

Task II historical data mining on bluefin tuna (BFT) caught in Norway 1950-1954

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Introduction

During 2010 new task II historical data has been found after considerable search in various places along the coast of Norway. Some of it was believed to have been lost, but found by luck after searching through several public archives. Some institutions did not even know that they were in possession of such data while other documents were believed to have been burned decades ago.

The search for Atlantic bluefin tuna (BFT) material resulted in Task II data (weight, date of catch and catching area) from a total of 14 839 BFT during the time period 1950 – 1954.

The data collected is by no means a complete record of BFT caught in Norway in that specific time period. Some periods of the BFT-season and some of the catching areas may not be represented every year. The data must therefore be used and treated as different bits and pieces of a larger picture. The data from 1950 is for instance not representing the first part of the season when the oldest BFT were expected to dominate the catches. The known BFT migration route in the 1950's also shows that different age-groups appeared in different parts along the Norwegian coastline. Years where task II data from the northern part of Norway is missing will not give correct information about the presence and strength of the oldest year-classes of BFT, which had the most northern migration route.

Almost all (about 99 % of) BFT caught in Norway were exported. The lack of a Norwegian market for BFT led to a detailed and well documented system of tracking the fish from it was caught by a fishing vessel until the Atlantic bluefin tuna left the country. In this trade the BFT had to be handled by several Norwegian workers and organizations. The purse seiners could choose to let another vessel gut the catch. The "gutting-vessels" should then have their part of the catch. The gutted tuna (every fish) was then weighed before it was loaded into the fish-carrier which transported the fish to a port where it could be shipped out of the country (mainly by train to Italy at that time). Documents followed the fish all the way to make sure that every part of this industry got their righteous payment after the season. Every participating entity in this fishery also got a copy of the document they passed on with the fish.

The large (but necessary) use of documents represents a challenge when working with bits and pieces. As the pieces are not very different, and we don't see the whole image, the same piece can appear in different documents. A large part of the work with the data has therefore been to check dates, vessels and catches in order to be sure that the same fish is not punched twice (or three times) in the data now provided to ICCAT. This has been a challenge only when different types of documents and copies of documents are representing the same time period and the same area.

The data collected is highly reliable. There was no reason for any of the involved parts in this industry to try to cheat or manipulate the weight of the fish. Crew from the purse seiner or the gutting vessel was present when every fish was weighed before it was loaded into the fish carrier. The note (document) filled out by the fish-carrier contained one copy that was given to the gutting vessel (if the catch was handed over to a gutting vessel) and another copy was given to the purse seiner. The nature of this industry had no "black markets" and it was no way the fishermen could sell the tuna themselves to buyers in other countries. In 1950 the BFT-fishery was a new fishery, and as the BFT-fishery and the export increased, the way of organizing the fishery became more efficient. The different documents and the number of different documents therefore also changed.

Material and Methods

Sources used for data collection

Here we have selected some of the different types of documents used to create the BFT task II data from Norway from 1950 to 1954. The Norwegian BFT-fishery is well documented and the collected data has provided valuable information about changes in migration patterns from 1950 until the BFT more or less disappeared from the Norwegian waters in 1987.

The note below was given to a fisherman (Nils N. Røttingen) from a buyer working for "Hordaland Fish-Selling Organization" (Figure 1). This fisherman was fishing with a harpoon gun. This note from September 29th shows that the fisherman delivered one tuna of 88 kilograms (head included). The value of the catch was NOK 127.60. A fee of 3% is paid to run the sales-organization. In this case there was no gutting vessel involved.

Task II data mining on Atlantic bluefin tuna in Norway 1950-1954

Hordaland Fiskeselslag ^{AS} - Bergen

Sluttsetel N^o 12407

Motteke frå *Nils N. Köttingen*
(Båten navn og reg.nr.)

