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SWEDISH HERRING TAGGING EXPERIMENTS 1949-1953.

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Contents.

Introduction.

The Swedish herring tagging work started with a tentative trial in March 1949 (see Rapp. et Proc.-Verb., Vol. 128, 1951, p.52) and since then it has been continued every year.

This report is intended to be only a brief account giving the main points of our tagging work and the results obtained. A more comprehensive paper on the subject is under preparation for publication at a later date.

The Technique.

The tag used by us has been, without any exception, the Lea hydrostatic tag. It is attached to the back of the fish by a stainless steel wire hinge consisting of a U-shaped link articulating with a transverse rod (see fig. on p.276 in Journ. du Conseil, Vol. XIX, No.2, 1953). In one experiment, however a simplified method of attaching was tried for the purpose of comparing it with the usual one. The efficiency of this simplified method proved to be very low and it was therefore abandoned.

An essentiel part of the Swedish technique is that length measurements are made and scale samples taken in connexion with the tagging operation.

As an absolute minimum a team of two men is needed to carry out the tagging, but, since the work is usually made on board a research vessel, more men as a rule are engaged. With a team of five men the tagging speed can reach a maximum of 60 fish an hour.

When operating in the archipelago of the eastern Skagerak we have taken the live herring from pound-nets; on the other hand the live herring were trawl-caught in the North Sea experiments. On practically every tagging expedition we have suffered from a constant shortage of live fish. This fact, not the meticulous tagging technique, has been the main restrictive factor in our tagging work.

The Taggings.

The tagging experiments have been executed twice yearly; firstly in late winter and/or early spring in the archipelago of the northern west coast of Sweden, i.e. eastern Skagerak; secondly in late summer and/or early autumn in the North Sea.

During the five years 1949-53 a total number of 8991 herring have been tagged out of which 6465 were released in the eastern Skagerak and 2526 in the western North Sea. Owing to the difficulty of getting sufficient supplies of live fish we have mostly had to be content with what we could get. Rarely have we been able to make any selection from the catches and consequently the composition of our releases will be mostly of the same mixture as in the catches with regard to herring types and year-classes. Thanks to the length-measurements and the scale samples and also to the notes regarding the maturity stage, so far as this can be seen externally, and lastly, of course, the recaptured fish, there is a possibility of establishing, at least approximately, what kind of herring we have liberated. Such data are necessary when it comes to estimating the percentage recoveries of each separate type and year-class.

Table 1.

Liberations and returns from tagging experiments in the Northern Bohuslän area.

Experiment No.	Year	Month	Number liberated	Number recovered 30.6.54
1	1949	March	525	23
3	1950	February-March	1016	155
		April-May	800	72
5	1951	April-May	1164 + 499[+)]	187 + 26
7	1952	April-May	461	82
9	1953	March-April	2000	318
		Total	5966 + 499	837 + 26
		Sum total	6465	863

[+)] 499 fish were tagged by the simplified attaching method.

Table 2.

Liberations and returns from tagging experiments in the North Sea.

Experiment No.	Year	Month	Area	Number liberated	Number recovered 30.6.54
2	1949	August	Fladen Gr.	399	2
4	1950	Aug.-Sep.	Fladen Gr.	124	2
6	1951	Aug.-Sep.	Fladen Gr.	464	3
8	1952	Sep.-Oct.	Dogger B.	498	11
10	1953	September	Fladen Gr.	128	3
		Sep.-Oct.	Dogger B.	913	28
		Total		2526	49

In the following section a very brief survey of the various experiments will be given, beginning with those made in the eastern Skagerak. A summary of the liberations is given in Tables 1 and 2.

Taggings in the northern Bohuslän archipelago (see Table 1).

E x p e r i m e n t No. 1. (See Rapp. et Proc.-Verb.,Vol.128, 1951, p.52) was carried out on board R/S "Skagerak" during the period March-4-14th. The first batch of 153 fish was caught in set-nets and thus formed an exception to the rest of this as well as to all subsequent eastern Skagerak experiments in which pound-net-caught live herring were used. The number of tagged herring amounted to 525 of which about half were spring spawners and half autumn spawners. This is, however, a very rough computation, since the method of taking length measurements and scale samples was not introduced until the first half of the experiment was over.

E x p e r i m e n t No. 3 in 1950 was divided into two periods; the first one lasting from February 10th to March 23rd, 1950, inclusive, the second from April 26th to May 5th, 1950, inclusive.

During the first period, when the taggings were made from R/S "Skagerak" a total of 1016 fish were liberated, out of which approximately 67% were spring spawners, 29% autumn spawners, and 4% indefinable.

