Annexe A

Recherches de pêche cotière à la côte de la Belgique

Researches on Shore Fishing on the Belgian Coast

Preliminary Report to the Bureau of the International Council for the Study of the Sea

by

Prof. Gustave Gilson, Louvain

Three sets of experimental researches have been undertaken concerning the fishing industry on the Belgian coast.

1. Researches tending to estimate the quantity of young fish actually destroyed in the course of one year by the Belgian fishermen.
2. Net experiments tending to fix the limit size of the fishes able to escape through meshes of a given size, and the proportion of fishes under that size that actually get out of the net.
3. Experimental researches in view of finding a shrimp net so disposed as to avoid the capture of young fishes without preventing that of the shrimps *(Crangon)*.

It has been found that these researches demand more time, — and money, — than was expected and, although two years have elapsed since their undertaking was suggested by the Bureau we still consider them quite incomplete. A very short account of the results hitherto obtained is given in the tables below.

1. Quantity of Undersized Fish Destroyed Annually

We call "undersized", all fish under the minimum size allowed to be landed under the present regulations in Belgium.

The minimum size is:

25 cm. for { Turbot, Brill, Ray, Halibut, Cod, Haddock } and: 18 cm. for { Sole, Dab, Plaice, Whiting }

Owing to a size limitation, great difficulties were encountered which are not met with in countries where no legal restriction is established. The only method

to adopt was to have a few salaried men fishing as often as possible with their own gear, and according to their own methods, and delivering the whole content of their nets to the laboratory, to be examined by naturalists.

The present communication gives only a preliminary account of the still very fragmental results, obtained with the aid of three salaried fishermen.

One of these used a nine-ton cutter and fished either within the three-mile limit or not very far outside. His net has a nine-meter beam and the meshes of the cod end are about 1.5 centimeter (measured along the side of the mesh).

Another used an open boat and a smaller shrimp net, with a six-meter beam and meshes of 12 millimeter in the cod end.

The boats of this kind do not fish outside the three-mile limit. Very often they are at work within a few hunderd meters from the shore.

The third used no boat, being a hand shrimper, and fished on the strand near Ostend.

All three have been working for us at least one day in every week; the other six days they generally spent fishing for themselves.

A. Total Numbers of Undersized Fishes Captured by the Three Fishermen when Fishing for the Scientific investigations

I. Cutter O 13

The following numbers of each species were caught in 44 days work, extending from July 31, 1906, to May 10, 1907.

In addition to the few commercially important fishes, the tables give also the number of small unmarketable species captured at the same time. The dead bodies of these when thrown overboard become mostly the prey of crustaceans, especially of *Portunus holsatus*, so abundant in the vicinity of the shore as to be a nuisance to the shrimpers. Their destruction involves a great loss of food for the larger fishes.

Table 1: Total Number of Undersized Fishes Captured in 44 Days of Work

Solea vulgaris	288	*Trigla hirundo*	161
„ *lutea*	58	*Trachinus vipera*	44
Pleuronectes platessa	1592	*Cottus scorpius*	182
„ *limanda*	2674	*Clupea sprattus*	3075
„ *flesus*	64	*Gobius minutus*	2912
Rhombus maximus	2	*Callionymus lyra*	219
„ *laevis*	2	*Liparis vulgaris*	1644
Arnoglossus laterna	115	*Agonus cataphractus*	1322
Merlangus vulgaris	397	*Raja clavata*	211
Gadus luscus	66	Total:	15028

II. Open Boat O 5

The open boat „Vélo" O 5 of 2 tons has been fishing for us on 216 days, extending from March 23, 1905, to May 6, 1907.

