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PART III. SELECTED PAPERS FROM THE 1964 ANNUAL MEETING

I. The selectivity of a flap-type topside chafer*

by R. J. H. Beverton
Fisheries Laboratory, Lowestoft

1. Introduction

A form of topside chafer used by some British factory trawlers consists of a series of flaps of netting attached at intervals across the cod-end, in just the same way as netting or other material is attached to the lower side of the cod-end to prevent wear from contact with the sea-bed. This paper reports on the results of tests of the selectivity of cod-ends fitted with this kind of chafer. The trials were carried out during a cruise of R/V Ernest Holt to West Spitsbergen in August, 1959.

2. Method

The chafing pieces were taken from used cod-ends. They were laced, along their upper edge only, across the full width of the top side of the cod-end from selvedge to selvedge. Fig. 1 shows the arrangement in diagrammatic form. Each piece was about ten meshes deep and was attached to the cod-end at intervals of about seven meshes, so that each overlapped about one-third of the adjacent chafer below. Four such chafing pieces were fitted, covering in all about two-thirds of the cod-end from the cod-line forwards.

The covered cod-end technique was employed for measuring selectivity, with the same cod-end and cover used throughout. The cover was of small-meshed (about 20 mm) nylon, shaped and rigged as described by Beverton (1958) except that it was made extra wide to avoid fouling the chafers. The mesh size of the cod-end averaged 119 mm, and this figure did not vary by more than a millimetre or so throughout the tests. Measurements were made of every third row across the full width of the cod-end for two-thirds of its length, starting at four rows up from the cod-line. The cod-end was measured in this way on five occasions during the tests.

Mesh measurements were made with the Lowestoft fixed-load scissors gauge operating at a load of 3 kg (Beverton & Bedford, 1955). The performance of this gauge is closely similar to that of the ICES gauge, but the difference between them of 1 kg in operating load means that the mesh measurements given here are about 3-4 mm lower than would have been obtained with an ICES gauge.

* Note: This paper was presented in summary form to the ICES Comparative Fishing Committee at the 1959 ICES Council Meeting.

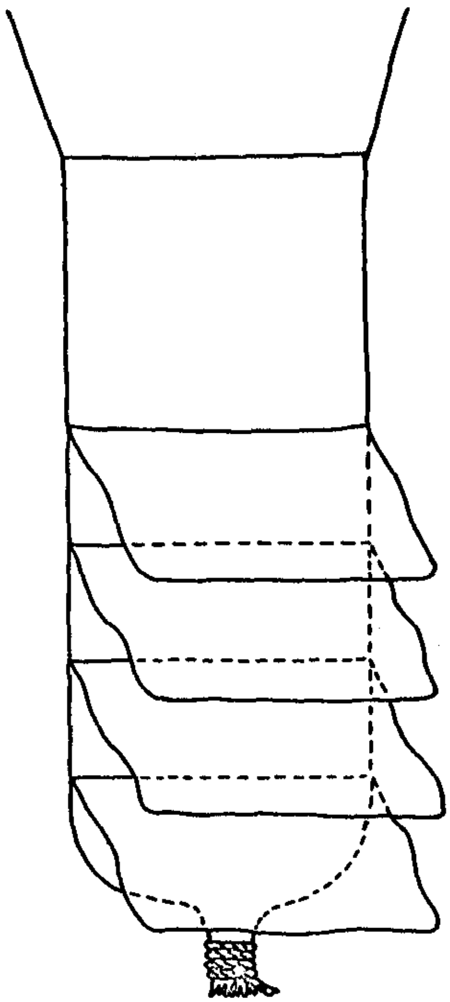

Fig. 1. Diagram showing attachment of flap-type chafers to cod-end.

To determine whether the flap-type chafer had any effect on selectivity, the cod-end was fished (a) without chafers, (b) with large-meshed (about 140 mm) chafers, and (c) with small-meshed (about 100 mm) chafers. Cod predominated in the catches, and catches ranged from 5 to 110 baskets (30 baskets = 1 metric ton, approximately); cod were sufficiently numerous in both the cod-end and cover to enable a selection factor to be estimated from most hauls individually. Some haddock were caught, for which approximate selection factors were obtained by grouping hauls made with each rig of the gear.

All fish caught were measured except from the largest hauls, when a sample of several hundred fish was measured. In such cases the total catch was obtained by basketing of all fish not measured, except on station 65 when only half of an estimated catch of 80 baskets was brought on board.

