

**SOME ASPECTS OF BIOLOGY AND FISHERY OF SCALLOP
HAMMERHEAD SHARK (*Sphyrna lewini*)
IN THE WEST COAST OF SRI LANKA.**

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Abstract:

Four species of hammerhead sharks are caught in Sri Lanka. They formed about 10-15% of the total shark catch. The most dominant of the four species is *Sphyrna lewini*. Its size in the commercial catch ranged from 80 cm to 210 cm. The size at maturity is 130 cm. The fecundity of *S. lewini* ranged from 20 to 32 and the size of the new born of springs ranged from 16 to 35cm. The peak spawning period is from June to October. About 23.5% of the females caught by the fishermen are immature. Fishermen in the west coast of Sri Lanka caught hammerhead sharks even from Arabic Sea.

Key wards: Hammerhead sharks, Fecundity, Spawning period.

1. Introduction:

There are reports of about 29 species of sharks, including hammerhead sharks, in Sri Lanka (Munro 1955). The most abundant of these species is **Carcharhinus melanopterus**. The total weight of all species of sharks caught in the Bay of Bengal is about 11000- 13,000 mt per year (Sivasubramanian 1992). Fishermen are using a multitude of gear to catch sharks, of which the most common ones being the gillnets and the long lines. The entire amount of sharks caught is consumed in Sri Lanka, except their fins, which are dried and exported to far east countries.

Previous studies on tuna longlines (Sivasubramanian, 1996) has indicated that a very high percentage of tuna caught in the long lines have been preyed upon by sharks. He (1965) had also reported that their distribution is broadly similar to the distribution of equatorial currants during the southwest monsoon. He had also identified about 40 species of fish caught in the tuna longline gear operated by the Japanese in the Indian

ocean. White tipped shark (**Carcharhinus longimanus**), black tipped shark (**C. melanopterus**), cub shark (**C. brachyunis**), great blue shark (**Glyphis glauca**) (**Alopius pelagicus**) and species of hammerhead sharks had been caught in the longlines. Weerasoriya et al, (1985) had reported that sharks formed about 3% to 5% of the bottom long line catch in the west coast where the major catch was **Lithrinus nebulosus**. According to their findings, shark catch had been better from about December to May than during the other periods. However, the percentage composition of the shark caught is not known.

Jinadasa (1985) had observed that sharks are more abundant off the coast of Trincomalee during the fishing season for flying fish than during the other periods as the former is a predator on the latter. He had also shown a direct negative relationship of flying fish catch with the shark catch. Gunawardhana (1971) had noted four species of hammerhead shark in Sri Lanka waters, of which **Eusphya blochii** was the smallest one. De Silva (1986) had studied the taxonomy and some behavioral features of 20 species of sharks from Sri Lanka waters. In his studies he had found that, out of the four species of hammerhead sharks, winghead shark (**E. blochii**) was the smallest one growing up to 1.5 m and the great hammerhead shark (**Sphyrna mokaran**) was the largest one growing up to 6m. He had also noted that all four species fed on bony fish and cephalopods. Exceptionally large specimen also fed on sting rays.

Sivasubramanian (1992) had further highlighted that, there are about 40 species of pelagic sharks in the Indian ocean, belonging to five families, of which whale shark is the largest, attaining a size as large as 12 m. Of the commercially valuable sharks, tiger shark is the largest weighing as much as 600Kg. Hammerhead sharks inhabit shallow waters up to about 125 m and therefore they are caught in the long line hooks set around 125 m from the surface (Sivasubramanian 1992). The distribution of most species of sharks in the Indian ocean is related to the latitudes. Tuna caught in the long lines are highly preyed upon by most species of sharks, of which species of **Carcharhinus** and great blue sharks are the most common (Sivasubramanian 1969)

Sharks play an important role in the fishery of Maldives, although exact amount of sharks caught are not reported. However the amount of shark liver oil exported had ranged from about 10 to 80 mt at a year between 1952 and 1980 (Anderson and Hudha Ahmed, 1992). Similarly, in India, sharks are widely caught by floating longlines and bottom set longlines.

