

NEW KNOWLEDGE ON THE MIGRATION OF ALBACORE (*T. ALALUNGA*) IN THE NORTHEAST ATLANTIC

S. B. Hue

SUMMARY

The summer migration route of albacore as a function of the different stocks in the northeast Atlantic has already been shown in previous reports. A total of 6,206 albacore released in the North Atlantic from 1968 to 1977 are analyzed in order to complete the summer migration and to know the route of winter migration and the local displacement. This document also confirms the heterogeneity of stocks from the point of view of tagging results.

RESUME

La migration estivale du germon en fonction de stocks différents dans l'Atlantique nord-est a déjà été exposée dans de précédentes publications. En tout, 6.206 germons relâchés de 1968 à 1977 en Atlantique nord sont analysés, afin de compléter la migration estivale et de connaître l'itinéraire de migration

hivernale et le déplacement local. Ce document confirme aussi l'hétérogénéité des stocks de germon du point de vue des résultats du marquage.

RESUMEN

Ya se conocía a través de informes anteriores, la ruta migratoria del atún blanco en verano, como función de los diferentes stocks en el nordeste del Atlántico. Se analizó el total de 6206 atunes blancos situados desde 1968 a 1977 en el Atlántico Norte, para completar la migración en el verano y conocer la ruta de migración invernal así como el desplazamiento local. Este documento también confirma la heterogeneidad de los stocks desde el punto de vista del marcado.

INTRODUCTION

Since 1938, the tagging experiments have been carried out by the several scientists for the migration of albacore in the north east Atlantic. However, the yearly successive tagging has been begun since 1968 by Aloncle and Delaporte. Until 1977, these last authors have tagged 5936 albacores in the zones located between the coast of Europe, Madeira, Azores and the south west of Ireland and 90 albacores between Azores and Newfoundland. They have also traced the route of summer migration of albacore as function of the different stocks in the north east Atlantic in 1973. Seventy-nine tagged fishes were recaptured during the period from 1968 to 1972 and the days of liberty varied from 6 to 892 days. In this present study, the recaptured fishes from 1963 to 1977 are analysed in order to determine the routes of the summer and winter migrations and the local displacement.

MATERIALS AND METHODS

The tagging has been executed for the live fish on board the oceanographic vessels, such as R/V "Pelagia". Two types of tags (FT and WH) have been used in the study. On the whole, 125 albacores were recaptured by the 1st February 1978, representing 2,1% of the total fish released. The number of the fishes released and recaptured are shown in the Figure 1 and Table 1. We studied the summer and winter migration at the point of view their time of liberty (less and more than 6 months) in term of the different stocks: azorian albacores migrating round Azores and classic albacores migrating along the European coast. The speed and the coefficient of the dispersion of fishes were calculated using the method described by Jones (1959).

RESULTS

Summer migration

Study on the fishes of less than 6 months of liberty

Forty-four fishes which are 35% of the total recaptured fishes have been liberated less than 6 months. The recaptured fishes are analysed as function of the month of release.

1. Fishes released in May and June

1-1. Fishes recaptured in July (Fig. 2)

Eight albacores recaptured in July which 3 individuals released in the north of Azores (40-41°N, 28-29°W), were recaptured at location slightly north-east of 44°N, 25-27°W. Two fishes liberated at an area between the cape Mondego and Vigo are retaken at the Bay of Biscay. One fish released in north-east of Azores (40°N-28°W) was recaptured in 42°N-14°W. One fish tagged in 43°N-14°W has been recaptured in the zone located east of 12°W after 29 days. The another one albacore released off Lisbon has migrated toward the north-east direction which appeared to be somewhat frequent route.

1-2. Fishes recaptured in August (Fig. 3)

Three albacores released in the region of Azores have been recaptured in the section of European coast. Body lengths at the moment of their release were 63, 75 and 61 cm respectively. The individual of 63 cm was characteristic of the group "classic" and that of 61 cm could be of the group "azorien". Four fishes released in front of the cape Mondego have been recaptured in the Bay of Biscay.

1-3. Fishes recaptured in September (Fig. 4)

Two albacores of azorian type tagged in 1971 in the section of Azores have been recaptured in the Bay of Biscay and 2 fishes (classic) released in front of cape Mondego have been recaptured in the north of cape Peñas.