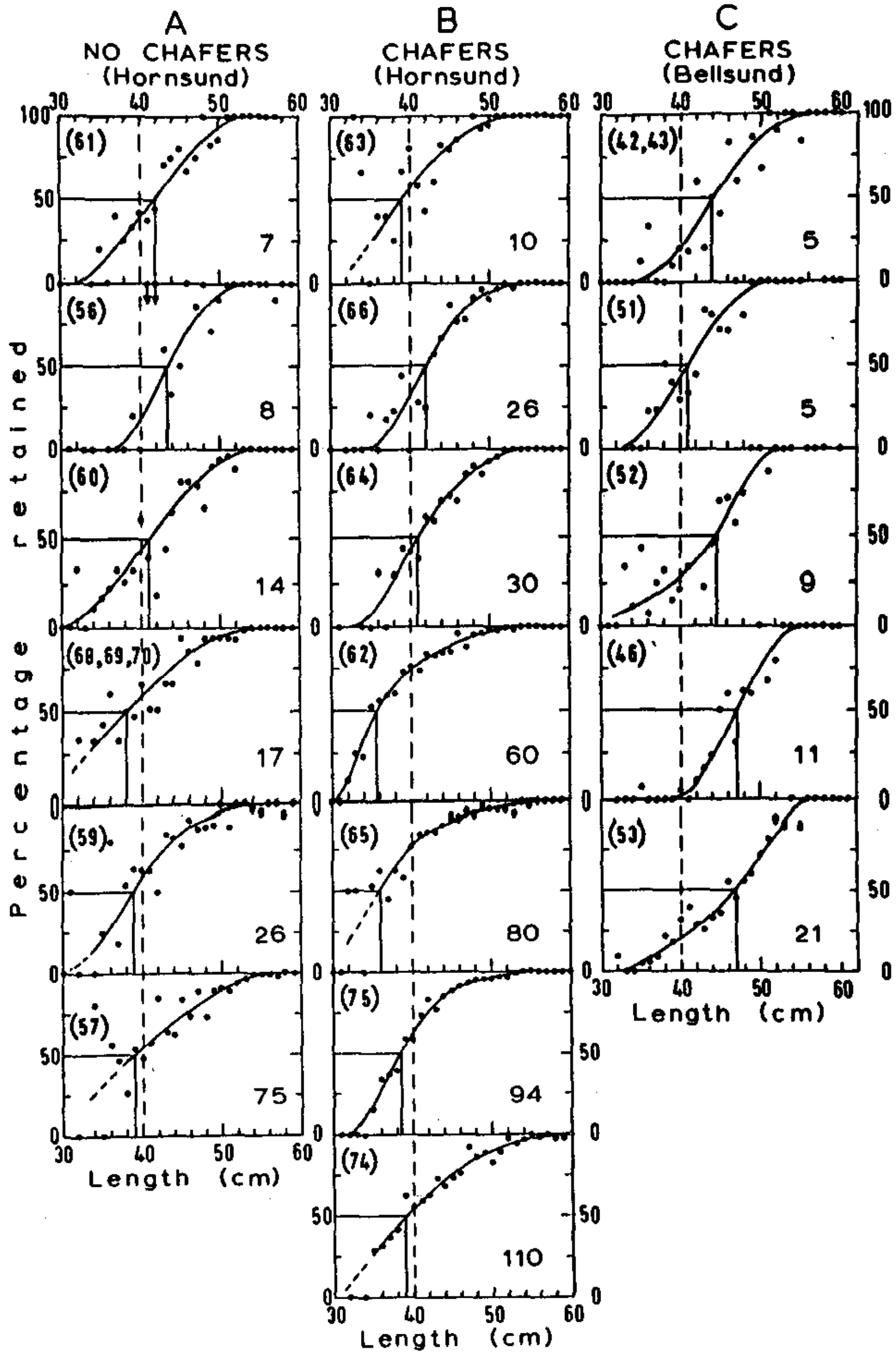

Fig. 2. Selectivity curves for cod.
Group A. No chafers, Hornsund Bank
Group B. Chafers, Hornsund Bank
Group C. Chafers, Bellsund Bank
Within each group hauls are arranged in order of increasing catch size, reading downwards. Station numbers are shown in parentheses, top left; catch (baskets) is shown bottom right. Note that hauls 74 and 75 are with large-meshed chafers, the remaining ones of group B being with small-meshed chafers. All hauls in group C are with large-meshed chafers.

3. Results

(i) Cod

The results are summarised in Table 1, the selection curves for individual hauls being shown in Fig. 2, arranged in order of increasing catch size (reading downwards). The first group of hauls (stations 42-53; Table 1) were made on Bellsund Bank with the cod-end fitted with large-meshed chafers; these gave an average selection factor of 3.75, which is substantially higher than was obtained on later hauls on Hornsund Bank some 30 miles to the south. Comparison of the effect of chafers is therefore restricted to the Hornsund Bank hauls, which gave the following average selection factors:-

Gear	Average selection factor
No chafers	3.37
Large-meshed chafers	3.26
Small-meshed chafers	3.25

On this evidence alone it would appear that the presence of chafers reduced the selection factor by about 3%, but inspection of Table 1 shows that the no-chafer group of hauls were those with the smallest average catch. Fig. 3 shows selection factor plotted against total catch (all species combined, but predominantly cod), the various rigs being distinguished according to the key shown in the figure. There is evidence here of a decrease of selection factor with catch size, amounting to about 0.1 per 35 baskets (from the fitted regression, excluding the Bellsund Bank hauls), which is significant at the 0.05 level and is in harmony with Hodder's (in press) findings using the alternating haul technique. There was also a tendency for the hauls made with chafers to be of shorter duration than those without, but there is no clear trend of selection factor with haul duration.

It may therefore be concluded that the small difference noted above between average selection factors with and without chafers can probably be accounted for by variation in catch size. Presumably the chafing pieces, being attached only along their upper side, extended sufficiently far from the cod-end while the trawl was being towed to permit fish freely to escape between and around them. If, instead, fish were escaping through the meshes of the chafing pieces, the presence of small-meshed chafers should have reduced the selection factor (calculated as before with reference to the same cod-end mesh size) to about 2.7, which is clearly incompatible with the observations. This is of practical significance, since the usual commercial practice is to use old pieces of cod-end netting for chafers, in which the mesh size may be appreciably less than in the cod-end proper through shrinkage.

Despite the close similarity in average selection factors there is considerable haul-to-haul variation which cannot be accounted for by catch size, as is shown by the individual haul selection curves of Fig. 2. The selection

Stn.	Gear	Mean cod-end mesh (mm)	Duration of haul (hr.)	Total catch (baskets)	50% retention length (cm)	Selection factor	25%-75% range (cm)	No. of fish in selection range (25%-75%) Cod-end	Cover
42+43	Large mesh chafers (141 mm)	118	1.5 (mean)	5 (mean)	42.0	3.56	7.0	24	24
46			1.5	11	47.0	3.98	6.0	40	48
51			1.5	5	41.0	3.48	6.5	31	30
52			1.5	9	44.5	3.77	8.5	66	67
53			1.5	26	47.0	3.98	9.5	138	179
Mean			1.5	11	44.3	3.75	7.5	60	70
56	No chafers	120	1.5	8	43.0	3.58	5.5	20	8
57			1.5	75	39.0	3.25	11.5	345	230
59			1.5	26	39.0	3.25	7.0	99	59
60			1.5	14	41.0	3.42	9.0	33	67
61			1.5	7	42.0	3.50	8.5	43	40
68-70			0.8 (mean)	17 (mean)	38.0	3.22	10.5	145	129
Mean			1.4	24	40.3	3.37	8.7	114	89
62	Small mesh chafers (100 mm)	119	1.1	60	35.5	2.98	7.5	407	216
63			0.7	10	39.0	3.28	8.5	42	32
64			0.7	30	41.0	3.45	7.5	152	128
65			0.5	(80)	36.0	3.03	6.5	302	199
66			1.0	26	42.0	3.53	6.0	79	79
Mean			0.8	41	38.7	3.25	7.2	196	131
74	Large mesh chafers (141 mm)	119	1.0	110	39.0	3.28	10.0	835	555
75			0.5	94	38.5	3.24	6.5	427	288
Mean			0.75	102	38.75	3.26	8.3	631	421

