

# The non-returning of fish tags recovered by Norwegian fishermen

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When fish are tagged and released the actual recovery is out of the hands of the investigators conducting the experiments. The responsibility of detecting and reporting the tags is left to the fishermen, workers in the fish processing industry, the sellers and to some extent the consumers too. Some non-returned recovered tags may be the result and this may lead to biases in the estimate of mortality and population size. A correction factor for non-returning can be calculated by planting a known number of tagged fish in the catch. This method is used by Ruud and Øynes (1954) in a study of the returning of whale tags from the Norwegian floating factories in the Antarctic and by Aasen (1958) in estimating the returning rate of internal herring tags from the reduction plants along the Norwegian coast. Margetts (1961) studied the reporting of tags which had passed the fishing vessel and the market respectively.

Tagging experiments may be designed to contain some provisions for testing the non-returning rate of recaptured tags. A direct method of estimating this rate is to have trained observers examine a portion of the catch for tags (Paulik 1961). This method may be difficult to carry out because of the manpower requirements and the costs.

Advertising, educational programs and different reward schemes have been used for the purpose of increasing the interest of the fishermen to search for and to return recovered tags. The size of the rewards differ from country to country as they do for different species. For returning a tag to the Inter-American Tropical Tuna Commission the fishermen receive \$ 1 and a chance in an annual \$ 300 drawing (Schaefer 1958). From two ponds in a Massachusetts stream \$ 1 was offered for each tag returned, and a monthly lottery was held for prizes of greater value (Stroud and Bitzer 1953). A partial creel census was made at the same ponds, and a comparison of the returning rate in these ponds with returning rate in other waters without rewards or a creel census indicated a non-returning of 25 per cent. Several tagging experiments on warm-

water game fishes in California with \$ 5 reward tags and non-reward tags have demonstrated that 35—60 per cent of non rewards tags actually recovered by anglers were not returned (McCammon and LaFaunce 1961).

Fiskeridirektoratets Havforskningsinstitutt is offering 5 N. Kr. for each cod, haddock, coalfish, halibut, catfish, sprat, spiny dogfish and mackerel (2.50 N.Kr. when the tagged mackerel is recovered just after release in the neighbourhood of the tagging locality), rewards of 10 N.Kr. for each returned herring and capelin tag and 25 N.Kr. for each tunny, porbeagle and seal tag. In 1959 the Institute introduced an annual 1000, 500 and 250 N.Kr. drawings for cod, coalfish, haddock, halibut and catfish tags, Norwegian and foreign, returned by Norwegian fishermen. The purpose was to estimate the non-returning rate of tags recovered by Norwegian fishermen.

## MATERIAL AND METHODS

During January 1959 the extra reward system was made familiar to the Norwegian fishermen through the local newspapers and placards along the coast from Bergen to Kirkenes. The first drawings took place in June 1959 over the Norwegian Broadcasting Company. All tags from the mentioned species returned between the 1st of January and the 15th of May 1959 had the chance to receive the extra rewards.

In 1960 and 1961 the same extra reward system was used and all tags returned between the 16th of May one year and the 15th of May the next year were taken into consideration. The drawings took place in June with a representative of the fishermen present. In 1960 the outcome of the drawings together with some facts about tag returning and the aim of tagging experiments was given in a "Fishery item" on the Norwegian radio, and in 1961 the outcome was given in some newspapers along the Norwegian coast.

In the following all recoveries of tagged cod, haddock, coalfish, halibut and catfish made by the Norwegian fishermen during the period of 1947—1962 have been taken into consideration.

## RESULTS

During 1959 one tag recovered in each of the years 1922, 1944, 1950 and 1955 and some more tags recovered in 1956—1958 were returned. In recent years a few tags recovered earlier than 1957, but not earlier than 1952, were returned. The extra rewards and the advertising may

Table 1. Total number of tags returned by Norwegian fishermen.

Year of recapture	Year of return															
	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
1922 .....													1			
.																
1944 .....													1			
.																
47 .....	182	1														
48 .....		392	2													
49 .....			483	1												
1950 .....				410	1					1						
51 .....					759	10										
52 .....						810	8	1	1			1				
53 .....							661	18	1		1	2				
54 .....								869	22	4	1	1				
1955 .....									1 525	25			2			
56 .....										1 720	122	8	4	1		
57 .....											1 376	68	13	4		
58 .....												1 686	146	15		
59 .....													2 158	107	7	
1960 .....														1 410	42	3
61 .....															1 588	84
?						9	1	4	4	11	5	2	4	36	10	12

