RUSSIAN TUNA RESEARCHES IN 2006

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INTRODUCTION

Research was conducted between April 11 and June 15, 2006 in the West Central Indian Ocean on the high seas (Figure 1) from purse seiners "Longevity" and "Golden Success". The results were sent to the Center of Collecting Fishery and Biology information on tunas harvested by purse seines. Besides, some information was collected on the operations of all tuna seiners of the "International Fishing Corporation" between January and May, 2006.

DATA AND METHODS

Information on 21 purse seine hauls was collected from these two tuna seiners throughout the observation period. Biological data was collected on the size-age structure of tunas, spatial distribution and biological status of the major fishing species. All the catches were used to determine the composition of all the fish in qualitative and numerical terms. The type of school was recorded with due regard to classification of the free-swimmers and associated schools, and the type of association. Fish were measured, cut; full and partial biological analysis was made, and size-weight indices of the main fishing species was determined. The same is true of the by-catch species. Fish were sampled for age. The incidental catch of marine mammals was recorded. The catch per unit effort was calculated. Fish-finding information was collected each day while the operations were under way to detect aggregations of tunas with floating objects. Any signs of free-swimming tuna schools porpoise of whales were recorded. The behaviors of groups and individual birds, the type of floating objects and the state of fish aggregating near them were observed both visually and with echosounder. The species composition of the associated concentrations including the fish in the immediate vicinity of the ocean surface, their position and the time of detection were registered. The hydrological and weather information was collected using the equipment on-board and the satellite monitoring system CATSAT.

Totally during the period of work measurements were made for 1590 skipjack tuna, 760 bigeye, and 650 yellowfin. Biological analysis was made for 200 skipjack tunas, 106 bigeye, 118 yellowfin, 40 frigate tunas and 40 other species. Eighty striped tuna, 35 yellowfin and 35 bigeyes were sampled for age.

RESULTS

While studies were being made the weather condition in April-May 2006 was rather stable: southern and south-eastern winds prevailed (1-6 m/sec); sea waves rarely exceeded 2 points; it was often 0-1 point. The air pressure varied within 1001-1014 mBar; it was mostly variably cloudy. Short rains were regular which usual for this area and season.

The hydrological characteristics in the fishing area were rather similar too. The temperature regime in various strata fluctuated insignificantly. Hence, water temperature close to Equator on the surface changed within 29,5-30,2ºC; at 75 m the range was 22,6-25,6ºC. The 22ºC isotherm's depth varied from 80 to 105 m.

During scientific research it was only associated aggregations of tunas with floating objects, both natural and FADs that were fished. Purse seine sets were made mainly at pre-dawn time. The dominant species in catches was skipjack tuna *Katsuwonus pelamis* (Linnaeus, 1758). Besides, bigeye tuna *Thunnus obesus* (Lowe, 1839) and yellowfin tuna *Thunnus albacares* (Bonaterre, 1788) frequently occurred in catches as well. In addition to these main fishing species present in associated concentrations with floating objects there were 24 fish species of 14 families (Table 1).

Table 1. Species composition, frequency of occurrence and fish size in associated concentrations in the West Central Indian Ocean in April-May 2006.

Семейство	Вид рыбы	Частота встречаемости, %	Длина (Smith) min-max, см
Carcharhinidae	Carcharhinus falciformis	9,5	71-128*
Dasyatidae	Pteroplatytrygon violacea	9,5	43-47*
Belonidae	Ablennes hians	+**	87
Coryphaenidae	Coryphaena equiselis	23,8	36-65
	Coryphaena hippurus	95,2	39-110
Carangidae	Carangoides orthogrammos	9,5	22-27
	Caranx sexfasciatus	9,5	27-35
	Decapterus macarellus	90,4	22-40
	Elagatis bipinnulata	90,4	30-92
	Seriola rivoliana	9,5	23-30
Lobotidae	Lobotes surinamensis	33,3	35-51
Kyphosidae	Kyphosus bigibbus	28,6	12-25
	Kyphosus cinerascens	9,5	12-34
	Kyphosus vaigiensis	9,5	20-41
Ephippidae	Platax orbicularis	+	23-27
Sphyraenidae	Sphyraena barracuda	57,1	60-112
Scombridae	Acanthocibium solandri	33,3	56-109
	Auxis thazard	28,6	25-40
	Katsuwonus pelamis	100	31-72
	Thunnus alalunga	+	101-102
	Thunnus albacares	95,2	35-113
	Thunnus obesus	100	38-105
Istiophoridae	Makaira indica	19,1	171-280
	Makaira mazara	+	nk
Balistidae	Canthidermis maculatus	100	12-35
Monacanthidae	Aluterus monoceros	42,8	25-40
Molidae	Mola mola	+	167

*- sharks – absolute body length; skates – disc length
** - occurrence below 5%

When purse seining was made using FADs, and natural floating objects were fished near, the catches basically consisted in most cases of skipjack (80-85% of the catch weight on the average). The remaining part is young fish, and adult individuals of yellowfin and bigeye tunas. The prevalence of one of these two species over the other depends on the time of the year and area of fishing.

