15% during the period from November to January.

Table 8. Relative distribution of fishing areas where anglers targeting cod has fished.

Area	Aug-Oct	Nov-Jan	Feb-April	May-July	Total nr. anglers
West Baltic	0.27	0.23	0.19	0.31	26
Skagerrak	0.33	0.09	0.29	0.29	66
East Baltic	0.23	0.15	0.19	0.42	26
The Sound	0.23	0.26	0.29	0.23	253
North Sea	0.30	0.15	0.27	0.28	60
Limfjord	0.33	0.00	0.00	0.67	3
Kattegat	0.44	0.15	0.10	0.31	39
Belt Sea	0.31	0.26	0.20	0.23	124

7.2.3.3.5 Anglers – cod

From our data close to 600 persons targeting cod were registered and the main part of those fished in the Sound (42%), followed by the Belt Sea (21%) and Skagerrak (11%) (Fig. 3).

In the four different periods we investigated the allocation of persons that had fished within a period was equally distributed with a small overweight in the period Aug-Oct (28%) and lesser in the period Nov-Jan (21%). Although there are some differences between periods and areas the data material is rather limited for some areas (Table 8). The respondents in our investigation caught close to 7 tons cod on rod corresponding to 634 t cod when up-scaled to include all with an annual license and the illegal fishery as well (annex 1D). Daily and weekly license holders caught 15.7 t and 27.2 t, respectively (Annex 1F).

The fishery was fairly equally distributed in time. The Sound was the most important area with 31% of the total catches followed by the Belt Sea (21%) and the North Sea (18%).

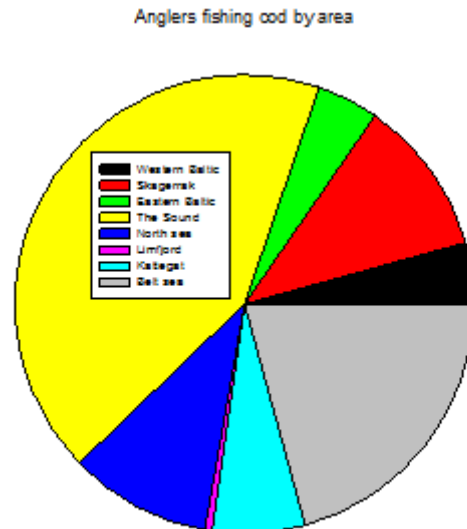


Fig. 3. Relative distribution of fishing areas where anglers targeting cod has fished.

7.2.4 Discussion

In present study the total Danish recreational eel and cod catches was found by; 1) estimating the catches from a subsample of persons that has issued a license within the last 12 month and 2) estimating the amount of illegal fishing from a interview round targeting the entire Danish population between the age of 16 and 74. It was found that the numbers of angler between 16 and 74 years which had practiced their hobby within the last 12 month was between 450,000 and 402,000. This corresponds to between 12 and 14 % which is very close to 12.5 % which was found in 1997 (Bohn and Roth, 1997). The number of anglers that claimed to have issued a license was between 240,000 and 201,000 which are very close to the 196,000 license that are issued. According to the interview survey between 24,000 and 28,000 had a license for passive gear fishing which is lower than the actual licenses sold, which is 34,000. This means that the numbers are somewhat overestimated for anglers but underestimated for passive gear fishers.

7.2.4.1 Eel

In recreational fishing eels are mostly caught in fykenets in saltwater, even though some freshwater fishing for eel exists. The intensity of the freshwater fishing is unknown since it can be carried out legally for all landowners along lakes and rivers. Limitations are that fykenets has to be 100 m apart, the gear must not cover more the one third of the river and fishing is only allowed from the 1st of August to the 15th of October. In the commercial fishery the catches from lakes are very low compared to those in saltwater. Of the total catches reported from 2005 to 2009 only between 2 and 3 % was from lakes (www.fd.dk).

Since fykenets set in saltwater are rather sensitive to wave and current action this fishing is mainly carried out in the inner Danish waters where wind and wave protected Fjords, Belts and Sounds are located. This is reflected in the very low catches of eel in the North Sea, Skagerrak and Eastern Baltic. The Belts Sea was the area with the highest catches followed by Kattegat and the Limfjord. Eel were not caught equally

throughout the season. The highest catches were reported in the period from August to October where the high water temperature prompts a high activity level and hence a higher catchability. The majority of effort is in this period as well. From 2009 the fishery with fykenets for eels is closed from the 10th of May to the 31st of July (Anon 2008). This is reflected in low catches during the period from May to July which has traditionally been months with a high CPUE of eel (Pedersen *et al.*, 2005). The total catch, including fishery without license was in our investigation estimated to be 96.5 t. In 1997 the total catch of eel in the legal recreational fishery was estimated to be 138 t, which at that time corresponded to 20 % of the total catch (Anon, 2008). That the recreational catches were estimated lower in 2009 was expected since 1) the eel stock has continued to decrease, 2) the eel recovery plan has been implemented with the objective to decrease the total catch in the recreational fishery with 50 %. The commercial catches were in 2008 448 t and if this number remains the same in 2009 the recreational fishing caught an equivalent of 18 % of the total Danish eel catches.

7.2.4.2 Cod

We estimated that nearly 1,150 t cod are caught in recreational fishing. From these, approximately 230 t cod were caught in the passive fishery; 212 t with gillnets and 20 t with fykenets. These catches cover cod caught by Danes within the Swedish zone. However this is probably only the case in the Sound and Kattegat. The main part (~80%) of cod was taken by anglers (677 t by angler license holders and 225 t by passive gear license holders). In the gillnet fishery the cod were caught in all areas, but the highest total catch was in the Skagerrak area where almost 50 % of the cod were taken.

Anecdotal information has highlighted the Sound as an important cod fishing area which was reflected in total catches of 211 t, 23.6 t and 21 t in the angling with an angling license, angling with a passive gear license and the passive gear fishery, respectively. Commercial catches in the Sound has the last 5 years fluctuated around 1,900 t (ICES 2009), hence recreational fishing caught 12 % of the total catch. However, the commercial catches are mainly from a small area north of Helsingør called "Kilen" where it has been legal to trawl. The rest of the Sound has had a trawling ban since 1932. Since 1st of January 2009 all fishing, commercial as well as recreational, was banned in February and March in an area covering the northern part of the Sound (bilateral agreement between Denmark and Sweden to protect the Kattegat cod). Therefore it can be expected that the commercial cod fishery in the Sound will be significantly decreased in 2009 compared to earlier and preliminary numbers from the Danish Fishery ministry indicate a reduction to 550 t in the Sound in 2009. If this number is true, then recreational fishing could account for 32% of the total Danish Sound cod catches and angling alone for 29 %. The angling catches might be even higher since we converted number of cod into weight assuming an average weight of 1.5 kg in the entire country. The average weight in the Sound is likely higher at least during the winter. The fishery during this season is very popular due to the very high average weight of cod captured.

In the Western and Eastern Baltic Danish commercial fishing for cod accounted for 8,600 t and 7,400 t in 2008, respectively (ICES 2009). In this light recreational fishing was minor and only accounted for an equivalent of 1.2 % and <1 % of the total cod catches, respectively. Anecdotal information has highlighted a large fraction of German anglers fishing in the Danish part of the Western Baltic. However, it has not been possible to quantify the amount fished by foreigners as it is possible in Denmark to

purchase a license for a day or a week without providing any personal information. Therefore, it has not been possible to contact this group of fishermen.

In Kattegat, 35 t cod was caught in recreational fishing; 32 t was from angling and 3 t from gillnet and fykenet fishery. However, due to the present very low commercial quota (359 t) and landings (296 t) in this area the recreational catches are equivalent to 11% of the total official Danish commercial cod catch in this area.

In the North Sea and Skagerrak the commercial Danish catches were by ICES estimated to be 3,800 t and 2,500 t, respectively in 2008 (ICES 2009b). The catches in the recreational fishing from these areas was estimated to be 177 t and 255 t respectively corresponding to an equivalent of 4.4 % and 9.3 % of the total cod catches. Overall, our investigations indicate that 4.8% of the total Danish cod catches was taken in recreational fishing.

7.2.4.3 Sources of error

As illustrated for the gillnet cod catches one weakness in this type of survey is how to treat very high reports. A single respondent reported catches of cod as high as 1000, 0, 1500 and 600 kg for the periods Aug-Oct, May-July, Feb- April and Nov-Jan, respectively. If this single respondent was excluded from the results the total catches of cod in gillnet decreases from 225 t to 135 t. This specific respondent also reported the highest number (400) cod caught within one quarter for any respondent that fished as an angler.

The interview presented in this report targets Danish citizens, which means that the proportion of fish caught by tourists is unknown. This is a specific problem in the angling fishery for cod where anecdotic information states a quite large catch in some areas, especially by German tourists. The Belt Sea area is expected to be the area where the highest numbers of cod are caught by German tourists. This is due to a combination of a rather high number of summerhouses for rent during the summer season; the possibility to rent smaller fishing-boats and a generally calm sea. One could expect the same pattern along the Western Coast of Denmark where lots of summerhouses are for rent during the summer, but the exposed nature of this shoreline makes it impossible to sail with smaller boats most of the time. The Sound and The North Sea/Skagerrak areas are probably also witnessing some cod catches from fishing tourist that travel to Denmark and fish from chartered boats either during the winter in the Sound area or in the North Sea/Skagerrak area.

7.2.4.4 Fishing without license

The inclusion of illegal fishing in was significant. Approximately 20-25 % reported that they fished illegally, though with a lower effort. One exception was in the November omnibus survey where 41 % of the passive gear fishers reported they fished without a license. However, there seemed - at least during the first interview round - to be a problem for respondents to differentiate between being fishing with passive gear ("fritidsfisker" in Danish) and angling ("lystfisker" in Danish). Indication of some misunderstanding of the classification during the two first interview rounds in October and November was that respectively 3 and 2 respondents claimed to not need a license. As arguments for that they used reasons that do not make sense when fishing with a passive gear. E.g. claiming to only fish in put & take lakes. In December, where the confusion had been resolved none of the respondents claimed not to need a license. Therefore, this single high percentage of illegal fishery (41%) should be treated with caution. Another aspect when asking people whether they have

fished illegally is the risk of under estimating the numbers since the respondents might be tempted to claim to hold a license when they actually do not. Furthermore the licenses are issued for a one year period; hence many might choose to renew their license the first time they go fishing after the expiration date and not at the exact expiration date. Even though some legal reasons for fishing without a license exist, illegal fishery without license takes place. In Table 1 the yearly number of license purchased from 1999 and until 2009 are shown.

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Annex 1A. Cod catches reported by respondents using gillnet. Based on these catches and the values in table 5 the total catch, including illegal fishery, of cod in the Danish recreational gillnet fishery are calculated.

Cod caught in gillnets	Reported catch from respondents (kg)									Estimated total Danish catch (t)								
	Central North Sea	Skagerrak	Limfjorden	Kattegat	The Sound	Belt Sea	Western Baltic	Eastern Baltic	Total	Central North Sea	Skagerrak	Limfjorden	Kattegat	The Sound	Belt Sea	Western Baltic	Eastern Baltic	Total
Aug-Oct	15.7	1151	29.6	18.7	130	343	506	91.2	2285	0.4	28.5	0.7	0.5	3.2	8.5	12.5	2.3	56.7
May-July	92.9	62.3	10	4.88	106	161	104	171	712	2.3	1.5	0.2	0.1	2.6	4.0	2.6	4.2	17.7
Feb- Apr	134	1701	60	0	263	474	528	104	3263	3.3	42.2	1.5	0.0	6.5	11.7	13.1	2.6	80.9
Nov-Jan	30	841	0	20.9	243	795	329	39.4	2299	0.7	20.8	0.0	0.5	6.0	19.7	8.2	1.0	57.0
Total	272	3756	99.6	44.5	742	1773	1466	405	8559	6.8	93.1	2.5	1.1	18.4	44.0	36.4	10.0	212.2

Annex 1B. Cod catches reported by respondents using fykenets. Based on these catches and the values in table 5 the total catch, including illegal fishery, of cod in the Danish recreational fykenet fishery are calculated.

Cod caught in fykenets	Reported catch from respondents (kg)									Estimated total Danish catch (t)								
	Central North Sea	Skagerrak	Limfjorden	Kattegat	The Sound	Belt Sea	Western Baltic	Eastern Baltic	Total	Central North Sea	Skagerrak	Limfjorden	Kattegat	The Sound	Belt Sea	Western Baltic	Eastern Baltic	Total
Aug-Oct	2.7	0	6.7	81	104	415	21	0	631	0.07	0.00	0.17	2.01	2.59	10.30	0.53	0.00	15.66
May-July	0	0	0	0.5	0	16	0	0	17	0.00	0.00	0.00	0.01	0.00	0.40	0.00	0.00	0.41
Feb- Apr	0	0	0	0	0	43	31	0	74	0.00	0.00	0.00	0.00	0.00	1.08	0.77	0.00	1.85
Nov-Jan	0	0	0	0	0	57	1.6	0	59	0.00	0.00	0.00	0.00	0.00	1.41	0.04	0.00	1.45
Total	2.7	0	6.7	81.7	104	532	53.8	0	781	0.07	0.00	0.17	2.03	2.59	13.18	1.33	0.00	19.36

Annex 1C. Eel catches reported by respondents using fykenets. Based on these catches and the values in table 5 the total catch, including illegal fishery, of eel in the Danish recreational fykenet fishery are calculated.

Eel caught in fykenets	Reported catch from respondents (kg)									Estimated total Danish catch (t)								
	Central North Sea	Skagerrak	Limfjorden	Kattegat	The Sound	Belt Sea	Western Baltic	Eastern Baltic	Total	Central North Sea	Skagerrak	Limfjorden	Kattegat	The Sound	Belt Sea	Western Baltic	Eastern Baltic	Total
Aug-Oct	57	25	350	894	209	1227	273	30	3065	1.4	0.6	8.7	22.2	5.2	30.4	6.8	0.7	76.0
May-July	5.8	1	78	46	18	118	25	7	300	0.1	0.0	1.9	1.2	0.5	2.9	0.6	0.2	7.4
Feb- Apr	0	0	26	60	0	269	39	0	395	0.0	0.0	0.7	1.5	0.0	6.7	1.0	0.0	9.8
Nov-Jan	0.8	0.8	11	15	2.3	86.8	16	0.8	132	0.0	0.0	0.3	0.4	0.1	2.2	0.4	0.0	3.3
Total	63.3	26.9	466	1016	229	1701	353	37.8	3893	1.6	0.7	11.6	25.2	5.7	42.2	8.7	0.9	96.5

Annex 1D; Cod catches reported by respondents that holds an annual angler license. Based on these catches and the values in table 5 the total catch, including illegal fishery, of cod caught by persons that holds an annual angling license are calculated

Cod caught by anglers holding a angler license	Reported catch from respondents (kg)									Estimated total Danish catch (t)								
	Central North Sea	Skagerrak	Limfjorden	Kattegat	The Sound	Belt Sea	Western Baltic	Eastern Baltic	Total	Central North Sea	Skagerrak	Limfjorden	Kattegat	The Sound	Belt Sea	Western Baltic	Eastern Baltic	Total
Aug-Oct	439	270	2	106	405	373.5	144	163	1901	38.3	23.6	0.2	9.3	35.3	32.6	12.5	14.2	166.0
May-July	300	144	3	38	597	395.5	71.5	22	1570	26.2	12.5	0.3	3.3	52.1	34.5	6.2	1.9	137.1
Feb- Apr	238	330	0	78	614	413.6	126	91	1890	20.8	28.8	0.0	6.8	53.6	36.1	11.0	7.9	165.0
Nov-Jan	324	323	4	70.3	645	329.2	109	92.3	1898	28.3	28.2	0.3	6.1	56.4	28.7	9.6	8.1	165.7
Total	1301	1066	9	292	2261	1512	450	368	7259	113.6	93.1	0.8	25.5	197.4	132.0	39.3	32.1	634

Annex 1E; Reported catches of cod by passive gear licence holders that also fish as anglers. Based on these catches and the values in table 5 the total catch, including illegal fishery, of cod caught by persons that holds a passive gear license and fish as angler are calculated.

Reported Catch from respondents										Estimated total Danish catch (t)								
Cod caught by anglers holding a passive gear license	Central North Sea	Skagerrak	Limfjorden	Kattegat	The Sound	Belt Sea	Western Baltic	Eastern Baltic	Total	Central North Sea	Skagerrak	Limfjorden	Kattegat	The Sound	Belt Sea	Western Baltic	Eastern Baltic	Total
	Aug-Oct	1180	640	0	34.5	356	373.5	373	212	3168	29.24	15.87	0.00	0.86	8.81	9.26	9.25	5.26
May-July	397	645	0	107	174	397	391	343	2453	9.84	15.99	0.00	2.65	4.30	9.84	9.69	8.49	60.82
Feb- Apr	199	870	0	18	239	337.5	194	260	2117	4.93	21.56	0.00	0.45	5.93	8.37	4.80	6.45	52.48
Nov-Jan	183	374	0	27	184	395.5	50.5	120	1333	4.54	9.27	0.00	0.67	4.55	9.81	1.25	2.96	33.05
Total	1959	2529	0	187	952	1504	1008	934	9071	48.56	62.69	0.00	4.62	23.59	37.28	24.99	23.16	225

Annex 1F; Estimated cod catches of anglers holding a daily or weekly license. Illegal fishing is included.

Cod caught by anglers holding a weekly or daily license	Estimated total catch by daily license holders (t)									Estimated total catch by weekly license holders (t)								
	Central North Sea	Skagerrak	Limfjorden	Kattegat	The Sound	Belt Sea	Western Baltic	Eastern Baltic	Total	Central North Sea	Skagerrak	Limfjorden	Kattegat	The Sound	Belt Sea	Western Baltic	Eastern Baltic	Total
Aug-Oct	1.0	0.6	0	0.2	0.9	0.8	0.3	0.4	4.1	1.6	1.0	0	0.4	1.5	1.4	0.5	0.6	7.1
May-July	0.6	0.3	0	0.1	1.3	0.9	0.2	0	3.4	1.1	0.5	0	0.1	2.2	1.5	0.3	0.1	5.9
Feb- Apr	0.5	0.7	0	0.2	1.3	0.9	0.3	0.2	4.1	0.9	1.2	0	0.3	2.3	1.5	0.5	0.3	7.1
Nov-Jan	0.7	0.7	0	0.2	1.4	0.7	0.2	0.2	4.1	1.2	1.2	0	0.3	2.4	1.2	0.4	0.3	7.1
Total	2.8	2.3	0	0.6	4.9	3.3	1.0	0.8	15.7	4.9	4.0	0	1.1	8.5	5.7	1.7	1.4	27.2

7.3 Finland

7.3.1 General overview of national recreational fisheries

In 2008, there were about 1.8 (± 0.1) million recreational fishermen in about one million households in Finland. The proportion of recreational fishermen was 34 (± 2) per cent.