Other data

Cod-end twine: (double manila; untreated; 4 ply
(runnage 50 yds/pound
(
Towing speed: (3-3 1/2 knots
(
Depth range: (50-70 fathoms

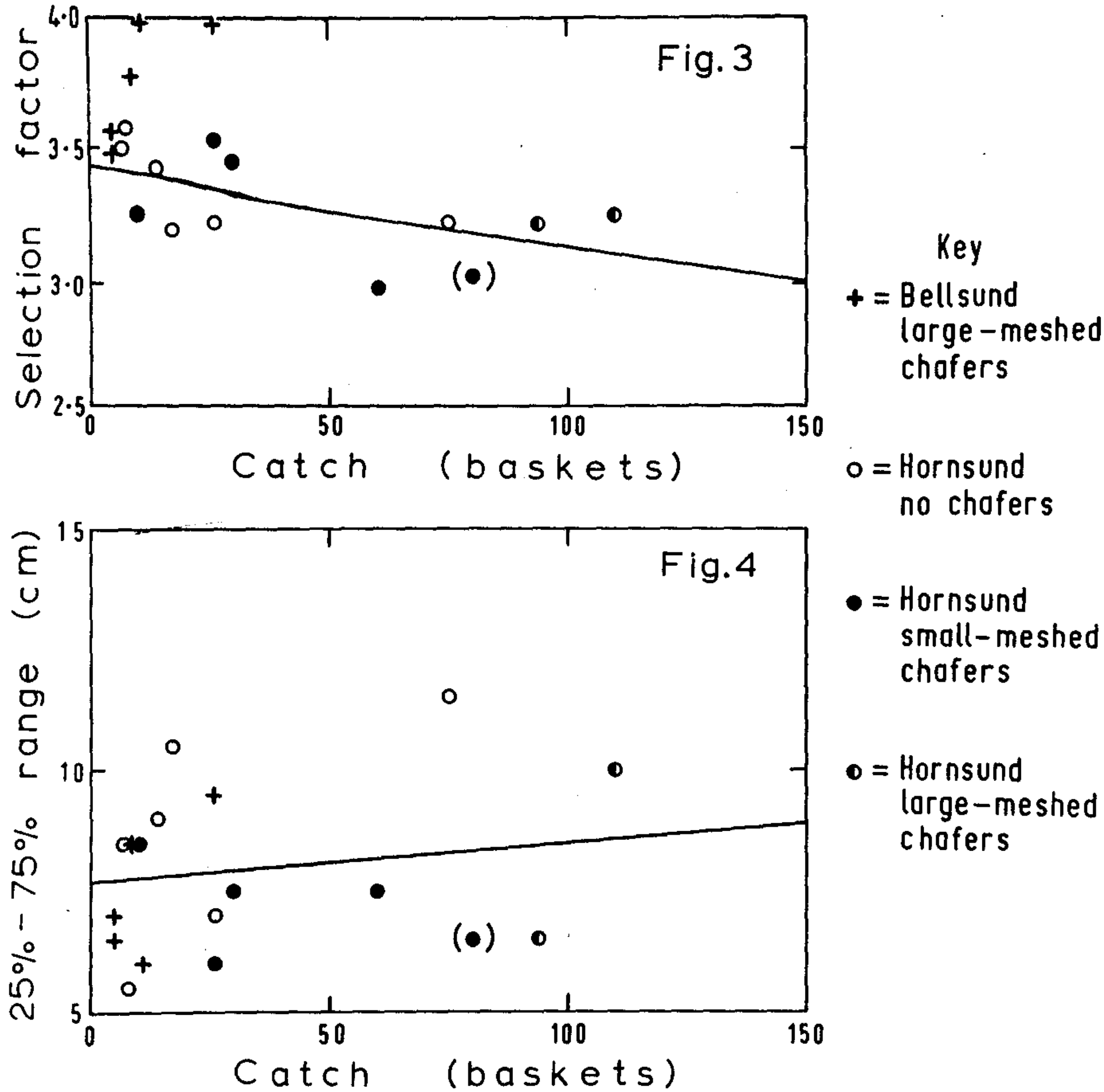

Fig. 3. Plot of selection factor against catch size for cod.

Fig. 4. Plot of selection range (25%-75%) against catch size for cod.

range, measured as the span of length between the 25% and 75% retention points, is no less variable, ranging from 5.5 to 11.5 cm. Contrast, for example, the range on hauls 74 and 75, made with the same gear in the same locality within three hours and giving almost the same selection factor, but a range of 10 cm compared with 6.5 cm. There seems, however, no clear relation between range and catch size (Fig. 4; $p = 0.6$). Selection factors for cod in the range of 3.2 to 3.3 are on the low side, and this is doubtless due to the fact that fish on Hornsund Bank were feeding very heavily (on euphausids). In contrast, the Bellsund Bank fish were feeding only moderately, which probably accounts for their higher selection factors. Comparative girth measurements were attempted but were abandoned because the stomachs of the Hornsund Bank fish were too soft and distended to permit of consistent measurement. Nevertheless, the fact that an average selection factor as high as 3.75 was obtained for the Bellsund Bank fish shows that the cover was not causing any undue masking of the cod-end, even in the presence of chafers. This conclusion is supported by the "normal" selection factor of 3.4 found for haddock, whose feeding was only light to moderate (see below).

