ICES WKISCON Report 2008

ICES ADVISORY Committee

ICES CM 2008/ACOM:31

REF. LRC, RMC, PGCCDBS

JOINT STECF/ICES WORKSHOP ON IMPLEMENTATION STUDIES ON CONCURRENT LENGTH SAMPLING (WKISCON)

29 – 31 JANUARY, 2008

ICES, COPENHAGEN, DENMARK

In memory of Frank Redant

(1950 – 2007)

ICES International Council for the Exploration of the Sea

CIEM Conseil International pour l'Exploration de la Mer

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

H. C. Andersens Boulevard 44–46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

Recommended format for purposes of citation:

ICES. 2008. Joint STECF/ICES Workshop on Implementation Studies on Concurrent Length Sampling (WKISCON), 29 - 31 January, 2008, ICES, Copenhagen, Denmark. ICES CM 2008/ACOM:31. 134 pp.
For permission to reproduce material from this publication, please apply to the General Secretary.

The document is a report of an Expert Group under the auspices of the International Council for the Exploration of the Sea and does not necessarily represent the views of the Council.

© 2008 International Council for the Exploration of the Sea

Contents

Executive summary

The current EU Data Collection Regulation will be revised during 2008 and comes into force in 2009. One of the major changes in the new DCR is the shift from a stock-based approach towards a fishing-activity based approach. Via this fishing-activity based approach, the new DCR facilitating the data demands of the existing stock-based assessments as well as serving the needs for future fishery based management and ecosystem approach. The new structure aims for a more flexible and less complex DCR than the current version.

One of the major changes in the new DCR is a shift towards concurrent length-sampling; a sampling strategy covering the sampling of all species during a sampling operation. PGCCDBS (ICES, 2007a) stated that the requirements of concurrent length-sampling are likely to cause significant problems for the institutes involved. To ease the shift towards concurrent length sampling, member states who foresaw practical problems, carried out implementation studies on concurrent sampling, testing the feasibility of and the possibilities for concurrent sampling.

Sixteen member states presented the results of their implementation study during WKISCON in Copenhagen. The following common problems were identified:

- *Restricted access* Several issues concerning access to the fish in auction were raised, including: limited access to storage, access to "fragile" species, valuable species or species specially packed for sales and the fear that data could be used for control and enforcement purposes.
- *Time restrictions* In nearly all cases the time window available to sample the fish was often too low.
- *Commercial grades* Some species are sorted into 7 categories, resulting in a time consuming sampling operation to cover all categories.
- *Higher costs* All countries participating in the implementation studies identified the possible increase in costs as a result of increased sampling effort. This increase is a result of: the extra samples that have to be taken; the risk of repeated sampling operations in case of incomplete samples; cost to gain access to the fish (buying of samples) and the possible increase in on-board sampling.
- *Data issues* Concerns were expressed on the representativeness of the samples, in particular relating to random vessel selection and the complexity of sampling polyvalent vessels fishing in multiple areas.

Sampling at sea is the preferred way of concurrent sampling and length sampling of landings on shore can be considered as a complement to at sea sampling. On shore sampling can be combined with at sea sampling where appropriate. WKISCON redesigned the sampling scheme proposed by PGCCDBS in 2007. The new scheme takes the results of the implementation studies into account. The new sampling scheme foresees full concurrent sampling even when this is done on a sufficient number of intermittent trips where extra resources can be made available.

One of the major concerns is the difficulty of performing random sampling, as concurrent sampling has to be implemented next to other sampling operations, e.g. sampling for ages. In general, concurrent sampling depends on the willingness of the fisherman to cooperate. Another concern is that the effort invested in sampling is redirected towards by-catch species, resulting in relative under-sampling of species that actually drive the fisheries management. To counteract this, additional sampling of the most important species might be appropriate.

Following the recommendations by PGCCDBS, WKISCON proposed 3 groups to allocate species to, covering the range from species that drive the management process to by-catch species. Regional coordination is needed to allocate a certain species to a group, ensuring all countries in a region use the same allocation. As with the allocation of species, the allocation of samples to a métier needs to be coordinated by region, preferably by the Regional Coordination Meetings (RCM) of that specific region.

Based on the ideas as suggested by SGRN in 2006, WKISCON suggests that the selection of the métiers to be sampled is done by arranging the métiers by effort and to include all métiers in the sampling program that cover the top 95% of the effort. It is suggested that some métiers can be merged for practical reasons, but this merging has to be done on such basis that the sampling coverage of the major métiers is ensured.

The number of trips that have to be sampled should be defined by precision objectives. As each métier catches several species, it is undesirable to find a compromise between the objectives of precision for each species. Therefore, WKISCON suggests that the objective of precision should be defined on the assemblage of target species and at a regional level.

1 Opening of the meeting

The meeting started at ICES HQ on Tuesday, 29 January at 09:00 and closed at Thursday, 31 January at 17:15. A total of 31 representatives from 18 countries attended the workshop.

2 Adoption of the agenda

The agenda of the meeting is included in Annex 2.

3 Introduction

The current Data Collection Regulation will be revised during 2008 and is expected to come into force in 2009. One of the major changes in the new DCR will be the shift from a stock-based approach towards a fishing activity based approach, thus facilitating the data demands of the existing stock-based assessments as well as serving the needs of future fishery based management and the ecosystem approach. The new structure aims for a more flexible and less complex DCR than the current version.

SGRN summarized the following ICES' data requirements (Anon., 2007):

- Fleet activity (including capacity, effort and catches)
- Population level (fecundity, maturity and growth at age)
- Ecosystem (trends in non-commercial by-catch and discards, both from surveys as well as on-board sampling)

One of the methods to answer these data requirements is to carry out concurrent length sampling. SGRN states that the obligation for fishing activity based sampling is restricted to the collection of length composition data of the removals. This sampling is to be carried out preferably by on-board sampling: In case this is not feasible market sampling might be applicable. A few restrictions may apply to market sampling as the time window available for sampling and the access to the landed fraction might be limited.

PGCCDBS (ICES, 2007a) stated that the requirements of concurrent length sampling are likely to cause significant problems for the involved institutes. To ease the shift towards concurrent length sampling, PGCCDBS suggested "that each lab which foresees problems with the implementation of concurrent métier-based market sampling, selects two or three métiers that can be regarded as typical (in terms of local landing and auctioning arrangements) and hence, are likely to reveal both typical as well as general problems in relation to concurrent length sampling".

Many member states carried out an implementation study in 2007 or early 2008, as proposed by PGCCDBS. The objective of the implementation studies was to gain experience with the logistic and practical aspects of implementing concurrent métier-based sampling and not for comparison of results between métiers.

Following the results of the implementation studies, common problems occurring in member states were discussed and advice is given on a new proposed sampling scheme.

4 Review of implementation studies

4.1 Cyprus

4.1.1 Methodology

The fishing activity selected for implementing a concurrent length sampling exercise of landings was the bottom otter trawl; this is the main fishing activity of the Cyprus fishing fleet for which problems are foreseen with the implementation of concurrent length sampling, due to the high number of species landed.

The study was implemented on – board; for the moment there are no auction markets in Cyprus, and it is not possible to perform concurrent length sampling at ports during landing, since the fish are usually landed by quality grade and not by species, and are sold to the fish mongers in a very short time, based on oral contracts.

On-board sampling was performed on one specific trawler (with only four trawlers licensed to operate in the territorial waters, and of similar size). The exercise was performed in November, for four weeks, and was conducted twice a week (either covering two daily trips or one two-day trip). Trips were randomly selected.

The sampling methodology included the collection of the following:

- Fishing trip characteristics (date/ location/ total number, duration and depth of hauls)
- Catch species composition (landings and discards) in terms of biomass and abundance. The aim was to sample a minimum of two hauls per sampling day
- Length measurements from all landed and discarded species. The aim was to length-sample 50 individuals for each landed and discarded species, per sampling day.

Priority in length sampling was given in landings and then in discards, as follows:

Landings	1. The 5 species currently length-measured under DCR
	2. Remaining species of DCR Appendix XV
	3. Other commercial species
Discards	1. The 5 species currently length-measured under DCR
	2. Remaining species of DCR Appendix XV
	3. Other commercial species
	4. Non-commercial species

The number of observers varied among the trips from 2–4 persons.

As sampling was performed on-board, there were no time restrictions. However, since fishing operations in daily trips take place from the afternoon (~ 6p.m.) until dawn (~6 a.m.), and in two-day trips last for 24hrs, not all of them can be covered by the observers.

4.1.2 Results

On-board sampling was conducted for a total number of six trips (four daily and two two-day trips), resulting to 8 sampling days. Length-measurements were taken during all sampling days. A summary of the results is provided in Table 4.1.2.1.

Table 4.1.2.1. Results of the Cyprus implementation study.

Country:	CYPRUS
Location:	ON - BOARD
Fleetsegment/Fishing activity:	OTB - MIXED SPECIES (VL1224)

	Trip 1		Trip 2		Trip 3	Trip 4	Trip 5	Trip 6
	day 1	day 2	day 3	day 4	day 5	day 6	day 7	day 8
Time available for sampling (minutes) for catch composition and length measurements	~830	~ 1000	~790	~1000	~720	~660	~630	~630
# staff members	3	3	2	2	4	2	2	4
No of vessels available for sampling	na	na	na	na	na	na	na	na
No of vessels sampled	na	na	na	na	na	na	na	na
Number of hauls with catch composition estimation / total number of hauls	3/5	0/7	1/6	2/7	2/6	2/5	2/5	2/5
Number of hauls with length measurements / total number of hauls	2/5	1/7	2/6	2/7	2/6	2/5	2/5	2/5
No of samples available (landed & discarded species)	36	31	30	51	42	40	38	34
No of species landed	23	22	15	19	21	20	18	20
No of landed species sampled	23	11	12	15	21	19	18	15
No of measurements from landed species	747	369	435	391	606	472	538	545
No of species discarded	13	9	15	32	21	20	20	14
No of discarded species sampled	13	0	15	26	21	20	19	13
No of measurements from discarded species	354	0	446	649	488	370	394	313
Applied scheme (1,2 or 3)*	1	1	1	1	1	1	1	1
Problems during sampling		Rough sea		Rough sea				
Sampling completed (Y/N)	Y	N	N	N	Y	N	N	N
If completed, duration of sampling (minutes) for catch composition and length measurement	~ 360				~ 300			

* Applied scheme: Sample all landed and discarded species (50 individuals) per sampling day

As it is shown in Table 4.1.2.1, usually 2 hauls per day were sampled. When 2 observers were working on-board, the time spent for estimating catch composition and length-measuring landings and discards from a haul was about 3–3.5 hours; when 4 observers were working on-board, this time was reduced to about 2–2.5 hours. It is noted that the average duration of hauls was about 2 hours, and the average interval among them was about 30 min.

A total number of 69 species were length sampled, representing about 88% of the recorded species; the overall sampled landed species were 48 (~85% of recorded landed species), while the overall sampled discarded species were 50 (~ 84% of recorded discarded species).

From the 48 landed species, 18 of them had sample sizes of 50 individuals (though not in all sampling days), while other 3 had sample sizes of ≥ 25 individuals. From landings composition, it was estimated that only 2–7 species represented ≥ 5% of the landings.

4.1.3 Discussion

The number of species length-sampled on-board and their sample size depend on i. the weather conditions, ii. the availability of the species in the trip and iii. the sorting of the species in the landing boxes, which is done by quality grade (a quality grade may include a number of species, while one species may be represented in different quality grades, depending on the individuals' size). Other important factors that affect sampling on-board are the cooperativeness of the fishermen and the space

available on the vessel for carrying out scientific work. In the present study, the trawler used is the most suitable, in terms of space, for carrying out scientific work, and fishermen were very cooperative, despite their work (sorting and storing the fish) was delayed due to the concurrent sampling.

In general, a high percentage of both landed and discarded species were length-measured. Taking into account the high number of species caught by the Cyprus bottom otter trawl fishery, and the low percentage of most of them in the catches, it is difficult to sample all species even when on-board, both for the observers and the fishermen. Priority criteria that could be used for length sampling are the commercial value of the species, their availability in the trips, their vulnerability and their potential use as indicators for evaluating the effects of fishing.

Except for the bottom otter trawl, the other main fishing activities exercised by the Cyprus fishing fleet are the drifting long lines targeting large pelagic fish, and the passive polyvalent gears fishing mixed demersal species (basically exercised by the small- scale inshore fleet). In the large pelagic fishery, a small number of species is landed, therefore it is not anticipated that concurrent sampling will create difficulties, either on-board or at landing sites. Concerning the small-scale inshore fishery, with the relatively small quantities and number of species landed, it is expected that concurrent length sampling can take place at landing sites.

Sampling under the current DCR is performed for 8 species, 5 demersal and 3 large pelagics. Concerning the bottom otter trawl fishery, samples are currently collected on board and at specific fish markets (upon arrangements with the fishermen and fishmongers). With the implementation of concurrent length sampling, samples from the bottom trawl fishery will only be collected on board, thus increasing the financial costs for obtaining them; the increase will depend on the precision level that will be required under the future DCR.

4.2 Denmark

In Denmark we have chosen to investigate our national sampling scheme in light of the fishery activities/métiers to see if there are statistical significant differences to be found between different fisheries activities given that the sampling scheme is stratified by commercial size sorting. If there is no difference between the samples of the same size grade coming from different fishery activities it is possible to estimate the fishery activity specific data by a join between logbooks data on fishing activity and the size distribution information of the catch estimated via the first buyer register. The analysis was done on North Sea cod samples from 2001 to 2007. The result was that there was no significant difference between size grade 4 from different métiers/ gear types. The same information that is being obtained by concurrent sampling can be derived from information already in the logbooks, first hand buyer register and market samples. Given the sampling design of the Danish sampling scheme, a shift towards a concurrent or fishery stratified sampling scheme is not possible without increasing the number of samples considerably.

(for more information on the Danish study see Annex 4, working document "Concurrent or Fishery-based sampling for length, age and mean weight in Danish Harbours")

4.3 Estonia

The last PGCCDBS (ICES 2007a) initiated a concurrent sampling pilot study in preparation of a workshop planned to be held in the beginning of 2008. However, it was decided not to perform any experiments on concurrent sampling in Estonia because the major part of current sampling scheme can be easily converted to the fleet-based approach.

In Estonia, the main fishery is the herring and sprat fishery in the Baltic while the cod fishery and coastal fishery (flounder, salmonids and freshwater species) are of lesser importance.

The share of herring and sprat in mixed catches is highly variable. However, the share of herring is somewhat increasing in northern direction. As a rule, no sorting and discarding takes place during the fishing process. All sampling takes place onboard at sea or in harbour. No market sampling takes place.

Catch and effort data come from logbooks, which are obligatory for vessels of all types and sizes.

Herring and sprat both are sampled by the observers from the Marine Institute. This includes the species composition, length measurements and biological sampling, incl. collection of otoliths, and in parallel the by environmental inspection (length and species composition). Both length data sets are available for assessment purposes.

The overall sampling scheme is stratified by métier (fleet composition is simple, using very few same size vessels and gears), subdivision and on monthly basis.

In coastal fisheries, the sampling strategy is similar to the described above. Additionally, length measurements of all species are performed on regular basis by fishermen (self-sampling).

4.4 Finland

4.4.1 Methodology

The fishing activities selected for the study of fleet-based "concurrent sampling" were ***trawl-fisheries*** for herring and sprat, and ***coastal gillnet fisheries*** targeting several species. These two fisheries cover the major part of all commercial catches in Finland. The study was carried out in September 2007 by implementing the concurrent sampling on normal sampling routines. The total number of samples in the study was 16 and they were taken from four sea-areas according to table 4.4.2.1.

For both fleets, the species were allocated in three groups (Finnish NP 2007 sampling target species in bold):

1) (assessed TAC-species) **herring, sprat, salmon**, cod

2) (other TAC-regulated species and major non-regulated valuable by-catch-species); **European whitefish, flounder**, turbot, **sea-trout, perch, pike-perch**, pike, eel, vendace.

3) All other by-catch-species

The catches are not auctioned in Finland but usually sold to whole-sale companies or straight to processing industry according to contracts made in advance and agreed price-formation rules. Most of the trawl-catches are landed in fishing ports, but a big part of especially gillnet catches are landed to several smaller ports and private docks.

The sampling is carried out by 5 coastal field stations, usually by a team of 2 persons, but in some units regularly or occasionally by only one person. The selection of landing site and vessel is quite opportunistic and depends usually on local fishing activities, fishermen's willingness of co-operation, and sometimes also on other practical things like the relation between distance to a certain landing site and probability of getting a proper sample. Working out of one sample takes usually 1–2 days (depending on the distance to the sampling location and size of the sampling crew), including collection and transport. In this study the time used for one sample was 1–4 workdays.

Sampling schemes vary by target species: when the fish are relatively small, the number of individuals in one sample is large and the catch consists of numerous length- and age-classes (e.g. herring and sprat), usually several length-distributions are made, but the ages are sampled (for year-quarterly ALK's) by length-stratified random sampling. When the target species in a catch is normally not very abundant (e.g. salmon, whitefish, pikeperch), simple random sampling is applied (usually the whole catch is sampled).

4.4.2 Results

Availability of samples

Availability of samples varies according to area and fisheries, but in this study the unusually warm season and water-temperature had a negative impact to the fishing activities, especially in early September.

Generally it is easier to get samples from trawl-fisheries compared to gill-net fisheries. The only (minor) constraint is only being able to sample those trawl vessels that don't sort their catches at all (when the catches are sold to fodder industry), sort them in harbour or are co-operative enough to self-sample on sea before sorting.

Gillnet sample availability is totally dependent on fisherman's willingness of co-operation. In every area, however, there are some trusted fishermen, who represent well the local fisheries (or métiers) and are more frequently used for sampling than others -especially in cases like this, where all the catch is needed. Motivation of fishermen to bring all their catches ashore was enhanced by setting a price / kg for the normally non-valuable by-catch.

Sampling opportunities vs. number of samples taken

No information on the number of (local) sampling opportunities vs. sampled vessels was recorded in field during the study. Nor can this be verified in larger scale, because the information on métier- and geographical distributions of active fishermen in 2007 is not available yet (January 2008), only the totals (1580 registered fishermen altogether, 1325 practising coastal gillnet fishery and 580 practising trawling; thus 325 are practising both at least to some extent).

Excluding a few ports in Bothnian sea-area, there are not many trawl vessels operating from one fishing port, so "not-sampling-the-same-vessel-as-last-time" is a common rule of thumb.

Number of species

In trawl catches there are very few by-catch species in general, and they are also few in number. Most common by-catches in trawl fishery are sticklebacks and smelt, and other species are present only occasionally. The shallow Bothnian bay-area with very low salinity forms an exception to this; also in this study largest number of by-catch

species (mostly freshwater species) was recorded in a trawl catch from Bothnian bay (Table 4.4.2.1).

The number of species in coastal gillnet catches is bigger and there is more variation in the species-compositions of the catch. In gillnet fishery, by-catches are mostly cyprinids and they often outnumber the target species. However, the probability of getting a valid sample (numerous enough) from a non-target species is also bigger in gillnet fishery.

Table 4.4.2.1. Species compositions in the Finnish samples of the study. Columns represent different samples. Target species in red.

species	sample G = gillnet T = trawl																
	Eastern Gulf of Finland				Western Gulf of Finland				Archipelago sea (SW coast)			Bothnian Sea		Bothnian Bay			Frequency
	G	G	G	G	T	T	T	T	G	G	T	T	T	G	G	T	
Herring	*	*	*	*	*	*	*	*			*	*	*	*	*	*	14
Sprat				*	*	*	*	*			*	*				*	8
Pikeperch	*	*	*	*					*	*							6
Perch	*	*	*	*				*	*	*				*	*	*	10
European Whitefish				*										*	*	*	4
Pike	*	*	*	*						*						*	6
Four-horned sculpin						*					*		*	*	*		5
Flounder			*							*							2
Ruffe				*										*	*	*	4
3-s Stickleback					*	*	*	*								*	5
Smelt	*	*	*	*		*								*	*	*	8
10-s Stickleback								*								*	2
Bream	*	*	*	*					*								5
Vendace																*	1
Silver bream	*	*		*													3
Lumpfish					*												1
Dace																*	1
Sculpin sp												*					1
Roach	*	*	*	*					*							*	6
Ide				*													1
Sea-trout													*				1
Vimba				*													1
Grand Total	8	8	8	13	4	5	3	5	4	4	3	3	3	6	6	12	

Sample size

In trawl catches the sample size is normally a box (12–15 kg) of fish where a minimum of 300 herring and 200 sprat are measured and the share (weight) of small by-catch species is recorded. The bigger by-catch species (e.g. salmon, trout, sculpins) are recorded from the whole catch.

In gillnet fisheries targeting e.g. whitefish or pike-perch the sample size is usually 50–100 specimen.

Time needed for sampling

There are no time limitations for sampling since all material is usually brought to laboratories for processing.

4.4.3 Discussion

Problems encountered during sampling activity

In sampling of trawl-fisheries in Finland a sort of fleet-based concurrent method is already in use. Making extra length distributions for other than target species was not considered to be a major trouble.

Getting an "all-inclusive" sample from gillnet-fishery was not easy and therefore certain, "trusted" fishermen were used in sampling. Using frequently same fishermen may bias the results in concurrent sampling, although the size distribution of the target species is not affected by such procedure.

The volume of one sample in gillnet fishery was manifold compared to normal sampling. This caused practical problems in transportation, refrigeration and waste disposal. Also the price of one sample was much higher due to obligation of purchasing the whole catch.

Restrictions of implementation

There are 3 important fisheries that were left out of this study: coastal trapnet fisheries for herring and salmon; and cod trawl-fishery in southern Baltic.

The study-season was not right for the two trapnet fisheries, and Finnish cod fishery is not sampled at all due to derogation caused by small share of landings of EU total.

The practise in sampling herring trapnet fishery is quite similar to the sampling of trawl-catches. The salmon fisheries by trapnets are usually self-sampled by the fishermen and the catches are thus not purchased. Although defined as salmon trapnet fishery, it is targeting also whitefish at the same time in some areas. Otherwise both of these fisheries have a very low by-catch rate.

All other types of Finnish commercial marine fisheries form a negligible part of the total catches and are not regularly sampled.

Comparison concurrent length sampling vs. current sampling methodology

In this study, the effort didn't increase markedly in collection of samples. In two-person teams even the extra measuring of by-catches was not considered to be a trouble although the time spent with one sample increased. However, in one person sampling it easily doubled the time spent.

Quality of the data

The practise of concurrent sampling did not have any impact to the quality of data collected from target species.

4.4.4 Other issues

Implications for databases, software etc

The extra information collected by concurrent sampling can easily be incorporated to existing databases.

Any other issues

The extra information gathered of the by-catch by concurrent sampling was mostly not sufficient for a formation of a proper sample.

4.5 France

4.5.1 Methodology

France has carried out two individual tests on concurrent sampling, one in Port-en-Bessin (Eastern Channel) and one in Concarneau (South Brittany). Additionally, a feasibility survey has been carried out in the major auctions used for market sampling.

In both harbours where a concurrent sampling has been tested, the methodology used was to choose one vessel operating bottom trawl targeting demersal species. This choice is given to enable assessing the feasibility of such a sampling scheme with regard to the known most difficult métier to sample in term of diversity of species. The harbours chosen were those giving the best working conditions for the test and are not representative of all the French harbours. In each harbour, a vessel has been chosen that corresponded to predefined criteria such as belonging to the chosen métier, availability of all the landings and early disposal of the fish under the auction. The two tests have been conducted by 2 scientific staff and the time window was more than 5 hours in Port-en-Bessin and 7 hours in Concarneau from 23: 00 pm to 06: 00 am.

4.5.2 Results

The table below summarises the results obtained during the concurrent sampling tests.

Country	FRA	FRA
Location	Concarneau	Port-en-Bessin
Fleetsegment/Fishing activity	OTB demersal (gadoids) in VIIfgh	OTB demersal in VIId
	09/01/2008	19/09/2007
Time available for sampling (minutes)	> 420	>360
# staff members	2	2
No of vessels available for sampling	1	5
No of vessels sampled	1	1
No of samples available (vessels x species x categories)	97	NA
No of species landed	40	27
No of species sampled	29	27
No of measurements	2296	1279
Applied scheme (1,2 or 3)	1A	1A
Sampling completed (Y/N)	N	Y
If completed, duration of sampling (minutes)	420	360

In both harbours, the availability of samples and the working conditions were good. The number of samples taken and the sample size were identical as the routine sampling schemes at Port-en-Bessin fish market. The procedure was lightened at Concarneau fish market where (i) the sub sampling for age was not carried out as for the routine sampling of the main species (cod, haddock, whiting, megrim, anglerfish) from Celtic Sea, (ii) the number of fish measured by species x categories routinely sampled was reduced to allow more species to be sampled during the landing time available for concurrent sampling. Such a routine sampling scheme requests to identify all the commercial sorting grades of one species and measure around 50 fish per lot when available or (half of) a complete box when fish is small and notice the total catch of that species * lot together with the sampled weight. Moreover, the samplers must have the knowledge of species identification and sorting categories by species at the chosen fish market in order not to waste time in waiting the recording of each lot by employees of the fish market. The allocation to species into group was different from the one suggested by PGCCDBS 2007. Group 1 included all species under recovery plan and TAC-regulated species, group 2 included all non-TAC-regulated species of regional importance and group 3 the remaining. This allocation was meant to give as much credit as possible to all TAC-regulated species without discrimination. The difference with PGCCDBS suggestion is rather slight, as only a few TAC-regulated by-catch species positioned in group 1 here should have been moved to group 2.

In Port-en-Bessin, 5 hours was needed to complete the sampling of the 27 species landed by one vessel. In Concarneau, 7 hours was needed to sample 29 species out of the 40 species landed by one vessel. In both cases, it was noticed that the species of group 3 necessitated the most work, because of mixture of species in the boxes and difficulties to measure some species like sharks, skates, congers and cephalopods. In both harbours sampled, the concurrent sampling of only group 1 species was considered relatively easy to implement on a routine basis.

The survey done in other auctions showed the diversity of situations encountered in the different French harbours. A summary of information is given in the three tables below.

Location	Boulogne sur Mer	Roscoff	Brest
Main fishing areas	VIId, IV	VIIe	VIIe, VIIIa, VIIfghj
Time available for sampling (minutes)	< 120	120	> 300
# staff members usually available	>= 2	2	2
Fishing activities	OTB demersal GTR demersal	OTB demersal OTM small pelagics GTR demersal	OTB demersal LLS demersal GTR demersal
Number of species per groups on average (G1 / G2 / G3)	NA	7 / 11 / 12 0 / 2 / 1 2 / 5 / 6	4 / 8 / 10 0 / 3 / 1 2 / 6 / 1
species sorted by commercial grades under auctions	No	Yes	Yes
Fish under auction representative of fish landed	No (pre-sales)	Yes	Yes
Current sampling strategy (Métier or Commercial category)	CC	Métier	Métier
Is concurrent sampling technically possible?	No	Yes	Yes

Location	La Rochelle / Les Sables	Herbaudiere/ Yeu	St-Jean de Luz
Main fishing areas	VIIIab	VIIIab	VIIIb
Time available for sampling (minutes)	< 180	150 - 240	120 - 180
# staff members usually available	1	1	1
Fishing activities	OTB demersal GTR demersal		LLS demersal OTM pelagics GTR demersal
Number of species per groups on average (G1 / G2 / G3)	> 8 (mainly G1) >10 (mainly G1)		1 / 2 / 2 2 / 2 / 1 4 / 5 / 6
species sorted by commercial grades	Yes	Yes	Yes
Fish under auction representative of fish landed	Yes (under auction)	Yes (under auction)	Yes (under auction)
Current sampling strategy (Métier or Commercial category)	Métier	Métier	Métier
Is concurrent sampling technically possible?	Yes	Yes	Yes

Location	Sète	Mediterranean out of auction
Main fishing areas	Golfe of Lion	Golfe of Lion
Time available for sampling (minutes)	60 - 90	60
# staff members usually available	1 - 2	1
Fishing activities	OTB demersal OTB small pelagic GTR demersal LLS, FPO, PS, DRB	Small-scale fisheries
Number of species per groups on average (G1 / G2 / G3)	average 25 species 43 commercial categories 8 / 5 / 12	
species sorted by commercial grades	Yes (on-board)	
Fish under auction representative of fish landed	Not always (pre-sales)	Yes
Current sampling strategy (Métier or Commercial category)	CC	CC
Is concurrent sampling technically possible?	No	Yes

4.5.3 Discussion

The principal information gained from the concurrent sampling tests conducted in France is that it is possible to implement, at least for the principal species (Group 1 and probably partly Group 2). A complete concurrent sampling (scheme 1A) is requesting far too much work, especially for those species of the group 3, sometimes mixed in the landed boxes.

Besides the test, the harbours surveyed, which are only a part of the French harbours, give a picture of the diversity of the situations. In summary, the French sampling programme is adapted to the local situation. Mainly, the sampling strategy is based on commercial categories in the North and in the Mediterranean, and based on métiers either internationally defined from SAMFISH project or nationally defined on the Atlantic coast.

The working conditions, time window and availability of all the landings are highly variable, and the main auctions are not always those providing the best working conditions.

The strategy based on métier is the one which will best accommodate to concurrent sampling. The strategy based on commercial categories makes the best use of the sorting grades, although based on assumptions such as. (i) identity of length structure within one category in a chosen fish market independently of the gear used, and (ii) full correspondence between the grades seen on the field and the grades used in official statistics. If this strategy is to be used as a fallback option to concurrent sampling, the assumptions used should be fully scrutinised and ascertained. The first may be circumvented by sampling the grades by types of gear, whereas the second is out of control of the scientific institutes. In the Mediterranean, the sampling out of auctions, directly at the harbour when the vessels arrive, may constitute a solution to concurrently sample the small-scale fisheries.

In conclusion, the French sampling strategies have been worked out for years to best adapt the local environments and the shift to concurrent sampling will have to be carefully implemented, not to constitute a step backward in the quality of the data.

4.6 Germany

4.6.1 Methodology

In the North Sea and East Arctic region and the Northeast Atlantic region, most fisheries under German flag land outside the country (mostly Denmark, The Netherlands and Iceland), and bilateral agreements have been concluded with Denmark and The Netherlands to ensure that these fisheries are covered either by the on-board observer programme or by market sampling by the agreement partner MS. The on-board sampling scheme foresees concurrent sampling of all species in the catches.

As only very few vessels operating in the RCM region land in German ports (Bremerhaven, Cuxhaven), and only few species are landed (saithe, redfish) or transported to the auction in containers, market sampling has decreased in importance to an almost negligible level. Consequently, no concurrent market sampling is planned in the near future.

The German Baltic fisheries are currently sampled the following ways:

- sea based sea-sampling
- lab based sea-sampling

Sea based sampling

The sea based sea-sampling is characterised by scientific observer sampling on board the fishing vessel while fishing at sea. This type of sampling yields the following reliable data for each fishing activity of the trip:

- target species

- location
- date and time
- effort
- gear
- target species catch = landing + discard in weight
- by-catch species catch = landing + discard in weight
- (target species catch = landing + discard length samples – if sampled)
- (by-catch species catch = landing + discard length samples– if sampled)
- (sex-maturity-age-length sample for analysis in the lab – usually one sample per trip)

This type of sampling is the basis for the data collection from the principal segments of the German trawl fisheries, targeting western and eastern Baltic cod and having as by-catch a flatfish species assemblage dominated by flounder.

Moreover, since 2006, the 'long distance' industrial sprat fishery in the central Baltic is sampled this way to roughly monitor the by-catch of herring and juvenile cod.

A 'land based' observer sea sampling yielding more than one sample per action was tested in 2007 and has been proven useful: Observers were present onboard different vessels operating from a chosen fishing harbour, where they spent some days. If possible, a sample was purchased for detailed processing in the lab.

Lab-based sea sampling

The lab-based sea sampling is characterised by

- purchased samples sampled at sea by the fishermen = self-sampling
- in the special case of unsorted herring landings: purchased samples sampled by scientific observers in harbours

This type of sampling is currently the alternative to observer sea-sampling either as a work around of various obstacles to boarding or to sample fisheries where this method is the most cost efficient to obtain unsorted catch (e.g. pelagic fisheries, small scale coastal fisheries). Lab-based sea sampling is much easier to implement than sea-based sampling (because no negotiations with the crew is needed on how to provide berthing on the vessel), and has the advantage that lab staff can be utilised to work up the sample. The cost for purchasing samples from Baltic fisheries amounts to about 50 000 € annually.

Self-sampling

The self-sampling yields reliable sex-maturity-age-length samples for target species to establish age-length keys and age-maturity keys for the stock assessment. The following data are gained from this type of sampling:

- target species
- location
- date and time
- effort
- gear
- target species catch = landing + discard in weight
- target species catch = landing + discard length samples

- sex-maturity-age-length sample for lab analysis – data obtained by scientific staff

Self-sampling is used to obtain (additional) samples from all types of German Baltic fisheries.

Observer harbour-sampling

The harbour sampling is mainly applicable for fisheries on small pelagic fish where discarding and sorting at sea can be excluded with some certainty (e.g. the fisheries for herring and industrial fishery for sprat). This type of sampling yields the following reliable data:

- target species
- location
- date and time
- effort
- gear
- species catch = landing + discard in weight
- species catch = landing + discard length samples – data obtained by scientific staff
- sex-maturity-age-length sample for lab analysis – data obtained by scientific staff

During the western Baltic spring herring season, the most important landing sites are sampled regularly and catch can be tracked back to individual vessels. The flounder fishery in Sub-division 24 in the second half of the year is also subject to this type of sampling.

4.6.2 Results

There were no results for Germany.

4.6.3 Discussion

Future amendments to the sampling practice

For the near future, additional effort will be exerted in the sea-sampling of Baltic fisheries in the most important inshore small-scale passive gear fisheries as e.g. that by set gillnet on herring, flounder and cod. As these small vessels usually cannot carry observers, sampling staff will have to use separate boats to get to the fishing sites. A close co-operation and intensive communication with fishers is needed to make this "boat-based" sea sampling successful.

Present sampling practice compared to concurrent sampling

The aim of concurrent sampling of the German fisheries is approached by sampling the catch as closely as possible to the catching process, i.e. by on-board sampling. Germany does not expect a gain in accuracy and precision or in cost from the implementation of a concurrent market sampling, also considering the small fraction of landings within the country. Moreover, a comparison of the results from concurrent market sampling and the present sampling scheme might yield differences and thus create the need of a third independent method to decide which of both methods is more appropriate.

4.7 Ireland

4.7.1 Methodology

Selection of fishing activity

Twelve fleets are currently described within the Irish discard sampling programme. Three métiers were chosen from this list.

Routinely The Marine Institute carries out market sampling at ten different locations around the coast. During the period of this pilot study, sampling events were completed in three of these ports. Options for sampling in other ports were restricted due to non – cooperation of the local fishing industry at the time. Also concerns were raised in one port about the idea of sampling the entire catch of a vessel and the potential for this information to be used against the skipper later in the event of a prosecution. So in spite of the fact that The Marine Institute, was allowed to carry out it's routine sampling in this particular port, concurrent sampling could not take place.

Selection of auction

Auctions were selected when, information gained through contact with the auction hall staff indicated that vessels from the selected métiers would be landing.

Selection of vessels

The intention was to select the vessel at random upon arrival, however only those vessels which landed the previous night or very early the morning of the auction could be sampled due to time constraints. This will always be the case, and essentially can result in the same vessels being targeted due to the landing patterns of the various vessels.

Selection of sampling schemes and allocation of species to groups 12 or 3

Species were allocated to groups 12,and 3 prior to any sampling event. In all cases the intension was to sample all species landed by the vessel for the targeted trip. This includes all target, recovery, by – catch and non-TAC species, i.e. concurrent sampling. On several occasions however, not all species landed for the trip could be sampled as they had already been sold prior to the auction and removed from the auction hall. In all cases all of group 1 species were sampled. For 2 out of the 6 vessels sampled within the group 2 species, one size category out of several landed was pre-sold and could not be sampled.

Crewsize (# of persons involved)

A group of five laboratory analysts were used for each sampling event, and this was deemed a minimum number of persons required to successfully complete the concurrent sampling events.

