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PECULIARITIES OF VERTICAL DISTRIBUTION AND MIGRATION OF TUNAS IN THE GULF OF GUINEA

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SUMMARY

In a review describing the Soviet investigations of tunas and billfishes in the Atlantic Ocean (Vialov, Ovchinnikov, 1979) the data on the biology, peculiarities of distribution and behaviour of the main commercial species of tunas and tuna-like species are given. Tuna aggregations are shown to be formed in the upwelling zones and in the areas of adjacent waters of different origin. These two zones are characterized by the highest productivity, are rich in nutrients, plankton, fish and cephalopod aggregations. These conditions are typical of the Guinean Hollow in the western part of the Gulf of Guinea which is an important area in the longline fishery.

In the present paper the data on the peculiarities of vertical distribution of tunas and billfishes in the Guinean Hollow area are given, and the dynamics of their distribution in the winter period are shown depending on horizontal migrations.

RESUME

Ce document décrit les recherches soviétiques sur les thonidés et poissons porte-épée de l'océan Atlantique (Vialov, Ovchinnikov, 1979), les données obtenues sur la biologie, et les particularités de la distribution et du comportement des principales espèces commerciales de thonidés et espèces voisines. Les agglomérations de thonidés semblent se former dans les zones d'affleurement et dans les zones d'eaux adjacentes d'origine diverse. On distingue ces deux types de zones par leur taux élevé de productivité; elles sont riches en concentrations d'éléments nutritifs, plancton, poissons et céphalopodes. Ces conditions sont propres au Bassin de Guinée, dans la partie ouest du Golfe de Guinée, qui s'avère être un secteur important de la pêcherie palangrière.

Ce document fournit les données obtenues sur les particularités de la distribution verticale des thonidés et poissons porte-épée dans la région du Bassin de Guinée, ainsi que la dynamique de leur distribution pendant la période d'hiver selon les migrations horizontales.

RESUMEN

En un estudio que describe las investigaciones soviéticas sobre túnidos y marlines en el Atlántico (Vialov, Ovchinnikov, 1979) se presentan datos acerca de la biología, características de la distribución y el comportamiento de las principales especies comerciales de túnidos y afines. Las concentraciones de túnidos se forman en las zonas de afloramiento y en áreas de aguas adyacentes de distinta procedencia. Ambas zonas son de la mas alta productividad y ricas en elementos nutritivos, plancton, concentraciones de peces y cefalópodos. Estas condiciones son típicas de la fosa guineana en la parte occidental del Golfo de Guinea, zona muy importante para la pesquería de palangre.

El presente documento contiene datos sobre las características de la distribución vertical de túnidos y marlines en la fosa de Guinea y la dinámica de su distribución durante el invierno aparece dependiente de las migraciones horizontales.

Materials and Methods

Vertical distribution of tunas and billfishes was studied aboard the longline trawlers in the Guinean Hollow during December 1967 - January 1968 and March - June 1979. The following data were recorded: type of baskets (single, double, triple), number of hooks with catch, number of baskets, catch time, species composition of the catch in per cent, fish condition (live, distressed, half distressed) and its biological characteristics (size, sex composition, maturity, stomach filling, food composition).

The depth of the longline setting was measured using the depth sensor which is a maximum manometer placed into a sealed metal vessel with the inlet communicating with the sea water. The weight of the depth sensor is about 1 kg in the open air.

The majority of live tunas was recorded during the first part of the day and at noon, i.e. immediately before the haulback of the longline. A significant amount of fish was found to be hooked during the haulback near the vessel. These fish are usually very active. Therefore, to obtain more valid results of the fish distribution by depth, the catch by hook was recorded only for distressed fish.

The maturity stages were identified according to a four grade scale: I- immature, II - mature, III - running and IV - post-spawning. The stomach filling was determined according to five-grade scale, where 0 means that the stomach is empty, 1- food traces, 2 - half filled stomach, 3 - almost full stomach, 4- overfilled stomach. FL was used to measure the body length.

Discussion

The results obtained using the depth sensor showed that the maximum depth of the longline setting ranged between 240 and 270 m. Table 1 represents the data on the depth of occurrence of tunas, swordfish and billfishes which were obtained applying the above-mentioned instrument.

Yellowfin tunas, swordfishes and billfishes inhabit primarily the upper layers (1-100 m) and only the bigeye tuna is usually confined to deeper layers of 100 to 200 m (46.4%) and even of 200 to 300 m (38.0%).

The obtained experimental data were interpreted for the commercial catches of bigeye and yellowfin tunas (table 2).

The largest recorded catches of yellowfin tunas (over 10%) were taken at 60 to 210 m depths with the maximum catches from 90 m, and of bigeye tunas at 90 to 240 m depths with the maximum catches from 210 m.