1-4. Fishes recaptured in October (Fig. 5)

One fish of typical azorian type (47 cm) has been recaptured in the Bay of Biscay front of cape Mayor. This is one of the examples which one ascertains the passage of azorian toward the zone of European coast.

2. Fishes released in July (Fig. 6)

Four albacores released in front of the cape Finisterre and Mayor have been recaptured in the Bay after 36 and 76 days of the release.

3. Fishes released in August (Fig. 7)

The fishes liberated in the north of Bay of Biscay at the end of August have been recovered in the south, at the end of September.

4. Fishes released in September (Fig. 8)

One observe the same thing as August, the albacores are recaptured in the further south in October and in the first part of November. The general diagram on the release and the recapture shows the displacement in the Bay of Biscay is forming in the clockwise direction.

Study on the fishes of more than 6 months of liberty (Figs.9,10,11)

The recaptured fishes after one season of liberty confirmed the existence of two routes of migrations which are well established. The albacores are recaptured on the migratory routes where they have been released.

Winter migration (Fig. 12)

The number of the recaptured fishes in winter were not numerous enough to determine the precise and comprehensive picture on the winter migration. There are six recaptured albacores by the bait-boat vessels in the section of Canaria between the October and March and three albacores by the Taiwan longline vessels in the west of 39° W in winter.

Relation of stock/Route of migration

Not knowing exactly the zone and the route of winter migration, we have selected only 44 fishes which have been released and recaptured in the same year. The samples utilised in this analysis have been liberated less than 6 months from May to October (Table 2). We have calculated the mean speed of displacement and the coefficient of dispersion. We have re-marked two migratory routes toward the north at the beginning of season: one route of azorian and the other of classic. However, the few quantity of samples and the passage of some fishes from western to eastern route did not permit to analyse two groups of stock separately. Therefore, the calculations of the period and the length were made. The mean speed of migration and the mean coefficient of dispersion, based on the 22 albacores recaptured before July 30th, were 6.6 miles/day and 877.8 miles²/day respectively, while they were 3.8 miles/day and 269.2 miles²/day for those 22 recaptured during the August 1st through the October 30th. The speed and the coefficient of dispersion of albacores as function of the different length are indicated on the table 3.

DISCUSSION AND CONCLUSION

With regard to the migration, there are always certain geographical dispersion of fishes and variation in the dates of recapture. In the aggregate, we can however retrace the routes of summer migration of albacores in the north-east Atlantic based on the average position of release and recapture. If we consider the tagged fishes in June, we distinguish two groups of tuna moving toward the north-east Atlantic taking two different migratory routes at the beginning of season. The first group (azorian) of which the model classes are essentially 47 and 60 cm, moves toward the Azores and is appeared in the just north of the archipelago. The second group (classic) of 53 and 61 cm goes up to the European coast. The first important concentration is found at the surface water in the north-west of the Iberia Peninsula. Insufficient data (number and dispersion of recaptures) do not permit to follow the winter displacement of two groups previously identified. However, it seems that there are two different winter zones: the one in the localities of the Canaria Archipelago and the other in the Atlantic west. These two zones appear to correspond respectively with the groups "azorian" and "classic". The variations in the mean speed of displacement and the coefficient of dispersion appeared to be somewhat great. During the September-October, the water temperature in the Bay of Biscay goes down below the optimal level for the albacores. It appears that the cooler water temperature may initiate the displacement of the fishes. When the school of albacore resume the southward migration during the time of surface water cooling, the speed of displacement is known to be accelerated. The albacores (mean 64 and 72 cm) migrate more rapidly than the small fishes (54 cm) in two periods. At the beginning of the season, the difference of speed between small and large fishes is not great. However, the difference on the coefficient of dispersion between

small (783.1 miles²/day) and large albacores (1,231.6 miles²/day) may indicate that the small fishes have more directed displacement than the large fishes. At the end of season, however, the coefficient of dispersion of small fishes is much larger than that of large fishes. In this regard, following three hypotheses can be proposed:

1. The difference is caused by the few number of the large albacores studied (5 fishes).

2. The thermoregulatory performance of the small fishes is less extent than that of the large ones. At the time of cooling of surface water at the end of season, the small fishes will move to the south more rapidly than large fishes in order to remain in the favourable waters.