Time window available for sampling

The time window for sampling events varies from port to port and from vessel to vessel. However a minimum of 20 man-hours was required to successfully carry out concurrent sampling.

4.7.2 Results

Availability of samples

Availability of vessels was limited due to the nature of the fisheries sampled, and the number of vessels landing into the targeted ports on a particular day. In two of the sampling events fish was sold prior to MI staff gaining access to the samples.

Number of samples taken vs. number of sampling opportunities

Event 1: DMR_23_07_07 2 vessels sampled out of 5 landed.

Event 2: KMR_07_08_07 1 vessel sampled out of 1 landed.

Event 3: HOW_13_08_07 1 vessel sampled out of 1 landed.

Event 4: KMR_27_08_07 2 vessels sampled out of 2 landed.

Number of species

During the period of this project the average species composition per vessel was made up of 18 different species, including gadoids, flatfish, cephalopods, crustaceans and elasmobranches.

Sample size

Sample size can be found in Table 4.7.2.1.

Table 4.7.2.1.

	Number of boxes/kg's measured			
Species	Event 1	Event 2	Event 3	Event 4
Monkfish	12	16	5	8
Cod	7.5	6	1	14
Blonde ray		15		8.4
Black Sole	2.2	3	0.1	6.75
Haddock	6.25	0.2	1	4
Plaice	2.5	3	0.5	4
Whiting	4.75	0.1		0.2
Cuckoo ray		3		0.5
Witch	1		2	0.1
Thornback ray		1		1.8
Ling	1 fish	0.5	0.1	2
John Dory	0.4	0.1		2
Lemon Sole	2	0.25	0.1	
Megrim	1	0.1	0.1	1
Nephrops C+D	2			
Hake	0.1	1 fish	1	0.5
Brill			0.1	1.25
Sandy ray				1.2
Turbot			1	
Sand sole				1
Pollack	0.5			
Brill	0.2			
Saithe	1 fish	1 fish		0.1
Loligo	0.1			
Red mullet	1 fish	0.1		1 fish
Dab		0.1		
Red gurnard		0.1		
Grey gurnard		0.1		
Spotted ray				0.1
Nephrops L	9kg			
Squat lobster	1kg			
Spurdog	1 fish			

Time needed for sampling

It was established that a minimum of 20 man hours is required to complete a concurrent sampling event, to scheme 1A e.g. all species landed by the vessel including all TAC and Non – TAC species sampled.

4.7.3 Discussion

Problems encountered during sampling activity

Initially the requirement for a large number of staff was identified as an issue. In order to complete a concurrent sampling event, it required three additional staff members travelling to the relevant port to assist the port-based analysts. This has implications in monetary terms and also time.

Currently the MI operates a random sampling scheme, where species are sampled regularly, and representatively, but at a lesser intensity per sampling event. E.g. more sampling events per month/quarter, with less fish measured per sampling event than is required under the concurrent sampling scheme.

In one port the auction hall manager would not allow MI staff to carry out concurrent sampling as they felt that the additional handling of the fish; "the product" would compromise its quality. Concerns were also expressed about the potential use of the

length only data for enforcement purposes, as all the species landed from a sampled vessel would have been recorded.

This also raises the question of vessel selection, where due to time constraints and the landings patterns of vessels, one vessel may be sampled more frequently than others, and this can lead to the perception of a vessel/skipper being targeted.

If it is the case that samples are taken more regularly from a limited number of vessels within a métier, are we sure that these samples are truly representative of the landings of the entire fleet operating within an area.

The Nephrops sampling protocol requires both catch and discard samples to be brought ashore by the skipper, in order to be included in the Irish sampling targets. If a vessel forgets these samples, is there any point in carry out a sampling event? This may well lead to difficulties as MI staff will already have travelled to the port before the vessels has landed.

During some of the sampling events some grades of fish or entire species were removed/sold prior to auction and therefore could not be sampled. Again in this scenario, the cost and time implications will have already accrued as staff will have travelled to the port.

During this project, MI staff encountered species presented in a way which are not routinely sampled within the Irish sampling programme, e.g. Spider crab claws, and monkfish tails. New species were also encountered and this will require national laboratories to develop routine sampling protocols for these additional species.

Restrictions of implementation study

During the period of this pilot study, sampling events were carried out in only three of the major fishing ports in Ireland. Options for sampling in other ports were restricted due to non – cooperation of the local fishing industry at the time. These issues have been resolved, however the problems outlined above will also apply to those ports not yet sampled concurrently. In addition, there may also be an issue with vessels landing fish immediately onto waiting trucks for export. If this is done routinely for a particular species, does it then become necessary for a national laboratory to buy these samples? If so this may have a significant cost implication within the Data Collection Regulation.

In the largest whitefish port in the country, fish are landed and sold very quickly and it will not be feasible to sample concurrently here given the time restraints.

Comparison concurrent length sampling vs. current sampling methodology

There is a significant increase in staff effort required to complete a concurrent sampling event compared with current market sampling procedures. Overall the resulting volume of data will be similar per quarter to the volumes of data generated through our current length sampling scheme, however as the effort required to complete a concurrent sampling event is so great this will mean fewer sampling events through out the quarter and an associated reduction in precision. In order to avoid the reduction in precision a significant investment would be required in staff resources.

Quality of the data

When you reduce the variance with in the sampling unit i.e. to the fleet level this may allow less samples while still maintaining the required level of precision. However

the method used to calculate the precision levels is the bootstrap method and this requires a minimum of 10 samples pre sampling unit.

It is important to note that Irish demersal fisheries are polyvalent in nature and this has implications for the implementation of a concurrent sampling scheme.

4.7.4 Other issues

Implications for databases, software etc

Modifications to the current stockman database will be required. However with adequate resources this can be resolved.

Any other issues

Current sampling practices within the Discard sampling programme will have to be reviewed to ensure that at a haul level length sampling is carried out concurrently.

4.8 Italy

4.8.1 Methodology

The implementation of the proposed shift in the EU data collection framework from species-based to métier-based sampling and, above all, the requirement on concurrent length sampling of the landings, are likely to cause significant problems for the institutes involved in length sampling. It has been suggested during the ICES PGCCDBS Report 2007 that each national Laboratory which foresees problems with the implementation of concurrent métier-based market sampling carries out implementation studies.

Unfortunately Italy has not carried out the implementation study scheduled for 2007. However, this was due to the fact that, since 2005, Italy has implemented in the national programme disaggregation levels for the fleet according to Appendix III of Commission Regulation (Ec) N 1639/2001 and the list of species reported in Appendix XII of the same regulation.

On the basis of these considerations, some information on the practical feasibility of the length data collection from the sampling activity carried out during the year 2007 is done.

The objective of the DCR in Italian waters consisted of the estimation of the length composition of the landed species listed in Table 4.8.1.1.

Table 4.8.1.1.

Giant red shrimp	*Aristaeomorpha foliacea*
Red shrimp	*Aristeus antennatus*
Horned octopus	*Eledone cirrhosa*
Musky octopus	*Eledone moschata*
Grey gurnard	*Eutrigla gurnardus*
Common squid	*Loligo vulgaris*
Blackbellied angler	*Lophius budegassa*
Anglerfish	*Lophius piscatorius*
European hake	*Merluccius merluccius*
Red mullet	*Mullus barbatus*
Striped mullet	*Mullus surmuletus*
Norway lobster	*Nephrops norvegicus*
Common pandora	*Pagellus erythrinus*
White shrimp	*Parapenaeus longirostris*
Common cuttlefish	*Sepia officinalis*
Common sole	*Solea vulgaris*
Mantis shrimp	*Squilla mantis*
Tub gurnard	*Trigla lucerna*

The selection of the species, in common for all Italian waters, has been done according to the importance on the total landing and, at the same time on the economic revenue. For example, red shrimps *Aristaeomorpha foliacea* and *Aristeus antennatus* contribute only for a low percentage of the total Italian landing, but they have a very high economic value and represent a target for a significant part of the bottom trawl fleet in many management areas.

Concerning the Italian fleet, it is characterised by a strong multi-specific and multi-gear activity. The fishing sector appears highly fragmented in many regions along the coast and there are many large structural and technical differences in vessels from different geographical areas.

In order to have more homogenous data the Italian area has been subdivided in seven Geographical sub-areas (GSA) taking into account the GFCM/FAO division:

- Geographical sub-areas 9; 10 and 11–Level IV of Appendix II Reg CE 1639/2001 (Corresponding to Division 13).
- Geographical sub-areas 16; 18 and 19–Level IV of Appendix II Reg CE 1639/2001 (Corresponding to Division 22).
- Geographical sub-areas 17–Level IV of Appendix II Reg CE 1639/2001 (Corresponding to Division 22).

The sampling activity carried out in the GSA 9 allow to make some considerations concerning some aspects and related issues.

The GSA 9 comprehends the Ligurian Sea (from the border with France) and the northern and central Tyrrhenian Sea (to the south of Rome) for about 800 km of coast (Figure 4.8.1.1). The Centro Interuniversitario di Biologia Marina (CIBM) placed in Leghorn is responsible for data collection in such area.

Figure 4.8.1.1.

The fleet in this sub-area consists of about 1800 vessels, of which more than 1400 are less than 12 meters. In Table 4.8.1.2 the total number of vessels subdivided among the different types of gears is reported.

Table 4.8.1.2.

Type of gear	Number of vessls
Bottom trawl	361
Purse seine	53
Hydraulic dredge	24
Small scale fishery	1309
Passive polyvalent	68
Total	1815

In Table 4.8.1.3 the list of the species to be measured as reported in the National plan and the total landing observed in 2006 in the GSA 9 is reported.

Table 4.8.1.3

Scientific name	Common name	Landing in tons	% on total landing
Engraulis encrasicholus	Anchovy	3720	16.2
Merluccius merluccius	Hake	2330	10.1
Mullus barbatus	Red mullet	1050	4.6
Mullus surmuletus	Striped red mullet	375	1.6
Sardina pilchardus	Sardine	4389	19.1
Thunnus thynnus	Blue fin tuna	51	0.2
Trachurus trachurus	Horse mackerel	419	1.8
Xiphias gladius	Swordfish	678	3.0
Eledone cirrhosa	Horned octopus	945	4.1
Sepia officinalis	Cuttlefish	814	3.5
Aristaeomorpha foliacea	Red shrimp	62	0.3
Aristeus antennatus	Blue-and-red shrimp	93	0.4
Parapenaeus longirostris	Deep-water rose shrimp	463	2.0
Nephrops norvegicus	Norway lobster	248	1.1
Squilla mantis	Mantis squillid	478	2.1
Other	Other	6846	29.8
Total		22961	

Bottom trawlers represent the most important segment of the fleet in terms of production. The main target species are shrimps, hakes, mullets, Nephrops, and cuttlefishes.

An important contribution is due to small pelagic species, Anchovy and Sardine, that are caught quite exclusively by purse seiners.

Small scale fishery is characterised by a high number of vessels, the majority of them characterised by very small length. Although many types of gears can be utilised, the majority of vessels fish with bottom set nets targeting demersal species.

In Table 4.8.1.4 the length sampling plan for 2007 as planned in the national programme is reported. The samples are allocated according to the type of gear, the capacity of the vessels (classes of length) and period of the year subdivide in quarters.

Table 4.8.1.4

GSA	Fishing segment	Vessel length (m)	I quarter	II quarter	III quarter	IV quarter	Tot
9	Demersal trawl	12 < 18	6	7	7	5	25
9	Demersal trawl	18 < 24	7	7	7	7	28
9	Small scale fishery	< 12	12	13	15	11	51
9	Gear using hooks		1	1	1	1	4
9	Passive polyvalent	< 12	2	2	3	2	9
9	Polyvalent	< 12	1	1	1	1	4
9	Pelagic trawl and seiners		1	4	4	1	10
9	Total		30	35	38	28	131

4.8.2 Discussion

The sampling activity was carried out in different ports located along all the coast of the GSA 9. Concerning bottom trawl, the fleet carry out day trips and only in few cases the vessels fish for two-three consecutive days. The strategy followed to measure samples was different according to the type of gear, the ports and the species.

In case of bottom trawl, in many cases the embarks on board were preferred as it was very difficult to measure the fish already landed. In many cases the vessels arrive at the port and the fish are quite immediately transported to the auction. In other cases the fish is not sold through the action and it is directly transported to other places.

One time the fish are at the auction, it is impossible to remove it from the boxes as the sale is very quick. Few boxes can be measured at the landing points before the transportation to the auction but the time window is very short.

In addition, many fishermen are not happy that the researchers handle the fish as it is already prepared for the sale. For this reason, in same case it is necessary to buy same boxes, but this is very expensive and the results are not always satisfactory (low number of specimens).

For these reasons the procedure on board was the most utilised in the GSA 9. In this manner the observers have time to measure all the species listed in the protocol and to maintain separated the catches obtained during the same trip but in different "métiers". However, also this procedure increases the costs as it requires daily allowance for the observers and a payment for the vessel.

Concerning the quality of data collected, representative samples can be easily obtained for the target and the more important species. Also for many by-catch species it is possible to obtain a representative length sample and this allows to obtain data for all the species listed in the Appendix XII of Commission Regulation (Ec) N 1639/2001.

As regards small scale fishery, the measurements have been done at the landing place. This is possible as the quantity landed by each vessel is very low, in particular for those targeting demersal species with trammel nets. These vessels normally land quantities lower than 50 kg and it possible to measure all the specimens of the species included in the protocol.

For larger vessels targeting hake with gillnet a sample was normally measured as the quantities landed are higher (about 80–100 kg) in respect to the vessels using passive

gears. Sometime embarks on board of the vessels targeting hake have been done in order to obtain more representative samples.

The sampling of small pelagic from purse seiners has been done measuring some boxes at the landing points. In some cases, samples have been bought.

In conclusion, due to the high quantities landed and the multi-specific characteristics of the catches the best strategy for the sampling of bottom trawl is the embark of observers on board. On the other hand, this means an increase of the costs due to the time and number of observers. In some cases, when fishermen show willingness to cooperate samplings at the landing points can be performed.

Concerning the other types of gears, mostly purse seiners for small pelagic species and small scale fishery, the sampling at the landing points resulted feasible.

4.9 Latvia

The last PGCCDBS (ICES, 2007a) initiated a concurrent sampling pilot study in preparation of a workshop planned to be held in the beginning of 2008. However, it was decided not to perform any experiments on concurrent sampling in Latvia because the major part of current sampling scheme can be easily converted to the fleet-based approach.

In Latvia sampling is performed by observers onboard the fishing vessels in fisheries targeting cod, sprat, herring and flounder and in coastal fisheries by fixed gears where there is often a mixture of sea and freshwater species. For sprat and herring we have also harbour sampling.

In cod fishery sampling is performed for three fishery fleets separately: cod gillnet fishery, cod trawl fishery and cod coastal gillnet fishery with boats <10 m. Cod is sampled both in landings and discards. In cod fishery there is usually a by-catch of flounder for which also a landing and discards are sampled. For other by-catch species total weight and numbers are registered.

In herring fishery sampling is performed for 2 stocks:

- In the Gulf of Riga (SD 28.1) from trawl fishery (small by-catch of sprat) and trap-net fishery (practically no by-catch)
- In open sea (SD 25, 26, 28) as by-catch in sprat trawl fishery

In sprat fishery sampling is performed in open sea in sprat trawl fishery (by-catch of herring on average 5%). Due to low TAC of herring in the Baltic Proper there could be an incentive to misreport herring as sprat. Therefore Latvia performs regular on-board sampling in sprat trawl fishery to estimate the species composition in the catches. Concurrently also biological samples of sprat and herring are collected.

In flounder direct fishery sampling is performed for flounder trawl fishery and Danish seines in coastal fishery. Flounder is sampled both in landings and discards.

For all above mentioned four species the sampling includes length and weight measurements, recording of sex and maturity stages, and collection of otoliths for age determination.

In coastal fisheries the length measurements of all the species in the catches is on regular basis performed by fishermen – self sampling.

4.10 Lithuania

4.10.1 Methodology

The major part of the Lithuanian national fleet in the Baltic Sea is represented by both demersal and pelagic trawlers. We have, therefore, chosen this fleet to implement the concurrent sampling studies. In total 7 studies with a total of 14 demersal trawlers, 2 pelagic trawlers and 2 gillnetters were implemented. All samplings in this study were performed in the ports (landing places). In case of pelagic species (herring and sprat) we did not need to perform length measurement as we can take a representative sample to the laboratory for biological analysis of the catch. For cod and flounder we can perform length measurements and weighing in the port. This could be done either in the hole of the vessel (onboard) or on the ground next to the vessel.

In the port usually, 2 groups (2 persons per groups) were sent to the sampling place to investigate various aspects of fish sampling. As an example, 5 visits to the port were carried out during which two groups analyzed a certain number of boxes independently on two different vessels (both belongs to segment 24–40 m) at the same time. Time availability depends on how quick the offload of fish will be done. Usually, wholesalers are already waiting for the vessels coming up. Fish is directly loaded from the vessel into the trucks. During this process the scientists have around 15–20 minutes to measure fish.

4.10.2 Results

The species that were chosen for this study were cod and flounder. The study showed that the number of boxes varied from 2 to 6 (on average number 4 boxes per sampling). Given the fact that cod is sorted out by market size or length categories, the most important factor is to choose the right number of boxes of the particular length category. This is a very important issue in order to get representative length distribution of catches. The main problem is that even the fishermen or skippers do not know how many boxes of each size category they have. This factor slightly complicates sampling as we have to presume how many boxes we analyze. The correction of length distribution of total catch could be done having results from observation trips.

Comparing the results of measurement we found a difference in mean length of measured fish. The difference, however between two measuring groups is not significant. This difference makes up to 80% of all sampling cases. Similar results were found for flounder.

The time available for sampling ranged from 30 to 60 minutes, while duration of sampling lasted from 20 to 40 minutes. Samplings were completed in all cases (Table 4.10.2.1).

Table 4.10.2.1

SAMPLING LOCATION: PORT (LANDING PLACE)					
FLEET SEGMENT: 24–40 M DEMERSAL TRAWLERS	VISIT 1	VISIT 2	VISIT 3	VISIT 4	VISIT 5
Time available for sampling (minutes)	60	40	45	60	30
# staff members	2	4	4	6	4
No of vessels available for sampling	2	4	3	5	2
No of vessels sampled	2	4	3	3	2
No of samples available (vessels x species x categories)	12	24	18	30	12
No of species landed	2	2	2	2	2
No of species sampled	2	2	2	2	2
No of measurements	308	481	475	1098	977
Applied scheme (12 or 3)	1	2	1	1	2
Sampling completed (Y/N)	Y	Y	Y	Y	Y
If completed, duration of sampling (minutes)	30	25	30	40	20

4.10.3 Discussion

The implementation of the concurrent sampling did, in general, not create any serious problems. In some cases this sampling scheme was applied during regular sampling. The number of people for sampling in port is set according to the plan and strategy. The availability is also an important factor. More staff effort is needed when all vessels come home just before severe weather conditions start. In general, extra costs are needed to implement this study. On other hand, concurrent sampling is impossible to implement onboard at sea as only one observer due to space limit can participate. Despite this fact, samples obtained during the trip are more representative and have higher quality.

4.11 Malta

4.11.1 Methodology

Aspects of the Maltese Fishery

Fisheries in Malta is a relatively small industry where its social significance far outweighs its economic importance. It is in fact a traditional activity which operates on a small scale producing small volumes of very precious product. The industry is mainly artisanal and fairly typical of the fisheries found in many Mediterranean countries (Leiva *et al*., 1998). There are no inland fisheries in Malta.

In 2006, the Maltese fishing population consisted of about 2378 registered fishing crafts Out of these 2378 vessels, only 57 are considered as industrial vessels (i.e. over 15 m overall length). These industrial vessels are mainly trawlers, long liners and netters. The rest of the vessels could be considered as multipurpose since they undertake all types of fishing and especially fishing for dolphinfish. The dolphinfish (*Coryphaena hippurus*) or 'lampuka' (in Maltese) is one of the most important species for the economy of the Maltese fishing industry. Dolphinfish are captured using "fish aggregating devices"(FAD's). The fish are then caught by surrounding nets similar to a purse-seine. The remaining 2321 boats are owned by full-time, part-time and recreational fishermen. They differ substantially in shape, size, gear utilised and hours spent in fishing activities. Both professional and amateur fishermen fish in coastal and offshore waters.

The Maltese Fish Market

The larger part of fish landings originates from international waters. The main landing sites in Malta are Marsaxlokk Harbour and the wholesale fish market in Valletta, whilst Mgarr Harbour is the main landing site in Gozo. Most of the fish caught by Maltese fishermen is sold through the Wholesale Fish market in Valletta. Catches are sold by public auction through a middleman to retailers and fish hawkers under the supervision of protection officers. All dealers in fish are registered with the Fisheries Department. Statistical data for fish landings is collected through the daily returns of sales submitted by middlemen at the Wholesale Fish market in Valletta. However this only covers sales effected in Malta since there is no such market in Gozo (Coppola, 1999). Since the only fish market present in Malta is at Valletta this is where sampling was carried out. The market opens at 3am and sales start at 4am.

The fish bought wholesale, is marketed by 250 registered fish vendors on carts or vans, each of which has his own particular zone where to dispose of his wares. However, most bluefin tuna and an increasing percentage of swordfish caught by Maltese long-liners and various species caught by bottom trawling are exported to foreign markets. The fish processing industry in Malta is practically non-existent.

Implementation study

With the proposed shift in the EU data collection framework, from species-based to fishery-based sampling, an implementation study was carried out to test the feasibility of concurrent length frequency sampling at the Maltese fish market. This pilot study was carried out in October 2007 at the Valletta Wholesale Fishmarket. Letters were sent to the fishing cooperatives in Malta and to all the intermediaries explaining what the study involved and its applications. As already mentioned, this is the only fish market present in the Maltese Islands and only one auction is present for all the fleets. In total, nine persons were involved in this exercise and these were split up into two groups. These two groups attended the market on alternate weeks. Each group was further split into two teams.

Sampling scheme 1A was adopted for concurrent length sampling in Malta. This sampling scheme addresses all species in each sampling operation (comprehensive concurrent sampling). All species groups are also covered, including landings of minor by catch species. Refer to Annex I – 'Concurrent sampling scenario' (pages 12 & 13) for the lists of species divided into groups 1, 2 and 3 for the different fleets.

Sampling was carried out on weekdays only. The time available for sampling varied between half an hour to one hour. This is because the market opens at 3am and the sales start at 4am. Most of the fisheries were sampled since the market is relatively small. In the case of Malta, it was pointless to focus only on one type of fishery since the quantities landed are very small.

The vessels sampled were chosen randomly. For each sample, the date, harbour, vessel registration number, flag of the vessel, geographical area of catch, the time window available for sampling, sampling duration and the number of species per group were recorded.

Total length or fork length was measured depending on the fish species. For cephalopods, mantle length was measured. When possible, the weight was also obtained.

4.11.2 Results

Below are tables providing an overview of the sampling carried out during the implementation study for each fleet segment:

- Trawls (Table 4.11.2.1)
- Hooks and lines (Table 4.11.2.2)
- Gillnets and entangling nets (Table 4.11.2.3)
- Traps (Table 4.11.2.4)
- Surrounding nets (Table 4.11.2.5)
- Grappling and wounding. Data for these landings could not be obtained as no vouchers were available (as these fishery products should not be present at the fish market) and the intermediaries did not want to give the vessel registration number or any details to the sampling team.

Refer to Annex 4.11 for the 'Overview of the current market sampling strategies'.

Table 4.11.2.1 Trawls

	2/10/07	3/10/07	4/10/07	8/10/07	9/10/07	10/10/07	12/10/07	16/10/07	23/10/07	26/10/07
Time available for sampling (minutes)	45	45	45	45	45	45	45	45	45	45
# staff members	4	4	4	5	5	5	5	4	5	4
No of vessels available for sampling	7	7	6	7	2	1	2	3	1	1
No of vessels sampled	3	2	2	1	2	1	2	3	1	1
No of samples available (vessels x species x categories)	91	91	21	35	14	13	77	7	1	42
No of species landed	13	13	6	9	6	13	11	3	1	8
No of species sampled	4	6	6	9	6	13	8	3	1	8
No of measurements	63	37	21	140	55	290	168	23	136	167
Applied scheme (12 or 3)	1	1	1	1	1	1	1	1	1	1
Sampling completed (Y/N)	N	N	Y	Y	Y	Y	N	Y	Y	Y
If completed, duration of sampling (minutes)			30	40	40	60		15	10	30

Table 4.11.2.2 Hooks and lines

	1/10/07	2/10/07	3/10/07	4/10/07	5/10/07	8/10/07	9/10/07	10/10/07
Time available for sampling (minutes)	45	45	45	45	45	45	45	45
# staff members	4	4	4	4	4	5	5	5
No of vessels available for sampling	9	19	15	18	16	5	10	5
No of vessels sampled	5	4	4	6	1	5	3	2
No of samples available (vessels x species x categories)	72	152	195	216	240	25	80	40
No of species landed	8	8	13	12	15	5	8	8
No of species sampled	5	3	10	3	1	5	4	2
No of measurements	26	18	33	26	3	25	22	13
Applied scheme (12 or 3)	1	1	1	1	1	1	1	1
Sampling completed (Y/N)	N	N	N	N	N	Y	N	N
	11/10/07	12/10/07	15/10/07	19/10/07	22/10/07	24/10/07	25/10/07	26/10/07
Time available for sampling (minutes)	45	45	45	45	45	45	45	45
# staff members	5	5	4	4	4	5	5	5
No of vessels available for sampling	1	8	1	1	1	5	14	8
No of vessels sampled	1	1	1	1	1	1	3	1
No of samples available (vessels x species x categories)	2	48	2	2	1	20	224	40
No of species landed	2	6	2	2	1	4	16	5
No of species sampled	1	1	2	1	1	1	5	3
No of measurements	15	9	2	3	22	15	29	4
Applied scheme (12 or 3)	1	1	1	1	1	1	1	1
Sampling completed (Y/N)	N	N	Y	N	Y	N	N	N
If completed, duration of sampling (minutes)			10		5			

Table 4.11.2.3 Gillnets and Entangling nets

	19/10/07	22/10/07	24/10/07
Time available for sampling (minutes)	45	45	45
# staff members	4	4	5
No of vessels available for sampling	1	1	2
No of vessels sampled	1	1	2
No of samples available (vessels x species x categories)	9	1	12
No of species landed	9	1	6
No of species sampled	9	1	5
No of measurements	27	47	53
Applied scheme (12 or 3)	1	1	1
Sampling completed (Y/N)	Y	Y	N
If completed, duration of sampling (minutes)	20	30	

Table 4.11.2.4 Traps

	1/10/07
Time available for sampling (minutes)	45
# staff members	4
No of vessels available for sampling	1
No of vessels sampled	1
No of samples available (vessels x species x categories)	2
No of species landed	2
No of species sampled	1
No of measurements	68
Applied scheme (12 or 3)	1
Sampling completed (Y/N)	N
If completed, duration of sampling (minutes)	

Table 4.11.2.5 Surrounding nets

	1/10/07	2/10/07	3/10/07	4/10/07	5/10/07	12/10/07	24/10/07	25/10/07	26/10/07
Time available for sampling (minutes)	45	45	45	45	45	45	45	45	45
# staff members	4	4	4	4	4	5	5	5	5
No of vessels available for sampling	9	7	24	20	18	1	2	8	3
No of vessels sampled	2	1	4	3	6	1	2	2	2
No of samples available (vessels x species x categories)	27	14	72	60	144	1	4	24	15
No of species landed	3	2	3	3	8	1	2	3	5
No of species sampled	3	1	3	3	8	1	2	2	5
No of measurements	81	19	76	43	85	17	33	48	47
Applied scheme (12 or 3)	1	1	1	1	1	1	1	1	1
Sampling completed (Y/N)	Y	N	Y	Y	Y	N	Y	N	Y
If completed, duration of sampling (minutes)	30		40	30	60		15		30

4.11.3 Discussion

Problems encountered

During sampling, several problems were encountered. The maximum sampling time was too short since the market opens at 3am and sales start at 4am, leaving only one hour for sampling. It is impractical and impossible to sample catches once the auction and sales start.

Some of the intermediaries only bring in the boxes containing fish just before or once the sales start. This procedure was probably carried out due to the presence of the sampling teams. This does not allow time for sampling the whole or even part of the catch. Some of the intermediaries showed good cooperation at the start of the sampling month but after a few days they became less cooperative. Others showed increased cooperation.

Even though letters were sent to the fishing cooperatives in Malta and to all the intermediaries explaining what the study involved and its applications, the intermediaries still thought that this was done for enforcement purposes. In December 2007, a new ICCAT recommendation on Mediterranean swordfish (Ref 07–01) was published that states that "*fishing for Mediterranean swordfish shall be prohibited in the Mediterranean Sea during the period from October 15 th to November 15 th, 2008"*. This will increase the problem of concurrent sampling in the future since sampling was carried out in October and this included the measuring of small swordfish. There is a risk that the fishers will be unwilling to cooperate in the future since their perception will be that the regulation was issued following the swordfish length measurements. Similar situations may arise in future sampling programs.

Problems with the enforcement and control inspectorate of the fisheries department may also arise as during sampling some irregularities were found. The data collected for the Data Collection Framework should not be used for enforcement purposes.

Sampling was not performed during weekends. If the landings during weekends are not entirely sold, these are re-auctioned on Monday, and hence length sampling carried out on Mondays may contain fishery products from the previous weekend.

The number of vessels and species available for sampling were obtained from the vouchers. If a particular vessel did not sell any of its products, this would not be included in the number of vessels available for sampling since no record of the landing vessel or catch would exist. This also applies for the species. If a particular species is not sold, this would not be included in the number of species available for sampling.

Problems for specific fisheries

Recreational fishing is very popular in the Maltese Islands and some intermediaries sell fishery products caught by recreational fishers. Such products are usually placed in one box for all the different vessels, making traceability of data impossible. Also, since such products should not enter the fish market, no vouchers were found and the intermediaries were reluctant to give any information.

Sampling was carried out during part of the 'dolphin fish season'. Traceability of data for landings from this fishery was difficult as many times, the catches caught from different vessels were placed together on a pellet by the intermediaries. The sampling team had to rely on what information the intermediaries gave. Since large quantities of dolphin fish (*Coryphaena hippurus*) are caught in this fishery, the individual fish are

packed nicely in boxes and covered with ice. Both intermediaries and fishers were reluctant to let the sampling team take out the fish from the boxes for sampling and more than 95% of the time the fishers refused.

With respect to surface long-lining in times of good weather, the catch was very large, especially for swordfish. When this happened, a portion of the catch was not auctioned the same day of the landing but was stored in the cold stores and auctioned the next day.

Sampling trawl catches gave a number of problems. In the majority of cases, most of the catch is not landed especially the high priced species such as Red shrimp (Aristaeomorpha *foliacea*) and Norwegian lobster (*Nephrops norvegicus*). It is sold directly to middlemen and exported and this also happens with large specimens of swordfish. Hence for trawling it is impossible to know the number of samples available and the percentage sampled. Also, when large numbers of the same species are present, it is impractical and not possible (given the time available) to count the number of individuals available for sampling. Many times, fishery products from trawlers are packed in ice and thus length sampling cannot be performed. Crustaceans, being highly valued species could not be sampled as the sampling team was not allowed to touch the catch.

Comparing concurrent length sampling with current sampling methodology

The current sampling methodology for Malta according the data collection regulation EC1639/2001 involves the collection of biological data such as length, weight, sex, maturity stage and age for three species: *Thunnus thynnus* (bluefin tuna), *Coryphaena hippurus* (dolphin fish) and *Xiphias gladius* (swordfish).

Although at present more biological parameters are measured for the three species when compared to the concurrent length sampling, more effort is involved in the concurrent length sampling exercise. This is because in the present programme samples are bought from the fish market and measurements are taken in the laboratory. With concurrent length sampling, many more species and fisheries are being taken into consideration and this requires increased staff effort and increased effort to obtain the required samples as mentioned above. However, one has to point out that with concurrent length sampling, more data is gathered and more replicates are available for each fishery.

Advice on best practice methods

From the concurrent length sampling exercise carried out in Malta several important problems and limiting factors were found. For example, since in many cases the whole catch cannot be sampled, guidelines referring to the percentage of the catch that needs to be sampled should be present.

With respect to trawling due to difficulty in measuring the catch, if funding is available, an entire catch or part of the catch can be bought once a month, especially for species such as crustaceans. Samples can be bought also for fishery products obtained by purse seining. Boat based observations are another option especially for surface long liners. Fishermen from each fleet segment can also be hired, especially for gill nets, trammel nets and bottom long liners.

An important issue is that the fishermen and intermediaries should be better informed about the importance of length sampling. Another possible solution would be that an EC regulation is set up stating that the fishermen have to allow scientists to take length measurements of the fishery products that are caught.

In conclusion, this implementation study revealed that several limiting factors are present for concurrent length sampling. The major problems were; the time window available for sampling and reluctance of fishers to cooperate in measurements of highly valuable species. Other problems are also present, but with method improvements, concurrent length sampling could be feasible. Within the time frame limits, it was still possible to obtain a significantly amount of data.

4.11.4 Other issues

As regards databases and software packages to be used, it would be ideal if a common database for all the member states would be present. This makes analyses and comparisons easier. Another option would be that every member state develops its own database system.

4.11.5 Bibliography

Coppola RS. (1999). *Review of the Maltese Fishery Statistical System and options for its improvement*. Fishery Resources Division. unpublished report. Malta 26 pp.

De Leiva I., Busuttil C., Darmanin M., Camilleri M. (1999). *Project: FAO Copemed: Artisinal Fisheries in the Western Mediterranean – Malta Fisheries'* – Department of fisheries, unpublished report. Malta 21 pp.

