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The Tuna Tagging Experiments in Norwegian Waters

by
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I. Introduction

The yield of the Norwegian tuna (*Thunnus thynnus* L.) fishery has decreased considerably during the last years, compared to the late forties when purse seining for tuna was introduced in Norwegian waters. The Norwegian Institute of Marine Research has been studying the biology of the fish during the last five years, and one of the main problems that has been dealt with is whether or not the apparent decrease of the stock depends upon an increase in the rate of the exploitation. A basic requirement in this connection is to define the population units (if more than one. Previous attempts to solve this question by marking and biometric studies have not been notably successful, and thus we have at present little information of this aspect. The recent Norwegian tagging experiments, which form the main subject matter in the present paper are, however, rather encouraging.

The first tagging of tuna was probably done by M. Sella, who in 1911 tagged 10 bluefin tunas in the Mediterranean. He used a tag of copper chain around the caudal peduncle, but no tagged fish were recovered (Rounsefell and Kask, 1945).

As caught tunas sometimes retain the hook of previous victorious encounters with fishermen, Heldt did in 1927 place identifying marks on hooks used by French fishermen of the Isle of Groix (Rounsefell and Kask, 1945). To my knowledge no reports of recaptures has been presented. Based upon recovery of 39 hooks and leads lost by fishermen, which obviously could be identified as to origin, M. Sella (1929) has dealt with the problems of the identity of the bluefin tuna stock, concluding that a migration through the Strait of Gibraltar takes place. During the years 1931 to 1935, Frade and dentino (1935) tagged 107 bluefins on the coast of Portugal, using several types of tags, but no recoveries has been reported. They also distributed marked hooks to fishermen.

As to the bluefin on the American coast of the Atlantic, Westman and Neville (1942) tagged 23 fish in the vicinity of Long Island. They used a pair of celluloid disks attached to the gill cover. Two fish were recaptured during the first two months after release. During the last ten years, several types of tuna tags have been developed and used with success by American biologists. As for the big bluefin, the Woods Hole Oceanographic Institution has reported on a tagging programme in the vicinity of the Bahama Islands (1954). The tuna were supposed to be caught by hooks, brought alongside the boat and a small stainless steel dart (to which a thin ten-inch plastic streamer was attached) harpooned into the fish. The present writer have no knowledge of the results obtained.
Recently the Woods Hole has through personal correspondence told about recoveries of their dorsal loop tags from tuna caught in the Bay of Biscay. A transatlantic tuna migration is thus a proven fact. Concerning the tuna species, however, there were no information..

II. Norwegian Taggings

The Norweian Institute of Marine Research has for several years been working with the problems of tagging the big bluefin tuna, and the first experiment was executed in September 1957. The experiments were continued in 1958 and 1959, and we have now succeeded in tagging 82 fish, using the Lea hydrostatic tag. So far we have had 8 recoveries.

A struggling tuna of adult size cannot be brought into a boat and held tight under the tagging operation. A suitable tag must therefore first of all be easily and rapidly fixed to the fish, and a new method of applying the Lea tag has been developed. The method is based upon the principle of harpooning (Figure 1). A small harpoon, to which a lea tag is attached by nylon, has been inserted into the muscles by means of a thin stainless steel pipe (or cylinder) mounted on a bamboo stick, 1.5 metres in length. The harpoon used in 1957 (model A in the figure) was made of stainless steel. The models B and C used in 1958 and 1959 respectively, are made of plastic material (Akulon). The plastic harpoons have 4 barbs. The models A and B have been inserted by a hollow pipe,

the model C by a small, solid steel cylinder fitting into a hole in the base of the harpoon (see figure). Owing to the lesser stiffness of the plastic material, the latter has been found to be the most successful.