3. The result obtained from the chemical study of the small fishes showed some heterogeneity of stock in the Bay of Biscay at the end of season which was not existed at the beginning of migration (HUE, 1978). This heterogeneity might be attributable to the greater dispersion of small fishes. In order to understand the migration more precisely, it appears that three types of tagging are particularly interesting. The first type is the tagging at the beginning of season to know the general summer displacement. The second one is the tagging at the end of season which will permit to verify, after eight or nine wintering months in tropical Atlantic, the fishes returning through their original route of migration. The third type of tagging on the fisheries of longline in the Atlantic north-west is to determine if there are some relationships between the stock of east and that of west. The existence of relationships between two zones will be possible if one considers certain similitude in the distribution of length between the albacores from the sections of west of Azores and those of Azores (HUE, 1979) and three recaptures in winter by the longline vessels in the north-west Atlantic.

LITERATURE CITED

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Fig. 1. Numbers of albacores released and recaptured by 1 square.

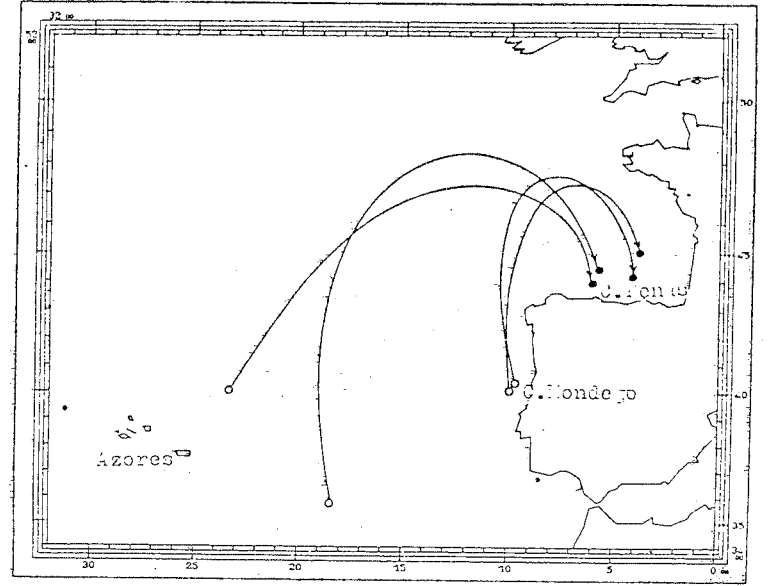
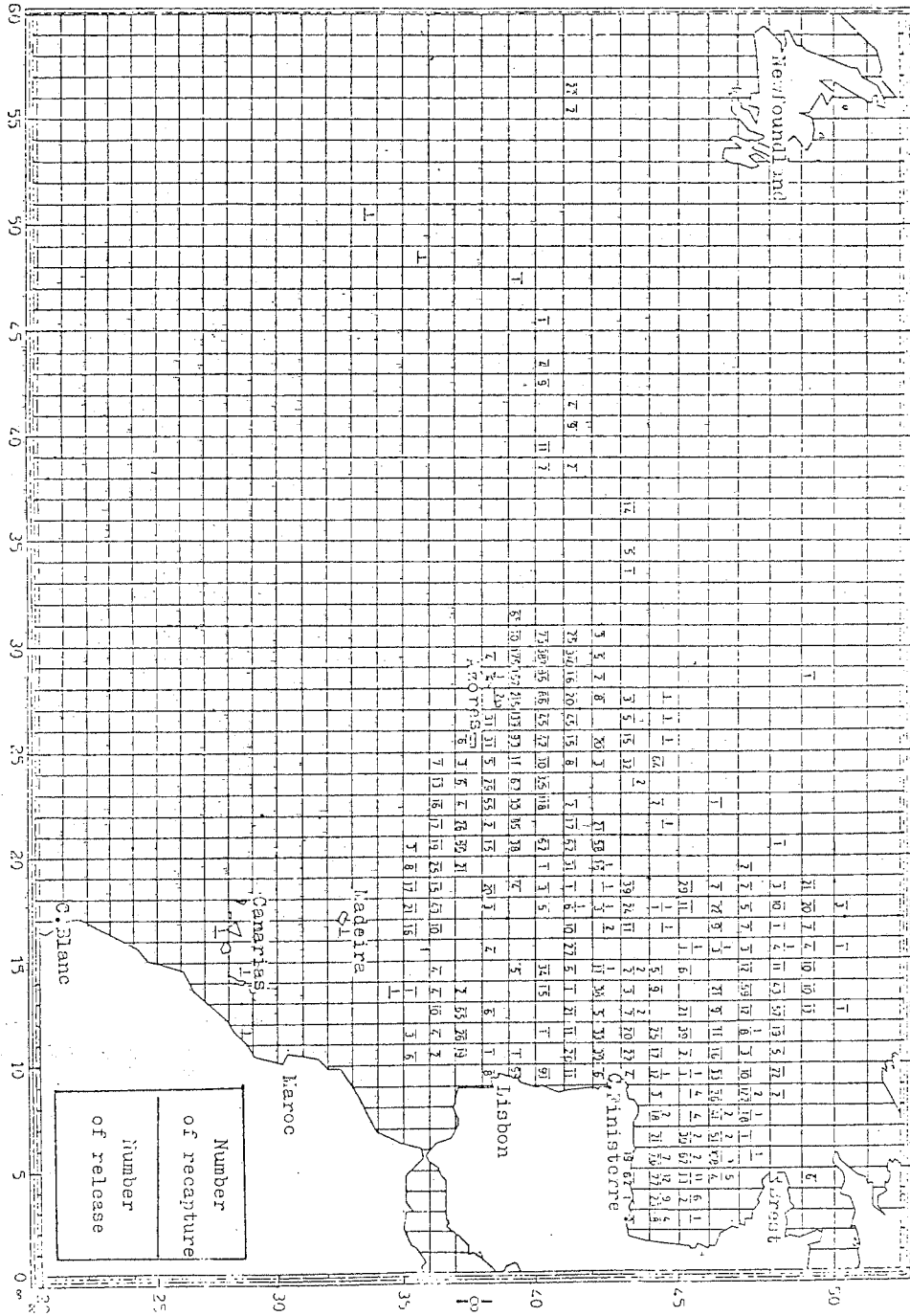


