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Report on the ICNAF Statistics & Sampling

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This report summarises the progress made by ICNAF in the compiling of statistical and sampling data on the fisheries of the Convention Area.

It is divided into six sections. In the first four sections a statement of the ICNAF requirements is followed by a discussion of how they are met by member countries. The final section proposes a number of changes in the form and content of the statistical submission, designed to reduce the bulk of the data to more manageable proportions and to help reduce some of the difficulties and delays which arise because of it.

I. Statistics on Landings

The present requirements are as follows:-

1. Statistics on landings of groundfish should be reported by individual species, by the kind and size-class of vessel and gear used in the capture, and by the statistical subdivision and month of capture.

2. Landings should be reported in terms of the condition first weighed. The state of dressing or processing in which the fish are landed should always be reported. Where a species is landed in more than one state of dressing or processing, the quantities landed in each state should be reported separately.

3. The annual landings of species other than groundfish should be reported by individual species by subarea (i.e. panel area).

Data on landings are reported by species/month/subdivision/gear as required by ICNAF, except as noted below.

1. Canada (Maritimes and Quebec)

   a) The landings for the inshore fisheries are not reported separately by gear.

   b) Part of the landings described as "shack" or "scale" are not reported by species.

2. Canada (Newfoundland)

   The landings for the inshore fisheries are not reported separately by gear. However, estimates of the proportion caught by traps are reported.

3. Denmark (Faroes)

   Landings are not broken down by statistical subdivisions.

4. Denmark (Greenland)

   The landings of the inshore fisheries are not reported separately by gear.

5. Italy

   Landings are not broken down by subareas nor months.

6. United States

   a) Part of the landings described as "Unclassified, for food" or "Unclassified, other" are not reported by species.

   b) Landings by "miscellaneous gear" in Subarea 5 are not allocated by gear - about 4,000 tons of groundfish.

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II. Data to Measure DISCARDS

The present requirements are:-

Data on the sizes and quantities of groundfish discarded at sea should be reported by species, kind and size-class of vessel and gear, statistical subdivision, and month of capture.

Various methods and data can be used to measure the sizes and quantities of fish discarded at sea. A number of these methods are outlined below.

Method 1: Data Required: a) Length frequency of catch before discarding

b) Length frequency of landings

c) Weight landed

Assumption: Some size is chosen above which it is assumed no discarding occurs.

The length frequencies are adjusted to equate the numbers above this size. Then the difference between the two frequencies is considered to be the fish discarded. This method was and is used by Canada.

Method 2: Data Required: a) Length frequency of discards

b) Estimates of weight discarded

i.e. the sizes and quantities of fish discarded are measured directly. To measure the 50 percent point of discarding it is also necessary to collect data on

c) Length frequency of landings

d) Quantity landed

This method was used by the United Kingdom in Subarea 1.

Method 3: Data Required: a) Estimates of the weight discarded

b) Length frequency of catch before discarding

c) Weight retained for landing

d) Weight/length table

It is possible from this data alone to obtain an estimate of the 50 percent point of discarding and then, after estimating the size range over which discarding is carried out, to estimate the length frequency of the discards.

In Methods 1 and 3 the size frequency, and in Method 1 also the quantity, of the discards is measured indirectly as the difference between the catch and the landings. The error of estimate for the discards will therefore be larger than that for either the catch or landings. Method 2 may, for some fisheries, be very difficult to apply, but it gives a direct measure of the discards which is desirable.

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In general, if the sizes and quantities of any two of the catch, landings or discards are known, the third can be calculated. The kind of data which can be used to estimate discarding which has been reported by member countries for the 1957 fishery is summarised below.

Country	Catch		Landings or Retained Catch		Discards	
	Quantities	Sizes	Quantities	Sizes	Quantities	Sizes
Canada (M)	-	10 trips[1] (cod)	X	X(cod) X(haddock)	For 10 trips (cod)	
Canada (N)	-	-	X	X(cod) X(haddock)	-	-
Denmark (F)	-	-	X	-	-	-
Denmark (G)	-	-	X	X(cod)	-	-
France	-	-	X	-	X	-
Germany	-	-	X	X(cod) X(redfish)	-	-
Iceland	-	-	X	-	-	-
Italy	-	-	X	-	-	-
Norway	-	-	X	X(cod)	-	-
Portugal	-	X	X	-	X(cod)	-
Spain	-	X	X	-	-	-
U.S.S.R.	-	X(redfish)	X	-	-	-
U.K.	-	-	X	X(cod)	For 1 trip (cod)	
U.S.	-	-	X	(cod) X(haddock) (redfish)	X(haddock)	-

1) The length frequencies of the catches made during 10 trips of commercial otter trawlers were determined from samples taken at sea.