In the second period when the work was carried out from a landing-stage, 800 fish were liberated. This time the autumn spawners predominated making 67%; the spring spawners made 29%, and 4% were indefinable.

In the middle of March Dr. E. Bertelsen from Denmark paid us a visit on board the "Skagerak". His intention was to make taggings with the Danish flag-tag simultaneously with our tagging with the Lea tag in order to compare the two methods. Unfortunately, the all too few days he had at his disposal coincided with a period of very meagre live herring supply, so our joint experiment was somewhat of a failure.

E x p e r i m e n t No.5, 1951, took place during the period April 11th-May 9th. For this experiment R/S "Eystrasalt" was used. In all 1663 tagged herring were liberated outside the archipelago of northern Bohuslän. The distribution was approximately: 74% autumn spawners, 23% spring spawners, and 3% indefinable. It was this year that the simplified method of attaching the tag was applied on 499 fish. Thus in reality only 1164 herrings were tagged by our ordinary method.

E x p e r i m e n t No.7, 1952. This year the tagging was carried out also from "Eystrasalt" firstly on two occasions in March, the 12th and the 26th, secondly in the period from April 17th to May 5th inclusive. Unfortunately, the catches in the pound-nets all through this experiment were remarkably small and the total number of releases amounted to 461 only, of which about 76% were spring spawners and 24% autumn spawners.

The scarcity of live herring, particularly during the second period, was all the more regrettable as Mr. B.B.Parrish from Aberdeen had joined us on "Eystrasalt" in order to perform comparative taggings with the Scottish one-man toggle. Our joint experiment thus comprised 475 liberated fish only out of which 238 were Scottish-tagged and 237 Swedish-tagged.

E x p e r i m e n t No.9, 1953, was carried out from "Eystrasalt" during the period March-April (March 13th-April 29th). The live herring supply this year was fairly good and exactly 2000 tagged herring were liberated, about 64% spring spawners, 34% autumn spawners, and about 2% indefinable.

Taggings in the North Sea (see Table 2).

E x p e r i m e n t No.2, 4 and 6 were all carried out in the Fladen Ground area in August 1949, August-September 1950 and August-September 1951. In 1949 and 1951 R/S "Skagerak" was used but in 1950 we had at our disposal only a small fishing-cutter, not very suitable for herring-trawling. On the whole we had very bad luck in these three experiments so the liberated herrings were not numerous, being 399, 124 and 464 respectively, and not in the very best condition.

E x p e r i m e n t No.8, 1952, was performed from the "Skagerak" in the Dogger Bank area, mainly in the vicinity of Outer Rough, during the period September 29th-October 17th which, unfortunately, coincided with a period of mainly very unfavourable weather. 498 herrings were tagged, all of them probably were autumn spawners.

E x p e r i m e n t No.10, 1953, was divided into two parts: the first on three days at the beginning of September, the 5th, 7th, and 8th, and the second during the period September 17th-October 8th. During the first period taggings were carried out SW of Fladen Ground and the intention was to concentrate upon spent herring. Owing to bad luck with the weather only 128 fish were liberated. The second period was spent in the Dogger Bank area and this time conditions were favourable. When913 fish were liberated our supply of tags was used up and the taggings had to be stopped. All taken together the liberations thus amounted to 1041 in this experiment.

Technical Results.

A very brief survey of the recoveries from the various experiments is given in Tables 1 and 2 (p.2).

A more comprehensive review of the results is given in the appendant tables 3-9. In these recaptures from all experiments, with the exception of Nos. 2, 4 and 6, are listed with regard to time at liberty and distance between the point of liberation and the place of recapture.

The experiments 2,4 and 6 on the Fladen Ground in 1949, 1950 and 1951 did not result in more than 2,2 and 3 recaptures respectively, and these were made not very far from the point of liberation.

The Time at Liberty.

For the sake of perspicuity Table 10 gives a summary of the days at liberty for all recoveries from the experiments carried out in the eastern Skagerak district.

Table 10.

Experiment No.	Year	Number of fish liberated	Nos. of fish recaptured within the following days at liberty				Total No. recovered
			0-350	351-750	751-1100	▸1100	
1	1949	525	19	3	1		23
3	1950	1816	174	43	8	2	227
5	1951	1663	183	26	3	1	213
7	1952	461	66	14	2		82
9	1953	2000	247	71			318
Totals		6465	689	157	14	3	863

The comperatively high number of long-time recoveries gives an idea of the survival of the tagged fish, and consequently of the efficiency of the tagging method.

Bleeding.