Table 2: Total Number of Undersized Fishes Captured in 216 Days of Work

Solea vulgaris	3119	*Trigla hirundo*	454
„ *lutea*	78	*Trachinus vipera*	766
Pleuronectes platessa	1751	*Cottus scorpius*	1181
„ *limanda*	1958	*Clupea sprattus*	10438
„ *flesus*	713	*Gobius minutus*	9223
Rhombus maximus	17	*Callionymus lyra*	181
„ *laevis*	4	*Liparis vulgaris*	7401
Arnoglossus laterna	306	*Agonus cataphractus*	2025
Merlangus vulgaris	1852	*Raja clavata*	810
Gadus luscus	463	Total:	42719

III. Hand Shrimper

In 31 days, extending from July 27, 1906, to November 11, 1906, the following captures were made:

Table 3. Total Number of Undersized Fishes Captured in 31 Days of Work

Solea vulgaris	10	*Trachinus vipera*	13
Pleuronectes platessa	1231	*Clupea sprattus*	503
„ *limanda*	2	*Gobius minutus*	168
„ *flesus*	1	*Liparis vulgaris*	7
Rhombus maximus	41	*Agonus cataphractus*	1
„ *laevis*	5	Total:	1982

NB. The fishes above the minimum size are not included in the tables.

B. Estimate of the Total Quantity of Undersized Fish Annually Destroyed

A gross estimate of the total destruction of young fish taking place on the Belgian coast may be deduced from the figures in the tables above.

I. Average Catch of One Boat in One Day

The average quantity of small fishes captured by one boat in one day is given in table IV, for each of the three methods of fishing under study.

Table 4: Average Catch in One Day

	Cutter O 13	Open boat O 5	Hand shrimper
Solea vulgaris	6.54	14.43	0.32
„ *lutea*	1.31	0.36	
Pleuronectes platessa	36.18	8.10	39.70
„ *limanda*	60.77	9.06	0.064
„ *flesus*	1.45	3.30	0.032
Rhombus maximus	0.045	0.078	1.32
„ *laevis*	0.045	0.018	0.16
Arnoglossus laterna	2.61	1.41	
Merlangus vulgaris	9.02	8.57	
Gadus luscus	1.50	2.14	
Trigla hirundo	3.65	2.10	
Trachinus vipera	1.00	3.54	0.41
Cottus scorpius	4.13	5.46	
Clupea sprattus	67.61	48.32	16.22
Gobius minutus	66.18	42.69	5.41
Callionymus lyra	4.97	0.83	
Liparis vulgaris	37.36	34.26	0.22
Agonus cataphractus	30.04	9.37	0.032
Raja clavata	4.79	3.75	

II. Average Catch of one Boat in one Year

It may be assumed that our fishermen, who are hard workers and daring seamen, undeterred by rough weather, go to sea four days out of seven. That gives them 208 working days in the year. Table V gives the average catch obtained in one year by each of the two boats, fishing on their own account.

Table 5: Average Annual Catch of One Boat

	Cutter O 13	Open boat O 5	Hand shrimper
Solea vulgaris	1360	3001	Number of working days very variable
„ *lutea*	272	74	
Pleuronectes platesssa	7525	1684	
„ *limanda*	12640	1884	
„ *flesus*	301	686	
Rhombus maximus	9	16	
„ *laevis*	9	3	
Arnoglossus laterna	542	293	
Merlangus vulgaris	1876	1782	
Gadus luscus	312	445	
Trigla hirundo	759	436	

	Cutter O 13	Open boat O 5	Handshrimper
Trachinus vipera	208	736	Number of working days very variable
Cottus scorpius	860	1135	
Clupea sprattus	14062	10050	
Gobius minutus	13765	8879	
Callionymus lyra	1033	172	
Liparis vulgaris	7770	7126	
Agonus cataphractus	6248	1948	
Raja clavata	996	780	
	70523	37918	

III. Average Catch of the Whole Fleet in One Year

The total number of vessels using a shrimp trawl of exactly or nearly the same size as that of our experimental cutter, amounted, in 1906, to 289, for the whole of the Belgian coast. Multiplied by this number, the average annual catch of each species gives the total of the fish destroyed in one year.

The number of open boats using a smaller trawl was 164.