The following countries reported on discards as follows:-

Canada (Maritimes and Quebec)

Studies were carried out on board commercial otter trawlers on ten trips in 4T in 1957. Measurements were made of samples of the whole catch and these were pooled to give the length frequency. Measurements taken later gave the length frequency of the landings. After adjusting, the difference between the two length frequencies gave estimates of both the sizes and quantities discarded. This work was continued in 1958.

France

The quantity caught but discarded in 1958 was estimated at about 2,500 tons; in 1957, 3,000 tons.

Portugal

The quantities of cod caught but discarded by otter trawlers are reported by month/subdivision. The estimated total for 1958 was 1,552 tons; for 1957, 1,994 tons; for 1956, 3,464 tons; for 1955, 7,888 tons.

United Kingdom

Studies were carried out on board an otter trawler during one trip to Subarea 1. Measurements were made of the sizes and quantities of fish discarded at sea. On landing, the length frequency of the landings was measured.

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United States

Estimates of the quantities of haddock caught but discarded at sea by subdivisions are reported. The total discarded in 1957 was estimated at 270 tons, compared to 1,110 tons in 1956.

III. Statistics on Fishing Efforts

The requirements are:-

a) Statistics on fishing efforts should be reported by month, statistical subdivision, kind and size-class of vessel and gear, i.e. in the same detailed breakdown as the statistical on landings.

b) Where several species are caught in the same month/subdivision, the effort data should be allocated to the species separately.

a) Effort data are reported by month/subdivision/gear except as noted below.

Canada (Maritimes and Quebec): Inshore gear

No effort data are reported for inshore fisheries.

Canada (Newfoundland): Inshore gear

No effort data are reported for inshore fisheries.

Denmark (Faroes)

Statistics are not broken down by subdivisions.

Denmark (Greenland)

Statistics of inshore fisheries are not broken down by gear.

France

Effort data are reported by month/subareas, not month/subdivisions.

Italy

Only yearly totals given, not by subarea.

Norway

Detailed statistics by month/subdivision are reported for only part of the fleets.

The following effort data were reported:-

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Country	Trips	Days Absent	Days on Grounds	Days Fished	Dory Hours Hours, Hauls[1] or No. of Hours Fished	Sets or Drags
Canada (M)	✓	✓	-	✓	✓	-
Canada (N)	✓	-	✓	✓	✓	-
Denmark (F)	✓	✓	✓	-	-	-
Denmark (G)	-	-	-	-	-	-
France	✓	✓	-	✓	-	-
Germany	✓	✓	-	✓	-	-
Iceland	✓	✓[2]	-	✓[2]	-	-
Italy	✓	-	-	-	-	-
Norway	✓	✓	✓	✓	✓	✓
Portugal	✓	✓	✓	-	✓	-
Spain	✓	✓	-	✓	✓	✓
U.S.S.R.	✓	✓	-	✓	✓	-
U.K.	✓	✓	-	-	✓	-
U.S.A.	✓	✓	-	✓	-	-

1) Depending on the gear.
2) Not in the 1958 statistics.

b) Effort by species sought

Comment: The ICNAF subdivisions are large, varying from 39 to 390 thousand square kilometres. The various species of commercial importance are not distributed uniformly over the fishing grounds but are in fact largely segregated according to depth, type of bottom, hydrography, etc. Fishermen are able to select the species which they wish to catch by varying their position and adjusting their gear. The echosounder probably plays a considerable part in this selection. It is therefore essential to allocate fishing effort according to the species to which it applies. This can be done usually without too great difficulty, as many trips are "pure" trips with substantial fishing for only one species, such as cod, redfish, American plaice, etc. Where two or more species are landed from one trip it is frequently possible by examination of log books to allocate fishing effort to the species separately. Where several species are caught at the same time, the total effort is applicable to each species.

Effort data are allocated by species as noted below.