Through the attaching of the tag the bloodvessels in the back of the fish are often hurt with the effect of a more or less heavy haemorrhage from the tag wound. In order to ascertain the influence of the bleeding upon the rate of survival notes were made in the last half of experiment No.9, 1953, about the "bleeders" and "non-bleeders". Out of 1090 fish liberated 673 were "non-bleeders" and 417 were "bleeder Up to June 30th 1954 12.3% of the"non-bleeders" and 10.6% of the"bleeders" were recaptured. These figures indicate that bleeding is by no means as fatal as might be expected.

The Manner of Recovery.

The tags are intended to be as conspicuous as possible, and for several reasons the purpose of the tagging experiments will naturally be best served when the recaptures are discovered by the fishermen at the time of the catch. Fortunately,

this has also been the case in the majority of our recapture. But sometimes it happens that the tagged fish passes unobserved through several hands before it is discovered.

In our records the finders of the tags are divided into four main categories: 1. Fishermen, 2.Wholesalers, curers etc., 3. Retailers, and 4. Consumers and in Table 11 the percentages in which the recoveries have been made by the various categories are given. The figures are based upon the total number of 912 returned tags.

Table 11.

Finders	Tag and fish	Tag only	Total
Fishermen	59,2%	28.1%	87.3%
Wholesalers	3.4%	1.2%	4.6%
Retailers	4.1%	1.5%	5.6%
Consumers	1.2%	0.9%	2.1%
Others		0.4%	0.4%
	67.9%	32.1%	100.0%

Tag + Fish or Tag only.

We are, of course, very anxious that not only the tag but also the fish is returned to us. Unfortunately, the number of tags returned without fish is rather high amounting to about one third of the total (see Table 11). In some cases the wrong herring has been sent with the tag. As a rule this has been done unintentionally, but in a few cases deliberate falsifications have been disclosed.

The Type of Gear

by which the recaptures have been made is manifold. The following list gives the relative frequency of the various fishing gears, which have served our tagging experiments. The percentage figures are computed from the total number of 912 recaptures:

1.	Herring bottom trawl	30.8%
2.	Mackerel drift net	19.8%
3.	Herring set net	16.5%
4.	Purse seine	4.3%
5.	Pound net	4.2%
6.	Pelagic trawl	4.0%
7.	Shore seine	3.5%
8.	Set net for flatfish, cod etc.	3.3%
9.	Fish trawl	2.7%
10.	Ripper & "häckla"	2.1%
11.	Prawn trawl	1.1%
12.	Herring drift net	1.1%
13.	Mackerel set net	0.7%
14.	Danish seine	0.4%
15.	Other sources	5.5%
		100,0%

As to the nationality of the finders the recaptures are distributed as follows:

1.	Swedish	64.0%
2.	Norwegian	14.9%
3.	Danish	9.5%
4.	German	7.3%
5.	Dutch	1.9%
6.	French	1.1%
7.	English	0.5%
8.	Scottish	0.4%
9.	Belgian	0.3%
10.	Greek	0.1%
		100.0%

Comparison between the Efficiency of the Scottish and Swedish Tagging Methods.

In April 1952 Mr. Parrish and I arranged a joint experiment in order to compare the relative merits of the two different methods used in Scotland and Sweden. The catches of live herring from pound-nets were divided into two parts as equal as possible with regard to number and size of fish and were shared evenly between us. The handling of the fish before and after the tagging procedure was exactly the same.

Details concerning the recoveries up to June 30th 1954 are given in Table 6. (see p.13) From the joint experiment 18 (= 7.56%) of the Scottish tags and 49 (= 20.67%) of the Swedish tags were recovered; that is to say, the Swedish method turned out to be 2.7 times as effective as the Scottish one.

The cause for one method being more efficient than another may be threefold. Firstly some part of the cause may be found in the tags themselves. With regard to this point I cannot enter upon a comparison, but it must be stressed that the Lea tag has the very great advantage of containing a letter in which full instructions are given to the finder about the purpose of the tagging and how to deal with the find.

Secondly the cause may be sought in the attaching gear. Here two factors are important: the possibility of the tag being shed from the still living fish and the possibility of the tag gradually bringing about a lethal injury to the fish.

Thirdly the handling of the fish during the tagging operation must be of great importance. In the Scottish method the operator grasps the fish with the bare hand. In the Swedish method the touching of the fish by human hand is avoided as far as possible and the fish is kept constantly in circulating sea-water.

The Scottish method is beyond comparison much quicker than the Swedish. One single trained operator is able to tag 3-4 herrings by the Scottish method within the same time as a Swedish team of 4-5 men are tagging one fish. Consequently the Scottish method is several times cheaper than the Swedish.