The total catch amounted to 33 (± 4) million kg, of which 76 per cent was taken in inland waters. The marine recreational catch in 2008 was about 7.8 (± 2.4) mill kg.

Perch and pike made up over half of the catch. The salmon catch in the sea area was estimated to be 54 (± 26) and the eel catch 13 (± 11) tons. The cod catch in 2008 was only one ton. The total commercial marine catch was 111.6 million kg in 2008. Excluding the Baltic herring and sprat catch the proportion of the marine recreational catch of the total marine catch was 63 percent.

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 70 (± 3) per cent of fishermen. The spinning rod was used by 41 (± 3) per cent of fishermen, the jig by 29 (± 3), the gill net by 23 (± 2) and the trolling gear by 23 (± 3) per cent of 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 division to the subareas is 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

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 they 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 do not 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

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Data collection in 2008

The data on recreational fishing was collected by a postal survey using a sample drawn from the population register maintained by the Finnish Population Register Centre. The whole recreational catch was surveyed, but a special attention was drawn to marine catches of salmon, cod and eel for instance in terms of sample allocation.

Frame population and statistical unit

The Finnish population register was the frame population, because there was no covering and usable register on the recreational fishermen. On the other hand, one could not predestinate, whether the contacted fishermen had been fishing at the sea, in inland waters or both.

The statistical unit in the recreational fishing statistics was the household. The term recreational fishing included all the fishing carried out by Finnish households with the exception of professional fishermen and their households.

Sampling design

The sample comprised 6000 household-dwelling units. One household-dwelling unit consists of the persons living permanently in the same dwelling and comprises one or more households. The sampling was targeted at persons aged 18-74 years.

The sample design was stratified sampling. The strata were formed taking into account the location of the person's municipality of residence, the type of municipality and the location of the municipality in relation to the sea. There were six strata in all.

The questionnaire

The questionnaire had four pages, and the focus of the questions was on the age and gender of the persons in the households and the persons participating in fishing, the importance of fishing as a hobby, fishing activity by fishing area, and catch sizes by species.

The survey was conducted at the beginning of 2009. Contact was made three times.

Post-sampling for non-respondents

For those who did not respond to the postal questionnaire, post-sampling was conducted as a telephone interview. The size of the sample was 1041 and the response percentage was 62. The purpose of the post-sampling was to establish the proportion of fishing households among non-responders.

In the postal questionnaire, the proportion of those fishing was 52% in the first, 45% in the second and 45% in the third contact group. The post-sampling gave the proportion of those fishing as 43%.

Estimation

For the estimation, a weighting factor was formed for each statistical unit, or household.

The weighting factor was formed from the inverses of the inclusion probability and response probability of the sampling unit, that is, household-dwelling unit, and from the calibration weight.

In practice, the estimation was carried out with SAS software and the SAS macro CLAN97 developed by Statistics Sweden (Andersson and Nordberg 1998).

Data collection strategy

A basic result of the pilot studies was that a cost-efficient data collection strategy, with respect to the reliability, is to collect data on recreational fishing every second year. The next survey will be conducted in 2011 (referring to the year 2010). This practice will produce a continuous and methodologically stable biennial time-series of recreational catches.

7.3.6 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		
	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

According to the results of the national survey of 2006-2008, based on a sample of approximately 15 000 people, 2.45 millions of sea recreational fishers (+/- 0.15 millions) practice this activity in France (mainland). Catches estimations for fish would represent between 20 000T and 30 000T, for shell-fish 3 100T (+/-1200), for crustaceous 1 600T (+/-900) and for cephalopods 495T (+/-600T). The main fished species are Sea-bass (G2* in DCF), Mackerel (G1* in DCF) and Seabream (G1* and G2* in DCF). They represent between 40 and 67% of total catches (source: first results from pilot survey of recreational fishing in France).

*: The conservation status of a species or ecosystem is designated by a number from 1 to 5, preceded by a letter reflecting the appropriate geographic scale of the assessment (G = Global), N = National, and S = Subnational). The numbers have the following meaning:

1 = critically imperilled; 2 = imperilled; 3 = vulnerable; 4 = apparently secure; 5 = secure.

7.4.2 Detailed description of national recreational fisheries

7.4.2.1 Categories of recreational fishing

In France, 5 different categories of fishing can be found: shellfish and seafood picking, angling from shore, fisheries activities from boat (except spearfishing), spearfishing from shore, spearfishing from boat.

2006-2008: National study results (source: telephone survey data 2006-2008):

- 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%

2009-2010: Seabass monitoring results (source: from telephone survey data 2009):

- Angling from shore (beaches and rocky shorelines): 67 % of recreational seabass fishers
- Angling from boat: 67 % of recreational seabass fishers
- Spearfishing from shore: 9 % of recreational seabass fishers
- Spearfishing from boat: 9 % of recreational seabass fishers

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)	

7.4.2.2 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 English Channel/North Sea.

Sampling and estimation methods must take those geographic boundaries in order to be able to consider in the future CIEM zone (VIId, 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 neither 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 Platforms for fishing

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

7.4.2.4 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, Sarda, Seriola, Coryphaena</i>	Fishing activities from boat, Scuba diving from shore, Spearfishingg 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

7.4.2.5 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

7.4.2.6 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. Recreational fishing is practiced all along the year with a pick in July and August. This period combine summer holidays and better weather. That the period where we can find most of the occasional fishers.

7.4.2.7 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

7.4.2.8 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 (for example the minimal size for seabass is 36 cm)
- 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 don't need to be registered anymore. License is mandatory only 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.

7.4.3 Possible sampling frames

7.4.3.1 Species

Cod

The number of recreational fishermen is presumed to be the same than the number previously estimated with the national survey 2006-2008. According to the demographic theory, the estimations of population are valid for about 3 years.

Then, the mean catch rate was update with a new on-site survey (access point) to estimate the total catch.

171 interviews were made during 5 week-ends (Friday to Sunday) in November and December 2009. The sites of interviews were:

- North sea coast: Boulogne, Dunkerque, Calais, Malo-les-bains, Leffrinckoucke, Bray-Dunes

- West English channel: St Valery en Caux, Veules les Roses, Dieppe, Le Tréport

84% of the fishermen declared at least one catch but only 4% had caught a cod.

The mean catch rate per trip with a catch of cod is:

- By boat: 2,7kg +/- 2,7 (CV = 85%)
- From shore: 1,6 kg +/- 1,4 (CV = 99 %)

The mean catch rate per year per fisher is:

- By boat: 8,4 kg +/- 13,0 (CV = 156%)
- From shore: 6,5 kg +/- 27,5 (CV = 427%)

Seabass

To evaluate the catch of seabass, the method used is the coupling of a telephone survey and diary. The telephone survey was conducted among the seabass recreational fishermen in the coastal departments of English Channel and Atlantic fronts. The diaries are filled by fishers recruited during the telephone survey. The telephone survey is used to estimate the number of recreational fishermen and their fishing practices. The diary can collect much more accurate catch data (species, height, weight). The coupling of two databases will allow us to extrapolate the results and to obtain estimates of catch on nationally.

The telephone survey was conducted in two waves (in June 2009 and November 2009). The collection of logbooks is currently underway and must continue until late 2010. Final estimates will be available and consolidated at the end of 2010/beginning of 2011.

Bluefin tuna

The catch of tournament and fishing clubs are collected by one of the 2 recreational fishing federations. But the data from businesses, independent fishers and the other federation is unknown. In Mediterranean coast it is very difficult to get data. The relationship with the federations is then very important.

Salmon and eel

They are both assessed by the freshwater research institute ONEMA.

7.4.3.2 Area frames

- a) Geographic areas defined by country and state or province boundaries

The geographic area for the French survey is the administrative division called "department". For the seabass survey implement this year, only the coastal departments of Atlantic, English Channel and North Sea are assessed. The extrapolations at a national scale are done according to the proportion of coastal and inland seabass fisher obtained in the national survey 2006-2008.

- b) Geographic areas defined by other easily identified management boundaries

None

7.4.3.3 List frames

None list frame is available in France for the moment. There is neither registry nor license for marine recreational fishing.

We are using screening survey method by phone using the CATI system of a private poll institute.

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

Global information about marine recreational fishing (source: National recreational fishing survey 2006-2008):

- Weight/fisherman/year: 10 kg of fishes, 1.3 kg of shellfish, 0.7 kg of crustaceans and 0.2 kg of cephalopods
- 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.
- Catches for main species:
- 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 estimation:
 - Expenditures related to outing: 1 milliard (+/- 0.4) EUR
 - Expenditures relating to the travel expenditures, housing, food, equipment, boat
 - Expenditures related to equipment: 435 millions EUR
 - Expenditures related to boat: 341 millions EUR

Interim results of the seabass telephone survey (2009):

The number of seabass fishermen in 2009 in the coastal departments of Atlantic and English Channel fronts is estimated at 230,000 and 378,500 by extrapolating to the whole of France. The main types of fishing are fishing from a boat (46%) and shore fishing (43%). The spearfishing represents 11% of the declarations. Cane fishing gear is the most cited (63%), followed by trolling (20%), net (7%), rifle (4%) and longline

(2%). The bait most commonly used is the lure (51%), followed by the live bait (36%). 11% of fishermen use no bait.

45% of fishermen own a boat used for the practice of recreational fishing, about 103,000 owners of boats in the coastal departments. It notes that fishing takes place primarily in the department of residence. The individual patterns associated ride to get to the fishing takes approximately 37 minutes. When fishing is by boat, the average travel time by boat last about 38 minutes to access the fishing site.

On average, a fisherman makes 24 trips per year (20% between 1 and 3 trips, 45% between 4 and 15 trips and 35% more than 16 trips). The seasonality of the fishery is clear. The number of trips is low from December to February and reaches a maximum in August.

By phone 45% of the fishermen said they had taken less than 5 bar in the year. On average 23% of the catch is released.

Interim results of the first returns of diaries:

The logbook can refine the data concerning the weight, size and species of catch. 96 books have already been processed, representing 404 fishing trips.

The boat trips represent 55% of the total against 45% for fishing trips from shore. 45% of trips last between two and four hours. 39% of trips lead to a catch of seabass. The average weight of the seabass kept is about 1kg. The harvest is 0.8 seabass per trip and the estimated total volume of seabass caught between July 2009 and April 2010 of 1,621,096. For other species, the average yield is 5.1 fishes per trip, corresponding to an estimated total volume of 9,973,882 fishes. On average, during a trip, a fisherman keeps 4.4 other fishes and rejects 0.7 ones.

7.4.5 Previous survey methods

A two step national study was carried out (2006-2008) under a steering committee with the Ministry in charge of fisheries, IFREMER, 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

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

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	A B C	A B C	A B C	A B C	A E	A E
	3 Total catch (retained/released) by species	A B C	A B C	A B C	A B C	A E	A E
	4 Catch per unit effort by species	A 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, Cod, blue fin tuna	G1 and G2 species	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:

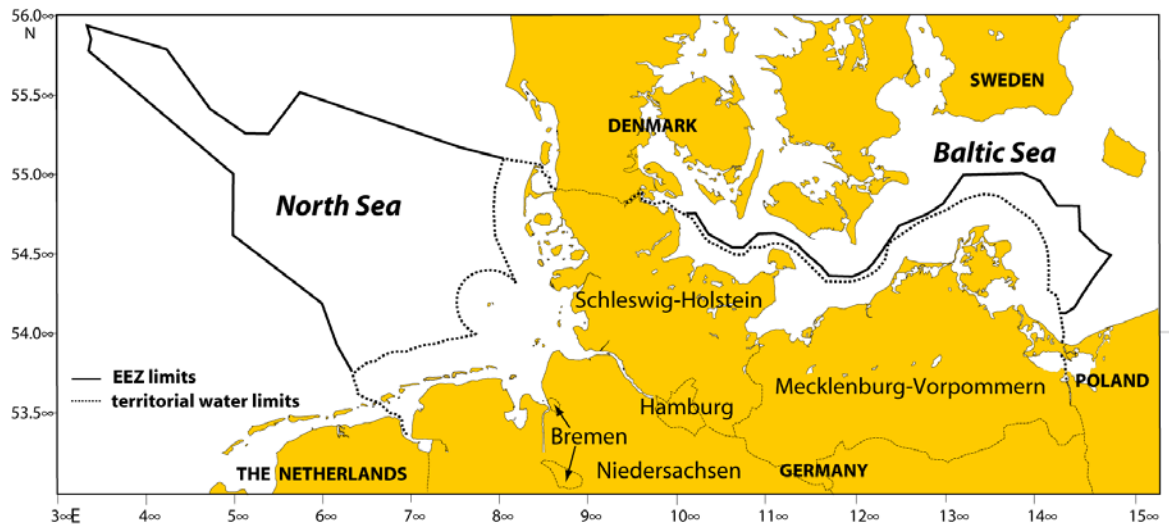
- A: General monitoring of trends
 B: Stock assessment evaluation
 C: Monitoring of annual statistics relative to annual management targets for specific species
 D: In-season monitoring of cumulative statistics relative to annual management targets for specific species
 E: other (specify)

7.5 Germany

7.5.1 General overview of national recreational fisheries

In 2004 about 1 430 000 fishing permits were sold in Germany (Brämick, 2005), roughly 1.7% 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 1200 persons. For the North Sea coast of Schleswig-Holstein, about 1000 leisure fishers are registered.



Exclusive Economic Zones of Germany in the North and Baltic Sea (Fig. Zimmermann).

Recreational fishing is under the jurisdiction of the federal states; consequently marine recreational fishing is covered by five federal states with different legislation. 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 not available for recreational fisheries surveys. In almost all federal states of Germany recreational fishermen are obliged to pay an annual fishery duty. Addresses of those having paid the annual duty are usually not kept. In two coastal states non-anglers can obtain a tourist license once a year, which requires no exam and is valid for 28 days. Again, addresses are not recorded from those anglers purchasing a tourist license.

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 targeted by 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 a salmon, trolling fishery in the waters of the isle of Rügen, which has developed since and will be monitored.

Eel is the main target species of leisure fishers. For 2010/11, 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 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). Currently 129 “angling cutters” are registered in Germany. 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.

Non-commercial subsistence fishing, collection of shellfish or spear-fishing is not practiced in German waters.

7.5.2.2 2.2 Geographic delineations

a) Baltic Sea

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

Mail surveys to estimate the **angling effort** have been conducted separately for the federal states of Schleswig-Holstein (SH) and Mecklenburg-Western Pomerania (MV) to account for the different fishery legislations in these two states, 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.

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 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 fresh-water 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 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")	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")	3
Private boats	4
Smaller charter or guide boats	5

7.5.2.5 2.5 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.

7.5.2.6 2.6 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, during beach fishing tournaments length distributions of the landings are collected to quantify landings for fish caught from the shore.

b) North Sea

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

7.5.2.7 2.7 Management regulations and affecting recreational fisheries

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-anglers 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. This permit is not required for the recreational marine fisheries in Schleswig-Holstein (both Baltic and North Sea) as well as Niedersachsen (North Sea).

7.5.3 Sampling frames

7.5.3.1 Area frames

a) Baltic Sea

The German Baltic coast bordered by the two federal states Mecklenburg-Western Pomerania (MV) and Schleswig-Holstein (SH) is divided into five strata for sampling:

- **Rügen**/Hiddensee und Barhöft
- **Rostock** (Darß – Scharbeutz)
- **Fehmarn**/Heiligenhafen (Neustadt – Hohwacht)
- **Kiel**/Eckernförde (Behrendorf – Damp)
- **Flensburg** (Kappeln/Schönhagen – Flensburg)

b) North Sea

The German North Sea coast is divided into two strata for sampling:

- Schleswig-Holstein
- Niedersachsen

7.5.3.2 List frames

The following table depicts the 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	

7.5.4 Survey methods

7.5.4.1 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.

7.5.4.2 North Sea

None

Previous methods

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.

7.5.4.3 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, Flounder, Sea trout, Herring, Garfish, Whiting, Salmon, partially Eel, Turbot, Sole, Dab, Mackerel
Quantity of catch by species or species group, that is released	Cod, Flounder, Sea trout
Quantity of catch by species and fishing methods, retained for consumption	Cod, Flounder, Sea trout, Salmon, partially Eel, Turbot, Sole, Dab
Commercial length/mass-relationship (passive gear)	Yes, estimated from commercial fishery surveys, OSF ¹ database
Commercial length/mass-relationship (active gear)	Yes, estimated from commercial fishery surveys, OSF ¹ database

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

7.5.5 Results

The following results apply to the Baltic Sea only, since earlier pilot studies revealed that there were no significant recreational fishery catches of cod in the North Sea. A pilot study for eel and shark is in preparation.

7.5.5.1 Sampling

To estimate the mean effort of anglers in 2009 (angling days/year) the results from the mail surveys 2004-2006 were used (pilot study). This data was augmented with the actual number of members in the angling associations in MV and SH, the number of fishery licenses sold in MV and SH and the annual numbers of angling licenses sold for the coastal waters of MV.

To estimate the catch per unit effort a total of 283 samples were realized in 2009. Thereby 49 samples were carried out targeting shore fishing activities interviewing 223 anglers and 234 samples were realized targeting boat and vessel angling yielding 2069 interviews.

The following table gives an overview of the sampling in 2009 to estimate the length composition of landings from beach fishing and boat/cutter angling.

