

DISTRIBUTION OF TUNA LARVAE IN THE ARABIAN SEA

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Out of the 694 collections made from the Arabian Sea during the International Indian Ocean Expedition, 88% were from the offshore and oceanic regions. Though fish larvae were represented in 92% of the samples, the tuna larvae were present in only about 10.6% of the stations. They were collected in all seasons of the year. The maximum abundance was noticed during July-August. February, March and April were the poor months for the larvae. The coastal stations were represented by mainly *Auxis* and *Euthynnus* species. *Thunnus albacares*, *Thunnus obesus*, *Thunnus alalunga* and *Katsuwonus pelamis* were the main species collected from the offshore and oceanic waters, their concentrations being along the equatorial zone.

INTRODUCTION

The tuna which constitutes a major oceanic pelagic fishery is widely distributed in the tropical and subtropical regions of the world oceans. Though there are several species of economically important scombroid fishes in the Indian Ocean, India's catch of tuna is very insignificant, as most of the species are harvested mainly from the open sea. The distribution, biology and larval history of this group are of great importance and information on the developmental stages and distributional aspects of tuna species from the Indian Ocean is scanty, except for the works of Gorbunova (1963), Jones (1960a, 1960b; 1961), Jones and Kumaran (1963; 1964), Jones and Silas (1963) and Ueyanagi (1969).

MATERIAL AND METHODS

During the International Indian Ocean Expedition, 694 IOSN collections were made (vertical hauls from 200-0 m) from different parts of the Arabian Sea. The tuna larvae sorted out from these samples form the material for this study. Total number of larvae in each sample was estimated and the abundance and distribution were recorded. The species composition of the larvae was determined from fractions of samples collected from the equatorial zone only where a high concentration of the larvae was noticed.

RESULTS

Arabian Sea recorded the presence of fish larvae in 92% of the collections. Though 88% of the samples were from the oceanic and offshore waters, tuna larvae were represented only in 10.6% of the samples. But they were collected in all seasons of the year, the maximum abundance was noticed during June-July months. February, March and April were the poor months for the larvae. About 28.8% of the stations had only one larva each, and 5.9% of the stations, 2 larvae each. The highest number of larvae in a collection was 10 and was recorded from the central part of the Somali coast. The next higher numbers (8-9) were from the northern region of Arabian coast. Out of 74 stations which recorded tuna larvae, 24 were day and 50 night stations.

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Along the western boundary of the Arabian Sea, the waters off the east coast of Africa showed a patchy and discontinuous distribution of tuna larvae (Table 1). Off the Arabian Coast excluding the southern half, they were distributed rather uniformly. But along the eastern boundary they were represented by only a few stations off the southwest coast of India, off Maharashtra coast and off Karachi, leaving the central part of Arabian Sea with no record of tuna larvae. On the other hand, along the equatorial region, they were quite abundant. Analysis of the specieswise composition of the larvae in the equatorial