One must, however, take into consideration that the length-measurements, the taking of scale samples and the necessary protocolling are factors by which the working speed is greatly delayed. These factors do not exist in the Scottish method. The information about the liberated fish given by this extra burden of work is, in my opinion, so valuable that the reduction of the tagging rate is compensated many times over.

When estimating the relative merits of different tags and different attachments one must, of course, take into account under which field-conditions the tagging work is intended to be executed. It is, for instance, quite out of the question to use the Swedish manner of tagging on a commercial fishing-boat.

The Results from a Biological Point of View.

The purpose of the tagging experiments is first and foremost to obtain information about the migrations of the herring. Secondly one might expect to get at least some hints about the fisheries' taxation of the herring stocks.

Furthermore the experiments, as applied by us in Sweden, have yielded valuable informations as to the rate of growth of the herring or, more correctly, the growth rate of the herring scales.

The Migrations.

In this report I shall restrict myself mainly to discussing very briefly the long-distance migrators to, within, and from the North Sea. Reference is made to the appendant Charts 1 and 2. It must bed noticed that most of the long-distance recaptures in the open North Sea have been autumn-spawners. None could be identified with absolute certainty as a spring-spawner.

As will be seen from Chart 1 recoveries from the eastern Skagerak experiments, however, are distributed almost all over the whole North Sea, from Walker Bank in the north to Dover Strait in the south. The distribution is not even, showing instead a grouping on the most prominent herring fishing grounds. Table 12 shows how the recoveries on the various "grounds" are scheduled in accordance with the seasonal changes in herring fishery.

In Chart 2 the recoveries from the 1952 and 1953 experiments in the North Sea are plotted. These, too, exhibit the same kind of grouping, and, as is shown in Table 13, they follow the same time-table.

There are several striking features to be found when studying Charts 1 and 2 and Tables 12 and 13. Most unexpectedly for instance, at least to me, is the indication of a herring-communication between the Skagerak and the Sandettie area. Another interesting feature, though negative, is, that not a single recapture from the liberations in the Skagerak has been made by the Scottish driftnet fishery.

The Charts in connexion with the "time-tables" indicate fairly clearly that the main part of the stocks of autumn-spawning herring in the North Sea is involved in a huge anti-clockwise circular movement with one revolution yearly.

Table 12.

"Time-table" for 77 of the recoveries in the North Sea from experiments Nos. 1, 3, 5, 7, & 9 (1949-1953), see Chart 1.

Area of recapture / Months	Egersund Bank	Fladen Ground	The Gut	Dogger Bank	Off Whitby	West Hole	Sand ettie	Horn Reef	Off Hanst-holm
January									
February								1	
March									
April									
May									
June									
July		1							
August	5	8							
September	2	4	4	16	3				
October			1	22	1				1
November				4		1	3		
December									
	7	13	5	42	4	1	3	1	1

Table 13.

"Time-table" for 22 recoveries from experiments Nos.8 & 10, see Chart 2.

Area of recapture / Months	Dogger Bight	Winterton Shoal	Sandettie	Skagerak	Fladen Ground
September	2				
October	4				
Nov. 1st half		2			
Nov. 2nd half			3		
December			1		
January				1	
February				6	
March				1	
April					
May				1	
June					
July					
August					1
	6	2	4	9	1

The detailed route of each separate recaptured fish cannot, of course, be traced in the Charts. To this extent the dotted lines between the places of liberation and recovery are misleading. It is not likely, for instance, that the three migrators from Skagerak to Sandettie should have taken the straight course indicated in Chart 1, or that the fish in Chart 2 that was liberated on the Doggor Bank in the autumn 1952 should have moved straight away to the Fladen Ground where it was refound in August 1953.

For various reasons the three herring liberated SW of the Fladen Ground and recaptured in the Skagerak deserve particular mention. All three were tagged on the 7th of September 1953 at pos. 57°46'N; 00°08'E and were protocolled as indubitable spents, thus probably belonging to the herring stock which spawn in August and September not far from the place of tagging. Two of them were recaptured N of Jutland on the 2nd and 3rd of February 1954; but the third was recaptured 15 miles west of the middle Bohuslän as late as May 3rd.

As already mentioned we were, in the 1953 experiment in the Fladen Ground area deliberately on the look-out for spents in order to make an attempt at unravelling the movements of this type of herring. In so far we were fortunate as this type could be proved to take part in the wintering in the Skagerak; but the migration route still remains to be explored.

Fisheries Taxation.

