

ON THE RESULTS OF PRELIMINARY FISHING TRIALS WITH SHARK LONG LINES IN VERAVAL WATERS

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Experimental fishing operations with shark longlines were conducted in the sea off Veraval with a view to studying their efficiency and gathering information on the available resources of sharks to be used for planning the future gear investigations. The trials were undertaken in 1967, employing departmental fishing vessel "Fishtech No. IV" (10.9 m O. L. and 48 H. P. engine). A total of 5525 hooks were employed and 242 sharks weighing 8629 kg were landed. Data on composition of catch, weight of fishes landed, effectiveness of various baits in capture of different species of sharks and effectiveness of gear including its catch efficiency in this area, were compiled. Bait preference was also observed in certain species of sharks caught. *Chirocentrus dorab* proved to be the cheapest and most effective bait in capture of all the three varieties of sharks landed.

INTRODUCTION

Accounts of the marine fishing gear of India show that longlines and bottom drift gillnets were in vogue along the Ratnagiri District of Maharashtra State from very early times. Possibly, due to their superiority in capture of deep sea fishes, the methods were introduced in South Kanara District and subsequently extended to north-west, south-west and south-east coasts of the country (Government of Madras, 1929, Sorley, 1932). Hornell (1916) indicated the probable existence of

good line fishing grounds off erstwhile Travancore State. John (1948) recorded the existence of good fishing grounds for longlines in the sea off Anjengo and Chavara in depths between 60 and 70 fathoms. Gopinath (1954) stated that this fact was known to the fishermen, a few of whom visited these grounds during the fair weather. According to John *et al* (1959) the muddy bottom and comparatively surfless region of west coast attract seasonal migratory schools of fishes and these in turn are chased by sharks and

other predatory fishes which subsist on them.

Sorley (*op cit*) in his report on the Marine Fisheries of Bombay Presidency gave a brief descriptive account of the shark longlines used by the fishermen of Sind, North Gujarat, Konkan and South Kanara. John (1964) and George (1964) described in a general way the shark longlines with revolving double chain hooks employed on the west and east coasts of Madras Presidency. Hornell (1924, 1950), Setna (1945), Moses (1948), Bal and Banerji (1951), Devanesan and Chidambaram (1951), Government of India (1951), Srivatsa (1954), Gokhale (1957), Kini (1958), John *et al* (*op cit*) and Kaikini (1960) made passing references about the longline gear in vogue. Specific design and operational details of the gear are conspicuous by their absence.

During 1963-65 the senior author made detailed observations on the landings of pomfret gill nets along the Kathiawar coast. These observations revealed the existence of favourable conditions for concentration of sharks in the area. However, there is no organised longline fishery. With a view to evolving a cheap and effective longline gear for capture of sharks and to assess the relative efficiency of various baits, experimental fishing trials were undertaken during the last quarter of 1967. The results of these tests along with the other note-worthy details of the gear are communicated in this paper.

PERIOD OF FISHING AND FISHING GROUND

Fishing trials commenced on 12-10-'67 and continued till 10-12-1967. 14 fishing cruises were made conducting 15 operations. The grounds selected were located within the depth range of 40 to 58 meters. Fig 1. (based on Admiralty chart No. 1470)

GEAR

Basically the gear consisted of a main-

line supporting a series of branch-lines and reinforced on either side by vertical lines with floats at surface and sinkers at bottom. 15 to 20 such units are generally tied in a string with two additional anchor lines attached to either end for completing the "Set". The longline gear used during the course of present studies were similar to the gear employed by the Ratnagiri fishermen, the design and constructional details of which are shown in Fig 2.

BAIT

Fresh fish were used as bait. Bigger specimens were cut into pieces of 10 to 15 cm size each and the smaller ones were used as whole. Particulars of the baits used during investigational fishing operations are given below:

Popular name	Scientific name	Local name (Gujarati)
Silver bar	<i>Chirocentrus dorab</i>	Dal
Devil Ray	<i>Aetobatus narinari</i>	Timri
Indian Shad	<i>Hilsa sp</i>	Palvi
Silver pomfret	<i>Pampus argenteus</i>	Vichuda
Croaker	<i>Sciaenids</i>	Bumla
Toothed Shad	<i>Pellona elongata</i>	Kati
Ribbon fish	<i>Trichiurus savala</i>	Baga
Cat fish	<i>Arius sp</i>	Khaga
Squid	<i>Loligo sp</i>	Narsinga

Fishes to be used as bait were purchased 4 to 6 hours prior to departure of the vessel. The fishes procured were washed, iced and kept in insulated boxes. While attaching the bait the hook was passed through the fish twice in such a way that the shank of the hook was covered and the pointed barb remained just outside the body of the bait.