Medl. nr. _____ Namn _____ Adr. *Leipsøy*

	Antall kassar	Pris pr. kg.	Fiskeslag	Antall kg.	Sum
Levande fisk			Torsk/Hyse Sei/Lyr - stor Sei/Lyr - liten Flyndre		
Rund fisk			Torsk/Lange Sei/Lyr - stor Sei/Lyr - liten Brosme Hyse Flyndre Makrell		
Støgd fisk			Torsk/Lange Sei/Lyr Brosme Hyse Kveite u./m. hode		
Sum					

Antall lok _____ Tillegg for frakt _____

Selaren gjev opp grunnen til at fisken ikkje er bløgga: _____

127.60
+ 3.83
131.43

Frådrag for undervekt Kr. _____
Frådrag for dårleg kvalitet " _____
Frådrag for omkostn. " _____
Returfrakt for kassar " _____

Netto *123.77*

Underskrive seljar seier frå om å ha føreteke lovpåbode bløgging.
Underskrive kjøpar seier frå om å ha føreteke lovpåbode granskning av fiskepartiet.

Johnsen den *29* 19*57*.
(Stad)

[Signature] (Kjøpar) *[Signature]* (Seljar)

Bokført den _____ Statistikkført den _____ Remittert den *[Signature]*

Figure 1. A receipt for a bluefin tuna weighing 88 kg caught with a harpoon gun.

The next document is from a private company buying BFT from the sales organization in August 1952 (Figure 2). The company, Hallvard Lerøy A/S in Bergen, bought a catch consisting of 111 specimen of BFT. The name of the purse seiner and the fish carrier is also mentioned. 142 kilograms of BFT-liver was also a part of the deal. The document has the weight of every fish in the catch. In this case the fish was sold gutted and without head. In the task II data given to ICCAT the weight was adjusted to represent the whole fish.

HALLVARD LERØY & CO
BERGEN

Utskrevet slutt. Nr. 2875
Hordaland fiskesalslag

111	113	141	69	194	98
109	110	109	128	103	125
104	107	109	102	57	109
99	101	144	107	98	111
111	87	86	113	62	129
100	143	78	89	68	94
107	94	118	88	127	136
124	123	106	89	89	86
108	116	140	124	116	103
102	161	102	92	113	64
112	93	119	122	124	53
116	104	108	87	122	
116	110	116	104	84	
120	105	130	122	113	
109	114	110	119	133	
122	107	121	109	100	
93	89	120	100	110	
106	107	123	86	122	
127	112	106	99	82	
106	102	116	117	96	

11845 ✓
+124 ✓

Sted og dato: Glesværdin 12/8 -52
Mottatt av: Mr. Grane
Førers underskrift:

111 Stk. storje
Kg. «
142 Kg. lever

for Hallvard Lerøy A.s
Alfred Tøssig

Fangstet av motorfiske
Eiers underskrift: Mett Hvalm
Adresse: Hordaland Varding
Lynnevik

Figure 2. Individual weights of BFT (Task II data) from a purse seine catch 12 August 1952.

The next note is from 1953 and this document from “Hordaland Fish-Selling Organization” is by now made especially for BFT-catches (Figure 3). By this time almost all BFT was caught by purse seiners. The color of the letters shows that this is one of the copies. Here we get the weight of 40 BFT caught near the island Feie in the western part of Norway. The tuna was gutted at Feie, a small island west of Bergen, and transported by the fish-carrier “Håmund”. The document was signed on behalf of the ship owner Olav Lerøy A/S.

Task II data mining on Atlantic bluefin tuna in Norway 1950-1954

For kontoret. Ordresetel nr. 5822

Hordaland Fiskeselslag S/L Bergen Bergen, den

Oppgave frå fartøy „Sluttna 16.2.1953

Kg	Nr.	Kg	Nr.	Kg	Nr.	Kg	Nr.	Kg
55	21	69	41		61		81	
68	22	90	42		62		82	
59	23	92	43		63		83	
57	24	73	44		64		84	
91	25	71	45		65		85	
54	26	92	46		66		86	
75	27	91	47		67		87	
81	28	69	48		68		88	
64	29	52	49		69		89	
51	30	64	50		70		90	
52	31	73	51		71		91	
62	32	74	52		72		92	
50	33	55	53		73		93	
50	34	59	54		74		94	
61	35	59	55		75		95	
50	36	48	56		76		96	
57	37	55	57		77		97	
50	38	50	58		78		98	
56	39	59	59		79		99	
86	40	76	60		80		100	
1223		1456						

an 40 stk. størje. Kg. 2658 2636

Tau den 16/2 (stad)

Motteke Olav Lerøy a/s Sluttsetel nr. 3508
P. Solheim

Figure 3. Document on BFT Task II catches from Hordaland Fish Selling Organization in 1953.

