

I C E S
HERRING TAGGING EXPERIMENT
at
BLØDEN GROUND
Part II
(A preliminary report)

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I. The Field Work. A. Work at Sea

1. Scientific Staff:

Olav Aasen	24. July to 19. August
Erik Bærtelsen	24. July to 31. July
David Cushing	24. July to 9. August
Gerhard Krefft	24. July to 9. August
Josef Popiel	1. August to 14. August
Harry Knudsen	4. August to 19. August
J. Zijlstra	9. August to 19. August
G. Bolster	9. August to 19. August

2. Survey Work

It was found desirable to make preliminary surveys of the area for bottom temperatures and fish traces. This was undertaken by "Jens Væver" from 16. -23. July in the northern half and by "Platessa" from 18. -24. July in the southern half. The dividing line of latitude was $55^{\circ}15'N$. The combined results were charted and used as basis for planning the first stages of tagging work. (Figure 1: Bottom temperatures and fish traces in Bløden Ground area 16. -24. July, 1957.)

3. The Taggings.

Tags were released from four ships, the purse-seiner "M/S Rygrunn" the research vessels, "Jens Væver", "Sir Lancelot", and "Clupea". The total number of tags, external and internal released from each ship are shown in Table 1.

Table 1.

	Internal tags		Lea tags		Danish Lea Trawl	Hodgson tag Purse-seine	Scottish Combination Drift	
	purse seine	trawl	purse seine	trawl			net	trawl
Rygrunn	9930							
Sir Lancelot		1739	12	177		379		
Clupea		592		119			96	1300
Jens Væver		50		51	74			
Total	9930	2381	12	347	74	379	96	1300

Grand Total { Internal tags 123311
External tags 2208

A grand total of 14,519 tags was released. The ships were used as follows:

a. M/S "Rygrunn". 24 July to 19. August

As the herring only left the bottom at night, it was found necessary to concentrate the shoals with the use of strong search-lights : Only 8 nights (out of) were the weather and tidal conditions suitable and in all 5 shots were made, 3 of which provided herring of suitable size for tagging. On the other two occasions only O-group herrings were caught.

b. R/S "Jens Væver" 16. July to 14. August.

After the preliminary survey was completed "Jens Væver" was used primarily as a scout ship, her job was to locate and identify echo-traces in the north-eastern part of the area.

c. "Sir Lancelot" - 10. August-26. August.

"Sir Lancelot" was used to survey the southern half of the area, locating and identifying echo-traces. After "Rygrunn" left the Bløden Ground internal and external tagging on trawl-caught fish was continued.

d. "Clupea" - 7. to 27. August.

"Clupea" was used to survey the north-western half of the area. After "Rygrunn" left the Bløden Ground, internal and external tagging was carried out on trawl-caught fish.

The details of position, date of liberation, type of tag, and serial numbers are given in Table 2 - see next page.

Table 2. Positions of liberation and serial numbers of tags released.

	Date	Position	Numbers	Total	Tags lost	or not used
"Jens Væver"						
1.	28.7.57 (trawl)	56°17'N 06°18'E	8001-8050	50		
"Rygrunn"						
2.	5.8.57 (purse-seine)	56°07'N 05°57'E	1-1000 4,001-6,000 8,051-9,100	997 1996 1048	142 4067 8051	146 221 4943 5197 5273 8112
3.	14.8.57 (Purse-seine)	55°10'N 04°12'E	1,001-2,000 7,501-8,000 9,100-9,600	1000 489 500	7551 7574 7794	7557 7558 7561 7566 7578 7600 7787 7791
4.	17.8.57 (Purse-seine)	54°39'N 04°14'E	2,001-4,000 6,001-7,500 9,601-10,000	2000 1500 400		
				<u>9930</u>		
"Sir Lancelot"						
5.	20.8.57 (trawl)	54°41'N 04°00'E	12,001-12,050	50		
6.	(trawl)	54°33'N 04°00'E	12,051-12,150	100		
7.	21.8.57 (trawl)	54°45'N 03°58'E	12,151-12,500	350		
8.	22.8.57 (trawl)	54°48'N 04°37'E	12,501-12,550 12,551-12,560 12,561-12,580 12,581-82,84 12,599 12,601-12,700	50 9 20 3 1 100	12552	
9.	23.8.57 (trawl)	54°40'N 04°06'E	12,552 12,583 - 85-90 12,591 - 12600 12,701-13,450 13,464-13,480 13,482-13,496 13,498-13,553 13,556 13,801-14,000	1 7 9 750 17 15 56 1 200	12599	
				<u>1739</u>		