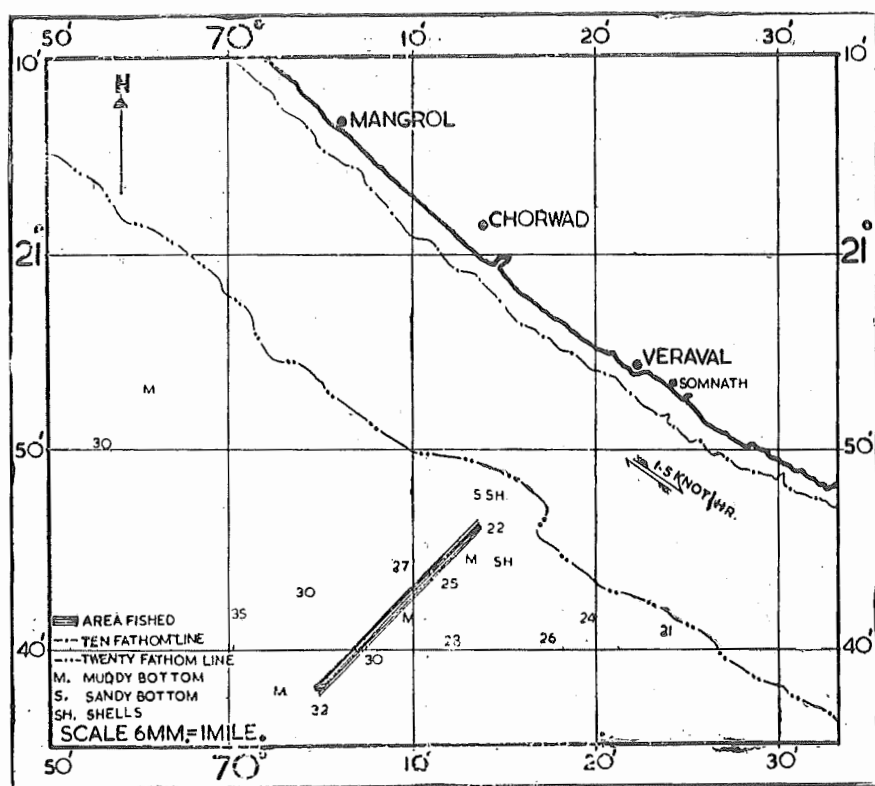


Fig 1. Fishing grounds off Veraval.

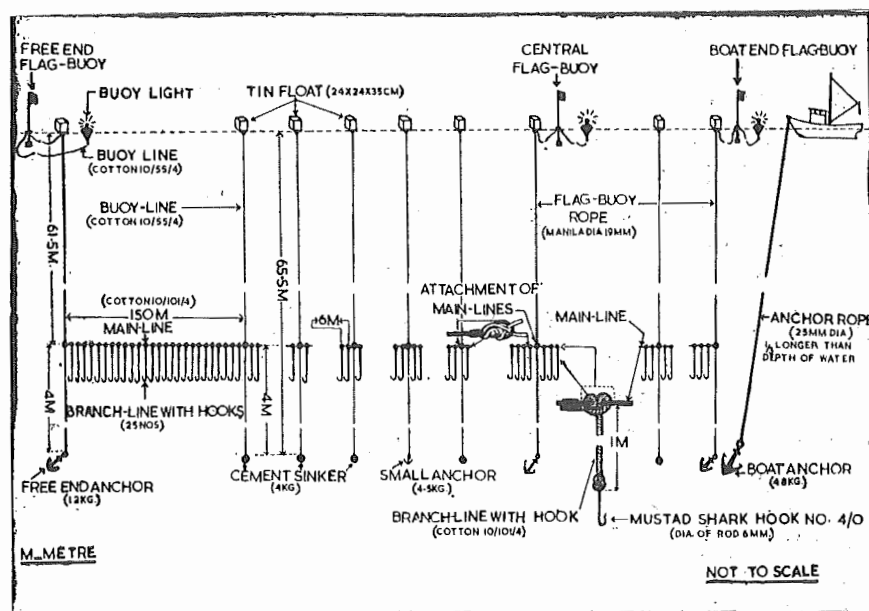


Fig 2. Construction and operation of shark longlines used for experiment.