Table 6: Average Annual Catch of the Whole Shrimping Fleet

	Cutters	Open boats	Hand shrimpers
Solea vulgaris	393040	492164	?
„ *lutea*	78608	12136	
Pleuronectes platessa	2.174725	276176	
„ *limanda*	3.652960	308976	
„ *flesus*	86989	112504	
Rhombus maximus	2601	2624	
„ *laevis*	2601	492	
Arnoglossus laterna	156638	48052	
Merlangus vulgaris	542164	292248	
Gadus luscus	90168	72980	
Trigla hirundo	219351	71504	
Trachinus vipera	60112	120704	
Cottus scorpius	248540	186104	
Clupea sprattus	4.063918	1.648200	
Gobius minutus	3.978085	1.456156	
Callionymus lyra	289537	28208	
Liparis vulgaris	2.245530	1.168664	
Agonus cataphractus	1.805672	319472	
Raja clavata	287844	127920	
	20.388083	6.745320	

The quantity of fish captured by hand shrimpers on the coast cannot be even grossly calculated. Their number is not known, but is certainly very small. Hand shrimping has been declining to next to nothing for the last thirty years. It is now restricted nearly entirely to the women belonging to the poorest class of fishermen. They fish very irregularly, some do it quite accessorily, only when they find no other work to do. Their catch in shrimps is always very small compared with that of the trawlers.

Nevertheless, they could be very harmful to the young flat fishes living quite close to the strand, especially to the plaice, also to the turbot and the brill, valuable fishes of which the sea is nowhere overcrowded and which are worthy of special protection.

Remarks:

1. The numerical data obtained from the normal working of three fishermen, important as they may appear, are very much below those published by other observers in other places.

Prof. HERDMAN, in the Report of the Lancashire sea Fisheries of 1901, p. 229, says that 567 young plaice are the average number taken in one haul by shrimpers on the grounds at the mouth on the river Mersey, during July, August and September.

I believe that these very high figures are due to local and temporary conditions. It is a recognised fact that young plaice congregate in particular spots at certain times in the year. We have such places along the Belgian coast. The well known Trapegeer, an extensive coastal bank, is one of them. Plaice and dabs accumulate there in great abundance in the summer months. Formerly, some twenty-five years ago, it was customary for the Ostend fishermen to go there after Easter, when the presence of small flat fishes was noticed, and they fished enormous quantities of small plaice, under 25 cm. Nowadays great accumulations of young plaice and dabs may still be observed at the same place, but not by any means approaching the large shoals of former times and the size of the fish has also greatly diminished. The after Easter fishing on the Trapegeer has been entirely given up. I have fished myself as many as 550 flat fishes in one haul on the same place, all under 18 centimeters, but the next day the shoal had left the place, and was nowhere to be found.

If the many hundred millions, by which the destruction of young plaice is believed to be measured in other localities, are not a very much too high estimation, the Belgian coast is not what it was supposed to be: a rich nursery for flat fishes.

We know that some of our boats have a somewhat higher fishing power

than the cutter from which we have collected continuous series of observations. The small luggers of La Panne are among them. But, as a matter of fact they destroy less undersized fish because they very often fish outside of the littoral waters, as far as fifty miles from the shore. I believe that the cutter gives a fairly good average of the destruction of undersized fish by that class of net, during the course of the year, (if the entire coast is taken into consideration).

Recently, however, I have arranged with one of the La Panne luggers to work on the same lines as the three Ostend men, for a year or two.

2. Our statistical tables show that very few young plaice, dabs and flounders are caught before June, just as the case seems to be on the Lancashire coast. Young soles however, sometimes but not every year, appear in good number a little earlier.

A conclusion that clearly comes out of the facts obtained from the whole of our fishing experiments is, that the prohibition by the Belgian law of fishing in territorial waters during April and May, is of no avail as to the generality of flat fishes. If this prohibition is to be maintained at all, it ought to be moved from April—May to June, and extended until the end of September.

I do not, however, advocate the reinforcement, or even the maintenance, of a prohibition so vexatious to the fishing population, as long as its efficacy has not been unquestionably demonstrated by scientific researches. On the contrary, I would rather suggest that the Government, as a temporary experiment, stop the prohibition entirely for three years. If, after that period a reduction in the average catch of small fish by the trawl and hand shrimpers is ascertained, the local efficacy of the restriction would be proved, and some restrictive regulations could be put into force again, provided that similar legislation be eventually adopted by all countries on whose shores the same biological conditions are prevailing.

2. Limit Size and Proportion of Escapes

Experiments with nets partly covered with very fine netting have been continued ever since an account of the first series was presented to the meeting at Copenhagen, in 1905.