The document below shows the same catch as referred to in the figure above (Figure 4). This is also a copy as the original was given to the owner of the purse seiner. This document states that the purse seiner “Aud II” owned by Alfred Alvestad has given 40 BFT (2626 kilograms) to the fish carrier owned by Olav Lerøy A/S. In addition it has the signature of an employee in “Hordaland Fish-Selling Organization”. This document focuses on the value of the catch but is also shows the reliability of

the documentation as it was signed by the fisherman, the owner of the fish carrier and then approved by a third person.

B For kontoret. 1953 **STØRJA**

Sluttsetel N^o 3509

HORDALAND FISKESALSLAG S/L – BERGEN
Telefon: 15872

Motteke frå Alfred Alneshad Namnet til foraren
Adresse Firesvik
Sæd II R.4.13 Namnet til båten Reg.mrk.

40 stk. kappa størja	<u>2653</u> kg. à kr.		
<u>1,167886</u>	<u>2626 netto of.</u>		<u>306687</u>
Brutto sum		kr.	
÷ 3 % avgift		»	<u>9201</u>
Netto sum		»	<u>297486</u>
÷ FORSKOT, den		»	
Restutbetaling, den		kr.	
		Summen motteke	<u>299</u>

Innmeldt til Fisc
Ordresetel nr. 5122 (må utfyllast)
Motteke Fisc 14/9 1953
P. Schwartz Kjøper Alfred Alneshad. Seljar

(Circular stamp: HORDALAND FISKESALSLAG S/L BERGEN)

Figure 4. Catch documentation scheme representing the overall BFT catch for a purse seiner.

“Weight-task” is shown from further north in Norway (Figure 5). This is a receipt from Norges Statsbaner (Norwegian Railroads) in Trondheim showing the weight of 72 BFT in one of the coaches leaving for Fratelli Salvatori, Chiasso (a town in Switzerland near the Italian border). When using

these data the weight is adjusted to represent a whole tuna as the exported BFT was gutted and sold without the head.

NORGES STATSBANER
TRONDHEIM DISTRIKT
 Spedisjon & Fiskekspedisjon
 Telefon 26190

Med svar bes oppgitt:
 J.-nr.

V e k t o p p g a v e

for vogn nr. Tnfrhs 32 DR. 303555 til Fratelli Salvadori, Chiasso.

Nr.	Kg.	Nr.	Kg.
O	113	O	122
"	106	"	81
"	90	"	110
H	115	"	101
O	109	"	119
H	96	"	118
"	101	"	111
O	124	"	106
"	108	"	126
"	99	"	94
H	101	S	85
O	111	O	105
H	101	H	64
"	116	"	99
O	153	"	94
"	92	"	97
H	87	"	73
O	140	O	99
"	109	H	101
S	97	"	82
"	75	"	121
O	115	"	105
H	79	"	99
O	124	"	96
"	106	O	112
"	137	H	89
"	122	"	116
H	113	O	110
O	117	H	103
"	103	"	110
"	96	H	95
"	93	"	98
"	102	"	114
"	89	O	118
"	126	O	93
"	62	"	110

Tilsammen 7.503 kg. 72

Johannes Salinger & Brønck
 Trondheim 6/2-52
 S. Jansen

Esp. M. Sævi
 Esp. Jansen

Figure 5. Receipt from the Norwegian Railroads on a coaches leaving for Fratelli Salvadori, Chiasso

All new and available task II data from such documents around Norway were carefully collected, organized, punched, standardized, double checked and presented to ICCAT in xls-format sorted by year, time of the year (week number) and area.

Results

A total of 14 839 new task II data on Atlantic bluefin tuna from 1950 to 1954 along the Norwegian coast was collected and analyzed in this study (Figure 6).