Fig. 2. Migration of albacores recaptured in July.

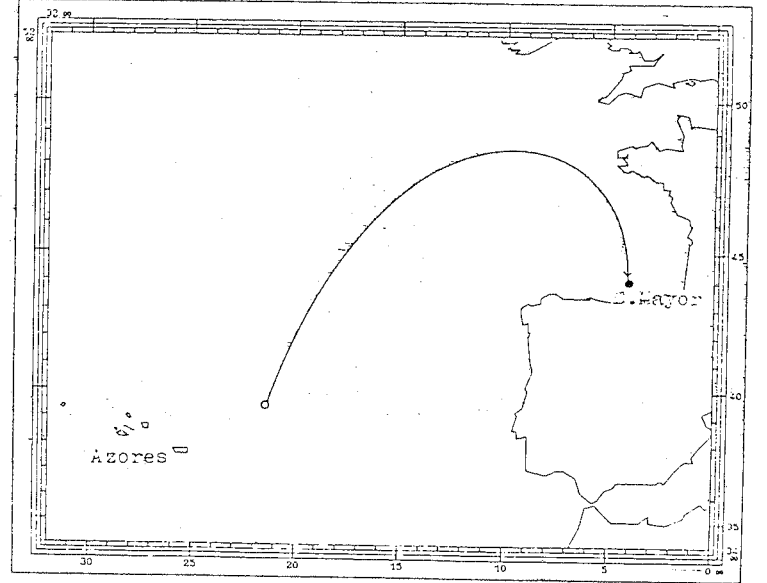


Fig. 3. Migration of albacores recaptured in August.