The catches of the above species depend on the fishing season, biological condition and migrating activity of bigeye and yellowfin tunas (Ovchinnikov, 1969).

The data on species composition of tunas in the Guinean Hollow in December 1967 - January 1968 is given as an example. Commercial aggregations of tunas were found in the most productive zone along the boundary between the warm (24-29°) and rather saline (34.5-35.5‰) Guinean current and more cool (15-28°) and highly saline (35.5-37.5‰) Southern Equatorial current. The tunas fed intensively on squids, as well as on Gempilidae and Myctophidae.

Table 3 shows the species composition of tunas and their biological characteristics.

According to the data in table 3, the catch composition and biological characteristics of tunas changed considerably although during December–January the fishing was carried out in the same comparatively small area and at the same depth.

The percentage of catch composition also changed significantly: bigeye tunas comprised 71.5% of the total tuna catch in December and only 27.8% by the end of January. On the contrary, the yellowfin tuna catches increased from 28.2% in December to 72.2% in January. Biological characteristics of tunas changed accordingly. Against the background of reduced catches of bigeye tunas in December–January, their sizes decreased due to increased number of the immature fish. The number of females also decreased, and post-spawners were not observed in January. The feeding intensity became somewhat lower. At the same time, against the background of increased catches of yellowfin tunas, their mean sizes decreased, the number of ripe fish increased and the number of post-spawners decreased. The females increased significantly in number. The feeding intensity became lower. It is noteworthy that the above-mentioned changes occurred during the period of heating of the surface water from 25.5° early in December to 27.7° by the end of January.

This dynamics indicates that the tuna aggregations fished in December–January differed in biological factors. Yellowfin tuna aggregations, in particular, appeared to be a part of the population inhabiting the Angolan area in November–December. The population starts to migrate northwestwardly with the heating of the water in January and its migration routes pass through the open Gulf of Guinea, including the area of our investigations, to Cap Vert (Zharov, 1967). The increased number of yellowfin tunas in the catches is apparently the result of migration of the species to the spawning areas in the northern latitudes. The water heating may cause the migration of commercial bigeye tuna aggregations to the southern and more oceanic waters. Similar migrations to high latitudes in the warm period and to low latitudes in the cold period of the year were recorded for the Pacific yellowfin and skipjack tunas (Sharp and Diron, 1978).

Conclusions

1. The catches of bigeye and yellowfin tunas depend on the depth of longline setting. The largest catches of yellowfin and bigeye tunas were taken from the 0–100 m depths and from 100–200 m or deeper, respectively.

2. The catches of yellowfin and bigeye tunas depend on biological condition of the fish provided that other factors are similar. The heating of the surface waters in the Gulf of Guinea causes the northward migration of yellowfin tunas for spawning, and, as a result, the increased catches. Simultaneously, as a result of the seasonal water heating the bigeye tuna aggregations leave the Gulf of Guinea and migrate to the southern latitudes or to the open ocean.

References

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Table 1

Distribution (%) of tuna and tuna-like species by depth in the Gulf of Guinea in May -June 1979

SPECIES	Depth, m 0 - 100	200	300	No. of sp.
Thunnus obesus	15.6	46.4	38.0	101
Thunnus albacares	65.0	27.0	11.0	87
Xiphias gladius L	72.4	27.6	-	29
Ishiophorus platypterus	45.5	27.4	27.1	11
Nakuira nigricans	100.0	-	-	2

Table 2

Distribution of yellowfin and bigeye tuna catches depending on the depth of longline setting (December 1967-February 1968)

Longline setting depth	Yellowfin sp.	%	Bigeye sp.	%
30	59	10.0	4	3.2
60	81	13.6	4	3.2
90	102	17.2	16	12.7
120	77	13.0	14	11.1
150	68	11.4	25	19.3
180	78	13.2	15	11.9
210	75	12.6	28	22.3
240	40	6.8	15	11.9
270	13	2.2	5	3.9
TOTAL:	593	100.0	126	100.0

Table 3

Species composition and comparative biological characteristics of longline tuna catches from the Guinean Gulf (December 1967-January 1968)

Characteristics	Bigeye (n=120 sp.)		Yellowfin (n=590 sp.)	
	December	January	December	January
%, in catch composition	71.5	27.8	28.5	72.2
fluctuations	46-177	62-162	69-170	66-172
size, cm				
average	130.5	120.0	140.7	138.3
maturity stages, %				
I	54.5	89.0	40.0	45.4
II	8.5	11.0	0.0	48.0
III	0.0	0.0	0.0	0.7
IV	37.0	0.0	60.0	7.9
sex composition				
♀	49.7	37.5	33.6	40.5
♂	46.1	51.0	64.6	59.5
juv	4.2	11.5	1.8	0.0
stomach filling				
(average)	1.40	1.26	1.50	1.02