TABLE 1. STATION LIST OF THE SAMPLES WHICH RECORDED THE LARVAE OF TUNA IN THE ARABIAN SEA

*Ship	Cruise	Station Number	Position	Date	Day/ Night	No. of larvae	Remarks	
AB	II	114	01°30'N 70°01'E	31- 5-1963	D	1		
		115	01°07'S 70°01'E	1- 6-1963	D	2	<i>Thunnus</i> sp.	
	III	148	04°05'N 59°58'E	17- 8-1963	N	1		
		150	02°00'N 59°59'E	20- 8-1963	N	1	<i>Thunnus</i> sp.	
	IVA	175	17°20'N 56°29'E	17-10-1963	N	1		
		133	23°43'N 66°21'E	28-10-1963	N	4		
		156	20°44'N 61°15'E	4-11-1963	N	3		
	V	325	01°04'N 75°07'E	28- 4-1964	D	1		
	VI	335	03°58'N 65°02'E	25- 5-1964	D	4		
	Ar	DO	69	03°00'N 55°00'E	29- 8-1964	N	3	
		Lu	17	00°01'S 65°04'E	14- 7-1962	N	1	<i>Auxis</i> sp.
18			00°03'S 62°41'E	15- 7-1962	N	1		
21			00°01'S 57°05'E	18- 7-1962	N	1	<i>K. pelamis</i>	
22			00°03'N 55°03'E	18- 7-1962	N	4	<i>T. obesus</i>	
24			00°05'S 50°56'E	21- 7-1962	N	2	<i>T. albacares</i>	
32			02°30'N 53°00'E	2- 8-1962	N	1	<i>T. alalunga</i>	
35			01°00'N 53°00'E	4- 8-1962	N	3	<i>T. obesus</i> and <i>Auxis</i> sp.	
39			01°00'S 53°00'E	8- 8-1962	N	1		
53			00°05'E 62°20'E	18- 8-1962	D	1	<i>T. albacares</i>	
54			00°29'N 62°19'E	19- 8-1962	N	2		
61		05°02'N 62°20'E	22- 8-1962	N	1	<i>T. albacares</i>		
64		02°55'N 78°58'E	30- 8-1962	N	2			
71	00°30'S 79°02'E	2- 9-1962	N	1				
Di	I	5002A	20°19'N 38°21'E	16- 6-1963	N	2		
		5002B	20°19'N 38°21'E	16- 6-1963	N	3		
		5009	15°10'N 52°32'E	26- 6-1963	D	1		
		5012	14°45'N 52°47'E	27- 6-1963	N	4		
		5014	14°15'N 53°12'E	27- 6-1963	D	1		
		5017	12°56'N 53°44'E	28- 6-1963	D	4		
		5026	16°31'N 54°03'E	30- 6-1963	D	2		
		5037	17°28'N 57°03'E	5- 7-1963	D	3		
		5041	16°45'N 57°30'E	6- 7-1963	D	2		
		5052	18°39'N 58°31'E	11- 7-1963	N	4		
		5053	18°20'N 58°59'E	11- 7-1963	D	4		

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Di	I	5067	20°13'N	60°20'E	17- 7-1963	N	9			
		5068	19°58'N	60°48'E	17- 7-1963	D	1			
		5069	19°34'N	61°14'E	17- 7-1963	N	8			
		5989	13°14'N	50°14'E	11- 8-1963	N	1			
		5094	15°45'N	53°11'E	17- 8-1963	N	6			
Di	III	5288A	03°06'S	57°58'E	24- 3-1964	N	1			
		5288B	03°06'S	57°58'E	24- 4-1964	N	1			
		5992A	04°56'S	58°04'E	24- 3-1964	N	2			
		5367A	14°18'S	67°36'E	2- 5-1964	N	1			
		5381A	09°57'N	74°27'E	19- 5-1964	N	1			
		5402A	11°09'N	56°30'E	29- 5-1964	D	4			
		5408A	04°20'N	57°58'E	31- 5-1964	N	6			
		5412B	02°02'N	56°03'E	2- 6-1964	N	6			
		5446B	00°05'S	64°45'E	18- 6-1964	N	3			
		5518B	04°39'S	41°01'E	26- 7-1964	N	1			
Ka	III	15	00°01'S	78°06'E	12-12-1963	N	1			
		16	01°06'S	78°03'E	13-12-1963	N	2			
Ki	II	70	12°00'N	63°00'E	7-11-1962	D	1			
		XI	258	11°00'N	74°33'E	25- 7-1963	N	2	<i>Auxis</i> sp.	
			294	07°00'N	71°30'E	20- 8-1963	N	4	<i>Auxis</i> sp.	
			297	01°42'N	71°38'E	22- 8-1963	N	1	<i>Thunnus</i> sp.	
			299	00°05'N	71°29'E	22- 8-1963	N	1	<i>E. affinis</i>	
Me	I	116B	08°26'N	50°32'E	27-12-1964	N	1			
		132	01°56'N	49°03'E	1- 1-1965	D	1			
		142	01°28'N	44°52'E	6- 1-1965	N	10			
		145	00°48'N	45°23'E	7- 1-1965	N	1			
		148	00°00'N	46°03'E	9- 1-1965	N	1			
		151	02°36'N	44°14'E	11- 1-1965	D	2			
		157	01°12'N	42°13'E	14- 1-1965	D	1			
		164	04°27'S	40°59'E	23- 1-1965	N	1			
		166	04°50'S	42°08'E	24- 1-1965	D	1			
		173	01°00'S	57°50'E	30- 1-1965	N	1			
		180	05°12'N	66°03'E	5- 2-1965	N	1			
		Va	XXX XXXI	1768	20°00'N	71°45'E	7- 5-1963	D	1	
				1800	18°30'N	71°30'E	13- 5-1963	D	5	
1801	18°30'N			71°15'E	13- 5-1963	D	1			
1802	18°30'N			71°00'E	13- 5-1963	D	3			
Vi	XXXV	5247	05°35'N	79°56'E	29- 9-1962	N	1			
		5248	05°28'N	78°33'E	29- 9-1962	D	1			
		5251	03°00'N	77°01'E	1-10-1962	N	5			