continue on next page

	<u>Date</u>	<u>Position</u>	<u>Numbers</u>	<u>Total</u>	<u>Tags lost or not used</u>
"Clupea"	21. 8. 57	54° 42' N	14001-14044	44	
10.	(trawl)	03° 56' E	14046-14082	37	
11.	21. 8. 57	54° 44' N	14045	1	
	(trawl)	03° 52' E	14083-14150	68	
12.	21. 7. 57	54° 44' N	14151-14200	50	
	(trawl)	03° 53' E			
13.	21. 7. 57	54° 47' N	14201-14221	21	
	(trawl)	03° 57' E			
14.	21. 7. 57	54° 44' N	14222-14253	32	
	(trawl)	03° 51' E			
15.	22. 7. 57	54° 43' N	14254-14300	47	
	(trawl)	03° 55' E			
16.	22. 7. 57	54° 45' N	14301-14450	150	
	(trawl)	04° 10' E			
17.	22. 7. 57	54° 43' N	14451-14464	14	
	(trawl)	04° 02' E	14466-14593	128	
				<u>592</u>	
<u>External tags</u>					
Jens Væver					
18.	5. 8. 57	56° 04' N	Lea:-		
	(Purse-seine caught)	05° 57' E	12488-12538	51	
			Danish Lea		
			3251-3325	74	3289
<u>"Sir Lancelot"</u>					
19.	15. 8. 57	54° 39' N	Lea:5485, 87, 91		
	(Purse-seine)	04° 14' E	5492-5500	12	
			Hodgson:8E 221-300	79	291
			9E301-500	200	
			10E901-1000	100	
20.	20. 8. 57	54° 41' N	Lea:12920-12991	72	
	(trawl-caught)	04° 11' E			
21.	21. 8. 57	54° 45' N	Lea:12896-12919	24	
	(trawl-caught)	03° 38' E			
22.	22. 8. 57	54° 46' N	Lea:12867-12873	7	
	(trawl-caught)	04° 39' E	Lea: 12885-12895	10	12893
23.	23. 8. 57	54° 40' N	Lea:12815-12866	52	
	(trawl-caught)	04° 16' E	Lea:12874-12887	11	
			Lea:12893		
<u>"Clupea"</u>					
24.	8. 8. 57	55° 08' N	Scot. x) AH 201-290	90	
	(Drift-caught)	04° 04' E	AH 295-300	6	
25.	8. 8. 57	55° 08' N	Scot. x) AH 291-294	4	
	(trawl-caught)	04° 41' E	AH301-600	300	
26.	8. 8. 57	55° 09' N	AH601-620	20	
	(trawl-caught)	05° 23' E			
27.	20. 8. 57	55° 01' N	AH621-760	140	
	(trawl-caught)	04° 22' E			
28.	20. 8. 57	55° 44' N	AH762-766	5	
	(trawl-caught)	04° 04' E	AH768-780	13	
29.	21. 8. 57	54° 44' N	AH 761	1	
	(trawl-caught)	03° 52' N	AH 767	1	continued
			AH 781-800	20	
			AH301-400	100	

(continued)	Date	Position	Numbers	total	Tags lost or not used
"Clupea"					
30.	22.8.57	54°45'N	AH 801-1000	200	
	(trawl-caught)	04°10'E	AJ 001-200	200	
31.	22.8.57	54°43'N	AJ 201-300	100	
	(trawl-caught)	04°02'E	AJ 401-423	23	AJ 424
			AJ 425-524	100	AJ 525
			AJ 526-562	37	AJ 563
			AJ 564-589	26	AJ 590
			AJ 591-600	10	

x) Scottish combination tag with Scottish bridles.