Only purse seine caught tuna have been used in the experiments. The tagging operation is illustrated in Figure 2. As long as there is room enough for swimming around, the tuns do not touch the purse seine, and they seem to be in normal condition. When they begin to run upon the seine wall, however, the activity of the fish decreases gradually, lying down quietly after 15-20 minutes. During that time the tagging operation must be executed. The tuna, which are more or less suffocated due to lack of oxygen, are caught by a hook in the lower jaw and brought onto a trough of aluminium, strengthened by an iron band at the far end. The nearer end I laced to the seine as shown in the figure. Two ropes, fastened to the iron band are crossed over the fish, and when the tuna is tagged and unhooked, the fish is released by pulling the ropes. Instead of hook and trough, dipnet has been tried without success.. The tag has been inserted in different parts of thew body, most frequently in the dorsal muscle. No individual measurement of the tagged fish has been taken.

Employing the tagging outfit described, 82 tunas have been tagged and released, 22 fish in 1957 using the model A (Figure 1), 18 tunas in 1958 using the model B, and 42 tunas in 1959 using the model C. Most of the fish seemed to be in good condition after the release. As doubtful cases we have noted 4 specimens in 1957, 3 in 1958 and 5 in 1959. None of these has been recaptured. The tagging area has been nearly the same in the three years, roughly between 59°N and 61°N latitude, from the coast to about 15 nautical miles off (Figure 3). The data of the fish recaptured are given in the table below.

Table 1. Releases and recoveries of 8 bluefin tunas tagged in Norwegian waters. Descriptions of area and tag model, see Figures 1 and 3 and text.

Release				Recovery					
Year	Date	Area	Tag model	Year	Date	Area	Fish L in cm	Fish W in kg	Days in liberty
1958	15.09	M 13	B	1959	20.06	Spain	215	138	278
1958	15.09	L 13	B	1959	20.08	I 12	-	138	339
1958	17.09	M 13	B	1959	19.06	Spain	226	176	275
1958	17.09	M 13	B	1959	04.07	Spain	220	153	290
1959	10.08	C 9	C	1959	17.08	G 12	-	218	7
1959	10.08	C 9	C	1959	17.08	I 12	-	223	7
1959	12.08	E 10	C	1959	17.08	E 11	-	-	5
1959	12.08	E 10	C	1959	18.08	I 12	-	218	6

As shown in the table, 4 of the 18 specimens tagged in 1958 have been recaptured this year (1959), one on the Norwegian coast, the others in Spain between Tarifa and Cadiz ("Sancti Petri" and "Barbate").

Concerning the specimens tagged and recovered in this year's season, one will recognize a migration from north to south on the Norwegian coast. The fish are relatively large (the non-measured specimens in the table were probably of a similar size). It is worth mentioning that at the time when these big size fish appeared in the northern part of the area, only 12 specimens were tagged. It would appear that the fishing mortality on the bluefin tuna is relatively high.

Attention may be drawn to the fact that none of the 22 tunas tagged with the stainless steel harpoon in 1957 has been recovered. Through personal correspondence, scientists of the Woods Hole Oceanographic Institution have pointed to the possibility that the stainless steel tags cause the flesh of the fish to fester, resulting in shedding of the tag. The wounds caused by the present tag models have not yet been examined, but the lack of recoveries from the steel harpoon employed in Norway is in conformity with the American experience.

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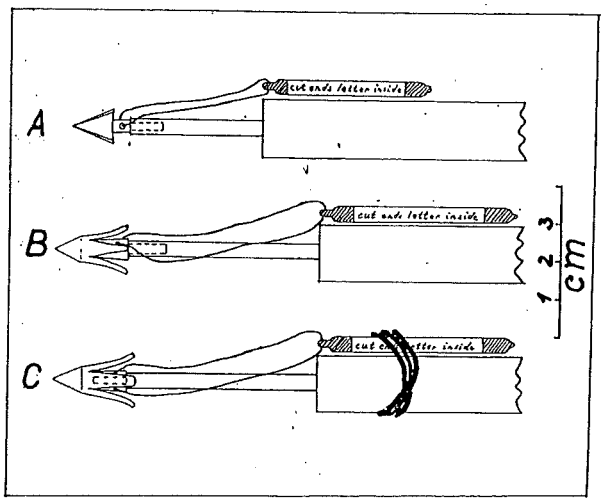

Figure 1.
Models of tags used in tagging the bluefin tuna on the Norwegian coast.