Canada (Maritimes and Quebec)

Yes. For long liners and dory vessels effort is allocated to salt fishing, halibut fishing, fresh fishing. All effort data for 1958 are allocated to redfish, halibut, salt cod, or mixed fish.

Canada (Newfoundland)

Yes. Special report submitted giving effort data by species: cod, haddock, redfish, American plaice, witch.

Denmark (Faroes)

Not necessary. Cod fishery.

Denmark (Greenland)

Not necessary. Cod fishery.

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France

Not necessary. Cod fishery.

Germany

Yes. Data separated as cod fishery, mixed fishery or redfish fishery.

Iceland

No. Largely redfish fishery.

Italy

No. Probably mostly cod fishery.

Norway

Yes. Cod and halibut effort data recorded separately.

Portugal

Not necessary. Cod fishery.

Spain

No. 74 percent cod fishery.

Union of Soviet Socialist Republics

Not necessary. 93 percent redfish fishery.

United Kingdom

No.

United States

No. Subarea 3 fishery is almost pure redfish. Subareas 4 and 5, however, are mixed, mostly haddock and redfish.

IV. Sampling

The requirements are:-

For each species sampled each country should report to the Secretariat the sizes, ages, weights, and sexes of the fish sampled by place and time of capture.

a) Length frequency data

The following tables give the number of samples of cod, haddock, and redfish reported to the Commission for 1957:-

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(These are abstracted from Tables I, II and III of the Sampling Yearbook Vol. 2. The numbers are the number of samples.)

COD

Country	Subarea 1	Subarea 2	Subarea 3	Subarea 4	Subarea 5	Total
Canada (M)	-	-	-	166[1]	-	166
Canada (N)	-	-	354	-	-	354
Denmark (F)	-	-	-	-	-	-
Denmark (G)	-	-	-	-	-	-
France	-	-	-	-	-	-
Germany	6	-	-	-	-	6
Iceland	2	-	-	-	-	2
Italy	-	-	-	-	-	-
Norway	10[1]	-	-	-	-	10
Portugal	39	35	5	13	-	92
Spain	83	11	52	-	-	146
U.S.S.R.	-	-	-	-	-	-
U.K.	54	-	-	-	-	54
U.S.A.	-	-	-	-	124	124
TOTAL	194	46	411	179	124	954

HADDOCK

Country	Subarea 1	Subarea 2	Subarea 3	Subarea 4	Subarea 5	Total
Canada (M)	-	-	-	66	-	66
Canada (N)	-	-	110	-	-	110
Spain	-	-	11	-	-	11
U.S.A.	-	-	-	82[2]	676	758
TOTAL	-	-	121	148	676	945

REDFISH

Country	Subarea 1	Subarea 2	Subarea 3	Subarea 4	Subarea 5	Total
Canada (M)	-	-	-	1	-	1
Canada (N)	-	-	-[3]	-	-	-
Germany	5	-	-	-	-	-
U.S.S.R.	-	20[1]	475[1]	-	-	495
U.S.A.	-	-	12	109	223	344
TOTAL	5	20	487	110	223	840

1) Estimated.
2) United States/Canada Co-opperative Programme.
3) Observations made but not reported to ICNAF.

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b) Age data

The reporting of age frequency data and age/length keys by member countries is summarised below. The numbers given are the number of fish aged.

R - research vessel catches C - commercial catches or landings

Country	Species	Age/Length Key or Frequency	Age Frequency		Subarea
			With Mean Length at each Age	Without Mean Length at each Age	
Canada (M)	-	Studies made but not reported to ICNAF			4
Canada (N)	-	Studies made but not reported to ICNAF			3
Denmark (F)	-	-	-	-	-
Denmark (G)	Cod	-	1556 R	5847 C	1
France	-	-	-	-	-
Germany	Cod	546 R 1283 C	-	-	1
Iceland	Cod	-	285	-	1
Italy	-	-	-	-	-
Norway	Cod	1091	-	-	1
Portugal	Cod	-	4795	-	1,2,3,4
Spain	Cod	1398	-	-	1,2,3
U.S.S.R.	Redfish	-	-	1184	2,3
U.K.	-	-	-	-	-
U.S.A.	Haddock	6087	-	-	5

Only cod age data were reported by more than one country. The total number of cod ages reported was 16,801.

c) Sea sampling

Sampling of the catches at sea is carried out by the following countries. C - commercial R - research

A subscript r means that the data is reported to the Commission.