(ii) Haddock

The selection curves for haddock are shown in Fig. 5. Only that for hauls made with large-meshed chafers is based on enough fish to enable a selection curve to be drawn with any precision, giving a 50% retention length of 40.5 cm and a selection factor of 3.4. The dotted curves shown on the diagrams for hauls without chafers and with small-meshed chafers are the large-meshed chafer curve displaced by ± 3 cm. These enclose most of the points in the selection ranges, from which it may be concluded that if the presence of a flap-type chafer influences cod-end selectivity for haddock at all, it is unlikely to do so by more than about ± 7% of selection factor.

4. Summary

(a) Results are given of the selectivity of a cod-end fitted with a flap-type topside chafer. This consists of a series of overlapping flaps of netting fastened along their top edge across the width of the cod-end.

(b) A reduction of selection factor for cod of about 0.1 (specifically from 3.37 to 3.25) was found on hauls in which the cod-end was fitted with chafers, but this small difference could reasonably be accounted for by the effect of catch size on selectivity.

(c) It is therefore concluded that on these tests, which included hauls ranging from 5 to 110 baskets, cod-end selectivity was for all practical purposes unaffected by the presence of flap-type chafers. This result was obtained with chafers having mesh sizes both larger and smaller (by about 20 mm) than the cod-end mesh size.

(d) Data on haddock were too few to give a precise test of the effect of chafers on cod-end selectivity; but if there was an effect it is unlikely to have exceeded about 7% of selection factor.

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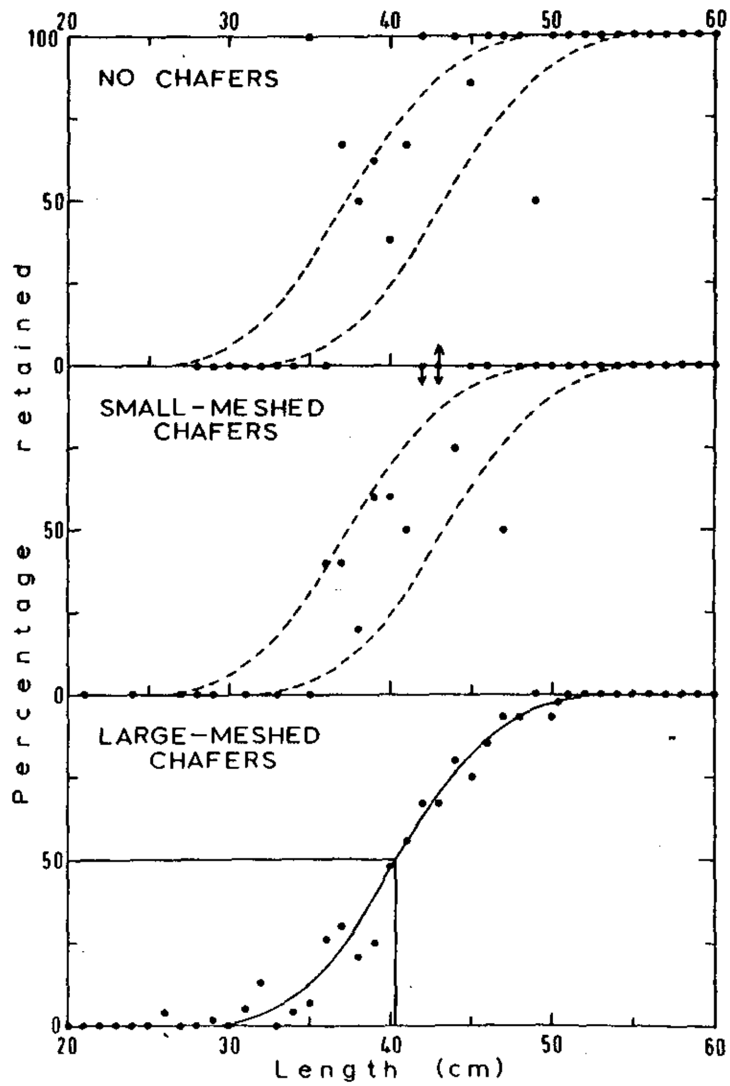

Fig. 5. Selection data for haddock based on group hauls (see text).

II. Review of tagging publicity methods used by ICNAF member countries

by S. A. Horsted
Grønlands Fiskeriundersøgelser, Copenhagen

An ICNAF Subcommittee preparing the Marking Symposium held in Woods Hole 1961 reviewed the tagging publicity methods used by member countries in 1958 (McCracken in Redbook, 1959, pp. 22-26).

Since then, however, defects in reporting of recaptures have been pointed out. Such defects are of two main sources:

I. Tags are not observed;
II. Tags are not reported although observed.

Re I. To improve the observation of tags, more visible tags could be introduced or tags could be fixed on the fish in a better way or position than hitherto used (e.g. in front of dorsal fin instead of in gill cover). Various papers submitted to the North Atlantic Fish Marking Symposium, Woods Hole, 1961 (ICNAF Spec. Publ. 4) deal with this problem and it is supposed that member countries have got new ideas of improvement from this symposium.

Re II. To ensure the reporting of observed tags, member countries use various systems of reporting and various publicity methods to improve the reporting. The Tagging Subcommittee at the 1963 Annual Meeting found that it might be of some value to review once more the various methods and recommended that member countries prepare a short written report of their propaganda and reporting systems for the 1964 meeting (Recommendation 30a) and that member countries make analysis of their tagging experiments so as to discover weaknesses in their reporting systems and where possible make seeding experiments (Rec. 30b). A circular letter concerning these recommendations was distributed to member countries by March 2nd, 1964. Replies have been received from most member countries. In the following a short review of these answers is given together with some remarks of special interest.

1. Summarized lists of taggings are distributed to other laboratories via ICNAF Card Release System. All member countries apparently do so when tagging is carried out in ICNAF Area (1964 Doc. 3).

2. The Lowestoft Laboratory, England, furthermore informs fisheries officers in main harbours about details of tagging experiments so that these officers can inform fishermen submitting tags about the details of their tag.

3. To inform fishermen about tagging experiments going on, member countries use different announcements. Personal contact is normal for Germany, Iceland, USA, and especially Portugal. Poland and Portugal furthermore announce by posters on board vessels. Many member countries use posters in

harbours, fish plants, cold storage plants, etc. Portugal and partly Germany and England also make announcements in fishermen's journals. Canada (St. Andrews) has a special broadcasting program for fishermen, in which, of course, tagging experiments are announced. Germany and Poland also give lectures on the problem in fisheries schools. Canada (St. John's) at the present moment announces only by the information on the tag itself.