In some of our experiments in the Skagerak the rate of recapture has been surprisingly high, in several cases between 15 and 20%; and as these are only minimum figures the taxation of the stock from the part of the fishery must be considerable. The taxation does not work indiscriminately, however, for the chances of being recaptured are widely different not only for different types of herring but also for different age-groups of the same stock.

The recoveries of spring spawners are, comparatively, much more numerous than those of autumn-spawners. The first part of experiment No.3, 1950, for instance, when the spring-spawners predominated in the releases, yielded a recovery of 15.2% while, on the other hand, the second part, when the autumn-spawners predominated, yielded only 9.0%.

As an example of the differences in the rate of recovery of the various age-groups some figures from experiment No.9, 1953, may be quoted. In this experiment a total of 2000 fish were liberated of which 1293 were spring-spawners, 674 were

autumn-spawners and 33 were indefinable.

In Table 14 below the distribution of the age-groups of the spring-spawners is given as well as the absolute and percentage numbers of recapture.

Table 14.

Spring-spawners in exp.No.9

No. of winter rings	No. liberated	No. recaptured	% recaptured
1	68	21	30.9
2	607	147	24.2
3	67	20	29.8
4	39	6	15.4
5	104	14	13.5
6	43	6	14.0
7	244	25	10.2
>7	121	11	9.1
	1293	250	19.3

It should be noticed that the recoveries of the autumn-spawners in the same experiment amounted only to 9.3%.

There is no doubt that the very high rate of recapture in the youngest age-groups of the spring-spawners is due to the fact that these herrings as our tagging results show do not generally make any long distance movements but mainly remain within the archipelago where, in places, the fishing intensity is, comparatively, very high.

Rate of Growth.

As a rule the condition of the recaptured fish does not permit exact determination of length increases during the period of liberty. Usually several days have elasped between the catch and the arrival of the fish at the laboratory and meanwhile shrinkage and putrefraction have set in. Only occasionally did we happen to be on the very spot where a tagged herring was recaught and were able to take length measurements of an absolutely fresh fish.

The advantage of being able to study the scales from one and the same fish at two different moments of its life is obvious in many respects. Above all it has proved to be usefull when attempting to establishing the time when the "winter-rings" are formed. Furthermore the scales can be used as evidence when it comes to veryfying whether a returned fish is genuine or not.

LEGENDS

Chart 1. Migrations from Skagerak to the North Sea. In this Chart 80 recaptures in the North Sea from experiments Nos. 1, 3, 5, 7 and 9(1949-1953) are plotted, whose positions of recapture are known for certain. The numerous recaptures in Skagerak and Kattegat are omitted.

Chart 2. Recaptures from the Dogger Bank tagging 1952 (Experiment No.8) and from the Fladen Ground & Dogger Bank taggings 1953 (Experiment No.10). (In addition to the 26 recaptures plotted in the Chart there were 16 more returns from these experiments whose points of recapture were within the area of liberation or else not precisely established).

Table 3.

Recaptures from experiment No.1, March 1949, Northern Bohuslän, 525 liberated.

Days at liberty	Distance naut.miles 0-10	11-20	21-50	51-100	101-150	151-200	201-250	251-300	301-350	Total	Sum total as %
0-10	1									1	0.2
11-20	1			1						2	0.6
21-30	1		1							2	1.0
31-50	3									3	1.5
51-100			1			1				2	1.9
101-150			2						1	3	2.5
151-200			1	1	1				2	5	3.4
201-250											
251-300			1							1	3.6
301-350											
351-400								1		1	3.8
401-450		1								1	4.0
451-500											
501-550								1		1	4.2
551-600											
601-650											
651-700											
701-750											
751-800											
801-850											
851-900											
901-950											
951-1000											
1001-1050				1						1	4.4
Totals	6	1	6	3	1	1		2	3	23	4.4

Table 4.

Recaptures from experiment No.3, late February-early May, 1950, Northern Bohuslän, 1816 liberated.

Days at liber-ty	Distance maut. miles	0-10	11-20	21-50	51-100	101-150	151-200	201-250	251-300	301-350	351-400	401-450	?	Total	Sum total as %
0-10		3	4	3		1								11	0.6
11-20		4	1	3										8	1.0
21-30		3	1	4										8	1.5
31-50		7	1	12	4	1							1	26	2.9
51-100		3	3	28	5	1								40	5.1
101-150				2	3		2			4	3	1		15	5.9
151-200			1	6	1	1	1			2	4	2	1	19	6.4
201-250		1	2	5	4	1				2		1		16	7.9
251-300		1	2	6	8								2	19	8.9
301-350			3	4	3			1					1	12	9.6
351-400		1	1	8	1								1	12	10.2
401-450		1		5	3								1	10	10.8
451-500				2	3	1				1				7	11.2
501-550					1					1		1		3	11.3
551-600				1	1									2	11.4
601-650				1	2									3	11.6
651-700				1										1	11.7
701-750			1	1	1	1							1	5	11.9
751-800				2										2	12.0
801-850				2										2	12.2
851-900						1				1				2	12.3
901-950				1										1	12.3
951-1000													1	1	12.4
1001-1050															
1051-1100															
1101-1150															
1151-1200															
1201-1250															
1251-1300				1										1	12.4
1301-1350				1										1	12.5
Totals	24	20	99	40	8	3	1		11	7	5	9	227	12.5	