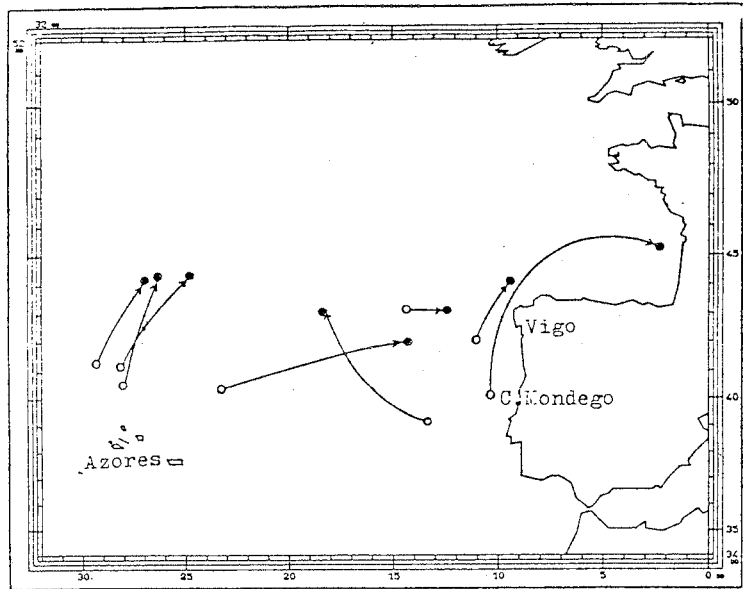


Fig. 4. Migration of albacores recaptured in September.

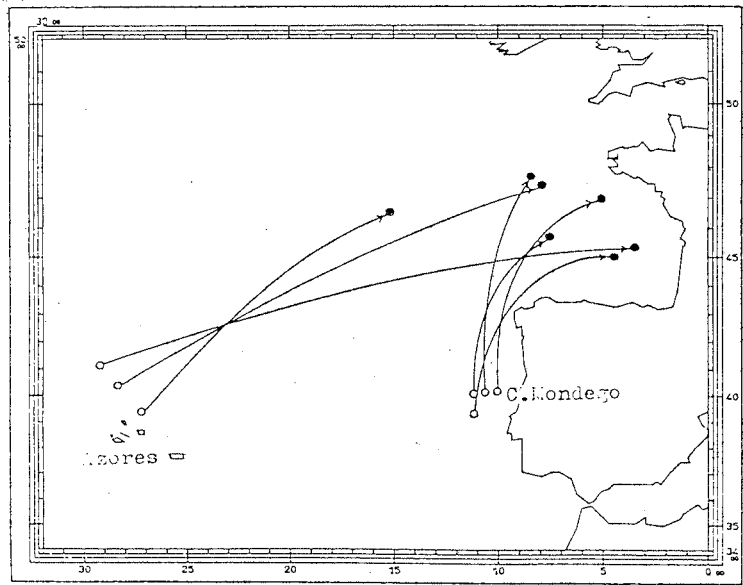


Fig. 5. Migration of albacores recaptured in October.

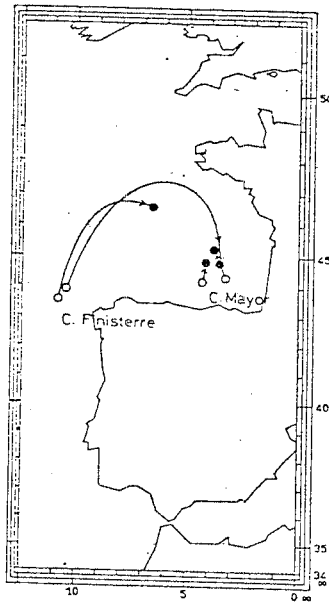


Fig. 6. Migrations of albacores released in July.

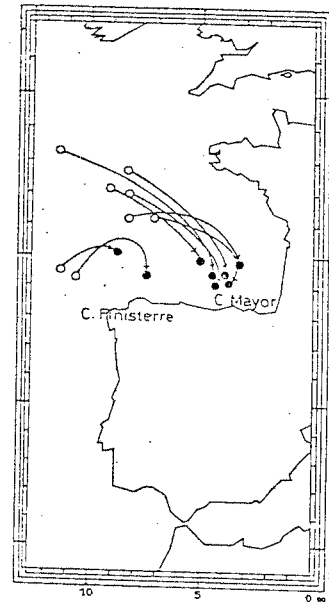


Fig. 7. Migrations of albacores released in August.

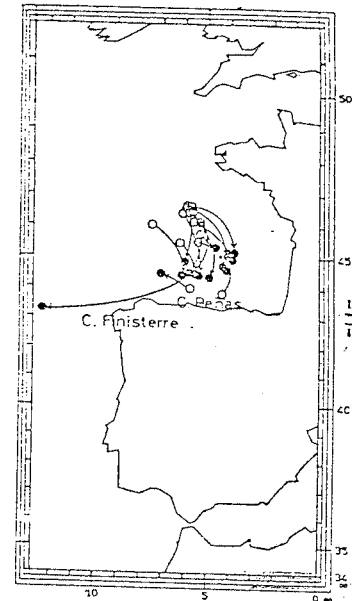


Fig. 8. Migrations of albacores released in September.