4. A very important link in the reporting system is what the fisherman has to do with the tag he discovers. Portugal presumably has solved this problem in an excellent simple way. The fisherman simply gives the tag to the captain of the vessel and the captain collects the tags and delivers them to the laboratory when the vessel returns to harbour. Some countries mainly use fisheries or harbour officers as receivers of tags, while Canada (Grande Rivière and St. John's) and Germany have most of their tags delivered (or mailed) directly from fisherman to the laboratory.

5. The information required is similar for all countries. When information is lacking, Canada (St. Andrews) uses a special "follow-up card" to ask for additional information.

6. The reward is paid in different ways. On the spot payment is used only by Portugal (by captains), England (fisheries officers) and USA. Greenland fishermen go to a special office to get the reward. Canada (St. Andrews) sends the reward out from the laboratory after receiving the tag.

It seems to be normal to pay the full reward although some information is missing. If the fish is delivered together with the tag, Canada pays a fixed extra reward of $1, while Greenland, England, and perhaps others, pay the value of the fish. The size of the reward varies from $0.45 to about $1.60 (US). In addition a lottery system has been introduced in Norway.

7. Most countries, but not all, inform the fisherman about the release data of his return. Canada, Iceland and USA use a map-letter. England informs the fisherman verbally by fisheries officers (see 2 above). Poland, Portugal and, to some extent, also USA, publish the name of the fisherman returning the tag in fishermen's journals or on posters. USA furthermore gives main results of their tagging experiments on posters in harbour.

8. No countries regard the reporting by their own fishermen to be poor, although some countries admit that reporting could be better. It is, however, evident that the reporting is not always as good as it ought to be. It is generally agreed that Portuguese fishermen have a very good reporting record. The points in the Portuguese reporting system which enables this fine reporting seems first of all to be the possibility of the fisherman to deliver tags and information to the captain who pays the finder right on the spot, and, secondly, the fine contact between captains and the laboratory. Finally, the publication of the finders' names in fishermen's journals seems to be stimulating.

In addition to this summarized information, the following remarks are worth noting:

Canada, Grand River (Marcotte): We doubt that we are getting the maximum returns. More tags are caught but not returned. To interest the fishermen, it would be necessary to pay them right on the spot when they bring the tagged fish or the tag itself. But on account of our administrative procedure it is impossible to do so.

To improve this situation, we intend in 1964 to ask the managers of cold storage or fish plants to collect the tags for us and we intend to pay the managers $0.50 for each tag collected. We would supply them with the form to be filled. That way the fishermen would be interested in bringing back the whole tagged fish with the certainty of being paid $2 for it. Otherwise, it is quite complicated for a fisherman to collect tags, to write a letter, etc.

I think we are wrong to haggle over the price to be paid for tag returns. Taggings are very expensive by themselves and we need not hesitate when the time comes to get the returns and results we expect from those taggings.

Canada, St. John's (Templeman): We place a complete address, amount of reward and request for necessary information on the tag and otherwise do not advertise at present. We believe the reporting of the Newfoundland fishermen to be fairly good. Many of our best tags have had 30-35% or higher returns.

Germany (Messtorff): In several cases data of recaptures are incomplete or uncertain even if reported by fishermen because the finder puts the tagged fish aside without reporting at once ... In this direction efforts must be made to improve the reporting system. But it seems to be dangerous to refuse rewards if data of recapture are incomplete.

Iceland (Jonsson): There are certainly some recaptures not reported and we suppose they tend to increase when it becomes commonplace for a fisherman to catch tagged fish.

Poland (Chrzan): The rather small number of tags found by our fishermen in the ICNAF area seems to be due to the mechanical processing lines. It may also be due to the fact that our factory vessels are trawling at higher depths where the tagged fish may be less numerous.

Portugal (Monteiro): A special box for sampling otoliths is now introduced.

U.S.A., Woods Hole: Results of major tagging experiments are published on posters in harbours. One man in Woods Hole has the primary duty of processing tag returns and generally supervising the tag recovery system to assure its being maintained at peak efficiency.

III. Minimum mesh sizes and equivalents for different materials to meet ICNAF regulations

by F. D. McCracken
Fisheries Research Board of Canada
Biological Station, St. Andrews, N.B.

Following documentation of Canadian legal difficulties with spring-loaded gauge for enforcement (Doc. 38, 1962) and recommendations from the *ad hoc* Committee on ICNAF Trawl Regulations (Proceedings 14, App. I, 1963), we have re-examined some of the minimum mesh size regulation problems. Among these were selection equivalents for various materials. comparison of regulations for the NW Atlantic with those of the NE Atlantic and North Sea; equivalent measurements with different gauges; manufacturers' specifications to meet minimum mesh regulations; and codend mesh sizes currently in use by Canadian trawlers according to material.

Selection equivalents

Selection factors ($\frac{\text{50\% retention length}}{\text{mesh size}}$) for various species and materials in the ICNAF area have been compiled by Clark *et al.* (1958) and Parrish (1963). These show that the current ICNAF minimum mesh size of 4 1/2-inches for manila trawls (as measured with an ICNAF gauge) should have a 50% retention length of about 40 cm for cod and 37 cm for haddock. Most data for synthetics show substantially higher escapement than manila for meshes of the same size, and this raises problems of equivalents, i.e., what mesh size in synthetics will produce the same selection as the specified manila mesh size. Estimates of mesh size in synthetics equivalent to the 4-1/2 inch (114 mm) manila mesh are presented in Table 1.

Table 1. Mesh size equivalents* (ICNAF gauge) by material for cod and haddock (50% retention, cod = 40 cm; haddock = 37 cm).

Material	Mesh size	
	Inches	mm
Manila (double)	4 1/2	114
Polyethylene (double)	4 1/2	114
Polyamides and esters (double)	4 1/8	105
Polyamides and esters (single)	4	102
Polypropylene (Ulstron)	?	?