145 experiments with an ordinary beam trawl have thus far been made. The meshes in the cod end were 2.5 centimeter, measured along the side.

In 125 of them the cod end and pockets were covered with or rather included in a bag of fine cotton netting with meshes of about 1 centimeter square.

In an other set of recently started researches, the posterior part of the dorsal portion of the trawl, in front of the cod end and between the pockets, was covered with the same fine netting. 20 hauls only have been hitherto recorded.

A. Limit size

From the covered cod end experiments, the size of the largest flat fishes that actually escape through meshes of 2.5 centimeter, is as follows:

Solea vulgaris ..... 18 cm. in length
Pleuronectes platessa ..... 11 „ „
„ *limanda* [1]) .... 9 „ „

Specimens above these sizes are very rarely found in the covering net. Some, however, may be forcibly pushed out under the pressure of the contents of the net.

The largest specimens accidentally found in the covering must have passed through some rent in the cod end.

B. Percentage of Fishes under the Limit Size retained in the larger Net

Table 7: *Solea vulgaris*

Number of the haul	Cod end	Covering	Percentage of escapes %	Number of the haul	Cod end	Covering	Percentage of escapes %
101	4	7	63	173	19	34	64
105	1	12	92	178	133	6	4
107	5	15	75	185	8	9	53
109	1	18	95	186	12	20	62
111	4	15	79	194	14	59	81
116	6	4	40	218	5	11	69
123	10	5	33	226	7	3	30
128	4	8	67	253	2	8	80
165	5	5	50				

Table 8: *Pleuronectes platessa*

Number of the haul	Cod end	Covering	Percentage of escapes %	Number of the haul	Cod end	Covering	Percentage of escapes %
98	26	25	49	106	18	32	64
99	22	56	72	107	67	127	65
100	8	7	47	109	38	20	34
103	8	14	64	111	66	72	52
105	8	11	58	115	61	87	59

[1]) Concerning *Pleuronectes flesus* we were unable to collect positive facts. The specimens caught were all too large to escape. Young flounders, on our coast, live mostly on muddy bottom where very few other fishes are caught. We assume that its limit size is very nearly that of the plaice.

As to the ray, it is only accidentally that they can escape, even immediately after they have been hatched.

Number of the haul	Cod end	Covering	Percentage of escapes %	Number of the haul	Cod end	Covering	Percentage of escapes %
116	35	45	56	181	14	28	67
118	27	2	7	186	51	49	49
119	37	36	49	195	6	15	71
120	13	8	38	197	3	22	89
123	59	74	56	208	78	34	30
126	29	78	73	210	39	2	5
128	78	130	62	217	5	25	83
129	8	9	53	218	68	4	5
159	175	113	39	233	50	12	19
161	56	5	8	242	8	17	68
162	182	70	28	243	18	43	70
163	292	353	55	246	36	132	79
167	5	13	72	253	59	64	52
168	11	5	31	257	138	10	7
169	15	1	6	263	35	31	47
170	17	3	15	266	27	3	10
177	93	48	34				

Table 9: *Pleuronectes limanda*

Number of the haul	Cod end	Covering	Percentage of escapes %	Number of the haul	Cod end	Covering	Percentage of escapes %
101	32	131	80	186	3	44	94
105	1	20	95	208	10	7	41
106	1	22	96	210	38	29	43
107	8	56	87	233	1	27	96
109	3	16	84	234	2	38	95
111	4	47	92	236	7	12	63
115	5	148	97	242	1	47	98
116	25	196	89	244	7	16	70
118	9	35	80	253	23	211	90
119	18	74	80	257	25	44	64
123	91	127	58	259	1	23	96
126	4	22	85	261	62	15	19
128	2	26	93	263	56	500	90
159	16	4	20	264	3	17	85
162	35	2	5	265	13	15	54
179	2	24	92	266	22	40	63
181	31	117	79				

The proportion of small fishes under the limit size that, in a given case, do not escape from the cod end, is extremely variable. It depends on the quantity and nature of the material which accumulates in the net. When an experimental trawl dragged on a barren sandy bottom meets and catches a shoal of small fishes without picking up any other material and no larger fish, the total amount of the shoal may, and very likely will, escape from the cod end, and be found in the covering. Such cases have been observed and are to be found in the tables.