	Samples	No. of measured cod (retained)	No. of measured cod (released)
Charter vessel trips with observer	41	1239	766
Boat- self-measurement	24	100	117
Trolling - self-measurement	12	45	1
Shore fishing – fishing events	3	3	10

7.5.5.2 Effort

In 2009 a minimum of 119 500 respectively 155 000 anglers maximum went fishing in the Baltic Sea. The total effort in the Baltic Sea in 2009 was estimated between 938 595 and 1 614 490 angling days.

The following table provides an overview of the estimated effort for the different fishing types, bi-annual and in total.

Type	Minimum			Maximum		
	1. Half year	2. Half year	Total	1. Half year	2. Half year	Total
Shore fishing	116695	198280	314975	223277	322160	545437
Wading	118753	11153	129906	170473	120076	290549
Boat fishing	121581	183663	305244	249188	287093	536281
Fishing cutters	80789	90196	170985	108596	109976	218573
Trolling	8431	9053	17485	11941	11708	23650
Total	446250	492345	938595	763477	851013	1614490

The catch per unit effort (CPUE) – based on on-site surveys in 2009 – was calculated for the different fishing categories and was the highest for the boat/cutter fishing and the lowest for wading.

Type	CPUE (catch/day) in numbers	
	Cod (landed)	Cod (released)
Fishing cutters	2.6	2.0
Boat fishing	2.3	1.6
Trolling	1.8	0.8
Shore fishing	0.6	3.5
Wading	0.1	0.1

7.5.5.3 Catches in numbers

The following table shows the cod catches (numbers) of the German recreational fishery in 2009, divided into released and landed cod, according to the applied fishing method, bi-annual and in total.

	Type	Minimum			Maximum		
		1. Half year	2. Half year	Total	1. Half year	2. Half year	Total
Released cod	Shore fishing	126302	1033988	1160289	267602	1605640	1873241
	Wading	5822	3718	9540	9847	28648	38495
	Boat fishing	214251	325299	539550	435684	501060	936744
	Fishing cutters	106223	170009	276233	149448	220775	370222
	Trolling	8493	0	8493	13197	0	13197
	Total	461091	1533014	1994105	875777	2356123	3231900
Landed cod	Shore fishing	37363	145585	182948	63591	236866	300457
	Wading	0	11153	11153	0	17682	17682
	Boat fishing	228629	343983	572612	474754	558264	1033018
	Fishing cutters	210567	468516	679083	252308	516914	769222
	Trolling	15022	5388	20410	24417	8025	32441
	Total	491581	974625	1466207	815069	1337751	2152820

7.5.5.4 Catches in weight

In 2009 a minimum of 2233 t respectively 3387 t of cod maximum were landed in the German recreational fisheries in the Baltic Sea.

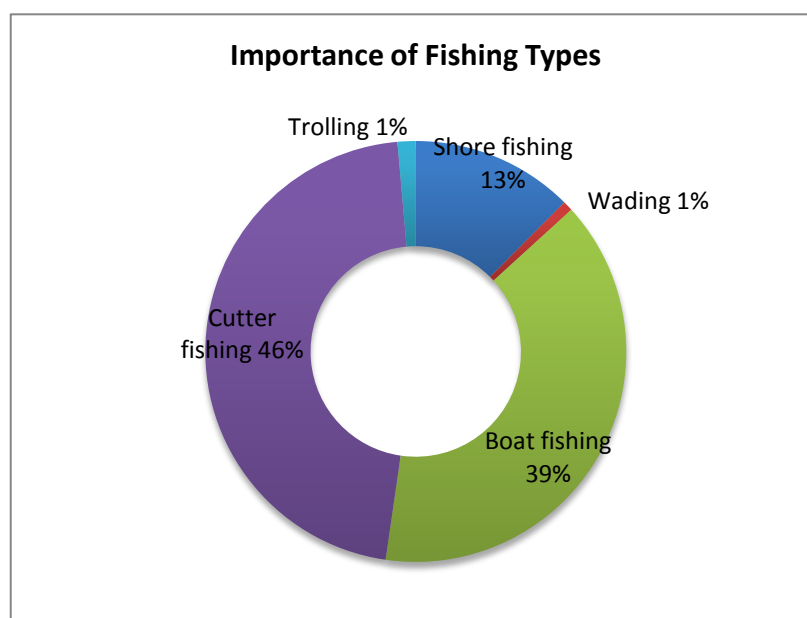
The following table shows the cod catches of recreational fishing in tons in 2009, divided into released and landed cod, according to the applied fishing method, bi-annual and in total.

	Type	Minimum			Maximum		
		1. Half year	2. Half year	Total	1. Half year	2. Half year	Total
Released cod	Shore fishing	23	297	320	50	461	510
	Wading	1	1	2	2	8	10
	Boat fishing	40	93	133	81	144	224
	Fishing cutters	20	49	68	28	63	91
	Trolling	2	0	2	2	0	2
	Total	85	440	525	162	676	838

Landed cod	Shore fishing	54	212	267	93	433	525
	Wading	0	16	16	0	32	32
	Boat fishing	350	527	878	728	865	1592
	Fishing cutters	323	718	1041	387	801	1187
	Trolling	23	8	31	37	12	50
	Total	751	1482	2233	1245	2143	3387

7.5.5.5 Fishing type

The majority of cod (85%) is landed by anglers fishing from private boats and angling cutters. The following diagram is based on landed cod catches in 2009.



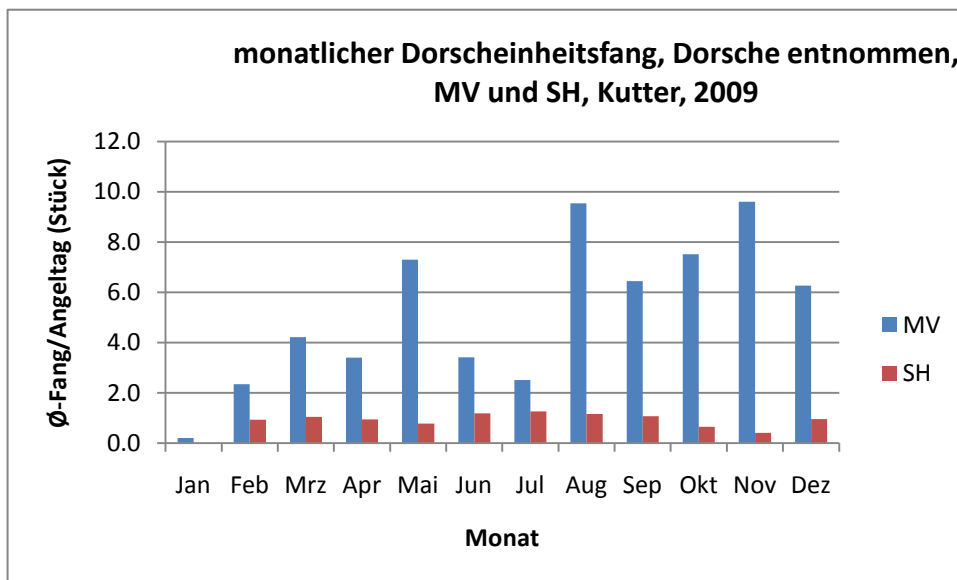
7.5.5.6 Seasonality/Trends

Based on the recreational fisheries survey data and the estimation method annual German cod catches in the Baltic Sea (SD 22 + 24) varied between 1907 t (2007) and 2766 t (2005) based on recorded effort data from diaries. Using effort data based on estimates from anglers annual catches varied between 2940 t (2007) and 4482 t (2005).

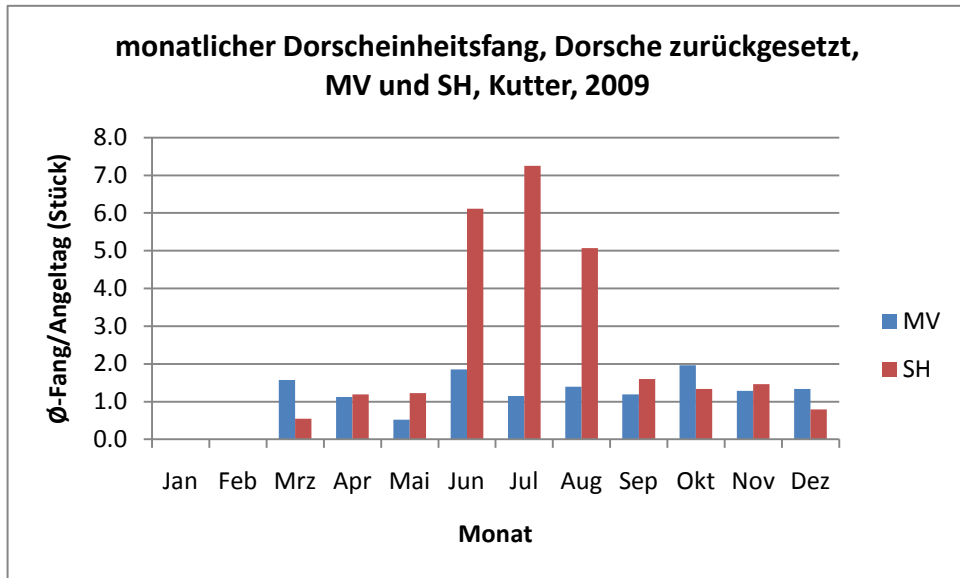
Year	Minimum	Maximum
2004*	1959	3330
2005*	2766	4482
2006*	1934	3017
2007	1907	2940
2008	2152	3307
2009	2233	3387

* Please note that yearly landings in the years 2004 - 2006 were calculated by means of average masses of the cod commercially caught in SD 22 + 24 and the length distribution of landings of the anglers using a general length-mass relationship. Since 2007 calculations are based on the recorded length distribution of angler landings and the length-mass relationship from the German commercial fishery (from the active commercial fishery for boat, cutter and trolling & from the passive commercial fishery for surf fishing and wading).

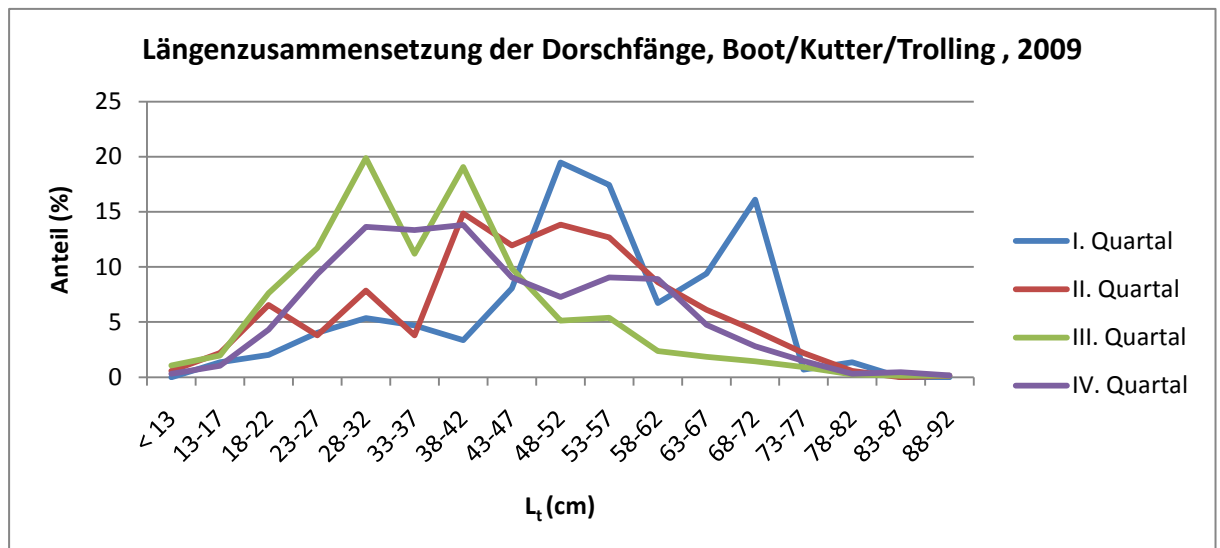
Cod is fished year round but spatial variation of catches is high between the two German coastal states. In general, cod catches increase from west (SH) to east (MV) with the highest catch per unit of effort (CPUE) for retained fish on the Island of Ruegen with on average 8.3 cod per fishing day in contrast to 0.8 cod caught around Flensburg. The following diagram depicts the monthly CPUE of retained cod catches from cutter fishing in the two coastal states.



In addition to smaller catches, fish size decreases from east to west resulting in higher numbers of released cod in the coastal state of Schleswig Holstein (SH). The following diagrams depict the monthly CPUE of retained cod from cutter fishing in the two coastal states.



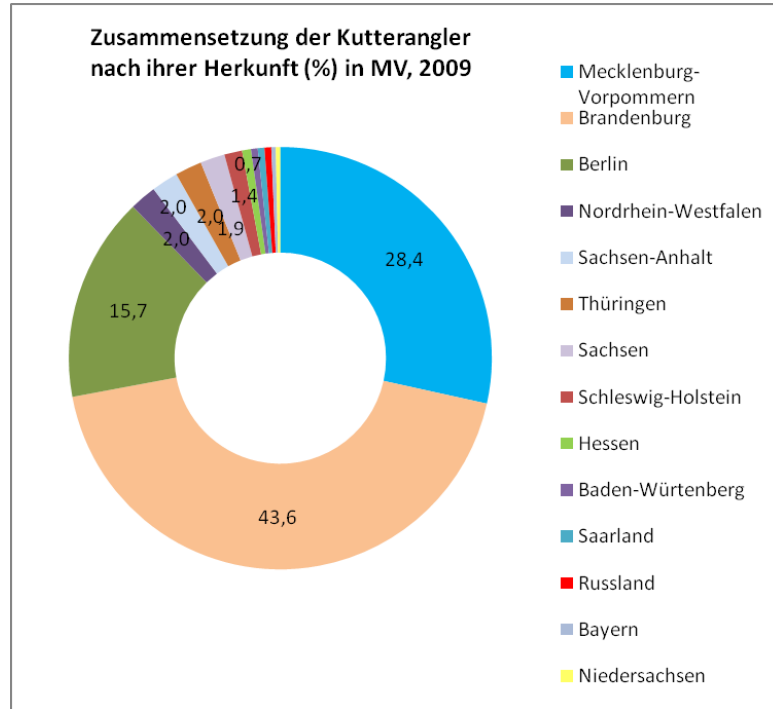
Next to spatial variations there are also temporal variations of cod catches. The following diagram gives an overview of the length distribution of cod catches per quarter (cutter fishing, boat fishing and trolling).



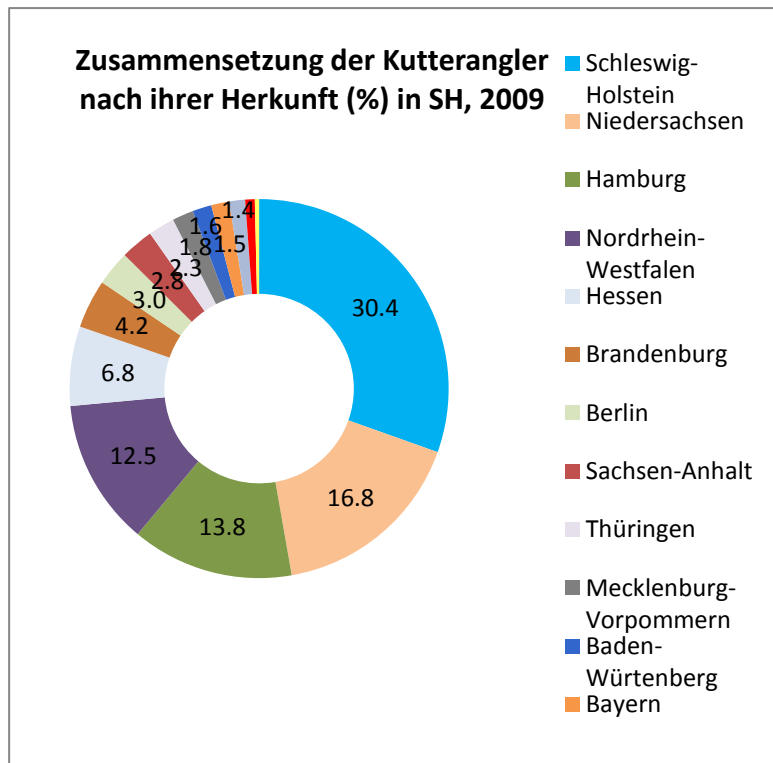
7.5.5.7 Origin of anglers/tourism

During interviews anglers were asked where they reside. Only a minority of anglers came from the coastal states bordering the Baltic Sea. The majority of anglers came as tourist anglers from the further inland federal states. Very few foreign tourist anglers were encountered.

The following tables give an overview of the origin of anglers fishing from angling cutters in Mecklenburg Western Pomerania (MV).



The following tables give an overview of the origin of anglers fishing from angling cutters in Schleswig Holstein (SH).



7.5.5.8 Data Quality

As required by Council Regulation (EC) No 949/2008, data related to annual estimates must achieve precision level 1 (95 % confidence interval inside a deviation of plus/minus 40 %).

An analysis of the calculated landing data (2009) by means of bootstrapping estimated a relative deviation between 13 % as minimum and 24 % as maximum for the different estimated numbers of landings (see table below).

	Landings (numbers)	Confidence intervals ($\alpha = 0,025$)	
		2,5 % Percentile	97,5 % Percentile
Recorded effort-data, Jan - Jun	491581	413091	588158
Recorded effort-data, Aug - Dec	974625	845867	1107919
Estimated effort-data, Jan - Jun	815069	655915	1008842
Estimated effort-data, Aug - Dec	1337751	1101987	1594772

7.6 Netherlands

7.6.1 General overview of national recreational fisheries

The 2009 Screening Survey demonstrated that about 1.6 million recreational fishers are active in the Netherlands based on a sample of ~52.000 households. The Screening Survey is part of the recently (2009) established Recreational Fisheries Programme by the Ministry of Agriculture, Nature and Food Security.

In the Netherlands, the Recreational Fisheries Programme is managed and designed by IMARES Wageningen UR in close co-operation with the Royal Dutch Angling Association (Sportvisserij Nederland). The current design of the Recreational Fisheries Survey will not only collect information on catch and effort but also on motivation and satisfaction of recreational fishers and spending patterns (lures, bait etc). Especially the last two items are of interest to the Royal Dutch Anglers Association to develop their strategies and policies to improve the quality of recreational fishing.