Annex 4.11

Concurrent sampling scenario

Sampling scheme	Métier	Group 1 Target and recovery species				Group 2 Other target species and major by-catch species										Group 3 All other by-catch species																								
		Aristaeomorpha foliacea	*Nephrops norvegicus*	*Parapenaeus longirostris*	*Mullus surmuletus*	*Aristeus antennatus*	*Octopus vulgaris*	*Loplitius budegassa*	*Lophius piscatorius*	*Mullus barbatus*	*Sepia officinalis*	*Zeus faber*	*Merluccius merluccius*	*Phycis blennoides*	*Raja clavata*	*Scyliorhinus canicula*	*Trachurus trachurus*	*Aspitrigla cuculus*	*Chelidonichthys cuculus*	*Chelidonichthys lastoviza*	*Eledone cirrosa*	*Eledone moschata*	*Illex coindetti*	*Loligo vulgaris*	*Sepia officinalis*	*Trachurus mediterraneus*	*Trachurus trachurus*	*Trisopterus minutes capelanus*	*Spicara smaris*	*Spicara flexuosa*	*Raja miraletus*	*Peristedion cataphractum*	*Citharus linguatula*	*Lepidorhombus boscii*	*Micromesistius*	*Galeus melastomus*			
Scheme 1A	Trawling	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			

Sampling scheme	Métier	Group 1 Target and recovery species				Group 2 Other target species and major by-catch species										Group 3 All other by-catch species																								
		Coryphaena hippurus	*Xiphias gladius*	*Boops boops*	*Octopus vulgaris*	*Naucratus ductor*	*Seriola dumerili*	*Polyprion americanus*	*Tetraptus belone*	Epinephelus spp	*Pagrus pagrus*	*Scorppaena scrofa*					*Balistidae spp.*	*Priomace glauca*	*Squalus acanthias*	*Conger conger*	*Merluccius merluccius*	*Diplodus sargus*	*Raja spp.*	*Molva molva*	*Pagellus acarne*	*Dentex dentex*	*Centophorus granulosus*	*Pagellus erythrinus*	*Trigla spp.*	*Trachinus SPP*									
Scheme 1A	FAD's	X				X	X	X									X																						
Scheme 1A	Surface long-lines		X						X									X																					
Scheme 1A	Bottom long-lines									X	X	X							X	X	X	X	X	X	X	X	X	X	X	X								
Scheme 1A	Traps			X	X																																	

Sampling scheme	Métier	Group 1 Target and recovery species									Group 2 Other target species and major by-catch species												Group 3 All other by-catch species														
		Scorpaena spp	*Sepia officinalis*	*Mullus spp*	*Diplodus spp*	*Seriola dumerili*	*Oblada melanura*	*Sphyrna zygaena*	*Auxis thazard*		*Octopus vulgaris*	*Boops boops*	*Pagellus spp*	*Sparus aurata*	*Trachurus spp*	*Seriola dumerili*	*Dentex spp*	*Sciena umbra*	*Sparisoma cretense*	*Zeus faber*				*Sarpa salpa*	*Labrus merula*	*Muraena helena*	*Uranoscopus scaber*	*Trachinus spp*	*Dasyatis pastinaca*	*Raja alba*	*Alosa alosa*	*Serranus scriba*	*Spicara spp*						
Scheme 1A	Trammel nets	X	X	X	X						X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X					
Scheme 1A	Gillnets					X	X	X	X		X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X					

Overview of the current market sampling strategies

COUNTRY	SPECIES	LOCATION OF SAMPLING	TYPE OF SAMPLING	STRATIFICATION BY MARKETCATEGORY
(ICES code)	(3-char. code)			
MLT	GUR	Auction	Length	NO
MLT	BOG	Auction	Length	NO
MLT	MOX	Auction	Length	NO
MLT	COE	Auction	Length	NO
MLT	DOL	Auction	Length	NO
MLT	DYL	Auction	Length	NO
MLT	SWA	Auction	Length	NO
MLT	CTB	Auction	Length	NO
MLT	TOZ	Auction	Length	NO
MLT	GPW	Auction	Length	NO
MLT	GPD	Auction	Length	NO
MLT	LTA	Auction	Length	NO
MLT	BON	Auction	Length	NO
MLT	SBL	Auction	Length	NO
MLT	SQM	Auction	Length	NO
MLT	WRM	Auction	Length	NO
MLT	SFS	Auction	Length	NO
MLT	LDB	Auction	Length	NO
MLT	LOB	Auction	Length	NO
MLT	SQR	Auction	Length	NO
MLT	HKE	Auction	Length	NO
MLT	MUT	Auction	Length	NO
MLT	NAU	Auction	Length	NO
MLT	SBS	Auction	Length	NO
MLT	PAC	Auction	Length	NO
MLT	RPG	Auction	Length	NO
MLT	GFB	Auction	Length	NO
MLT	WRF	Auction	Length	NO
MLT	BSH	Auction	Length	NO
MLT	RJC	Auction	Length	NO
MLT	RJO	Auction	Length	NO
MLT	OIL	Auction	Length	NO
MLT	CBM	Auction	Length	NO
MLT	RSE	Auction	Length	NO
MLT	SYC	Auction	Length	NO
MLT	CTC	Auction	Length	NO
MLT	AMB	Auction	Length	NO
MLT	CBR	Auction	Length	NO
MLT	CTC	Auction	Length	NO
MLT	PRR	Auction	Length	NO
MLT	SBG	Auction	Length	NO
MLT	YRS	Auction	Length	NO
MLT	QUB	Auction	Length	NO
MLT	AGN	Auction	Length	NO
MLT	SDR	Auction	Length	NO
MLT	MSP	Auction	Length	NO
MLT	SQE	Auction	Length	NO
MLT	TDQ	Auction	Length	NO
MLT	UUC	Auction	Length	NO
MLT	SWO	Auction	Length	NO
MLT	JOD	Auction	Length	NO
MLT	EFJ	Auction	Length	NO

Table (Continued)

MLT	LOB	Auction	Length	NO
MLT	SLM	Auction	Length	NO
MLT	BFT	Auction	Length	NO
MLT	GUY	Auction	Length	NO
MLT	BAS	Auction	Length	NO
MLT	MAZ	Auction	Length	NO
MLT	JAX	Auction	Length	NO
MLT	MNZ	Auction	Length	NO
MLT	OCZ	Auction	Length	NO
MLT	DEX	Auction	Length	NO
MLT	MGS	Auction	Length	NO

4.12 Poland

4.12.1 Methodology

The study was implemented on-board during two fishing trips and one test was done in First Center Sale in fishing harbour in Kołobrzeg form landings.

On-board sampling was performed on trawlers category VL2440 using bottom trawl targeting flounder. Trips were semi-randomly selected.

The sampling methodology for at-sea sampling included collecting data about landings and discards and performing length measurements on landed and discarded species. For these exercises scheme 1A was set for group 1 fishes (recovery and target species: cod, herring, sprat, salmon) and scheme 2B 2nd row for species form second group. Other species were pooled in on sample for trip.

The sampling methodology for CLS from landings in Kołobrzeg was the same as for at-sea.

For on-board selected trawlers belongs to métier VL2440-OTB-DEF-FLE-105–1–110, and landing sampling in FSC come from métier VL1224-OTB-DEF-COD-105–1–120.

Two observers were in the founder trips and six technicians were sampling landings in the sale centre.

4.12.2 Results

At-Sea sampling

At-Sea sampling was conducted for two trips (three and eight hauls). A summary of the results is provided in Table 4.12.2.1 and 4.12.2.2.

Table4.12.2.1. Results form trip 1

Country	POL
Location	At-Sea
Fleetsegment/Fishing activity	VL2440-OTB-DEF-FLE-105-1-120 (vessel no 1)

	04.12.2007	04.12.2007	05.12.2007
Time available for sampling (minutes)	360	300	200
# staff members	2	2	2
No of vessels available for sampling	1	1	1
No of vessels sampled	1	1	1
No of samples available (vessels x species x categories)	9	6	6
No of species landed	6	4	3
No of species sampled	5	4	3
No of measurements	326	283	240
Applied scheme (1,2 or 3)	1	1	1
Sampling completed (Y/N)	Y	Y	Y
If completed, duration of sampling (minutes)	120	100	90

1- group 1species	2-flounder-landing	flounder-landing	2-flounder-landing
2 – group 2	2-flounder-discard	flounder-discard	2-flounder-discard
3 – group 3	3-plaice-landing		
	3-whiting-discard		
	3-turbot-discard	3-turbot-discard	
	3-plaice-discard	3-plaice-discard	3-plaice-discard
	flounder-landing-analyse		flounder-landing-analyse
	flounder-discard-analyse		
	1-cod-landing	1-cod-landing	1-cod-landing
		1-cod-discard	1-cod-discard

For cod samples form each haul were taken from landing and discard parts of catches. For flounder for which the rolling scheme was set up, samples were taken from the first and third hauls. For the other species one sample was collected.

Table 4.12.2.2. Results from trip no 2. Min, max and total values for 8 hauls.

Country	POL
Location	At-Sea
Fleetsegment/Fishing activity	VL2440-OTB-DEF-FLE-105-1-120 (vessel no 2)

	Min	Max	Total
Time available for sampling (minutes)	180	240	1620
# staff members	2	2	2
No of vessels available for sampling	1	1	1
No of vessels sampled	1	1	1
No of samples available (vessels x species x categories)	2	8	40
No of species landed	1	5	5
No of species sampled	1	177	193
No of measurements	4	289	1407
Applied scheme (1,2 or 3)	1	1	8
Sampling completed (Y/N)	Y	Y	0
If completed, duration of sampling (minutes)	50	155	885

In total 40 samples were taken for five species. Cod form retained catch and discard was sampled witch 1A scheme.

First Sale Center sampling

Landings delivered to First Sale Center in Kołobrzeg fishing port from trawler were sampled accordingly to methodology set up in point 1. All boxes with fish were flagged and separated into landing and discard parts. So it was easy to find appropriate boxes to sampling. Fishes was not graded by size category.

Country	POL
Location	Harbour: Kolobrzeg, First Sale Center
Fleetsegment/Fishing activity	VL1224-OTB-DEF-COD-105-1-120

Boxes form each **3 hauls** were flaged in the sea

	24.01.2008
Time available for sampling (minutes)	240
# staff members	6
No of vessels available for sampling	1
No of vessels sampled	1
No of samples available (vessels x species x categories)	8
No of species landed	4
No of species sampled	4
No of measurements	1467
Applied scheme (1,2 or 3)	1 for cod, 2 for flounder, 3 for other
Sampling completed (Y/N)	Y
If completed, duration of sampling (minutes)	200

1- group 2 – group , 3 – group 3

Haul 1	Haul 2	Haul 3
3 Turbot-landing	1 Cod-discard	1 cod-landings-age
3 Plaice-discard	1 Cod-landing	1 cod-discard-age
3 Plaice-landing		2 Flounder-discard
2 Founder-discard		2 Flounder-landins
2 Flounder-landing		1 Cod-discard
1 Cod-discard		1 Cod-landing
1 Cod-landing		
3 Plaice-landing		

It was taken three complementary samples of cod from landing and discard parts. Additionally it was done analyses for age and other parameters of cod from two parts of catch. Flounders were sampled form hauls 1 and 3 for landings and discard. One sample was taken from two parts of plaice catches only from haul no1, because in hauls 2 and 3 plaice was not presented.

4.12.3 Discussion

At-Sea CLS is much easy to do, and it gives us more reliable data. CLS can be implemented in Poland. Two technicians are enough to do at-sea sampling.

On-Market CLS is not so easy from pragmatic view. Time window for sampling is changing. Scheme 1 is practically not workable. CLS needs more technicians. There are problems with fishermen with owners of Centers of Sale, etc. Problem with size category.

CLS needs more time and labor.

Overview current market sampling strategies

Country (ICES code) (e.g SPA)	Species (3-char. code) (e.g. HER)	Location of sampling (auction, on board)	Type of sampling (age, length or age/length	Stratification by marketcategor (YES, NO)	Remarks
POL	ANE	on board, harbour directly from vessel	length/age	NO	
POL	COD	on board, harbour directly from vessel	length/age	NO	
POL	ELE	harbour directly from vessel	length/age	NO	
POL	FLE	on board, harbour directly from vessel	length/age	NO	
POL	FSA	on board, harbour directly from vessel	length/age	NO	
POL	HER	on board, harbour directly from vessel	length/age	NO	
POL	LUM	on board, harbour directly from vessel	length/age	NO	
POL	MAC	on board, harbour directly from vessel	length/age	NO	
POL	MOT	on board, harbour directly from vessel	length/age	NO	
POL	MUR	on board, harbour directly from vessel	length/age	NO	
POL	PLE	on board, harbour directly from vessel	length/age	NO	
POL	POK	on board	length/age	NO	
POL	REB	on board	length/age	NO	
POL	SAL	harbour directly from vessel	length/age	NO	
POL	SCU	on board, harbour directly from vessel	length/age	NO	
POL	SHD	on board, harbour directly from vessel	length/age	NO	
POL	TRS	harbour directly from vessel	length/age	NO	
POL	TUR	on board, harbour directly from vessel	length/age	NO	
POL	WHG	on board, harbour directly from vessel	length/age	NO	

4.13 Portugal (Azores)

4.13.1 Methodology

In Azores this study was conducted in October and November 2007 at Horta and Ponta Delgada's first sale fish market, respectively, which are two of the most important auctions for the Region. The implementation study on concurrent length sampling was applied to the bottom long liners and hand lines. The fishing activities left out of the study don't seem to be a future problem in terms of concurrent sampling.

Vessel selection

The vessels start to be randomly selected but usually the selected vessel never come to the port in that specific day, so the way of selection was promptly changed to the first vessel that starts landing in that day. As in Azores, and for these métiers, a pattern of arrivals of the vessels or starting hour for landings does not exist (it depends on the weather conditions, catches and market prices) this method of selection was appeared to be the most effective in order to test all the aspects of the implementation of concurrent length sampling.

Species to be sampled

The species to be sampled where allocated into three groups: Group 1 with the target species; Group 2 composed by other TAC regulated species within the ICES X Area and major by-catch species; and Group 3 including all the other by-catch species landed.

The species that compose the majority of the landings were allocated to certain group depending if it was a target, major by-catch or simple by-catch species, many other different species can occur and automatically allocated to the group 3 (Table 4.13.1.1).

Table 4.13.1.1–Allocation of species into Groups 1, 2 and 3 for the Bottom long liners and Hand lines.

MÉTIER	GRUPO 1	GRUPO 2	GRUPO 3
Bottom Longliners	SBR, WRF	COE, BRF	FOR, BXD, BYS, RIB, SLI, EPI, GFB, MUI, SCK, JOS
Handlines	SBR, WRF	MAS, JAA, BRF, POI, SFS, RPG, MUI	COE, FOR, MON

Sampling procedure

The sampling scheme adopted was the scheme 1A, since the samplers don't know the catch and don't have time to wait and see what to sample, so they just sample everything that is staying available.

The size of the team varied between two and three elements, one or two measured and the other one registered the measurements.

4.13.2 Results

The number of species landed varied between 9 and 17 different species for the 15 sampling sessions occurred for bottom logline fleet, and between 10 and 13 different species for hand line fleet in a total of 12 sessions. For the majority of the species three size categories can be found. The time window available varied between 50 and 210 minutes.

With a three element team it was possible to complete the sampling scheme except for the ultimate species to be landed or non-authorized species by the fishermen.

4.13.3 Discussion

The unfinished sampling schemes are due to several accessibility problems that occurred and generally are not associated to the available time window. However, limited periods of availability and the additional time required to sample concurrently makes it difficult to randomize.

Sampling scheme was compromised due to the non availability of the target species or some specific size categories of this species. Also, it is common this species been landed in the end of the landing. That depends a lot on fishermen good-will, because they don't appreciate the extra handling of the valuable and touchy species.

4.14 Portugal (Mainland)

4.14.1 Methodology

This study was conducted throughout October 2007 at the Matosinhos' first sale fish market which has three auctions depending on the fleet type: bottom otter trawlers, purse seiners and polyvalent fleet. The polyvalent fleet (small-scale fisheries) is composed by several fishing gears, but for the purpose of this study they were divided into active gears (beam trawlers and dredges) and passive gears (netters, potters and long liners). The implementation study on concurrent length sampling was applied to the bottom otter trawlers, to the beam trawlers and to the whole group of passive gears. The seiners and dredges were excluded from this study due

to operational reasons and also because its catches are composed by few species, and so, the conclusions drawn from this study are thought to be easily applied to them.

Vessel selection

One vessel of each type (beam trawler, bottom otter trawler, and passive gears) should be sampled at the fish market daily, but two different methods were applied to select the vessels to sample. From the 1st until the 12 th October the vessels were randomly selected from the group of vessels that had already landed at the harbour at the time of draw. However, the samples were getting biased because the same vessels usually land at the same hour, and a second selection method was used from the 15 th until the 31st. For each fishing activity a list of the vessels that had landed at the Matosinhos' harbour during the months of July, August and September 2007 was compiled and the vessels were randomly selected from that list. During this period three vessels from each fishing activity were drawn, but only one was sampled.

Species to be sampled

The species to be sampled where allocated into three groups: Group 1 included recovery species; Group 2 was composed by TAC-regulated species within the ICES Division IXa and species with high landing frequency at the market; and Group 3 included all the other species landed.

Based on the data from the 2006 landings at the Matosinhos' fish market, the landing frequency of each species was calculated separately for the polyvalent fleet and for the trawl fleet. This was done by dividing the number of times a species was landed by the total number of fishing trips. Species with a landing frequency higher than 75% in the otter trawl fleet and species with a landing frequency higher than 50% in the polyvalent fleet were allocated at Group 2 and all the other species at Group 3 (Table 4.14.1.1).

Table 4.14.1.1–Allocation of species into Groups 1, 2 and 3 for the otter trawlers and polyvalent fleet.

	BOTTOM OTTER TRAWLERS SPECIES	POLYVALENT FLEET SPECIES
Group 1	*Merluccius merluccius*	*Merluccius merluccius*
	Nephrops norvegicus	*Nephrops norvegicus*
Group 2	*Merlangius merlangus*	*Merlangius merlangus*
	Solea solea	*Solea solea*
	Solea senegalensis	*Solea senegalensis*
	Solea lascaris	*Solea lascaris*
	Pleuronectes platessa	*Pleuronectes platessa*
	Lophius budegassa	*Lophius budegassa*
	Lophius piscatorius	*Lophius piscatorius*
	Lepidorhombus whiffiagonis	*Lepidorhombus whiffiagonis*
	Lepidorhombus boscii	*Lepidorhombus boscii*
	Scomber japonicus	*Scomber japonicus*
	Scomber scombrus	*Scomber scombrus*
	Trachurus trachurus	*Trachurus trachurus*
	Trachurus picturatus	*Trachurus picturatus*
	Micromesistius poutassou	*Micromesistius poutassou*
	Trisopterus luscus	*Trisopterus luscus*
	Raja spp.	
Group 3	All other species	All other species

Sampling procedure

Initially it was intended to use the sampling scheme 2A in which Group 1 species should always be sampled and Group 2 and Group 3 species were sampled in a rolling system (part of the species sampled every x^{th} sampling operation, and the other part during each $(X+1)^{th}$ sampling operation). However, as the time available for sampling was scarce, the team wasn't able to verify what species should be sampled at the sampling operation according to the scheme, and ended up sampling all the species present in the catch. So, in practice, the applied sampling scheme was 1A, in which all species present in the landing were addressed. For each species, 50 individuals of each commercial category were measured at the lowest centimetre and the weight of the sample was recorded.

At the market, boxes with a mixture of species (e.g. Atlantic mackerel and chub mackerel; common sole and senegalese sole; or several species of *Trigla* spp.), are frequently sold. When this occurred the species were separated and sampled individually.

Throughout the experiment the crew composition varied between one team of two elements, one team of three elements, and two teams of two elements each. When a team was composed by two elements one measured and the other one registered the measurements. When it was composed by three elements two measured and one registered.

For each sampled vessel the following data was also collected:

- Date
- Vessel code
- Flag of the vessel
- Gear
- Geographical area of catch (ICES Division)
- How was vessel selected for sampling?
- Time window available for sampling (as the time between the end of the weighing procedure and the beginning of the sale. Sometimes the time spent on sampling was superior to the one available and the sampling was conducted while the fish was being weighed and even sold. In these cases, the time available for sampling was recorded as the duration of sampling.)
- Starting hour of time window (end of weighing procedure)
- Duration of sampling
- Sampling method applied (1A, 2A or 3A)
- Was sampling procedure finished? (Y/N)
- If No, why?
- Nº of technicians involved
- Nº of Group 1 species landed
- Nº of Group 1 species sampled
- Nº of Group 2 species landed
- Nº of Group 2 species sampled
- Nº of Group 3 species landed
- Nº of Group 3 species sampled
- Were predefined sampling targets per species met? (Y/N)
- If No, why?

4.14.2 Results

Bottom otter trawlers

Bottom otter trawlers were sampled on 13 (59 1%) of the 22 days available for sampling in October 2007. The absence of sampling was due to the fast sale of the fish (55 6%) which didn't allow the sampling procedure and to the fact that the selected vessels didn't land (44 4%). Table 4.14.2.1 summarizes the results of the implementation study on the bottom otter trawlers landings.

Table 4.14.2.1 – Results of the implementation study on the bottom otter trawlers landings at the Matosinhos fish market in October 2007.

DAY	1	2	3	4	9	11	18	19	23	24	26	29	31
Time available for sampling (minutes)	69	45	15	152	70	23	35	33	25	25	15	105	30
# staff members	3	3	3	2	3	3	3	4	4	3	3	2	3
No of vessels available for sampling	3	2	2	3	2	2	3	3	4	2	2	3	3
No of vessels sampled	1	1	1	1	1	1	1	1	1	1	1	1	1
No of samples available*	32	26	15	31	29	22	32	31	30	23	22	21	28
No of species landed by the sampled vessel	11	16	11	22	15	9	28	15	13	14	9	1	11
No of species sampled	2	6	10	16	15	9	18	15	6	13	4	1	11
No of measurements	111	388	263	556	740	375	648	542	340	506	129	56	325
Applied scheme	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A
Sampling completed (Y/N)	N	N	N	N	Y	Y	N	Y	N	N	N	Y	Y
Duration of sampling (minutes)	19	31	15	75	10	16	35	33	25	25	12	2	25

*** In Portugal the number of species landed is the number of samples available.**

The mean time available for sampling was of 49 4 minutes and the mean sampling duration of 24 8 minutes. A mean of 26 species were landed by this vessels at the sampling days, but the mean number of species landed by the sampled vessels was 13 (50 6% of the total species). On average 8 species were sampled daily, which accounts for 37 2% of the total species landed and 74 4% of the species landed by the sampled vessel. From the 383 measurements performed daily, 43 were made for each species, which took 31 minutes to sample. These are all mean values.

Beam trawlers

Beam trawlers were sampled on 11 (50 0%) of the 22 days available for sampling in October 2007. The samplings weren't performed because at the time of draw the vessels had already sold the catch (18 2%), because the selected vessels didn't land (45 4%) and because the sale was fast disabling the sampling procedure. Table 4.14.2.2 summarizes the results of the implementation study on the beam trawlers landings.

Table 4.14.2.2 – Results of the implementation study on the beam trawlers landings at the Matosinhos fish market in October 2007.

DAY	8	16	18	19	22	23	24	25	29	30	31
Time available for sampling (minutes)	20	270	102	90	30	30	40	90	25	45	70
# staff members	3	3	3	4	3	3	3	3	2	2	3
No of vessels available for sampling	8	6	6	5	7	7	3	7	8	7	7
No of vessels sampled	1	1	1	1	1	1	1	1	1	1	1
No of samples available*	14	9	12	8	12	12	7	12	11	12	12
No of species landed by the sampled vessel	3	1	4	1	6	5	5	1	7	10	5
No of species sampled	3	1	4	1	5	4	5	1	6	9	4
No of measurements	149	41	33	62	141	48	109	37	74	144	107
Applied scheme	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A
Sampling completed (Y/N)	Y	Y	Y	Y	N	N	Y	Y	N	N	N
Duration of sampling (minutes)	20	5	4	3	8	7	5	2	5	17	7

*** In Portugal the number of species landed is the number of samples available.**

The mean time available for sampling was of 73 8 minutes and the mean sampling duration was 75 minutes. A mean of 11 species were landed by the beam trawlers at the sampling days, but the mean number of species landed by the sampled vessel was 4 (39 9% of the total species). On average, 4 species were sampled daily, which accounts for 36 0% of the total species landed and 92 6% of the species landed by the sampled vessels. From the 86 measurements performed daily 29 measures were made for each species, which took 24 minutes to sample. These are all mean values.

Passive gears

The vessels with passive gears were sampled on 14 (63 2%) of the 22 days available for sampling in October 2007. On the days were no samplings were performed it was due to the fast sale of the fish (50 0%) and to the fact that the selected vessels didn't land (50 0%). Table 4.14.2.3 summarizes the results of the implementation study on the landings of the vessels with passive gears.

Table 4.14.2.3 – Results of the implementation study on the landings of vessels with passive gears at the Matosinhos fish market in October 2007.

DAY	2	4	8	10	11	12	15	16	18	22	23	25	26	29
Time available for sampling (minutes)	13	250	55	110	82	20	20	5	25	70	38	60	20	8
# staff members	3	2	3	2	2	2	3	3	3	3	3	3	3	2
No of vessels available for sampling	25	32	41	35	31	30	35	33	40	37	32	33	27	30
No of vessels sampled	1	1	1	1	1	1	1	1	1	1	1	1	1	1
No of samples available*	30	36	37	36	37	34	38	36	44	31	44	38	31	35
No of species landed by the sampled vessel	4	9	13	5	6	3	8	13	11	1	16	11	9	10
No of species sampled	4	9	13	5	4	3	8	4	11	1	16	11	3	2
No of samples performed	7	13	18	9	6	5	12	8	12	2	23	16	6	5
No of measurements	259	276	559	109	209	122	176	182	175	10	266	205	235	156
Applied scheme	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A
Sampling completed (Y/N)	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	N	N
Duration of sampling (minutes)	13	15	55	48	22	20	20	14	16	5	32	15	16	14

*** In Portugal the number of species landed is the number of samples available.**

The mean time available for sampling was of 55 4 minutes and the mean sampling duration was 21 8 minutes. A mean of 36 species were landed daily by this vessels, but the mean number of species landed by the sampled vessels was 9 (22 9% of the total species). On average 7 species were sampled daily, which accounts for 17 7% of the total species landed and for 82 2% of the species landed by the sampled vessels. Of the 210 measurements performed daily, 38 measures were made for each species, which took 42 minutes to sample. These are all mean values.

4.14.3 Discussion

The only major problem encountered during the sampling activity was some unfinished sampling procedures (61 5% in bottom otter trawlers, 45 5% in beam trawlers and 28 6% in passive gears). In the case of the beam trawlers it was always due to the fact that the common shrimp (*Palaemon serratus*) is sold before the rest of the catch for its freshness, immediately after being weighed, and it's not possible to sample it. Concerning the otter trawlers and the vessels with passive gears the samplings were not completed because they were interrupted by the sale of the fish. In these cases the estimated necessary time to sample all the species present in the catch almost always exceeded the time available for sampling. In only two occasions (one for the otter trawlers and one for the passive gears) the sampling procedure could have been finished regarding the time available.

In comparison with the current length sampling programme the effort to collect data increased because the number of species sampled also increased but the number of technicians collecting them remained the same.

The conclusions drawn from this implementation study should be treated with caution before being applied to other fleets and harbours.

4.14.4 Other issues

There should be no major implications for the Portuguese database since it can accommodate the species sampled at the implementation study that aren't addressed in the current sampling programme.

4.15 Spain (Atlantic)

4.15.1 Methodology

In the ICES area two ports were chosen for this experiment, A Coruña and Santa Eugenia de Ribeira, which present most of the difficulties that might be expected at ports in the ICES area. Table 4.15.1 shows an overview of current market sampling strategies for these two ports.

In the case of the métiers, those with the greatest degree of complexity were selected, which are mixed bottom otter trawl (OTB-MIXED) in A Coruña and Santa Eugenia de Ribeira and bottom otter trawl targeting horse mackerel (OTB-HOM) in Santa Eugenia de Ribeira only. Sampling more than one métier is considered to be of interest in order to encounter different kinds of problems. The identification of métiers used was that resulting from the fleet segmentation performed in the IBERMIX project (Castro et al., 2007).

Table 4.15.1. Overview of current market sampling strategies for A Coruña and Santa Eugenia de Ribeira´s ports.

OTB-MIXED (A Coruña)				
Country (ICES code)	**Species (FAO code)**	**Location of sampling**	**Type of sampling**	**Stratification by market category**
SPA	HKE	Auction	Length	YES
SPA	MEG	Auction	Length	YES
SPA	LDB	Auction	Length	YES
SPA	ANK	Auction	Length	YES
SPA	MON	Auction	Length	YES
SPA	NEP	Auction	Length	YES
SPA	WHB	Auction	Length	YES
SPA	HOM	Auction	Length	YES
SPA	MAC	Auction	Length	YES
SPA	GFB	Auction	Length	YES
OTB-MIXED and OTB-HOM (Santa Eugenia de Ribeira)				
SPA	MEG	Auction	Length	YES
SPA	LDB	Auction	Length	YES
SPA	HKE	Auction	Length	YES
SPA	WHB	Auction	Length	YES
SPA	HOM	Auction	Length	YES
SPA	MAC	Auction	Length	YES
SPA	BIB	Auction	Length	YES

Sampling took place from 27 th November to 8 th December at the port of A Coruña and from 10 th to 21st of December in the port of Santa Eugenia de Ribeira.

Different sampling scenarios were proposed for the different métiers following the limited number of scenarios to be tested proposed by PGCCDBS as part of the implementation studies

In order to carry out sampling, a prioritized list of species was drawn up for each of the métiers based on the percentage of the mean catch for those ports between 2003 and 2005, and a distinction was made between three groups of species (Table 4.15.2. Prioritized list of species for the métiers OTB-MIXED and OTB-HOM):

- Group 1.–Species in a recovery plan and target species (according to the métier).
- Group 2.–Species with TAC and quota and important species by weight landed.
- Group 3.–Other species.

Table 4.15.2. Prioritized list of species for the métiers OTB-MIXED and OTB-HOM.

METIER: OTB-MIXED	
Group 1	
Merluccius merluccius	
Nephrops norvegicus	
Lophius spp	*L. piscatorius* *l. budegassa*
Trachurus spp	*T. mediterraneus* *T. trachurus* *T. picturatus*
Lepidorhombus spp	*L. boscii* *L. whiffiagonis*
Micromesistius poutassou	
Scomber spp	*S. scombrus* *S. colias*
Group 2	
Solea spp	*S. vulgaris* *S. solea*
Pollachius pollachius	
Trisopterus spp	*T. luscus* *T. minutus* *Trisopterus esmarkii*
Group 3	
Other species	Other species

METIER: OTB-HOM	
Group 1	
Merluccius merluccius	
Nephrops norvegicus	
Trachurus spp	*T. mediterraneus* *T. trachurus* *T. picturatus*
Group 2	
Lepidorhombus spp	*L. boscii* *L. whiffiagonis*
Lophius spp	*L. piscatorius* *l. budegassa*
Micromesistius poutassou	
Scomber spp	*S. scombrus* *S. colias*
Solea spp	*S. vulgaris* *S. solea*
Pollachius pollachius	
Trisopterus spp	*T. luscus* *T. minutus* *Trisopterus esmarkii*
Group 3	
Other species	Other species

The sampling team was made up of a controller, who was the sampling organizer and four samplers. The controller is the usual sampler of the fish market in question, who had perfect knowledge of its workings (timetables, buyers, patterns followed by vessels etc.)

At the port of A Coruña there is a lot of time available for sampling since vessels begin to make their landings at 12 at night, and sales begin at 7 in the morning. The landed catch is left in the market overnight and so there is enough time for it to be sampled.

By contrast, at the port of Santa Eugenia de Ribeira, time for sampling is short due to the swiftness of the sale. The vessels return to port at 6 in the afternoon and the catch is sold as it is landed. The mean time taken to unload a trawl vessel is 50 minutes (from unloading the first box on its way to the market until the last box is auctioned). The time that each batch spends in the market is approximately 5–10 minutes.

Sampling consisted of the following:

- Firstly, the coordinator of the experiment identified whether the trip landed belonged to the métier of interest in each case, or not.
- For all of the vessels, one of the métiers, the order of arrival, vessel name, total catch of the trip and number of species landed were collected daily
- The vessel to begin sampling was selected randomly from the first three to land on the day (in order of landings reaching the market at A Coruña and in order of arrival at the port of Santa Eugenia de Ribeira). The aim of randomly selecting the catch to sample from the first three to land was to prevent the loss of the chance of sampling on that day.
- Whenever a vessel's landings could not be sampled, the reasons for the failure were collected in detail and the following vessel to enter into port was sampled.
    - The statistical sheets of the trip's characteristics were completed. Among others, these were métier, vessel name, date of landing, geographical area, whether sampling could be performed or not, reasons for failure to sample, number of species landed and sampled of each group during the trip
    - Length sampling of fish species was performed, and sampling by sex in the case of Norway lobster. This sheet was used to record the time at which sampling began and the time it finished for each species sampled and the number of samplers involved in the sampling of each species.

Audio recordings of all samplings were made at the market and these data were later passed to their corresponding statistical sheet and were fed into the data base created for the experiment.

4.15.2 Results

There was no need to apply the different sampling scenarios proposed for the different métiers, since all species could be sampled in each sampling operation (Scheme 1A).

At the port of A Coruña there were performed samplings in 8 days, 22 vessels were sampled. In each sampling operation all the species landed by the vessel were sampled, except cephalopods, which were not measured due to a mistake in the design of sampling and they were not included in the prioritized list of species, in those cases, we consider sampling completed.

At the port of Santa Eugenia de Ribeira there were performed samplings in 10 days:

- OTB-MIXED ◎ 24 vessels were sampled :
    - 5 sampling operation were considered unsuccessful (1 o 2 species from Group 2 were not measured)
    - 12 sampling operation were considered successful but cephalopods were not measured
    - 7 sampling operation were completed

OTB-HOM ◎ 5 vessels were sampled:

- 2 sampling operation were considered unsuccessful (1 o 2 species from Group 2 were not measured)
- 1 sampling operation were considered successful but cephalopods were not measured
- 2 sampling operation were completed

The results obtained for the port of A Coruña are presented on Table 4.15.3 and for Santa Eugenia de Ribeira on Table 4

Table 4.15.3. Result obtained for the port of A Coruña.

Date	Time available for sampling (minutes)	#staff members	No of vessels available for sampling	No of vessels sampled	No of samples available (species x categories) of each vessel	No of species landed	No of species sampled	No of measurements	Applied scheme (1,2 or 3)	Sampling completed (Y/N)	Duration of sampling (minutes)
01/01/1900	>120	4	10	1	40	29	27	545	1A	Y*	35
28/11/2007	>120	4	17	2	25	16	16	540	1A	Y	50
	>120	4	17	2	37	29	26	610	1A	Y*	55
29/11/2007	>120	4	12	2	32	25	22	543	1A	Y*	35
	>120	4	12	2	30	20	18	667	1A	Y*	35
30/11/2007	>120	4	15	3	40	27	24	762	1A	Y*	35
	>120	4	15	3	38	24	21	913	1A	Y*	40
	>120	4	15	3	33	21	21	913	1A	Y	45
01/12/2007	>120	4	17	4	24	18	16	344	1A	Y*	76
	>120	4	17	4	23	17	16	342	1A	Y*	87
	>120	4	17	4	19	15	13	426	1A	Y*	55
	>120	4	17	4	14	8	6	265	1A	Y*	61
04/12/2007	>120	4	10	2	18	15	13	361	1A	Y*	20
	>120	4	10	2	19	12	12	456	1A	Y	20
05/12/2007	>120	4	19	4	25	19	18	685	1A	Y*	15
	>120	4	19	4	37	27	24	745	1A	Y*	42
	>120	4	19	4	13	9	7	264	1A	Y*	35
	>120	4	19	4	26	13	12	437	1A	Y*	20
07/12/2007	>120	4	18	4	39	28	25	861	1A	Y*	50
	>120	4	18	4	36	23	23	776	1A	Y	45
	>120	4	18	4	36	25	23	856	1A	Y*	35
	>120	4	18	4	22	17	13	520	1A	Y*	30

Y*: all species were measured except cephalopods because of a mistake in the sampling design

Table 4.15.4. Results for the port of Santa Eugenia de Ribeira:

OTB-MIXED

Date	Time available for sampling (minutes)	# staff members	No of vessels available for sampling	No of vessels sampled	No of samples available (species x categories) of each vessel	No of species landed	No of species sampled	No of measurements	Applied scheme (1,2 or 3)	Sampling completed (Y/N)	Duration of sampling (minutes)
10/12/2007	<120	4	1	1	19	13	12	707	1A	Y*	45
11/12/2007	<120	4	4	4	15	10	9	643	1A	Y*	23
	<120	4	4	4	11	12	9	362	1A	N	50
	<120	4	4	4	4	6	4	174	1A	N	35
	<120	4	4	4	12	14	12	476	1A	N	65
12/12/2007	<120	4	3	3	6	5	5	213	1A	Y	45
	<120	4	3	3	16	13	13	546	1A	Y	35
	<120	4	3	3	18	18	16	557	1A	Y*	55
13/10/2007	<120	4	4	4	10	11	10	473	1A	Y*	45
	<120	4	4	4	14	11	10	589	1A	Y*	40
	<120	4	4	4	11	11	10	672	1A	N	50
	<120	4	4	4	16	15	14	404	1A	Y*	50
14/12/2007	<120	4	2	2	6	8	6	407	1A	Y*	45
	<120	4	2	2	10	9	8	508	1A	Y*	65
17/12/2007	<120	4	2	2	17	17	16	395	1A	Y*	65
	<120	4	2	2	14	14	12	557	1A	Y*	90
18/12/2007	<120	4	2	2	12	13	11	610	1A	Y*	78
	<120	4	2	2	10	10	9	590	1A	Y*	120
19/12/2007	<120	4	2	2	10	11	9	407	1A	Y*	45
	<120	4	2	2	17	14	12	876	1A	Y*	120
20/12/2007	<120	4	2	2	2	2	2	175	1A	Y	90
	<120	4	2	2	12	9	9	474	1A	Y	85
21/12/2007	<120	4	2	2	15	12	11	624	1A	Y*	82
	<120	4	2	2	9	13	9	404	1A	N	65

Y*: all species were measured except cephalopods because of a mistake in the sampling design

OTB-HOM

Date	Time available for sampling (minutes)	# staff members	No of vessels available for sampling	No of vessels sampled	No of samples available (species x categories) of each vessel	No of species landed	No of species sampled	No of measurements	Applied scheme (1,2 or 3)	Sampling completed (Y/N)	Duration of sampling (minutes)
11/12/2007	<120	4	1	1	4	6	4	182	1A	N	27
14/12/2007	<120	4	1	1	10	11	9	385	1A	N	65
17/12/2007	<120	4	1	1	1	1	1	109	1A	Y	70
18/12/2007	<120	4	1	1	1	1	1	98	1A	Y	45
20/12/2007	<120	4	1	1	7	8	6	474	1A	Y*	75

Y*: all species were measured except cephalopods because of a mistake in the sampling design

At the port of A Coruña there were sampled 48 species and at Santa Eugenia de Ribeira OTB-MIXED métier were sampled 30, and for OTB-HOM métier 13 species (Table 5 and 6).

