



## Note

# Selectivity of hooks for seerfishes in the longline fishery of Thoothukudi coast, Tamil Nadu, India

P. SELVA MUTHU KUMARAN, CHERYL ANTONY\* AND B. SUNDARAMOORTHY

Fisheries College and Research Institute, Tamil Nadu Fisheries University, Thoothukudi - 628 008, Tamil Nadu, India

\*Institute of Fisheries Technology, Tamil Nadu Fisheries University, Ponneri - 601 204, Tamil Nadu, India

e-mail: cherylanthony96@gmail.com

## ABSTRACT

The study was conducted in Thoothukudi coast of Tamil Nadu to optimise the hook size for commercial exploitation of seerfishes. Analysis was done using three different sized hooks (Nos. 7, 8 and 9). A wide range of length groups of seerfishes were caught by these hooks. The study concludes that hooks No. 7 and 8 are effective for commercial exploitation of seerfish.

Keywords: Hook selectivity, Longline fishery, Seerfish, Thoothukudi

Longline is a static fishing gear consisting of many hooks, which are operated simultaneously for capturing carnivorous pelagic and demersal fishes. The fish catch can be optimised by selecting the hook with right shape and size (Huse and Ferno, 1990). Hook size and shape have to be optimised for the target species and size groups. In studies relating to longline fishing, it has often been shown that smaller hooks catch greater numbers of fish than larger hooks (Bjordal, 1989; Ralston, 1990). The line fishery is found to be very effective in exploiting large predator fishes, such as catfishes, elasmobranchs, tunnies, seerfishes and perches from uneven non-trawlable fishing grounds of coastal waters with coral or rocky outcrops (Jayasankar, 1990).

The structure of longline used by the fishermen varies from place to place. In Thoothukudi coast, longline is used to catch seerfishes, perches, tuna, sharks and rays and this gear does not use sekiyama, snood wire and swivel in its construction.

The present study was carried out for one year from June 2007 to May 2008 at Kombuthurai fishing village (lat. 8°34'N, long. 78°08'E), in Thoothukudi. Fishermen mainly engage longline fishing to catch seerfishes from *vallam*. The data on the seerfish landings and the longline fishing methods were collected from fishermen operating *vallams*. Data on species of seerfish, their total catch, length and weight were collected twice a week. Total weight was recorded using electronic balance available at the landing centre. Fishes landed were identified to species level following Fisher and Bianchi (1984).

Total length (TL) was measured from the tip of the snout to tip of the upper lobe of caudal fin. The catch landed using the different hook sizes were segregated species-wise and hook-wise (Nos. 7, 8 and 9). Length frequency data of seerfish landed by different hook sizes were recorded. The total numbers of hooks used with different hook numbers were observed to work out the hooking percentage.

Length frequency data of seerfishes landed were analysed using FiSAT package (Fish stock assessment tool of FAO/ICLARM). Length frequency curves were derived, based on catch by different sized hooks and these were compared with the length frequency distribution curves derived from the total seerfish catch data.

The optimum length of capture of each species was worked out on the basis of commercially significant length groups in the fishery and also by considering the length at first maturity. Optimum hook size for the commercial exploitation of *Scomberomorus commerson* based on the selectivity characteristics of each hook size was studied. The fishing pressure exerted on the different length groups of seerfish, due to the operation of different sizes of hooks, was analysed by estimating the percentage contribution of each size group under each species. Extent of growth overfishing was estimated based on the contribution of immature animals caught by each hook size. Animals with length below the length at first maturity were considered as groups subjected to growth overfishing.

Four species of seerfish viz., *Scomberomorus commerson*, *Scomberomorus guttatus*, *Scomberomorus*

*lineolatus* and *Acanthocybium solandri* are commercially important groups. There are seven major fishing grounds for seerfishes around Kombuthurai coast near Thoothukudi viz., Semandthalai Paar, Kili Paar, Munnai Paar, Mannu Paar, Karuvalu Paar, Thoondi Paar and Mundichan Paar. During the period of study, *S. commerson* was the major species caught in longline gear from this region. There was only sporadic occurrence of the other three species in longline landings and their catch was not sufficient enough to work out selectivity characteristics of the hooks, hence they were exempted from hook selectivity studies.

Three different hook sizes were used in the longline viz., No. 7, 8 and 9. The technical details such as length of shank, throat and gape for each hook size used are presented in Table 1.

Table 1. Technical specifications of longline hooks used in Thoothukudi coast

Hook no.	Length of shank (mm)	Throat / Depth (mm)	Gap (mm)
7	35	18	16
8	33	16	14
9	31	14	13

Big eye scad, *Selar crumenophthalmus* with length ranging from 15 to 20 cm and weighing about 100 to 150 g were used as baits as whole fish for seerfishes. Besides this, sardines (in whole and chopped) and squid tentacles or mantle having length ranging from 5 to 10 cm and weighing about 5 to 12 g were also used as baits. *S. commerson* caught using longline was available throughout the year. They were caught in waters from a distance ranging between 10 to 20 nautical miles at a depth of 15 to 25 m.