N tuna in the database

1950	243
1951	177
1952	2800
1953	8239
1954	24107
1955	23694
1956	17018
1957	30560
1958	21486
1959	16081
1960	21808
1961	38435
1962	36915
1963	615
1964	4839
1965	8382
1966	3292
1967	6353
1968	2259
1969	1944
1970	812
1971	1637
1972	299
1973	193
1974	2286
1975	2797
1976	1798
1977	1547
1978	534
1979	155
1980	747

$\Sigma(\text{Ni})$	1 cm (II) / 1 kg (II)		TOTAL
YearC	current	New	
1950		243	243
1951		177	177
1952		2800	2800
1953		8239	8239
1954	20727	3380	24107
1955	23694		23694
1956	17018		17018
1957	30560		30560
1958	21486		21486
1959	16081		16081
1960	21808		21808
1961	38435		38435
1962	36915		36915
1963	615		615
1964	4839		4839
1965	8382		8382
1966	3292		3292
1967	6353		6353
1968	2259		2259
1969	1944		1944
1970	812		812
1971	1637		1637
1972	299		299
1973	193		193
1974	2286		2286
1975	2797		2797
1976	1798		1798
1977	1547		1547
1978	534		534
1979	155	revision	155
1980	747		747

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1981	459	1981	459		459
1982					
1983		1983			0
1984	734	1984	734	revision	734
1985	283245				
	70	1986	70		70

Figure 6. New task II data provided from Norway to the ICCAT database on Atlantic bluefin tuna.

A schematic illustration provide detailed information on migration pattern and weight distribution from different regions along the coast of Norway; Northern Norway, Mid Norway, Western Norway and Eastern Norway (Figure 7).