The most frequently sampled species at the port of A Coruña were: hake and white anglerfish (5.6%) and at the port of Santa Eugenia de Ribeira were: hake (9.8%), pouting (9%) for OTB-MIXED métier and horse mackerel (20%) and pouting (12%) for OTB-HOM métier.

Table 4.15.5.Samples performed for the port of A Coruña

A Coruña		
Scientific Name	**Nr Samples**	**%**
Argentina sphyraena	8	2.02
Beryx decadactylus	5	1.26
Boops boops	2	0.51
Chelidonichthys cuculus	11	2.78
Chelidonichthys obscurus	5	1.26
Conger conger	15	3.79
Coris julis	2	0.51
Epinephelus marginatus	1	0.25
Eutrigla gurnardus	16	4.04
Gaidropsarus vulgaris	14	3.54
Galeorhinus galeus	2	0.51
Galeus melastomus	1	0.25
Glyptocephalus cynoglossus	2	0.51
Helicolenus dactylopterus	17	4.29
Hoplostethus mediterraneus medit.	2	0.51
Isurus oxyrinchus	1	0.25
Labrus bergylta	1	0.25
Lepidorhombus boscii	21	5.30
Lepidorhombus whiffiagonis	16	4.04
Leucoraja circularis	2	0.51
Leucoraja naevus	6	1.52
Lophius budegassa	19	4.80
Lophius piscatorius	22	5.56
Merluccius merluccius	22	5.56
Micromesistius poutassou	16	4.04
Molva dypterygia	8	2.02
Mullus surmuletus	10	2.53
Nephrops norvegicus	11	2.78
Pagellus acarne	10	2.53
Pagellus bogaraveo	6	1.52
Phycis blennoides	16	4.04
Pollachius pollachius	1	0.25
Raja clavata	2	0.51
Raja montagui	11	2.78
Scomber colias	2	0.51
Scomber scombrus	12	3.03
Scorpaena scrofa	4	1.01
Scyliorhinus canicula	13	3.28
Serranus Cabrilla	1	0.25
Solea solea	8	2.02
Spondyliosoma cantharus	1	0.25
Trachinus draco	1	0.25
Trachurus picturatus	2	0.51
Trachurus trachurus	13	3.28
Trigla lyra	4	1.01
Trisopterus luscus	15	3.79
Trisopterus minutus	5	1.26
Zeus faber	11	2.78
Total Number of Samples	396	100

Table 4.15.6. Samples performed for the port of Santa Eugenia de Ribeira

Santa Eugenia de Ribeira(OTB-MIXED)			Santa Eugenia de Ribeira (OTB-HOM)		
Scientific Name	**Nr Samples**	**%**	**Scientific Name**	**Nr Samples**	**%**
Beryx decadactylus	1	0.41	*Chelidonichthys cuculus*	1	4.17
Chelidonichthys cuculus	15	6.15	*Chelidonichthys lucerna*	1	4.17
Chelidonichthys lucerna	8	3.28	*Chelidonichthys obscurus*	2	8.33
Chelidonichthys obscurus	17	6.97	*Eutrigla gurnardus*	1	4.17
Conger conger	9	3.69	*Lepidorhombus boscii*	2	8.33
Deania calcea	2	0.82	*Lophius budegassa*	2	8.33
Eutrigla gurnardus	18	7.38	*Lophius piscatorius*	1	4.17
Gaidropsarus vulgaris	7	2.87	*Merluccius merluccius*	2	8.33
Galeus melastomus	1	0.41	*Micromesistius poutassou*	2	8.33
Helicolenus dactylopterus	5	2.05	*Polyprion americanus*	1	4.17
Lepidorhombus boscii	21	8.61	*Solea solea*	1	4.17
Lepidorhombus whiffiagonis	3	1.23	*Trachurus trachurus*	5	20.83
Lophius budegassa	22	9.02	*Trisopterus luscus*	3	12.50
Lophius piscatorius	14	5.74	**Total Number of Samples**	24	100
Merluccius merluccius	24	9.84			
Micromesistius poutassou	21	8.61			
Molva dypterygia	2	0.82			
Mullus surmuletus	2	0.82			
Nephrops norvegicus	2	0.82			
Pagellus bogaraveo	1	0.41			
Phycis blennoides	2	0.82			
Pollachius pollachius	1	0.41			
Raja montagui	1	0.41			
Rajidae	1	0.41			
Scomber colias	2	0.82			
Scomber scombrus	7	2.87			
Solea solea	3	1.23			
Trachurus trachurus	4	1.64			
Trigla lyra	2	0.82			
Trisopterus luscus	22	9.02			
Zeus faber	4	1.64			
Total Number of Samples	244	100			

4.15.3 Discussion and Conclusion

Problems encountered during sampling activity

A Coruña

One of the problems foreseen concerned physical access to the fish to obtain the samples required.

At this port access to the fish is difficult because when it enters the market it has been perfectly laid out on trays and covered with plastic sheets. Interfering with the landed catch once it has been thus laid out is not taken kindly to.

Santa Eugenia de Ribeira

Owing to several difficulties the sampling experiment was delayed by one month with respect to the date initially established. This delay meant that at this port the experiment coincided with the biological stoppage period for the fishing gear, which led to a considerable fall in the number of active trawl vessels and thus fewer trips to sample. Another factor to take into account was that, given how late in autumn it had become, trawl vessels used the traditional fishing gear, which meant the practical exclusion of the large vertical opening gear targeting horse mackerel due to the scarcity of the species. For this reason, the métier OTB-HOM was hardly sampled.

At this port, landing, auctioning and removal from the market of the catch is all performed very quickly, giving rise to difficulties in the time available for sampling.

Restrictions to its applicability

Access to sampling

- Access to species:

Although there were no problems in these experiments, it has come to our knowledge that problems will arise concerning coastal species of greater commercial value.

Methods of preservation: Not all species are preserved in the same way. In the otter trawl fishery that takes place in areas VII and VIII ab, part of the samples of Norway lobster are now landed frozen. This may render it necessary to buy samples in the future

Changes to the presentation of the catch make sampling more difficult: With the aim of improving economic yields the presentation of catch is being made more attractive. These improvements include wrapping boxes with plastic, which makes it difficult or even impossible to sample some species

- Access to the trip:

Refusal to be sampled by part of the fleet

Application to other fleets/métiers or harbours:

Despite having chosen the most complex study cases possible, it is difficult to apply the experiment to the sampling of other métiers or ports. This is because some of the main problems are obtaining permission to gain access to sampling/species. This makes each fleet and port an individual case.

Comparison between concurrent and traditional sampling

- Sample size: As it was proposed as an aim to sample the greatest number of species possible, the sample size became secondary for the sampler, and was smaller than that made in the traditional sampling by species
- Structure: The actual structure of the IEO of one sampler per sampling harbour is not valid. The number of samplers at each port must be increased and sampling teams created to move between ports. In addition to the increased cost in personnel, this latter need will lead to an increase in costs such as expenses, accommodation and transport.

Quality data

- Non-random selection of the trip to be sampled: Work is done mainly with the fleet that makes it easiest to carry out sampling. This problem must be solved either by involving the fleet in sampling (for example, by passing over to the fleet itself the process of determining by lottery which vessels are to be sampled) or by means of directives from the EU and its member states
- Taxonomic identification of species: Length distributions of the catches of species that do not appear in the Log books (due to difficulty in their

identification or low catch) will be available to us. Discrepancies will arise between the landing information and the information in the log books.

4.16 Spain (Basque country)

4.16.1 Methodology

Selection of fishing activity

The fishing activity selected for this implementation study, was the otter bottom trawlers ("Bakas") operating in ICES area VIIIabd. This mixed fishery is characterized by a high level of sampling complexity, as it exploits a high variety of species, and presents important seasonal differences in terms of target species and major by-catch species.

The port chosen was the port of Ondarroa, which represents more than 90% of the landings of Otter bottom trawlers in all the Basque Country.

The period of study lasted 47 days, from the 21st of November of 2007 to the 7 th of January of 2008

Selection of vessels

Each day, the sampler in charge wrote down a list with the vessels which had arrived that day, sorted by arrival time. The name, fishing gear and fishing area of each vessel were recorded. As such, the target vessels of the experiment ("Bakas" VIIIabd) could be identified

The sampling started with the first target vessel in the list. When it was not possible to sample the landings of the first vessel, the reasons of no sampling were recorded, and the next vessel in the list sampled. This scheme was repeated with the rest of the vessels.

Selection of sampling schemes and allocation of species to groups 12 or 3

For this experiment, sampling scheme 1A was followed, with the purpose of estimating the maximum number of categories which could be sampled in the time window available.

Species were allocated to groups 1, 2, 3, following the distinction made in PGCCDBS Malta 2007. It is important to note that the species included into these groups vary during the year, due to the variability of this fishing activity in terms of main target and by-catch species. During the present study, the same groups were maintained:

Group1 (target species and recovery plan):

Hake (*Merluccius merluccius*), Lobster (*Nephrops norvegicus*), Anglerfish (*Lophius piscatorius*), Blackbellied angler (*Lophius budegassa*), Squids (*Loligo spp*), Cuttlefish (*Sepiidae*), Red mullets (*Mullus spp*), Megrims (*Lepidorhombus spp.*)

Group2 (TAC and major by-catch species):

Pouting (*Trisopterus luscus*), Poor cod (*Trisopterus minutus*), Whiting (*Merlangius merlangus*), Turbot (*Psetta maxima*), Mackerel (*Scomber scombrus*), Pollac (*Pollachius pollachius*), Horse mackerel (*Trachurus trachurus*), Blue whiting (*Micromesistius poutassou*)

Group3 (all other by-catch species):

Rays (*Raja spp*), Atlantic John Dory (*Zeus faber*), Triglidae (*Triglidae*), Argentines (*Argentina spp*), Conger (*Conger conger*), etc, etc

Crew size (# of persons involved)

5 samplers were involved in the experiment. They worked in groups from 1 to 5 persons in order to estimate the effort needed to complete the sampling.

Time window available for sampling

In the port of Ondarroa, there are two possible time windows to perform the length sampling.

The first one is the time just after the catch is landed, before the fish sale. It starts approximately at 24h. The duration of this time window depends on the number of vessels that the ship owner has discharging at the same time and can be prolonged for more than 3h.

The second time window available is the period of time from when the fish sellers watch the fish in the stores (before the fish sale), until they take it away (after the fish sale). The duration varies from 1h30 to 2h30 depending on the order of sale, which is set by drawing and is unknown at the beginning of the sampling.

Current ordinary length samplings are done after the sale. However, for this study the time window available just after the landing of catch was selected. This was the longest time window and we wanted to have the maximum time possible to sample all species.

4.16.2 Results

Availability of samples

The period of the study lasted 46 days (from November the 21st to December the 27 th of 2007), from which 18 days presented landings of the target fishing activity (Otter bottom trawlers of the VIIIabd). Length samplings could be carried out only during 7 days (Table 4.16.2.1).

Table 4.16.2.1: Summary table of the pilot study sampling. At dates marked with * two different vessels were sampled. Note that at these dates the number of vessels and categories available for sampling are the same, as they refer to the same sampling day.

Country	Spain
Location	Ondarroa
Fleetsegment/Fishing activity	Otter bottom trawlers ("Bakas"); VIIIabd

	21/11/2007	22/11/2007	26/11/2007	27/11/2007	28/11/2007	30/11/2007	03/12/2007	04/12/2007	* 10/12/2007	* 10/12/2007	11/12/2007	14/12/2007	* 17/12/2007	* 17/12/2007	18/12/2007	19/12/2007	20/12/2007	26/12/2007	04/01/2008	07/01/2008
Time available for sampling (min.)	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190
# staff members	4		4		5		5		1	2			2	1			3			
No of vessels available for sampling	4	1	7	4	2	1	10	2	12		1	2	7		3	2	3	7	5	7
No of vessels sampled	1	0	1	0	1	0	1	0	2		0	0	2		0	0	1	0	0	0
No of categories available for sampling	231	16	372	212	99	23	456	78	600		50	103	295		150	90	89	281	n.a	
No of species landed	26		22		21		17		22	10			29	14			15			
No of species sampled	26		20		20		18		21	11			2	13			2			
No categories landed	61		52		39		34		47	28			62	27			32			
No categories sampled	66		46		40		35		41	31			4	30			6			
No of measurements	1034		832		757		752		637	674			101	671			160			
Applied scheme (1,2 or 3)	1		1		1		1		1	1			1	1			1			
Sampling completed (Y/N)	Y		N		Y		Y		Y	Y			N	Y			N			
If completed, duration of sampling (min.)	135		80		60		75		190	138			20	100			13			

Number of samples taken vs. number of sampling opportunities

From 205 vessels landing in the port, 80 (39%) were otter bottom trawlers of the VIIIabd. Form these target vessels, only 9 (11.3%) could be sampled (Table 4.16.2.1).

Of the 80 vessels that were not sampled, 54 (76.1%) times the ship owner did not let the samplers access to the fish; 10 (14.1%) times landings were very late; 6 (8.5%) times the fish was sold directly from the vessel; and 1 (1.4%) time the vessel arrival was not registered.

Of the 9 performed samplings, 6 were completed. The resting three could not be finished due to the closing of the fish store (Table 4.16.2.1).

Number of species

In the 6 samplings completed, a maximum of 26 species and 66 categories were sampled in a single vessel. The mean number of sampled categories was 40 (Table 4.16.2.1).

During the experiment, target vessels landed a mean of 46 categories per vessel. From these, 19 corresponded to Group1, 5 to Group2; and 22 to Group3.

Sample size

From each category, a number of individuals enough to obtain a normal distribution were sampled.

Time needed for sampling

The time needed for sampling varied depending on the number of categories landed and the number of samplers involved. The longest sampling lasted 190 minutes, in which 41 different categories were sampled by only one person.

The time per category ranged from 1.8 minutes when the sampling is carried out by 5 samplers, to 4.7 minutes when there are only 2 samplers involved (Table 4.16.2.2).

Group3 of species was the group presenting a higher mean number of categories. Therefore it was the group which needed a larger time to be sampled (106 minutes with 2 samplers involved, and 40 minutes with 5).

Table 4.16.2.2: Number of samplers, number of samplings, time spent in sampling each category, total time and time spent to sample each group of species. Total time and time spent to sample each group of species (in minutes), were estimated using the mean number of species landed by the 68 target vessels registered during the study (Total= 46.2 species; Group1 = 18.7 species; Group2 = 5 species; Group3 = 22.5 species).

# Technicians	# Samplings	Time /Category	Time (total)	Time (Group1)	Time (Group2)	Time (Group3)
1	2	4	184.8	74.8	20	90
2	2	4.7	217.14	87.89	23.5	105.75
3	2	2.2	101.64	41.14	11	49.5
4	2	1.9	87.78	35.53	9.5	42.75
5	1	1.8	83.16	33.66	9	40.5

4.16.3 Discussion

Problems encountered during sampling activity

The main problems found during this implementation study were related to the physical access to the fish to obtain the samples required. This access is controlled by ship owners. The majority of the times, they did not let the samplers enter to the fish stores. Three were the main reasons for this behaviour:

- Ship owners do not like that the fish is handled before the buyers watch it, as it could be damaged with handling and decrease its market price.
- Because this was a one month- intensive sampling, the same fish stores were sampled one day after another. This annoyed the ship owners.
- Ship owners do not like that certain species are sampled; especially very delicate fishes which reach high prices in the market, as red mullets, small squids or argentines.

In addition to these difficulties, other methodological problems were found:

- In a mixed fishery like bottom otter trawlers, Group 3 includes a very large number of by-catch species (and categories)
- In practice, the number of categories sampled in the stores, in a completed sampling, is not always the same as the number of categories registered in the sale notes.
- It must be taken into account that occasionally, some otter bottom trawlers (mostly French ones) land part of their catches in France. This fact is important because it adds variability to our data

As stated above, ship owners do not like that the length sample is carried out before the fish sale. In many times they encouraged us to come back later, after the sale. These difficulties are especially relevant before and during Christmas (when the study was carried out), because the fish reach maximum prices at this time of the year. Additionally, in many ports of the Basque Country (including the port of Ondarroa), the fish is manipulated with special care. Another important point is that the totality of target vessels (14) is controlled by only 8 ship owners. During the study, ship owners felt that their own vessels were being sampled too often and they become less and less cooperative.

These difficulties to access to the fish before the fish sale, highlight the second time window (after the fish sale) as the only alternative. The duration of the second time window varies from 1h30 to 2h30 depending on the order of sale, which is set by drawing and is unknown when the sampling starts. Supposing a reasonable time window of 2h and considering the mean number of categories landed for each group (Table 4.16.2.2), there would be needed 3 samplers to complete a sampling. With the current sampling scheme (one sampler perform all the sampling, supported occasionally by a second sampler), it would be possible to sample only the categories of Group1 and Group 2 (Table 4.16.2.1).

It may seem striking that the time needed for category was higher for two samplers than for one sampler (Table 4.16.2.2). In our opinion, this two times would tend to be similar if a higher number of samplings are performed. Moreover, it must be noted that, although the sampling time at the port is similar, the total time needed is higher when there is only one sampler involved. In this situation, the measurements are

recorded in a digital recorder during the sampling, and they have to be transcribed afterwards.

One way to complete concurrent sampling can be to increase the number of samplers, which will have an important economic cost. Another possible solution could be to sample at sea the categories that cannot be sampled at the market (Group 3). Samplings at sea may be performed taking advantage of the discards sampling programme. The results of a preliminary test show that it is possible to sample at sea all the species retained in a trip basis. This would be enough to cover Group 3, and perhaps Group 2 too. However, some problems need to be solved, as the resolution of the discards sampling programme is lower than the resolution of the current sampling programme, and an increase of on-board samplings would be needed to fulfil DCR requirements (thus, increasing the financial cost). Additionally, discard sampling is performed by species, ad not by commercial category.

Restrictions of implementation study

Otter bottom trawlers ("Bakas"), especially those operating in ICES area VIIIabd, present the highest sampling complexity among fisheries of the Basque country. This mixed fishery exploits a high variety of species and presents important seasonal differences. In such a way, that the same fishery may be classified as different métiers during the year, due to changes in the species exploited.

Otter bottom trawlers operating in areas VIa and VII, as well as Pair bottom trawlers operating in areas VII and VIIIabd, exploit also a high variety of different fish categories (Table 4.16.3.1). These fishing activities are likely to have similar problems than the Otter bottom trawlers VIIIabd (target of the present study). The rest of fishing activities present smaller variability in their landings, and they should not present major problems for concurrent length sampling.

It must be taken into account that Table 4.16.3.1 was elaborated with landings of the port of Ondarroa. However, no major differences are expected when all ports are considered.

Table 4.16.3.1: Mean number of categories landed by each fishing gear, in the port of Ondarroa, during 2007. In brackets, it is represented the mean number of categories landed by otter bottom trawlers, if French vessels are excluded.

Fishing gear	Area	Mean nº of categories
Otter botom trawlers	VIa	33.1 (33.1)
	VII	30.0 (45.9)
	VIIIc	10.6 (10.6)
	VIIIabd	43.4 (46.6)
Pair bottom trawlers	VII	26.4
	VIIIc	18.2
	VIIIabd	36.5
Bottom longlines (British)	all	11.3
Bottom longlines	all	8.6
Bottom longlines (French)	all	7.1
Longlines	all	3.8
Purse seine	all	3.7
Baitboat	all	3.0
Troll	all	3.0
Grillnet	all	1.9
Surface longlines	all	1.8
Handlines	all	1.0

Comparison concurrent length sampling vs. current sampling methodology

An overview of current market sampling strategies is given in Table 4.16.3.2. It must be pointed out that current sampling is carried out by only one sampler, supported occasionally by a second one. To complete the number of species required in the concurrent sampling scheme, only the species of group 1 and group 2 can be sampled with such a number of samplers. To ensure that all species are sampled, it will be absolutely necessary to build a team of 3 people.

On the other hand, one-person teams don't attract the attention of the ship owners and merchants as much as a large group. With a large sampling team, ship owners feel that their vessels are being "over sampled" and become less cooperative.

Table 4.16.3.2: Overview of current market sampling strategies. To assign the type of sampling, A is used for age, and L for length sampling

Country	Species	Location of sampling	Type of sampling	Stratification by marketcategory	Remarks
AZTI (SPAIN)	HKE	Market	A/L	YES	Length Sampling by CC, Sampling Unit Trip
AZTI (SPAIN)	MEG	Market	A/L	YES	Length Sampling by CC, Sampling Unit Trip
AZTI (SPAIN)	MON	Market	A/L	YES	Length Sampling by CC, Sampling Unit Trip
AZTI (SPAIN)	ANK	Market	A/L	YES	Length Sampling by CC, Sampling Unit Trip
AZTI (SPAIN)	ANE	Market	A/L	YES	Length Sampling by CC, Sampling Unit Trip
AZTI (SPAIN)	MAC	Market	A/L	YES	Length Sampling by CC, Sampling Unit Trip
AZTI (SPAIN)	MAS	Market	L	YES	Length Sampling by CC, Sampling Unit Trip
AZTI (SPAIN)	HOM	Market	A/L	YES	Length Sampling by CC, Sampling Unit Trip
AZTI (SPAIN)	HMM	Market	L	YES	Length Sampling by CC, Sampling Unit Trip
AZTI (SPAIN)	PIL	Market	A/L	YES	Length Sampling by CC, Sampling Unit Trip
AZTI (SPAIN)	ALB	Market	L	YES	Length Sampling by CC, Sampling Unit Trip
AZTI (SPAIN)	BFT	Market	L	YES	Length Sampling by CC, Sampling Unit Trip
AZTI (SPAIN)	ALL	On board	L	NO	

4.16.4 Other issues

As it is expected that the raising procedures continue being done in a specie/stock basis, no problems in this issue are expected.

4.17 Spain (Mediterranean Sea)

4.17.1 Methodology

After a study of the ports along the Mediterranean coast, assessing each on the availability and ease of access to the landing in the fish market, we have selected a standard Northern Alboran Sea Port (Fuengirola, Figure 4.17.1) as it represents a typical range of métiers and landing practices. Usually in these ports the first sale in the fish market is divided into three auctions according to the fleet: Bottom trawl, Purse seiners and Small scale fisheries. We have focused this study on the Bottom trawl fleet as it shows a variety of schemes regarded as integral to obtaining clear results of concurrent sampling implementation. The main problem encountered when studying Bottom trawl fleet is that the sale of the landing occurs in the afternoon almost immediately after the catch is brought to shore (Traditionally the sale began the next morning which meant the landing could be thoroughly studied and assessed before being dispersed), which can lead to friction as the fishermen are anxious to sell the fish as soon as possible and the samplers are asking to measure the fish before they are boxed, stacked and inaccessible.

Métiers identification in bottom trawl fleet

With the aim to identify each métier vessel, their fishing patterns and their catch, we analyzed daily sales declarations for 2006 which were summarized as total landings in kilos by species and vessel. This data has been standardised as a percentage per

species of the total landing per vessel. The data was depurated by deleting the species which provide less than 1000 k/year. We have applied the Bray-Curtis Similarity Test to our data.

In this way we have separated two Bottom trawl fishing strategies in Fuengirola Port, related to the landing species composition.

1) Coastal Continental Shelf (ARPLATCOS). These are vessels fishing near the coastline. Their target species are *Octopus vulgaris*, *Mullus* spp. (mullet), *Pagellus* spp (different Sparid bream fish), *Sepia* spp (Cuttlefish), *Loligo* spp (Squid).
2) Deep Continental Shelf (ARPLATPROF). These are vessels fishing far away the coastline (to 400–500 m depth). Their target species are *Meluccius merluccius* (Hake), *Parapenaeus longirostris* (White shrimp) and occasionally *Nephrops norvegicus* (Norway Lobster).

As a rule those coastal vessels are between 10–15 m in length and deep continental shelf ones between 15–20 m in length(See Table 4.17.1 for fleet composition). The average number of species landing by trip and vessel are between 14 and 18 species.

For the purpose of the study, landings over last year (2006) have been analysed for the period covering the proposed trips. In this area three groups of species have been identified in each métier, as recommended by PGCCDBS: Group 1 Species (Target species only, in this area there are not any Recovery Plan), Group 2 Species (other major by-catch species, in the Mediterranean Sea there are not TACs in these fisheries) and Group 3 Species (All other by-catch species).

Group 1 is constituted by target species, they have been classified by our personal experience in Fuengirola port. In order to find out group 2 and 3 species, they have been classified following three different criteria: total landings by species, number of trips in which this species appear and species average price. The average rising of these tree data have been used as an overview to constitute groups 2 and 3 (Table 4.17.2).

The experience about concurrent sampling itself began on November 22nd and ending on 18 th December (Table 4.17.3). We have been tried an experience as complete as possible so each sampling scheme was verified (Table 4.17.4), as well as we have tried sampling the two métiers at the same day but it was not possible to finish it. There were five people involved in the sampling team, one of them as a working coordinator, selecting sampling boats, species to sampling and recording characteristics métiers and landings.

4.17.2 Results and Discussion

There have been only a few sampling weeks, but the results are not very promising due to vessels coming back to the Fish Market too late. So there is no time for sampling. Also fishermen are not very fond of sampling teams handling their fish and measuring them. Currently it is usually difficult to perform the sampling procedure properly. In fact only one of the sampling days has been entirely finished successfully, as many it were measured 2 or 3 species each time (Table 4.17.5 & 4.17.6). The sampling finished was due to that vessel was a breakdown and arrive to the port earlier.

1) Fishermen should be more informed about the nature of fisheries research study and receive more input from different sources (from Local to Regional Administration).

2) Usually each individual vessel returns to the port approximately at the same time everyday. This is a limitation about selecting those arriving earlier. Then the sampling rate would be bias to a few of them. This is a possibility to suggest that the order in landings for sale in this instance is biased in favour of a particular fleet component, it could be more coastal ones for instances.

3) Of the 13 vessels usually landing in the pilot port:

- Three of them didn't participate at all.
- Two of them were very difficult to get sampling.
- Seven of them were always willing to cooperate.

4) The main reasons exposed for the fishermen to refuse cooperation:

- They don't want anyone handling the fish ready for the fish Market.
- They don't receive information or attention from any Administration.
- They fear the information obtained come back against them.

5) About the sampling itself:

- Usually there is no time enough to end the whole sampling scheme. As a rule average sampling time was 20 minutes, except for those days with bad weather or breakdown a vessel, then obviously they come back earlier.
- Sometimes even the landings were hidden.
- A whole sampling team shouldn't be more than two people because usually there is no space enough and it is too shocking for people working around.

After analyze the results of the sampling pilot study our proposal to get a successfully Concurrent Sampling is getting an adequate sampling programme on board by qualified scientific observers

Figure 4.17.1. Study Area with identification of the origin of the catches corresponding to the GFCM Management Units (Geographical Subareas).

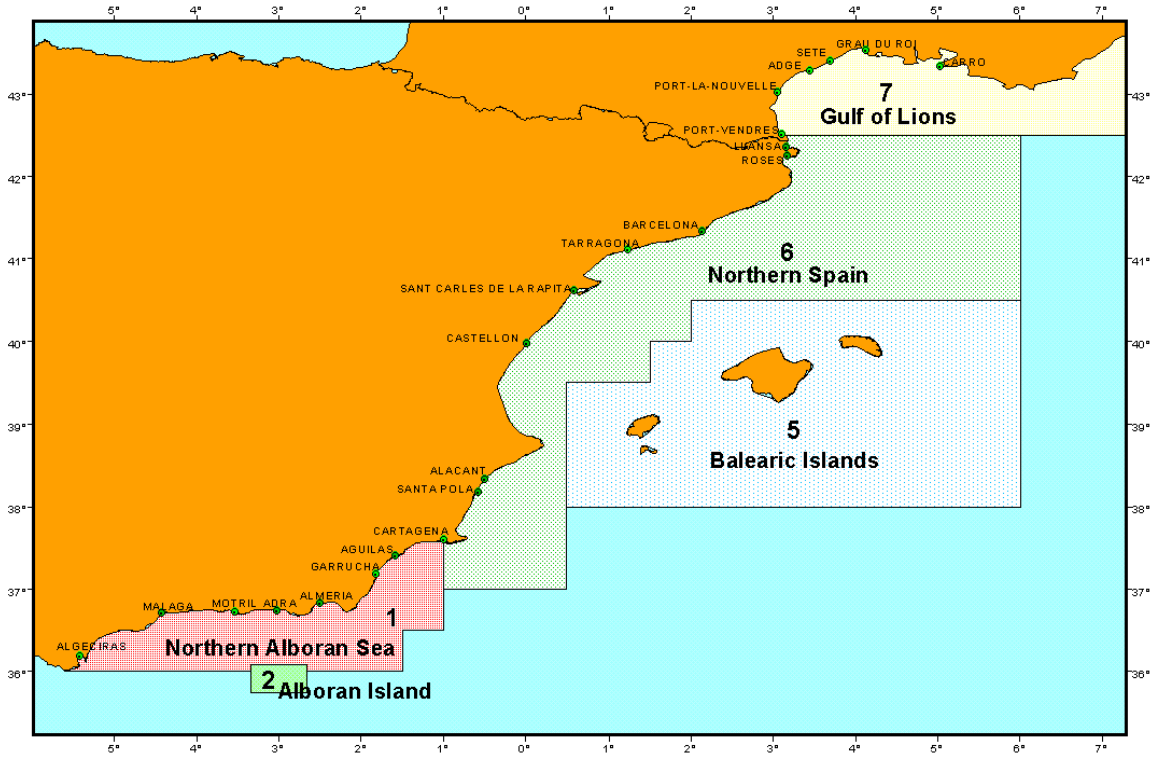


Table 4.17.1: Vessels belonging to the fishing bottom trawl strategies in Fuengirola port.

Coastal Continental Shelf	Deep Continental Shelf
Virgen del Mar	Hermanos Corpas
José y Fernanda	Rumbo Sohail
Rafael y Margarita	Maruja y Antonio
Esperanza	Harormar Segundo
José Ruiz	Nuevo Haro Rodríguez
Isabel y Lolita	Primer Nuevo Faro
Segundo Haro Rodríguez	

Table 4.17.2: Species grouping by métier.

Coastal Continental Shelf

Group 1	Group 3	*Conger coger*	*Trachinus ssp*
Octopus vulgaris	*Pagellus erythrinus*	*Uranoscopus scaber*	*Arnoglossus ssp*
Mullus barvatus	*Scyliorhinus canicula*	*Serranus ssp*	*Gobious ssp*
Mullus surmuletus	*Diplodus sargas*	*Epinephelus marginatus*	*Sparus auratus*
Merluccius merluccius	*Parapeneus longirostris*	*Phycis blennoides*	*Dicentrarchus labrax*
Group 2	*Palinurus elephas*	*Xiphias gladius*	*Pagrus pagrus*
Sepia officinalis	*Lithognathus mormyrus*	*Scorpaena ssp*	*Maja squinado*
Pagellus acarne	*Sepia spp*	*Sarpa salpa*	*Eledone cirrhosa*
Loligo vulgaris	*Spondyliosoma cantharus*	*Seriola dumerili*	*Scomber ssp*
Trachurus spp	*Zeus faber*	*Raja spp*	*Microchirus variegates*

Deep Continental Shelf

Group 1	Group 3		
Microm. poutassou	*Scyliorhinus canicula*	*Maja squinado*	*Gobius spp*
M. merluccius.	*Pagellus acarne*	*Lepidopus caudatus*	*Conger conger*
Lophius budegassa	*Galeorhinus galeus*	*Sarpa salpa*	*Sparus auratus*
Parapen. longirostris	*Loligo vulgaris*	*Uranoscopus scaber*	*Plesionika spp*
Nephrops norvegicus	*Sepia spp*	*Pagellus erythrinus*	*Illex spp*
Octopus vulgaris	*Raja spp*	*Zeus faber*	*Scomber spp*
Group 2	*Diplodus sargus*	*Lithognathus mormyrus*	*Serranus spp*
Trachurus spp.	*Microch.. variegatus*	*Dicentrarchus labrax*	*Pagrus pagrus*
Mullus barbatus	*Chelidonichthys ssp*	*Epinephelus marginatus*	*Arnoglossus spp*
Mullus surmuletus	*Seriola dumerili*	*Scorpaena ssp*	
Eledone cirrhosa	*Trachinus ssp*	*Citharus linguatula*	
Phycis blennoides	*Helicol. dactylopterus*	*Solea spp*	

Table 4.17.3. Sampling programme and time schedule. Each cell shows the sampling scheme applied.

Week	Monday	Tuesday	Wednesday	Thursday	Friday
1st			Training	1	1
2nd	1	1	2a	2b	2a
3rd	2b	2a	2b		3a
4 th	3b	3c	3a	3b	3c
5 th	3a	3b	3c		

Table 4.17.4 Explanation of the Sampling scheme.

Coastal Continental Shelf métier

Sampling scheme	Kind of samplind	Frequency (days)	Group 1				Group 2					Group 3																													
			Octopus vulgaris	*Mullus barbatus*	*Mullus surmuletus*	*Merluccius merluccius*	*Sepia officinalis*	*Pagellus acarne*	*Loligo vulgaris*	*Trachurus trachurus*	*Trachurus mediterraneus*	*Scyliorhinus canicula*	*Diplodus sargus*	*Eledone cirhosa*	*Pagellus erythrinus*	*Trachinus spp*	*Arnoglosus spp*	*Gobious ssp*	*Sparus auratus*	*Dicentrarchus labrax*	*Pagrus pagrus*	*Maja squinado*	*Microchirus variegatus*	*Chelidonichthys ssp*	*Scomber ssp*	*Conger conger*	*Uranoscopus scaber*	*Serranus ssp*	*Epinephelus marginatus*	*Phycis blennoides*	*Xiphias gladius*	*Scorpaena ssp*	*Sarpa salpa*	*Seriola dumerili*	*Parapeneus longirostris*	Zeus faber	*Palinurus elephas*
1-A	-	4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
2-A	a	3	*	*	*	*	*	*	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*															
	b	3	*	*	*	*				*	*															*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
3-A	a	3	*	*	*	*	*	*				*	*	*	*	*	*	*	*	*	*																				
	b	3	*	*	*	*			*													*	*	*	*	*	*	*	*	*											
	c	3	*	*	*	*				*	*																				*	*	*	*	*	*	*	*	*	*	*

Deep continental shelf métier.