SAMPLING AT SEA 1957

Country \ Subarea	1	2	3	4	5
Canada (M)	-	-	-	Cr,R	-
Canada (N)	-	-	C,R	-	-
Denmark (F)	-	-	-	-	-
Denmark (G)	Rr	-	-	-	-
France	-	-	-	-	-
Germany	Rr	-	-	-	-
Iceland	Cr	-	-	-	-
Italy	-	-	-	-	-
Norway	Rr	-	-	-	-
Portugal	Cr	Cr	Cr	Cr	-
Spain	Cr	Cr	Cr	-	-
U.K.	Cr	-	-	-	-
U.S.A.	-	-	-	-	R

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V. Standardisation of Fishing Effort

For ICNAF, the standardisation of fishing effort falls naturally into two parts.

Part I. Standardisation within a fleet.

Because of the varying fishing power of the vessels of a fleet, the fishing efforts of the individual vessels must be adjusted before compiling the statistics on efforts into summaries for the fleet as a whole. This will normally be done before reporting data to ICNAF.

Part II. Standardisation between fleets.

The fishing efforts of different fleets must be standardised. This will normally be done after the data have been reported to ICNAF, although it may be done either by member countries or by the ICNAF Secretariat.

The general methods of standardising fishing power are discussed in the meeting document by Holt, Parrish and Keir. Hence, further discussion here will be limited to Part II - the standardisation of the efforts of the different fleets fishing the Convention Area. This requires the determination of conversion factors to convert the effort data of various fleets to a standard effort. The method used to determine these conversion factors will be to use the comparative statistics on catch and effort as published by ICNAF. In order for this method to yield the most satisfactory results it is necessary that (1) the effort for each fleet should be reasonably homogeneous, i.e. the fishing powers of the individual vessels should have been standardised; (2) effort should be allocated by species; (3) relative selectivity coefficients should be known.

For several of the cod fishing fleets the first two requirements are sufficiently well met and, although the third is relatively unknown, its effect will tend to be of a second order of magnitude.

Comment on Relative Selectivity:

There are now considerable quantities of data in earlier "Annual Proceedings" and in the two volumes of the "Sampling Yearbook" now published to provide estimates of the relative selectivity of various of the major gears in use in the Convention Area. More data, however, are required - especially for traps and hook and line vessels. It is possibly worth illustrating how selectivity may vary between two different kinds of gear. Data reported by Ruivo on the size composition of the catches of Portuguese otter trawlers and dory vessels in 1956 and 1957 allow comparison of the relative effective selectivity of the two fleets.

The table and figure which follow are based on data taken in 1956 and 1957 when otter trawlers and dory vessels were fishing in the same month/subdivisions. The otter trawler data have been adjusted to retained catches. It is apparent that otter trawlers retain relatively more of the smaller fish, that dory vessels catch more larger fish, and that for fish of about 55 to 70 cm both gears select equally. Dory vessels are relatively less efficient for catching fish of about 40 to 55 cm and they are more efficient than otter trawlers in catching fish greater than 70 cm.

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Length Frequencies, Retained Catches

cm	OT	DV	DV/OT	
42-44	6	-	0	
45-47	17	7	0.4	1)
48-50	25	10	0.4	
51-53	32	15	0.5	
54-56	40	38	0.9	
57-59	45	49	1.1	
60-62	93	75	0.8	
63-65	109	90	0.8	2)
66-68	138	120	0.9	
69-71	132	138	1.0	
72-74	130	148	1.2	
75-77	64	106	1.7	
78-80	50	89	1.8	3)
> 80	49	115	2.3	

1) Dory Vessel less efficient than Otter Trawler.
2) Dory Vessel = Otter Trawler.
3) Dory Vessel more efficient than Otter Trawler