There are about 1.000 angling clubs in the Netherlands, there are eight regional federations which are a member of the Royal Dutch Angling Association (Sportvisserij Nederland). Also three specialist organizations for carp-, pike- and fly fishing are associated with Sportvisserij Nederland. Over 450.000 anglers are a member of this country-wide organization. These members get the VISpas which, together with a book describes numerous water bodies, forms the fishing permit for these water bodies with maximum two rods. Furthermore Sportvisserij Nederland distributes the so-called small VISpas for these people that only want to fish with one rod in only the larger water bodies. Artificial lures and dead bait is not permitted with this permit. These 125.000 participants do not get a membership of an angling club.

For non-angling recreational fisheries (leisure fishers), a licence is needed for the delta areas along the Dutch coast (Waddensea, Eems, Dollard, Oosterschelde, Westerschelde) to fish with gillnets, long-lines and fykes on a recreational basis. However, for other areas along the Dutch coast, no license is needed. It is not allowed to use non-angling fishing gear for recreational purposes in inland waters. Data on the

number of fishers are not available for these areas. In the Waddensea, Eems and Dollard there are 466 licenses in 2010, while in the Delta (including Oosterschelde and Westerschelde) there were 711 licenses. About 80% of the licenses are probably used (Jansen et al., 2008). From 2011 onwards, the use of fyke nets and long-lines by recreational fishers will be forbidden. The future of the recreational gillnet fishery in coastal waters is currently under review by the Ministry of Agriculture, Nature and Food Quality. It is not allowed to use non-angling fishing gear for recreational purposes in inland waters.

The Dutch Recreational Fisheries Programme and this report will, until further notice, focus on angling recreational fishermen.

7.6.2 Detailed description of national recreational fisheries

7.6.2.1 Categories of recreational fishing

In the Netherlands, from 2011 onwards, three categories of recreational fisheries can be taken into account: 1) freshwater angling, 2) marine angling shore-based, and 3) marine angling boat-based.

Based on the outcome of the current review process, a fourth category may be added after 2011: marine recreational gillnet fishery.

7.6.2.2 Geographic delineations

In the Netherlands, marine angling is predominantly situated in the Southern North Sea (ICES Sub-Division IVc).

7.6.2.3 Water bodies

Preliminary results of the 2009 Screening Survey indicated that 75% of the recreational fishermen fishes in inland waters and 25% fishes in marine waters; 62% fishing only in freshwater, 12% fishing only in marine water and 26% fishing in both fresh and marine water.

Water body type	Ranking
Freshwater rivers or lakes	1 (75%)
River estuaries	N/A
Marine waters	2 (25%)
Open sea: inshore (e.g. shore out to <20m depth)	N/A
Open sea: Offshore demersal (e.g. > 20m depth)	N/A

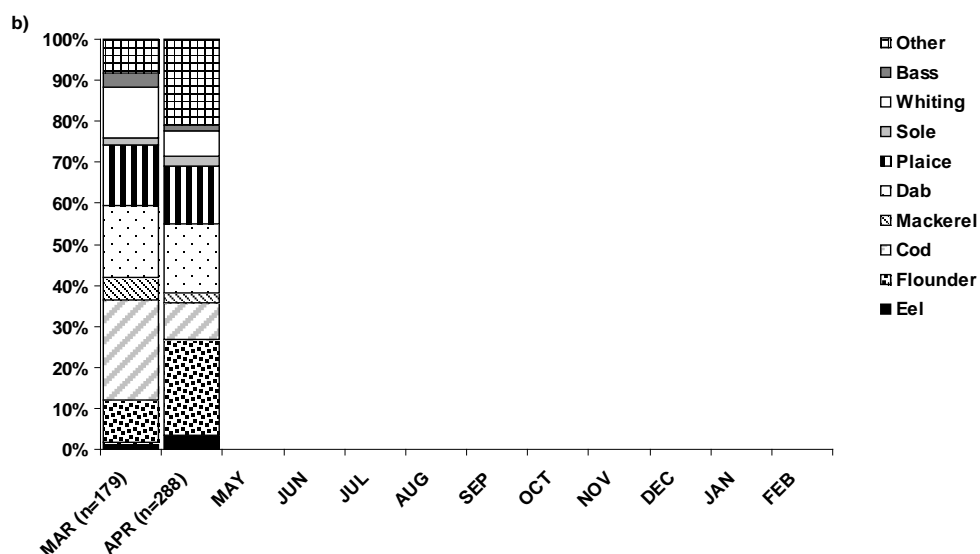


Fig. 1. Species composition of the recreational fisheries in inland waters (a) and marine waters (b) based on preliminary results of the diary survey of 2000 fishers.

Cod (*Gadus morhua*)

In 2005 and 2006, a pilot survey was carried out under the DCR to estimate the catches of cod by anglers in the Netherlands (van Keecken *et al.*, 2007). The annual catches in the years of the study were estimated between 456 1765 tonnes and landings were estimated between 264 1037. However, the estimates were considered very uncertain. An earlier study (Smit *et al.*, 2004) estimated annual catches between 186 408. In comparison the commercial landings of cod in the Netherlands in 2005 and 2006 was about 1600 tonnes in each of those years. The different results in both studies can be mostly attributed to the different methodological approaches and assumptions.

7.6.2.6 Fishing gears used

Preliminary results from on the 2009 Screening Survey (de Graaf *et al.* 2010, unpublished results). As some recreational fishermen use more than one type of gear the total is higher than 100%.

Gear type FRESHWATER	Ranking
Rod and line	1 (99%)
Snigglng	5 (1%)
Fykes	5 (1%)
Gill net	5 (1%)
Long-lines	5 (0%)

Gear type MARINE	Ranking
Rod and line	1 (97%)
Snigglng	5 (2%)
Fykes	5 (3%)
Gill net	5 (3%)
Long-lines	5 (1%)

7.6.2.7 Seasonality

Seasonality data is currently being collected as part of the 12-month Recreational Fisheries Survey which started in March 2010.

7.6.2.8 Tournament fishing

As part of the 12-month Recreational Fisheries Survey, tournament data is being collected in co-operation with several fishing clubs.

7.6.2.9 Management regulations and other schemes affecting recreational fisheries

For angling at the open sea and along the coast, there is no license system. There is a minimum landing size for most species (see Table), but no bag limit.

Minimum legal size MARINE		Minimum legal size FRESHWATER	
Cod	35 cm	Barbel	30 cm
Haddock	30 cm	Flounder	20 cm
Saith	35 cm	Chub	30 cm
Coley	30 cm	Serpeling	15 cm
Hake	27 cm	Pike	45 cm
Megrim	20 cm	Grayling	35 cm
Sole	24 cm	Tench	25 cm
Flounder	27 cm	Redfin perch	22 cm
whiting	27 cm	Beekridder	25 cm
Ling	63 cm	Trout (brown, rainbow, brook)	25 cm
Blue ling	70 cm	Rudd	15 cm
Seabass	36 cm	Nase	30 cm
Herring	20 cm	Pike perch	42 cm
Scad	15 cm	Ide	30 cm
Sardine	11 cm	Eel	28 cm
Mackerel	30 cm		
Anchovy	12 cm		
Eel	28 cm		

Closed season FRESHWATER	
Pike	1 March – 30 June
Barbel, Chub, Dace, Nase, Ide, Grayling	1 April – 31 May
Pikeperch, perch	1 April – last Saturday in May
Brown trout, Arctic charr, Brook trout	1 October – 31 March
Sea trout, salmon	All year

In freshwater it is forbidden:

- to use vertebrates (fish, amphibians, reptiles, bird, mammals) as live bait.
- to take grass carp
- according to the Dutch Flora and Fauna Act it is forbidden to fish for Schneider, Brook Lamprey, Stone loach, Bitterling, Minnow, Houting, Catfish, Weatherfish, Spined loach, Bullhead, River lamprey, and Sturgeon.

Since 2009 it is mandatory for all recreational fishers in inland waters where the fishing rights are with the recreational fishers (clubs, federations etc) and marine waters (federal regulation), to release eel back in the water immediately upon capture. In addition the whole eel fishery, both commercial and marine, is closed during September, October and November in 2010.

7.6.3 Possible sampling frames

7.6.3.1 Area frames

- a) inland waters
- b) marine waters shore-based fishing
- c) marine waters boat-based fishing
- d) North Sea (ICES IVc)
- e) Wadden Sea
- f) Delta (Oosterschelde, Westerschelde)

7.6.3.2 List frames

See Table 2.

7.6.4 Available statistics

Statistic	Data sets available, and where/how archived
Number of resident anglers	2010: Screening Survey 52.000 households, to be repeated every other year Past: several participation surveys since 1993
Number of visiting anglers	-
Number of resident vessels	-
Number of visiting vessels	-
Fishing effort: Angler days	Present: 2010 online diary 2000 fishers and Screening Survey 52.000 households Past: several recall surveys
Fishing effort: Vessel days	-
Quantity of catch by species or species group, retained for consumption	2010: online diary 2000 fishers, to be repeated every other year Past: several recall surveys
Quantity of catch by species or species group, used for bait	N/A
Quantity of catch by species or species group, that is released	2010 online diary 2000 fishers, to be repeated every other year
Other statistics (specify)	2010 Satisfaction and motivation; Expenditure based on online diary 2000 fishers, to be repeated every six year 2002 Expenditure, recall survey

7.6.5 Previous survey methods

7.6.5.1 Current methods

To collect data on fishing participation (e.g. "Have you fished in the past 12 months?"), assessing attitudes or awareness and/or socioeconomic and demographic profiling of recreational fishers, phone or mail recall surveys are straightforward, easy to administer and relatively cost-effective.

However, if detailed information on effort (e.g. "How many days have you fished in the past 12 months?"), catch (e.g. number or size) and/or economic activity is required, recall surveys are of limited applicability due to the impacts of recall bias, non-response bias, digit preference and/or prestige bias (Pollock et al 1994; Lyle *et al* 2002; Henry and Lyle 2003; Baharthah 2006).

In recent years several estimates of the total catch of cod (*Gadus morhua*) by angling recreational fishers have been reported: 264-1037 tonnes (Van Keeken *et al.* 2007) based on phone and mail recall survey, ~1650 tonnes in 2006 (Wijnstroom, 2006) based on a phone recall survey. Due to the methods (recall surveys) the accuracy of these catch estimates are doubtful as recall surveys have been demonstrated to over-estimate recreational catches by as much as a factor two (Baharthah, 2006).

Recently the EU installed additional regulations, which obliges Member States to estimate and report recreational catches of cod, eel, salmon, seabass, bluefin tuna, sharks and rays in European waters. To fulfil the requirements of the EU regulations, the Netherlands has implemented a Recreational Fisheries Programme to estimate the recreational catches of cod, eel, sharks and rays.

In the Netherlands, marine recreational fishers are not registered and are not required to obtain a recreational fishing permit. Therefore the most reliable survey should comprise of two components following Lyle et al. (2002) and Henry and Lyle (2003):

- (1) **Screening Survey:** identify fishing households, profile fishing households, select participants for a follow-up, and
- (2) **Diary Survey:** monitoring fishing (and economic) activity through regular contact (monthly) by survey interviewers.

Furthermore, an 'on-site' sampling program has been implemented to provide additional independent data on catch, size and species composition of recreational fishers along the coast, charter boats and private boats.

In principle the programme will cover all types of recreational fishery in the Netherlands and the information described below will become available for all species caught in recreational fisheries in fresh and marine waters. For eel, also information will become available on the ration caught in marine and fresh water. Screening Surveys (2009, 2011, etc) and 12 month Diary Surveys (2010, 2012 etc) are planned every other year. In 2011, priority will be given to the estimation of recreational catches of North Sea cod. In principle, new estimates of cod, eel and shark catches will be available in 2011, 2013 and so on.

Screening Survey

The sampled population is an unbiased sample of the total population. Since the introduction of a ban on all other recreational fisheries in marine coastal waters, apart from angling, the number of 'métiers' in the population is limited.

Biases in the Screening Survey were negligible due to careful design of the survey. The demographics of the frame population (56,730 households) is selected and maintained by one of the largest commercial marketing companies in the Netherlands (TNS-NIPO) to ensure its frame population does not deviate from the demographics of the whole Dutch population as determined by the Central Bureau of Statistics. The Screening Survey was offered 'blind' to the 56,730 households towards the end of December 2009. Every month the commercial marketing company (TNS-NIPO) sends a questionnaire about a range of divers' topics (social, politics, products) to the households in its database. The households do not know what the topics are when they start filling in the online questionnaire and they are not allowed to skip topics or pick and choose topics. The general (including questions on recreational fisheries) online survey of TNS-NIPO in December 2009 was completed by 45,518 households (109,264 people).

Diary Survey

During the Screening Survey, people were not only asked if they had participated in freshwater and/or marine recreational fisheries and if they wanted to participate in a 12 month Diary Survey but also to indicate roughly how often they had fished in the past 12 months to determine the level of fishing 'avidity' (1-5, 5-10, 10-25, 25-50, >50 annual fishing trips). As expected the level of avidity was higher among the people that indicated to be willing to participate in the 12 month Diary Survey compared to the avidity of all the people in the screening survey. To avoid this type of bias (over-estimation of the catch because the participants of the Diary Survey are more fanatic than the average recreational fisher), the demographics (including avidity) of the 2000 people selected for the Diary Survey was similar to the demographics of the recreational fishers as determined during the Screening Survey. Participants of the Diary Survey were asked to maintain to carefully maintain a logbook. Participants are approached on a monthly base by staff of TNS-NIPO and requested to transfer the data recorded in their logbooks to online questionnaires. Participants of the Diary Survey record per fishing trip detailed information on the fishing location, gear, catches (species, size), ratio kept-retained, reason released, motivation and satisfaction and expenditure.

7.6.5.2 Previous methods

Participation

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.

Total catches, CPUE, species composition and length-frequency

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.

Satisfaction and motivation

No previous surveys regarding satisfaction and motivation of recreational fishers have been conducted in the past in the Netherlands.

Economics

In 2004 Smit *et al.* (2004) provided an overview of the contribution of the recreational fishery to the economy in the Netherlands. The expenditure of recreational fishers (men >15 years old) was determined by TNS-NIPO using an online questionnaire (recall survey, 3816 households, 546 interviews with men >15 years old; Boutkan 2002). According to the 2002 TNS-NIPO survey the average male fisher spend €577 annually. This amount was relatively high compared to other (inter)national sources (NRIT 1988) on expenditure of recreational fishers and Smit *et al.* (2004) raised some concern about the methodology applied in the 2002 TNS-NIPO survey.

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, B, C	A	A	A
	2 Fishing effort	A	A	A, B, C,	A	A	A
	3 Total catch (retained/released) by species	A	A	A, B, C,	A	A	A
	4 Catch per unit effort by species	A	A	A, B, C,	A	A	
	5 Size/age distribution of catch	A	A	A, B, C,	A	A	
	6 Socio-economic data	A	A		A	A,B	A
	Key species (give list)	Cod, Eel	Cod, Eel	Cod, Eel	Cod, Eel	Cod, Eel	Cod, Eel

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)

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Table 1: Summary of national recreational fisheries: angling

	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
Inland waters	shore	redfin perch, roach, rudd, bream, carp, eel	Rod and line	S	S, MLS, VCR	A	Partial	None
	Private /charter / for hire boats	redfin perch, pikeperch, bream, eel	Rod and line	S	S, MLS, VCR	C	Partial	None
Open sea: Inshore (e.g. shore to <20m depth):	Man-made structures	bass, cod, whiting, flatfish	Rod and line	S	MLS, VCR	B	Partial	None
	Beaches	bass, flatfish, cod, whiting	Rod and line	S	MLS, VCR	B	Partial	None
	Private /charter / for hire boats	bass, cod, whiting, flatfish	Rod and line	S	MLS, VCR	B	Partial	None
Open sea: Offshore demersal (e.g. 20m+ depth):	Private /charter / for hire boats	Cod, flatfish, sharks, rays	Rod and line	S	MLS, VCR	B	Partial	None
Open sea: Offshore pelagic (e.g. 20m+ depth):	Private /charter / for hire boats	mackerel	Rod and line	S		C	Partial	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 2: 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	partial
			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	

7.7 Norway

Study of the tourist sector of the Norwegian marine recreational fishery.

Recreational fishing as tourism has become an increasingly important part of the Norwegian travel industry and may account for a significant portion of the fishing mortality of local fish stocks. Vølstad *et al.* (2010) evaluated the use of a probability-based sampling survey to estimate yearly catch and effort taken by boat anglers associated with 445 registered tourist fishing businesses that we were able to identify. The target population for this study was all recreational fishers that rent lodging and boats from a tourist fishing businesses (see Figure 1.) The major objective was to estimate the number and weight of the landed catch by species for boat anglers in the business segment of the tourist fishery. Fishing from shore was considered to contribute marginally to total catches of this segment and was not included in the study. In practice, not all elements (business units) in the target population of all businesses may be accessible for sampling. Our sampling frame was based on a list of 445 businesses that could be sampled with known probability. From a stratified random sample of businesses (Figure 2), fishing tourists were recruited every 6th week (with a random start) and asked to record their catch and effort in catch diaries. Vølstad *et al.* (2010) documents methods and results of the survey conducted in 2009.

Estimated species composition and catch-per-unit of effort for commercially important species by region were judged to be credible (Figure 3). Atlantic cod (*Gadus morpha*) dominated the catches in northern Norway, while saithe and mackerel were the most common species caught in western and southern Norway. Vølstad *et al.* (2010) estimated that the total catch of all species taken by tourist fishers in the business sector during 2009 was 3.3×10^3 metric tons (RSE=17%), and that 1.6×10^3 metric tons (RSE =22%) of cod were caught overall (Figure 4). Most of the cod (1.58×10^3 metric tons, RSE= 22%), was caught north of 62°N. Based on the study it was concluded that self-reporting can provide reliable data on catch per unit effort (CPUE) and total catches. Survey methods that are applicable to cover the informal sector of tourist fishing (figure 1) are discussed. Choice of survey methods for this sector is limited because no complete registry of businesses catering to fishing tourists exists in Norway. Conducting a cost-effective survey of the entire tourist fishery is also made difficult by Norway's intricate coastline that extends over 25,000 km, which does not include the shores of islands, the diverse assortment of fishing activities, and the lack of a comprehensive sampling frame. No license is required for tourists fishing in Norway's coastal waters. The lack of a tracking tool means that foreign fishing tourists cannot be contacted to conduct a random telephone interview survey.