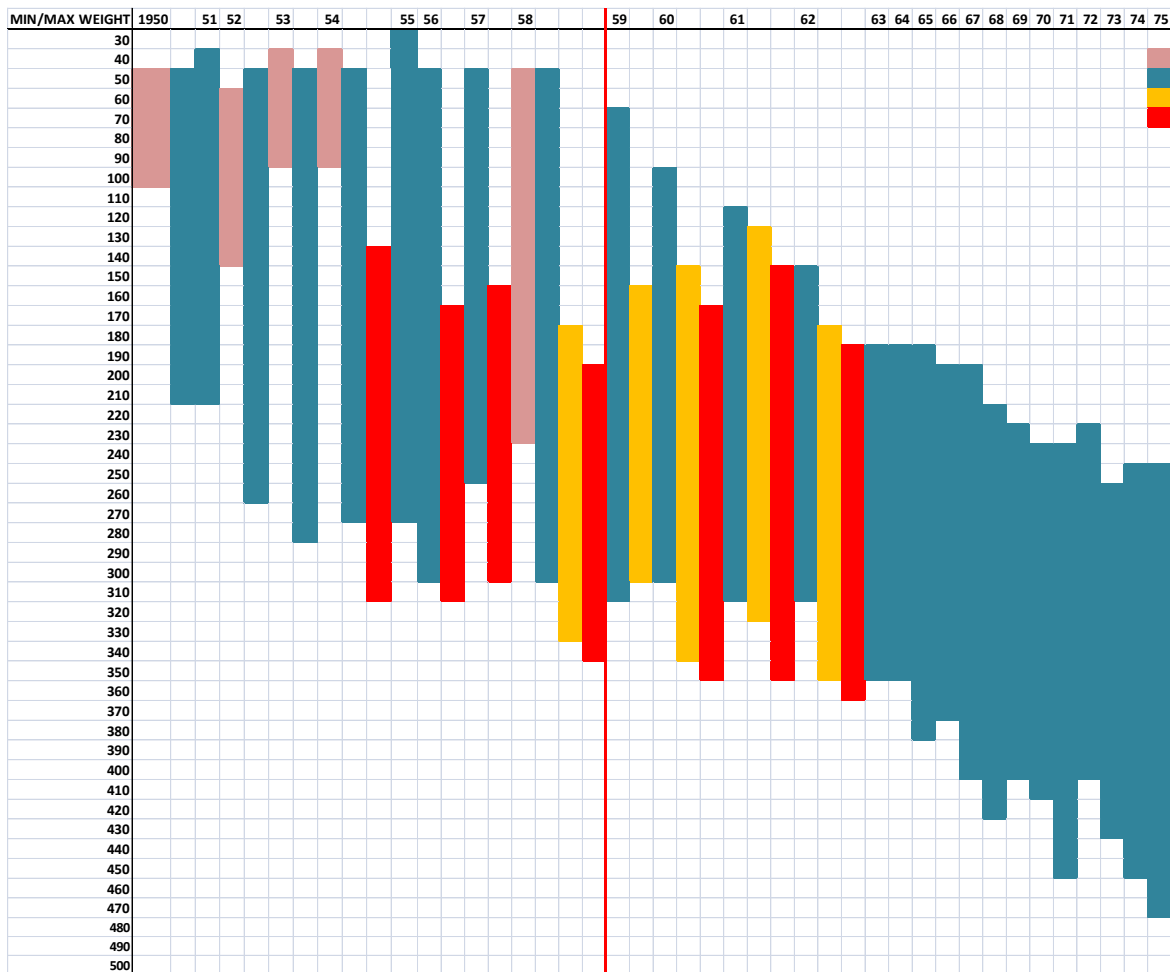


Figure 7. Weight distribution of bluefin tuna from 1950 to 1975 in eastern Norway (brown), western Norway (blue), Mid-Norway (yellow) and Northern Norway (red).

Migration pattern and timing of bluefin tuna along the coast of Norway, 1950-1959.

Based on the new Task II data from 1950-1954, including more detailed information on catch date, bluefin tuna size and location we have tried to reconstruct an illustrated migration pattern for different year classes of bluefin tuna along the coast of Norway (figures 8 to 10).



Figure 8. Adult Atlantic bluefin tuna (BFT), sized 120-260 kg, were the first to arrive the Norwegian coast, normally within the first week of July. Most of the oldest fish in this age-group migrated northward towards Nordland and Troms. Violet stars show first catch of the year, 1950-1958. Letter A in red indicate bluefin tuna arrival from the ocean to coastal waters off Norway.