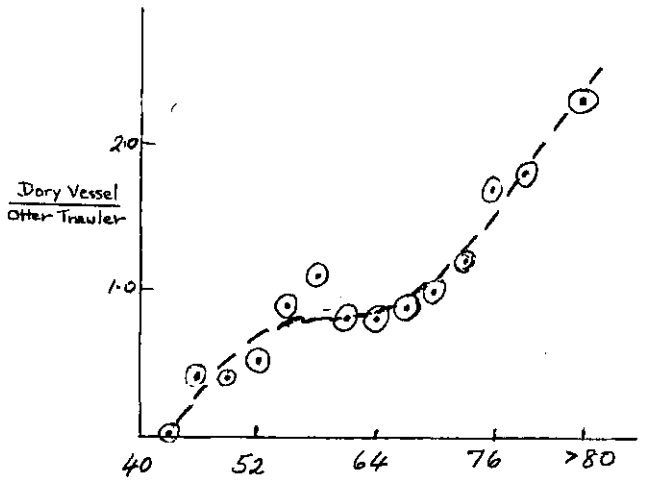

Fig. 1. Relative Selectivity of Portuguese Otter Trawlers and Dory Vessels

The conversion factor to convert dory vessel effort to otter trawl effort will therefore vary depending on the size of the fish being considered.

Estimation of Effort Conversion Factors:

Estimates were made by comparing the catches per unit of effort of various fleets. The comparison was restricted to vessels fishing predominantly for cod. More detailed discussion was given in a paper to the Lisbon Workshop (Keir, E10). Because of the wide-ranging fishing activities of the Portuguese otter trawler fleet it was used as the standard of comparison. The table which follows gives the conversion factors found. Two different estimates were made: the first was based on data from month/subdivisions fished in common, the second on annual performance figures by subareas. The fact that the two estimates agree quite well (see figure) suggests that the estimates were of the right order of magnitude.

Approximate conversion factors to convert effort data of various fleets as published by ICNAF to hours fished of Portuguese Otter Trawlers.

Country	Gear	Tonnage Class	Effort Unit	Estimates based on data from month/subdivisions fished in common	Estimates based on annual performance
Spain	Otter Trawler	900-1800	Hour	0.66	0.94
Norway	Otter Trawler	500-900	Hour	1.03	1.40
Nfld.	Otter Trawler	151-500	Hour	0.87	0.80
U.K.	Otter Trawler	500-900	Hour	-	1.26
France	Otter Trawler	900-1800	Day	-	16.20
Spain	Pareja	151-500	Hour	0.90	0.71
Portugal	Dory Vessel	(Motor & Refrig.)	(Day Hour)	2.29	1.59
Norway	Long Liner	90-374	1000 hrs.	0.21	0.34
Canada	Dory Vessel	150-350	1000 hrs.	-	0.38

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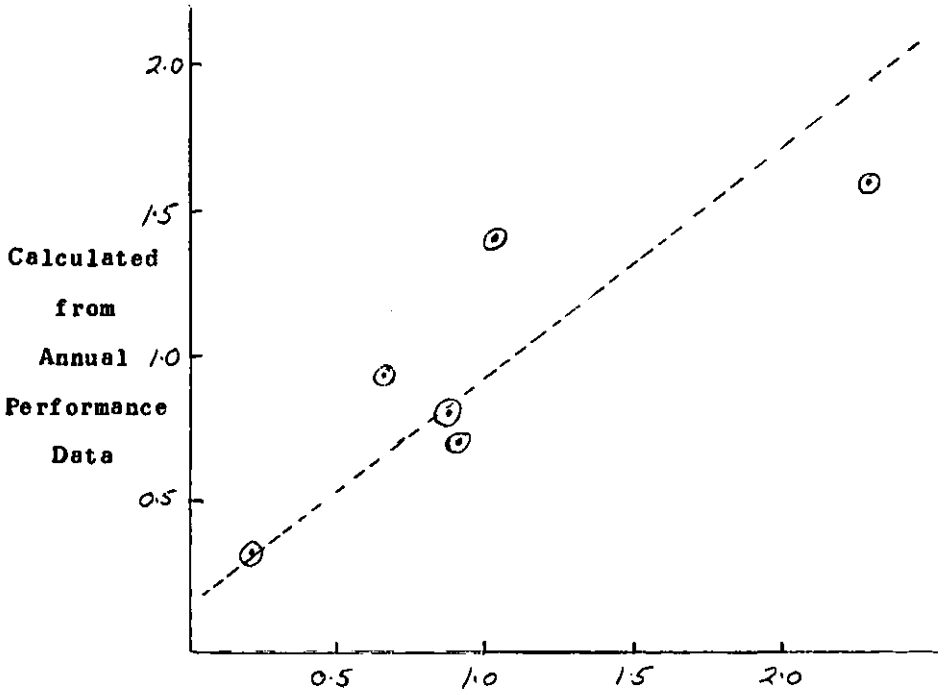

Fig. 2. Comparison of effort conversion factors calculated by different methods

On the basis of this study it is quite practicable to proceed at once with the calculation of standardised efforts. One major problem - the bulk of the ICNAF statistical data - has stood in the way and proposals to reduce this are contained in Section IV.