The conditions of fisheries in the Indian Ocean in the first half of 2006 were not stable. The absolute and average indicators of catches taken by the fleet, and the catch rate varied considerably from month to month (Figure 2). For example the largest catches were in March-April when the total catch taken by the fleet exceeded 3500 metric tons. CPUE in that period was 20-25 tons per vessel day.

The total catch of 13770 metric tons was taken in 357 sets of purse seines made by a fleet of 6 vessels belonging to the "International Fishing Corporation" during the first 5 months of 2006. CPUE was 38.6 metric tons per one set, and 18,8 per day (Figure 3). The average catch per seiner that period was 2300 metric tons.

Skipjack made up the basis of catches taken by PS "Longevity" and PS "Golden Success" in April-May 2006. The greatest catch per one set was over 118 metric tons (30,7 tons on the average). The mean catch per vessel day was 25,8 metric tons. The share of this species in catch by weight was 9-95% (78,6% on the average). Juvenile bigeye of up to 70 cm were found in catches in considerable amounts. The largest catch of this species per one set was 17,6 metric tons (average of 3,9 tons per set); it was 3,3 tons per vessel day. Its average share in catches was 8,7% by weight; the largest volume per one set was 35%. Yellowfin tuna ranked third among the species occurring in purse seine catches. Similarly to bigeye, most individuals of this species were young an immature. The average catch per one set was 2,1 metric tons; it was 1,8 tons per vessel day. Its share in catches did not exceed 20% (7% on the average).

The size of skipjack occurring in purse seine catches in April-May, 2006 ranged widely (31-72 cm); fish of 45-55 cm prevailed. The average size of skipjack was 50,1 cm. The weight of specimens varied between 0,3 and 9,5 kg (2,6 kg on the average). The mean length of females of this species was 50,01 cm; males were 50,14 cm long on the average. Their mean weight was 2,58 and 2,67 kg respectively.

Fish at various stages of maturity were found in catches. However, the catches basically consisted of 2-3 year-old males and females at maturity stages III and IV. Besides, the fish, which had already spawned once in 2006 constituted an important share as well. The number of young specimens was somewhat less than 20% of all fish of this species in aggregations. The sex ratio among the skipjack was close to 1:1; juveniles made up 3,5% of their total number.

The stomachs of virtually all the skipjacks occurring in purse seine catches were empty. Only several specimens contained in their stomachs insignificant amounts of digested food. Of all the food items only remains of squid could be identified; in some cases there were also bones of small fish.

As for the vertical distribution of the skipjack in the area of study at this time of the year, we can say that this species prefers the 20-50 m layer both in day-time and at night.

The size of bigeye tuna found in purse seine catches ranged widely from 35 to 105 cm. Yet, the group of 55-65 cm weighting 2,5-7 kg was more abundant. The weight of youngest fish was nearly 0,5 kg, with the length of about 35 cm; the largest fish were over 40 kg. The mean size of bigeye was 60,1 cm, the mean weight was about 4,25 kg. The sex ratio among bigeyes was close to 1:1.

Schools of bigeye tuna staying jointly with concentrations of skipjack, and harvested with purse seines, consist mostly of young and maturing individuals aged 1-2 years. Of all the fish of this species examined for biological analysis juveniles made up 16%. In most cases bigeye tuna's sex becomes identifiable when the fish reaches 42-50 cm. The bulk of this species' catches were females and males of 50-65 cm at maturity stage I and II. No pre-spawning or ready-for-spawning fish were found. However, there were two females of over 1 meter thad had ended their spawning, most likely in winter, and they were preparing for the next year spawning (stage VI-III of maturity).

In by far most cases the stomachs of bigeye tunas were empty too. In several instances some squids and flying fish were recorded in the food bolus.

The bigeye tunas' vertical distribution depends on their age and, accordingly, size of fish. Juvenile individuals of this species in the area examined are found jointly with skipjack school, and they roughly agree with them in size. Fish of over 80 cm are deeper preferring a cooler layer of 60-100 m where water temperatures are 19-24ºC. Larger fish, bigger than 120 cm, like to stay still lower not accessible to purse seines, or are able to get away from the net range.