References

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Figures

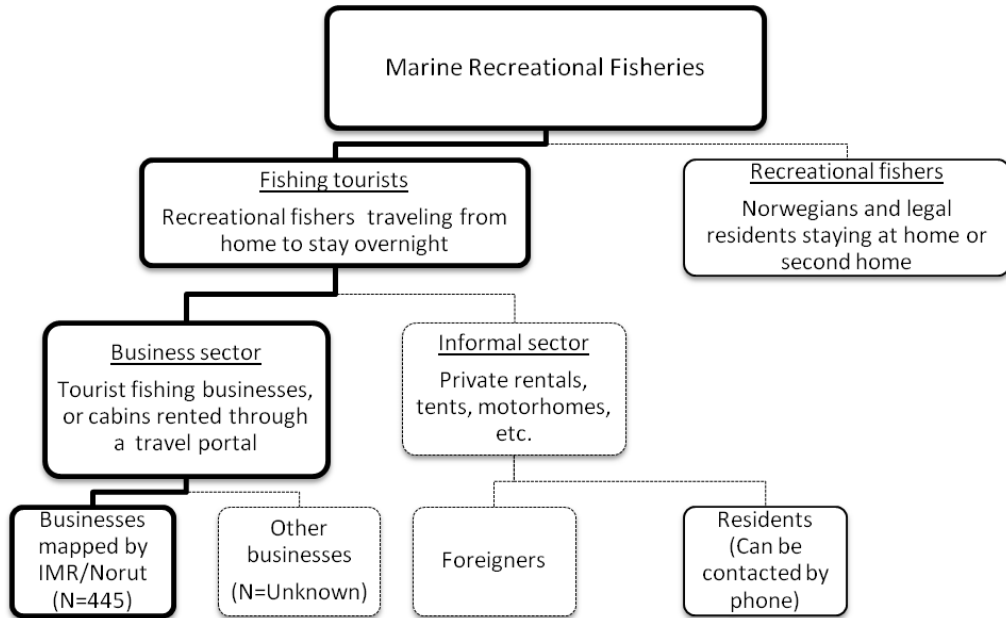


Figure 1. Diagram of the marine recreational fishery sectors in Norway as defined in this study.

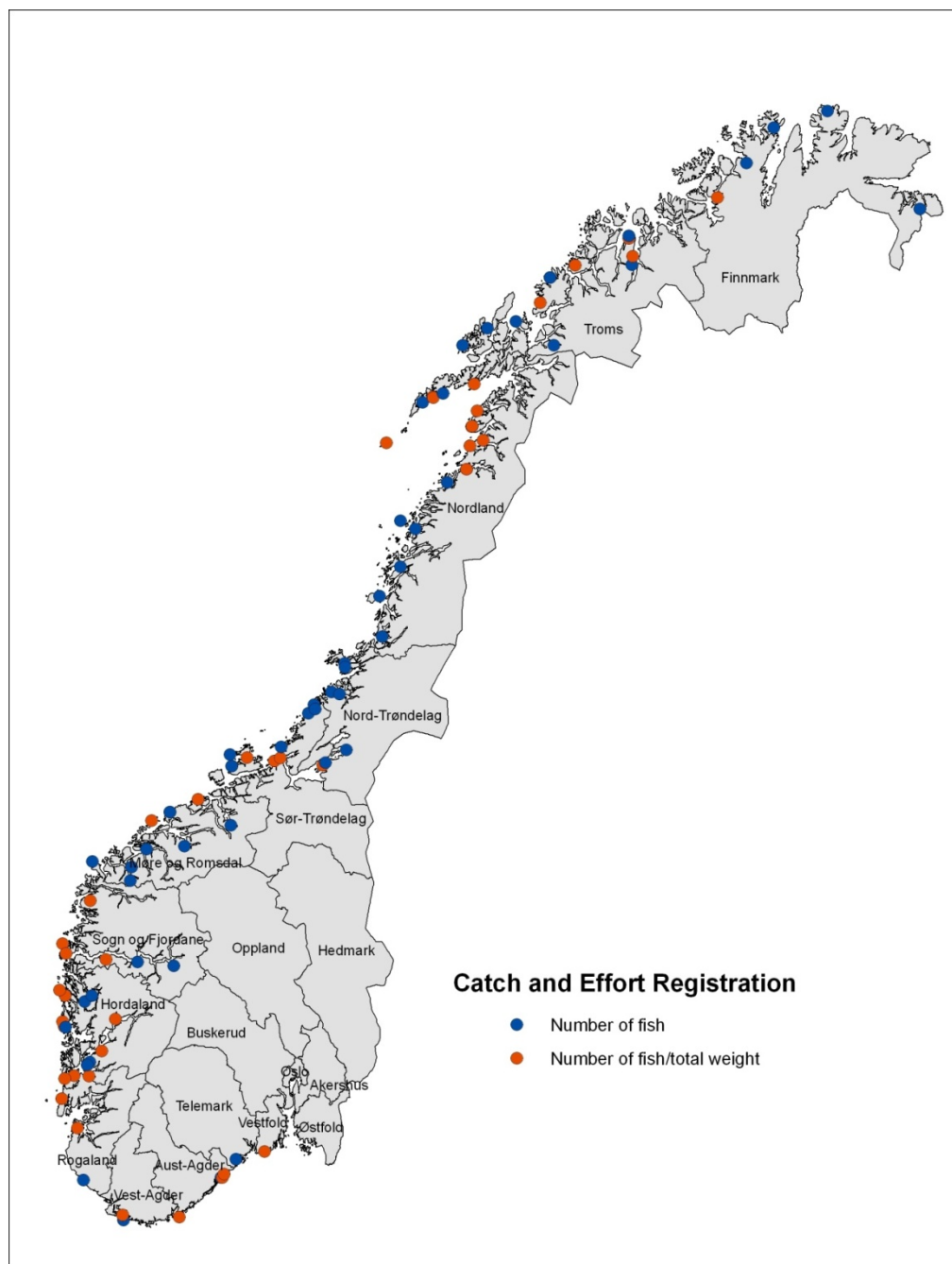


Figure 2. Map of tourist fishing businesses that collaborated with the Institute of Marine Research in 2009.

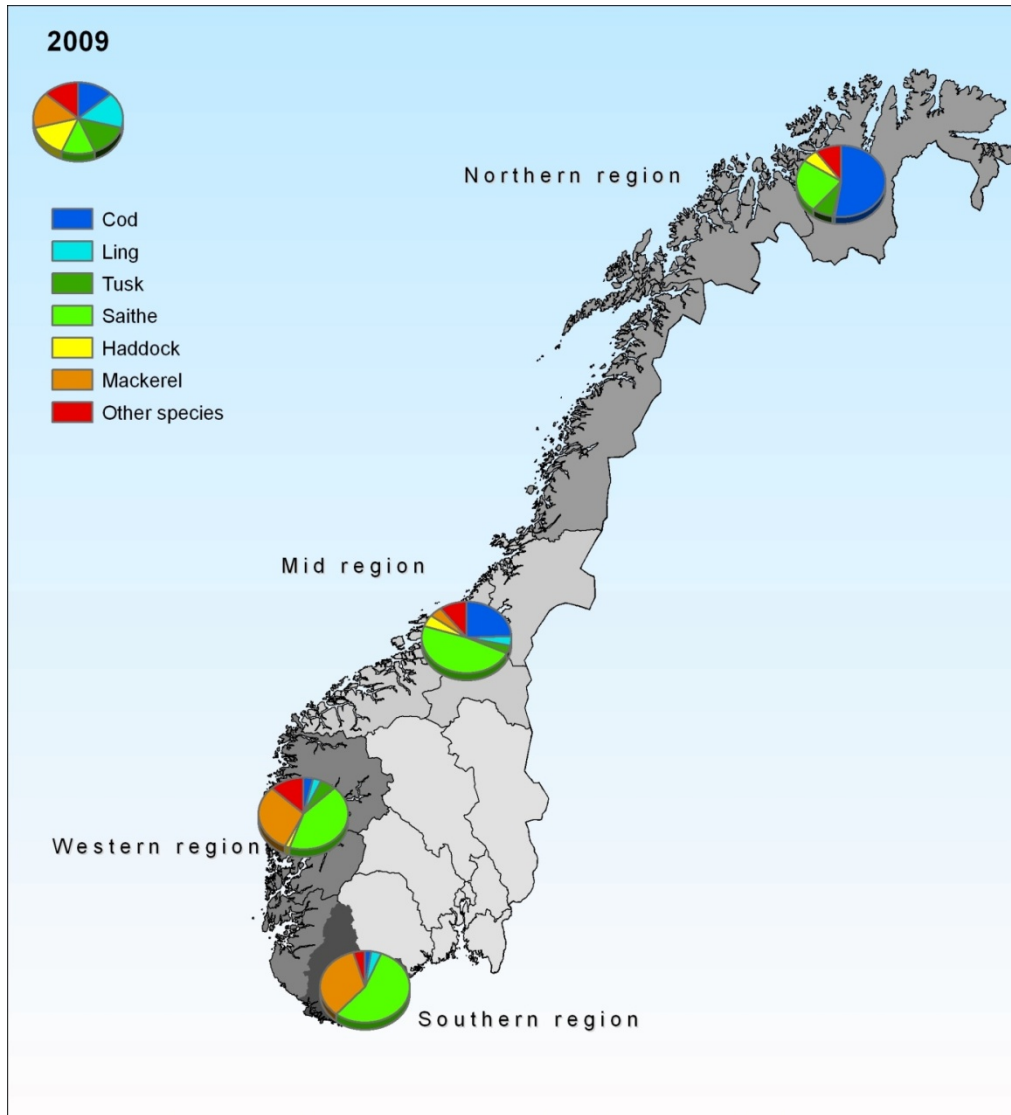


Figure 3. Species composition in numbers of reported of fish caught in 2009.

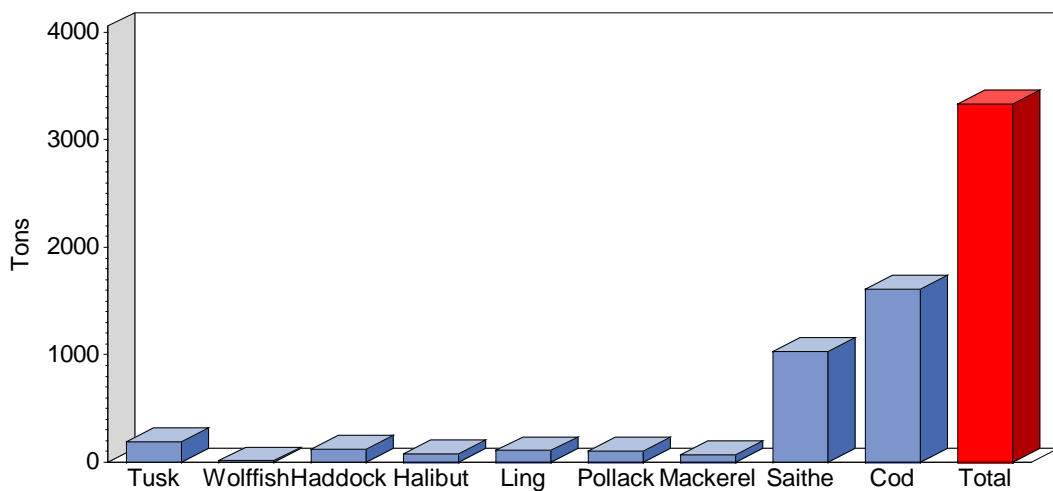


Figure 4. Estimated total catch (metric tons) by species taken in the business sector of the marine fishing tourism in Norway during 2009.

7.8 Poland

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. Recreational fishing for salmon takes place accidentally in rivers and open sea angling in Polish waters does not occur. Eel recreational fishing will be investigated starting from 2010 within the framework of Polish Eel Management Plan following Council Regulation 1100/2007 adopting Eel Management Plan (EMP) to be prepared by all Member States. Consequently, Polish recreational fisheries survey in 2009 was focused on cod investigations.

Recreational fishing for cod is only carried out by anglers equipped with fishing rods with artificial lure (pilker). It is not allowed to fish recreationally for cod with commercial fishing gears like gill-nets or hooks. Cod angling is mainly conducted in open sea offshore waters (>20m) and it has been developing very rapidly for approximately 10 recent years. Cod offshore recreational fishing is conducted all year-round with a peak of activity between May-October. Cod inshore (<20 m) angling season conducted with small boats is much shorter due to safety reasons (June-August). That type of angling with small boats is still distributed very locally.

Management regimes include size limit for cod which 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. Anglers are not required to evidence their cod catch. There are no regulations in terms of fishing effort.

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 to conduct any off-site surveying method. 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 information in terms of boat owners addresses but anglers' addresses are not recorded. Until now, neither off-site survey methods nor on-site survey have been used. The main reason for not having applied till now any of the commonly used recreational fisheries survey methods is the availability of the data on the number of sea going angling trips and the number of anglers on-board of these trips recorded by Maritime Offices along the Polish coast. In addition to the Maritime Offices data, on-board observer trips are used to estimate total catch in a given angling trip, randomly selected from the list of angling vessels, and also during the trip biological data on cod (length, weight, age) is collected. Total cod catch taken during on-board observer trips is next raised by the number of angling trips registered by Maritime Offices in order to estimate total weight of cod angled in Polish recreational fisheries (similar methodology is used to estimate discards level in commercial fisheries). For comparison purpose also raising by number of anglers is applied. Biological information resulting from sampling allows for disaggregation the estimated total catch by age, which next can be used in

analytical assessment models. This approach is in line with the expectations of the European Commission and the ICES.

On-site survey method is planned to be applied in 2011 in parallel to on-board observer trips when the catch and biological data on angled cod is collected.

The study carried out in 2009 revealed that cod angling is absolutely dominating one in Polish marine recreational fisheries and its role is still increasing. That is confirmed by the data on number of angling trips, number of vessels exploited in recreational fishing and the number of anglers participating in cod at sea angling trips as registered by Maritime Offices. Maritime Offices data collected by scientific staff of Sea Fisheries Institute in Gdynia indicate that in 2009 in total there was 12.2 thousand angling trips (vessels above 10 m total length) and 163 thousand anglers were fishing at sea (this figure may include single anglers who participated in several trips at sea). Total catch of cod in Polish recreational fisheries estimated in 2009 by applying raising by number of angling trips and by number of anglers was 1350 tonnes and 1092 tonnes respectively. These figures represent approximately 10% of the Polish total catch of cod in 2009 taken in commercial fisheries. Length distributions of cod vary depending on fishing depth. Combined length frequency distribution (1028 cods measured) for 2009 indicate length class 42 cm as the dominant one (8.6% share in numbers). Age distribution of cod (269 cods age sampled) in recreational fisheries was dominated by age group 3 (57% share in numbers), similarly to commercial fisheries age distribution. However, in recreational fisheries the share of age groups older than age 3 was considerably lower than the one observed in commercial fisheries.

7.9 Spain – Basque country (Atlantic area)

7.9.1 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 tunas. 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. Under the DCF a pilot study is proposed for the 2011-2013 Spanish National Data Collection Program. The main goal is to try to coordinate all the work done by the different autonomous regions from Spain.

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.

A three year project (2009-2011) will be carried out by AZTI Tecnalia focused in boat anglers. This study was proposed by the Basque Country government and recreational fisheries Federations.

7.9.2 Detailed description of national recreational fisheries

7.9.2.1 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.

7.9.2.2 Geographic delineations

n/a

7.9.2.3 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 tunas. 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)	

7.9.2.4 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)	

7.9.2.5 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 tunas are the most important in boat angling, and in winter the glass eels.

Except from the tunas which are fished in offshore pelagic waters, the rest of the species could be fished from all the platforms described before.

7.9.2.6 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 tuna 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

7.9.2.7 Seasonality

There are two clear Seasonal fisheries where all the effort is concentrated on those months:

- Tuna 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.

7.9.2.8 Tournament fishing

Some tournament fishing exists during all the year in the Basque Country (Spain). Many of them are in summer and tunas are the target species. There is partial information of these kinds of tournaments.

7.9.2.9 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. 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 tunas 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.

7.9.3 Possible sampling frames

n/a

7.9.4 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 (2008 Data).

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)	

7.9.5 Previous survey methods

7.9.5.1 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*) with 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.

7.9.5.2 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 witch 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.

Some different information sources have been used to try to update this fleet census., the National Marine Command, Regional Fisheries Directorate, Regional Ports Directorate, Fleet associations etc. There are some problems associated to these sources. The most important is that some vessels are duplicated in the different census. Other problems that have been found are the personal Data Access Restrictions, no discharge of the vessels, no vessel registers from other autonomies or countries.

Once a preliminary census has been obtained some samplers from AZTI staff checked the information on site in the different harbours.

To try to get estimates of catches, effort, spatial distribution, and socioeconomic data, enquiries based survey has been done. As first approach, some meetings were realized with the Federations trying to explain them the main objectives and the importance of the project and the data requested. In these meetings the enquiries were provided directly to skippers.

1360 enquiries were given to the skippers and until now, 200 enquiries have been recovered. 50 logbooks were also provided.

Some preliminary results will be obtained by the end of 2010.

7.9.5.3 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, 2008,2009 and 2010) . 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).

Glass eels fisheries Data

Table 1. Number of glass eel licenses per river basin

		2006-2007				2007-2008				2008-2009				
RBD	RB	Boat	Land	Ns	Total	Boat	Land	Ns	Total	Boat	Land	Ns	Total	
Basque C.	B. Inner	Barbadun	0	14	2	16	3	10	13	SC	SC	SC	SC	
		Nervion Ibaizabal	1	63	4	68	2	46	1	49	SC	SC	SC	SC
		Butron	2	52	10	64	1	55	8	64	SC	SC	SC	SC
		Oka	0	6	0	6	6	0	6	SC	SC	SC	SC	
		Lea	0	9	3	12	10	2	12	SC	SC	SC	SC	
		Artibai	0	2	0	2	4	0	4	SC	SC	SC	SC	
		Deba	4	119	16	139	98	6	104	SC	SC	SC	SC	
		Urola	16	12	1	29	17	7	0	24	SC	SC	SC	SC
		Oria	27	70	10	107	22	54	1	77	SC	SC	SC	SC
		Bidasoa	0	0	2	2	1	1	2	SC	SC	SC	SC	
	Total	50	347	48	445	42	284	29	355					

A decrease in the licenses is seen in boat and land licenses (table 1). The same trends are expected in 2008-2009 after analysing the preliminary results.