32.	22.8.57	54°43'N	Lea:12992-13074	83	
	(trawl-caught)	03°55'E			
33.	22.8.57	54°45'N	Lea: 13075-13110	36	
	(trawl-caught)	04°10'E			

B. Shore Installations

1. Efficiency tests in reduction plants. It is convenient to record the results by countries:-

USSR: no account.

Poland: no reduction plant.

Sweden: two out of four factories have been tested, giving 78% and 58% efficiency. Of the other two factories, one is not yet working and the other only deals with canning waste and the shrimp fishery.

Denmark:- The control experiments carried out and their results are given in Table 4. - More than 90% of the Danish catch of young North Sea herring are landed in the west-coast harbours: Esbjerg, and Thyborøn. The importance in connexion with the experiment of each of the controlled factories in these harbours appears from their share in the landings of North Sea herring in August 1957.

Table 3. Quantity of Herring landed in August (4/8-31/8) 1957.

	tons	% of grand total	efficiency of magnets(%)	corrected % of grand total
Esbjerg, all landings	12.744			
"Andelssildolie"	10.400	66	98	65
"Vestjydsk"	1.760	11	56	6.2
"Kødfoder"	380	2.4	57	1.4
"Esbjerg"	198	1.3	93	1.2
Factories total	12.738	81		73.8
% of Esbjerg total	(99.9)			
Thyborøn, all landings	2.870			
"Rønland"	1.446	9.2	ca. 75 ?	ca. 7
% of Thyborøn total	(50)			
Grand total				
Esbjerg + Thyborøn	15.614			
Controlled factories	14.184	90%		ca. 81%

The Table shows that 90% of the herring landings to these harbours have passed through factories furnished with magnets, and according to the observed efficiencies of these about 80% of all tags which are landed in these harbours will be returned (and between 75 and 80% of all which are landed in Denmark).

From the more detailed report on the control experiments in Table 4 the following facts will appear:-

The magnets of all factories in Esbjerg have been controlled. The most important (in "Andelssildeoliefabrikken") is very effective. Those in the other two factories ("Vestjysk" and "Kødfoderfabrikken") are not quite satisfactory, but reliable corrections can be made for the loss of tags due to this, and our repeated appeals may lead to the installation of more effective magnets in these reduction plants.

None of the two factories in Thyborøn had magnets when the preparation of the tagging experiment was started. As a result of our appeals one of them ("Rønland") installed magnets just in time for the experiment. (The magnet has not yet been controlled, but the number of returned tags from the experiment indicates that it is quite effective).

/internal Complete statistics on the small quantity of North Sea herring landed to the factories in Hirtshals, Limfjorden and Skagen are not yet available. At least at this stage of the experiment these factories are of little importance. Only one/tag has been returned from Hirtshals and none from the others. The magnets in the two Hirtshals factories are quite effective and those of the large factory in Skagen ("Nordjylland") satisfactory. The magnet of the small factory in Limfjorden ("Oddesund") has not yet been examined.

Table 4 . Control of Magnets in Danish Reduction Plants.