Yellowfin tunas in catches were 35-113 cm. However, despite such a wide size range, most fish were 52-62 cm. Their individual weight was within 0,5 and 40 kg. The average size of yellowfins was 58,7 cm; the mean weight was about 3 kg. No significant differences in the sizes of males and females were detected either.

The most numerous size group of 48-70 cm mostly included individual yellowfins at maturity stage II. Accordingly, smaller fish were at stage I or juveniles, while larger ones were at stage III. No pre-spawning or spawning yellowfins occurred. As was the case with the bigeye tuna though, several large post-spawning fish were found (spawned probably in January-February 2006).

The stomachs of yellowfin tunas contained food more often than those of skipjack and bigeye, though the average index of fullness was negligible too. The food items found were squid, flying fish, and remnants of fish of Gempylidae and Echeneidae families. The yellowfin tuna is most warmth-loving species of the three. Both small and large individuals prefer the subsurface layer down to 50-70 m where temperatures are 23-30ºC. However, large yellowfins are less stenothermal than small ones and like the bigeye, they are able to dive under the purse seine.

During the cruises there were studies of the time of formation and recruitment of tuna aggregations associated with natural floating objects and FADs. It should be pointed out that the time of formation of such concentrations depends primarily on the bioproduction in the region where the floating object is. According to the data obtained, the time period needed for establishment of associated aggregations of tunas having a biomass of fishing size is about one month. However, depending on the productivity in the area where FADs drift this time may be longer or shorter.

Associated concentrations are enlarged with tuna schools much faster than new ones are formed. In some cases it takes several days. Hence, in some cases, after the concentrations near the floating objects were fully taken out, new concentrations of commercial size of biomass emerged near the same object already after 4-5 days. There have also been repeated cases of recruitment of the concentrations with new fishing-sized ones within 8-12 days.

Consequently, it may be stated that in the event of primary formation of a concentration of a biomass reaching a commercial size near the floating object, the fish groups are replenished then after harvesting within 7-10 days if the object is drifting in a productive area.

CONLUSIONS

When associated concentrations are harvested the basic species in catches throughout the whole year is skipjack, which makes up about 80% of the total weight. The remainder consists of young yellowfins and bigeyes.

The total catch of the tuna fleet taken during five month of fishing was 13770 metric tons. The average catch per vessel day was 18,8 tons. The mean catch per seiner in that period was 2300 metric tons.

The best period for conducting purse seining for tunas in the West Central Indian Ocean on the high seas in the first half of 2006 was from the second half of February to late April.

The time needed for the formation of a concentration of tuna of a commercial size in the immediate vicinity of a floating object is about one month. This time period may be extended depending on the rate of production in the area where the object is drifting. After being fished, an

associated concentration may be replenished within 4-10 days if the floating object is in a productive region.