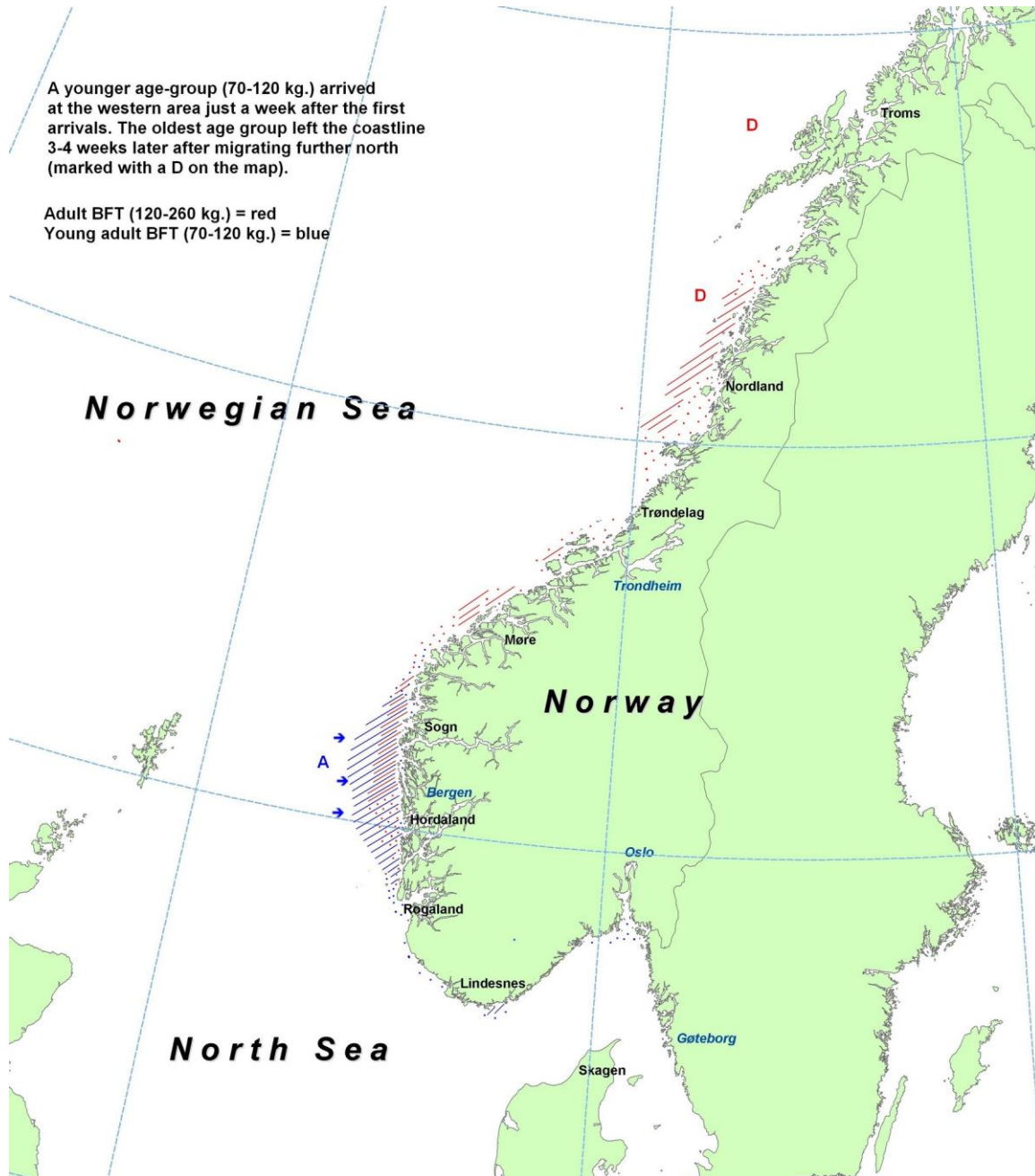


Figure 9. Younger age groups (blue) sized 70-120 kg arrived to the western area only a week after the first arrivals. The oldest age groups (red) left the coastline 3-4 weeks later, after migrating further north.



Figure 10. In late August or in September the youngest bluefin tuna sized 40-70 kg entered the south-eastern and southern areas. A part of these younger adult age groups (blue) migrated northwards, overtaking the feeding areas of the older age groups which left these coastal areas. The youngest bluefin tuna (green) were the last to leave the Norwegian coast, normally in October. The red stars show the last catch of the year for the period 1950-1958. Letter D indicate bluefin tuna departure from the coast of Norway.

Discussion

We knew that different age groups of BFT had different migration patterns along the Norwegian coastline. The oldest fish had the northernmost migration route based on Task II data from the late 1950's. Young adult BFT were mainly caught off the western coast, while young BFT were caught at the southwestern and southeastern coastline. We did not know for how long this age-based migration pattern had existed, but we knew that young adults were caught in the western area also in the first part of the 1950's. We had no task-II data from other parts of the Norwegian coast.

Newly found task-II data from different parts of the coastline gives valuable additional information about the migration route during the first part of the 1950's. From other sources (diaries, pictures, interviews and newspaper articles) we had reason to believe that the age-segregated migration pattern was established also in the first half of the 1950's. The newly found task-II data from the northern part of Norway confirms this, since the oldest BFT already then were caught in the north. Other new data from the same year, but from other parts of the coastline shows that the difference in migration pattern between age-groups found in the late 1950's were present and established also in the first part of the decade. We do not have a complete set of task-II data from every area for every year, but the new additional task-II data of 11459 individual bluefin tuna from 1950 until 1954 fits information from other sources from the same time-period. Altogether we now have a wide and rich set of documentation about the behavior and movement patterns of the BFT in Norwegian waters from 1950 until 1986.

A summary of BFT migrating to Norwegian waters 1950-1986

Adult tuna (120-260 kg) were the first to arrive based on collected data from the 1950's. It seems that they divide into two groups before hitting the Norwegian coastline. Most of the oldest fish migrated to the northern area while the rest went straight east to the western area. The oldest fish continued moving northwards during their feeding migration along the northern coastline. As the oldest BFT headed north, schools of young adult tuna (70-120 kg) entered the stage in the western and southwestern area. Young BFT (40-70 kg) were found in the southern and south-eastern area in the summer, but during the autumn they could appear in the southwestern and western part of the coast – replacing the young adult BFT. It seems like different age-groups of BFT would “give away” their feeding areas to younger BFT that entered their area and that all age-groups ended their migration further north before leaving the coastal area.