Table 5.

Recaptures from experiment No.5, April-early May 1951, - Northern Bohuslän.1164 tagged by the method

Days at liberty	Distance naut.miles	0 - 10			11-20			21-50			51-100			101-150			151-200			201-250			251-300			301-350			351-400			401-450		
		I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
0-10			1		2	1		1	2																									
11-20						2		3	4	1	1						1																	
21-30							1	6	6	2	1			1																				
31-50			1		2		1	5	2			1	1		1																		
51-100			1					5	7	1	17	5	8													1								
101-150					1	1		2			10	4	3		1											2	2	1	1	1	1	1	1	
151-200					1	2		4	2		1	2			1								1			3	3					2	1	
201-250			1			1					1															1								
251-300					1	3		4					1																					
301-350		1	4				2	3	1	1	2	2																						
351-400					1	1		1	7	1	1				1																			
401-450								1	1		1	1																						
451-500																					1						1							
501-550											1				1												1							
551-600		1																																
601-650																																		
651-700												1																						
701-750																																		
751-800												1																						
801-850																																		
851-900					1																													
901-950																																		
951-1000																																		
1001-1050											1																							
1051-1100																																		
1101-1150						1																												
Totals I		2			9			35			37			1			1			1			1			7			1			3		
" II			8			12			32			18			5			-			1			-			6			1			2		
" III				-			4			6			13			-			-			-			-			2			1			-	

I: Tagged by the ordinary method, 11/4-11/4-51 and 7/5-9/5-51: 665

II: " " " " " , 27/4-7/5-51 499 } 1164

III: " " " simplified " , 27/4-7/5-51 499

Liberated

Recaptured

101 = 15.2 %
86 = 17.2 % } 187 = 16.1 % I II

26 = 5.2 % III

5.

Northern Bohuslän.1164 tagged by the ordinary attaching method;499 tagged by simplified method

201-250			251-300			301-350			351-400			401-450			451-500			501-550			551-600			?			Total			Sum-total in %		
II	III		I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II		I	II	III
						1																		1			3	4	-	0.4	0.8	0
						2	2	1	1	1	1	1	1														5	6	1	1.2	2.0	0.2
			1			3	3					2	1					1						1			8	6	3	2.4	3.2	0.8
						1																					7	5	2	3.4	4.2	1.2
						2																					23	14	9	6.9	7.0	3.0
						3																					18	10	5	9.6	9.0	4.0
						1																					14	11	-	11.7	11.2	4.0
																											2	2	-	12.0	11.6	4.0
																											5	3	1	12.8	12.2	4.2
																											6	7	3	13.7	13.6	4.8
																											3	10	1	14.1	15.6	5.0
																											2	2	-	14.4	16.0	5.0
1							1																				-	1	1	14.4	16.2	5.2
						1																					1	2	-	14.6	16.6	5.2
																		1									2	-	-	14.9	16.6	5.2
																											-	1	-	14.9	16.8	5.2
																											-	1	-	14.9	17.0	5.2
																											1	-	-	15.0	17.0	5.2
																											1	-	-	15.2	17.0	5.2
																											-	1	-	15.2	17.2	5.2
			1			7			1			3			-			2			-			2			101			15.2		
-				-			6			1			2			-			-			-			1				86			17.2	
	-				-			2			1			-			-			-			-			-			26			5.2

Recaptured

101 = 15.2 %
86 = 17.2 %
} 187 = 16.1 % I II

26 = 5.2 % III

Table 6.

Recaptures from experiment No.7, March-early May 1952, Northern Bohuslän. 461 Swedish-tagged and 341 Scottish-tagged herrings liberated.