*AB—ANTON BRUUN, Ar Do—ARGO DO DO, Ar Lu—ARGO LUSIAD, Di—DISCOVERY,
Ka—KAGOSHIMA MARU, Ki—KISINA, Me—METEOR, Va—VARUNA, Vi—VITIAZ.

regions showed the presence of larvae of *Auxis* sp., *Euthynnus affinis*, *Katsuwonus pelamis* and *Thunnus* sp. like *T. alalunga*, *T. obesus* and *T. albacares*.

DISCUSSION

The general pattern of distribution of tuna larvae indicates that they are concentrated along particular regions. The areas rich in the larvae are coastal and offshore waters parallel to the coast and the equatorial zone. These areas of high abundance coincide with regions noted for upwelling during some seasons of the year, or divergence caused by equatorial currents and equatorial counter current systems. On the other hand, in the central part of Arabian Sea which is a zone of cyclonic gyre during the SW monsoon season, the water is not well mixed up with the water of the surrounding regions. This probably accounts for the total absence of larvae in this region.

The data available for the species composition showed that almost all species of tuna in the Arabian Sea are represented in the equatorial zone. The presence of larvae of *Auxis* and *Euthynnus* in this region indicates that the spawning of these species which occurs in the coastal waters seem to take place in the oceanic region too, along with the species of other genera like *Thunnus* and *Katsuwonus*.

The capture of larvae during all seasons of the year (Table 1) would suggest that the spawning is continuous throughout the year. Gorbunova (1963) has reported that the prolonged spawning which is typical of all tuna species begins by September, reaching the maximum in November, December and January months and decreasing by June, July and August.

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DISCUSSION

- CHRYA : Was any intensive collection done in Gujarat waters and if so, what was the concentration of tuna larvae?
- PETER : During the IIOE, only 34 stations were covered in the coastal and offshore waters of Gujarat and only 4 specimens of tuna larvae were collected in total.
- VAGN HANSEN : What is the growth rate of tuna larvae?
- PETER : Growth rate of scombroid fishes is rather very fast, particularly in the tropical waters. An *Auzis* larvae of 5 mm length is not more than two weeks old.
- VAGN HANSEN : Has any spawning ground been detected?
- PETER : Most of the scombroids spawn in the open ocean and offshore waters. Records show that there is a possible spawning ground of *Auzis* sp. off the waters between Cochin and Vizhingam.
- RAYMONT : Is there a relationship between size (age) of larvae and distance offshore?
- PETER : Yes, the relationship is that the very early larval stages will be located nearer to the spawning grounds which are the oceanic and offshore waters in the case of tuna.
- JILLETT : Can the stocks of tuna of the various species be regarded as single or separate populations or races?
- PETER : They are different populations.
- GRIFFITHS : Please comment on the importance of the Arabian Sea nursery area in comparison with other tuna nursery areas, particularly the northwest coast of Australia.
- Peter : The distribution of tuna larvae shows that the Arabian Sea, particularly the waters off the southwest coast of India supports a nursery of some kind. But the northwest coast of Australia is a probable nursery for more species of tuna than that in the Indian Ocean.
- GEORGE FERNANDEZ : What is the distribution pattern of tuna larvae on the east coast of India?
- PETER : During the IIOE, out of the 400 stations in the Bay of Bengal, only 57 stations represented tuna larvae, the total number being only 113.