Sampling scheme	Kind of sampling	Frequency (days)	Group 1					Group 2							Group 3																									
			Micromesistius poutasou	*Merluccius merluccius*	*Lophius budegassa*	*Parapenaeus longirostris*	*Nephrops norvergicus*	*Octopus vulgaris*	*Trachurus trachurus*	*Trachurus mediterraneus*	*Mullus barbatus*	*Mullus surmuletus*	*Eledone cirrhosa*	*Phycis blennoides*	*Scyliorhinus canicula*	*Pagellus acarne*	*Galeorhinus galeus*	*Loligo vulgaris*	*Sepia spp*	*Raja spp*	*Diplodus sargus*	*Microchirus variegatus*	*Chelidonichthys ssp*	*Seriola dumerili*	*Trachinus ssp*	*Helicolenus dactylopterus*	*Pagellus erythrinus*	Gobius spp	*Conger conger*	*Sparus auratus*	*Plesionika spp*	*Scomber spp*	*Serranus spp*	*Pagrus pagrus*	*Arnoglossus spp*	*Maja squinado*	*Lepidopus caudatus*	*Sarpa salpa*	*Uranoscopus scaber*	*Epinephelus marginatus*
1-A	-	4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
2-A	A	3	*	*	*	*	*	*	*	*					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*										
	B	3	*	*	*	*	*				*	*	*	*																	*	*	*	*	*	*	*	*	*	*
3-A	A	3	*	*	*	*	*	*	*	*					*	*	*	*	*	*	*	*	*	*	*															
	B	3	*	*	*	*	*				*	*														*	*	*	*	*	*	*	*	*	*	*				
	C	3	*	*	*	*	*						*	*																							*	*	*	*

Table 4.17.5. Results Implementation studies

COUNTRY	SPAIN
Location	Auction
Fleetsegment/Fishing activity	Demersal species–LOA 10–15

	22/11/07	26/11/07	27/11/07	29/11/07	3/12/07	4/12/07	5/12/07	12/12/07	13/12/07
Time available for sampling (min.)	20	70	15	40	40			20	25
# staff members	4	2	2	3	2			2	2
No of vessels available for sampling	4	5	5	5	5	5	5	5	3
No of vessels sampled	1	1	1	1	1	0	0	1	1
No of samples available (vessels x species x cat.)	54	43	58	49	51	58	56	48	35
No of species landed	12	11	5	12	11			9	11
No of species sampled	4	6	2	3	3			3	4
No of measurements	2220	3070	306	1392	1180	0	0	376	1240
Applied scheme (1,2 or 3)	1	1	1	2	2	2	2	2	3
Sampling completed (Y/N)	N	N	N	N	N	N	N	N	N
If completed, duration of sampling (minutes)									

Table 4.17.6. Results Implementation studies.

COUNTRY	SPAIN
Location	auction
Fleetsegment/Fishing activity	Demersal species–LOA 15–20

	26/11/07	27/11/07	28/11/07	30/11/07	6/12/07	10/12/07	11/12/07	14/12/07	17/12/07	18/12/07
Time available for sampling (minutes)	20	15	60	35		25	5	70	20	40
# staff members	1	2	3	2		2	2	2	2	2
No of vessels available for sampling	6	4	5	5	6	7	5	5	3	3
No of vessels sampled	1	1	1	1	0	1	1	1	1	1
No of samples available (vessels x sps x cat.)	61	54	41	51	64	78	62	43	34	30
No of species landed	15	10	10	11		9	10	8	12	7
No of species sampled	1	1	10	3		6	1	6	2	3
No of measurements	299	492	3530	990	0	1743	56	1592	1668	420
Applied scheme (1,2 or 3)	1	1	1	2	2	2	2	3	3	3
Sampling completed (Y/N)	N	N	S	N	N	N	N	N	N	N
If completed, duration of sampling (minutes)			60							

4.18 Sweden

4.18.1 Methodology

With the proposed change in 2009, from species-based to a métier-based sampling in the EU data collection the EU member states were requested to comprise an implementation study to examine the possibility of concurrent length frequency sampling in the DCR programme nation vise in 2007.

Ottertrawls targeting demersal fish and crustaceans are the main fishing activities in the Kattegat-Skagerrak area at the Swedish west coast. In Kattegat ottertrawls represent 90% or more of the demersal fishing effort. Common otter trawls further generally have a relative complex landing pattern. So, in order to reflect the situation, otter trawlers were chosen for the pilot project on concurrent sampling.

The concurrent length sampling pilot study was carried out in Träslövsläge harbour in the Kattegat area during November 2007.

The fish landed in the Kattegat ports are either sent to the auction in Gothenburg or bought by first- hand buyers. Usually the fish is stored in cold rooms from the termination of landings until it is picked up by lorries. In order to keep track of all the species and size gradings landed from a vessel the sampling had to be performed in the harbour, directly after termination of the landing. Träslövsläge harbour was chosen as the sampling site since it constitutes the largest landing site in Kattegat. Previous co-operation with the skippers, easy access, access to a cold storage room and fresh ice and the fact that the vessels normally do one day trips and are easy to keep track of were all also conclusive for the selection of this port.

All the fishermen in the harbour were contacted prior to landing and asked if they were willing to participate. The majority of the fishermen were willing to cooperate. In order to optimise the time window available for sampling, vessels were sampled in an opportunistic way when they terminated their landings.

Sampling schedule 1A was adopted for the concurrent length sampling. This implies that all species landed should bee sampled. Adopted species in group one were plaice (*Pleuronectes platessa*), sole (*Solea solea*) and *Nephrops* (*Nephrops norvegicus*). Normally cod (*Gadus morhua*) would have been included in group one as well. Unfortunately there was no quota left and as a result no landings were available. Group two species included hake (*Merluccius merluccius*), haddock *(Melanogrammus aeglefinus*), ling (*Molva molva*) and whiting (*Merlangius merlangus*). Only hake and whiting was available for the same reasons as group one was reduced. However, this diminished the number of measurements performed of group one and two species. Group three included all the other species.

A team of two persons performed the sampling at all 4 occasions and in total three persons were involved. The time-window available was dependent of the first vessels arrival at the port and when the transport were leaving for the auction or pre-buyers and therefore varied between 180 minutes to 230 minutes.

4.18.2 Results

The availability of vessels to sample was good but entirely dependent on the skipper's goodwill. Seven vessels were available at three occasions and five at one occasion. However, we only succeeded in sampling all available vessels one time. The

rest of the sampling occasions the time window was not enough or one skipper refused to let the staff sample his landings.

Minimum 12 and maximum 16 species were landed and all species except edible crab (*Cancer pagurus*) was sampled. Due to the limited time window, *Nephrops* was only sampled for lengths for one vessel/occasion. Timekeeping was done for every vessel sampled. Time used for sampling raged from 15 minutes to 1, 5 hours, depending on the numbers of species and size categories landed. The number of measurements varied between 95 and 700 between vessels.

However due to the quota termination for some important species (cod, haddock) at time for the study, the time consumed for a "normal" sampling is estimated to be longer. If the most common size grades for cod and haddock are available in a landing the sampling time can increase with 1 hour/vessel. One extra sampling was made for gillnet due to some spare time before the first landing of a trawler. For this vessel the time window for sampling was larger due to earlier arriving at the landing site.

Table 4.18.2.1. The ottertrawl sampling in Träslövsläge, Sweden, November 2007.

Country	SWE			
Location	Träslövsläge			
Fleetsegment/Fishing activity	OTB_CRU_90			
	2007–11–14	2007–11–15	2007–11–19	2007–11–20
Time available for sampling (minutes)	180	200	140	230
# staff members	2	2	2	2
No of vessels available for sampling	5	7	7	7
No of vessels sampled	4	3	5	7
No of samples available (vessels x species x categories)	37	57	32	52
No of species landed	13	12	13	16
No of species sampled	12	12	13	16
No of measurements	1299	1441	739	1724
Applied scheme (12 or 3)	1A	1A	1A	1A
Sampling completed (Y/N)	Y	Y	Y	Y
If completed, duration of sampling (minutes)	175	200	120	160

Table 4.18.2.2. Gillnet sampling (one vessel available, one sampling performed) in Träslövsläge, Sweden, November 2007.

Country	SWE
Location	Träslövsläge
Fleetsegment/Fishing activity	Gillnet

	2007–11–15
Time available for sampling (minutes)	275
# staff members	2
No of vessels available for sampling	1
No of vessels sampled	1
No of samples available (vessels x species x categories)	11
No of species landed	6
No of species sampled	6
No of measurements	539
Applied scheme (12 or 3)	1A
Sampling completed (Y/N)	Y
If completed, duration of sampling (minutes)	63

4.18.3 Discussion

The risk of bias and unrepresentatively in the sampling is obvious since all the landing ports are not suitable for concurrent sampling due to the small time window available for sampling. The selection of vessels might also be limited due to landing practice as well as the fishermen's goodwill in cooperating. This dependence on fishermen's cooperation is though impending in all concurrent sampling. There is also a potential risk for conflicts with the fishermen because of the extra handling of the fish. The staffs were actually told that in case of low prices in the auction the interconnection would bee to the handling in the sampling.

The present Swedish sampling in Kattegat is based on quarterly on-board sampling and market sampling. The on board sampling is haul based and scope 20 sampling events/year. Every sampling event encompasses 1 to 2 trips and at minimum three hauls. Both the discarded and retained part of the catch is sampled for every species on a haul to haul basis. The market sampling target cod, plaice and *Nephrops* and are stratified by commercial size categories. The effort put in to the Swedish on board sampling is (per sampling event) in the same magnitude as to the effort put in the studied concurrent sampling. Both strategies are time consuming (long travels to port, hours spent waiting for vessels etc.) but the current data collection system is delivering more precise and optimized data. The concurrent sampling proposed can however be used to complement the on board sampling.

For small scale fisheries, like some gillnet fisheries, were on-board sampling is complicated and discard rates low, concurrent sampling of landings could be a more cost efficient alternative.

4.19 The Netherlands

4.19.1 Methodology

Selection of fishing activity

PGCCDBS (ICES, 2007a) suggests different fishing activities be sampled during this implementation study. In the Netherlands all fish (except frozen fish from large freezer trawlers) is auctioned, regardless the fishing activity. This implies that working procedures are similar amongst different fishing activities. The most important fishing gear in the Netherlands is the beam trawl. As working procedures in an auction do not differ by fishing activity, the main focus in this study will be on beam trawlers. In this study, fishing activity is therefore interpreted as geartype, fishing area and period.

The pelagic fleet was not included in this study as their landings can only be sampled at sea or sampled by buying samples.

Selection of auction

Five major auctions are available for sampling in the Netherlands. These auctions are located along the Dutch coast, except the auction in Urk. This auction mainly sells landings from vessels that landed their fish elsewhere, where after the fish is transported to Urk. Due to this procedure, the auction in Urk is not suitable for this implementation study.

The four remaining auctions (IJmuiden, Stellendam, Vlissingen, Den Helder) do not differ very much in their working procedures and the fleetsegments they serve. Figure 4.19.1.1 shows the number of beam trawlers that were served by an auction per week (for weeks 40–53 during the period 2004–2006).

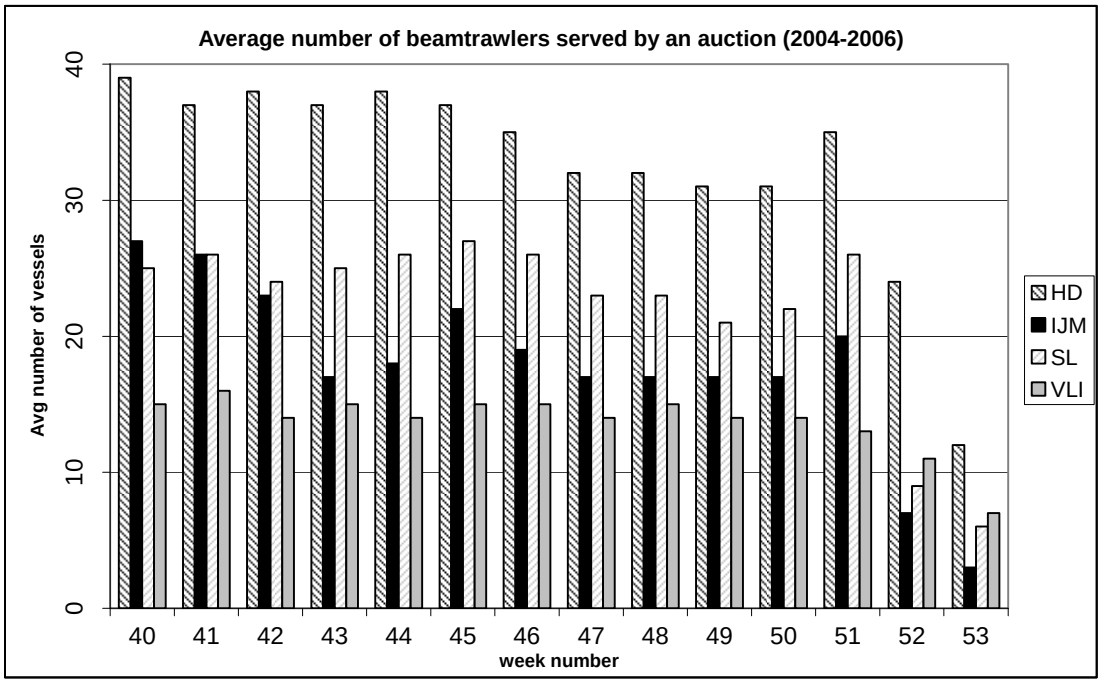


Figure 4.19.1.1: Average number of beam trawlers calling into the ports of Den Helder (HD), IJmuiden (IJM), Stellendam (SL) and Vlissingen (VLI) in week 40–53 in 2004–2006.

Figure 4.19.1.1 shows that both Den Helder (HD) and Stellendam (SL) in general served more vessels during a week than IJmuiden. However, IJmuiden was still considered to serve enough vessels to facilitate a random sampling scheme. By selecting IJmuiden, this study benefited from shorter travel distances and easier logistics.

This study was designed to test the sampling procedures primarily on the busiest day of the week, namely on Friday. In general, the Dutch beam trawl fleet spends the whole week out at sea and calls into port early on Friday morning; where after the fish is sorted and auctioned, leaving a time window of approximately 2 hours for sampling.

Selection of vessels

As vessels are not obliged to allow researchers access to their fish, random sampling is difficult. A pseudo-random sampling strategy was therefore applied. Before the vessels call into port, the auction is notified. During this pilot study the researchers should receive a copy of this notification and determine, based on their experience, which vessels would allow sampling. These vessels were then selected based on their expected time of landing.

Sampling schemes and groups of species

The number of different species landed by trip differs by geartype. With an average number of 8 different species, the beam trawl fleet lands the highest variety in species by week in the Netherlands. As shown in Figure 4.19.1.2, the number of species by landing has not, on average, exceeded 10 species in the last 3 years.

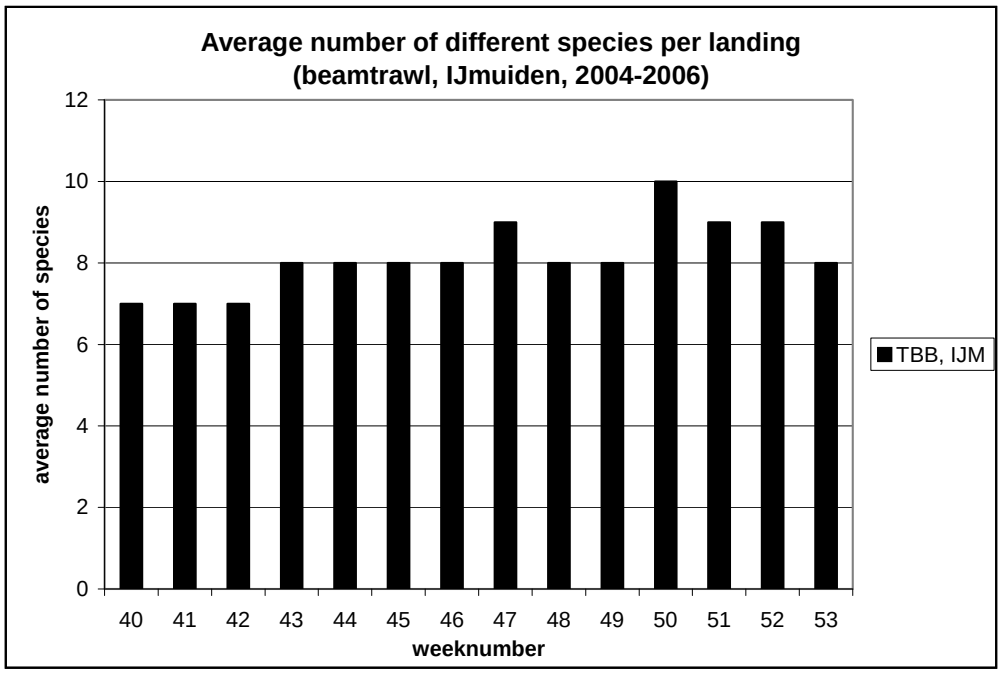


Figure 4.19.1.2: Average number of species per landing (beam trawl, IJmuiden, 2004–2006)

As beam trawlers target several species of flatfish, these species obviously have the highest probability of occurring in the landings. This is shown in figure 4.19.1.3 in which the relative landing frequency of a certain species in 2006 is depicted.

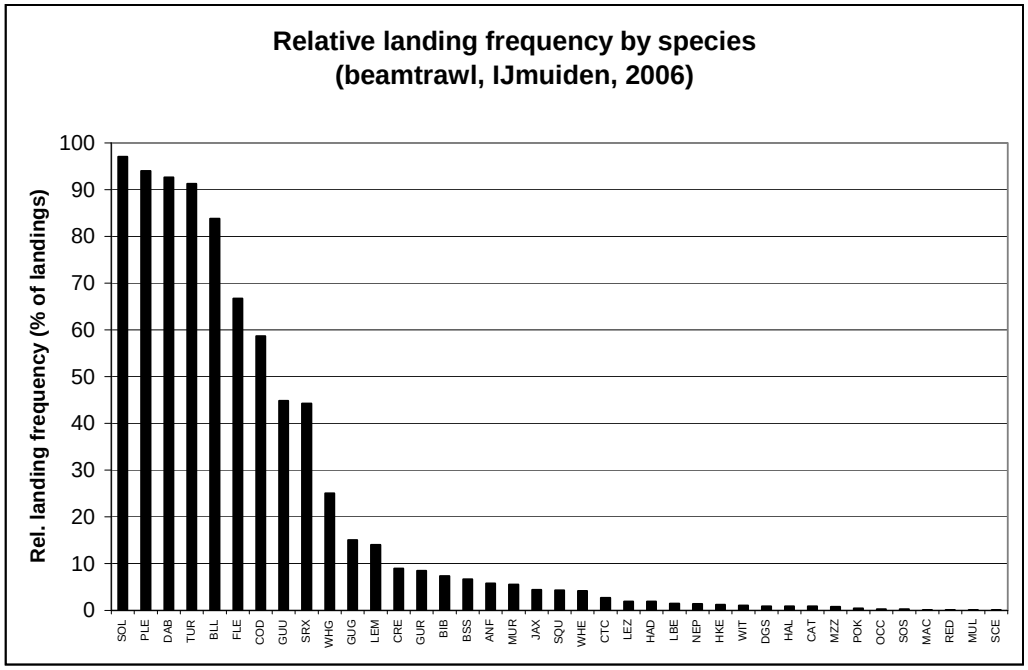


Figure 4.19.1.3: Relative landing frequency by species (beam trawl, IJmuiden, 2006)

The species distribution in the landing of beam trawlers in IJmuiden in 2006 was dominated by sole, plaice, dab, turbot, brill and flounder, followed in 56% of the landings by cod (Figure 4.19.1.3).

PGCCDBS proposes 3 different sampling schemes be conducted, divided over 3 groups of species. The basic difference in the sampling schemes is the number of species that has to be sampled per operation. The sampling schemes are shown in Table 4.19.1.1.

Table 4.19.1.1 Proposed sampling schemes (ICES 2007a)

Sampling scheme	Frequency	Group 1 --- Target and recovery species				Group 2 --- Other TAC regulated species and major by-catch species						Group 3 --- All other by-catch species									
		Species 01	Species 02	Species 03	Species 04	Species 05	Species 06	Species 07	Species 08	Species 09	Species 10	Species 11	Species 12	Species 13	Species 14	Species 15	Species 16	Species 17	Species 18	Species 19	Species 20
Scheme 1A	Every sampling operation	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Scheme 1B	Every sampling operation	●	●	●	●	●	●	●	●	●	●	Data derived from at-sea sampling									
Scheme 2A	Every 1st sampling operation	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Every 2nd sampling operation	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Scheme 2B	Every 1st sampling operation	●	●	●	●	●	●	●	●	●	●	Data derived from at-sea sampling									
	Every 2nd sampling operation	●	●	●	●	●	●	●	●	●	●	Data derived from at-sea sampling									
Scheme 3A	Every 1st sampling operation	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Every 2nd sampling operation	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Every 3rd sampling operation	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Scheme 3B	Every 1st sampling operation	●	●	●	●	●	●	●	●	●	●	Data derived from at-sea sampling									
	Every 2nd sampling operation	●	●	●	●	●	●	●	●	●	●	Data derived from at-sea sampling									
	Every 3rd sampling operation	●	●	●	●	●	●	●	●	●	●	Data derived from at-sea sampling									
		●	Species to be sampled for length																		

As the beam trawl fleet targets flatfish, in particular plaice and sole, the group 1 species should encompass the most important flatfish species that dominate the catch

composition, as well as cod, being a recovery species. Within this study, the group 1 species are defined as; plaice, dab, turbot, sole, brill, cod and whiting.

Group 2 species are defined as other TAC regulated species or major by-catch species. Following the relative landing frequency, the TAC regulated species within group 2 are: rays (several species), whiting and lemon sole. The major by-catch species in group 2 are: flounder, seabass, red mullet, tub gurnard and grey gurnard. Species with a landing frequency below 10% are not considered as major by-catch species.

All other species, besides gastropods and crustaceans, which were landed by beam trawlers in 2006 are included in group 3 and were sampled following the chosen sampling scheme. Gastropods and crustaceans are not included in this study as *Nephrops* is the only major representative in this group and a dedicated sampling procedure will be set up to sample *Nephrops* when the fleet based sampling approach comes into action. Table 4.19.1.2 provides a complete overview of the species included in this pilot study.

Table 4.19.1.2 Groups of species

SAMPLING FREQUENCY	Group	Species id	Species (Dutch)	Species (English)	Shortcode
Every sample	1	1	Schol	Plaice	PLE
	1	2	Schar	Dab	DAB
	1	3	Tarbot	Turbot	TUR
	1	4	Tong	Sole	SOL
	1	5	Griet	Brill	BLL
	1	6	Kabeljauw	Cod	COD
	1	7	Wijting	Whiting	WHG
Every sample	2	8	Bot	Flounder	FLE
	2	9	Roggen	Skates and Rays	SRX
	2	10	Rode Poon	Tub gurnard	GUU
	2	11	Grauwe Poon	Grey Gurnard	GUG
	2	12	Tongschar	Lemon Sole	LEM
	2	13	Engelse Poon	Red Gurnard	GUR
	2	14	Zeebaars	Seabass	BSS
	2	15	Mul	Red Mullet	MUR
Every first sample	3	16	Steenbolk	Pout	BIB
	3	17	Horsmakreel	Horse Mackerel spp	JAX
	3	18	Schartong	Megrim	LEZ
	3	19	Schelvis	Haddock	HAD
	3	20	Witje	Witch Flounder	WIT
	3	21	Heilbot	Halibut	HAL
	3	22	Zeewolf	Wolffish	CAT
	3	23	Roodbaars	Redfish	RED
Every second sample	3	24	Zeeduivel	Anglerfish	ANF
	3	25	Harders	Mullet spp	MUL
	3	26	Doornhaai	Spurdog	DGS
	3	27	Koolvis	Saith	POK
	3	28	Heek	Hake	HKE
	3	29	Franse tong	Sand sole	SOS
	3	30	Ongedefinieerde soorten	species undef.	MZZ

The three groups of species had to be sampled following a predefined sampling scheme. PGCCDBS distinguishes 3 sampling schemes of which the first one is based on sampling the entire landing. The second and third scheme is based on a "rolling" system. This means that only a predefined part of the species in groups 2 and 3 is sampled. The remaining species are then to be sampled during the next sampling operation.

As many species landed by the beam trawl fleet are at least TAC regulated species, the proposal was to test sampling scheme 1, the most extensive scheme. 2 crews of 2 staff members tested this scheme simultaneously in the auction.

4.19.2 Results

Sampling activity

The sampling was carried out during 4 days in November 2007. On the first day, only one vessel was available for sampling, although many vessels called into port that day. Consequently the two crews worked together to sample this particular vessel. During the other sampling days 4 to 14 vessels were potentially available for sampling. Both crews were able to carry out their own sampling scheme. As a general rule, it is stated that as soon as auctioning starts, researchers do no longer have access to the fish. Because many vessels did not land their fish early enough, it was not possible to sample their fish prior to auctioning.

On average 17 species were available for sampling. Most of these species are sorted in market categories. The number of samples potentially available for sampling ranged from 264 up to 924. As a number of species, such as squid and edible crab, were excluded from this pilot, 9 to 13 species were sampled (out of the average 17 species).

Time window

During the sampling sessions, the time available per vessel prior to auctioning the landings ranged from 60 to 90 minutes. In 3 occasions sampling could not be completed within the available time. This resulted in incomplete sets of samples. At least 65 minutes were needed to get a complete set of samples from one vessel. This was the total time window in which the fish was available for sampling.

Sample size

In case a species was sorted into market categories, 20 randomly selected individuals were measured per category. For unsorted species, 50 individuals were measured, provided that 50 individuals were available. The total number of measurements during the sampling exercises ranged from 555 up to 691 per crew for a complete set of samples (Table 4.19.2.1).

For each category, the time needed for sampling was monitored. The average time needed to take a sample from one category was 3 minutes. Some species are sorted into 7 market categories, thus taking up to half an hour to complete the sampling just for a single species.

Table 4.19.2.1 Complete overview of the sampling results.

COUNTRY	NED						
Location	IJmuiden						
Fleetsegment/Fishing activity	BEAMTRAWL >300 HP						
	date1	date2.1	date2.2	date3.1	date3.2	date4.1	date4.2
Time available for sampling (minutes)	75	60	80	40	70	65	90
# staff members	4	2	2	2	2	2	2
No of vessels available for sampling	14	4	4	12	12	5	5
No of vessels sampled	1	2	2	2	2	2	2
No of samples available	924	264	264	792	792	330	330
No of species landed	17	15	17	20	14	17	13
No of species sampled	13	9	11	10	13	10	12
No of measurements	632	555	589	592	653	612	691
Applied scheme (12 or 3)	1	1	1	1	1	1	1
Sampling completed (Y/N)	Y	N	N	N	Y	Y	Y
duration of sampling (minutes)	75	-	-	-	70	65	90
No of categories available	66	66	66	66	66	66	66

4.19.3 Conclusions

This implementation study shows that, from a pragmatic point of view, concurrent sampling can be implemented in the Netherlands. Concurrent sampling is technically feasible, although a couple of practical issues arise. The results show that in many occasions the time window available for sampling is not sufficient to carry out a complete sampling exercise, following scheme 1. Scheme 2 is more likely to be feasible as this scheme encompasses fewer species per sampling activity.

The sampling itself is time consuming and labour intensive, especially for the species that are sorted into many market categories.

From a more general point of view, if all fishing activities in the Netherlands have to be sampled following these protocols, a very extensive sampling scheme has to be set up to cover all auctions, fleetsegments and temporal variability during the year.

4.19.4 Discussion

This study was designed to test the practical feasibility of concurrent sampling in the Netherlands. During the study, only landings from the large beam trawlers were sampled. One might conclude that, if concurrent sampling is possible for this fleetsegment, which is expected to land the highest number of different fish, the other fleetsegments can be sampled as well.

The average number of landed species registered for the last three years in the logbooks differs from the number of species that were sampled during this study (8 species in the logbooks *versus* 17 species sampled). This can be explained by the fact that only species with landings exceeding 50 kg are registered in the logbooks. So in reality more species may be observed and sampled at auction than are registered in the logbooks.

It took 2 staff members up to 90 minutes to complete a full sampling routine. After these 90 minutes, no other vessel could be sampled as the auction had started by then. In practice this would come down to one sampled vessel per day for a crew consisting of 2 people. If all fleetsegments in the Netherlands, approximately 9, were to be sampled according to the concurrent sampling programme it would create an enormous workload. In addition, the regular market programme sampling for ages has to continue as well. When the concurrent sampling programme is included in the regular programme, the actual time window available for sampling will be even lower than the time that is shown in this study, due to the accumulation of tasks for the researchers.

A solution to this could be to implement onboard concurrent sampling. This would allow a longer time window for sampling. Unfortunately onboard sampling also has its drawbacks. It depends on the cooperation of the skipper and it interferes with the daily routines of the fishermen. Experiences from the past have shown that access to vessels can be denied. What is more, the smaller Dutch vessels do not always have enough space available for another person. It can therefore be concluded that onboard concurrent sampling is not possible for all fleet segments. Overall, it is therefore recommended that scheme 2A is the best feasible programme for concurrent sampling.

4.20 United Kingdom (England and Wales)

4.20.1 Methodology

To attempt to cover the diversity and range of different métiers and landing practices around England and Wales four areas were chosen that offered different characteristics. The study would then provide an indication of how these characteristics affect fleet based sampling. To make the most of the sampling opportunities and the limited time available for the study we had to be strict about the number of métiers we attempted to sample and limited the definition of métier to gear, geographical area (port) and period. Each of the areas were visited for a period of one week.

It was not possible within the time frame to adopt the best method for randomly sampling each métier. Instead the focus of the study was to see what could be achieved within a time frame whilst gathering information that might help identify how best to randomise sampling in the future.

Study areas

Newlyn

Sampling was focussed on the Newlyn beam trawl fleet (around 20 vessels >20 m LOA) in the 3rd quarter. Their activity is characterised by long trips; regular and frequent large volume landings to a market floor offering relatively easy access for up to 4 hours. Landings are characterised by four or five high value target and by catch species and up to 20 other species (occasionally more).

For the period of the visit, four staff attempted to sample to PGCCDBS Scheme 1A adapting to pre-proposed Schemes 2A or 3A if overwhelmed. For the period of the study, landings were selected on the basis of convenience – first come first served. The length of a beam trawl trip is around 8 days. This combined with length of the study meant there was little chance of the same vessel being sampled twice and there

was little evidence to suggest that the order in which landings are laid out for sale was biased in favour of a particular fleet component.

Hastings

Sampling was focussed on netters targeting flatfish and other demersal species from Hastings. The fleet is made up of small vessels and is characterised by regular landings to merchants from weather and tide dependant day trips. Landings are characterised by only two or three high value target species with up to five other by catch species and are often available for relatively long periods of time – up to 12 hours.

For the period of the visit two staff attempted to sample to PGCCDBS Scheme 1A with the option of adapting to a pre-proposed Scheme 3A if overwhelmed. For the duration of the study landings were selected on the basis of convenience but if a choice of vessel had to be made, another vessel was selected rather than one that had been sampled earlier in the week.

Fleetwood

Sampling was focused on the otter trawl fleet (around 7 vessels) at Fleetwood targeting plaice at the end of the third quarter. This was not the peak of the season but any trawlers left in the Irish sea at the end of the *Nephrops* season appear to concentrate on plaice, skates & rays. Landings are characterised by only two or three apparent target species with up to 15 other by catch species. It was perceived that this area would be more difficult to sample as landings are relatively infrequent and often made to merchants. Parts of the landing are often sold pre-auction and consigned elsewhere and are also graded and combined with other vessels landings. Access to the landings did depend on the cooperation of the merchants and was limited to the period between merchants grading the landings by vessel and the landings being mixed pre-sale. So for the period of the study the time window was between 2 – 6 hours pre-sale depending on the number of landings and the species. The opportunity to sample a vessel at the point of landing when it goes into storage for grading the following morning may be feasible but was not investigated.

Landings were selected on the basis of availability and accessibility.

North Shields

Sampling was focussed on the North Shields *Nephrops* trawl fleet at the start of the 1st quarter around the middle of the *Nephrops* season. The fleet was made up of around 20 large visiting vessels using multi trawls and around 20 smaller local vessels using mainly single *Nephrops* trawls generally working day trips. Landings are characterised by one high value target species, a couple of high value by catch species and up to 15 other by catch species. Landings are frequent but availability for sampling depends on different components of the fleet. Large visitors tend to keep everything on board for 2 or 3 days, landing the *Nephrops* directly to lorries that redistribute them to producers, merchants and markets elsewhere. Some land the finfish to the local market otherwise they go the same way as their *Nephrops*. Large local boats may land the *Nephrops* every night but keep the finfish on board until they have 'enough' to land to market later in the week. As with the larger, the smaller local vessels will land the *Nephrops* direct to merchants every night but will also tend to land the fish to storage the same night for sale on the market floor the following morning. So access was limited to up to 3 hrs in the evening for *Nephrops* but this had to be arranged with the merchant taking them – and up to 4 hrs for the fin fish the

following morning pre-auction. Access to the landings of the local vessels is easier than those of the visiting vessels.

For the period of the study two staff attempted to sample to PGCCDBS Scheme 1A with the option of adapting to a pre-proposed Scheme 3A if Scheme 1 became unfeasible. The size of the entire fleet and frequency of landings allowed different vessels to be selected throughout the week, but primarily vessels were selected on the basis of availability and accessibility.

Allocation of species to groups

Landings over the last three years were broadly analysed for the period covering the proposed trips. In each area three groups of species were identified.

- Group 1 Species–Target and Recovery species

Five species were selected which include 2 recovery species that may be taken as either a target species or by-catch. This group of species would be sampled irrespective of the Scheme used.

- Group 2 Species–TAC and other major by-catch species

This group of nine species included any other TAC species likely to be caught and what appeared to be the next most important by catch species by weight and value for that fleet. Species in this group would be sampled in turn every second or third landing under scheme 2A or 3A respectively.

- Group 3 Species–All other by-catch species

This list was unlikely to be exhaustive so any additional species seen whilst sampling was to be noted and sampled. Shellfish by-catch in these fisheries were unlikely to be available for sampling at the same time as the rest of the catch so these were identified as a sub group of Group 3. These would be sampled if seen but if not, it would not be assumed that they had not been landed.

Figures 4.20.1 to 4.20.4 provide brief summaries of the historic landings in each métier. Table 4.20.1 shows the species lists and groupings for each of the study areas and provides a key to the species codes used in the previous figures.

Irrespective of the scheme all length samples were to be collected in accordance to current guidance and to existing protocols.

4.20.2 Results

Newlyn (See Table 4.20.2)

During the week fifteen Beamers were available for sampling, of these vessels thirteen were attempted. Three were sampled successfully to scheme 1, two to scheme 2 and five to scheme 3. Two vessels sampled to scheme 3 and one to scheme 2 were not completed before sale. For the vessel sampled to scheme 2 staff were caught out by the auction and order of sale and as a consequence one from each of the Group 1 and Group 2 species was missed. For the scheme three vessels one was not completed before sale and the other because part of the landings were sold and removed pre-sale before they could be sampled. No beamers were expected for one the auctions so a scheme was quickly drawn up to sample some of the local otter trawlers which were expected to land. In the event one Beamer did land so as well as sampling this to scheme 1A, two otter trawlers were sampled to scheme 2A and one to scheme 1A.

Of the 314 samples available from the beamers 170 were measured and all of the 31 species noted were sampled.

All 31 species landed by the fleet were sampled at least once.

Each beamer took between 2.5 and 3.5 hours for two staff to complete. More was achieved each morning because four staff were sampling. Normal practice would be to only use two staff. The range of times it took to sample each scheme was similar – probably because of the range of species encountered and the number of grades sorted for the group 1 species sampled every time.

Hastings (See Table 4.20.2)

Samples were not available during the day at Hastings. Landings in the afternoon were stored in a chiller to be graded and packed for distribution by merchants the following morning. Sampling staff had access to these landings over night. Arrangements were made on one day to sample at merchants in Rye. Small landings and the time available allowed all the landings witnessed to be sampled to scheme 1A. 18 landings were sampled from Hastings and 5 from Rye. Each landing took around 20 minutes to sample. The samples collected on Sunday night included the landings over the weekend from Friday on – so, although kept separate, they included landings from the same vessel. So on the first night, the Sunday, 9 landings were present and sampled although only 4 vessels had contributed to them.

Fleetwood (See Table 4.20.2)

All the sampling this week had to be prearranged and in correspondence with the market graders. Of seventeen landings only nine were sampled successfully to Scheme 1. One landing had to be abandoned as parts of the landing were removed pre-auction by a merchant. Of the seven not sampled, one landing was avoided because of pre-auction removals; five landings had already been graded and combined before staff arrived and two landings were sorted and laid out just ahead of the sale so were unavailable.