The age-groups mentioned above were not absolute, but indicates an average of fish migrating together. The effect of some strong year classes would also affect the mechanisms between age-groups as they at one stage would change group or become divided between two age-groups. The delayed arrival of younger fish and the decrease in the mean weight during the season is though clear when looking at the total age-distribution during the season.

This migration pattern is seen from 1950 up to 1959. From then on the youngest BFT were almost absent in the catches, and in 1960 BFT was no longer found in the south-eastern area.

Then – in 1963 – BFT disappeared from the northern areas. From then on all year classes of adult BFT is found in the western area. With no new year classes of young BFT entering the coast, the mean weight of the caught BFT increased gradually year by year. They did not have to “give away” their feeding area as no schools of younger tuna were “pushing” them northwards. From 1964 and onwards BFT (all adults) arrived at the western area and left the coast from the same area. The migration area/feeding area was reduced according to the reduction of age-groups. The decline in catches and lack of recruitment also indicate an overall troubled and changing period for the BFT stock.

During the 1970's the mean weight of the BFT was still increasing, indicating that the same year classes were coming back every year. If there was any recruitment to the stock in the 1970's it must be from adult/older fish following the schools migrating to Norwegian waters. We do know that BFT from the western stock could mix with BFT from the eastern stock during their feeding migration. This would represent a sort of recruitment to the BFT-population feeding off the western coast of Norway.

In the 1970's BFT was still migrating to the western area only, but the migrating fish could by then be considered as adult and old BFT. For the first time (counting from 1950) we found an established migration-rout consisting of both adult BFT (200 – 300 kg) and old BFT (300 – 500 kg) to the Norwegian coast. All other age-groups had disappeared, and after a further decrease in the fishery during the 1980's the last school of BFT was caught off the western coast of Norway in 1986.

The changes in migration-patterns and the behavior of different age-groups give us knowledge about mechanisms within the BFT stock. Some take-home messages could be:

- a) A BFT seem to prefer to migrate with other BFT within the same age or size group.
- b) A BFT will seek alternate feeding areas if their preferred feeding area gets invaded by numbers of younger BFT.
- c) A BFT will not migrate longer than necessary in order to find suitable feeding areas.
- d) Expansion of the migrating area and BFT appearing in age-groups are indicators of a large stock.
- e) A short migration route and/or tuna of different age-groups feeding in the same area indicate a small stock as the density of young fish is too low to make older fish seek alternative feeding areas and there is enough food for all age-groups in one more restricted area.
- f) Age segregation is a sign of one or more strong year-classes while a mixed population may be a result of weak year-classes.

1. We see an established and age-segregated migration pattern from 1950 till 1959. Is this pattern unique for the 1950's or could we find evidence or indications of a similar pattern in the 1940's? The challenge by this question is that the Norwegian BFT-fishery got its breakthrough in 1950 when the BFT-purse seine was introduced. The BFT-fishery in the 1940's was a small-scale fishery in some parts of the country. It is not likely that there exist any task-

II data from these years (1940-1949), but other sources can contribute with bits and pieces that can be analyzed and compared to the migration pattern we have found in the 1950's.

2. In the 1950's and the first part of the 1960's we can hardly find any old BFT in the task-II data (nor in other sources). In the time period 1950-1959 only 14 individuals of the 144 405 BFT had a weight of more than 350 kg with most cases from the northern area. We see three age-segregated migration routes along the Norwegian coast (young, young adult and adult BFT) in the 1950's, but there must be a fourth and maybe also a fifth route for the oldest year classes in the stock. Where did they go? Presently we do not know their migration route.

3. The age- and time-segregated feeding migration in the 1950's could indicate that

- different age-groups left their spawning grounds at different times and/or
- different age-groups chose different routes on their way to the feeding area and/or
- different age-groups had different distance from their spawning grounds to the Norwegian coast.

Could the behavior between age-groups at their feeding migration indicate that a similar segregation occurred during spawning (meaning different spawning areas and/or time of spawning)?

Our new task II data from 1950 to 1954 has answered some questions and raised new ones. Norway will continue to work on collecting historical data on Atlantic bluefin tuna for an increased understanding of migration routes and mechanisms involved in this fascinating species.