*From Clark *et al.* (1958) and Parrish (1963)

Comparisons of regulations

ICNAF regulations for cod and haddock call for a minimum mesh size of 4 1/2 inches (114 mm) for manila and equivalent selectivity for other materials throughout the whole region. This requires interpretation at a national level. In contrast, regulations for the NE Atlantic and North Sea state the internationally agreed equivalents. A comparison of these regulations with North American practice is presented in Table 2.

Table 2. Comparison of current mesh regulations.

	ICNAF (mm)		NE Atlantic (mm)	North Sea (mm)
Manila	114		120	80
	Canada	USA*		
Polyamides and Polyesters (dbl)	111	108	110	75
Polyethylene (dbl)	111	108	120	75
Ulstron (dbl)	111	108	120	?
Synthetics (single)	102	108	...	70
Seine nets	Same as OT		100	70

*The USA commonly uses a system of measuring nets before use and certifying the new codends.

The comparison points out: (a) the somewhat different interpretation of equivalents by Canada and USA for the ICNAF regulation; (b) that North American countries have grouped synthetics while European countries have separated some of these; and (c) that the two areas differ in treatment of minimum mesh sizes for newly introduced materials. North Americans group with synthetics, Europeans group with manila until selectivities are determined. In addition, the table shows differences by country and area in treatment of single synthetics and seine nets.

Comparison of mesh measuring methods

The literature about mesh measuring shows a general lack of precision but suggests that greater precision is reached using a "spring-loaded" gauge rather than a "simple" gauge. Measurements (recorded in the literature) obtained with the ICES gauge (8 lb pressure) were generally lower than those with an ICNAF gauge (12-15 lb pressure). Measurements with a simple non-pressure gauge depended on interpretation of amount of pressure.

Our comparisons between "spring-loaded" gauges and the "simple" gauge were carried out by officers who might normally be concerned with regulations. We obtained used codends of manila, polypropylene, terylene (polyester) and polyethylene, wetted, and then used for measurements. Simple gauges, 3/32 inch thick, of 100, 105, 110, 114 and 120 mm width, were tried in meshes that they would "pass easily through" (suggested for possible regulation and interpreted by us to mean slight pressure) and the same meshes subsequently measured in sequence with the ICES gauge at 8 lb pressure and the ICNAF gauge at 12-15 lb pressure. The results are shown in Fig. 1.

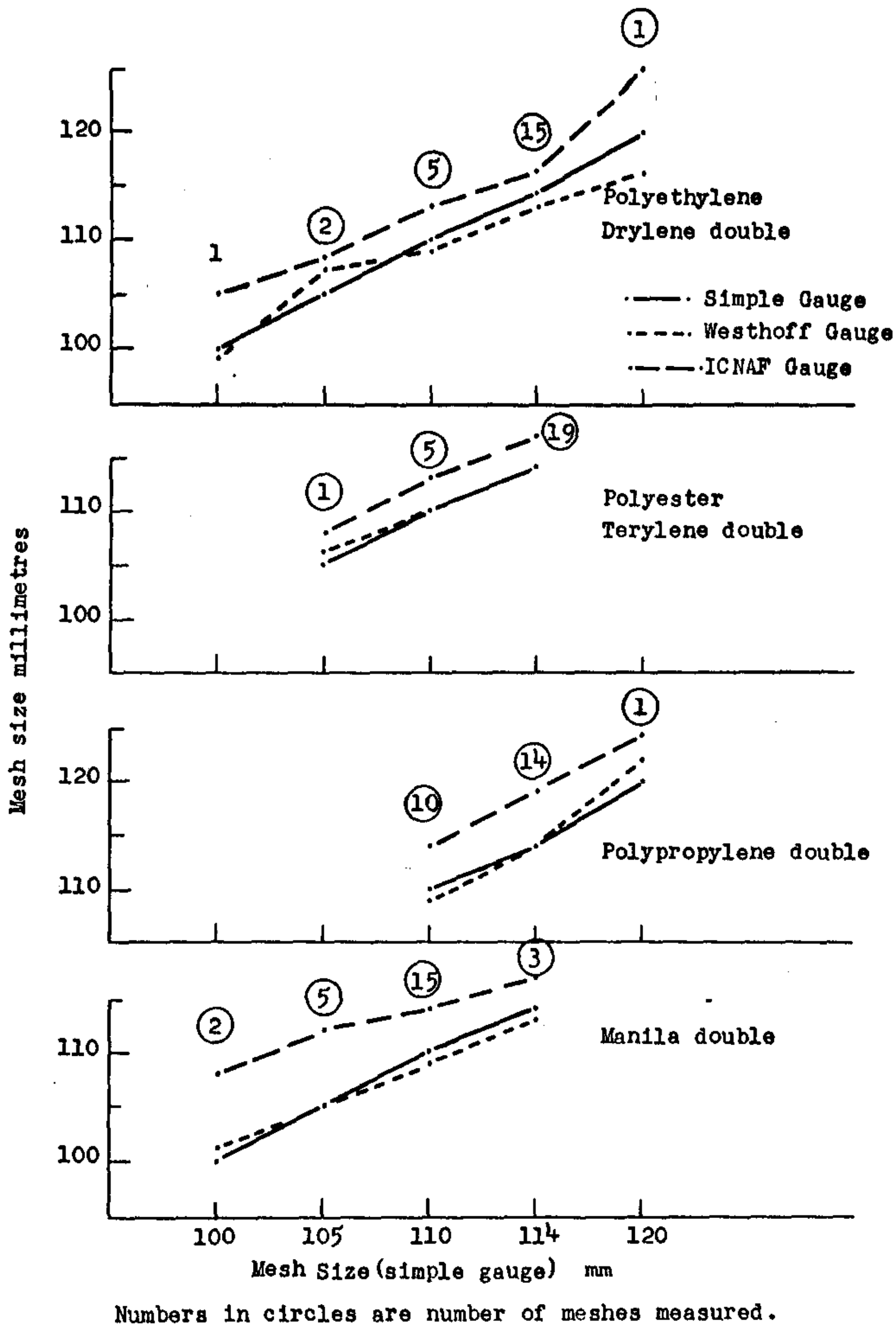

Fig. 1. Comparison of mesh sizes with different gauges.