Of 106 samples available 64 were collected and all 20 of the species landed were sampled at least once.

A landing took between 0.5 and 3 hours to sample depending on the number of species and on average took 1.5 hours.

North Shields

Nephrops sampling had to be carried out the night before the fish auction. To optimise the time available a sample of the tail category was bought to be sampled after the fish auction the following day. For the period of the study it was only feasible to collect at the most 4 *Nephrops* samples.

Of 27 landings available for sampling on the market floor over the four days of sampling only 11 *Nephrops* samples were collected. Of these vessels one did not land any fish to auction but all the others were sampled to Scheme 1. Despite the *Nephrops* having been missed all the fish landed by 4 other vessels were sampled.

Only 18 vessels landed *Nephrops* to the merchant that staff had an arrangement with, the other vessels landed their *Nephrops* elsewhere.

Of 284 sampling opportunities 147 samples were collected and 21 of the species noted were sampled.

Each vessel took between 1.5 and 2 hours to sample. Without the *Nephrops* the landings took between 15 minutes and 1 hour to complete.

4.20.3 Discussion

- Concurrent sampling is potentially feasible in the fisheries that have been examined given sufficient resources and if a number of regional problems can be resolved. In Newlyn, Fleetwood and North Shields shellfish is not available for sampling unless the vessel is met at the point of landing. This logistically is more of a problem if that component is the target species or an important part of the catch, as that vessels landing may need to be sampled in two or more sessions. If they make up part of an irregular by catch, this component may best be sampled at sea. In each port sampled the cooperation of the industry is paramount to the success of this method of sampling, particularly in Hastings and Fleetwood. The sampling for the period of the study was very intensive and did test the patience of some of the market staff we were working with. Any sampling programme designed with this level of sampling intensity would not be feasible, as cooperation would likely be withdrawn in some areas.

- Concurrent sampling is only feasible with <u>further</u> cooperation from the industry.

- Although this study covers a range of métiers there are a still a wide range of other métiers and landing practices that this study does not cover. Table 4.20.3 (overview of current targets) gives some indication of the stocks sampled and the sources for samples. Each area or port of sampling offers different characteristics and landing practices and would need to be considered on its own merit.

- This system of sampling would be more expensive to implement if current precision levels on DCR species are to be maintained. For instance to meet current quarterly targets for Plaice in Fleetwood an additional 3 vessels would need to be sampled – the targets for other stocks would be exceeded by up to 150% and the whole process would take around 3 times longer than current stock based sampling. This increase in costs could be multi-plied further in Newlyn because of the number of species landed by the fleet; problems associated with trips fishing in more than one area; and the number of stock based targets which would could be 'over sampling'.

- Concurrent sampling targets and resources will have to allow for failures to sample to pre-determined schemes. If targets are in terms of the number of trips successfully sampled the cost of not completing one trip and having to sample another one is greater than having to just resample one species from another trip.

- Limited periods of availability and the additional time required to sample concurrently makes it difficult to randomise the sampling effectively. Taking Newlyn as an example, if its going to take up to 3.5 hours to sample one vessel and the window of opportunity is only 4 hours the targeted vessel may not be available and there is only enough time to sample the first vessel sampled.

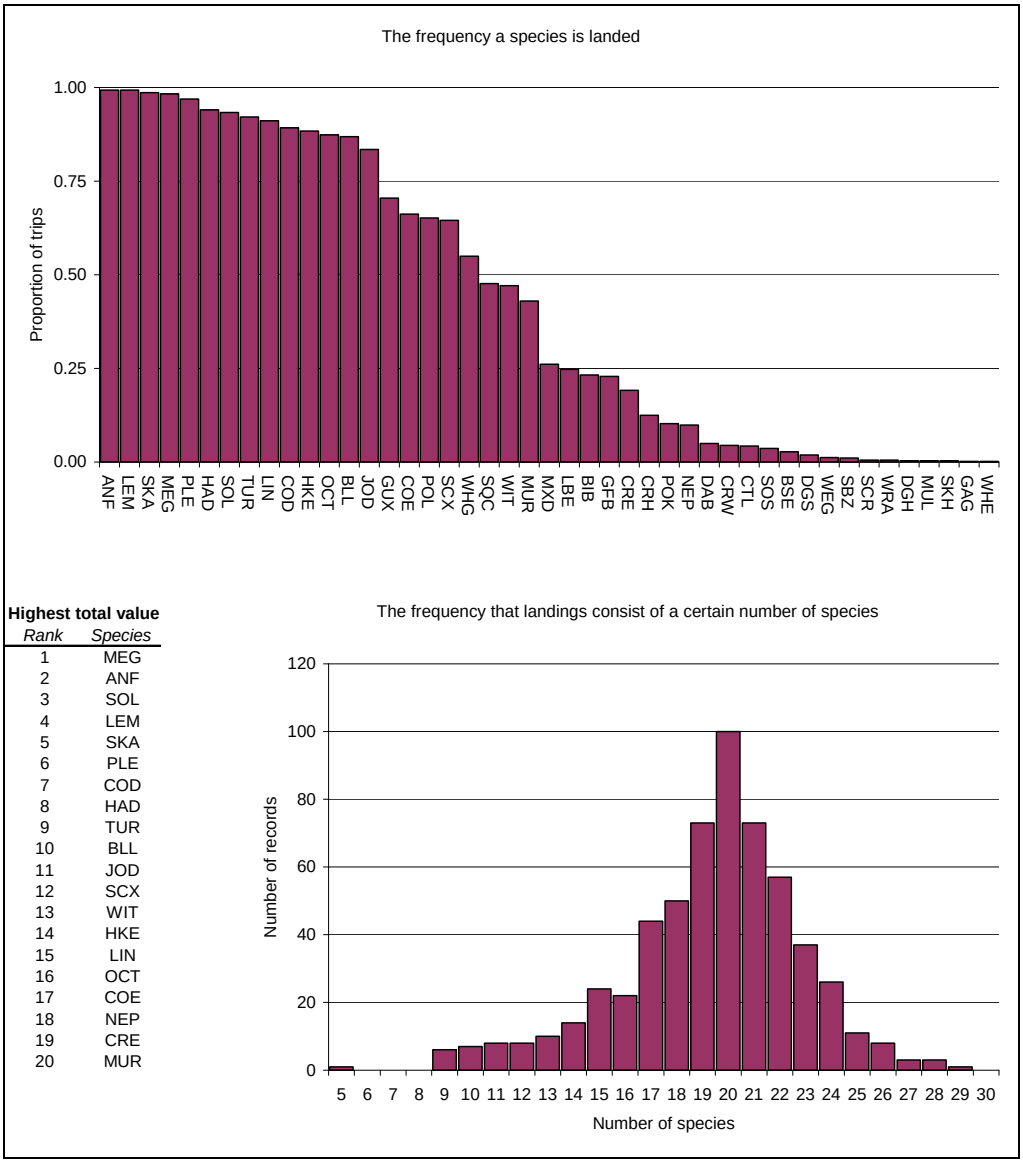
- Concurrent sampling ashore is less flexible than species based sampling to changing landing practices. In recent years fleets have declined and auctions have closed. In some areas the local industry are relying more on visiting fleets who have the tendency to land directly onto the back of lorries and not to a local auction this severely affects the feasibility of sampling these vessels concurrently

ashore. Where this is occurring it is still feasible at times to sample to stock targets without getting in the way of the landing operation.

- Limited periods of availability and the additional time required to sample concurrently makes it difficult to randomise the sampling effectively. Taking Newlyn as an example, if its going to take up to 3.5 hours to sample one vessel and the window of opportunity is only 4 hours the targeted vessel may not be available and there is only enough time to sample the first vessel sampled.
- Use of the at sea sampling scheme to provide components of onshore concurrent sampling needs to be evaluated.

4.20.4 Other issues

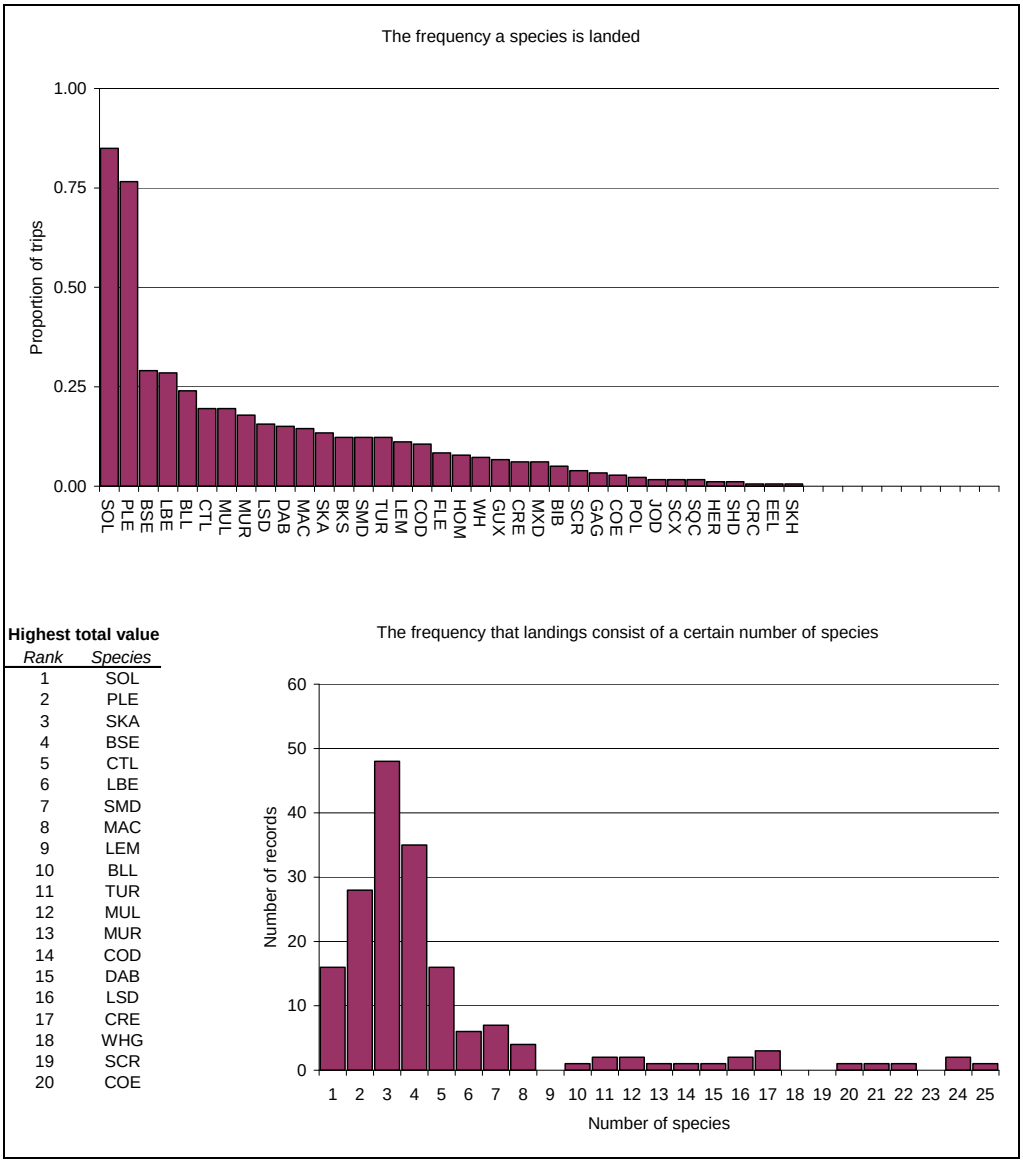
Samples collected under the current sampling programme are entered and held electronically on a national database. Samples are stored as part of a sample group, the group being defined by the trip details, so there is unlikely to be major changes required to the software. If these sample groups need to be identified as concurrently complete and the schemes used (see Section 6) then some amendment to the current system will be required. Some reporting software may need to be developed to provide the data in the format required by users. There will be a greater range of species being sampled and therefore held on the system so biological parameters for 'additional' species, like length/weight coefficients, will need to be collated or collected for some of the validation processes to work effectively. Target allocation and monitoring software will need to be adapted or a new system developed.



Highest total value

Rank	*Species*
1	MEG
2	ANF
3	SOL
4	LEM
5	SKA
6	PLE
7	COD
8	HAD
9	TUR
10	BLL
11	JOD
12	SCX
13	WIT
14	HKE
15	LIN
16	OCT
17	COE
18	NEP
19	CRE
20	MUR

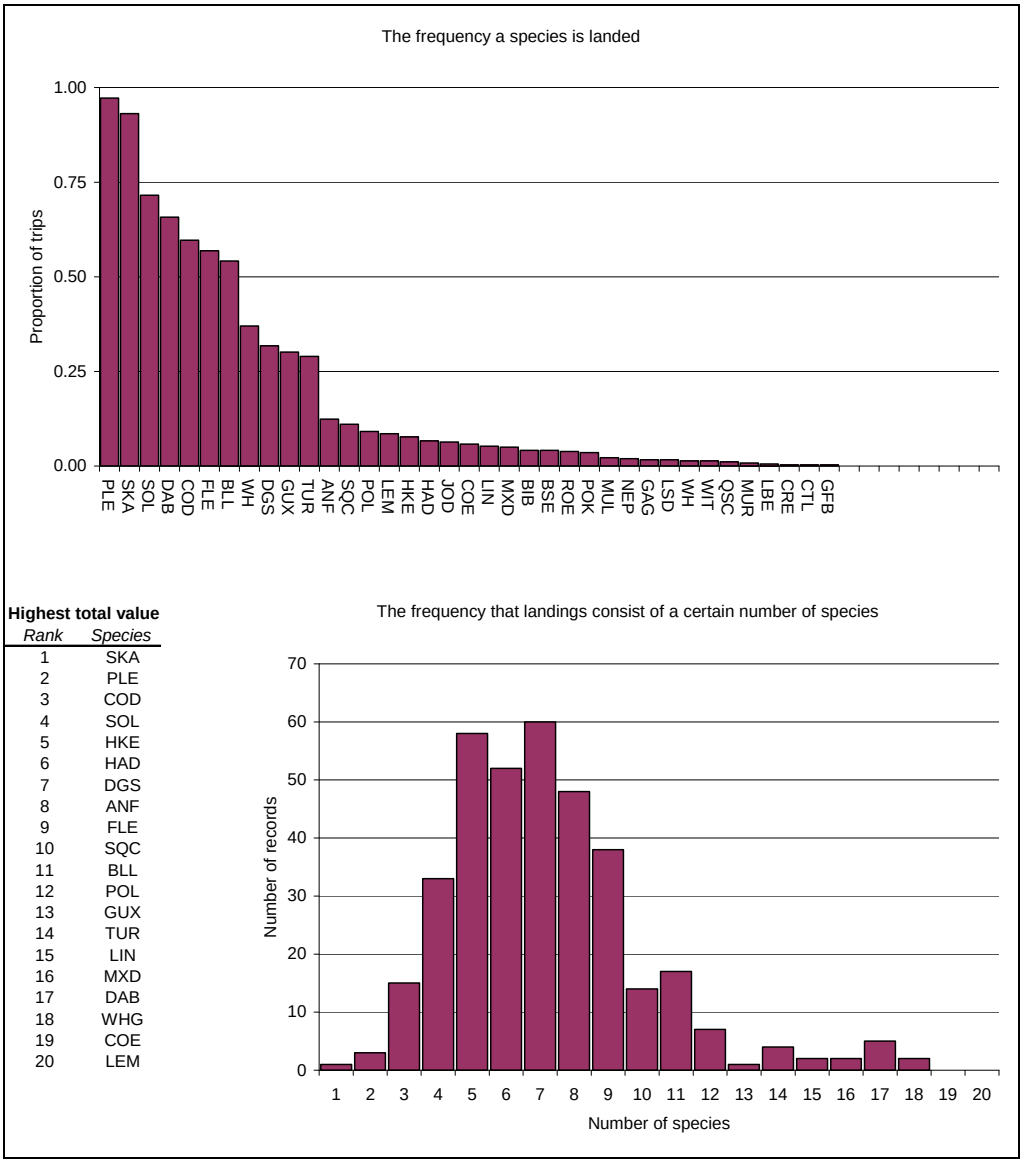
Figure 4.20.1 Summary of landings of beamers to Newlyn in Q3 2004–2006



Highest total value

Rank	*Species*
1	SOL
2	PLE
3	SKA
4	BSE
5	CTL
6	LBE
7	SMD
8	MAC
9	LEM
10	BLL
11	TUR
12	MUL
13	MUR
14	COD
15	DAB
16	LSD
17	CRE
18	WHG
19	SCR
20	COE

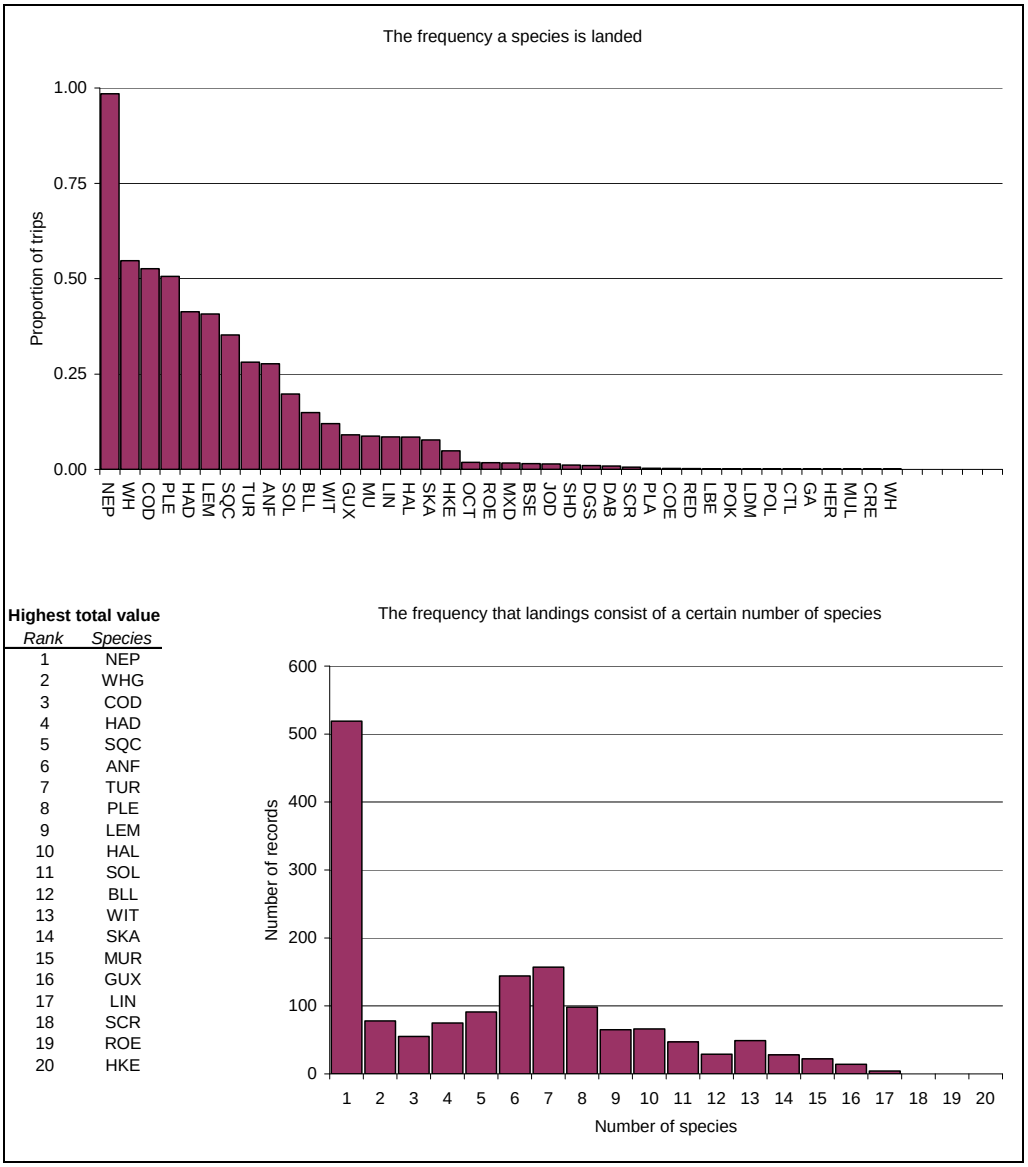
Figure 4.20.2 Summary of landings of netters to Hastings in Q3 2004–2006



Highest total value

Rank	*Species*
1	SKA
2	PLE
3	COD
4	SOL
5	HKE
6	HAD
7	DGS
8	ANF
9	FLE
10	SQC
11	BLL
12	POL
13	GUX
14	TUR
15	LIN
16	MXD
17	DAB
18	WHG
19	COE
20	LEM

Figure 4.20.3 Summary of landings of trawlers to Fleetwood in Q4 2004–2006



Highest total value

Rank	*Species*
1	NEP
2	WHG
3	COD
4	HAD
5	SQC
6	ANF
7	TUR
8	PLE
9	LEM
10	HAL
11	SOL
12	BLL
13	WIT
14	SKA
15	MUR
16	GUX
17	LIN
18	SCR
19	ROE
20	HKE

Figure 4.20.4 Summary of landings of trawlers to North Shields in Q1&Q4 2004–2006

Table 4.20.1 Species lists and groupings for each of the study areas.

	Newlyn			Hastings			Fleetwood			North Shields		
	Code	Common name	Species	Code	Common name	Species	Code	Common name	Species	Code	Common name	Species
Group 1	ANF	Angler fishes	*Lophiidae*	SOL	Sole (dover sole)	*Solea solea (s.vulgaris)*	PLE	European plaice	*Pleuronectes platessa*	NEP	Norway lobster	*Nephrops norvegicus*
	MEG	Megrim	*Lepidorhombus whiffiagonis*	PLE	European plaice	*Pleuronectes platessa*	SKA	Skates and rays	*Rajidae*	WHG	Whiting	*Merlangius merlangus*
	SOL	Sole (dover sole)	*Solea solea (s.vulgaris)*	BSE	Basses	*Dicentrarchus (morone) spp*	SOL	Sole (dover sole)	*Solea solea (s.vulgaris)*	HAD	Haddock	*Melanogrammus aeglefinus*
	COD	Cod	*Gadus morhua*	COD	Cod	*Gadus morhua*	COD	Cod	*Gadus morhua*	COD	Cod	*Gadus morhua*
	HKE	European hake	*Merluccius merluccius*	HKE	European hake	*Merluccius merluccius*	HKE	European hake	*Merluccius merluccius*	HKE	European hake	*Merluccius merluccius*
Group 2	PLE	European plaice	*Pleuronectes platessa*	CTL	Cuttle-fishes	*Cephalopoda-sepiida*	NEP	Norway lobster	*Nephrops norvegicus*	LEM	Lemon sole	*Microstomus kitt*
	HAD	Haddock	*Melanogrammus aeglefinus*	SKA	Skates and rays	*Rajidae*	ANF	Angler fishes	*Lophiidae*	PLE	European plaice	*Pleuronectes platessa*
	WHG	Whiting	*Merlangius merlangus*	LEM	Lemon sole	*Microstomus kitt*	LEM	Lemon sole	*Microstomus kitt*	SKA	Skates and rays	*Rajidae*
	LIN	Common ling	*Molva molva*	SMD	Smooth hound	*Mustelus mustelus*	TUR	Turbot	*Scophthalmus maximus*	ANF	Angler fishes	*Lophiidae*
	POK	Saithe	*Pollachius virens*	TUR	Turbot	*Scophthalmus maximus*	BLL	Brill	*Scophthalmus rhombus*	SOL	Sole (dover sole)	*Solea solea (s.vulgaris)*
	TUR	Turbot	*Scophthalmus maximus*	BLL	Brill	*Scophthalmus rhombus*	GUX	Gurnards	*Trigla spp*	WIT	Witch	*Glyptocephalus cynoglossus*
	CTL	Cuttle-fishes	*Cephalopoda-sepiida*	WHG	Whiting	*Merlangius merlangus*	POK	Saithe	*Pollachius virens*	TUR	Turbot	*Scophthalmus maximus*
	SKA	Skates and rays	*Rajidae*	LSD	Lesser spotted dogfish	*Scyliorhinus canicula*	LIN	Common ling	*Molva molva*	BLL	Brill	*Scophthalmus rhombus*
	LEM	Lemon sole	*Microstomus kitt*	DAB	Dab	*Limanda limanda*	BSE	Basses	*Dicentrarchus (morone) spp*	POK	Saithe	*Pollachius virens*
Group 3	COE	European conger eel	*Conger conger*	MUR	Red mullet	*Mullus surmuletus*	DGS	Spurdog	*Squalus acanthias*	LIN	Common ling	*Molva molva*
	OCT	Octopuses	*Octopodidae*	MUL	Grey mullets	*Mugilidae*	JOD	John dory	*Zeus faber*	GUX	Gurnards	*Trigla spp*
	GUX	Gurnards	*Trigla spp*	SQC	Common squids	*Loligo spp*	POL	Pollack	*Pollachius pollachius*	SQC	Common squids	*Loligo spp*
	BLL	Brill	*Scophthalmus rhombus*	GUX	Gurnards	*Trigla spp*	MUR	Red mullet	*Mullus surmuletus*	MUR	Red mullet	*Mullus surmuletus*
	MUR	Red mullet	*Mullus surmuletus*	GAG	Tope shark	*Galeorhinus galeus*	MUL	Grey mullets	*Mugilidae*	HAL	Halibut	*Hippoglossus hippoglossus*
	WIT	Witch	*Glyptocephalus cynoglossus*	FLE	Flounder (european)	*Platichthys flesus*				BSE	Basses	*Dicentrarchus (morone) spp*
	JOD	John dory	*Zeus faber*	COE	European conger eel	*Conger conger*				POL	Pollack	*Pollachius pollachius*
	BIB	Whiting-pout (bib)	*Trisopterus luscus*	BKS	Black seabream	*Spondyliosoma cantharus*				LDM	Stone crab	*Lithodes maja*
	POL	Pollack	*Pollachius pollachius*	POL	Pollack	*Pollachius pollachius*				OCT	Octopuses	*Octopodidae*
	GFB	Greater forkbeard	*Phycis blennoides*	BIB	Whiting-pout (bib)	*Trisopterus luscus*				SHD	Shads	*Alosa spp*
	SOS	Sand sole	*Pegusa (solea) lascaris*	SHD	Shads	*Alosa spp*				DGS	Spurdog	*Squalus acanthias*
	DAB	Dab	*Limanda limanda*	JOD	John dory	*Zeus faber*				JOD	John dory	*Zeus faber*
	DGS	Spurdog	*Squalus acanthias*	HER	Herring	*Clupea harengus*				RED	Redfishes	*Sebastes spp*
	BSE	Basses	*Dicentrarchus (morone) spp*	HOM	Horse-mackerel (scad)	*Trachurus trachurus*				DAB	Dab	*Limanda limanda*
	DGH	Dogfishes	*Scyliorhinidae*	MAC	(European) mackerel	*Scomber scombrus*				HER	Herring	*Clupea harengus*
	MUL	Grey mullets	*Mugilidae*							COE	European conger eel	*Conger conger*
	WEG	Greater weever fish	*Trachinus draco*							CTL	Cuttle-fishes	*Cephalopoda-sepiida*
	GAG	Tope shark	*Galeorhinus galeus*									
	SKH	Sharks	*Squalus acanthias*									
	WRA	Wrasses	*Labridae*									
	SBZ	Sea breams	*Sparidae*									
	FLE	Flounder (european)	*Platichthys flesus*									
	SQC	Common squids	*Loligo spp*									
Sub group	*NEP*	Norway lobster	*Nephrops norvegicus*	*SCR*	Spiny spider crab	*Maia squinado*	*CRE*	Edible crab	*Cancer pagurus*	*LBE*	European lobster	*Homarus gammarus*
	SCR	Spiny spider crab	*Maia squinado*	*CRC*	Edible crab (Male)	*Cancer pagurus (Male)*				*CRE*	Edible crab	*Cancer pagurus*
	LBE	European lobster	*Homarus gammarus*	*CRE*	Edible crab	*Cancer pagurus*				*LDM*	Stone crab	*Lithodes maja*
	CRW	Crawfishes	*Palinurus spp*	*LBE*	European lobster	*Homarus gammarus*						
	CRC	Edible crab (Male)	*Cancer pagurus (Male)*	*SCX*	Scallops	*Pectinidae*						
	MLP	Velvet swimming crab	*Necora puber*									
	SCX	Scallops	*Pectinidae*									
	CRE	Edible crab	*Cancer pagurus*									
	CRH	Edible crab (Female)	*Cancer pagurus (Female)*									

Table 4.20.2 Results implementation study

Country	GBE&W
Location	Newlyn
Fleetsegment/Fishing activity	Beam Trawl (and Otter trawl)

	Beam	Beam	Beam	Beam	Beam	Otter
	23/07/2007	24/07/2007	25/07/2007	26/07/2007	27/07/2007	25/07/2007
Time available for sampling (minutes)	325	180	240	285	310	240
# staff members	4	4	4	4	4	4
No of vessels available for sampling	4	2	1	4	4	9
No of vessels sampled	3	2	1	4	3	3
No of samples available (vessels x species x categories)	80	39	20	90	85	142
No of species landed	25	21	20	28	24	27
No of species sampled	24	20	19	27	16	23
No of measurements	3205	1765	765	3690	2661	765
Applied scheme (1,2 or 3)	1,2	2	1	3	3	1,2
Sampling completed (Y/N)	Y	Y	Y	Y	N	Y
If completed, duration of sampling (minutes)	325	180	56	285	310	108

Country	GBE&W
Location	Newlyn
Fleetsegment/Fishing activity	Otter Trawl

	25/07/2007
Time available for sampling (minutes)	240
# staff members	4
No of vessels available for sampling	9
No of vessels sampled	3
No of samples available (vessels x species x categories)	142
No of species landed	27
No of species sampled	23
No of measurements	765
Applied scheme (1,2 or 3)	1,2
Sampling completed (Y/N)	Y
If completed, duration of sampling (minutes)	108

Country	GBE&W
Location	Hastings
Fleetsegment/Fishing activity	Netters

	23/09/2007	24/09/2007	25/09/2007	26/09/2007	27/09/2007
Time available for sampling (minutes)	720	720	720	720	720
# staff members	2	2	2	2	2
No of vessels available for sampling	4	1	3	3	2
No of vessels sampled	4	1	3	3	2
No of samples available (vessels x species x categories)	40	1	19	8	10
No of species landed	15	1	12	13	8
No of species sampled	15	1	12	13	8
No of measurements	1349	138	591	518	208
Applied scheme (1,2 or 3)	1	1	1	1	1
Sampling completed (Y/N)	Y	Y	Y	Y	Y
If completed, duration of sampling (minutes)	360	20	120	60	45

Country	GBE&W
Location	Rye
Fleetsegment/Fishing activity	Netters

	26/09/2007
Time available for sampling (minutes)	180
# staff members	2
No of vessels available for sampling	4
No of vessels sampled	4
No of samples available (vessels x species x categories)	32
No of species landed	15
No of species sampled	15
No of measurements	688
Applied scheme (1,2 or 3)	1
Sampling completed (Y/N)	Y
If completed, duration of sampling (minutes)	180

Country	GBE&W
Location	North Shields
Fleetsegment/Fishing activity	Nephrops Trawl

	14/01/2008	15/01/2008	16/01/2008
Time available for sampling (minutes)	480	530	490
# staff members	2	2	2
No of vessels available for sampling	11	6	10
No of vessels sampled	4	5	4
No of samples available (vessels x species x categories)	115	60	109
No of species landed	21	20	23
No of species sampled	19	17	17
No of measurements	2490	1952	1974
Applied scheme (1,2 or 3)	1	1	1
Sampling completed (Y/N)	Y	Y/N	Y/N
If completed, duration of sampling (minutes)	370	370	390

Country	GBE&W
Location	Fleetwood
Fleetsegment/Fishing activity	Otter trawl

	10/09/2007	12/09/2007	13/09/2007	14/09/2007
Time available for sampling (minutes)	360	60	360	360
# staff members	2	2	2	2
No of vessels available for sampling	7	1	6	3
No of vessels sampled	5	1	1	3
No of samples available (vessels x species x categories)	43	5	35	23
No of species landed	12	5	9	12
No of species sampled	9	5	4	12
No of measurements	1411	385	141	1519
Applied scheme (1,2 or 3)	1	1	1	1
Sampling completed (Y/N)	Y/N	Y	N	Y
If completed, duration of sampling (minutes)	183	50	30	250

Table 4.20.3 Overview current market sampling strategies

Country (ICES code) (e.g SPA)	Species (3-char. code) (e.g. HER)	Location of sampling (auction, on board)	Type of sampling (age, length or age/lengte)	Stratification by marketcategory (YES, NO)
GBE&W	ANF	Auction	Length	NO
GBE&W	ANF	Onboard	Age	NO
GBE&W	BSE	Auction/Merchants	Age/Length	NO
GBE&W	BSH	Auction	Length	NO
GBE&W	COD	Auction/Merchants	Age/Length	NO
GBE&W	CRE	Quay/Merchants/Onboard	Length	NO
GBE&W	CRW	Merchants	Length	NO
GBE&W	HAD	Auction	Length	NO
GBE&W	HER	Lab	Age/Length	NO
GBE&W	HER	Merchants/Onboard	Length	NO
GBE&W	HKE	Onboard	Length	NO
GBE&W	HKE	Auction	Age/length	NO
GBE&W	HOM	Merchants	Length	NO
GBE&W	LBE	Quay/Merchants/Onboard	Length	NO
GBE&W	LEM	Auction	Age/Length	NO
GBE&W	MAC	Auction	Length	NO
GBE&W	MAC	Lab	Age/Length	NO
GBE&W	MEG	Auction	Age/Length	NO
GBE&W	MLP	Quay/Merchants/Onboard	Length	NO
GBE&W	MUR	Auction	Length	NO
GBE&W	NEP	Quay/Merchants/Onboard	Length	NO
GBE&W	PLE	Auction/Merchants	Length/Age	NO
GBE&W	POK	Auction	Length	NO
GBE&W	POR	Auction	Length	NO
GBE&W	SCR	Quay/Merchants/Onboard	Length	NO
GBE&W	SKA	Auction/Merchants	Length/Weight	NO
GBE&W	SOL	Auction/Merchants	Age/Length	NO
GBE&W	SPR	Lab	Age/Length	NO
GBE&W	WHG	Auction	Age/Length	NO

4.21 United Kingdom (Scotland)

4.21.1 Methodology

Selection of fishing activity

The predominant fishing activity in Scotland to which concurrent sampling may be relevant comprises the demersal towed gear mixed fisheries for finfish (where *Nephrops* may also comprise a fraction of the landings) and the towed gear fisheries for *Nephrops* (where finfish may comprise a fraction of the landings). These vessels undertake multi-day fishing trips. Due to prior knowledge of the operational difficulties to sample the latter concurrently, the former activity formed the focus of FRS's implementation trials. No at-sea concurrent sampling was trialled.

Selection of auction

FRS Marine Laboratory arranged for concurrent sampling exercises to be carried out at Aberdeen (May 2007) and at Peterhead (October 2007). The former market was chosen due to its historic role as a major landing port for Scottish vessels and FRS's long-term history of weekly sampling. The latter was chosen due to its current predominance as a market for Scottish demersal landings, encompassing both North Sea landings and also some from vessels operating to the west of Scotland.

Selection of vessels

Ideally, the sampling teams would have selected vessels comprising fishing activities based on the sample requirements of the existing FRS market sampling protocols; a stratified sampling scheme comprising fleet/gear, area and month strata. However, at the Aberdeen market the sampling team was faced with limited options due to a low number of vessels landing and a restricted access time for sampling.

Selection of sampling schemes and allocation of species to groups 12 or 3

The sampling scheme adopted for the exercise was scheme 'A1' which was one of the options outlined at PGCCDBS (ICES 2007a), i.e. (scheme '1'): sampling schemes that address all species in each sampling operation (comprehensive concurrent sampling) and (scheme 'A'): a scheme that covers all species groups, inclusive of minor by-catch species. For the purpose of the exercise, species sampled were allocated to three groups: Group 1 (cod, haddock, whiting and saithe), Group 2 (lemon sole, plaice, megrim, angler and hake)[1] and Group 3 (all other species).

