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Some Results of the Norwegian Bluefin Tuna Investigations

by

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I. Introduction

The yield of the Norwegian bluefin tuna fishery in 1961 amounts to about 5800 tonnes. This is about 2600 tonnes more than in 1960. Work has been carried out during the fishing season, according to the Norwegian tuna research programme for 1961, already distributed among the members of the Scombriform Fish Committee. The material collected has been partly worked out, the preliminary results obtained are presented in this paper.

II. Material and Methods

In Table 1 are shown the weekly catches by districts for the week numbers 28 – 36. The tuna season is not yet ended, but only few catches have been landed after week number 36. The weight (w') refers to the weight of gutted tuna, the total weight (w) can be calculated after the formula $w = 1.285w' + 0.3$.

The statistical analysis of the catches has so far been worked out for district VI only, and the weight frequency curve is shown at the bottom of Figure 2. The collection of the statistical data and the grouping of the material have been done in the same way as for the previous years (Hamre 1958). 80 tuna have been tagged during the 1961 season employing the same method as in 1959 (Hamre 1959), making a total of 202 tuna tagged off Norway since 1958. So far 20 recoveries are reported (Table 2).

III. Immigration Routes

In a paper read in this Committee last year (CM.1960) the present author dealt with questions concerning the immigration of the tuna into Norwegian coastal waters. On the basis of the observations presented below, the likely immigration routes are shown in Figure 1.

1. The average weight of tuna caught in districts I – III is always considerably higher than that of the tuna caught in the districts IV – VIII. From the statistical analysis of the catches it is concluded that the tuna in the northern districts consist mainly of 12 – 14 years old fish. In the southern districts, however, the age of the tuna range from 5 to 12 years (Hamre 1959).
2. The tuna schools moving northwards are usually first observed in district III, sometimes also in the northern part of district IV. The northward migration is so rapid that the fishing boats often have difficulties in following the schools.
3. The schools of tuna which migrate to the southern fishing districts are usually first observed in the southern part of district V. These schools which are composed of medium sized fish (about 8 – 12 years of age) appear in the beginning of the season. The smaller fish (5 – 8 years) appear later and are usually first observed in district VI. When reaching the coast the schools migrate southwards, an observation corroborated by the tagging experiments (Table 2: tag nos 5; 6; 8; 9; 13; 19; 20). According to Meyer-Waarden and Tiews (1959) the medium sized fish migrate into the North Sea. The small tuna, however, seems to follow the Norwegian coastal waters and are frequently observed in district VIII late in the season.
4. During the immigration period, very few tuna have been caught in district IV and in the northern part of district V.

From these observations it appears that the tuna most likely most likely migrate into the Norwegian Sea west of Shetland, and proceed towards the Norwegian coast. Further, the big tuna, being 12 years or more of age, follow the northern migration route shown in Figure 1. The smaller fish, being less than 12 years of age, migrate to the coast following the southern route (Figure 1). Since very few tuna are caught between 62°N and 63°N during the immigration, it would appear that these two immigration routes are separated far out at sea. The Norwegian coast

may accordingly be divided into a northern fishing area (districts I – III) and a southern fishing area (districts V – VIII), the district IV being intermediate (Hamre 1959).

IV. Preliminary Results of the Investigations in 1961.

During the season there have been at least three distinct runs of tuna to the Norwegian fishing grounds. From Table 1 it is seen that the first run to the southern fishing area occurred in week no 28, the second one in week no 33 on the boundary between district V and VI. The first one moved slowly, the second one very rapidly towards the south (Table 2: tag nos 19; 20). From the analysis of catches landed in district VI, it has been found that the two runs consisted of mainly 11 years old fish (1950 yearclass, Figure 2).

The run of tuna to the northern fishing area was first observed in district III in week no 29. The further migration into district II is demonstrated in Table 1.

In district IV, a few catches of tuna have been landed during the weeks 28 – 32 in the southern part of the district. The mean weights as shown in Table 1, indicate that the fish apparently belonged to the first run to the southern fishing area.

During the season, 7 tagged tuna were recaptured in Norwegian waters (Table 2: nos 14 – 20), all tagged on the west coast of Norway. The two within season recaptures (nos 19; 20), demonstrate the rapid migration southwards of the tuna schools belonging to the second run. Four were tagged in 1960 and one in 1959. The most interesting recovery is the tuna tagged in the southern fishing area last year, and recaptured in the northern one this season (tag no 17). The supposition that the tuna may change their feeding area, from south to north at about 12 year of age is thus substantiated.