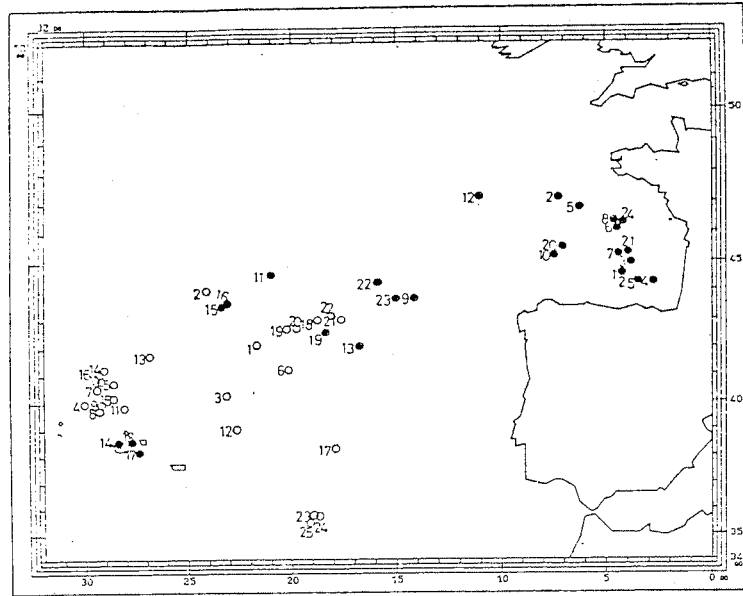


Fig. 9. Summer migrations of azorians released in June and July. (o-release, ●-recapture)

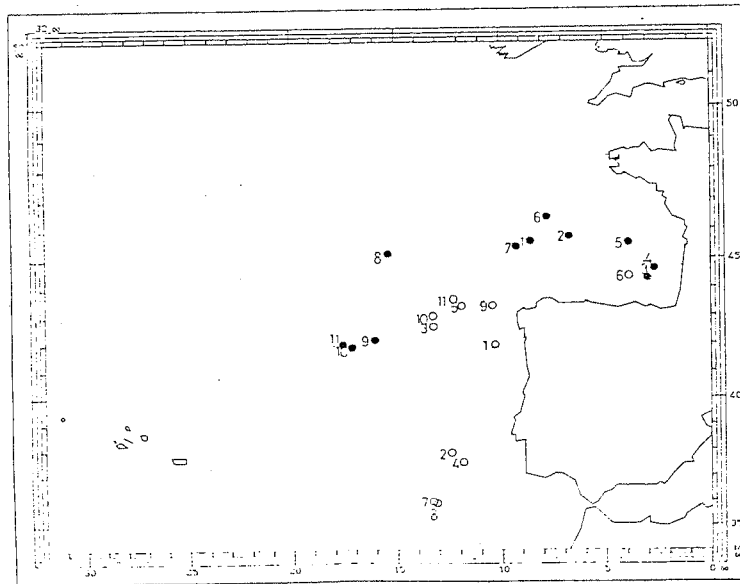


Fig. 10. Summer migrations of clonics released in June and July. (o-release, ●-recapture)