METHOD OF OPERATION OF GEAR

On way to the ground, the hooks were baited and the gear was arranged on the stern-deck in such a way as to avoid entanglement while shooting. After

reaching the expected fishing ground, the depth of water was measured and the vessel took proper course for commencing the shooting operations. The speed of the vessel was reduced considerably and the

shooting of longline started with throwing overboard the free end flag-buoy with buoy-light, anchor-rope and anchor. The moment the free end anchor was cast, the end buoy-line with tin float as well as baited hooks were thrown individually along with the main-line. After releasing the first unit, the intermittent buoy-line with the float and sinker was thrown and the next unit released. The process of shooting was continued till the entire gear was payed out and the boat anchored. Fig. 2 illustrates the operational details of shark longlines.

HAULING-IN OPERATION

The process of hauling the gear started with the weighing of boat anchor. By then the line would have remained in water for nearly 10 to 12 hours. As soon as the anchor was lifted, the main line was retrieved and pulled in by hand from port or starboard side of the vessel depending upon the direction and velocity of the wind and current. The hauling-in operations of the main-line and their subsequent coiling was continued. Whenever a slight pull was felt on the line, the same was

taken up slowly and when the branch-line with fish approached the vessel the hooked shark was lifted aboard by hand. When the fish caught was heavy, the same was gaffed, taken to the stern-deck and lifted with the help of lift-hook and derrick. When a live shark was observed the same was hooked to lift hook and tied alongside the boat to be hauled up only on completing the hauling-in operation of the gear. Whenever the shark was hooked, details such as the bait with which it was hooked were noted and number tag attached to facilitate its easy identification. On retrieving the free end flag-buoy with buoy-light the boat started steaming towards the base. During the return voyage, the sharks caught were identified, weighed and gutted.

FISHING TIME

The shark longline was set in the evening between 18.30 to 18.45 hours and a five man crew was able to handle 11 to 16 units of gear in about 30 minutes. The boat along with the longline was anchored at the fishing site for 10 to 12 hours. Generally the hauling-in operation comm-

TABLE I RESULTS OF SHARK LONGLINE FISHING OPERATION

S. No.	Date	Depth fished in metres	No of hooks operated	Total Fishing time Hrs min	CATCH		AVERAGE CATCH PER 100 HOOKS	
					No	Wt.(kg)	No	Wt.(kg)
1	12-10-67	45.5	400	11.25	8	140	2.00	37.25
2	6-11-67	54.5	400	10.00	13	800	3.25	200.00
3	8-11-67	54.5	400	11.00	7	262	1.75	65.5
4	10-11-67	54.5	400	11.00	32	1010	8.00	252.5
5	13-11-67	54.5	375	11.00	11	539	2.93	143.73
6	14-11-67	54.5	375	12.15	37	860	9.81	229.33
7	16-11-67	58.0	375	10.45	12	449	3.2	119.73
8	20-11-67	56.5	350	10.00	13	341	3.7	97.43
9	22-11-67	58.0	375	11.15	17	699	4.53	186.4
10	24-11-67	56.5	375	12.00	31	605	8.27	185.4
11	27-11-67	56.5	350	11.45	16	544	4.6	156.1
12	30-11-67	58.0	400	13.00	11	944	2.75	236.0
13	5-12-67	40.0	275	11.45	14	595	5.1	216.4
14	7-12-67	47.0	375	12.45	11	516	2.9	137.6
15	10-12-67	51.0	300	12.00	9	226	3.9	75.3
TOTALS & AVERAGE			368	11.28	242	862	4.4	156.2

enced at 6 A. M. and completed at 10 A.M. depending on the shark landings.

RESULTS

In Table I, the catch is broken by day each fish having been identified and weighed individually.

It would be evident from Table I that during the course of present fishing operations 5525 hooks were operated and 242 sharks weighing 8629 kg were landed. The average catch per operation when calculated comes to 16.13 numbers weighing 575.26 kg. The average body weight of sharks landed during the period of present trials was also worked out and found to be 35.7 kg each.

DISCUSSION

(1) Catch per unit effort

The catch of sharks landed by longline gear during the course of present investigations and tabulated in Table I was further analysed. The average catch per hundred hooks works out to 4.4 in numbers weighing 156 kg.