On the other hand, if the same net, partly filled up with *Flustra, Alcyonidium*, polyps, starfishes, medusae and large fishes, meets the same shoal, it is quite possible that very few or even no fish will escape, the whole lot being stopped by the obstructing material and buried under the mass of similar objects picked up afterwards. Such seems to have been the case in some of the hauls recorded.

It is to be noted also that the meshes may be made very nearly unpassable through the powerful traction of some heavy objects captured, like a stone or an accumulation of large fishes.

Obviously short hauls leave to the small fishes more chance of escape than longer ones, not only because these occasion the death of the fish caught, but also on account of the obstruction of the meshes by the voluminous and heavy contents.

All these facts must be taken into account in discussing the possible effects of the adoption of a minimal size of meshes. Larger meshes will certainly allow the escape of a larger number of fishes and of larger fishes. But even the largest in use will occasionally, and especially during long hauls, capture quantities not only of young fishes but also of much smaller animals, like shrimps and schizopods, that are sometimes found by the thousand among the contents of even the coarsest nets used by the steam trawlers.

3. Nets to Catch the Shrimps and Spare the Fish

Some nets used by the shrimpers in other countries are said to capture the shrimps fairly well and notably to reduce the destruction of small fishes. One of them, the so called "Shank net" used on the Lancashire and Irish coasts, is "a net like a trawl, but having the beam, foot rope, and irons replaced by a rectangular wooden frame. A further improvement consists in attaching the lower edge of the net, not to the lower bar which drags on the ground, but to another bar placed two or three inches above it"[1]. The idea is that the shrimp, when disturbed by the wooden bar, jumps high enough to clear the second bar and be caught by the net, while the fish swims low and, passing under the bar, escapes capture.

Having, through the kindness of Mr. Holt, obtained a shank net from the Department of Agriculture at Dublin, I had it submitted to a series of experiments, comparatively with an ordinary shrimp trawl of the same size.

[1] Herdman, Lancashire Sea-Fisheries Laboratory. No. X. Report for 1901. p. 230.

Although 207 hauls have been made, all directed by myself, I still consider that it would be premature to present an account of all the work done and to formulate definite conclusions. A very cursory sketch of the methods adopted, — intended for the naturalists engaged in the same kind of work — can only find place in this preliminary report.

I have been trying, at first, to use the shank net and the shrimp trawl successively, during half an hour each, and to drag them from the same initial to the same final points.

It was soon discovered, however, that no two successive hauls could ever be found exactly equivalent, even when all circumstances of time, net, place, rapidity and depth remained apparently unchanged.

Two nets were then shot, dragged and hauled up simultaneously and from the same ship, but with no greater success: the two contents were sometimes very different, both in quantity and quality.

Another method was then resorted to: two shrimp-nets were used, attached to the frame of a shank net, one above the other, — the object being to compare the quantities of fish and shrimps that pass under the normal net and avoid capture, to those which, having jumped above the bar, enter the normal net and are caught.

The lower net is acting as a witness giving evidence as to the reality and importance of the fish-saving power of the shank net.

The results of a number of hauls will be found in the final report.

There is no doubt that a certain number of fishes pass under the bar of the shank net and escape: we find them in the test net. A large number, however, when disturbed by the wooden frame, swim over the middle bar and are captured. On the other hand, more shrimps are often found in the normal net than in the test net below. But, when the bar is placed high enough to allow a satisfactory proportion of flat fishes to escape, the quantity of shrimps that does not jump high enough and is lost for the fisherman is not at all inconsiderable. If, thus, the shank net gives some partial satisfaction as to the protection of the fish, it does not recommend itself to the shrimper, under the circumstances prevailing in our shrimping grounds. In addition to that, the shank net cannot be made large enough to equal the catching power of the trawl commonly used, without becoming very inconvenient to the boat. It is hardly to be expected that our shrimpers could ever be induced to adopt it and give up their large and very handy trawls.

I have attempted also to modify the ordinary shrimp trawl so as to reduce its fish-catching power without greatly diminishing its shrimping qualities. Some rather satisfactory results have hitherto been obtained, and will be eventually made known after being submitted to serious test during the coming summer months.