Days at liberty	Distance naut.miles	0-10				11-20				21-50				51-100				101-150				151-200				301-350				501-550				?				Total			
		Sw		So		Sw		Sc		Sw		Sc		Sw		Sc		Sw		Sc		Sw		Sc		Sw		Sc		Sw		Sc		Sw		Sc		Sw		Sc	
		a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
0-10			3				1		1		1																							1	2		5	1	3
11-20			2	1			1	1																										1	1		4	2	1
21-30		1	2	1		1	1				1																									2	4	1	-
31-50				2			1			3																										3	1	2	-
51-100			1	2		1		1		5	7	1		1	1							1												1	2	7	9	6	2
101-150										1		1		2		1		1	1	1														2		4	1	5	-
151-200			1				3		1		1											1						1							1	1	6	-	2
201-250						1	1		1	1	2																1							1		2	4	1	1
251-300						2				1																										3			
301-350			1			1	1			1	2			2	2																					4	6		
351-400		3					1			1					1																					4	2		
401-450										1	1																									1	1		
451-500										1	1				1																					1	2		
501-550																																							
551-600																																							
601-650																																							
651-700																																							
701-750		1					1								1																					1	2		
751-800											2																										2		
Totals	Sw.a	5				6				15				4				1				2														33			
"	Sw.b		10				11				18				6				1							1												49		
"	So.a			6				2				1				2				1														1	5				18		
"	Sc.b								3				2																						6					9	

Sw.a: Recaptures from Swedish taggings before and after the joint experiments
Sw.b: " " " the Swedish part of the Joint experiment
Sc.a: " " " Scottish " " " " " "
Sc.b: " " " " taggings after the joint experiments

	Liberated		Recaptured	
Sw a	224	461	33 = 14.7%	82(17.79%)
Sw b	237		49 = 20.67%	
Sc a	238	341	18 = 7.56%	27(7.90%)
Sc b	103		9 = 8.7%	

Table 7.

Recaptures from experiment No.8 late Sept.-early Oct. 1952, Dogger Bank, 498 liberated.

Days at liberty	Distance naut.miles 0-10	11-20	21-50	51-100	101-150	151-200	201-250	251-300	?	Total	Sum total as %
0-10	1	3							1	5	1.0
11-20			1						2	3	1.6
21-30				1						1	1.8
313						1				1	2.0
492								1		1	2.2
Totals	1	3	1	1		1		1	3	11	2.2

Table 8.

Recaptures from experiment No.9, March-April 1953, Northern Bohuslän. 2000 liberated.

Days at liberty	Distance naut.miles 0-10	11-20	21-50	51-100	101-150	151-200	201-250	251-300	301-350	351-400	401-450	?	Total	Sum total as %
0-10	19	5	3										27	1.3
11-20	9	6	1	4									20	2.3
21-30	5	3	7	4									19	3.3
31-50	5	3	9	3									20	4.3
51-100		5	13	6	2							1	27	5.6
101-150		1	14	7		3		1	4	1	1	2	34	7.3
151-200	3	9	12	4				1		3	4	3	39	9.3
201-250	3	12	12	1								1	29	10.75
251-300	1	1	6	5								1	14	11.45
301-350	2		6	4				1				5	18	12.35
351-400	7	12	26	9	2								56	15.15
401-450			11	4									15	15.9
Totals	54	57	120	51	4	3		3	4	4	5	13	318	15.9

Table 9.

Recaptures from experiment No.10. September-October, North Sea (Fladen Gr., Dogger B.) 1041 liberated.

Days at liberty	Distance naut.miles 0-10	11-20	21-50	51-100	101-150	151-200	201-250	251-300	301-350	?	Total	Sum total as %
0-10	2		2	3							7	0.7
11-20				3						3	6	1.2
21-30			1			1				2	4	1.6
31-50						1		1			2	1.8
51-100								3			3	2.1
101-150								1	5	1	7	2.8
151-200								1			1	2.9
201-250									1		1	3.0
Totals	2		3	6		2		6	6	6	31	3.0