(2) Catch composition

In Table II are shown the varieties and quantities of sharks caught :

TABLE II PARTICULARS OF SHARKS CAUGHT

Name	Catch		Weight	
	No.	%	(kg)	%
<i>Carcharias</i> sp. (Grey shark)	165	68	4761	55
<i>Galeocerdo</i> sp. (Tiger shark)	58	24	3106	36
<i>Zygaena</i> sp. (Hammer-headed shark)	19	8	762	9
TOTAL	242	100	8629	100

It is clear from the table that *Carcharias* sp. accounted for 68% in number and 55% in weight of the total landings, followed by tiger sharks which constituted 24% and 36% respectively. The hammer-

headed sharks formed 8% and 9% in number and weight respectively.

(3) Catch efficiency of baits

According to Balasubramanyan (1964) the baits used for shark longlines have a great influence on the catch. Devanesan and Chidambaram (*op cit*) and John *et al* (*op cit*) made a passing reference of the different types of baits used by the fishermen of the erstwhile Madras State for capture of different species of sharks. In order to assess the effectiveness of various baits in capture of sharks, different types of fishes were used as baits during the course of present investigations. Full particulars such as the type of bait used, their number and position during actual fishing operation, number of sharks hooked by differently baited hooks etc were recorded. The results are presented in Table III.

TABLE III COMPARATIVE CATCHES LANDED BY DIFFERENT BAITS

Bait used	Average catch per 100 hooks	
	Number	Weight (Kg)
Silver-bar	5.4	190
Devil ray	1.96	126
Hilsa sp.	3.4	128
Silver pomfret	5	93
Sciaenids	1.56	12
Ribbon fish	...	...
Cat fish	...	...
Cuttle fish	...	...
Pellona sp.	...	...

It would be obvious from Table III that sharks were landed by hooks baited with only five types of fishes viz., silver-bar, hilsa sp, devil ray, pomfret and dhoma. The average efficiency of gear with these five types of baits during present studies was also calculated for the three species of sharks caught and reproduced in Fig. 3.

It would be evident from Fig. 3 that *Hilsa* sp. landed maximum catch of

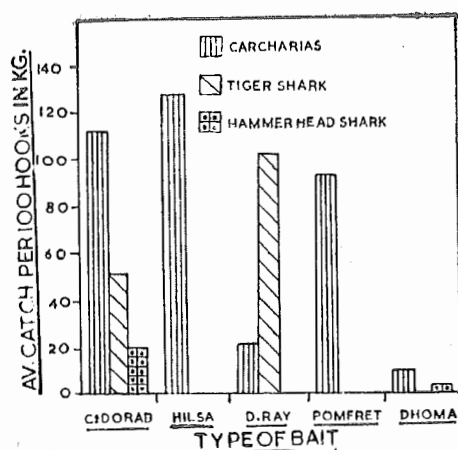


Fig 3. Histogram showing catch of sharks landed per 100 hooks with different baits.

Carcharias sp. of sharks per 100 hooks followed by *Chirocentrus dorab* and pomfret. The catch landed by Devil ray and Dhoma is negligible. The average catch efficiency of gear in capture of Tiger sharks is more in respect of hooks baited with Devil ray followed by *Chirocentrus dorab*. These varieties of sharks were not caught by the remaining baits. The Hammer-headed sharks were caught by hooks baited with *Chirocentrus dorab* and dhoma only. However, catch per 100 hooks is negligible in case of hooks baited with dhoma.

From Table III and Fig. 3, it can be concluded that the average catch per 100 hooks is maximum in respect of *Chirocentrus dorab* and it has also landed all the three varieties of sharks during the course of present studies. *Chirocentrus dorab* also satisfies another most important pre-requisite as a bait, in its low cost and availability all along the Indian Coast throughout the year. Though the Devil ray has proved to be very effective bait in capture of Tiger sharks it has failed in hooking the remaining two varieties. Regarding pomfret as a bait it can be said that although its average catch per 100 hooks works out to third in rank (Fig. 3), it has proved to be effective in capturing the

Carcharias sp alone. The average catch efficiency of hooks baited with *Hilsa sp* suggests that only *Carcharias sp* were landed most by this bait which again is indicative of the fact that *Hilsa sp* as a bait is very selective. Further, hilsa and pomfret being priced fishes their purchase cost makes them prohibitive for use as a bait.

(4) Relation between the body and liver weight

As started earlier, the sharks hooked on each day were weighed, gutted and liver obtained from each fish was also weighed and recorded. The information is presented in Table IV.

TABLE IV PARTICULARS OF BODY AND LIVER WEIGHT OF SHARKS CAUGHT

Name	Total weight (Kg)	Wt of liver (Kg)	% Liver to body wt.
Grey shark :	2616	184	7
Tiger shark :	1557	258	16.5
Hammer-headed shark :	684	40	6
TOTALS & AVERAGE	4857	482	10

It can be seen from Table IV that the liver in sharks constitute about 10% of their body weights. The yield of liver from Tiger sharks proved to be the highest being 16.5%.