Silky sharks, (*Carcharhius falciformis*) and scallop hammerhead shark (*Sphyrna lewini*) are the most commonly caught species in floating longlines (Thomas Dahlgren, 1992)

The total production of all species of sharks in the Bay of Bengal region had been estimated to be between 11000-13000 mt/year, of which more than half is taken by Sri Lanka (Sivasubramanian, 1992). According to Sivasubramanian (personal communication, 1994) sharks are the least studied commercially important fishes and their production capabilities, recruitment, fecundity, age and spawning periodicity are virtually unknown.

Therefore, the purpose of the present study was to reveal the population dynamics, size of the animals in the commercial catch, size at maturity, fecundity, spawning periodicities and the size of the newly born offsprings of scallop hammerhead shark (*Sphyrna lewini*) and also the extent of the fishing area of Sri Lankan fishermen.

2. Material and methods.

Studies on sharks were initiated in 1985 and are continuing. The data collected at Beruwala fish landing sites from 1985 to 1987, and Negombo from 1985 to 1994 are used from the present investigation (Fig 1.). Sharks caught in long lines and gill nets were identified according to Monro (1955) and De Silva (1986) and their numbers were counted and recorded at the time of unloading. Mouths and snouts of sharks caught in longlines contained either patches of blood or cuts by the metal wire of the branch line of the long line. It facilitated the identification of the gear in which they were caught. The Scallop hammerhead sharks were then sorted out and their fork length and the width of the head between the two eyes were measured. The condition of the abdomen of the females, whether distended, straight, tight or loose was also noted. The abdomen was also pressed to find out whether there were fully developed but unborn sharks in the uterus. Such offsprings were rejected with the application of slight pressure on to the abdomen. Frequently, there were half born offsprings hanging from the cloaca and those were pulled out, counted and the fork lengths were measured. Uterii were also further examined at the time of evisceration before selling the carcasses to whole sale merchants.

Uterii were cut open, the unborn offsprings were removed and their fork lengths were measured. New born sharks sold at the public market were counted and their fork lengths were measured.