Seasonal occurrence of different length groups of *S. commerson* is presented in Fig. 1. Occurrence of *S. commerson* was year round along Thoothukudi coast. Fishery was dominant during the months of June to September, with catch distribution in all length groups ranging from 61 to 140 cm. Moderate fishing was observed during the months of October to January showing higher catch in length range between 76 to 80 cm followed by 96 to 115 cm. Catch was minimum during the period from March to May showing very narrow distribution of different length groups. Maximum length groups caught irrespective of the month was between 76 to 80 cm followed by 96 to 105 cm.

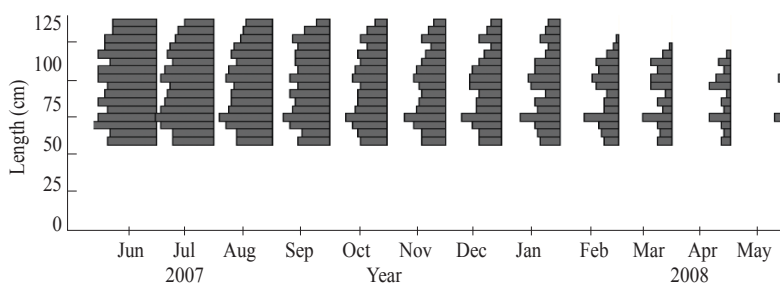


Fig. 1. Seasonal occurrence of different length groups of *S. commerson*

The length frequency distribution of *S. commerson* showed a distinct variation in length groups with respect to hook sizes. The overall hooking percentage was worked out as 1.03. The combined length frequency distribution showed a peak at 102.5 cm (Fig. 2).

In hook No. 7, length groups ranging from 66 to 140 cm were caught (Fig. 2). The curve shows a peak at 102.5 cm which is similar to peak of combined length frequency data and it implies that larger length groups are caught more in hook No. 7. Numbers in length groups between 101 to 120 cm was the highest, followed by the length groups between 91 to 100 cm and 121 to 130 cm. The length group in the range 66 to 80 cm was comparatively less in number. The length frequency curve of hook No. 8 showed a peak at 97.5 cm (Fig. 2). Fishes in the length group between 81 to 110 cm were found to be high, between 71 to 80 cm were found to be moderate and between 131 to 135 cm were less in number.

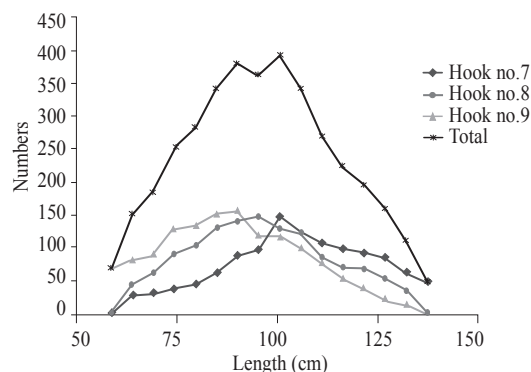


Fig. 2. Combined length frequency distribution of *Scomberomorus commerson* in its fishery with various hook sizes

In hook No. 9, the curve shows a clear-cut peak at 92.5 cm (Fig. 2). Numbers in the length group between 81 to 95 cm was higher, followed by the length group between 96 to 110 cm. Numbers in the length group between 131 to 135 cm was low.

Length of seerfish caught by hook no. 7 ranged from 66 to 140 cm (Fig. 3). No fish was caught between the 61 to 65 cm length range. Length group between 101-105 cm dominated the catch with 12.8%, followed by 106-110 cm (10.6%) and 111-115 cm (9.3%) length

groups. Out of the total catch, seerfish caught in length ranging from 96 to 120 cm contributed 50%. Fish caught by hook no. 8 ranged in length from 66 to 135 cm (Fig. 4). No fish was caught in the length ranges of 60 to 65 cm and 135 to 140 cm. Length group between 96-100 cm dominated the catch with 11.47%, followed by 91-95 cm (10.9%) and 86-90 cm (10.2%) length groups. Fish caught in lengths ranging from 86 to 110 cm contributed more than 50% to the total catch. Fish caught in hook no.9 ranged from 61 to 135 cm (Fig. 5). No fish was caught in 135 to 140 cm length range. The length group between 91-95 cm dominated the catch with 11.6% followed by the length groups 86-90 cm (11.2%) and 81-85 cm (10%) and around 50% of the total catch, was caught in the length groups ranging from 76 to 100 cm.