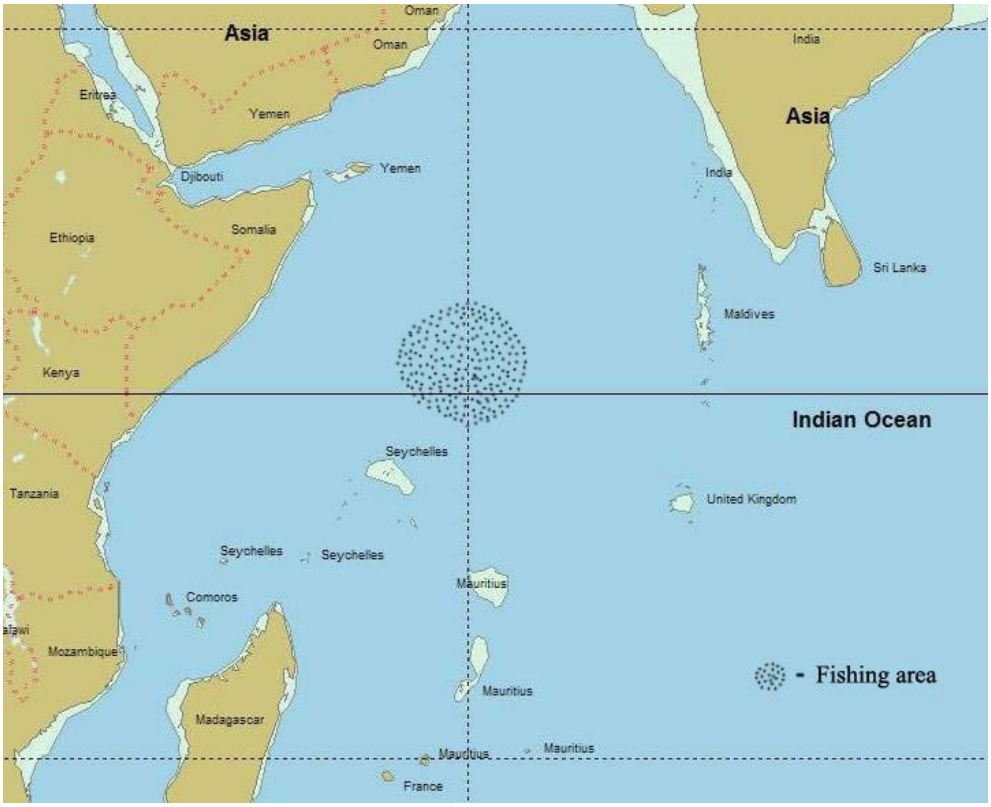

Figure 1. Fishing area of purse seine vessels “Longevity” and “Golden Success”

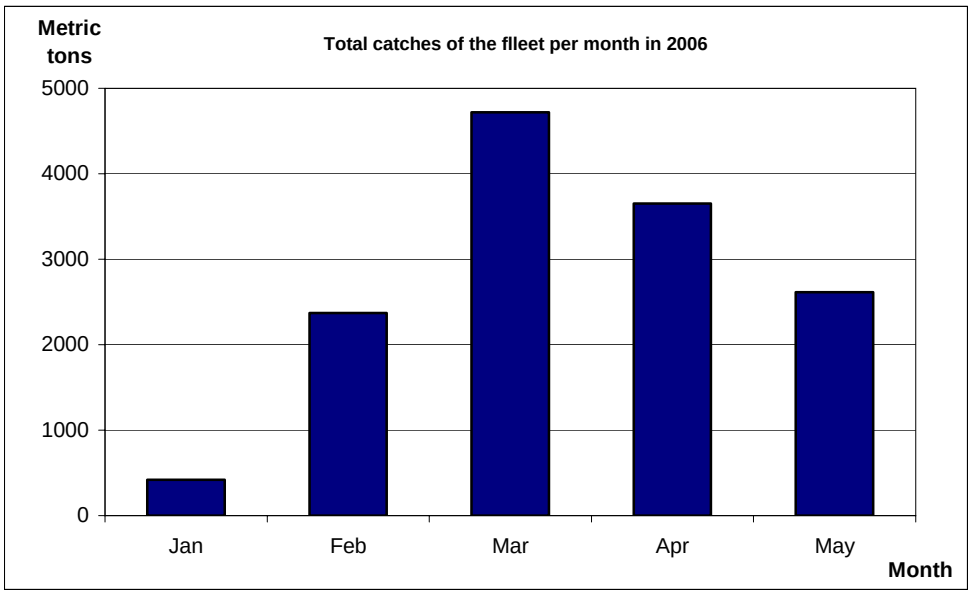

Figure 2. Total catches of the fleet per month in 2006

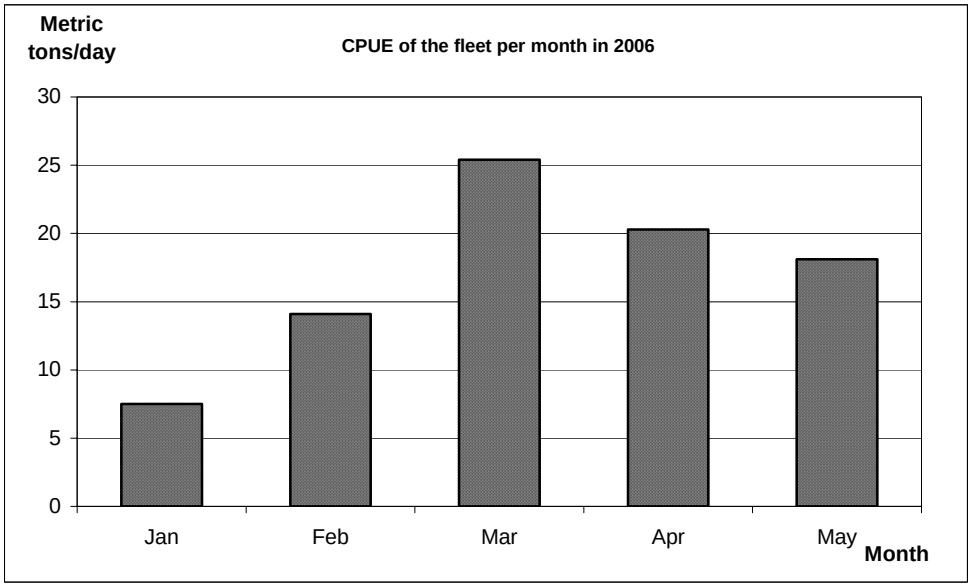

Figure 3. CPUE of the fleet per month in 2006