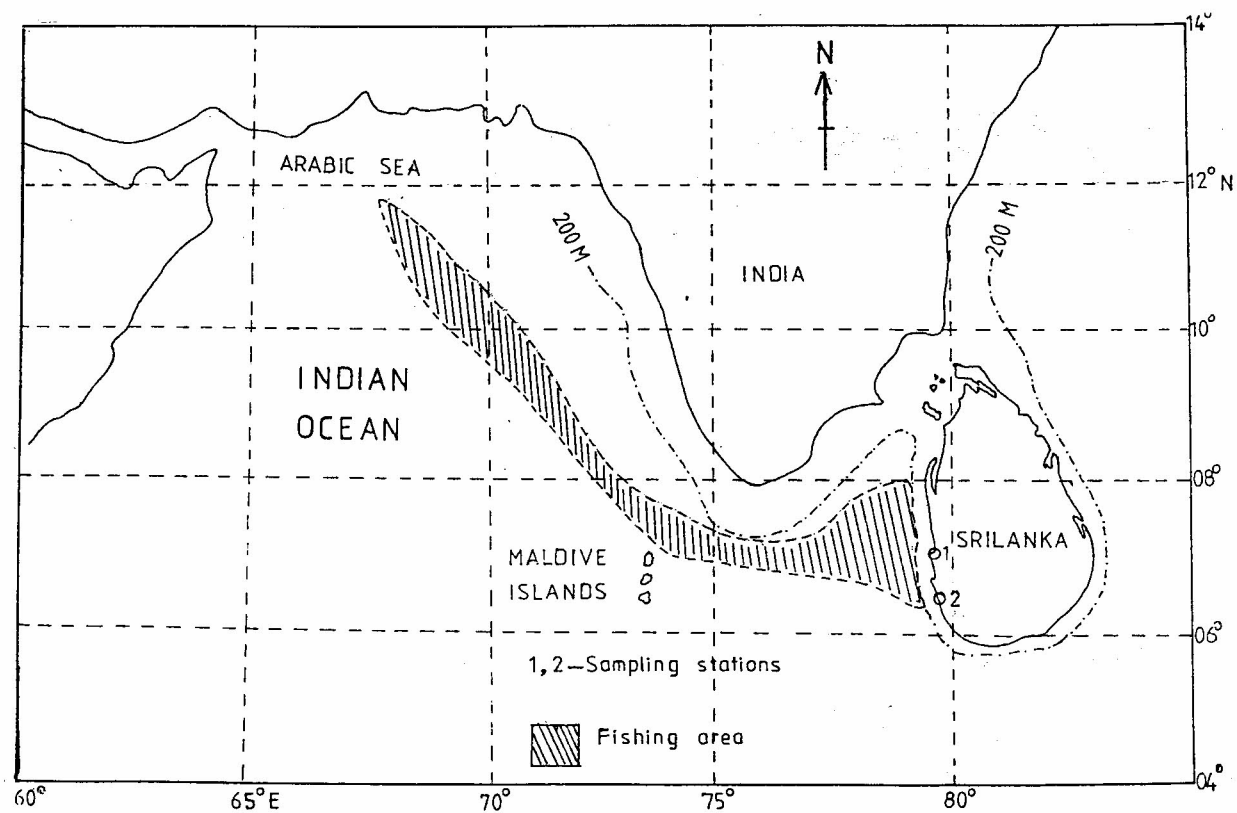


Figure 1. Sampling stations. 1. Negombo 2. Beruwela; and area of the Indian ocean exploited by fishermen of Sri Lanka.

3. Results

The total number of all species of sharks unloaded at Nugombo landing site ranged from 38 to 410 and that of Beruwala from 78 to 338 per day. The most abundant species at both stations was blacktip shark (*Carcharhinus melanopterus*). It formed about 62% to 78% of the total number of sharks caught and their size ranged from 44 cm to 167 cm (mean=113 cm and SD=18.2). *C. melanopterus* was predominant from June to September in the commercial catch. The mean number of sharks caught per day was high from January to May, very low from June to July and was once again high until the end of the year (Fig 2). Four species of hammerhead sharks, namely *S. lewini*, *S. zygaene*, *S. makaran* and *Euphyra blochii* are caught in the west cost of Sri Lanka. The mean number of hammerhead sharks caught per day ranged from 2 to 66 during the study period. Their seasonal distribution pattern was generally similar to that of all species of sharks (Fig 2)

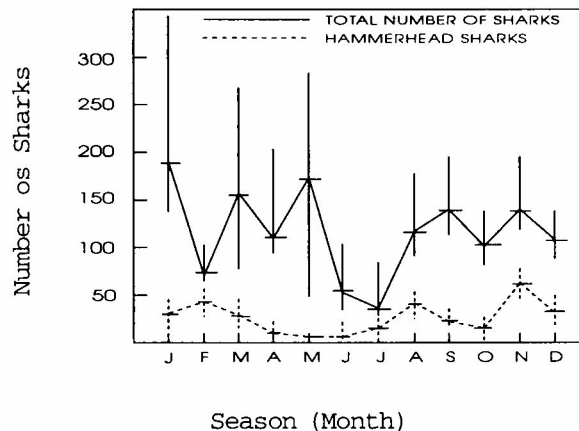


Figure 2. The Seasonal variation of the total number of sharks and Hammerhead sharks caught.