Crewsize (# of persons involved)

A single sampling team comprising two staff was allocated to each of the market exercises. Although insufficient in itself to fulfill the 'A1' scheme in all cases, this provided sufficient information on the *likely* staffing requirements to fulfill an 'A1' scheme under the current FRS sampling protocol. (If increased sample levels are required to meet enhanced precision requirements under the DCR requirements, then staffing requirements will increase commensurately).

Timewindow available for sampling

A sampling team was present on a daily basis, Monday to Friday, at Aberdeen through May and at Peterhead in October. Sampling commenced at 05.00 at Aberdeen and sales commenced at 07.30. At Peterhead sampling took place during the evening and/or morning depending on the progress of sampling against targets. In principle, sampling teams could have accessed the Aberdeen market at an earlier hour; however, due to the uncertainty of sampling opportunities through either few or no landings and partial consignments (see below) this was not considered to be justifiable on resource grounds.

4.21.2 Results

Availability of samples

Table 4.21.2.1 indicates the proportion of days on which samples were available when sampling teams were deployed. On 50% of days there was no opportunity to sample concurrently at Aberdeen, whereas this was attainable on 100% of days spent at Peterhead.

Table 4.21.2.1

Port	No of days	Full sampling opportunities	Partial sampling opportunities	Partial consignments, no sampling	Zero landings
Aberdeen	23	11	2	4	6
Peterhead	16	16	0	0	0

Number of samples taken vs. number of sampling opportunities

In total there were 28 landings available to sample at Aberdeen market, from which 18 vessels were sampled. The corresponding values for Peterhead were 140 and 26.

1 This group also included *Nephrops*, but, as discussed later, consignment of the *Nephrops* fraction of landings direct to processors meant that this species could not be sampled concurrently.

Number of species

Once a vessel was chosen, it was intended that the sampling team should target all species in Group 1 (4) followed by all species in Group 2 (5) and then, if time permitted, as many as possible in Group 3.

Sampling in Aberdeen was generally good for Group 1 species, but only partly effective for Group 2 species and ineffective for Group 3 species. If the number of sampling teams was increased to two, then good coverage of all species would be anticipated, but given the number of days on which sampling opportunities did not arise or was restricted, this would be an inefficient and costly option. On three occasions, the vessels also landed quantities of *Nephrops* that were consigned directly to a processing factory. Because of this it was not possible to sample that species. FRS has yet to identify appropriate opportunities to link the concurrent sampling of other species to *Nephrops*.

Concurrent sampling at Peterhead was restricted to Group 1 and Group 2 species during the trial; however, it would not be problematic to extend this to Group 3 species. On a single day of sampling the team was able to sample all Group 1 and Group 2 species from a single vessel and, on many occasions, was able to extend this partially or fully to at least one other vessel.

Details of the number of species sampled per group compared with the number of species available per group in the sampled landings are given in Table 4.21.1 and 4.21.2.

Sample size

At Peterhead, on average[2], 13 species were present per landing of which 11 species were sampled and 1520 fish measured. At Aberdeen, on average, 9 species were landed of which 4 were sampled and 870 fish measured. (The species to which these values refer comprise only those species for which FRS has a responsibility to sample landings under the current DCR. They also include all skates and rays combined as a single category; however, the sampling of skates and rays was carried out at the species level).

Time needed for sampling

At Aberdeen, 2.5 hours was available for sampling and, providing samples were available, this time was fully utilised although it was insufficient to permit concurrent sampling.

At Peterhead, concurrent sampling from at least a single vessel and in part or fully from another vessel was completed for sampling durations between 4 and 9.5 hours. The minimum available sampling window was 11 hours at this market. (This may not always be the case as seasonal factors, weather conditions and market demands may influence both the timing of a vessel's return to port and the availability of fish).

In both ports, age as well as length samples were taken.

2 Median values are used

4.21.3 Discussion

Problems encountered during sampling activity

At Aberdeen, the available sampling window was short relative to the time available at Peterhead and although, in principle, additional resources could be deployed to counter that, the frequency of non-sample availability would make this rather inefficient and costly. In contrast, sample availability at Peterhead was such that it would be reasonable to extend concurrent sampling to include Group 3 species.

Restrictions of implementation study

Although no concurrent sampling exercises were carried out at ports to the west of Scotland, it is the view of the FRS sampling co-ordinators that due to irregular landings patterns, the frequency of consignments to other markets and short sampling windows, it would be very difficult to implement a cost effective concurrent sampling scheme at them. This is further exacerbated by the remoteness of some of their locations. FRS intends to increase its presence at the Peterhead market and to take concurrent samples from landings at Peterhead from vessels fishing to the west of Scotland (as well as North Sea landings). Demersal landings at Shetland will continue to be sampled separately from Peterhead. It is thought, in principle, it would be possible to sample Shetland landings concurrently.

Due to the onboard sampling design of the FRS observer scheme, it was not possible to carry out concurrent sampling at sea of retained marketable fish as envisaged by PGCCDBS. However, a number of issues suggest that a review of onboard sampling within the Scottish demersal discard scheme may be appropriate.

No trial work was undertaken on the concurrent sampling of pelagic fisheries as the existing sampling programme is, effectively, a concurrent scheme already due to the seasonality and predominantly mono-specific nature of the Scottish pelagic fisheries.

Targeted *Nephrops* fisheries are not sampled concurrently. In fact, for these fisheries, *Nephrops* sampling teams only sample *Nephrops* whilst the by-catch species are sampled as part of the demersal finfish sampling programme. The development of this two-part sampling scheme has arisen historically because although FRS's sampling is nominally through an integrated sampling programme, it has always proven logistically difficult to sample both whitefish and *Nephrops* landings from the same vessel.

Comparison concurrent length sampling vs. current sampling methodology

With the possible exception of Shetland landings, it is highly unlikely that additional resources will be available to increase sampling effort. Any changes that are made to encompass concurrent sampling will have to arise from the re-allocation of existing FRS resources or, as is more likely, from within the current FRS fish sampling programme. For example, through the lessening of activity at (i) an increasingly reduced market (Aberdeen) and (ii) in areas where landings are irregular and frequently consigned elsewhere (e.g. west of Scotland whitefish landings) will free-up resources for a corresponding increase in activity at Peterhead.

Quality of the data

No formal analysis has been made of the trial data. The judgement of experienced sampling staff is, not unsurprisingly, that by extending sampling to previously unsampled minor species, it will be more difficult to hit the FRS sampling targets for the major landed species as additional staff resources are not available. As things

stand, this impact of this can only really be assessed as progress is made in the adoption of a regional rather than country sampling designs and information on appropriate precision levels (including the provision of tools to adequately assess precision) becomes clearer in relation to the objectives of the sampling programmes (eg, the balance between sampling for single species assessments, fishery-based assessments and ecosystem effects).

4.21.4 Other issues

FRS is currently working to develop its fisheries database system to integrate the functionality of a number of external, separate databases and processing routines. It is also seeking to accommodate the various reporting requirements of the existing Data Collection Regulation. The revised Data Collection regulation and its move to métier matrix sampling will require substantial additional development of the system; however, developer time is at a premium within FRS with, currently, the database development project's risk register indicating an increased risk of key staff leaving or resources being otherwise moved away from the project.

Table 4.21.1. Concurrent sampling overview: FRS (UK Scotland) at Aberdeen.

Country	Scotland
Location	Aberdeen
Fleetsegment/Fishing activity	Demersal towed gears (roundfish)

Date	01/05/2007	02/05/2007	03/05/2007	04/05/2007	08/05/2007	10/05/2007	11/05/2007	14/05/2007	15/05/2007
Time available for sampling (minutes)	150	150	150	150	150	150	150	150	150
# staff members	2	2	2	2	2	2	2	2	2
No of vessels available for sampling	2	1	3	2	1	1	2	1	1
No of vessels sampled	1	1	1	2	1	1	1	1	1
No of samples available (vessels x species x categories)	12	11	24	16	7	7	15	9	9
No of species landed	12	11	24	16	7	7	15	9	9
No of species sampled	6	1	8	2	1	3	4	5	7
No of measurements	729	132	961	436	284	300	941	1029	931
Applied scheme (1,2 or 3)	1	1	1	1	1	1	1	1	1
Sampling completed (Y/N)	N	N	N	N	N	N	N	N	N
If completed, duration of sampling (minutes)									

Date	16/05/2007	17/05/2007	22/05/2007	23/05/2007	25/05/2007	28/05/2007	29/05/2007	30/05/2007
Time available for sampling (minutes)	150	150	150	150	150	150	150	150
# staff members	2	2	2	2	2	2	2	2
No of vessels available for sampling	2	2	1	1	2	2	1	3
No of vessels sampled	1	1	1	1	1	1	1	1
No of samples available (vessels x species x categories)	14	19	6	10	18	20	8	32
No of species landed	14	19	6	10	18	20	8	32
No of species sampled	7	9	1	2	7	11	3	3
No of measurements	1384	1044	464	629	870	925	649	972
Applied scheme (1,2 or 3)	1	1	1	1	1	1	1	1
Sampling completed (Y/N)	N	N	N	N	N	N	N	N
If completed, duration of sampling (minutes)								

Table 4.21.2 Concurrent sampling overview: FRS (UK Scotland) at Peterhead

Country	Scotland
Location	Peterhead
Fleetsegment/Fishing activity	Demersal towed gears (roundfish)

	02/10/2007	03/10/2007	04/10/2007	05/10/2007	09/10/2007	10/10/2007	11/10/2007	12/10/2007
Time available for sampling (minutes)	660	750	660	900	690	750	990	750
# staff members	2	2	2	2	2	2	2	2
No of vessels available for sampling	9	5	7	11	10	7	8	6
No of vessels sampled	1	2	1	2	1	2	2	2
No of samples available (vessels x species x categories)	85	48	56	95	86	63	79	58
No of species landed	85	48	56	95	86	63	79	58
No of species sampled	10	18	11	18	10	18	21	15
No of measurements	1397	2468	1275	1892	1881	2239	2087	1642
Applied scheme (1,2 or 3)	1	1	1	1	1	1	1	1
Sampling completed (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y
If completed, duration of sampling (minutes)	360	540	330	450	300	330	570	300

	16/10/2007	17/10/2007	18/10/2007	19/10/2007	23/10/2007	24/10/2007	25/10/2007	26/10/2007
Time available for sampling (minutes)	750	750	780	870	750	870	720	720
# staff members	2	2	2	2	2	2	2	2
No of vessels available for sampling	11	5	12	9	9	2	12	17
No of vessels sampled	1	1	1	3	2	2	2	1
No of samples available (vessels x species x categories)	98	43	108	80	77	16	105	136
No of species landed	98	43	108	80	77	16	105	136
No of species sampled	12	13	11	16	8	15	12	10
No of measurements	1112	1153	1019	1726	850	1720	780	784
Applied scheme (1,2 or 3)	1	1	1	1	1	1	1	1
Sampling completed (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y
If completed, duration of sampling (minutes)	300	300	300	360	480	510	240	300

5 Common problems of implementation studies

5.1 Practical issues

5.1.1 Restricted access

Access to both the sampling sites and to the landings themselves depends entirely on the cooperation of vessel owners, skippers, merchants, co-op staff etc. During the course of the concurrent sampling studies several issues were highlighted in relation to access to the fish. These include:

- Physical access to the landed catch when boxes are stacked by vessel, and stored in a confined space.
- Limited or no access to fish species pre prepared or "dressed" for sale, particularly those which are highly valued or fragile. Industry concerns relate to the potential degradation of the quality and therefore the value of the fish landed.
- Fears were expressed in relation to the potential use of the data from concurrent sampling for control and enforcement purposes.
- Part or all of the landed catch of the target vessel to be sampled may be absent, as some species/grades can be consigned and pre sold.

5.1.2 Commercial grades

Landings are often graded into commercial categories, based on species or species group, size, quality etc. When these categories exist within the landings, they all need to be sampled. This is challenging and time consuming when several species within one vessel's landings are graded into as many as 7 categories.

5.1.3 Time restrictions

The issue of limited time available for sampling was consistently raised in relation to both the market sampling and on board sampling.

Market sampling: In nearly all cases the amount of time available for market sampling was limiting, and often prevented the completion of a sampling event. Time is a far more restrictive factor when implementing the concurrent sampling approach than the current species based sampling. If the time required to sample a vessel is similar to the time available, the process of selecting a vessel is dependant on the landing patterns of the vessels and/or grading practices just prior to auctions. The additional time required to sample concurrently, makes it harder to select vessels at random. On board

Onboard sampling: Time available to sample the retained part of the catch on board can also be restrictive and in some cases can delay the processing of the catch by the crew.

5.1.4 Higher costs

All countries participating in the concurrent sampling project were concerned about the potential increase required in both personnel and associated costs.

- In order to cover all relevant métiers and to maintain current precision levels, it is anticipated that additional resources will be required (staff and travel & subsistence costs).
- If the measure of sampling success within the reporting structure of the DCR is to be the completion of a predefined number of vessels per métier, the cost of repeating a non successful sampling event is significantly more expensive than the current stock based sampling scheme.
- Some countries are currently buying parts of the catch to meet stock based sampling targets. With the concurrent sampling approach these costs will increase.
- Onboard sampling is the only or best option in some areas to carry out concurrent sampling. Most member states, if not already doing so, have indicated that they intend to optimise their sampling effort on board to include length sampling of the retained part of the catch. This has implications, particularly in the Mediterranean, where under the current system on board sampling occurs every three years for discard sampling.

5.2 Data issues

Doubts were expressed about how representative the data acquired during concurrent sampling might be. This issue relates in particular to the random selection of vessels to be sampled. Due to time restrictions and the landings patterns of the vessels, concurrent sampling for length will, more likely, be opportunistic rather than random. As a consequence there is the increased risk of introducing bias. Sampling effort should be determined by the landing patterns of the fleet and landing location or date should also be considered for random selection.

Considering the potential extra effort required to carry out each concurrent sampling event it is important to ascertain the use of data resulting from non (or partial) fulfilment of concurrent sampling events. A suggestion is to flag the data as being useful for stock assessment purposes but as not being useful for fleet based assessments.

The validity of sampling polyvalent trips and trips that have been fishing in multiple areas ashore needs to be considered. It becomes more complicated, possibly too complex, to allocate components of the landings from these trips to separate métiers. In areas where this is common sampling effort may be better directed at on board sampling.

6 Advice on best practice

The proposed shift in the data collection framework from species based to fishery based sampling is aiming to support in future a more fishery-based management process including the ecosystem approach. The sampling programmes must also meet the requirements for stock-based assessments. This section of the report deals with aspects of best practice in designing concurrent sampling programmes making most efficient use of the national resources available to do the work. General aspects of best practice for designing and executing fishery sampling programmes are well covered by existing literature including reports of ICES Workshops such as the Workshop on Discard Raising Procedures (ICES, 2007b).

6.1 Identifying best practice

There is a prevailing need to be quite clear about what is meant by the term 'best practice' and its relationship with other terms that may be used in conjunction with it and with the data collection process. A quick online search for the definition of best practice can provide numerous and variable definitions. Four examples are given below:

1) Recommendations regarding processes or techniques for the use or implementation of products or services.
2) When a company acts according to best practice, it uses proven, cost effective processes, technical systems, and business processes, which make it an industrial model for others, at least in the major fields of activity.
3) The achievement of best practice refers to the way in which leading-edge organisations are able to manage and organise their operations to deliver world-class standards of performance in areas such as cost, quality and timeliness.
4) Systematically applying sound public policy and business principles in internal processes; thereby achieving value for money and meeting departmental needs.

When considering best practice in terms of sampling schemes, it is necessary to differentiate between (i) the 'ideal' objective and (ii) the process of working towards the attainment of that objective or perhaps some lesser level of attainment. For example, in the context of this workshop, it can be argued that 'best practice' would involve the concurrent onboard sampling of all species within a given métier (to include haul-based sampling of both the retained and discarded catch) and for a sufficient number of such samples to be taken so as to achieve a prescribed precision value for at least the major target species of that métier. Such a definition clearly relates to an ideal objective, but given real-life constraints on public expenditure and the varying funding models for institutes that carry out sampling, it is questionable whether it actually defines best practice according to the latter three definitions, above. In particular, the fourth definition seems more accurately to identify best practice in the context of managing both the resources and diverse monitoring and research programmes in publicly-funded science institutes. One could easily add 'scientific principles' to the internal processes to which it refers, but the point is that it refers to processes by which decisions are made regarding the allocation of resources and procedures to broader departmental needs rather than to a single ideal objective.

Best practice for concurrent sampling could be seen as the process optimising sampling schemes to meet the different objectives for fleet based management, ecosystem approach and single species assessment within available resources taking the logistical constrains into account. Key issues to know are the objectives in terms of quality of the international and national data. Best practise when setting up concurrent sampling programmes further require detailed knowledge on sources of variability and logistical constrains that could lead to bias (Fig. 6.1).

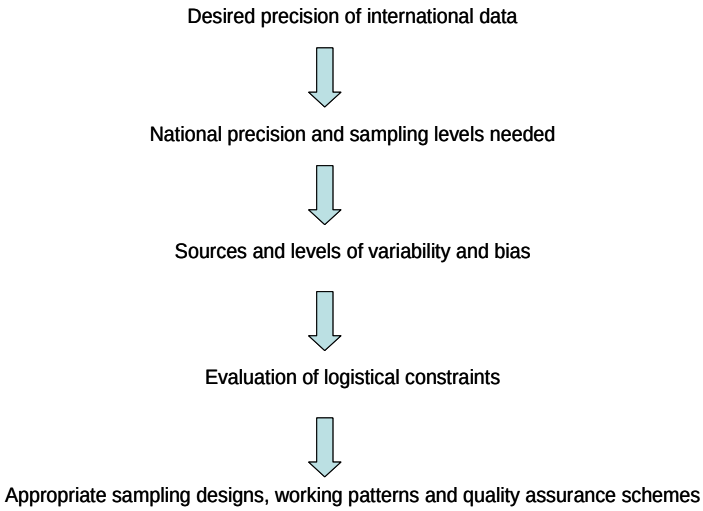


Figure. 6.1. Hierarchy of evaluation steps in designing national concurrent sampling schemes for a given fishery management area.

6.2 Sampling strategy

Fishery based management requires knowlege of the exploitation patterns of different fishing activities/métiers. The new DCR will restrict the obligation for métier-based biological sampling to length composition data on the removals of each stock. Although the concurrent sampling strategy is length-based, the sampling schemes for collection of age data remain vitally important for consideration of precision requirements for age-based analytical assessments. The assumption is that sampling areas can be defined within a region for which the age compositions within length classes are independent of fishing method. This will allow a common age-length key, derived from collaborative sampling between Member States where appropriate, to be applied to all métiers catching the stock in the sampling area. This assumption should be tested with available data when setting up spatial otolith sampling schemes. This aspect of sampling schemes is discussed further in SGRN06–03.

The idea of concurrent length sampling of landings has its basis in concurrent sampling at sea. On-board sampling of catches (discarded and retained parts) is considered the "ideal" way to sample exploitation patterns of fisheries. Hauls should preferably be sampled for both discards and landings, rather than discards at the haul level and retained fish at the trip level. This provides greatest flexibility for establishing discarding ogives and is necessary if the fishing trip covers different stock areas or fishing methods. It is acknowledged that on some types of vessels, access to the retained component after each haul is currently difficult or impossible unless fishermen alter their working pattern.

Concurrent length sampling of landings ashore could be considered as a supplement to sampling at sea, and can be combined with sampling of length compositions of the retained catches sampled at sea where appropriate. Shore-based sampling is however subject to a range of logistical difficulties affecting access to all components of the landings, as discussed in Section 5. A range of different sampling schemes were suggested by PGCCDBS (ICES 2007a) to cope with local difficulties in sampling all species in landings ashore. The schemes ranged from comprehensive sampling of all species on shore (scheme 1A) or sampling all recovery species. TAC, target and major by-catch species on shore and other by-catch species at sea (scheme 1B), to sampling

schemes that address all target and recovery species plus a restricted number of the TAC and by-catch species in a "rolling" system either on shore or at sea (schemes "2" and "3").

WKISCON considers rolling sampling schemes to be difficult to implement and monitor, and favours full concurrent sampling even if this is only done on a sufficient number of intermittent sampling trips where additional staff resources can be made available.

The redesigned sampling schemes proposed by WKISCON are described in Table 6.1.

Table 6.1 Schemes for concurrent sampling with additional sampling to achieve precision targets

Sampling scheme	Frequency	Group 1 e.g. Target and recovery species					Group 2 e.g. other TAC regulated and major by-catch					Group 3 Other by-catch				
		1	2	3	.	*n*	1	2	3	.	*n*	1	2	3	.	*n*
Scheme 1	Every sampling event	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Scheme 2	*x%* of sampling events	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	(100-x)% of sampling events	x	x	x	x	x										
Scheme 3	*x%* of sampling operations	x	x	x	x	x	x	x	x	x	x	Sampling at sea				
	(100-x)% of sampling events	x	x	x	x	x										

Future concurrent sampling is foreseen to be a mixture of concurrent sampling at sea and concurrent sampling of landings in harbours/at markets, adapted to deal most effectively with local sampling difficulties and the resource implications. Each source of data has specific issues for best practice and data quality.

Advantages of at-sea sampling include:

- High resolution (haul level data where fishing operations permit)
- All catch components available
- Potential for added value for money in being able to collect additional biological data and control when and where samples collected

Limitations of at-sea concurrent sampling include:

- Further increase in work load on typically only one or two observers, limiting the amount of sampling possible
- Fewer trips sampled than can be sampled at ports unless many observers available
- Problems of covering large number of métiers if resources limited
- Large raising factors often required
- Access to vessels can be withdrawn

Advantages of port-based schemes include:

- Relatively large numbers of trips can be sampled
- Easier to cover all métiers to be sampled

Disadvantages of port-based schemes include:

- Difficult or impossible to collect data for different sea areas or different gears within a trip
- Landed component only, providing reduced information on exploitation pattern in a multi species context
- Many logistical problems in accessing and handling all landings components (likely to get worse in the future)
- Often limited time windows for sampling
- More difficult to attain random sampling

The implementation studies showed a large amount of logistical problems and quality issues that need to be taken into account when setting up concurrent sampling programmes. Some of the problems encountered during the implementation studies reveal general problems for market sampling. In most cases access to all landings is not the case even when sampling single species.

A major concern is the difficulty of performing random sampling. Concurrent sampling interferes with the normal working practice in markets and there are concerns about lower quality (price) of the fish after handling by market samplers. Concurrent sampling is therefore depending on the industry's willingness to cooperate. Industry-science partnerships may solve some of these issues. Experience however shows that fishermen need to gain something for partnerships to be successful, and this needs to be addressed at the outset.

The difficulties of performing on-shore random sampling are also related to the landing/market practice at the sampling location. In some cases the time window for sampling is simply too narrow and may lead to over-sampling of some vessels that tend to land earlier than other vessels.

Attention must be given to appropriate randomisation of sampling locations and sampling dates. Cluster sampling issues (variation between trips on the same market vs. variation between market days) need to be taken into account. This could specifically be a problem for institutes where mobile sampling teams have to travel far to reach the sampling locations.

Another major concern is the risk of compromising individual species requirements when sampling concurrently. The results from some of the implementation studies show that sampling effort is redistributed from target species driving the management process to by-catch species. To some extent this is desirable and within the objectives for concurrent sampling. The redistribution of sampling effort should however not be allowed to be so large that the quality of data for single stock assessments are compromised. This may require targeted single-stock sampling in addition to concurrent sampling.

Methods for applying length composition data from sampled vessels to non-sampled vessels within métiers will become a more important issue if concurrent sampling further reduces the proportion of trips sampled. Considerable work has however already been done on raising methods for discard sampling at sea. The same or similar methods are supposed to be applicable for concurrent sampling. In particular the flow chart on how to raise discard samples to fishery level from the WKDRP (2007) could be helpful. It is possible that better use could be made of records of

landings by EU size categories in non-sampled vessels together with length measures for categories in the sampled vessels within métiers.

The implementation studies show that completion of sampling operations is not always possible. Non-completed samples have more limited use for fishery based management. The samples could however still be highly relevant for single-stock assessment or analyses concerned only with concurrent catches of the target or recovery species. It is important to implement a recording system to identify which sampling events have concurrent sampling and the sampling scheme adopted.

6.3 Species selection

PGCCDBS and PGMED (ICES 2007a) recommended the allocation of species to three groups to facilitate the operation of the different concurrent sampling schemes during the national pilot studies :

- Group 1: Species that ”drive” the management process and for which the data requirements are highest (target species of the fishery and species under a recovery plan).
- Group 2: Other TAC-regulated species and major non-regulated by-catch species.
- Group 3: All other by-catch species.

In practice, the new fishery-based DCR will need to provide for sampling that delivers the necessary precision for individual stocks to meet different management objectives. This will determine regional allocation of species to any groupings needed to facilitate particular concurrent sampling schemes.

7 Allocation of samples

At a scale of a fishing area (region), the national fishing fleets operate with different gears and target different (assemblage of) species, and every single fishing operation can be classified in a comprehensive list of métiers. The estimation of the length structure of the catches per métier and per species must be done through a sampling program, taking into account the multi-species characteristics and international share of the métiers.

The sampling procedure to be promoted in a European regulation must be consistent with the established needs and set up the rules for sharing the overall samples between Member States. The set of rules must take into account the métiers to sample at the regional level, the métiers to sample at a national level, then the number of samples per strata and the number of individuals to measure.

7.1 The allocation of métiers to sample at a regional and national level

Based on previous discussion in the SGRN-06–03 (Anon., 2007), the proposed solution is to use a ranking system. The ranking system consists on sorting all the métiers in a descending order based on one or several indicators and cumulate the share of the métiers, starting from the most important one. The métiers cumulating all together a fixed threshold (90 – 95%) become mandatory to sample, whereas the remaining métiers may be candidate to derogation.

The test on one area (Celtic sea) carried out during the workshop was based on the information available from the annex of the RCM NEA 2007 meeting. This test showed that the choice of one indicator, be it the total landings or the total effort is not sufficient to include, even with a threshold of 95%, the principal métiers of the area. It has then been recommended to use three indicators, the total landings, the total value of the landings and the total effort in days-at-sea. The métiers belonging to the top 95% of the share of at least one indicator become mandatory.

It has been discussed that even after such a decision process, some métiers of particular importance may be left apart, although they should be sampled. One candidate solution to this is then to state that: **Sampling of all the métiers is mandatory with possible derogation when the métier is not belonging to any top 95% and does not present a particular interest in terms of management**.

The spatial scale to which the ranking system should apply is of particular importance. The ranking system should not be applied at the scale of the entire RCM region. This would lead to e.g. mixing Kattegat and Eastern Channel for the North Sea region, or Gulf of Lion and Aegean Sea for the Mediterranean. The RCM have already identified fishing grounds in their will to coordinate the samplings and GFCM has identified geographical sub-areas (GSA). For the latter, a reflection must be made whether it is accurate to divide the Mediterranean into 30 sub-areas for sampling purpose. **The fishing grounds as used by the RCM's are the accurate spatial scale to be defined for coordinating the sampling**.

The same ranking system should apply to distribute the sampling obligations among Member States at a métier level. **All Member States must participate to the sampling effort but may request derogation if they are not belonging to the top 95% on any indicator nor being of special importance for management purpose**.

This ranking system ensures the sampling coverage of the major métiers and the major Member States operating each métiers, but for practical reasons**, some métiers can be merged to constitute a unique stratum and used as such in the ranking system**. These mergers must be agreed in the relevant RCM provided scientific evidence.

7.2 The allocation of number of trips to sample per métier and time strata

Sampling a fishing trip may be done at-sea or on-shore or a mixture of both sources. The importance to sample at-sea rather than at the market may come from .e.g. the need to provide information on the discarded fraction for assessment purposes or from a lack of correspondence between the retained fraction and the landed fraction when no discards information is requested. In both cases, only the demand from a regional scientific or fisheries organisation is to be taken as reference. In order to emphasise on the fact that the real catch can only be assessed on-board fishing vessels and that the collection of the information at the market is an approximation, **the new DCR should encourage sampling on-board, and it should be up to the RCM to evaluate when the approximation by the market sampling is considered acceptable and when sampling on-board is preferable following the established needs**.

The number of trips to sample should be defined upon precision objectives. Considering that each métier catch several species and that it is not desirable to find a compromise between the objectives of precision on all the species, **the objective of precision should be defined on the (assemblage of) target species and at the regional level**, i.e. the level which is effectively used. For concurrent length sampling, the reference could be the length structure of the catches, or the length structure of

the landings combining the information from on-board sampling and market sampling if proved that both retained fraction and landed fraction are equivalent (see also section 6).

There is a point that no precision has been calculated so far on all the target species, and there is a need to define some quantitative rules. Without any data processing, it was impossible during the meeting to come to any conclusion. During the discussion, the following points were raised:

- There is a need to specify boundaries to avoid discrepancies seen with the first DCR, such as very low or unnecessary high number of samples to take.
- When specifying the boundaries, attention should be taken on the seasonality of some métiers.
- The precision of the estimates will be sensitive to the heterogeneity and the size of the strata. To approximate the size effect (and assuming homoscedasticity between the strata), there is the need to find a linear relationship between the number of trips to sample and the total number of trips per strata. The trip unit may not be the more accurate measure of effort, and days-at-sea and number of fishing operations were cited as possible candidates.

7.3 The allocation of number of measurements per species

Like the number of trips to sample, the absence of any data to process has made it impossible to come to any quantitative conclusion on the number of individuals to measure. The following issues were identified:

- It is known that the number of individuals to achieve a level of precision on a length structure is linearly linked to the number of length classes (ref.).
- Some species are landed as mixed *taxa* (e.g. anglerfish) or the sex must be distinguished (e.g. *Nephrops*, megrim), and this information must be taken into account.
- The sampling intensity will vary between the groups of species but allocating the species to a specific group is not sufficient to meet all the data needs. It may be necessary to complement the concurrent samples with species specific samples (see section 6).
- The new regulation must prepare the ground to specifying the optimum number of both trips to sample and individuals to sample per trip once the methods to calculate precision will be available and used.

8 References

Anon. 2007. Commission Staff Working Paper: STECF Sub-group on Research Needs (SGRN) - Revision of the Biological Data Requirements under the Data Collection Regulation, Brussels, 27 November – 1 December 2006, 95 pp.

ICES. 2007a. Report of the Planning Group on Commercial Catch, Discards and Biological Sampling (PGCCDBS), 5–9 March 2007, Valetta, Malta. ACFM:09. 115 pp.

ICES. 2007b. Report of the Workshop on Discard Raising Procedures, 6–9 February 2007, San Sebastian, Spain. ICES CM 2007ACFM:06. 57 pp.

Annex 1: List of participants

Name	Address	Telephone/Fax	Email
Antonio Punzòn	Instituto Español de Oceanografía, Centro Oceanográfico de Santander, Promotorio San Martin, P.O. Box 240, E-39080 Santander, Spain		antonio.punzon@st.ieo.es
Antonio Cervantes	European Commission Directorate for Fisheries and Maritime Affairs, 200 rue de la Loi, B-1049 Brussels, Belgium		antonio.cervantes@ec.europa.eu
Carmen Hernández	Centro Oceanográfico de Santander, Instituto Español de Oceanografía, Promontorio San Martin s/n, Apartado 240, 39004 Santander, Spain	+34 942 291060 +34 942 275072	carmen.hernandez@st.ieo.es
Charis Charilaou	Department of Fisheries and Marine Research, Ministry of Agriculture, Natural Resources and Environment, 1416 Nicosia, Cyprus	+357 22 807842 +357 22 775955	ccharilaou@dfmr.moa.gov.cy
Christoph Stransky	Johann Heinrich von Tühnen Institute [vTI], Federal Research Institute for Rural Areas, Forestry and Fisheries, Institute of Sea Fisheries, Palmaille 9, D-22767 Hamburg, Germany	+49 4038905228 +49 4038905263	christoph.stransky@vti.bund.de
Dália Reis	Dept. of Oceanography and Fisheries, University of Azores, DOP/UAC 9901 862 Horta, Portugal	+351 292 200435 +351 292 200411	dreis@uac.pt
Daniel Stepputtis	Johann Heinrich von Tühnen Institute [vTI], Federal Research Institute for Rural Areas, Forestry and Fisheries, Institute of Baltic Sea Fisheries, Alter Hafen Süd 2, D-18069 Rostock, Germany	+49 381 8116-136 +49 381 8116-199	daniel.stepputtis@vti.bund.de
Francesca Gravino	Malta Centre for Fisheries Sciences, Fort San Lucjan, BBG 06, Marsaxlokk, Malta		francesca.gravino@gmail.com
Grainne Ni Choncuir	The Marine Institute, Rinville, Co. Galway, Oranmore, Ireland		grainne.nichonchuir@marine.ie

Harriët van Overzee	IMARES, Wageningen UR, P.O. Box 68, NL-1970 AB Ijmuiden, Netherlands	+31 6 10670095	harriet.vanoverzee@wur.nl
Helen McCormick	The Marine Institute, Rinville, Co. Galway, Oranmore, Ireland		helen.mccormick@marine.ie
Inaki Artetxe	AZTI-Tecnalia, AZTI Sukarrieta, Txatxarramendi ugartea z/g, E-48395 Sukarrieta (Bizkaia), Spain		iartexte@suk.azti.es
Ivo Sics	Latvian Fish Resources Agency, 8 Daugavgrivas Str., LV-1048 Riga, Latvia	+371 7610 776 +371 7616 946	ivo.sics@latzra.lv
Joël Vigneau	IFREMER, Port-en-Bessin Station, Avenue du Général De Gaulle, P.O. Box 32, F-14520 Port-en-Bessin, France	+33 231 515 600 +33 231 515 601	joel.vigneau@ifremer.fr
Jon Elson	Centre for Environment, Fisheries & Aquaculture Science, Lowestoft Laboratory, Pakefield Road, NR33 0HT, Lowestoft, Suffolk, United Kingdom	+44 1 502 524 243 +44 1 502 562 244	jon.elson@cefas.co.uk
Jukka Pönni	Finnish Game & Fisheries Research Institute, Kotka Unit, Keskuskatu 19, FIN-48100 Kotka, Finland	+358 205 751 894 +358 5 234 4040	jukka.ponni@rktl.fi
Katja Ringdahl	Swedish Board of Fisheries, Institute of Marine Research, Lysekil, P.O. Box 4, SE-453 21 Lysekil, Sweden		katja.ringdahl@fiskeriverket.se
Lidia Gouveia	Fisheries Directorate of Madeira, Estrada de Pontinha, 9004-562 Funchal, Madeira, Portugal	+351 291 203200	lidiagouveia@hotmail.comt
Lucia Zarauz	AZTI-Tecnalia, AZTI Sukarrieta, Txatxarramendi ugartea z/g, E-48395 Sukarrieta (Bizkaia), Spain		lzarauz@suk.azti.es
Mario Sbrana	Centro Interuniversitario di Biologia Marina, Viale Nazario Sauro 4, 57128 Livorno, Italy		msbrana@cibm.it
Mark Dimech	Malta Centre for Fisheries Sciences, Fort San Lucjan, BBG 06 Marsaxlokk, Malta		mark.dimech@gov.mt

Marta Gonçalves	Centro Regional de Investigaçao Pesqueira do Norte L-IPIMAR, Av. General Norton de Matos, n. 4, 4450-208 Matosinhos, Portugal	+351 229 396940	mgoncalves@ipimar.pt
Mike Armstrong	Centre for Environment, Fisheries & Aquaculture Science, Lowestoft Laboratory, Pakefield Road, NR33 0HT Lowestoft, Suffolk, United Kingdom	+44 1502 524362 +44 1502 524511	mike.armstrong@cefas.co.uk
Ole Folmer	The National Institute of Aquatic Resources, Department of Sea Fisheries, Charlottenlund Slot, DK-2920 Charlottenlund, Denmark	+45 33 96 34 69 +45 33 96 33 33	ofo@difres.dk
Pedro Torres	Instituto Español de Oceanografía, Centro Oceanografico de Málaga, Puerto Pesquero, P.O. Box 285, E-29640 Fuengirola (Malaga), Spain		pedro.torres@ma.ieo.es
Phil Kunzlick	Fisheries Research Services, 375 Victoria Road, AB11 9DB, Aberdeen, United Kingdom		p.kunzlik@marlab.ac.uk
Romas Statkus	Lithuanian State Pisciculture and Fisheries Research Centre, Fisheries Research Laboratory, Smiltynes pl 1, LT-91001 Klaipeda, Lithuania	+370 46 391122 +370 46 391104	statrom@gmail.com
Ryszard Grzebielec	Sea Fisheries Institute in Gdynia, ul. Kollataja 1, PL-81-332 Gdynia, Poland	+48 58 735 6226	rysiek@mir.gdynia.pl
Sieto Verver (Chair)	IMARES, Wageningen UR, P.O. Box 68, NL-1970 AB Ijmuiden, Netherlands	+31 6 10670095	sieto.verver@wur.nl
Therese Jansson	Swedish Board of Fisheries, Institute of Marine Research, Lysekil, P.O. Box 4, SE-453 21 Lysekil, Sweden		therese.jansson@fiskeriverket.se
Tiit Raid	Estonian Marine Institute, 10a Mäealuse Street, EE-126 18 Tallinn, Estonia	+372 671 89 53 +372 671 89 00	tiit.raid@ut.ee

Ulrich Berth	Johann Heinrich von Thünen-Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries, Institute for Baltic Sea Fisheries, Alter Hafen Süd 2, D-18069 Rostock, Germany	+49 381 811 6128 +49 381 811 6199	ulrich.berth@vti.bund.de
Valdas Piscikas	Fishery Research Laboratory, Smiltynes 1, LT-5800 Klaipeda Lithuania	+370 46391104	ztl@is.lt

Annex 2: Agenda

Time	Duration	Tuesday, January 29
09:00	**00:45**	**Start**
		house-keeping (ICES)
		introduction round
		Terms of reference
		Agenda
		Report sections (appointment rapporteurs, subgroups)
09:45	00:45	Concurrent sampling, backgrounds and rationale
		Presentation by Joël Vigneau
10:30	**00:15**	**Coffee-break**
		Presentations and discussion on implementation studies by country
10:40	00:15	Cyprus
10:55	00:15	Denmark
11:10	00:10	Estonia
11:20	00:10	The Netherlands
11:30	00:15	France
12:30	**01:00**	**Lunch**
13:30	00:25	Current status new DCR, update and studies
		Presentation by Antonio Cervantes
13:55	00:25	Ireland
14:20	00:25	Latvia
14:45	**00:15**	**Tea-break**
15:00	00:25	Lithuania
15:25	00:25	Malta
15:50	00:25	Poland
16:15	00:25	Portugal
16:40	00:25	Spain 1
17:05	00:25	Spain 2
17:30	00:25	Spain 3
17:55		**End**
		Wednesday, January 30
09:00	**00:20**	**Sweden**
09:20	00:20	Finland
09:40	00:20	UK, England and Wales
10:00	00:20	UK, Scotland
10:20	**00:15**	**Coffee-break**
10:35	02:00	Subgroups meet, discussion
12:35	**01:00**	**Lunch**
13:35	01:15	Subgroups
14:50	00:15	Subgroups
15:05	01:00	Subgroups
16:05	01:30	Report back from subgroups
17:35		**End**
		Thursday, January 30
09:00	01:30	Writing
10:30	**00:15**	**Coffee-break**
10:45	01:15	Discuss text report
12:00	**01:00**	**Lunch**
13:00	03:00	Finalize report
16:00		**End meeting**

Annex 3: WKISCON Terms of Reference

2007/2/ACOM31 The **Joint STECF/ICES Workshop on Implementation Studies on Concurrent Length Sampling** [WKISCON] (Chair: Sieto Verver*, The Netherlands, Belgium) will be established and will meet at ICES HQ, Copenhagen, 29–31 January 2008 to:

a) review the results of the 2007 implementation studies on concurrent length sampling of commercial landings. A standardized format for reporting and presenting the results will be sent around by the Chairs before the meeting to the national correspondents for DCR and participants;

b) advise on best practice methods for concurrent sampling, taking into account both technical feasibility and quality aspects of data collection.