Table 2. *Percent of tags returned in the years after the recapture year.*

Year of recapture	Returned in the					
	First	Second	Third	Fourth	Fifth	Sixth
	year after recapture					
1947 .....	0,5					
48 .....	0,5					
49 .....	0,2					
1950 .....	0,2					
51 .....	1,3					
52 .....	1,0					
53 .....	2,7	0,1				
54 .....	2,5	0,1	0,1			
1955 .....	1,6	0,4	—			0,2
56 .....	6,6	—	0,1	0,1		—
57 .....	4,7	0,4	—	0,1	0,3	0,1
58 .....	8,0	0,9	0,2	0,1		
59 .....	4,7	0,8	0,3	0,1		
1960 .....	2,9	0,3				
61 .....	5,0	0,2				

have stimulated people to send these “older tags”. Since the number of tags that would not have been returned without the system is unknown, there are difficulties in estimating the real effect of the extra rewards.

If the extra rewards stimulate the returning of recovered tags, it is expected that the returning rate of tags recovered and returned at once and returned after some time will be higher. The present material gives no possibility of estimating the effect of the new system on the reporting of tags recovered and returned the same year, but the stimulating effect may be reflected in the reporting rate of tags returned one, two and three years after they are recovered. Unfortunately the mailing dates are not listed in our tagging journals nor transferred to the punchcards of the recaptured fish. However, the returning year may be established. Every returned tag from each experimental year gets a serial number, and the distinction between two returning years is in the following based on the first serial number with a new recapture year.

All the tags recovered each year from 1947—1961 and returned the same year as recovered and one or more years after, are given together with the number of returned tags with unknown recapture years in Table 1. During 1948—1953 the returning rate of the tags returned one year after they were recovered (Table 2) was about 1 per cent or less. The rate increased to 8 per cent in 1959, but decreased to about 3 per cent in 1961. In 1962 it increased again to 5 per cent. More or less the

Table 3. *Total number of tags recovered in different periods of a year and returned the next year.*

Year of recapture	Number of tags recovered the first six months of a year			Number of tags recovered the third quarter of a year			Number of tags recovered the fourth quarter of a year		
	Total re- turned	Returned the next year		Total re- turned	Returned the next year		Total re- turned	Returned the next year	
		No	Per cent		No	Per cent		No	Per cent
1947 .....	177	—	—	6	1	16,7	—	—	—
48 .....	390	2	0,5	4	—	—	—	—	—
49 .....	467	—	—	12	1	8,3	5	—	—
1950 .....	408	1	0,2	3	—	—	—	—	—
51 .....	750	4	0,5	12	—	—	7	6	85,7
52 .....	780	3	0,4	12	—	—	26	5	19,2
53 .....	601	6	1,0	42	4	9,5	36	8	22,2
54 .....	757	3	0,4	49	2	4,1	85	17	20,0
55 .....	1 150	4	0,3	292	7	2,4	108	14	13,0
56 .....	1 227	8	0,7	440	65	14,8	175	49	28,0
57 .....	918	15	1,6	380	32	8,4	146	21	14,4
58 .....	1 186	53	4,5	477	72	15,1	169	21	12,3
59 .....	1 725	25	1,4	376	42	11,2	164	40	24,4
1960 .....	1 130	15	1,3	206	9	4,4	116	18	15,5
61 .....	1 336	43	3,2	244	31	12,7	92	10	10,9

same tendency is recognizable in the reporting rate of tags returned two years after they were recovered. The highest rates are given for the reporting years 1958—1961. The tags returned three and more years after recovery were mainly returned in 1957—1960.

Since some tags might always be reported some time after recovery the reporting rate of tags recovered one year and returned the next may vary for different periods of the year. In Table 3 is given the reporting rate of tags recovered in the first six months, the third and fourth quarters of a year, but returned the next year. During 1948—1957 the rates are mostly less than 1 per cent in the first period of the year, but it increased in 1959 to 4,5 per cent. In the next two years the rates decreased but in 1962 it was higher again. The same tendency is recognizable in the second period, while the corresponding values for the last period show a slight decreasing tendency from 1951 and onwards, with an interruption of higher values in 1956 and 1959. However, these calculations demonstrate a higher returning the year after recovery for tags recovered in later periods of a year.

## DISCUSSION

The reporting rate of fish returned one or more years after recapture has been studied. Since exact information on the reporting year is not available, the distinction between the "returning years" is based on the first serial recapture number with a new recapture year. This may cause some biases in the number of tags returned each year. Tags returned at the beginning of a year, but recovered the year before, may get an earlier serial recapture number than the first tag recovered this year. For some tags the bias of the year of recapture may be serious. If a tag is recovered in the same year as the tag with the recapture number just before or in an earlier year, but returned several years afterwards, it will get the same year of returning as the serial number just before. For example, the tag recovered in 1950, but returned in 1956 (Table 1), is in fact returned in 1959.