The percentage composition of the hammerhead sharks caught in the west coast of Sri Lanka indicated that scalloped hammerhead shark (*S. lewini*) and smooth hammerhead shark (*S. zygaene*) dominated the catch (Table 1). However the former species was the most dominant species contributing for over 73% of the total catch. The above percentage also varied with the season, from August to April each year, well over 94% of the catch contained *S. lewini*. The size of *S. lewini* caught ranged from 80 to 210 cm. The modal length of the males was 150 and that of the females was 160 indicating that females were dominant among large sharks (Fig 3). The sex

ratio of small female and male sharks (<125 cm) was 1:2 and that of large ones (>160 cm) was 3:2. Large sharks were more predominant in the catches from May to November than in other month.

Table 1. Size and percentage composition and the size range of hammerhead sharks caught in the west coast of Sri Lanka

Species	Percentage	Size range Cm
<i>Sphyrna aygaena</i>	18.00	156(40-200)
<i>S. lewini</i>	73.00	142(80-210)
<i>S. mokaran</i>	8.00	232(160-264)
<i>Eusphyra blochii</i>	1.00	108(86-142)

The length of the new born offsprings ranged from 16 cm to 35cm (Fig 4). All embryos were attached to the mother shark's uterus by separate cords that were connected to the offspring ventrally in the region of the heart in between the ventral fins. New born sharks also possessed the cord making them easily identifiable from the rest. The length of the spawning females was greater than 130 cm, 50% and 100% of 140 cm and 160 cm long females were spawning (Fig 5). The minimum size of the spawning female was therefore 130 cm.

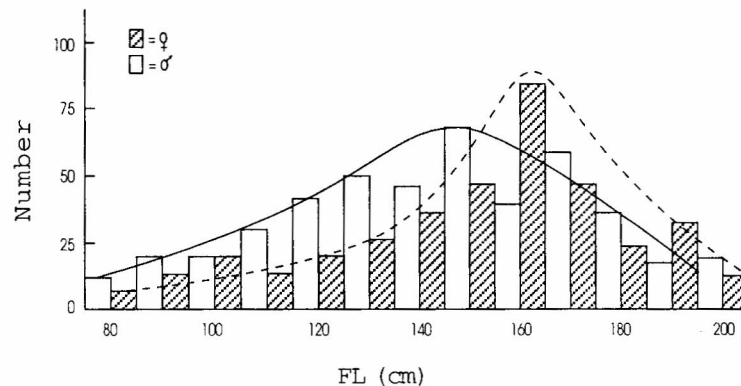


Figure 3. Length frequency distribution of male and female Scallop hammerhead shark (*Sphyrna lewini*) caught.

The percentage length frequency distribution of male and female sharks in the commercial catch (Fig 3) indicated that about 23.5% of the females caught are smaller than 130 cm and therefore, they have not spawned at least once, at the time of capture.

The number of spawners sharply increased from April to June and then remained almost at the same level until October and then declined until April (Fig6). Therefore the peak spawning period of this species could be from about June to October. The number of new born sharks enumerated in the market also supported this the length of new born shark varied from 17 to 35 cm (Fig 4.). The variability of the length of new borns is greater among

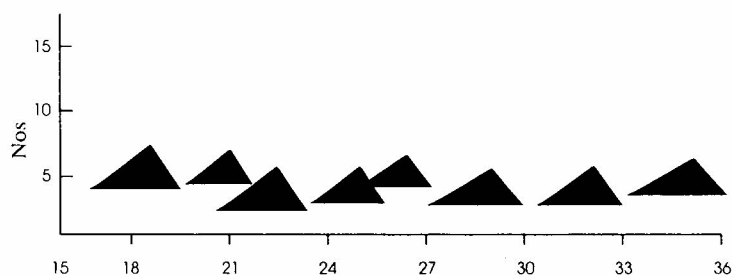


Figure 4. Length frequency distribution of newly born offsprings of *S. lewini*. each triangle denotes offsprings of one mother shark.