Table 2. Data catches of Basque Country glass eel fishery per river basin and season

	2003-2004		2004-2005		2005-2006	
	Kg	%	Kg	%	Kg	%
Barbadun	2,2	0,3	3,0	0,3	1,8	0,1
N. Ibaizabal	101,6	11,8	175,1	14,8	140,5	11,0
Butron	78,9	9,2	121,0	10,2	66,3	5,2
Oka	6,5	0,8	10,7	0,9	11,9	0,9
Lea	21,0	2,4	7,9	0,7	27,5	2,1
Artibai	4,5	0,5	5,1	0,4	2,9	0,2
Deba	158,6	18,5	201,7	17,1	332,7	26,0
Urola	93,6	10,9	123,8	10,5	149,9	11,7
Oria	391,4	45,6	534,0	45,1	547,7	42,7
Bidasoa	0	0	0,8	0,1	1,0	0,1
Total	858,3	100,0	1183,1	100,0	1282,1	100,0
	2006-2007		2007-2008		2008-2009	
	Kg	%	Kg	%	Kg	%
Barbadun	5,0	0,7	13,7	1,1	9,4	4,40
N. Ibaizabal	97,2	12,6	108,8	8,9	70,8	33,32
Butron	67,9	8,8	80,8	6,6	11,2	5,30
Oka	7,4	1,0	12,4	1,0	2,5	1,19
Lea	0,0	0,0	9,0	0,7	0,9	0,40
Artibai	0,0	0,0	0,9	0,1	0,0	0,00
Deba	200,5	26,1	430,7	35,4	29,4	13,85
Urola	83,9	10,9	134,0	11,0	8,8	4,12
Oria	307,0	39,9	427,2	35,1	71,6	33,70
Bidasoa	0,1	0,0	0,5	0,0	0,1	0,05
Total	769,0	100,00	1218,1	100,0	212,5	100,00

The last season 2008-2009 shows the lower catches since the managing plan started (table 2). Interviews with veteran local fishermen confirm this season as one of the worst that they have had in the last forty years.

This decrease in the catches has been observed in the rest of the autonomies of Spain and also in the rest of European countries.

Table.3 Effort (in hours) per river basin

RBD	RB	2006–2007				2007–2008				2008–2009					
		Boat	Land	Ns	Total	Boat	Land	Ns	Total	Boat	Land	Ns	Total		
Basque C. *	B. Inner	Barbadun	-	334	22	356		317	41	357	SC	SC	SC	SC	
		Nervion									SC	SC	SC	SC	
		Ibaizabal	16	1318	168	1501		1016	246	1261					
		Butron	67	946	212	1225	32	910	71	1012	SC	SC	SC	SC	
		Oka	-	97		97		331	0	331	SC	SC	SC	SC	
		Lea	-	143	40	183		132	11	142	SC	SC	SC	SC	
		Artibai	-	39		39		24	0	24	SC	SC	SC	SC	
		Deba	22	2919	126	3068	96	3182	23	3301	SC	SC	SC	SC	
		Urola	996	325	62	1382	1172	148	0	1320	SC	SC	SC	SC	
		Oria	1576	1400	98	3073	1932	1442	0	3374	SC	SC	SC	SC	
		Bidasoa	-	-	18	18	0	0	0	0	SC	SC	SC	SC	
		Total		2677	7551	745	10 973	3231	7502	391	11 123				

Despite the decrease in the number of licenses, an increase in the effort is given in both fishing types (table 3). A preliminary result of the last season 2008-2009 seems to follow this trend in effort.

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7.9.6 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

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

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)

7.10 Spain – Balearics Islands (NW Mediterranean)

7.10.1 General overview of the Spanish Mediterranean and Balearic Islands recreational fisheries

Mediterranean fisheries are influenced by a number of characteristics that are specific to this region. These include the narrowness of the continental shelf, which means that a substantial part of the fishing activities are carried out close to the coast, the presence of several straddling and shared fish stocks, the dispersion of scientific data, the importance of recreational fisheries and a lack of co-operation in fisheries management in this region. Recreational fishing is particularly important in the Mediterranean, and represents more than 10% of total catches in this area. Mediterranean fisheries play an important socio-economic role in the European fishing industry. Around 106,000 fishermen are employed on over 40,000 vessels (80% of them under 12 metres), which represents 42% of the employment in the EU catching sector. These vessels contribute 12% of EU catches. Many of the fish resources targeted in the demersal, pelagic and highly migratory fisheries are overexploited.

Overlapping with the small scale fishery in space and resource use, is a very important and increasingly popular recreational fishery, with more than 2 106 anglers and 300,000 recreational fishing boats in the Mediterranean. There are several management levels for Mediterranean coastal fisheries: first, the European Union supported by the CGPM (FAO), secondly the National Fisheries Authorities and finally the Regional Governments, each with different competences. Moreover, the impact of recreational fisheries on coastal resources has been recognized but not included in any assessment. Therefore, the actual state of the coastal resources has not been specifically evaluated and may vary depending on the species (Morales-Nin et al. 2010).

The Spanish law defines maritime recreational fishery as the one carried out for pleasure without any economic profit involved. The captures must be for personal consume. This fishery is multigear and multispecific. The Spanish Mediterranean comprises 5 autonomous regional Governments with different recreational fisheries management rules for inner waters, while open waters are competence of the central government, affecting mainly the sportive fishery for tuna. The total of fishing licenses from boat were estimated to be 110,000 on 2003 (Tragsatec 2004) distributed 32% in the Balearic Islands, 28% in Andalucia, 18% in Catalonia, 14% in Valencia Community and 8% in Murcia. The activity is centred in 200 recreational harbours. In the same study the socio-economy of the activity was studied by means of mail enquiries (N=4,200, answers=361). The main conclusions of the study were (Tragsatec 2004):

- The expenditure generated by the recreational fisheries is higher than the added value of the professional fishing. In Barcelona, Balearic Islands, Girona and Malaga the recreational fishery generates 4 times the added value of the professional fishing.
The recreational boats (not including the foreign ones) showed a density of 41 boat/km of coast.
- The recreational harbours had a density of 5.7 harbours by 100 km of coastal line.
- The mean profile of the angler is male (92.5%), with a middle age of 48 years, employed (31.3%), owner of a boat (50%) of 4.66 m size.
- The activity is mostly produced during summer, using hand line and trolling.

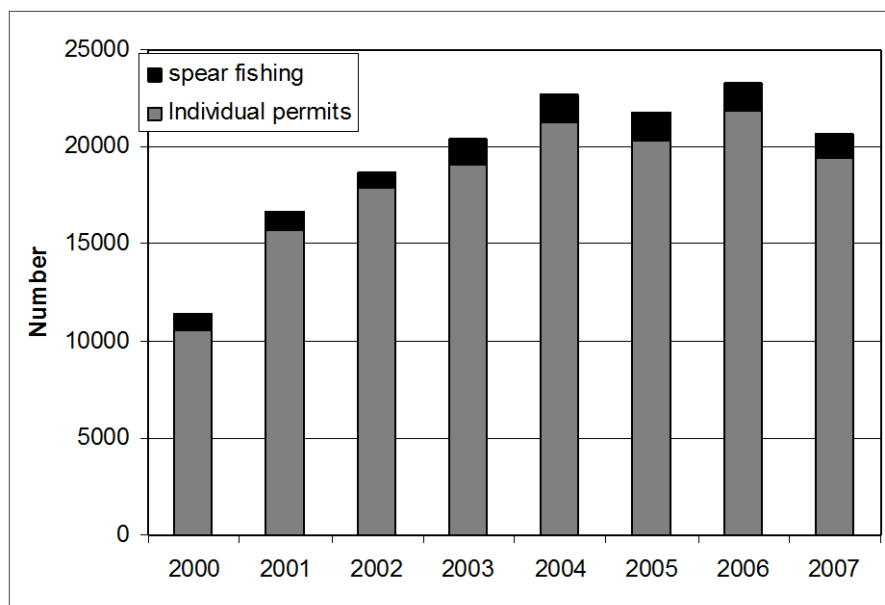
The present report focuses only in the recreational fisheries of the Balearic Islands because generalization at the scale of Spanish Mediterranean is problematic due to the large amount of regional specificities. However, as the relevance of the Balearic Islands is high it can be an example of the trends for the whole Spanish Mediterranean.

An aspect that is not reported, albeit might be a rising trend, is the resurgence of subsistence fisheries related to the economic crisis. No data exists but this might represent a sizeable part of coastal catches.

Balearic Island fishery

On the Balearic Islands (NW Mediterranean), the number of recreational anglers has increased from 19,000 marine licenses in 1999–2000 to the current number of 50,000 on 2010 (unpublished data from Direcció General de Pesca, Govern de les Illes Balears). This trend is related to an increased awareness of the requirement to have a license to fish and to a true increase in the number of anglers. Therefore, 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). Another relevant characteristic of the recreational fishery at the Balearic Islands is that it is largely multispecific.

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 11,367 permits on 2000 to 24,933 in 2006, the mean annual increase was 2,261 licenses for fishing from shore or from a boat. The evolution of the spear fishing licenses was more reduced from 810 to 1,417 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.



Evolution of the number of licenses between 2000 and 2007 (unpublished data from Direcció General de Pesca, DGPBG, from the Balearic Government).

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), which represents 27% of the landings from the artisanal commercial fleet (Morales-Nin *et al.*, 2005). Thus, the amount of carbon extracted annually is at least 137 kg C km⁻² 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).

Negative impacts on targeted species on the Balearic Islands were demonstrated by Coll *et al.* (2004) evaluating the changes in the catch per unit effort (CPUE) resulting from sport-spear tournaments since 1975 and demonstrated how the abundance and size of the Serranid *Epinephelus marginatus* (L.) have decreased as a consequence of this activity. Ordines *et al.* (2005) showed that sites with lower fishing pressures presented higher species richness and abundance than exploited sites. Most recently, Cardona *et al.* (2007) reported that the boat angling pressure on *Posidonia oceanica* (L.) Delile meadows may be related to a decrease in the abundance of the fish inhabitants.

7.10.2 Detailed description of national recreational fisheries

7.10.2.1 Categories of recreational fishing

There are three main groups of angling categories; 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) called sportive fishery.

1.2) Coastal boat angling

1.2.1 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.*). Pearl razor fish has high commercial value.

d) Electric reel at range of depths from 150m to 600 m (*Pagellus bogavareo*, *Epinephelus caninus*).

1.2.2 Jigging, relatively new but low yield. It focuses in species with very high commercial interest (*Seriola durmerili*, *Dentex dentex*).

1.2.3 Trolling (surface trolling and deep trolling) (*Trachurus sp.*, *Lichia amia*, *Auxis rochei*, *Seriola durmerili*, *Dentex dentex*).

1.2.4 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.

1.2.5 "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*, *Dicentrarchus labrax*, *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*)

2.2.2 Night fishing for Sea breams and conger.

2.2.3 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), cuttlefish fishing.

7.10.2.2 Geographic delineations

The Spanish Mediterranean coast is situated in ecoregion H, western Mediterranean. 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.

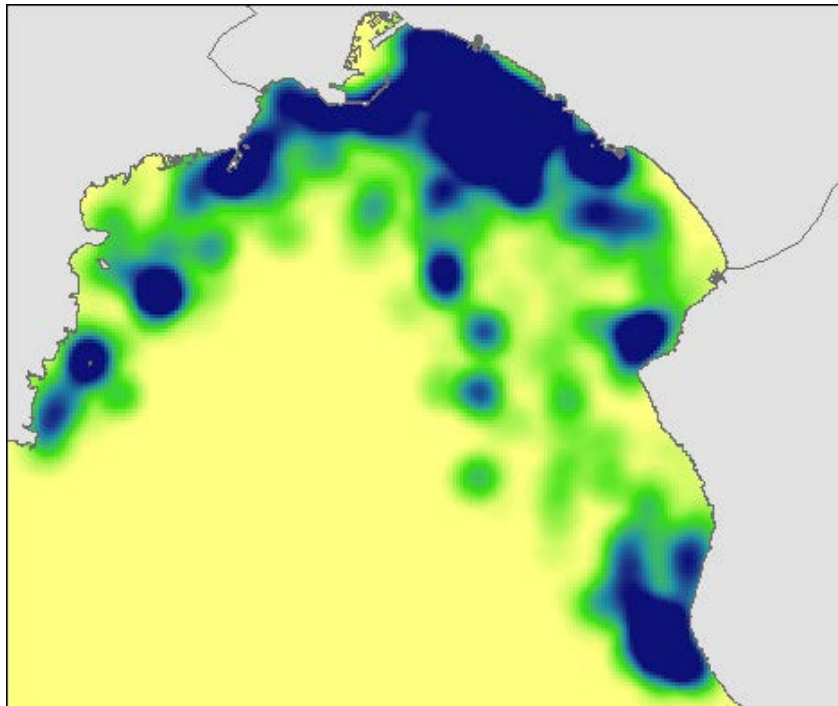
7.10.2.3 Water bodies

In the Balearic Islands there are no rivers, only two water reservoirs with introduced species and few marsh areas. Therefore the main activity is produced in the coastal waters included in the 20 nm inshore. A small activity is produced in outer coastal waters and open seas.

Rank from most important (largest participation of fishermen = 1) to least important (smallest participation). N/A is showed for no information available and (-) for no presence of this modality

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 in-shore hook-and-line fishing. However, the main fishing pressure occurs in Palma Bay where the main city Palma is placed and in the other main bays (Pollença and Alcudia).



Smoothed map by point pattern analysis of the fishing effort in Palma Bay from May 2005 to February 2007, each boat is weighed by its gears.

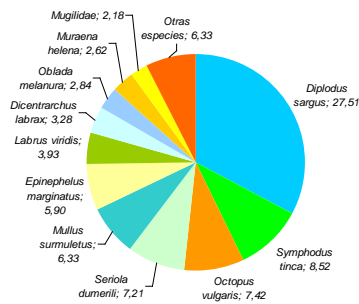
7.10.2.4 Platforms for fishing

Rank from most important (largest participation of fishermen = 1) to least important (smallest participation). N/A is showed for no information available and (-) for no presence of this platform

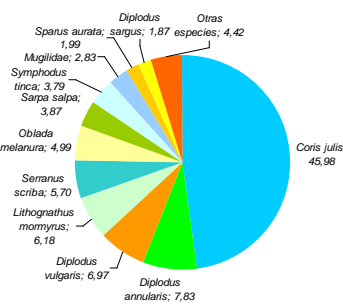
Platform	Ranking
Man-made structures (piers, jetties, docks, bridges etc.)	4
Beaches	3
Rocky shorelines	2
Private boats	1
Rental boats	N/A
Charter or Guide boats (for-hire boats where passengers pay as a group to hire the vessel and the services of the captain and crew in advance of the trip)	5
Head, Party, or Open boats (for-hire boats where passengers pay as individuals for space on the boat and can “walk on” just prior to the trip)	6
Other boats	
Other (specify)	

7.10.2.5 Target species or species groups

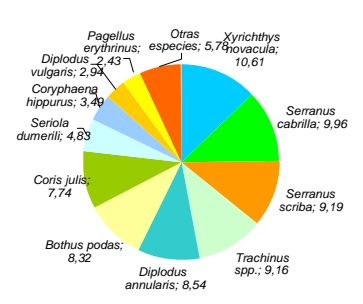
One of the main characteristics of recreational fishery at the Balearic Island, and possibly at all the Spanish Mediterranean is the large number of target species. The catches made from boats constituted the largest number of species (54 species), followed by fishing from shore (43 species), with spearfishing (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, *Xyrichthys novacula* and *Seriola dumerili*, are also among the most frequently caught.



Spearfishing
 90 t/yr
 4% anglers



From land
 855 t/yr
 33% anglers



From boat
 1734 t/yr
 62% anglers

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
Sphyracidae			
<i>Sphyracna spp.</i> *	XXX		X
Trachinidae			
<i>Trachinus spp.</i> *	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).

7.10.2.6 Fishing gears used

Rank from most important (largest participation of fishermen = 1) to least important (smallest participation). N/A is showed for no information available and (-) for no presence of this gear

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)	

7.10.2.7 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).

7.10.2.8 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...).

7.10.2.9 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 and access regulations (Morales-Nin *et al.* 2010) such as minimum legal sizes, daily bag limitations, seasonal closures, and marine protected areas.