The methods used in estimating the year of return cause some tags to get an earlier and some tags a later year of return than is correct. But the bias in the number actually returned one or more years after recapture is probably insignificant or it may be of the same order each year.

The returning rate of tags recovered in the first 6 months of a year, but returned the next year, is smaller than the rates of the third and fourth quarters of the year (Table 3). The reason may be that the fishermen are waiting for a quiet fishing period before the tags are mailed. Another reason is that it is much easier for the fishermen to return tags in the first part of the year. During the bigger seasonal cod and herring fisheries the recovered tags can be delivered to official inspectors along the Norwegian coast, which write down the recovery data and mail it to the Institute.

During 1947—1952 most of the returned tags were from recaptured cod, tagged and recaptured in Lofoten during the skreifishery from January to April. The tags could be delivered to the fishery inspectors, and this may account for the low reporting rate of tags returned the year after they were recovered (Tables 2 and 3). An extensive cod and coalfish tagging program started in 1953—54 in the North-eastern Atlantic waters. Many tags from these experiments were recovered during summer and autumn (Table 3), when very few fishery inspectors are present along the coast. The consequence may have been an increased reporting of tags recovered in the third quarter of a year but returned the next.

During the spring of 1957 the advertising in newspapers along the Norwegian coast was intensified, and this may have stimulated the fishermen to increase their reporting in 1957 of tags recovered in 1956 (Table 2). The increase in the relative number of tags returned in 1959 but recovered in 1958 and earlier might be the effect of the extra reward

system introduced in 1959. The relatively smaller number of tags returned one year after recovery in 1960 and 1961 was then caused by the higher returning of tags recovered and returned in 1959 and 1960 respectively. However, the same might happen with a decreasing interest in returning tags, but the great number of tags returned in 1960—1962 without information of recapture year (Table 1) may reflect a continuous interest in returning tags. Most of the mentioned tags without recapture years may have been returned as a response of advertising, because it was said that the Institute was interested in "old tags" even if the recapture data should be incomplete.

The reporting rates during 1948—1958 of tags recovered in the first six months and the third quarter of a year, but returned the next year are 0.5 and 9.0 per cent respectively. With a constant reporting rate in these years the increase in the rates in 1959 reflects an annual loss of 4—6 per cent in earlier years. This estimate of the non-returning rate by Norwegian fishermen is a minimum, because in spite of the extra rewards there may be some non-response in 1959, which is reflected in some tags returned in 1960 two years after recapture (Table 2).

The non-reporting rate of recaptured Danish cod tags in West-Greenland Waters is estimated to be between 50 per cent (Poulsen 1957) and 58 per cent (Horsted 1961). The basis for this calculation is that the Portuguese dorry-vessel fishermen are reporting recaptured tags to a much higher degree than other fishing fleets, and that the actual number of tags recaptured per 1000 tons of cod landed is the same for all fishing fleets. The non-returning rate of the Portuguese trawlers was estimated to be about 50 per cent (Poulsen 1957) and 60 per cent (Horsted 1961), while the non-reporting rate of the Norwegian fishing fleets, mostly longliners, was 82 per cent (Poulsen 1957). The estimated non-returning rate of the Norwegian fishermen is in disagreement with the estimation based on all tags reported by Norwegian fishermen after the extra reward system was introduced.

Many circumstances may effect the estimated non-returning from West-Greenland Waters. In 1955 the younger fish were more numerous in the Danish (Hansen 1956) and the Portuguese (Ruivo 1956) samples than in the Norwegian (Rasmussen 1956). This may reflect a segregation in fish size or age according to depth, because the Norwegian samples are from catches taken between a depth of 150—350 m., while the Danish and Portuguese are from less than 100 m. According to Hansen (1956) the recaptured fish in 1955 consisted of a great number of younger fish, which then were available to a lesser degree for the Norwegian fishermen. The estimated non-returning rate of tags recovered by Norwegian Fishermen in West-Greenland Waters is therefore less than estimated by Poulsen.

## SUMMARY

In addition to 5 N.Kr. reward for each returned cod, coalfish, haddock, halibut and catfish tag, Fiskeridirektoratets Havforskningsinstitutt introduced in 1959 an annual drawing of 1000, 500 and 250 N.Kr. for tags, Norwegian and foreign, returned by Norwegian fishermen. The extra reward system was in use during 1959—1961.

After the extra rewards were introduced, the reporting rate of tags returned the same year as recovered and one or more years afterwards has increased. The non-returning rate of tags recovered by Norwegian fishermen in 1947—1957 was estimated to be at least 4—6 percent and the indication from the calculations is that the non-returning rate is decreasing with the continuous advertising and with people in the fishing ports to receive the recovered tags.

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