WKISCON will report 11 February 2008 for the attention of ACOM, LRC, RMC and PGCCDBS.

Supporting Information

PRIORITY:	High. The implementation of the proposed shift in the EU data collection framework from species-based to métier-based sampling and, above all, the requirement on concurrent length sampling of the landings (both foreseen as part of the new EU Data Collection Regulation, DCR), are likely to cause significant problems for the institutes involved in length sampling of commercial catches.
SCIENTIFIC JUSTIFICATION AND RELATION TO ACTION PLAN:	One of the major challenges fleet-fisheries based sampling raises is the need to know the multispecies fishing mortality for each species caught within each fleet/fishery. This will require a better knowledge of the fleet behaviour in terms of specific landings composition, in particular the multispecies length frequency of the total landings. The complete representation of the multivariate length frequency requires the knowledge of the covariance between its marginal distributions, that can be obtained by e.g. sampling directly the multi species length frequency of the landings by trip, named concurrent sampling. The pragmatic implementation of such method requires a sampling effort impossible to execute due to the time available for sampling and the human resources necessary for such task. To explore the possibilities of concurrent sampling in each country, implementation studies take place during 2007. The workshop aims at analyzing the results of this implementation studies and to translate the experiences from these studies into sampling schemes that account for the requirements of the DCR framework.
RESOURCE REQUIREMENTS:	
PARTICIPANTS:	The Workshop is expected to attract wide interest from fisheries institutes involved in market sampling, both within and outside the ICES community. The proposal for this Workshop is supported by both PGCCDBS and PGMED. A participation of around 25 is expected.
SECRETARIAT FACILITIES:	None.
FINANCIAL:	To ensure wide attendance of relevant experts, some additional funding may be required, preferably through the EU, e.g. by making attendance to the Workshop eligible under the DCR.

LINKAGES TO ADVISORY COMMITTEES:	The implementation studies and the proposed Workshop have a direct link with the upcoming shift from stock-based to metier-based sampling and hence, are of relevance to all bodies that make use of length composition data collected under the DCR (assessment WGs, advisory committees, etc.).
LINKAGES TO OTHER COMMITTEES OR GROUPS:	There will be important outcomes from this Workshop of interest to the ICES Living Resources and Resource Management Committees.
LINKAGES TO OTHER ORGANIZATIONS:	Outcomes from this Workshop will be relevant to several regional fisheries organisations and advisory bodies, including ICES, NAFO, GFCM, STECF and others.

Annex 4: Working document Denmark

Working document to the 2008 ICES Workshop on Implementation Studies on Concurrent Length Sampling (WKISCON held in Copenhagen 29 Jan. – 31 Jan.)

Concurrent or Fishery-based sampling for length, age and mean weight in Danish harbours.

By Ole Folmer
Danish Technical University
National Institute of Aquatic Resources
Charlottenlund Slot
DK-2970 Charlottenlund
Phone +0045 3396 3456, E-mail ofo@difres.dk

Introduction

The new data collection framework to be introduces in the EU from 2009 will be base more on samples from fishery activities and should at the same time still be able to produce the data that can be used for the traditional stock assessments purpose. At the PGCCDBS meeting (ICES 2007) it was recommended that the national labs selected a limited number of fisheries activities and to implement a test of a concurrent sampling procedure. The EU Commission followed up on this recommendation and EU Member States were requested to include this pilot study in the 2007 DCR programme. In Denmark we have chosen to investigate our national sampling scheme in light of the fishery activities/métiers to see if there are statistical significant differences to be found between different fisheries activities given that the sampling scheme is stratified by commercial size sorting. If there is no difference between the samples of the same size grade coming from different fishery activities it is possible to estimate the fishery activity specific data by a join between logbooks data on fishing activity and the size distribution information of the catch estimated via the first buyer register.

The Danish Sampling scheme

The Danish harbour sampling scheme is stratified by year, area, harbour, quarter, species and EU size grade. Information about gear type is collected together with other relevant information about the landing vessel, but fishing activity is not a part of the sampling design. Concurrent sampling of Danish fisheries are conducted during sea sampling where both the discarded and the retained part of the catch is measured, but during data collection in harbours the sampling scheme also include the commercial EU size sorting strata. Information about the quantity of each species in a landing is recorded in the Danish first-hand buyer register, where they are obliged also to report on catch area, size grades, value and vessel identity. To give an example of the yearly sampling effort 76 samples where taken of North Sea cod in 2006. These samples are divided in five size grade groups with around 15 samples for each size grade. The sampling scheme is further stratifies into four quarter, and for each quarter there are from two to five samples pr size grade group.

Methods

As reported in the RCM North Sea and East Arctic 2007 meeting (Anon. 2007), the concurrent sampling scheme will be tested as if there are differences between the length distributions from a given EU size sorting resulting from different fishery operation. If the size grade does not differ between different types of gear, then the information about the length distribution of a size sorting combined with the information from the first hand buyer register on the relative amount of different size groups can be used to estimate the length distribution for the hole catch on a specific fishing trip.

Differences between samples from different types of fishery activities will be tested by multiple linier regressions using SAS (Proc GLM). In order to get a statistics design to test data has to be pooled over some of the sampling strata. The different sampling strata were first tested for significant effect prior to a combination of strata.

The parameters to investigate are mean length, mean weight and average age. All three parameters are very closely tied to EU size sorting strata, and it is therefore difficult to analyse the effect gear type without this strata as part of the model.

Data

In order to analyse if there is a static significant difference between different gear types there has to be at least a few samples in each of the cells compared. For plaice, haddock and saithe there are only a few samples pr strata (few with more than one sample) and it is therefore difficult to investigate the effect of gear type. For species that are only sampled with a low intensity, it is impossible to include fishing activity as sampling strata without increasing the number of samples drastically.

For cod in EU size grade 4 there is a fair number of samples, as this is the one of the species and EU size sorting from the Danish fishery that contains most samples. Cod is caught in two distinct fisheries; gillnet and bottom trawl. If there are significant differences between gear types to be found they should be most evident here. To get a sufficient number of samples to work with samples from 2001 to 2007 was extracted. The statistics of the number of samples is given in appendix 2. A total of 771 samples are extracted from the database for the analysis. 177 samples lack information on gear used and have therefore not been used One reason for not being able to record the gear type for a sample is that sample can come from collection facility on the harbour, where the fishermen can land unsorted catch, and where the catch is being prepared for auction. In this case a size grade can be a combined from several vessels and thereby from several gear types. Three samples where excluded for other reasons. The final dataset were of 768 samples of which between 548 and 602 was used for the GLM models.

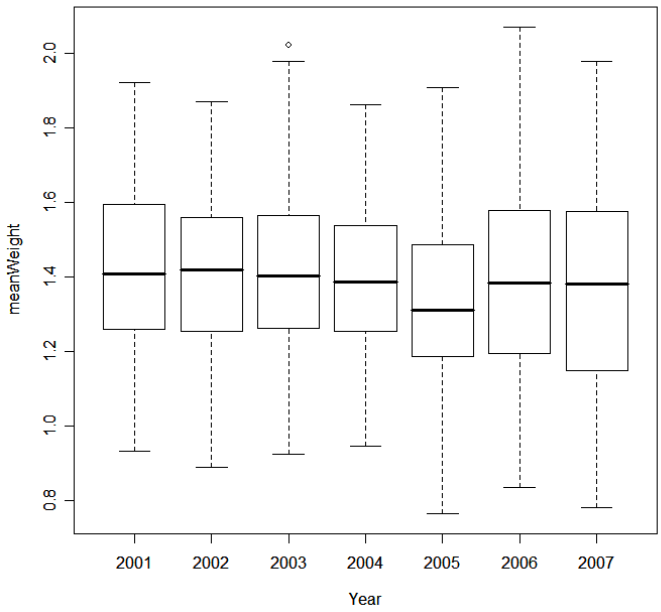
For the chosen strata of cod and size grade 4 there are a potential number of six different area, 14 gear types, four quarter and eight years giving a total of 2688 strata, plus the extra dimension of harbours in the sampling scheme that is not included in this analysis. The total number of samples is 771. The sampling scheme is therefore clearly over stratified and has to be post stratified in order to make statistical inferences about differences among strata. Both the harbour and year dimension of the sampling design where tested and they both gave a non significant result and data have therefore been pooled over these strata in the further analysis.

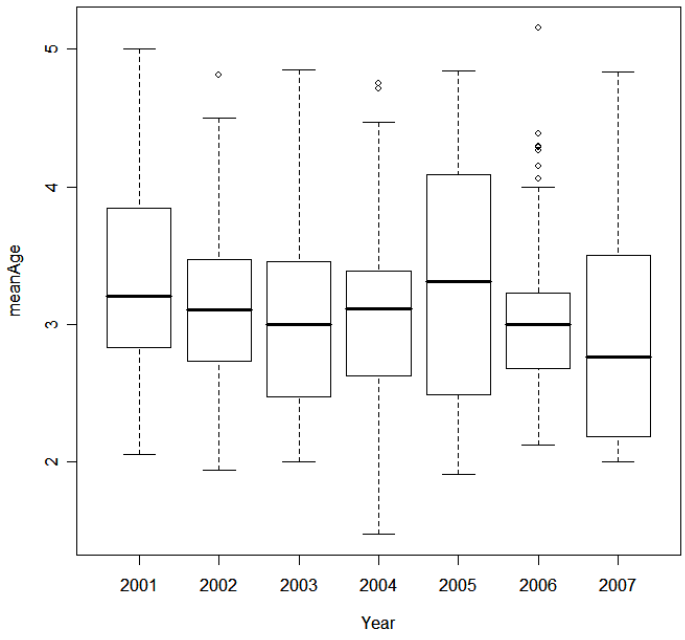
Results

The first analysis to be conducted is an exploratory data analysis to see if there are strata without significant differences, so that these strata can be combined in order to give a number of samples by strata adequate for making statistical testing. The data set include eight years to get a fair number of samples to test.

The first test was to see if there is any difference from year to year within the size sorting strata. There does not seem to be a strong effect of year either on mean length, mean weight or average age.

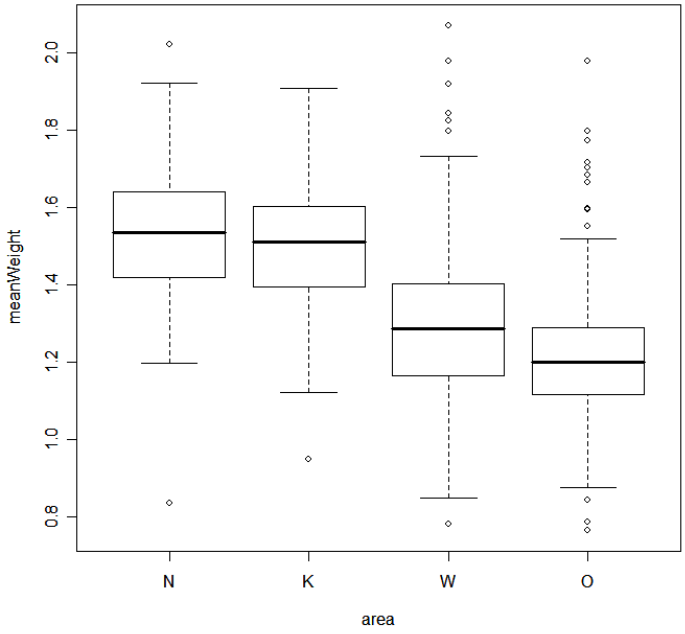
Her only mean weight and mean age in ICES area IIIc22-IIId24 is shown.

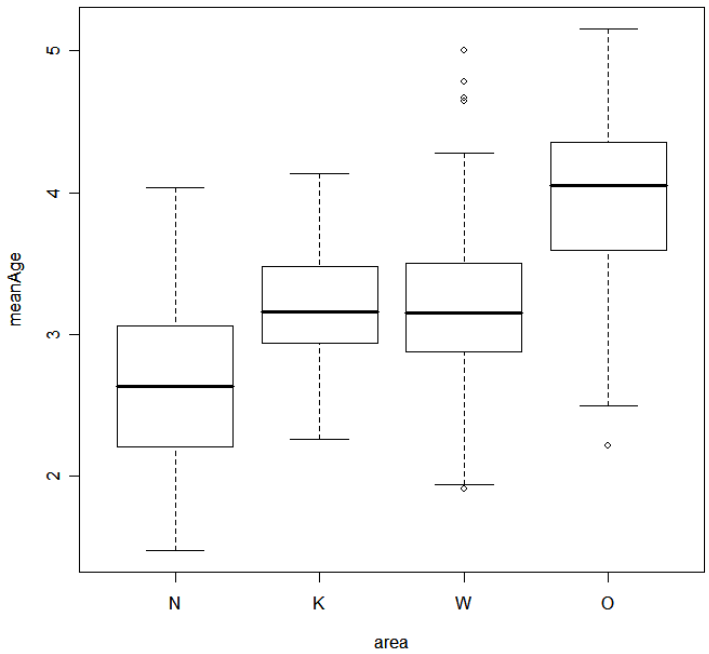




The next strata to be combined are the area strata that contain the same stock of cod. ICES area IV, IVa, IVb and IIIaN is combined to area N, ICES area IIIaS is called area K, ICES Area IIIc22, IIIb23 and IIId24 is called area W and ICES area IIId25 is call area O. This is done under the assumptions that samples from the same stock will have the same mean length, mean weight and mean age regardless of the sampling port within the specific area.

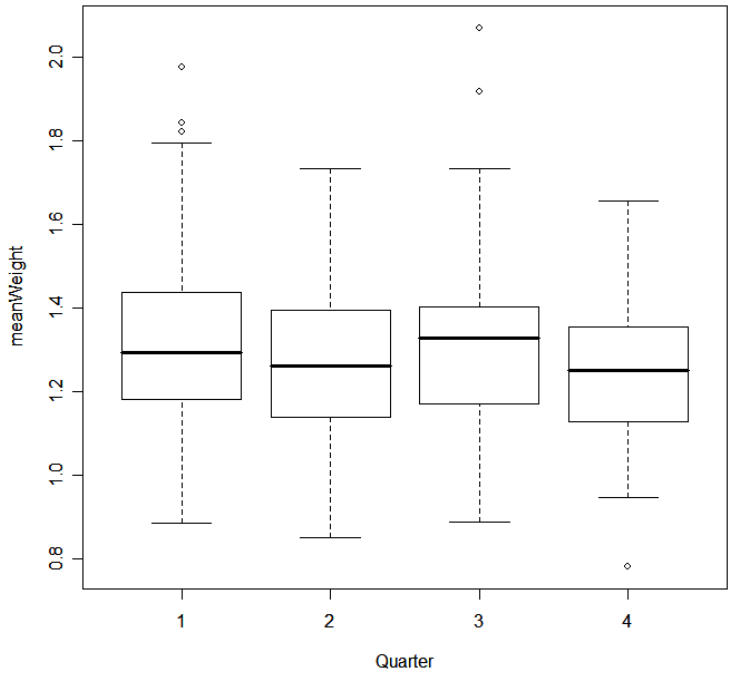
The four different areas has a significant difference in mean weight, mean length and mean age. Only mean weight and mean age shown here.

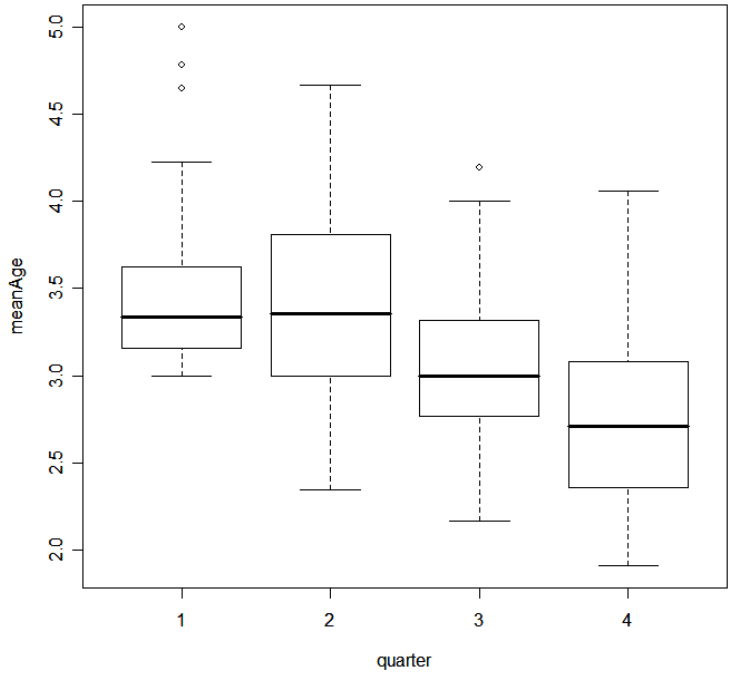




The next sampling dimension to investigate is the effect of time of year in the quarter dimension. This analysis is done within a specific area.

There dose not seems to be any effect on the mean weight or the mean length between quarters but for average age there is a significant effect. The average age of cod in size grade 4 is lower in the third and fourth quarter where individuals of two years of age are starting to be represented in this sorting group. Only mean weight and average age in area W (ICES area IIIb23 IIIc22 IIId24) is shown here.





To analyse if there are significant differences between fishing activities three multiple regression models where tested with PROC GLM in SAS:

Mean length = β0 + gear type β1 + area β2 + ε
Mean weight = β0 + gear type β1 + area β2 + ε
Mean age = β0 + gear type β1 + area β2 + quarter β3+ ε

The results of the regression models can be found in appendix 1. In all three models area gives a highly significant result. For the model of mean age quarter gives a significant response.

None of the models gives a significant response for gear type. In an attempt to further simplify the analysis and increase the response of a gear response only samples from the two most common gear types OTB and GNS where tested, and the result was still without any significant response on the gear type (result not shown).

Discussion

The current EU data collections framework (EC 2001 and EC 2004) is primarily based on the data requirement for stock assessment and less on the requirement for fishery based studies. The new data collection framework should be designed to meet both needs. In the process of sampling the needed data, the sampling design has to be planned in a way that gives representative samples of the parameters of interest within each of the strata. The number of strata therefore has to be dimensioned in relation to the total number of samples that are going to be collected. In this working example the stratification of the samples into quarters and size grade groups is difficult to further stratify the sampling without increasing the effort considerably. As the Danish first hand buyer register contain additional information that can be used in relation to the need for fishery based information the current collection system are able to produce both the data for the traditional assessment work and data for analysis of length frequency analysis of catch from different fishery activities or analysis that involves landing from mixed fisheries.

The problems foreseen with a concurrent sampling scheme is the potential higher number of strata to be sampled, the logistics of covering all the strata, the availability of vessels to be sampled and the catch composition of the sampled vessel. There might not be enough of the main species of interest, or there might not be all the required size sorting groups on a specific vessel to cover the landings within a sampling stratum. It is therefore foreseen that a concurrent sampling scheme there will require more samples and there will have to be spent more sampling days at the harbours to cover all the strata in a concurrent sampling scheme.

Conclusion

This study shows that there are no significant differences between samples taken from different fisheries within the same commercial EU size grade and within the same area. Given the sampling design of the Danish sampling scheme, a shift towards a concurrent or fishery stratified sampling scheme is not possible without increasing the number of samples considerably.

The information contained within the sales slips register can give information on the size distribution and the species composition of the catch. Together with the logbook data this information can be used to estimate fishery related data.

Further given the size grade data the catch from different fishery activities can be partition into length or age distributions.

References

EC. 2001. Commission Regulation (EC) N° 1639/2001 of 25 July 2001 establishing the minimum and extended Community programmes for the collection of data in the fisheries sector and laying down detailed rules for the application of Council Regulation (EC) N° 1543/2000 – OJ L 222, 17.8.2001, p.53.

EC. 2004. Commission Regulation (EC) N° 1581/2004 of 27 August 2004 Amending Regulation (EC) N°1639/2001 establishing the minimum and extended Community programmes for the collection of data in the fisheries sector and laying down detailed rules for the application of Council Regulation (EC) N° 1543/2000 – OJ L 289 27.8.2004, p 6.

Anon. 2007. Commission Staff Working paper: Report of the Regional Co-ordination Meeting for the North Sea and East Artic 2007 (RCM NSEA), Uddevalla, Sweden 25-28 Sep. 2007, 44 p + annexes.

ICES. 2007. Report of the Planning Group on Commercial Catch, Discards and Biological Sampling (PGCCDBS). ICES CM 2007/ACFM:09, 172 pp.

Appendix 1

Output from the GLM procedure from SAS

```
                                   The GLM Procedure
                                Class Level Information
                Class                 Levels    Values
                area                       4    K N O W
                quarterGearStart           4    1 2 3 4
                gearType                  14    FPN GNS GNX GTR LL LLS OTB OTM OTT PTB SDN SSC TBB TBX

                                Number of Observations Read         768
                                Number of Observations Used         548
Dependent Variable: meanAge   meanAge

                                                 Sum of
                Source                     DF        Squares     Mean Square    F Value    Pr > F
                Model                      19     192.8049009      10.1476264      58.95    <.0001
                Error                     528      90.8970661       0.1721535
                Corrected Total           547     283.7019670

                              R-Square     Coeff Var      Root MSE    meanAge Mean
                              0.679604      13.05481      0.414914        3.178245

                Source                     DF       Type I SS     Mean Square    F Value    Pr > F
                quarterGearStart            3     45.4107506      15.1369169      87.93    <.0001
                area                        3     140.4572822      46.8190941     271.96    <.0001
                gearType                   13       6.9368682       0.5336052       3.10    0.0002

                Source                     DF     Type III SS     Mean Square    F Value    Pr > F
                quarterGearStart            3      43.2375980      14.4125327      83.72    <.0001
                area                        3     107.3722667      35.7907556     207.90    <.0001
                gearType                   13       6.9368682       0.5336052       3.10    0.0002

                                                                    Standard
                  Parameter                      Estimate             Error    t Value    Pr > |t|
                  Intercept                3.012713019 B      0.14408345      20.91      <.0001
                  quarterGearStart 1       0.737125457 B      0.05155648      14.30      <.0001
                  quarterGearStart 2       0.592711110 B      0.05466026      10.84      <.0001
                  quarterGearStart 3       0.234233281 B      0.05448339       4.30      <.0001
                  quarterGearStart 4       0.000000000 B       .               .         .
                  area             K      -0.110560548 B      0.08053853      -1.37      0.1704
                  area             N      -0.528152292 B      0.04785549     -11.04      <.0001
                  area             O       0.681158436 B      0.05170359      13.17      <.0001
                  area             W       0.000000000 B       .               .         .
                  gearType         FPN    -0.626349382 B      0.43921928      -1.43      0.1544
                  gearType         GNS    -0.292402407 B      0.13979338      -2.09      0.0369
                  gearType         GNX    -0.080196784 B      0.27372642      -0.29      0.7697
                  gearType         GTR     0.038311356 B      0.23196701       0.17      0.8689
                  gearType         LL      0.213379362 B      0.16678444       1.28      0.2013
                  gearType         LLS     0.191400847 B      0.18635186       1.03      0.3048
                  gearType         OTB    -0.230935196 B      0.13551046      -1.70      0.0889
                  gearType         OTM    -0.221106374 B      0.32297532      -0.68      0.4939
                  gearType         OTT    -0.263549201 B      0.14947368      -1.76      0.0784
                  gearType         PTB    -0.195971345 B      0.20809748      -0.94      0.3468
                  gearType         SDN    -0.189290368 B      0.17250088      -1.10      0.2730
                  gearType         SSC     0.313313816 B      0.32525643       0.96      0.3358
                  gearType         TBB    -0.284560727 B      0.43908453      -0.65      0.5172
                  gearType         TBX     0.000000000 B       .               .         .

NOTE: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations.
Terms whose
      estimates are followed by the letter 'B' are not uniquely estimable.
```

The GLM Procedure
Class Level Information

Class	Levels	Values
area	4	K N O W
quarterGearStart	4	1 2 3 4
gearType	14	FPN GNS GNX GTR LL LLS OTB OTM OTT PTB SDN SSC TBB TBX

Number of Observations Read 768
Number of Observations Used 602

The GLM Procedure

Dependent Variable: meanLength meanLength

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	16	83828.4620	5239.2789	6.86	<.0001
Error	585	446786.8951	763.7383		
Corrected Total	601	530615.3571			

R-Square	Coeff Var	Root MSE	meanLength Mean
0.157983	5.187041	27.63582	532.7857

Source	DF	Type I SS	Mean Square	F Value	Pr > F
area	3	62027.55924	20675.85308	27.07	<.0001
gearType	13	21800.90277	1676.99252	2.20	0.0087

Source	DF	Type III SS	Mean Square	F Value	Pr > F
area	3	46379.80412	15459.93471	20.24	<.0001
gearType	13	21800.90277	1676.99252	2.20	0.0087

Parameter		Estimate		Standard Error	t Value	Pr > |t|
Intercept		520.1858053	B	8.68586610	59.89	<.0001
area	K	22.8572754	B	5.22266744	4.38	<.0001
area	N	13.3733287	B	3.07804211	4.34	<.0001
area	O	-6.7376417	B	3.12065723	-2.16	0.0313
area	W	0.0000000	B	.	.	.
gearType	FPN	-0.1858053	B	21.38488744	-0.01	0.9931
gearType	GNS	10.6666251	B	8.83761863	1.21	0.2279
gearType	GNX	1.8481796	B	18.02371756	0.10	0.9184
gearType	GTR	22.4371350	B	14.15971875	1.58	0.1136
gearType	LL	23.7354395	B	10.74204021	2.21	0.0275
gearType	LLS	9.8858439	B	11.14413969	0.89	0.3754
gearType	OTB	5.4146255	B	8.54505285	0.63	0.5266
gearType	OTM	4.5518364	B	21.26054415	0.21	0.8305
gearType	OTT	9.4036392	B	9.48777868	0.99	0.3220
gearType	PTB	9.8132931	B	12.22116946	0.80	0.4223
gearType	SDN	19.3714523	B	11.10126653	1.74	0.0815
gearType	SSC	50.9408660	B	21.41571882	2.38	0.0177
gearType	TBB	-74.5591340	B	28.99141517	-2.57	0.0104
gearType	TBX	0.0000000	B	.	.	.

NOTE: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose
estimates are followed by the letter 'B' are not uniquely estimable.

The GLM Procedure
Class Level Information

Class	Levels	Values
area	4	K N O W
quarterGearStart	4	1 2 3 4
gearType	14	FPN GNS GNX GTR LL LLS OTB OTM OTT PTB SDN SSC TBB TBX

Number of Observations Read 768
Number of Observations Used 601

Dependent Variable: meanWeight meanWeight

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	16	10.83046290	0.67690393	19.88	<.0001
Error	584	19.88495167	0.03404957		
Corrected Total	600	30.71541457			

R-Square	Coeff Var	Root MSE	meanWeight Mean
0.352607	13.45006	0.184525	1.371929

Source	DF	Type I SS	Mean Square	F Value	Pr > F
area	3	9.87526418	3.29175473	96.68	<.0001
gearType	13	0.95519873	0.07347683	2.16	0.0101

Source	DF	Type III SS	Mean Square	F Value	Pr > F
area	3	7.34477639	2.44825880	71.90	<.0001
gearType	13	0.95519873	0.07347683	2.16	0.0101

Parameter		Estimate		Standard Error	t Value	Pr > |t|
Intercept		1.250148171 B		0.05800276	21.55	<.0001
area	K	0.161736681 B		0.03487193	4.64	<.0001
area	N	0.187865184 B		0.02055257	9.14	<.0001
area	O	-0.098462946 B		0.02087339	-4.72	<.0001
area	W	0.000000000 B		.	.	.
gearType	FPN	0.044692329 B		0.14279043	0.31	0.7544
gearType	GNS	0.104881484 B		0.05901156	1.78	0.0760
gearType	GNX	0.029030398 B		0.12034497	0.24	0.8095
gearType	GTR	0.199593986 B		0.09454745	2.11	0.0352
gearType	LL	0.107980385 B		0.07172548	1.51	0.1327
gearType	LLS	0.047237205 B		0.07440980	0.63	0.5258
gearType	OTB	0.049632122 B		0.05706502	0.87	0.3848
gearType	OTM	-0.002615226 B		0.14195777	-0.02	0.9853
gearType	OTT	0.090692661 B		0.06335439	1.43	0.1528
gearType	PTB	0.057817886 B		0.08160459	0.71	0.4789
gearType	SDN	0.097838188 B		0.07412773	1.32	0.1874
gearType	SSC	0.035257145 B		0.14299556	0.25	0.8053
gearType	TBB	-0.601528355 B		0.19357819	-3.11	0.0020
gearType	TBX	0.000000000 B		.	.	.

NOTE: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.

Appendix 2.

Number of samples for cod in sort 4: 8 samples from 4 different gear types (FPN, GNX,SSC, TBB) have been listen under (blank).

Count of station		Iare quarterGearStart																						
		IIIaN				IIIaS				IIIc22				IIId24				IIId25				IV				Grand Total
year	gearType	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
2001	GNS	5		1	2			1		1			1		1	1	2	1	1	1	1	1				20
	GTR									1	2		1													4
	LL		1	1							1												1			4
	LLS																							1		1
	OTB	1	3	4	3	3	1	1	3	4	4	3	3	6	6	7	5	8	3	5	3					76
	OTM																		1							1
	OTT							1							2					2						5
	PTB											1													1	2
	SDN	1	2				1																			4
	(blank)								1								1					3	3	4	2	14
2002	GNS	1	1											1	1							1	2	2	1	10
	GTR												1													1
	LL																								1	1
	OTB	7	6	4	2	3			1	6	2	3	1	3	2			7		2						49
	PTB				1											1	1									3
	SDN		1	1										1									1			4
	(blank)					1	1	2	1						2	3	4		2	3	2	3	2	4	3	33
2003	GNS	2		1	2						1				2				2	1		1				12
	LL															1		1		1						3
	OTB	3	4	4	1				1	8	1	2		1	1	3	2	2	1	2		1	2	1		40
	OTT		2		1	1																			1	5
	SDN																							1		1
	TBX																			1	1					2
	(blank)	1				2	1	2	2				2	3			1	2	2		1	3	3	3	2	30
2004	GNS	1	2		2			1												2		3		4	2	17
	LL																		1	1			1			3
	OTB	4	3	4	3	1				6	2	1		2	1	1	1				3			1	1	34
	OTT		1	1																			1			3
	PTB																		1							1
	SDN																							1		1
	(blank)					4	1	1	2	1			3	1	1	2	2	5	3	1		3	3	1	1	35
2005	GNS	2	3	3	2							1	1				2		2	4	2	2	1	1	1	27
	LL													1					2	1						4
	LLS															1	1	1			3					6
	OTB	4	3	2	3	1			1	4	2	1	1		1	1		7	8	4	11	2	2			58
	OTT	1	2	2	1	1	1											1						1		10
	SDN			2																		1				3
	TBX								1					2				2	2							7
	(blank)	1				3	4	1						1	2	2	2	3	1				2	2	6	30
2006	GNS	2	3	5	3					1	1		1			3	1	1	1	2	6	1				31
	LL																	1					1			2
	LLS																	2	1		2					5
	OTB	5	2		1	3	2	2	1	3	1	1		1			2	7	3		5	1		1		41
	OTM																		1							1
	OTT	2	1	2	4		1															1		1		12
	PTB											1														1
	SDN																							1	1	2
	(blank)		1			1	1							4	2	2	2					1	2	1	3	20
2007	GNS	1	4	2	3														1	1	1			1	1	15
	GTR																			1						1
	LLS														1				1							2
	OTB	1				1				5	2	3		1	1	1	2	12	4	1	3			1		38
	OTT	2	3	3	2			1														2	1			14
	PTB															2	1									3
	SDN																						1			1
	(blank)			2	2			1	1			1	1	2								2	1		1	14
Grand Total		47	48	44	38	25	14	14	15	40	19	18	16	30	26	31	32	63	44	36	44	32	30	33	28	767