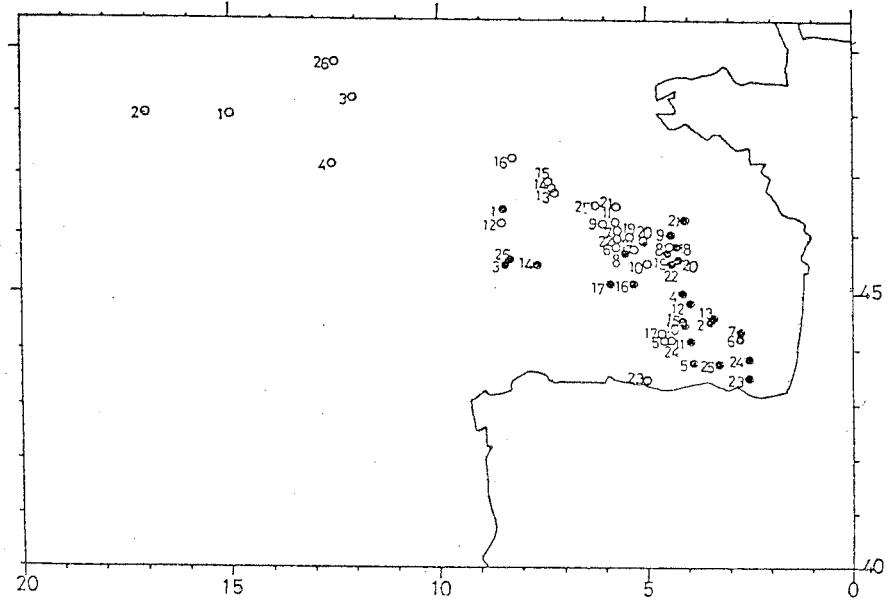


Fig. 11. Summers migrations of albacores released and recaptured from August to October. (o-release, o-recapture)

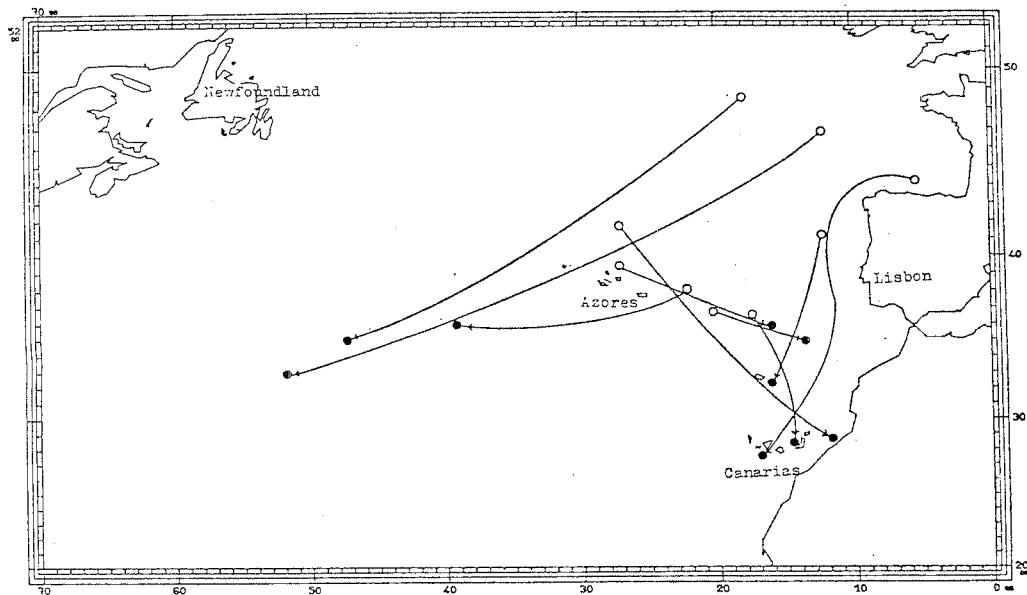


Fig. 12. Winter migrations of albacores in north Atlantic.

Year	Number of release	Type	Recaptures			
			Total	Double tagging		
			2/2	1**/2*	1/2*	
1968	421	PT	6			
	50	VH	2			
Total	471		8			
1969	288	PT	11			
"	315	VH	0			
1970	500	PT	9			
"	524	VH	1			
1971	247	PT	14			
	124	PT + PT	3	3		
	147	VH	4			
	91	VH + VH	2	2		
"	643	VH + PT	1	1		
1972	691	PT	8			
	138	PT + PT	3	3		
	668	VH	3			
	59	VH + VH	0			
"	1 511	VH + PT	5	5		
1973	553	PT	7			
	76	PT + PT	4	1	3	
	45	VH	6			
	0	VH + VH	2			
"	686	VH + PT	0			
1974	170	PT	4			
	12	PT + PT	3	3		
	21	VH	4			
	0	VH + VH				
"	204	VH + PT	1	1		
1975	228	PT	5			
	80	PT + PT	4	2	2	
	157	VH	1			
	3	VH + VH	0			
"	470	VH + PT	0			
1976	283	PT	1			
	176	PT + PT	2		2	
	105	VH	1			
	5	VH + VH	0			
"	573	VH + PT	0			
1977	418	PT	1			
	21	PT + PT	1	1		
	89	VH	2			
	1	VH + VH	0			
	0	VH + PT	0			
	529		4			
total	6 026		121			

(2 unknown + 2 in 1978 — total 125 recaptures)

Table 1. Numbers of releases and recaptures of albacores as function of the year and the types of tags.