(5) Scope for future development

Considering the number of sharks caught by the limited quantity of indigenous gear it can be said that several species of sharks of fairly big size occur in reasonable abundance along this part of the Gujarat Coast and off-shore fisheries seem to be capable of producing a better and bigger catch than is presently the case. Attempts will therefore have to be made for increasing the efficiency of longline gear. Modifications in construction as well as operation of the gear to suit

capture of bigger sharks from deeper and distant waters, use of cheap and effective mixed baits and mechanisation of the entire operations should invariably increase the catch per unit effort of the gear and in turn total landings. In addition, biological and oceanographical surveys will also have to be carried out along with the exploratory and experimental fishing operations with the object of locating productive fishing grounds and developing a cheap and effective gear. Research work on these lines will eventually lead to a more efficient exploitation of shark resources of the country. There are other considerations than those mentioned above which must not be overlooked and which in turn directly affect the development of shark fishery. The demand for fresh fish being very limited in the local market the greater part of the catch must be processed, cured or smoked for shipment to interior markets in a palatable form and also need outlets other than local market.

SUMMARY

(i) The average catch per hundred hooks on the grounds fished worked out to 4.4 in number and 156 kg in weight.

(ii) Three varieties of sharks viz., *Carcharias* sp., *Galeocerdo* sp. (Tiger shark) and *Zygaena* sp. (Hammer-headed shark) were landed and their percentage in the total catch worked out to 55%, 36% and 9% respectively.

(iii) Amongst nine different types of baits used only five types, namely, silverbar, hilsa sp., Devil ray, silver pomfret and dhoma proved to be useful in capture of sharks.

(iv) *Chirocentrus dorab* landed maximum catch (190 kg per hundred hooks) and was effective in capturing all the three varieties of sharks.

(v) *Hilsa* sp and silver pomfret were effective in capture of only *Carcharias* sp and the average catch per hundred hooks

in respect of these two baits works out to 128 kg and 93 kg respectively.

(vi) Devil ray as a bait proved to be very effective in capturing Tiger sharks and its average efficiency works out to 126 kg.

(vii) The percentage of liver to body weight in *Carcharias* sp, Tiger shark and Hammer headed shark was observed to be 7%, 16.5% and 6% respectively.

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REFERENCES

- Bal, D. V. and Banerji, S. K. 1951, *I. P. F. C. Hand book on Indian Fisheries*, 3rd meeting, Madras.
- Balasubramanyan, R. 1964, *Fish Technol*, 1 (1), 41.
- Day, F. 1889, *Fauna of British India Fisheries* 2, London.
- Devanescen, D. W. and Chidambaram, K. 1948. *The common fishes of the Madras Presidency*. Government Press, Madras.
- George, A. I. 1964 *Ind. Com Jour.* 1 (4); 164-167.
- Gokhale, S. V. 1957 *Fishing gear of Saurashtra region*. Gujarat Government publication.
- Gopinath K. 1954 *Indian J. Fish*, 1, 163.
- Government of Madras 1929 *Report of Madras Committee of Fisheries*. Government Press, Madras.
- Hornell, J. 1916 *Madras Fish. Bull.*, 1 (8), 23.
- , 1924 *Ibid*; 1 (2), 78.
- , 1950 *Fishing in many waters*. University Press, Cambridge.
- John, C. C. 1948 "Progress Report of the Fisheries Development Scheme". Central Research Institute, Travancore

- University. *Division of Marine Biology & Fisheries*, 1-8.
- John, V. 1964, *Ind-Com Jour.* 1 (4), 157-164.
- John, V; Chacko, P. I.; Venkataraman, R. and Sheriff, A. T. 1959 *Report of Fishing experiments in the off shore waters of the Madras State.* Government Press, Madras.
- Kaikini, S. S. 1960 *Indian J. Fish.*, 7 (2), 348.
- Kini, U. S. 1958 *C. M. F. R. I. Souvenir*, 101.
- Moses, S. T. 1948. *J. Gujarat Res. Soc.*, 75.
- Sorley, H. T. 1932 *Marine Fisheries of Bombay Presidency.* Government Press, Bombay.
- Setna, S. B. 1945, *J. Soc. Ind. Res.*, 3.
- Srivatsa, K. R. 1954 *I. P. F. C.* 5th. Session, Technical paper 21.
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