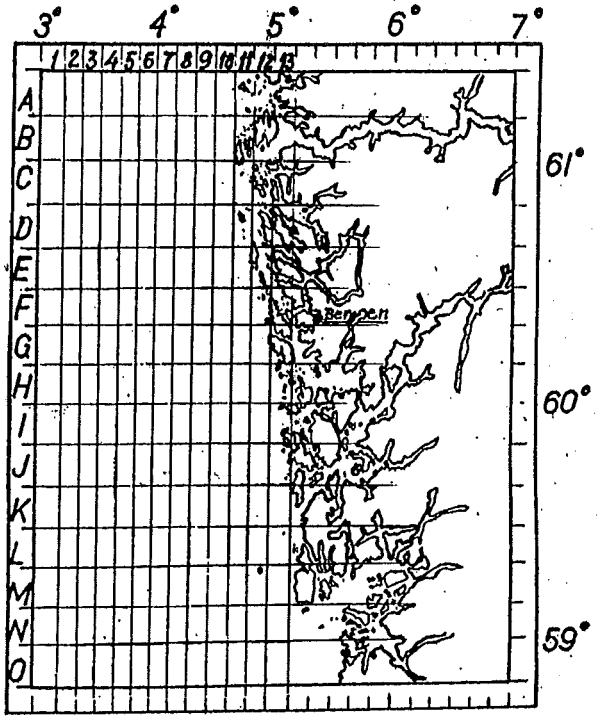

Figure 3.
Map showing the tuna tagging localities on the west coast of Norway.

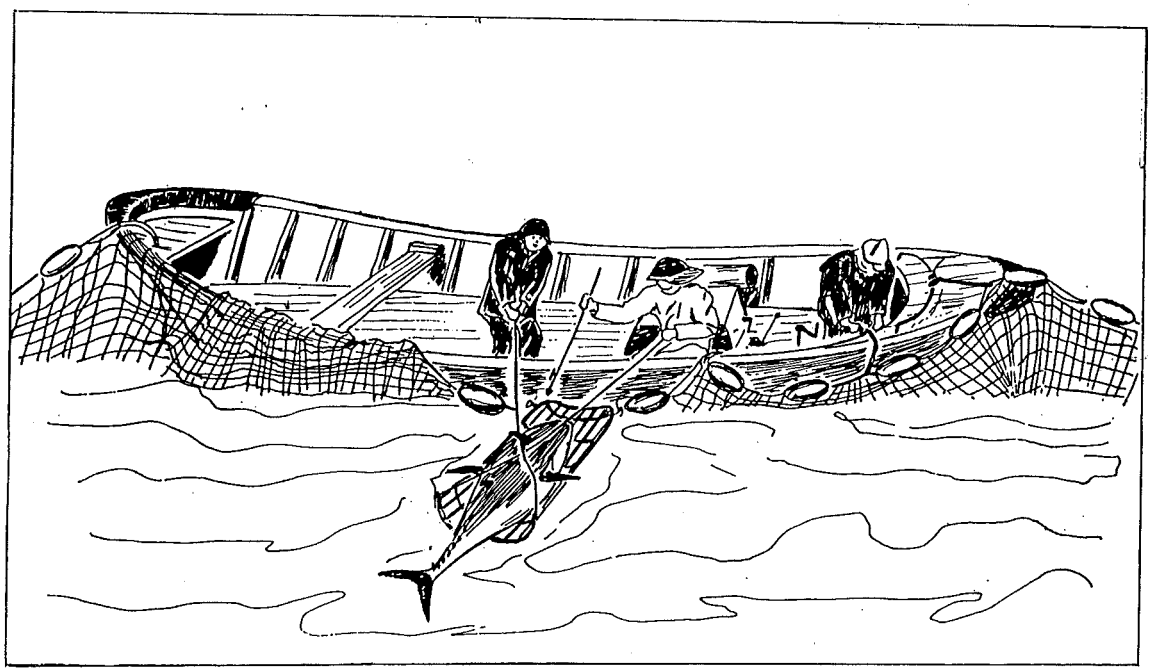

Figure 2.
Tagging and releasing of purse seine caught tuna. After inserting the tag, the fish is released by pulling the ropes.