With our interpretation of "pass easily through", the simple gauge was close to the measurements obtained with the ICES gauge but 2-5 mm less than those obtained with the ICNAF gauge.

ICNAF regulations were drawn up for measurements with the ICNAF gauge, which is still used in the USA and may be used by other countries. Canada is obliged by law to drop the spring-loaded gauge and use a simple gauge for regulation. From the comparisons described above it is apparent that insistence on conformity with these regulations based on measurements with simple gauges would require that Canada use larger meshes than those possible for other countries. Thus, to ensure uniformity in meshes used, there would need to be two versions of the regulation schedule -- one for those countries in which the spring-loaded gauge is legal, and one for countries where simple gauges only are legal. The equivalents shown in Table 1 should be revised to provide for both measuring systems as shown in Table 3.

Table 3. Mesh size equivalents for ICNAF and simple "pass through" gauges.

Material	Mesh size		
	ICNAF gauge		Simple gauge
	Inches	mm	mm
Manila (dbl)	4 1/2	114	110
Polyethylene (dbl)	4 1/2	114	110
Polyamides and esters (dbl)	4 1/8	105	103
Polyamides and esters (single)	4	102	100
Polypropylene (Ulstron)		?	?

Net manufacturers' specifications

By contacting several net manufacturers who provide trawl nets for both Canadian and NE Atlantic vessels, we were able to obtain information about sizes of newly knit codend meshes which apparently satisfy the regulations specified for codend meshes measured wet after use. These are presented in Table 4 and show between knot centre measurements of new nets related to after use regulations.

It is obvious from Table 4 that net manufacturers allow for the difference in mesh size for manila but they consider that the difference between polyamides and esters for the different regions is negligible, even though they are measured with different gauges.

Table 4. Net makers' specifications to meet mesh size regulations.

Material	Can. regulations		NE Atl. regulations	
	New netting Knot centres	Minimum Used netting	New netting Knot centres	Minimum Used netting
	inches	mm	inches	mm
Manila 50/4	5 5/8	114		
75/4	5 3/8	114		
50/4			6	120
75/4			5 1/2	120
Polyamides and esters	5	111	5	110
Polypropylene (Ulstron)	4 3/4	111	5 1/4	120

It is obvious from Table 4 that net manufacturers allow for the difference in mesh size for manila but they consider that the difference between polyamides and esters for the different regions is negligible, even though they are measured with different gauges.

Mesh sizes in codends used by Canadian trawlers

Records of inspections by Canadian Department of Fisheries officers have been used to show mean mesh sizes of codends used by Canadian mainland trawlers in 1963 and Newfoundland trawlers in 1962 and 1963 (Jan.-June, main haddock fishing period), Fig. 2 and 3. The results have been presented according to material used and the relation between the ICNAF gauge and a simple gauge measurement has been approximated along the horizontal axis.

On the Canadian mainland larger trawlers used double synthetic codends with average mesh sizes of 4 3/8 inches or greater (4 1/4 inches, 108 mm, simple gauge). Smaller trawlers used single twine synthetics with mesh sizes between 4 and 4 1/4 inches, ICNAF gauge (about 3 15/16 to 4 1/8 inches, simple gauge).

In Newfoundland, larger trawlers were using mainly manila codends with average mesh size ranging from 4 1/8 to 4 1/2 inches, ICNAF gauge (4 to 4 3/8 inches, simple gauge).

Summary

Current data for selectivity in the ICNAF area from recent compilations referred to in the text show large differentials between manila and some synthetics (polyamides and polyesters) but not for others (polyethylenes).