Effect of Echosounders on the Catch per Unit of Effort:

Most vessels operating in the Convention Area possess echosounders. Hence the main interest in studying the effect of echosounders on the catch per unit of effort is to enable us to adjust the data collected before echosounders were introduced so that it will be comparable to data collected now.

The echosounder helps a fisherman (1) to locate shoals of fish, (2) locate depths and types of bottom. Thus less time may be spent searching with the trawl. It is possible that the echosounder

1. Increases the overall catch per unit of effort
2. Increases the ability of fishermen to choose the species fished
3. Increases the proportion of the annual catch taken from large concentrations and reduces the proportion of the catch taken from scattered or thin shoals.

The last might result in an apparent increase in the size of large year-classes and in reduction in the size of small year-classes if year-classes tend to shoal separately.

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VI. Simplification of Statistical Returns

The growth of the ICNAF statistics on landings, efforts and sampling has been a natural result of the increased attention paid to the scientific investigation of fisheries and to the increased interest shown in the Convention Area by the fishing industries of many countries. This growth will continue for some years, probably at an accelerated rate. Several countries not yet members of ICNAF have already begun or are planning to fish in the Convention Area. Among them are Belgium, Brazil, Cuba, Greece, and Poland.

This increase requires an increase in the power of the Secretariat to handle data more rapidly and more efficiently so that the essential data and information are not lost in complexity or so delayed as to lose much of their value.

In earlier years much of the delay in publishing statistics was due to the relative lateness with which final returns were submitted. This is no longer essentially the cause of delay. It is probably possible with very rapid processing of the data within the Secretariat and with some further speeding up of the promptness of statistical returns to publish both the Statistical Bulletin and the data on sampling for length by the time of the Annual Meeting first following the year to which the data refer. This means an advance of publication date of about eight months to one year and this would take a year or two to achieve. The following proposals are put forward to help bring about this advance of publication date.

Proposal 1. A condensed statistical return should be submitted in addition to the present detailed report. The condensed return would

a. Give all landings in metric tons, round fresh

b. Only cod, haddock, redfish, and halibut would be identified by species; all other species would be grouped either as flounders, other groundfish, shellfish, others.

c. Condition landed and size categories would not be reported.

Proposal 2. Elimination of the size-classification of vessels from statistical submissions. Statistics are now submitted and published by size class of vessel. The size classes used are 0-25, 26-50, 51-150, 501-900, 901-1800, over 1800 gross tons. However, if the effort data of the individual vessels of a fleet are standardised, the reporting and publication of statistical data by size classes of vessels is of little value in the assessment of the ICNAF fisheries. It is proposed, therefore, that the fishing effort be standardised according to the power of the vessels making up the various fleets, e.g. by using the ton/hour as the unit of effort. The statistics should be summarised and reported only by kind of vessel and gear.

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Data for the following kinds of vessels should be reported separately:

Trawlers:	Otter Trawlers Pair Trawlers Factory Trawlers
Seiners:	Danish Seiners Purse Seiners
Gill Netters:	Sink Gill Netters Floating Gill Netters
Traps:	Pound Nets - Stake Trap Floating Traps
Hook and Line and Dory Vessels:	Dory Vessels Long Liners Hand Liners Others - specified
Harpoons	
Miscellaneous	Gear specified
Shellfish gears, etc.	

This proposal would affect the submissions of the following countries at the present time:

Canada:	Otter Trawlers Dory Vessels Long Liners Danish Seiners
Denmark (F):	Otter Trawlers
Norway:	Long Liners
Portugal:	Dory Vessels
United States:	Otter Trawlers

Proposal 3. Sampling data on cod length frequencies should be reported by three-centimetre groups or by centimetres. This is already an ICNAF recommendation and is gradually being introduced by member countries. However, considerable quantities of data are still being summarised by five-centimetre groups.