large mothers. The fecundity varied from 10 to 16, Fig 7) which showed a positive correlation with the length of the mother shark. ($r=0.73$)

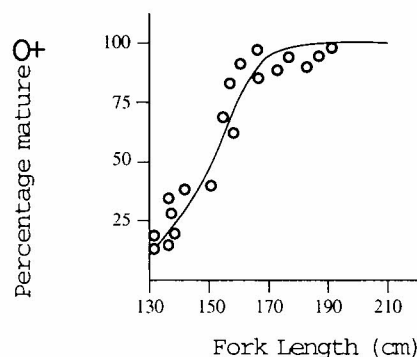


Figure 5. Variation of the percentage of mature females of *S. lewini* with size.

Information gathered from the fishermen on the area of fishing showed that the fishing area extended from about 40 km to about 1248 km from the shore (Fig 1). However the majority of the fishermen, 59% fished in the northwestern waters, in the area of Gulf of Manner. About 11% of the fishermen fished in the region of Arabic sea. The balance 30% of the fishermen fished in the southwestern waters, and western waters, around Maldivian atolls.

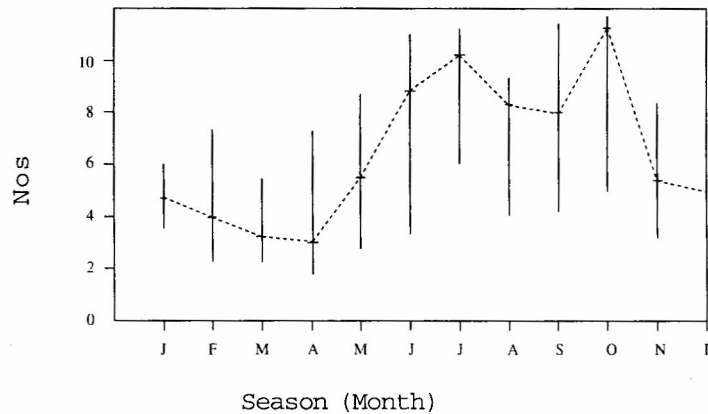


Figure 6. Seasonal variation of the number of spawners of *S. lewini*, according to months.

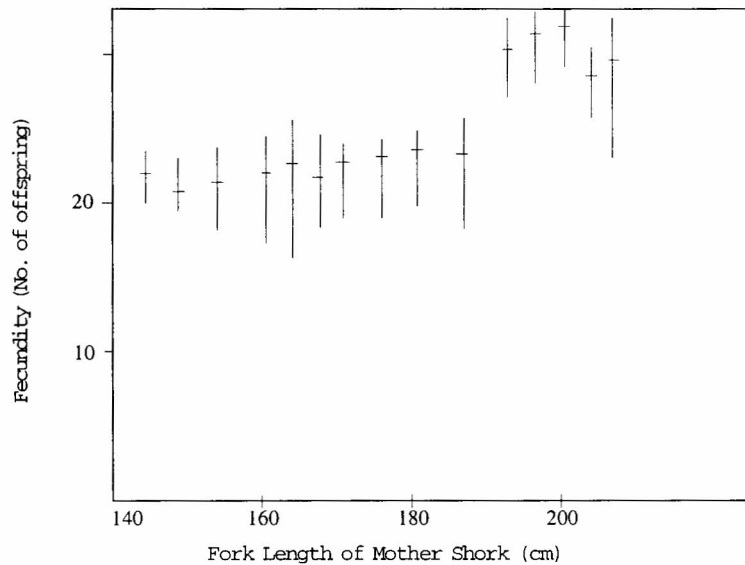


Figure 7. Variation of fecundity with the size of the mother shark of *S. lewini*.