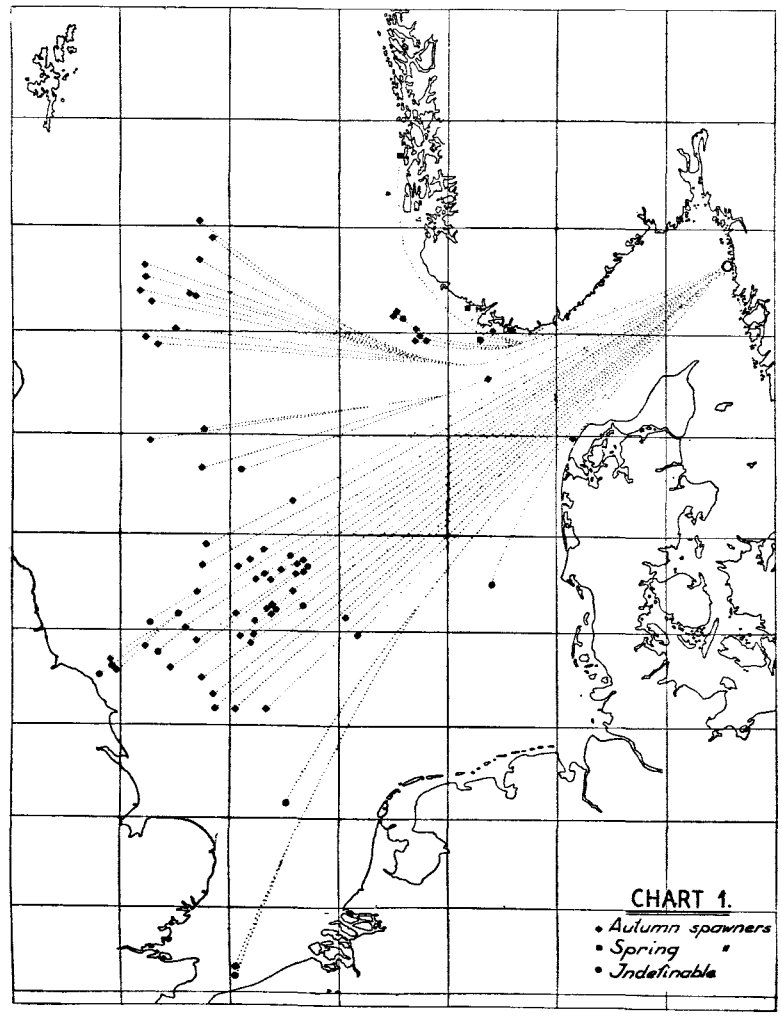
CHART 1.
• Autumn spawners
• Spring "
• Indefinable

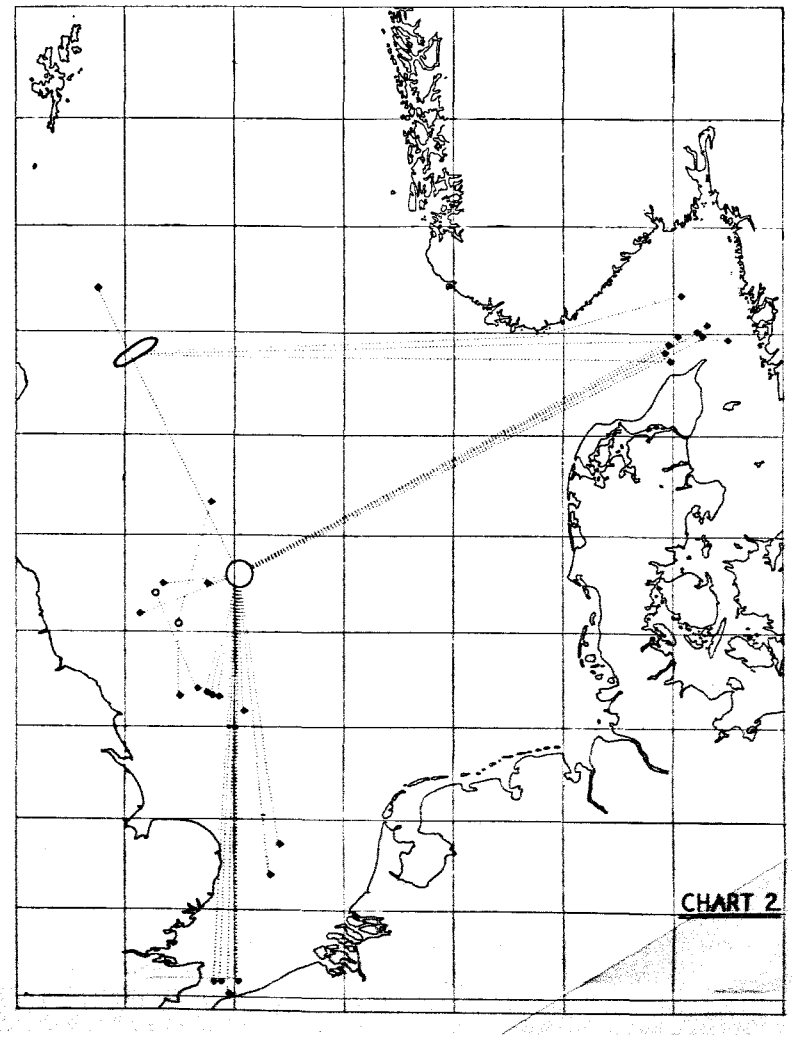
CHART 2