	January 1956		March 1957		June-Aug. 1957		Mean recapture for each factory in	
	after 24 hours	Total	after 24 hours	Total	after 24 hours	Total	%	
Andelssilde- oliefabrikken Esbjerg					83 84 83	95 97 98		<u>96.7</u>
Vestjysk Silde- olieindustri, Esbjerg			93 96 91	95 98 94				<u>56.0</u>
Esbjerg Kød- foderfabrik, Esbjerg					52 51 54	52 51 68		<u>57.0</u>
Esbjerg Silde- ølsfabrik, Esbjerg					85 80 86	96 93 91		<u>93.3</u>
Frederikshavn Sildeoliefabrik, Hirtshals	94	94			42 29	75 ^x) 79 ^x)	(82.7)	<u>77.0</u>
Hirtshals Fiske- melsfabrik, Hirtshals	67 88	75 88			7 8	84 ^x) 67 ^x)	(78.5)	<u>75.5</u>
Nordjylland II Skagen	83 66	84 66			51 39	51 ^x) 39 ^x)	(60.0)	<u>45.0</u>
Nordjylland III Skagen	87 90	84 91			52 76	82 ^x) 87 ^x)	(86.0)	<u>84.5</u>

In all the control experiments 100 tags were placed in the raw material. The table gives the number of tags returned in each experiment. The experiments marked with an asterisk were carried out with fish in a very bad condition, which probably accounts for the difference from the earlier experiments.

It is recommended to use the average of the new experiments, only. Since the control on "Vestjysk Sildeolieindustri" was made the magnet on one reduction line in the factory broke down. Consequently, only about 58% of the material passes a magnet and the correlation factor should be 56%.

Germany: Die Magnetanlagen aller für die Öheringsverarbeitung in Betracht kommenden Fabriken wurden getestet (siehe Table 5).

Die Versuchen wurden unter der Leitung folgender Herren vorgenommen:-

In Cuxhaven	Dr. H. Kühl (Institut für Küsten- und Binnenfischerei der Bundesforschungsanstalt für Fischerei),
In Bremerhaven	Dr. C. H. Brandes (Institut für Meeresforschung)
Einfeld i. Holstein	Dr. F. Thurow (Institut für Meereskunde, Kiel)
Büsum	Dr. G. Krefft (Institut für Seefischerei der Bundesforschungsanstalt für Fischerei)

Wie aus Tabelle 1 ersichtlich, ergaben sich starke Unterschiede in der Wirksamkeit der Magnetanlagen. Diese wurden gesprächsweise von einem der Fabrikdirektoren auf Unterschiede in der jeweils verarbeiteten Menge zurückgeführt, da bei dichter Beschickung der Transportbänder die Magneten nicht die genügende Kraft besäßen, die Marken herauszuziehen.

In einigen Fabriken ("Ostsee", "Nordfriesland") konnte der zweite Test infolge Heringsmangels noch nicht durchgeführt werden, zumal die Testung dieser Fabriken Reisen erfordert, die nur bei sicherem Vorhandensein von Heringen unternommen werden können.

Die Wiederfunde der Testmarken erfolgt in der Regel innerhalb der ersten 24 Stunden, doch sind teilweise auch überraschende Spätfunde zu verzeichnen. Von den bis zum 19.9 erhaltenen Testbögen wurden für 13 Teste folgende Zahlen ermittelt. Wiedergefunden nach:

1 Stunde	2 Stunden	4 Stunden	8 Stunden	16 Stunden
42	243	250	298	129
3.9%	22.7%	23.4%	27.8%	12.1%
1 Tag	2 Tagen	3 Tagen	Später	Gesamt
47	23	5	33	1070
4.4%	2.1%	0.5%	3.1	

89.9%

Innerhalb der ersten 24 Stunden wurden demnach/aller wiedergefundenen Testmarken erhalten. Die Spätfunde (später als nach 3 Tagen) sind in ihrer Höhe wohl in erster Linie darauf zurückzuführen, dass in der Fabrik "Nordfriesland" in der am 5. Tage 19 Marken gefunden wurden, am 4. Tage überhaupt nicht, am 3. und 2. nur stundenweise gearbeitet wurde. Ohne diese 19 Marken ergeben sich 14 "echte" Spätfunde : 1.3%, unter denen der bemerkenswerteste der Wiederfund einer Testmarke am Magneten nach 31 Tagen.