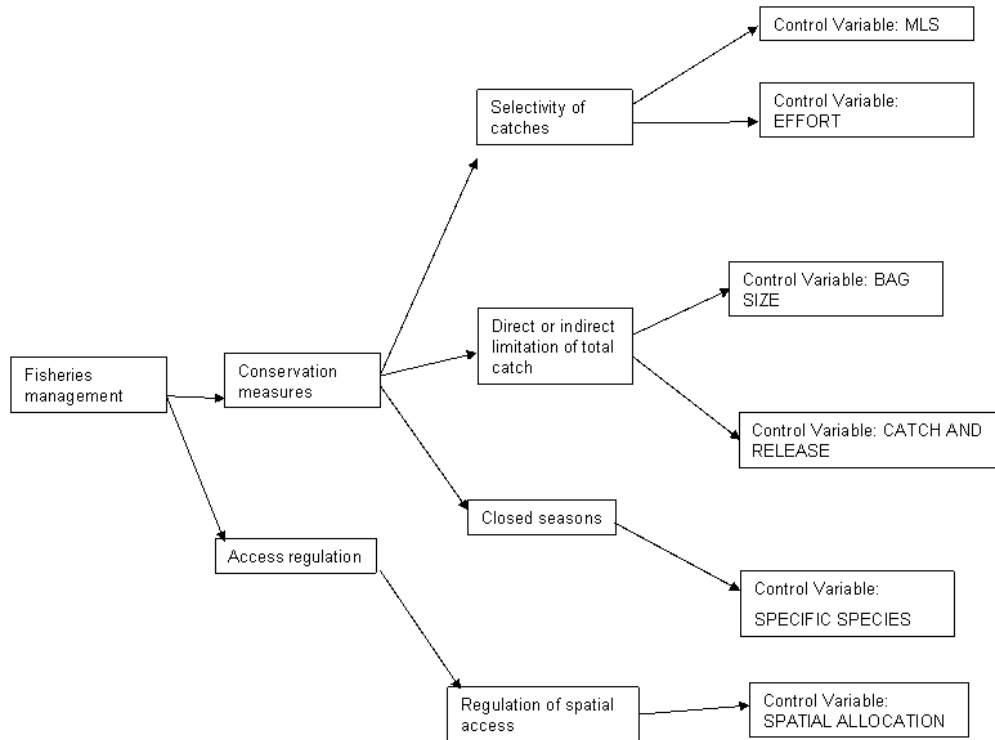
MPAs, Cabrera National Park and closed zones represent nearly 63.500 Ha of protected coastal zone with 16.500 Ha totally closed to any fishery. Recreational fishing in the partially protected areas of MPAs is allowed with additional rules. Management plans are specific for each MPA but it is common to 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 have 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 pearl 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 harbours 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 (Morales-Nin *et al.* 2010).

Enforcement of a minimum legal fish size as a way to reduce fishing mortality in early life-history stages has been considered an important tool for the management of recreational fisheries (Lewin *et al.*, 2006; Arlinghaus *et al.*, 2007). In the Balearic Islands, there are a number of species targeted by the recreational anglers for which a minimum legal size limit has been stipulated (UE Regulation 1967/2006, from the council of 21st December 2006, and other local regulations). Moreover, daily bag limitations, amount of gear limitations (i.e., number of rods and hooks), seasonal closures, marine protected area establishments and, more recently, minimum hook sizes, are used by the local administration to manage the recreational fishery from the Balearic Islands. Many of the tools focus on the reduction of the mortality of under- or small sized fishes. However, the effectiveness of this measure should be reinforced by restrictions on gear characteristics to bias the catches outside the illegal lengths of the target species (Alós *et al.*, 2009). Restrictions on gear characteristics should be compatible with acceptable catch and harvest rates from the point of view of the anglers. Adaptive management (e.g., Alós *et al.*, 2008) advocates an agreement of all the partners concerned with management measures.

7.10.3 Possible sampling frames

A three step study is being carried out (2005-2011) in Majorca island by IMEDEA (CSIC/UIB), initially promoted by the regional D.G. Fisheries, and with the support of local fishing organizations and the participation of other research Institutes. In each step the data are updated because the scenario is evolving.

First stage: Project SUMA'T (2002-2005) to characterize the size, modalities, distribution, catch and angler profile of the recreational fishery.

Second stage: Project ROQUER (2006-2008) to complete the fishing profiles and spatial distribution, including the effects upon the fish biology and distribution.

Third stage: Project CONFLICT (2009-2011) to obtain a socio-economic profile of the recreational fishery and its overlapping with the small-scale fishery. The tourist's relevance on the recreational fishery is explored.

Main goal: to know the fishery and the anglers to provide essential data to the stakeholders for an adaptative management.

7.10.3.1 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.

7.10.4 Available statistics

Use the following table to summarize any existing statistical results or data sets.

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 Project CONFLICT (2009-2011)
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)	

7.10.5 Survey methods

Different kinds of information acquisition have been used and evaluated in the recreational research projects done by our research group:

1) Fishing licenses.

Data about social aspects such as spatial (residence location) and temporal patterns or age and sex participation can be accessible from these licenses.

Area coverage: entire Archipelago

Spatial resolution: by towns

Temporal resolution: by year

Fishing modalities: all

Cost: 0 (provided by the regional government)

Operators: 1 data bank manager

Limitations: illegal anglers not registered

2) Recall telephone survey

Area coverage: Majorca Island, the phone calls by town were weighed by the size of the relative population

Spatial resolution: by towns

Temporal resolution: undefined (active anglers)

Fishing modalities: all

Cost: > 5000 phone calls, 1271 positive answers

Operators: 2

Limitations: 4.91% of the people interviewed in a veracity test carried out with the members of a fishing club denied being active fishers. Moreover, the recalled mean bag weigh was unrealistic.

3) Face-to-face interviews to 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 midmorning along the shore.

Area coverage: Majorca island

Spatial resolution: by stratum

Temporal resolution: days

Fishing modalities: all

Cost: travelling, per diems, car rental

Operators: 5

Limitations: the most active anglers were over-represented

4) Mail recall surveys

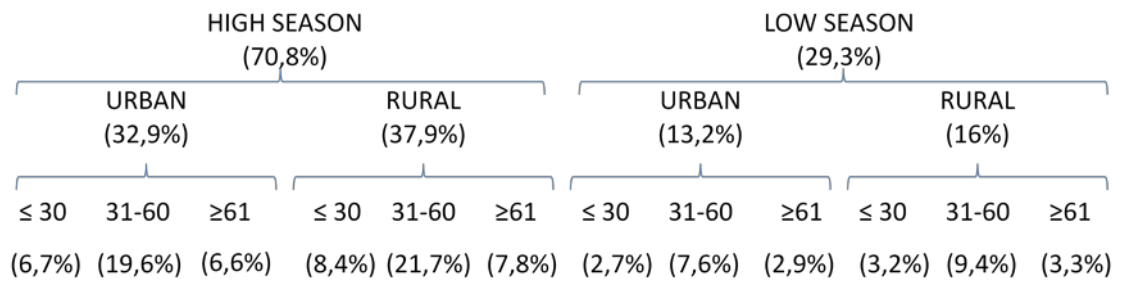
The aim of this survey was to improve the knowledge about the Mallorca recreational fishermen profile in social and economic terms. In Mallorca (and all the Spanish territory) recreational fishermen have to own a recreational fishing license. Information about the fishermen profile (age, municipality, address, etc...) is required to get the license. The Spanish law bans administration from give personal information (name, address and national identification number) to other organizations including research centres. Fishermen agreement was needed to obtain their address. In order to carry out this study the possibility to collaborate in a survey regarding recreational fisheries in Mallorca Island was included in the application form to get the recreational fishing license.

Using the general public data (not personal information) of the recreational fishermen holders the recreational fishermen population was stratified depending on the season when they get the license (high or low season), the municipality where they live (urban or rural), and their age. High season was considered from May to October, and low season from November to April. The 53 Mallorca municipalities were collapsed into two groups (rural or urban). Finally the fishermen age was collapsed in three different groups: under 31 years old, from 31 to 60 and 61 or more. The survey was planned in four different waves. The first and the second ones were focused on the low season and high season respectively. The third and fourth waves were planned to avoid the possible bias found in the first and second wave in terms of municipality and age.

However, a poor 5,6% of the recreational fishermen agreed to participate in the survey, rendering useless the survey stratification because of insufficient collaborators to try to correct the bias. Therefore only three waves of surveys were sent: a first one during the low season, a second one the high season and a third one covering all remain addresses we had.

The stratification offered using the official data was the following:

RECREATIONAL FISHERMEN POPULATION (MALLORCA 2009)



Procedure: A 75 question survey was send to the Mallorca fishing license holders who agreed to take part in a socio economic study. The survey was edited in book format. Each mail included the survey, a cover letter and a pre-paid envelope to let the polled fishermen send the fulfilled survey. A first reminder was send 12 days after the survey sending. A second reminder was send nearly 12 days before the first reminder. A telephonic reminder was carried out about 10 days after the second mail reminder. A second mail survey was send to the ones who said they had lost the survey and agreed to collaborate in case they received another one.

General results (three different waves together)

Surveys sent: 895.

Surveys returned by the post office (wrong address or unknown addressee): 115 (13%)

Number of surveys received: 325 (in course)

Response tax: 42% (in course)

Cost:

- a) Staff: 1
- b) Time required: 8 weeks / wave = 24 weeks
- c) Equipment / Requirements
 - a. Survey edition: 800 €
 - b. Surveys sending: $895 \times 0,75 \text{ €} = 671,25 \text{ €}$
 - c. Surveys received: $325 \times 0,45 \text{ €} = 146,25 \text{ €}$
 - d. Reminder edition: 210 €
 - e. Reminders sending: $1399 \times 0.45 = 629,55 \text{ €}$
 - f. Phone calls: 188

Vulnerability to possible biases:

The illegal fishermen (the ones who don't get the recreational fishing license) are undercovered). The sample was stratified by season (high / low), origin (urban / rural) and age. Different waves were planned to correct the bias found using this stratification. High and low season were considered separately and a second wave for each season was considered to correct the possible bias in origin and age. The fact that in Spain the agreement of the fishermen is needed to obtain their address makes the bias correction impossible because we hadn't enough collaborators with the desired characteristics to avoid the found bias in origin and age.

5) Volunteer recreational anglers fishing logbooks

Area coverage: punctual

Spatial resolution: depending of the volunteer, 1 Km²

Temporal resolution: week

Fishing modalities: all

Cost: 0

Operators: 1

Limitations: unrealistic reports, few provided correct reporting

6) Monitoring recreational fishing tournaments

From 1998 to 2009, the DG Fishing 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.

Area coverage: punctual

Spatial resolution: depending of the tournament

Temporal resolution: punctual

Fishing modalities: all

Cost: assumed by the DG Fisheries

Operators: 4

Limitations: size and species selectivity depending of the tournament

7) Monitoring tourism relevance for recreational fishing

The Balearic Islands are one of the preferred touristic destinations in the Mediterranean with an estimate of 10 million visitants on 2008. The relevance of this temporal population must be included in any assessment albeit no data are available of the fishing activities.

7.1) The general tourist survey

The aim of this survey was to know how many tourists practiced recreational fishing and establish their profile and quantify their fishing effort and their expenditures regarding their fishing outings. On the other hand the second goal was to know how many tourists hadn't been fishing in Mallorca despite they were recreational fishermen in their country or place of origin and to know why didn't they fished in Mallorca.

This survey was carried out at the airport and the port of Palma de Mallorca. Both AENA and Autoritat Portuaria (airport and port solicitors respectively) let the pollster go into their installations and interview the tourists while they were waiting to go onboard coming back to their countries. The cost to gain access to airport and port installations is zero to public research institutions like IMEDEA. Private institutions or agencies have to pay a fee to interview people at the airport and port.

Number of surveys done: 1448

Response tax: 96, 3% (1448/1504)

Cost:

- a) Staff: 2 people / day
- b) Time required: 11 working days
- c) Equipment: none

Vulnerability to possible biases:

- a) Nonresponse: This methodology offered a high response tax. None of the pollster spoke German either French. The surveys were carried out in Spanish and English so French and German population can be undersampled. Most of the tourist who refused collaborate adduced they do not speak English or either Spanish.
- b) Undercoverage: The survey was done in August to minimize the time and effort required to obtain a large number of surveys done. Because of this the results should be considered only in high season.

7.2) The Nautical tourist survey

The aim of this survey was to know how many nautical tourists practiced recreational fishing and establish their profile. The second goal was improve the knowledge of the nautical tourist profile in Mallorca.

As nautical tourists we considered the boats which didn't spend the night before the survey in their base port. The survey was carried out in different places all around Mallorca, depending on the weather conditions. The pollsters boarded the tourist boats while they were anchored, identifying themselves as pollsters from the university. After a first round delivering surveys, each 5 – 10 surveys delivered, depending on how far were the boats one from another, the pollster did a second round picking the fulfilled surveys up.

Number of surveys done: 405

Response tax: 96% (405/422)

Cost:

- a) Staff: 2 people each day
- b) Time required: 11 working days.
- c) Equipment: 6 meters length pneumatic boat with a 90 Hp engine. Towing vehicle.
- d) Requirements: Towing large vehicles license, boat license.

Vulnerability to possible biases (undercoverage, nonresponse):

- a) Nonresponse: This methodology offered a high response tax. There isn't any evidence of bias. The surveys were delivered in English, French and Spanish. The nautical tourist from Germany agreed, in this case, to answer the English version of the survey.
- b) Undercoverage: The survey was done in August to minimize the time and effort required to obtain a large number of surveys done. Despite there isn't any official data regarding nautical tourism in Mallorca its development during winter is almost nonexistent so it's assumed the survey offers a good representation of the reality of the nautical tourism.

8) The fish consumer survey

The aim of this survey was to know if the recreational fishermen are avid fresh fish consumers, how many recreational fishermen use to go to the market to buy fish and to know about the fish consumer habits of the Mallorca population.

The "face to face" survey was carried out in two different fish markets considering two different seasons, high (from May to October) and low (from November to April) season.

Number of surveys done: 397

Response tax: very low, less than 30%.

Cost:

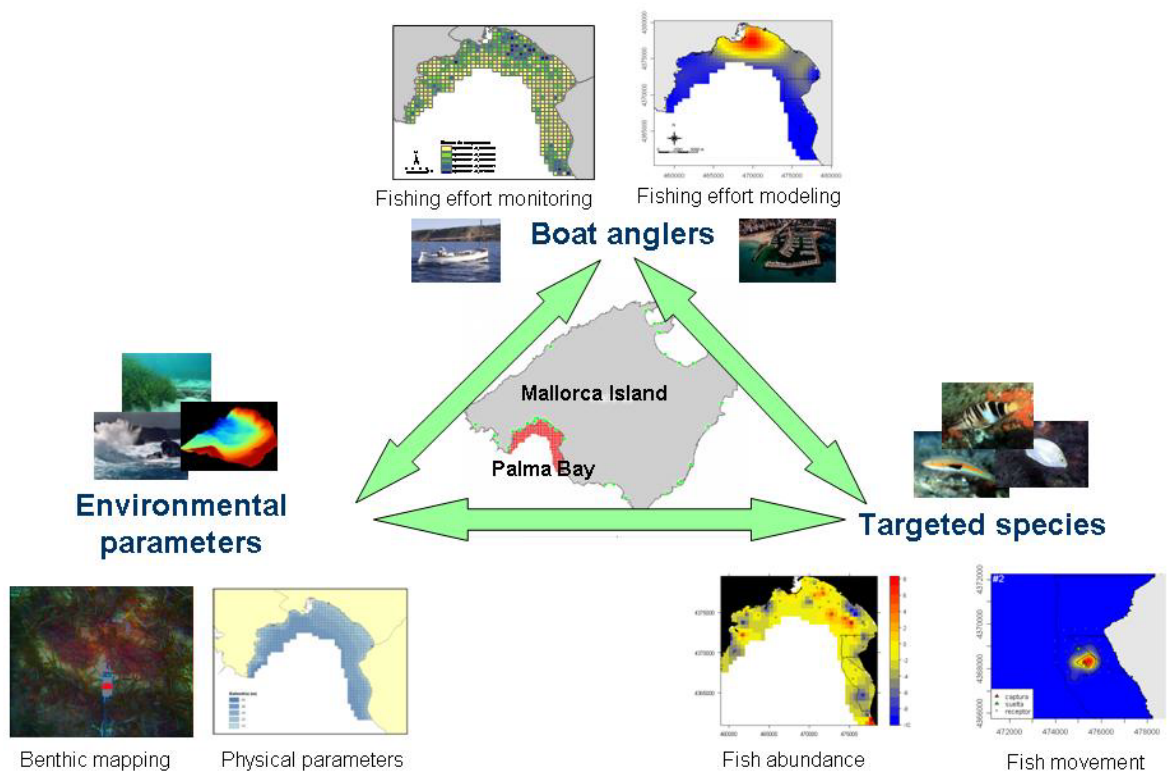
- a) Staff: 2 people each day
- b) Time required: 15 working days.
- c) Equipment: none

Vulnerability to possible biases: Nonresponse rate can induce nonresponse bias in survey estimates. The survey was carried out from Monday to Friday, it's possible a different fish consumer profile on Saturdays, when most of the people enjoy a free day.

9) Direct effort 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 from 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.

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.

An important role in moving towards ecosystem-based management is played by the defining and understanding of the relationships among marine habitat characteristics, species distribution and human activities. This work summarizes results regarding the spatial distribution of recreational fishing effort and main targeted species by using different geospatial applications. First, spatial distribution of fishing effort was obtained by counting all recreational fishers from a survey vessel, recording each angler position with a GPS. The main goal of this monitoring concerns the development of spatial predictive models in order to determine main spatial pattern of boat anglers. In addition, we preliminary data regarding map-based interviews suggest the usefulness of incorporating anglers knowledge into spatial management.

Second, spatial distribution patterns of target species were analysed by experimental sampling. Spatial movement patterns of different fish were analysed using conventional anchor T-tags and acoustic telemetry. Home range estimates are used to evaluate the usefulness of this species as bioindicators of high fishing effort.

Finally, the benthic mapping of seagrass meadows is incorporated in the GIS and the spatial modelling process. In conjunction with other oceanographic features such as bathymetry, wave exposure, or water turbidity, this information is used to characterize the Essential Fish Habitat (EFH).

Spatial and temporal distribution of the recreational fleets fishing effort: Visual census

The objective of the visual census is the characterization of the spatial and temporal distribution of the recreational fishing efforts within the geographical area of Palma Bay. Two hours of average are necessary to cover all Bay, spending more time correlated with the number of recreational boat. The *Doncella* is the boat (5.20 meter length) with which is utilised by carried out the census. Two persons (PhD Students, technicians or investigators) are required, one managing the boat and another recording the different parameters. In this sense, during the visual census, we recorded the GPS position, modality practised, number of anglers, boat length, conditions of the sea (i.e. temporary, calm) and of the weather (i.e. % cloudy, sun).

In order to characterize the spatial and temporal distribution of the all modalities of recreational fishing, six visual census per months are realised. The census are distributed 3 in the morning and 3 in the evening, of which 3 census in working day and 3 in holidays (weekends) are executed.

Until February 2010, 70 visual census have been realised. We have censused 2,692 angling boats and detected 8 modalities of angling (Squid fishing with hand lines, Trolling Squid, Octopus fishing, "Roquer", Bottom fishing "pesca de fondo", trolling, jigging and the fishing of the particular species *Xyrichthys novacula*). 6 types of boats (boat, sailboat, launch, motorboat, pneumatic boat, kayak, and typical Balear boat "llaut") between 3-15 meter length with a number of angler between 1-7.