Results of the present study showed that out of the four species of seerfishes viz., *S. commerson*, *S. guttatus*, *S. lineolatus* and *Acanthocybium solandri*, only single

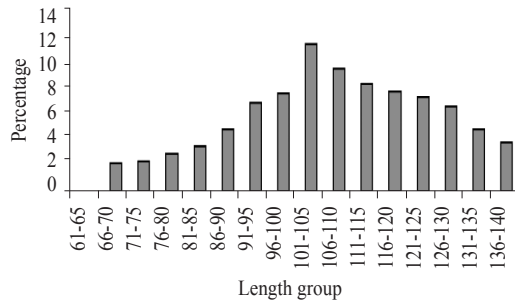


Fig. 3. Fishing pressure on the longline fishery of *Scomberomorus commerson* by hook no.7

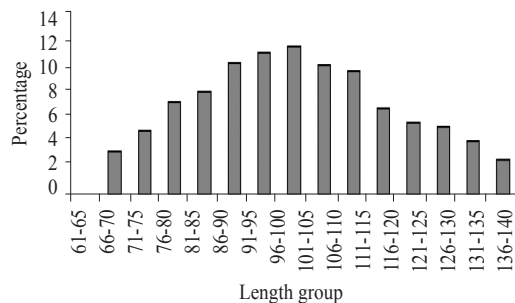


Fig. 4. Fishing pressure on the longline fishery of *Scomberomorus commerson* by hook no.8

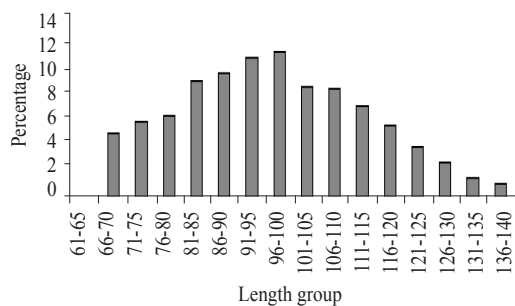


Fig. 5. Fishing pressure on the longline fishery of *Scomberomorus commerson* by hook no.9

species *S. commerson* was recorded in the longline fish catch along Thoothukudi coast during the course of observation from June 2007 to May 2008. Muthiah *et al.* (2005) reported the presence of the above four species of seerfishes, in Gulf of Mannar among which *S. commerson* was abundant followed by *S. guttatus*, *S. lineolatus* and *A. solandri*. The longline units in Thoothukudi coast lacked components like sekiyama, snood wire and swivel. The main line was made of polyethylene of 0.9 to 1.2 mm dia with branch line made of nylon monofilament of 0.8 to 1.1mm dia. The longline operators of Thoothukudi coast are using only imported ‘J’ type Mustad hooks. A detailed investigation to improve the efficiency of long line units of Thoothukudi coast is required, including evaluation of other designs of hooks.

During the present study, three different types of baits were observed to be used in longline gears such as big eye scad (*Selar crumenophthalmus*), sardines and squids (mantles and tentacles). Fishermen opined that squids are preferred bait compared to scad and sardine as seerfish bait. Yamaguchi *et al.* (1983) recorded better catch using squid as bait when compared to use of fish as bait. Menon (1993) reported that sardine is also a good bait for longlines in Indian waters.

Devaraj (1999) reported 51 to 174 cm as the dominant size group of *S. commerson* that form fishery in Thoothukudi waters. In the present study the length frequency distribution of *S. commerson* ranged from 61 to 140 cm. The length groups between 101 to 140 cm dominated the fishery from June to August. During the period from September to December, the length groups between 81 to 100 cm dominated the catch. The length group ranging from 71 to 80 cm dominated during the period of January to March. Narrow distribution of all length groups were recorded during the months of April and May.

Koike *et al.* (1968) and Kanda *et al.* (1978) found that the optimum catching efficiency of the hook is according to the length of fish. According to Millar and Holst (1997), the selectivity pattern of fishing hook is similar to gillnet. However, in contrast to gillnets, there is still considerable debate regarding the appropriate form of the selectivity model for hook and line gear. Both logistic type selectivity and bell-shaped selectivity curves have been proposed to model size selectivity for hooks. Erzini *et al.* (1997) used the skew normal selectivity curves for longline gears. In the present study, length frequency curves were used to derive the selectivity characteristics of longline hooks on the fishery of *S. commerson*. The length frequency curves showed clear cut shift of peaks towards lower length groups as the hook number increased. Ralston (1982) reported the shift in the length composition of catch according to hook size as observed in the present study.

The combined hooking percentage for *S. commerson* in present study was 1.03. Kartha *et al.* (1973) reported the hooking percentage as 3% for perches from hook Nos. 5 and 6 in the bottom drift longlines. The hooking percentage of 3.35 in Arabian sea, 1.99 in east coast and 1.51 in Andaman coast was reported from longline catches by Menon *et al.* (1993). The low hooking percentage recorded in the present study may be attributed to the poor technical design of the longline units of Thoothukudi coast. The landings of *S. commerson* from longlines of Thoothukudi coast were influenced by catches from hook Nos. 7, 8 and 9 (Fig. 2).