Es ist also nicht ausgeschlossen, dass ein kleiner Teil der wiedergefundenen Heringsmarken aus dem Blödengrundexperiment aus früher verarbeiteten Anlandungen stammten, als nach dem Funddatum anzunehmen. Das gilt wahrscheinlich für die einzige von der "Cufida" wiedergefundene Marke C 3647, die bei der Verarbeitung von Industrieabfällen am 6.9. gefunden wurde, während die letzte Öheringsanlandung für diese Fabrik am 23.8. erhalten wurde. Auch die bei der Verarbeitung von Fladengrundheringen vom F.D. "Schütting" bei Pust als einzige wiedergefundene Marke C 3543 stammt zweifellos von einer vorhergegangenen Kutteranlandung, wie schliesslich in der Fabrik "Unterweser" am 18.9. die Marke C 9283 gefunden wurde, nachdem seit dem 5.9. dort keine Blödengrundfänge mehr gelöscht wurden.

Table 5. Ergebnisse der Testversuche der Magnetanlagen deutscher Fischmelfabriken.

Name der Fabrik	Ort	Wiederfunde %		Mittelwerte	Bemerkungen
		1. Versuch	2. Versuch		
"Unterweser" Fuhrmann & Co.	Bremerhaven	88	81	84.5	
Lüllich & Co.	Bremerhaven	77	95	86	Marken teilweise stark beschädigt
F. Albt. Pust	"	91	81	86	"
J. H. Wilhelms	"	52	-	-	
Seelhoff & Co.	"	93	89	91	
Erste Deutsche Klippfischwerke	"	-	-	-	Keine Magnetanlage vorhanden
Baumgarten	"	-	-	-	Keine Magnetanlage vorhanden, verarbeitete keine Öheringe
Hussmann & Hahn	Cuxhaven	77/98	85/88	85	2 Anlagen, von denen die erst- genannte 2/3, die zweite 1/3 der Produktion aufnimmt.
Lohmann & Co.	"	94	95	94.5	
Cufida	"	46	70	58	
Neue Fischmehlwerke	"	0	-	-	Keine Magnetanlagen vorhanden. Ein Versuch mit 100 Marken gab keine Wiederfunde bei der Ver- arbeitung.
Fischmelfabrik Ostsee	Einfeld	?	?	?	Testergebnissen noch nicht erhalten.
Nordfriesland	Büsum	83	-	-	2. Versuch steht noch aus.

2. Collection of Statistics

a) Catch and effort statistics. These are being collected by the Danish authorities as catch and effort in each statistical square (15 miles by 15 miles). The statistics are not yet available.

Catch and effort statistics have not been successfully obtained from the German fishermen.

b) Factory statistics. Daily processed quantities of herring are not yet available for all factories in Denmark and Germany, but it is expected that such data will be collected.

II. The Returns.

a) Internal tags.

1) Purse-seine-caught fish. Up to the 12th of September a total of 351 tags were returned from the reduction plants in Denmark and Germany (Table 6).

. Table 6. Returns of Internal Tags.