V. Emigration of the Tuna from Norwegian Waters

The Norwegian tuna fishery is mainly based on the fish during the immigration. Some years, however, there have been taken catches at the very end of the season, which probably are tuna on their way back to the Atlantic ocean. These tuna are frequently caught far off the coast in districts IV – V and the weight distribution of the landings frequently indicate a mixture of all sizes of fish which have been found in the season. The fishermen often report to have observed very large schools, especially far off the coast in district V. These tuna migrate rapidly northwards and the fish is "wild", to use a fisherman's expression, and very difficult to catch with the purse seine. The schools are reported to be very extensive and are obviously on the point of departing for more southerly latitudes.

VI. Discussion.

Compared to the foregoing years, the Norwegian tuna fishery in 1961 has given a rather good result. The increase in the total catch this year (1961) is mainly caused by a considerably increase in number of fish caught in the northern fishing area and the increase in weight of the fish owing to the yearly growth (Figure 2).

It is fair to assume that the 1950 yearclass has been the strongest yearclass in the adult tuna stock since 1957. The lack of 9 years old fish in 1959 (Figure 2) is caused by special fishing conditions in the southern fishing area that year, the catches making a completely wrong picture of the age composition pattern of the adult stock (Hamre 1959). The runs of tuna dominated by the 1950 yearclass have always been mixed with tuna of the yearclass 1949 (even dominant in 1955) and since 1958 also with fish from the 1952 yearclass.

The weight frequency curve of the southern area of 1961 (Figure 2) is based only upon the catches landed in district VI. According to the migration of the fish, however, it seems likely that the catches landed in district VI are representative for the size composition of the schools which occur in the other part of the southern fishing area. Comparing the weight distributions of the tuna landed in the southern area in 1960 and in 1961 (Figure 2) one will recognize that a part of the larger sized fish is lacking in the latter year. Bearing in mind the age composition in the adult stock found in previous years, it is fair to assume that the fish missing in the area concerned in 1961, are the tuna from the 1949 yearclass mainly, i.e. 12 years old fish.

Complete data for the catches landed in the northern area are not yet available for 1961. However, the mean weight of the tuna landings in the northern area is 183 kg (Table 1) which is approximately the calculated mean weight of 12 years old tuna. From these results it may be concluded that the main reason for the increase in the

Summary

The present paper is an investigation on the depth range of tagged bluefin tuna based on pressure marks on the Lea tag (Figure 1). It was observed that the within season recaptures were without pressure marks, while the pressure marks occur on all the between season recoveries (Table 1). A test of the pressure resistance of the Lea tag showed that the bluefin tuna stock feeding off the Norwegian west coast during the summer does not go below 250 metres depth, whereas the stock seems to have a deeper distribution range during the winter.

Reference

Tiews, K. 1963. Synopsis of biological data on bluefin tuna *Thunnus thynnus* (Linnaeus) 1758 (Atlantic and Mediterranean). FAO Fisheries Reports 2(6):422-481.

Table 1. Release and recovery data for Norwegian tagged bluefin tuna.

Release Date	Locality	Recapture Date	Locality	Days in liberty	W in kg
Uncollapsed tags:					
10 Aug 1959	60°55'N 4°25'E	17 Aug 1959	60°15'N 4°45'E	7	218
10 Aug 1959	60°55'N 4°25'E	17 Aug 1959	60°00'N 4°45'E	7	223
12 Aug 1959	60°30'N 4°40'E	17 Aug 1959	60°30'N 4°40'E	5	-
12 Aug 1959	60°30'N 4°40'E	18 Aug 1959	60°05'N 4°50'E	6	218
21 Aug 1959	59°30'N 5°05'E	6 Oct 1959	Anholt Island, Kattegat	46	170
8 Aug 1960	60°47'N 4°15'E	17 Aug 1960	60°39'N 4°20'E	9	231
16 Aug 1961	60°44'N 4°40'E	30 Aug 1961	59°41'N 5°00'E	14	198
21 Aug 1961	60°44'N 4°38'E	28 Aug 1961	60°08'N 4°58'E	7	180
28 Aug 1961	60°15'N 4°50'E	6 Oct 1961	60°50'N 4°40'E	39	146
Collapsed tags:					
15 Sep 1958	59°35'N 5°04'E	20 Jun 1959	Cadiz, Spain	278	138
15 Sep 1958	59°32'N 5°04'E	20 Aug 1959	59°55'N 5°00'E	339	138
17 Sep 1958	59°38'N 5°02'E	19 Jun 1959	Cadiz, Spain	275	176
21 Aug 1959	59°40'N 4°55'E	20 May 1960	Cadiz, Spain	273	217
1 Sep 1959	59°55'N 4°55'E	1 Aug 1960	61°52'N 4°35'E	335	102
3 Sep 1959	60°15'N 4°45'E	30 Sep 1961	60°40'N 4°40'E	758	-
8 Sep 1959	59°44'N 4°51'E	19 Sep 1960	61°02'N 4°20'E	377	113
8 Sep 1959	59°44'N 5°00'E	5 Aug 1961	60°43'N 4°35'E	697	163
8 Aug 1960	60°44'N 4°29'E	31 Jul 1961	60°51'N 4°35'E	358	163
8 Aug 1960	60°44'N 4°29'E	28 Aug 1961	60°18'N 4°49'E	385	180
9 Aug 1960	60°30'N 4°42'E	3 Aug 1961	66°15'N 10°30'E	359	224
25 Aug 1960	60°24'N 4°50'E	18 Aug 1961	61°03'N 4°25'E	358	136
25 Aug 1960	60°35'N 4°50'E	2 Aug 1962	Cadiz, Spain	707	-
21 Aug 1961	60°45'N 4°35'E	2 Aug 1962	61°00'N 4°30'E	346	182
23 Aug 1961	60°45'N 4°35'E	25 Aug 1962	61°35'N 4°35'E	367	255