We apply Multi-variant analysis (multi-modality) to study the general patterns of angling effort in Palma Bay. A Response matrix explains the abundance of boat depending of the modality and census. Moreover, an Explanatory matrix explain the characteristics of the census such as morning vs evening, working days vs holidays, months of the year, sea and weather conditions. Therefore, the 51% of the samples variance (census) is explained by the explanatory variables such as morning vs evening (27%), working days vs holidays (4%), months of the year (11%), sea and weather conditions (8% and 1%, respectively).

We will monitor the fishing efforts until January 2011 (two years of sampling). An important sampling efforts that contribute to knowledge the fishing efforts of a fishery sector in expansion.

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.

Area coverage: Palma Bay

Spatial resolution: 0.25 Km²

Temporal resolution: day

Fishing modalities: boat fishing

Cost: the high work force required is possible in the frame of a main project and 3 PhD thesis

Operators: 6

Limitations: high cost

7.10.6 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)						

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

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: Example summary of national recreational fisheries: angling (National Tables 1&2 could include finer scale resolution at the “main species targeted” level, if this is necessary for the design of surveys and sampling schemes. However avoid making the tables too long and complicated.) 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)	Lithognathus mormyrus, Sparus aurata)	Rod and line (bait)	S	MLS, BL,A	B-C	<Partial	Low
	Private boats	Xyrichtys novacula	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 (Serranus cabrilla 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 (Trachurus sp, Lichia amia, Auxis rochei, Seriola durmerili, Dentex dentex)	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

Table 2: Example summary of national recreational fisheries: non-angling: We omitted this table because the only relevant non-angling modality is spearfishing.

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

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 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	

In “Availability” column enter “exhaustive” if the following conditions are true:

- -effectively all recreational fishermen are potentially contactable through mail-shots;
- -effectively all recreational are required to have a license or permit or otherwise register their activities on a database;

- -effectively all recreational fishermen are potentially contactable by telephone (either through random-digit-dialing, phonebooks, or telephone numbers given when buying licenses or permits);
- -effectively complete lists are available of all points of departure or return for fishing trips where fishermen could be interviewed

If the fraction of fishermen potentially not contactable is sufficiently high, or the lists of departure/return sites sufficiently incomplete, so that potentially large biases could be present in surveys, enter "partial". If no lists are available, enter "none". If no information is available on sampling frames, enter "N/A"

7.11 Sweden

7.11.1 General overview of national recreational fisheries

There is no mandatory requirement in Sweden to collect data regarding recreational fisheries. In Sweden recreational fishing is not licensed. Sweden do not either have any register on recreational fishermen which is a problem when it comes to collecting data on recreational fisheries.

Swedish recreational fisheries are spread out along a very long coastline, in rivers and far 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.

Fishing rights in inland waters are in Sweden private in principle, and therefore fishing is not allowed without being either the fishing right owner or having bought or been given the right to fish by the owner. Fishing in inland water is commonly organised by an association of fishing right owner in one or several lakes and rivers, i.e. fishing management units. Sweden has 95 700 lakes, 60 000 lakes over 4 hectares area, and some 100 000 km running waters.

Fishing in coastal waters using rod and line is free of charge and so is also the case in the five major lakes, Vänern, Vättern, Mälaren, Hjälmaren and Storsjön. In part of this water areas also net fishing and other methods is allowed and free of charge. The Swedish Board of Fisheries is responsible of the regulation of these fisheries.

Fishing in the open sea is regulated within the general framework of the EU's common fisheries policy. Sweden also has its own national regulations, primarily for coastal waters, the five major lakes and rivers emptying in these lakes or in the sea. It is the Board of Fisheries that lays down fisheries regulations at the national level.

The primary motive for fishing is relaxation, to enjoy nature and consumption in the household. The kept part of the catch are estimated 18 100 in 2006 and 11 800 ton in 2008. The total catch in tons is approximately equally distributed between marine and inland recreational fisheries. The marine part of the catches are estimated 9 000 ton (2006) and 4 100 ton (2008). The inland water part of the catches are estimated 9 000 ton (2006) and 7 700 ton (2008).

The total number of fishing days in 2008 was estimated 13.0 million days. Fifty percent of the fishing days are situated not more than 30 km from peoples home and 80 percent not more than 100 km from their home. Twenty percent of the fishing days are long-distance trips mainly to the Northern Sweden.

The largest number of fishing days, 87 percent, is estimated for rod and reel while other methods are estimated 13 percent of the fishing days. The lowest catches per fishing day are estimated for rod and line. Other methods, often fishing with net, are more effective.

7.11.2 Detailed description of national recreational fisheries

7.11.2.1 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".

7.11.2.2 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.

7.11.2.3 Target species or species groups

(Only some general information given here)

Cod

Angling in the Sound target cod (using private boats or charter boats)

Angling in Skagerrak, Kattegat and Baltic Sea

Fishing with nets in the Sound, Baltic Sea, Skagerrak and Kattegat.

Salmon

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.

Net, seine fishery or fishery with trap-nets by fishermen not record as commercial fishermen coastal regions in Baltic mainly coastal regions in Gulf of Bothnia and in rivers.

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.

7.11.2.4 Fishing gears used

Estimated for all recreational fishermen, not only salmon and cod, as one group.

Gear type	Used by % recreational fishermen
Rod and line, or hand-lines	85%
Gill net	10%
Pot	4%
Trap	1%

For salmon a natural division is “all angling” in one area/river.

Traps would only be important for lobster (only traps are allowed).

A very few non licensed fishermen use trap nets in the coastal salmon fishery but the catches can be important and the aim is marketing of catches.

7.11.2.5 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.

7.11.2.6 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.

7.11.2.7 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 30 cm (Kattegat, Skagerrak) or 38 cm (Baltic) and bag limit is 3 fish per day in some areas.

Offshore salmonid trolling is so far not restricted, coastal recreational trap-net fishery may be affected by regional restrictions close to wild salmon rivers. In rivers there are seasonal restrictions as well as often 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.

7.11.2.8 Definitions on recreational fisheries and the DCF

It is important to clarify the catch-categories 2011 when marketing of recreational catches in the sea will be prohibited. Where do catch data from marketed catches from 2011 belong which neither is from recreational fisheries or professional fishermen and how can we compare data of recreational fisheries 2010 and 2011.

The definitions on recreational fisheries in the DCF is:

- Recreational fisheries mean non-commercial fishing activities exploiting living aquatic resources for recreation or sport.

The COUNCIL REGULATION (EC) No 1224/2009 establishing a Community control system for ensuring compliance with the rules of the common fisheries policy gives the following definition on recreational fisheries:

- Recreational fisheries means non-commercial fishing activities exploiting marine living aquatic resources for recreation, tourism or sport. Article 55 in the control regulation also declares: The marketing of catches from recreational fisheries shall be prohibited. Recreational fisheries in inland waters are not included in article 55.

Until 2010 non-commercial catches that has been marketed also are included in the data collection on recreational fisheries – at least in Sweden. An unknown part of the catches has been marketed. This part is probably relative small.

In some regions and for some species part of the catches is marketed in a higher degree. Especially salmon net, seine fishery or fishery with trap-nets. Most of these are operated by commercial fishermen, who are obliged to use logbooks. However, trap-nets are also operated by non-commercial fishermen without obligations to report the catches, but the aim is marketing of catches.

7.11.3 Available statistics and the recreational part of TAC

Below we provide a 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					
Cod E Baltic, 25-32	49200	49	3	52	0
Cod W Baltic, 22+24 ³		21	101	122	
Sound, 23 ³		86	437	523	
Cod W Baltic total, 22-24	28 400	107	538	645	2
Cod Kattegat, 21	850	3	29	32	4
Cod Skagerrak, 20 ⁴	3 300	12	152	164	5
Salmon ^{5,6}					
Baltic, coast and sea 22-29		333	333	666	0
Gulf of Bothnia, coast and sea 30-31		7029		7029	2
Baltic Sea, 22-31 ⁵	460000	7362	333	7695	2
Rivers, 22-31		8049	4180	12229	3
Baltic Sea, including rivers, 22-31		15411	4513	19924	4

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 takes 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 fishermen 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 was submitted to the WKSMRF meeting in 2009.
National survey on recreational fisheries 2009 gave much lower estimate of the total cod catches, total catch 2008 - 276 ton.
 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.
 6. The recreational salmon catch in coastal and sea areas made up 6% of the Swedish catch quota and as only 65% of the catch quota was utilized, the recreational catch made up 9% of the catch covered by TAC regulations. The total recreational catch in sea, coast and rivers as estimated to 20% of total salmon catch.
-

Overview on national studies of recreational fisheries regarding general information and catches of cod, eel, shark and salmon.

The following table 1 – 4 gives some information on general surveys (1975-2005, 2007 – 2009), surveys on salmon (2006-2010) and pilot study on cod (2010).

Table 1. Some information on recreational fisheries surveys realized 1975 – 2005.

Survey, Method	General Information	Cod, catch	Eel, catch	Salmon, catch	Shark, catch	Cost, staff, time required
1975,1990 , 1995,2000, 2005. A nationwide postal enquiry. 11000-6000 randomly selected inhabitants between 16-74 years. Response rate 60-70% after max 3 contacts. Some years telephone interview for part of the non respondents. 11 – 35 questions	Only yearly data. Number of fishermen and fishing days, motive for fishing, total expenditure, total catch and distribution on some species. Gears used. Differences between age, sex and parts of Sweden. Later surveys show that the surveys give 43% overestimation number of fishermen, and 30% of catches.	Catches of cod only 2000, 2005. Results: 2000 - 6.000 ton +/- 2.000 ton. 2005 -1.703 ton +/- 408 ton. At least 30% overestimation on catches. Not possible to use data without validation and cross-controlling other sources. Difficulties using data in regions, especially catch data of species.	Catches of eel only 2005. Catch data very uncertain. At least 30% overestimation on catches. Not possible to use data without validation and cross-controlling other sources. Difficulties using data in regions, especially catch data of species.	Catches of salmon only 2005 – 1.303 ton +/-303 ton. Uncertain data. At least 30% overestimation of catches. Catches is probably including trout and rainbow trout. Not possible to use data without validation and cross-controlling other sources. Difficulties using data in regions, especially catch data of species.	No information	Estimated cost if the survey was done 2009 carried out by Statistics Sweden: 400.000 SEK – 600.000 SEK. Staff costs Swedish Board of Fisheries not included.

Table 2. Some information on national recreational fisheries surveys realized 2006 – 2009

Survey, method	General information	Cod catch	Eel catch	Salmon catch	Shark catch	Cost, staff, time required
2007,2009. A nation-wide postal enquiry in two steps. Step no 1. 10 000 randomly selected inhabitants 16-74 years. Questions to find fishermen. Response rate 60-70% after max 3 contacts. Interview part of non respondents Step no 2. Enquiry to the about 1800 persons actually fishermen. 35-40 questions About 1300 answers	Only yearly data. Number of fishermen and fishing days, motive for fishing, total expenditure, total catch and catch distribution on nearly all species. Gears used. Differences between age, sex, and parts of Sweden. Difficulties using data broken down in regions, especially catch data of species.	Results: 2006 – 893 ton +/- 444 ton 2008 – 276 ton +/- 160 ton Not possible to use data without validation and cross-controlling other sources. Difficulties using data in regions, especially catch data of species.	Recreational fisheries on eel is prohibited	Results: Baltic and Baltic rivers 2006 – 210 ton +/- 124 ton. 2008 – catch data recreational net fisheries very uncertain - catch data rod and line including lake Vänern and Vättern, Skagerrak, Kattegat 163 ton +/- 156 ton Not possible to use data without validation and cross-controlling other sources. Difficulties using data in regions, especially catch data of species.	No observations of catches in the enquiries	Estimated cost carried out by Statistics Sweden: 950.000 SEK. Staff costs Swedish Board of Fisheries not included.

Table 3. Some information on national recreational fisheries surveys on salmon in the Baltic Sea and in rivers emptying in Baltic Sea 2006 - 2009. Including broodstock fishery and marketed catches

Survey method	Salmon catch	Cost, staff, time required
Recreational salmon fisheries	2006	2006: 158.000 SEK
Rivers: logbooks from licensed fisherman and from fishing clubs etc. (enquiries, surveys); collected annually, large variation in fisheries issues and data collection.	- 25 000 salmons - 130 ton	2007: 478.000 SEK
Coastal: Available number of traps of recr. fishermen and catches (length's also). Compared with data from of comm. Fishermen.	2007 - 26 300 salmons - 147 ton	2008: 154.000 SEK
Offshore: voluntary reports from trolling in harbors, investigations only necessary in intermediate years	2008 - 38 300 salmons - 208 ton	(including staff cost, freight, samples. For 2007 258.000 SEK of the total cost were used for conducting surveys on trolling fishery, and survey on coastal gear)
	2009 - 36 700 salmons - 188 ton	

Table 4. Recreational fisheries actions to be carried out by Sweden according to the planned sampling for 2010.

Cod	Eel	Salmon	Cost, staff, time required
<p>Pilot study in the Sound (Öresund)</p> <p>In the Swedish national surveys it has been estimated that 50% of all the cod taken in the recreational fisheries originates from fishing in the Öresund area (ICES division 23) The Swedish Board of Fisheries has started a pilot study where:</p> <ol style="list-style-type: none"> 1. The skippers of all the charter vessels reports the daily catches in a "log-book" during the first months of 2010. 2. A survey is carried out targeting the fishing guests of the charter vessels asking questions of their other recreational fishing habits and some socio-economic issues (i.e. the costs associated with their fishing). <p>Not possible to use data without cross-controlling other sources.</p>	<p>It is prohibited to fish for eel – additional information to RCM</p>	<p>Rivers: logbooks from licensed fisherman and from fishing clubs etc. (enquiries, surveys); collected annually, large variation in fisheries issues and data collection.</p> <p>Coastal: Available number of traps of recr. fishermen and catches (length's also). Compared with data from commercial fishermen.</p> <p>Offshore: voluntary reports from trolling in harbors, investigations only necessary in intermediate years.</p> <p>Not possible to use data without cross-controlling other sources.</p>	<p>Pilot study in the Sound - 220 000 SEK inclusive staff costs</p> <p>Salmon surveys - 521 000 SEK including staff costs, probably more – onsite studys will be done in two rivers.</p>

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 (WKSMTF) 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

Annex 4: Summary from the ICES-PGRFS Baltic meeting from 16–17 September 2010 in Charlottenlund, Denmark.

During the ICES-PGRFS Baltic meeting from 16-17 September 2010 in Charlottenlund, Denmark representatives from Denmark, Sweden and Germany discussed the potential for regional coordination of recreational fisheries surveys. Exemplary, estimated cod catches in SD 22-24 in 2009 varied between 2200-3400 t in Germany, 600 t in Denmark and approximately 500 t in Sweden.

Due to the progress in this area and the relative high recreational catches the potential to include recreational fisheries catch data in the stock assessment for the western Baltic cod stock was investigated together with a stock assessment scientist. An outcome of this discussion was to aim for the inclusion of recreational fisheries into the assessment as a tuning fleet, by setting up panels of fishermen and/or fishing vessels. MS discussed the panel surveys required to establish a common tuning fleet in the western Baltic. The group discussed the possibility to include recreational fisheries data into FishFrame as special métier.

Through the exchange of information about the national recreational fisheries surveys and the methods used the potential for complementing and validating these surveys was discussed. In particular in bordering sea areas, e.g. the Sound, CPUE data and/or length distributions of catches can be either used to validate findings or complement surveys.

Other species currently not covered by regulation 2008/949/EC but with considerable recreational fisheries catches were identified. These were European lobster for Sweden and Denmark and Sea trout for Sweden, Denmark and Germany. MS discussed the need to include these species in ongoing surveys and to investigate the potential for a coordinated approach MS discussed the value of socioeconomic data of recreational fisheries and encouraged each other including the collection of socioeconomic data into the recreational fisheries surveys.

During the ICES PGRFS-Baltic meeting it was indicated that a particular problem in the estimation of recreational fisheries catches was the question how to address release mortality. The implications are twofold: (a) release mortality of undersized fish is highly unknown for the affected species in the Baltic and (b) it was unclear to which extent MS need to sample released fish. The need to set up a pilot project to investigate release mortality was identified. Numbers of released fish should be collected uniformly across MS.

Recommendations from the ICES-PGRFS Baltic meeting from 16-17 September 2010 in Charlottenlund, Denmark.

<i>ICES PGRFS-Baltic 2010 Recommendations</i>		
Coordinating fishery surveys	<ol style="list-style-type: none"> 1. Complementing national fishery surveys with data from other Member States (MS), 2. Validation of national surveys through MS comparison, 3. Tourist fishermen. 	<ol style="list-style-type: none"> 1. Not all MS sample at the temporal resolution required by the DCR. Low resolution data can be raised to a higher resolution by using high resolution data from other MS, 2. Key information such as CPUE data is collected differently between MS and should be used to validate national sampling procedures, 3. Information on tourist fishing days/catches should be exchanged between MS to ensure proper sampling.
Panel survey/tuning fleet	<ol style="list-style-type: none"> 1. Setting up regional coordinated panel survey/tuning fleet. 	<ol style="list-style-type: none"> 1. A panel of fishermen and/or fishing vessels will provide the opportunity to improve and complement the questionnaire surveys and will in addition provide the stock assessment with a tuning fleet.
Include new data	<ol style="list-style-type: none"> 1. New species: Sea trout, European lobster, 2. Socioeconomic data. 	<ol style="list-style-type: none"> 1. Some species (not covered by the DCF) have considerable recreational fisheries catches and should be sampled in the future. Marginal costs of adding new questions to questionnaires are low, which provides a cost effective solution.
General improvements	<ol style="list-style-type: none"> 1. Average length, 2. Release mortality. 	<ol style="list-style-type: none"> 1. Where catch length distributions from different fishing methods/types are required, sampling should be coordinated to assure that data can be used in all MS, 2. Release mortality is highly unknown and should be addressed in a coordinated approach.