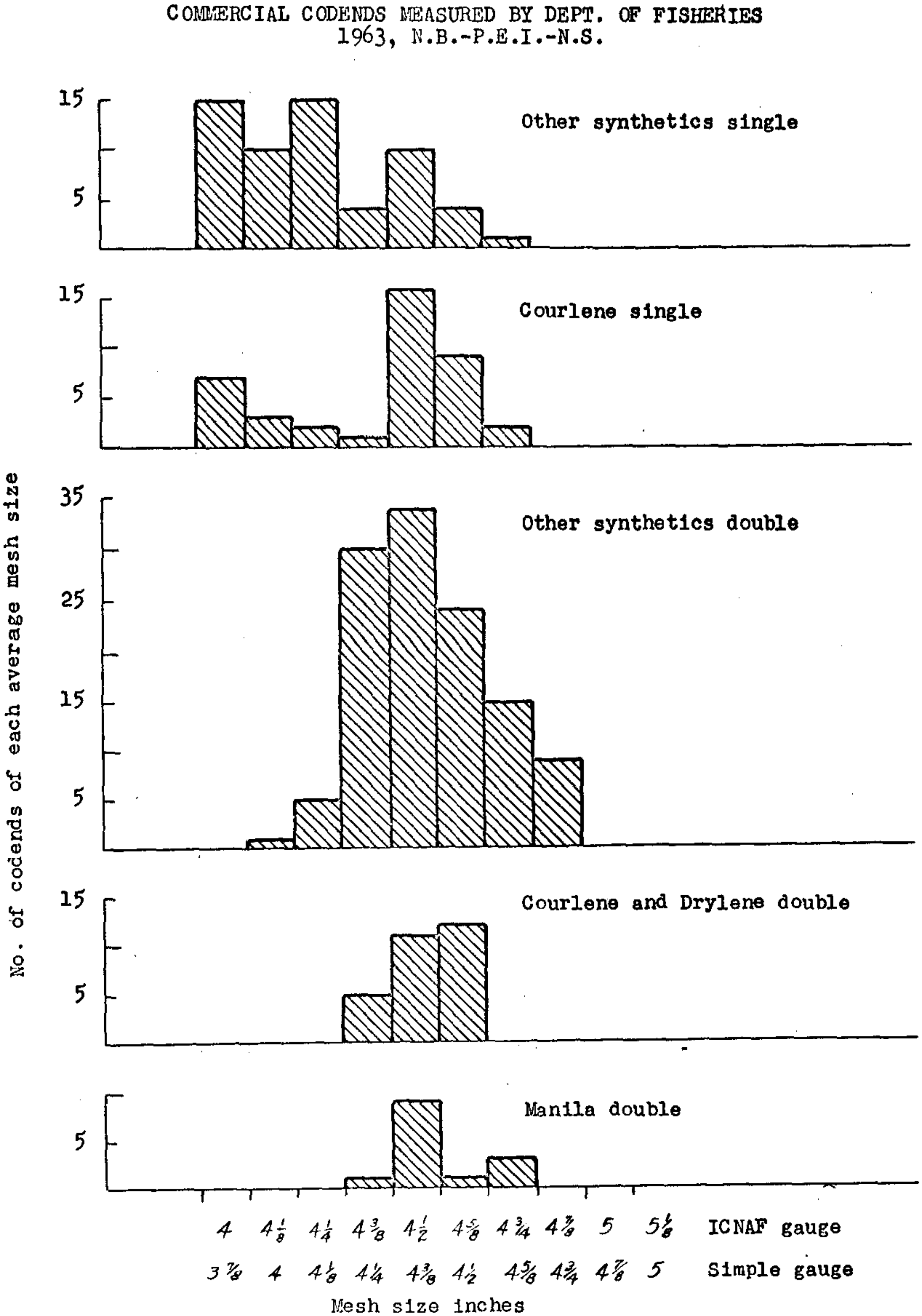

Fig. 2. Mesh sizes in Canadian mainland codends.

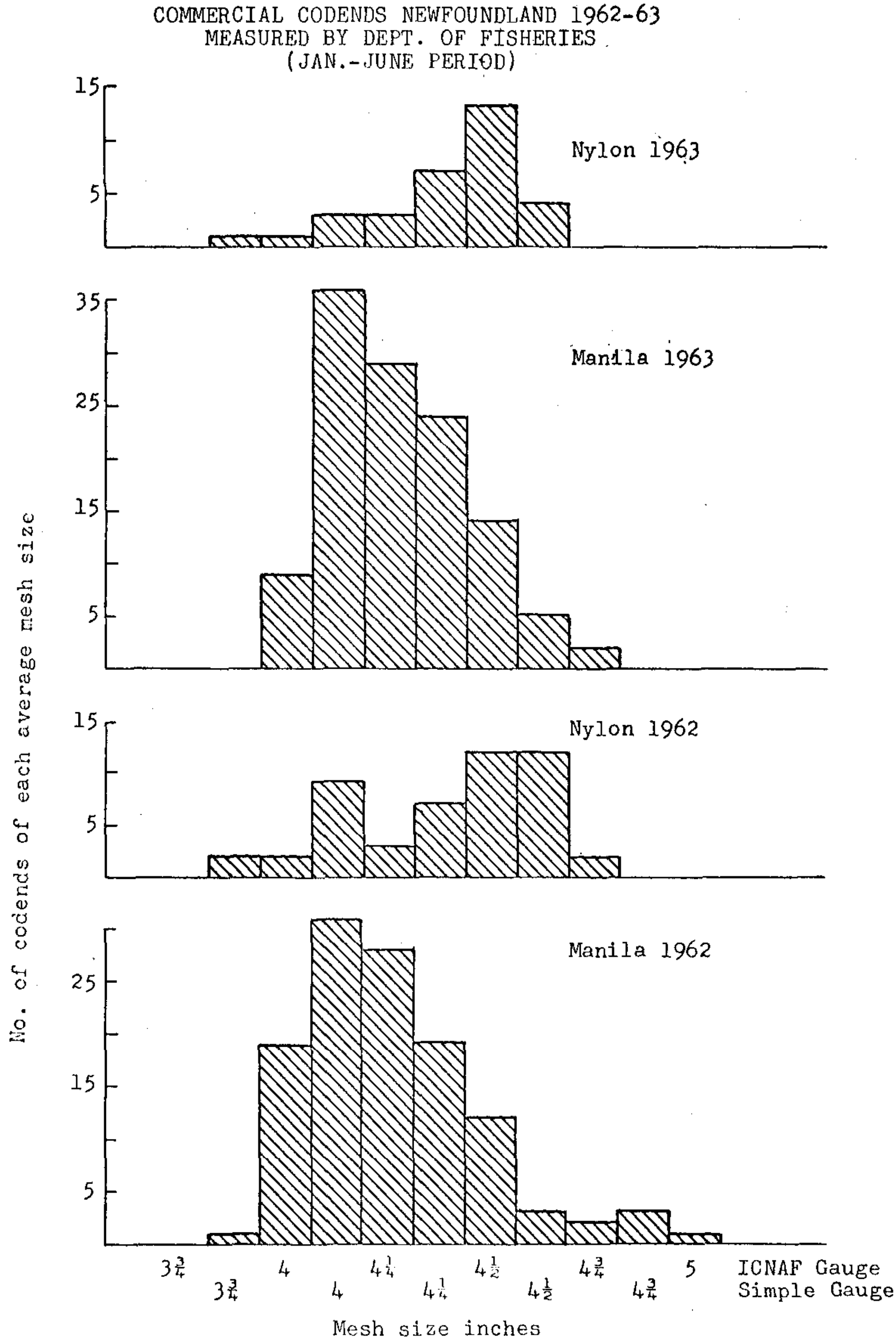

Fig. 3. Mesh sizes in Newfoundland codends.

National interpretation of equivalents for the ICNAF minimum mesh size regulation by North American countries has led to grouping of all synthetics under one mesh size; differentials that are too great for some materials; and differences in equivalents provided by different countries. International agreement on equivalents seems desirable.

Mesh measuring comparisons and net manufacturers' specifications suggest that ICNAF regulations should be written in two forms (1) for countries using spring-loaded ICNAF gauges, and (2) those using simple gauges, the latter being about 4 mm less than the former (for manila).

Provision of more reliably estimated equivalents for synthetics would make little difference in present Canadian practice, except for one group of mainland trawlers (mostly large) which are currently using meshes in synthetic materials larger than those which would be required.

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