tuna landings in northern Norway in 1961, is that the strong 1949 yearclass has now reached the age when the tuna change its migration pattern.

Concerning the southern area, one should expect that the lack of the 1949 yearclass would lead to a decrease in the yield of the fishery, at least in number of fish, since there is no recruitment of younger age groups to the area concerned. However, the fishery has yielded 4000 fish more than last year. In the writer's opinion the main reason for this unexpected good result is the early arrival of the fish this year. Further, the concentrations of foodfishes in the vicinity of the coast have been considerably greater than for several years, a circumstance that without doubt has favoured the tuna fishery in the southern area as well as the fishery in the northern.

These analyses of the Norwegian tuna catches indicate the possibility to predict at an early stage the long term development of the Norwegian tuna fishery. Thus it seems likely that the increase in yield of the northern fishing area in relation to that of the southern one, will continue in the first years to come. The main part of the tuna from the very strong yearclass 1950, may already migrate to the north of Norway in 1962. The lack of recruits to the adult tuna stock will no doubt lead to a radical regional change in the Norwegian tuna fishery in years to come.

References

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Annales Biologiques XV(1958):197-211.
- Hamre, J. 1961. The Norwegian tuna investigations in 1959.
Annales Biologiques XVI(1959):236-240.
- Meyer-Waarden, P.F. & K. Tiews. 1959. Further results of the German tuna investigations.
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Table 1. Weekly catches of bluefin tuna by districts in 1961. Total catch in 1960 included for comparison (n denotes number of fish caught, w' denotes weight in kg of gutted tuna).

1961 Week	Districts																	
	II			III			IV			V			VI			VII		
n	w'	w'	n	w'	w'	n	w'	w'	n	w'	w'	n	w'	w'	n	w'	w'	
28						311	48570	156	1728	261432	151	1647	261459	159				
29			192	34554	180				1096	168586	154	3555	565975	159				
30	1753	319102	182	912	156465	172	302	49424	164	993	150128	151	2090	320696	153	210	33243	158
31	2194	397333	181	519	28184	177	114	17941	157	533	84890	159	1850	280618	152			
32	1928	342399	176	514	90822	177	11	1935	176	323	47511	147	958	148592	155			
33	830	151623	183	219	41423	189				1186	180622	152	2438	368989	151	10	1458	146
34	843	167338	199	72	14123	196				113	18498	164	974	144200	148			
35	700	143900	206							263	33582	128	3131	456583	146	164	26122	159
36	17	3468	204							193	28631	148	631	97577	155			
Tot	8265	1525163	185	2068	365571	177	738	117870	160	6428	973880	152	17274	2644689	153	384	60823	158
1960	389	71435	184	1275	240889	189	194	33018	170	6234	919442	147	14270	1991117	140			

Table 2. Release and recovery data for Norwegian tagged bluefin tuna.

No	Release Date	Locality	Recapture Date	Locality	Days in liberty	Weight in kg (w)
1	15 Sep 1958	59°35'N 5°04'E	20 Jun 1959	Cadiz, Spain	278	138
2	15 Sep 1958	59°32'N 5°04'E	20 Aug 1959	59°55'N 5°00'E	339	138
3	17 Sep 1958	59°38'N 5°02'E	19 Jun 1959	Cadiz, Spain	275	176
4	17 Sep 1958	59°38'N 5°02'E	4 Jul 1959	Cadiz, Spain	290	153
5	10 Aug 1959	60°55'N 4°25'E	17 Aug 1959	60°15'N 4°45'E	7	218
6	10 Aug 1959	60°55'N 4°45'E	17 Aug 1959	60°00'N 4°45'E	7	223
7	12 Aug 1959	60°30'N 4°40'E	17 Aug 1959	60°30'N 4°40'E	5	-
8	12 Aug 1959	60°30'N 4°40'E	18 Aug 1959	60°05'N 4°50'E	6	218
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18	25 Aug 1960	60°24'N 4°50'E	8 Aug 1961	61°03'N 4°25'E	348	136
19	16 Aug 1961	60°44'N 4°40'E	30 Aug 1961	59°41'N 5°00'E	14	198
20	21 Aug 1961	60°44'N 4°38'E	28 Aug 1961	60°08'N 4°58'E	7	180