Date	Denmark			Total	Germany	
	1st Lib.	2nd Lib.	3rd Lib.		Total	Grand Total
4.-6. Aug.	4	-	-	4	-	4
7. Aug.	1	-	-	1	-	1
8. Aug.	4	-	-	4	-	4
9. Aug.	10	-	-	10	-	10
10. Aug.	12	-	-	12	-	12
11. Aug.	9	-	-	9	-	9
12. Aug.	27	-	-	27	-	27
13. Aug.	7	-	-	7	-	7
14. Aug.	-	-	-	-	-	-
15. Aug.	-	-	-	-	-	-
16. Aug.	6	-	-	6	-	6
17. Aug.	-	-	-	-	-	-
18. Aug.	17	17	-	34	-	34
19. Aug.	5	11	-	16	-	16
20. Aug.	5	21	-	26	-	26
21. Aug.	2	4	-	6	-	6
22. Aug.	9	9	-	18	20	38
23. Aug.	8	10	1	19	11	30
24. Aug.	12	9	2	23	19	42
25. Aug.	5	5	-	10	9	19
26. Aug.	2	1	1	4	12	16
27. Aug.	2	-	1	3	1	4
28. Aug.	-	2	-	2	1	3
29. Aug.	-	-	-	-	1	1
30. Aug.	-	2	1	3	-	3
31. Aug.	-	-	-	-	-	-
1st Sept.	-	1	1	1	-	1
2nd Sept.	-	-	-	-	-	-
3rd Sept.	1	-	-	1	1	2
4th Sept.	1	-	6	7	-	7
5th Sept.	2	1	3	6	3	9
6th Sept.	1	-	-	1	1	2
7th Sept.	1	-	1	2	-	2
8th Sept.	-	-	-	-	-	-
9th Sept.	-	-	-	-	-	-
10th Sept.	-	1	-	1	-	1
11th Sept.	6	1	1	8	-	8
12th Sept.	-	1	-	1	-	1
13th Sept.	-	-	-	-	-	-
14th Sept.	-	-	-	-	-	-
Total	159	96	17	272	79	351

The Danish recaptures are given for each liberation according to recovery dates. For the German recaptures the information is incomplete at the present stage and only the totals appear in the table. In addition 2 tags were returned from Netherlands found in stomachs of whittings, and 1 tag was found in a Norwegian factory. This tag was released in the second liberation, 14/8- 56°04'N, 05°57'E, and recaptured 23/8, 57°40'N, 05°30'E. The herring has thus migrated about 100 n. m. northwards in 18 days. The total recovery percentage (12/9) of tags from purse-seine-caught herring is 3,5%.

Table 7. Distribution on landing ports of recaptures in per mille of released number of tags (no correction for efficiency of magnets).

Rygrunn Liberation no.	1	2	3	total
Egersund	0.25	0	0	0.1
Hirtshals	0.25	0	0	0.1
Thyborøn	5.0	0	0.26	2.1
Esbjerg	34.1	48.2	4.1	25.1
Cuxhaven)	0	19.1	10.5	8.0
Bremerhaven)				
Total	39.6	67.3	14.9	35.4

ii) Trawl-caught fish. In total 7 tags were recovered from a total of 2318 released. The recapture percentage in this case amounts to 0.3%.

b) External Tags.

i) Purse-seine-caught fish. 2 Danish Lea tags have been recovered, one of these was found on the shore about 150 n. m. from the tagging position.

ii) Trawl-caught fish. 1 Lea tag has been returned from the Netherlands found in the stomach of a whiting.

c) Scottish Combination Tags.

1 tag liberated the 8th of August was recovered in a factory in Esbjerg 4 days later.

In Figures 2, 3 and 4 are illustrated the distribution of the Danish caught tags on the fishing ground. The localities are established. The efficiency tests in the reduction plants indicate that the probability of a tag to appear on the magnet within 24 hours is 0.85. Therefore, the majority of the positions given by the factories should/correct. For the positions of Rygrunn's liberations it will be seen that most of the recaptures have been made in the vicinity of the tagging locality, while the rest is dispersed in south-westerly and north-easterly directions, i. e. roughly keeping in bottom water of less than 10°C (compare Figure 1). The same general feature will be found in the next liberations (Figs. 3 and 4) and accordingly the migrations are mainly directed north-eastwards.

The localities of the German recaptures from the same liberations are illustrated in Figure 5. The complete absence of recaptures from the first (Rygrunn) liberation is quite striking.

III. Concluding Remarks.

At the present stage the tagging experiment cannot be regarded as completed. The final conclusions from the autumn season will have to be postponed to a later date, awaiting collection and working up of the relevant statistics.

What can be stated is that:

1. It has been demonstrated that it is possible to catch the Bløden herring with purse-seines,
2. It is possible to tag this herring in the open sea in an excellent condition.
3. The shore installations have been brought in good working order.
4. There is ample reason to expect that the final working up of the data will furnish very valuable information.