- : 2 tags returned
- ** : 1 tag (VH) returned
- *** : 1 tag (PT) returned

Month	LAT	LGT	LAR	LGR	DL	PAS	SP	DIR
June	43.12	14.30	43.30	12.15	29	100	3.45	10.39
	41.13	28.58	44.25	25.00	27	263	9.74	46.89
	40.43	28.41	44.13	26.10	24	239	9.96	61.48
	41.33	29.31	44.10	27.30	24	181	7.54	60.16
	39.16	13.14	43.27	17.15	38	313	8.24	53.31
	40.05	10.50	45.40	7.30	54	368	6.81	65.55
	40.10	10.27	45.00	2.30	49	466	9.51	38.49
	40.20	9.58	47.00	5.00	34	460	13.53	60.41
	42.05	11.42	44.02	9.48	35	144	4.11	54.34
	40.06	10.46	47.50	8.30	75	476	6.35	77.11
	40.12	9.50	45.09	3.45	69	407	5.90	15.24
	40.26	9.43	44.20	4.07	68	347	5.10	42.41
	39.36	11.12	45.03	4.27	74	452	6.11	46.34
	40.02	23.31	44.19	5.56	83	848	10.22	17.64
	40.35	28.49	47.30	8.00	86	1035	12.03	23.64
	39.34	29.59	46.53	15.02	75	743	9.91	36.22
	35.44	18.35	44.37	5.45	101	821	8.13	40.48
39.31	21.12	44.00	3.50	123	848	6.89	18.49	
July	44.36	3.30	45.20	3.50	36	46	1.28	73.04
	44.32	4.29	44.50	4.00	46	27	0.59	41.81
	43.53	10.39	44.40	3.30	68	313	4.60	8.64
	43.36	10.43	46.40	6.30	76	260	3.42	45.05
August	44.25	10.36	44.30	7.20	29	140	4.83	1.64
	47.43	8.23	44.30	4.05	49	267	5.45	46.29
	47.05	8.24	44.20	4.15	38	243	6.39	42.77
	46.26	7.01	44.20	4.00	38	181	4.76	44.12
	48.20	11.14	44.40	4.44	34	354	10.41	36.39
	47.12	9.00	44.50	4.50	54	227	4.20	38.72
	46.17	8.13	44.50	3.27	66	221	3.35	23.18
44.32	11.16	45.10	8.45	72	114	1.58	19.47	
September	43.55	4.15	45.00	4.00	13	66	5.08	80.01
	46.35	5.57	44.40	4.20	27	134	4.96	51.59
	45.47	5.29	45.20	4.50	6	38	6.33	45.28
	46.25	5.42	45.07	3.45	17	114	6.71	43.17
	46.03	5.38	43.20	12.15	33	332	10.06	27.44
	45.46	5.26	44.40	4.10	39	85	2.18	50.94
	46.33	5.47	44.35	5.05	42	122	2.90	75.29
	46.16	5.48	45.00	4.00	38	108	2.84	44.72
	46.33	6.04	44.53	6.04	31	100	3.23	90.00
	45.35	6.19	44.35	5.05	39	80	2.05	48.59
	44.01	5.44	44.30	7.00	39	62	1.59	27.89
	46.33	6.04	44.34	5.30	33	66	2.00	67.55
46.15	7.31	44.34	5.53	35	130	3.71	57.80	
46.33	5.47	44.30	5.50	40	123	3.08	90.00	

Table 2. Quantitative data of albacores which are recaptured in the year of release. (LAT: latitude of release, LGT: longitude of release, LAR: latitude of recapture, LGR: longitude of recapture, DL: day of liberty, PAS: passage(mile), SP: speed (mile/day), Dir: direction (°)).

Period	Length interval	Means length	Number of fish	Speed	Coefficient of dispersion
June-July	70 - 75 cm	72 cm	5	6.8 miles/day	1,231.6 miles ² /day
	40 - 59 cm	54 cm	8	6.6 " "	783.1 " "
August-October	60 - 69 cm	64 cm	5	5.1 " "	59.7 " "
	40 - 59 cm	54 cm	17	3.6 " "	333.53 " "

Table 3. The speed and coefficient of dispersion of albacores as function of different lengths.