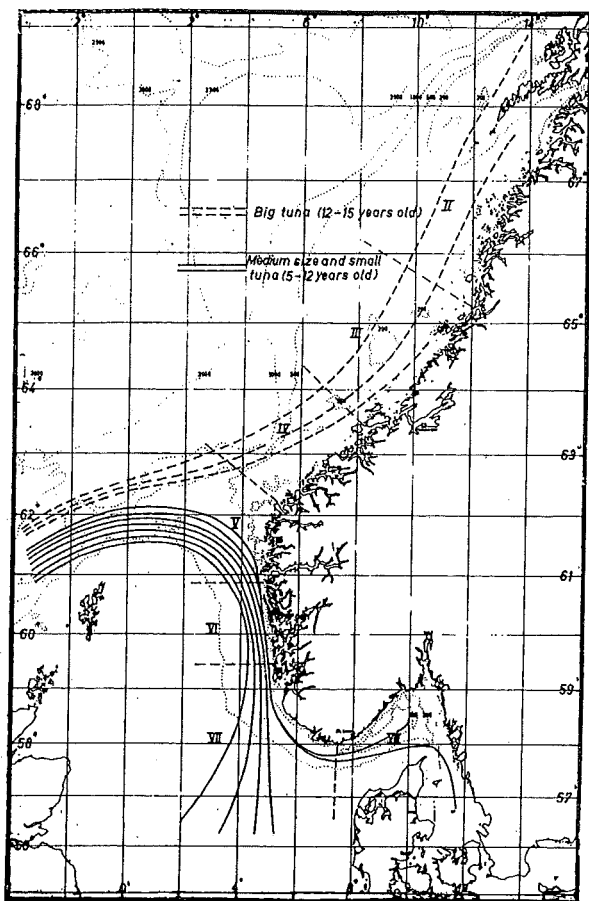


Figure 1.

Immigration routes of bluefin tuna to the Norwegian fishing grounds.
The numerals II – VIII refer to fishing districts.

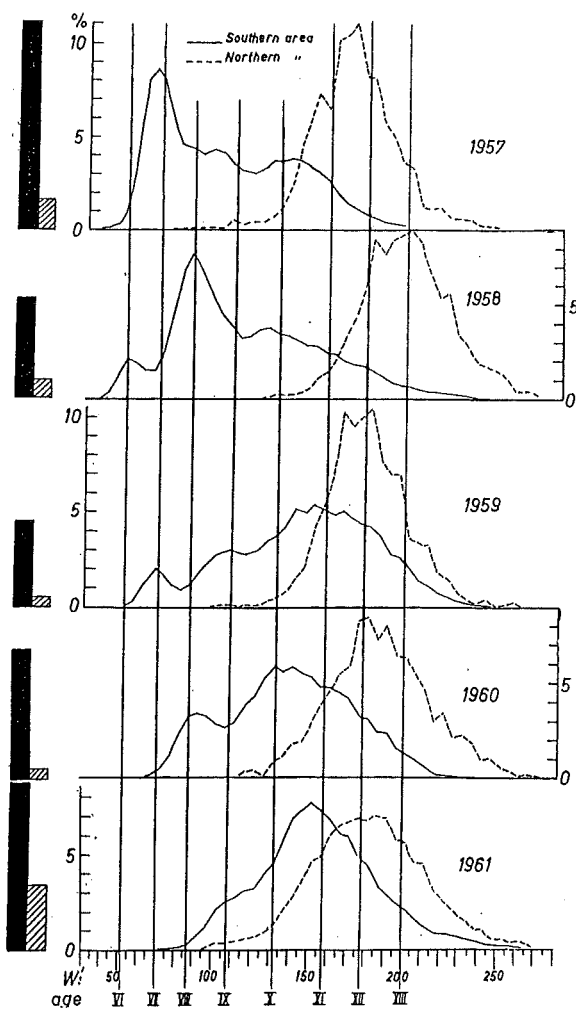


Figure 2.

Weight composition (w' = commercial weight in kg) of Norwegian tuna landings by fishing areas. The shaded columns illustrate number of fish caught in the northern area (districts I – III), the black column districts in the southern area (districts V – VIII). One unit = 3000 fish.