It is clearly evident from the length frequency curves of *S. commerson* that catches from hook No.7 showed a peak at 102.5 cm. Besides this, the length frequency curve of hook No.7 showed clear shift towards higher length group. The length frequency curve of hook No. 8 and 9 (Fig. 2) showed a peak at 97.5 cm and 92.5 cm respectively.

As the peak of combined length frequency curve is on the right side represented by higher length group (Fig. 2), total fish catch may not be affected in the event of discouraging use of hook No. 9. The general rule of longline selectivity, *i.e.*, shifting of peaks towards lower length groups with the increase in hook number is evident in the combined length frequency curves for *S. commerson* (Fig. 2). The fishing pressure on various length groups of *S. commerson* by different sizes of hooks was calculated to find out whether immature fishes are caught by a particular hook size.

In the present study, hook no.7 showed least impact on the immature fishes, since the major proportion of fish caught by this hook belonged to higher length groups. Hook No. 8 had lower impact on the immature fishes, as their percentage was only 8.3% in the landings by this hook size. Hook No. 9 may be discouraged as it caught more immature fishes (17.8%) compared to other two hook sizes prevalent in commercial longline fisheries of Thoothukudi coast.

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### References

Bjorndal, A. 1989. Recent developments in longline fishing -catching performance and conservation aspects. In: *Proceedings of the world symposium on fishing gear and*

*fishing vessel design*, St. Johns, Nfld., Canada, 21-24, November, 1988, p. 19-224.

Devaraj, M., Mohamad Kasim, H., Muthiah, C. and Pillai, N. G. K. 1999. Assessment of the exploited seerfish stocks in the Indian waters. *J. Mar. Biol. Ass. India.*, 41(1): 62-84.

Erzini, K., Concalvas, J. M. S., Bentes, L. and Lino, P. G. 1997. Fish mouth dimension and size selectivity in Portuguese long line fishery. *J. App. Ichthyol.*, 13: 41-44.

Fischer, W. and Bianchi, G. 1984. *FAO species identification sheet for fishery purposes. Western Indian Ocean (Fishing Area 51)*. FAO, Rome, Vol.1-6.

Huse, I. and Ferno, A. 1990. Fish behaviour studies as an aid to improved long line hook design. *Fish. Res.*, 9: 287-297.

Jayasankar, P. 1990. On the seasonal hooks and line fishery at Pamban, near Mandapam in the Gulf of Mannar. *Mar. Fish. Infor. Serv. T&E Ser.*, 105: 13-14.

Kanda, K., Koike, A., Takeuchi, S. and Ogura, M. 1978. Selectivity of the hook for mackerel, *Scomber japonicus* houttuyn, Pole fishing. *J. Tokyo Univ. Fish.*, 64 : 109-114.

Kartha, K., N. Deshpande, S. D. and Rao. S.V.S.R. 1973. On the results of bottom drift-long-lines operated off Veraval with particular reference to selective action of baits and hooks used. *Fish. Tech.*, 10 (2): 105-109.

Koike, A., Takeckhi, S., Ogura, M., Kanda, K. and Arihara, C. 1968. Selection curve of the hook of long line. *J. Tokyo Univ. Fish.*, 64: 115-123.

Menon, N. G., Bensam, P. and Balachandran, K. 1993. Hooks and line fishery resources of India. *Proceedings of national workshop on low energy fishing*. Society of Fisheries Technologists (India), Cochin. p. 30-38.

Millar, R. B., and Holst, R. 1997. Estimation of gillnet and hook selectivity using log-linear models. *ICES. J. Mar. Sci.*, 54: 471-477.

Muthiah, C., Pillai, N. G. K., Abdussamad, E. M., Mohamad, H., Kasim and Nasser, A. K. V. 2005. *CMFRI Annual report, 2004-2005*. Central Marine Fisheries Research Institute, Kochi, India, 28 pp.

Ralston, S. 1982. Influence of hook size in the Hawaiian deep-sea handline Fishery. *Can. J. Fish. Aquat. Sci.*, 39: 1297-1302.

Ralston, S. 1990. Size selection of snappers (Lutjanidae) by hook and line gear *Can. J. Fish. Aquat. Sci.*, 47: 696-700.

Yamaguchi, Y., Nonada, T., Kunihiko, H., Jinno, T., Ishikura, I., Ushida, M. and Tonogai, M. 1983. Effectiveness of artificial bait for obtaining higher hooking rate on bottom-set long line fishing. *Bull. of Jap. Soc. Sci. Fish.*, 49(12): 1819-1824.

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