4. Discussion

The species composition of hammerhead sharks observed in the present study are similar to that recorded by Gunawardena (1971) and De Silva (1986). However the relative abundance of each species was not highlighted by the above workers. The present study revealed that the most abundant of the four species is *S. lewini* and the least abundant is *S. mokaran*. *S. lewini* was the only species of hammerhead shark present throughout the year. The size of the hammerhead sharks caught indicated that *E. blochii* is

the smallest and *S. mokaran* is the largest of the four species. This had been true even in the past. However, none of the previous workers had shown the details of the size of sharks caught. The present study revealed that the size of the sharks in the commercial catch ranged from 80 to 210 cm.

Size of Mature sharks, their fecundity, size of new born offsprings and spawning sharks, spawning seasons of any of the sharks in Sri Lankan waters have never been reported before. However, De Silva (1986) had noted that schools of scallop hammerhead sharks appeared close to shore during the southwest monsoon period. Present study shows that most *S. levini* are spawning during this period. Perhaps they may have migrated to the surface waters of shallow areas to give birth to the young ones. Spawners might be approaching shallow waters to evade large predators, it would also help new born to find prey easily as well as to avoid predators. Most cartilaginous fishes are solitary, however, sometimes hammerhead sharks and mantas had been found swimming in small schools (Peter Castro and Huber, 1991). The present study also revealed that the minimum size of the mature female is 130 cm and the fecundity of 140-220 cm long individuals ranged from 10-18. The size of new born offsprings ranged from 16 to 35 cm. Their hammer shaped head is kept folded while they are in the uterus, facilitating easy delivery. The variability of the length of the new born offsprings in fishes is related to multitude of factors, such as length of the mother, the size of blood vessels in the vicinity of the eggs and trophic conditions (Mejen, 1940, Springate and Bromage, 1985). Yet in the bony fish *Gadus morhua* the size of the female had no effect on the size of the egg. (Osthuizen and Dean, 1974). However, endogenous feeding period, the amount of yolk present in the egg are related to the size of the offsprings in viviparous fish (Balan, 1975). Many species of fish, including viviparous fish continue to increase in length after attaining sexual maturity and spawning. They also have high metabolic rate, which is associated with spawning migration, courtship and spawning. (Mejen 1940). It is also shown that, in the case of bony fishes first time spawners usually lay small eggs which produce small offsprings. (Potabova, 1985).

According to Weerasooriya et al (1985), the shark catch in the west coast of Sri Lanka is higher from June to December than in other months. Present study shows that the hammerhead sharks too followed almost a similar seasonal variation pattern. Findings of Silva (1986) and that of the present study also conclusively indicated that the spawning period is from about June to September. The present findings also shed light on the minimum size of scallops hammerhead sharks that could be exploited. At

present about 23.5% of the female sharks caught are immature and therefore, not spawned. It is better if gear could be designed for selective exploitation of larger individuals.

According to Sivasubramanian (1992) the size of mature scalloped hammerhead sharks is about 212 cm and the maximum size that he had recorded was 370 cm. However, my studies showed that the minimum size at maturity is 130 cm and the largest size recorded in the west coast was 214 cm. Therefore, at maturity, they are about 54% of the largest size. According to him it is a semioceanic species. However, multiday fishermen who fish for sharks even in the Arabic sea and other oceanic regions of the Indian ocean have brought in this species to Negombo and Beruwala. Thus, this species could be both oceanic and semioceanic in distribution. According Joseph (1991) about 10-15% of the fishermen of Sri Lanka are engaged in multiday fishing. They are using Abu Dhabi or medium size (11-13 m) boats to operate their gear.

Present findings revealed that the distance covered by Sri Lankan fishermen in the Indian ocean exceeds that of EEZ of Sri Lanka. About 8-10% of the multiday fishermen steam their boats as long as 4-5 days (96 - 120 hrs) none stop, which means they are fishing at least 1526 -1900 km (960 - 1200 miles), away from the shore. This indicates that Sri Lankan fishermen may be catching hammerhead sharks even from the Western Indian Ocean.

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