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## THE DUGONG IN INDIA—IS IT GOING THE WAY OF THE DODO

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### ABSTRACT

The residual population of the dugong *Dugong dugon* in the Gulf of Mannar and Palk Bay is today the most vulnerable marine mammal in this region. The sudden escalation of the illegal take of dugongs is discussed here. The number captured or slaughtered has multiplied by 14 times or more within the past 2 years. The use of dynamite sticks is accelerating the possible depletion of this animal aided by other factors such as sail boat trawling along the shore line and the sea grass beds both day and night. The habitat perturbations due to excessive and unregulated mechanised fishing has also become a very critical factor not only disturbing the animals but in incidental capture as well as destroying their grazing grounds. The methods of illegal take, disposal and other related aspects are discussed here. The role that Community Councils and religious leaders could play in the conservation programme for the dugong is stressed. There is a need for an international approach to the problem of conservation and management of the dugong population in this region. This as well as the priority steps to be considered at national level are detailed here.

### INTRODUCTION

There is a world wide concern for the protection of the dugong and in India today the residual population of this species in the Gulf of Mannar and Palk Bay is the most vulnerable of species facing extinction. The listing of the dugong in the IUCN Red Data Book, nor its total protection under the Indian Wildlife (Protection) Act 1972, and the efforts of the authorities to curb its illegal take has in anyway slackened the pressure on the remnants of the once large population in the Gulf of Mannar and Palk Bay. Much has been written about the dugong from the Indian seas (Annandale, 1905; James, 1974; Jones, 1959, 1967, 1977, 1980, 1981; Mani, 1960; Mohan, 1963; Moses, 1942; Nair *et al.*, 1975; Pocock, 1941; Prater, 1928; Silas, 1961 and others).

According to Marsh (1981) dugongs 'appear to be long-lived animals with a low reproductive rate, a long generation time and a large invest-

ment in each offspring. As such they are very susceptible to over exploitation. Their vulnerability is increased by dependence on a specialised environment which must also be protected'.

At the recently held Indian Ocean Alliance Conference in the Seychelles in 1981, a major recommendation was that priority be given to a dugong survey in the Indian Ocean, with the aim of monitoring and protecting local populations and consider the feasibility of reestablishing the species in the areas where it no longer occurs. Despite the greater awareness to this pressing problem, there are large gaps in our knowledge about the biology, ecology and the behaviour of the dugong. Nor have we mastered the management of the environment of the dugong, especially their feeding grounds. More specifically our knowledge of the unit population, feeding biology, age determination, parasitology and pathology in wild populations to mention a few are greatly inadequate.

The dugong has been kept in captivity in some places and here again the range of observations on its life habits could certainly be improved for a better understanding of the animal itself. In the light of this, we consider that the Seminar/Workshop on the Dugong held at the James Cook University, Townsville, Australia in 1979 to be a land-mark as it brought together for the first time scientists and administrators concerned with dugong research, conservation and management problems and a fund of information on the species from various locations of its distributional range in the Indo-Pacific. In India, unless we build up a greater awareness among the local coastal population on the importance of conserving this resource all efforts as it stands today may turn out to be futile. Today we have no mechanism of thoroughly monitoring the non-legal take of dugongs especially as incidental catch as well as in unauthorised gears deliberately meant for dugong capture. There is a need for an assessment of the fishing activity in the Gulf and Palk Bay areas to evaluate the impact of this type of human interference on the dugong population. Hence it is felt that this report should be timely to highlight the depredation taking place and the urgent need to call a halt to the same.

#### FISHERY IN THE PAST AND THE PRESENT

From our knowledge as well as from enquiry about the fishery of dugongs in this region we are able to gather that in the past 25 years starting from 1960 only 20 to 25 dugongs were caught accidentally as well as by fishing efforts in a year. When Nair *et al.*, (1975) warned of the possible depletion of dugong population the capture figure stood at an average of 40 per year. The following fact is to be noted with grave concern that in Kilakara-Tondi region in one year period starting from April, 1983 to August, 1984 more than 250 dugongs were caught and butchered, an average of 4

per week. This figure was arrived at by head counting the animals butchered at Kilakarai and Periapatnam. Therefore this figure does not include those that were consumed at Tondi, Karangadu, Tiruppalaikudi and other minor landing centres.

Kilakarai is the foremost place in this unscrupulous exploitation and consumption of dugongs followed by Periapatnam, Thirupalaikudi and Tondi. Only in these places dugong meat is highly priced. In Gulf of Mannar, Pudumadam and Vedalai and in Palk Bay Karangadu, Nambuthalai, Morepanai and Mullimunai are some of the minor fishing villages where dugongs are caught and consumed. In all these places butchering is done with admirable secrecy that a buyer informs only the closest of kith and kin about the sale of meat and not any one else. The craze for the flesh of dugong is so intense in Kilakarai that the failure to inform a friend of the availability of the meat is despised and is known to cause misunderstanding among relatives. With the exception of Tondi in all other centres mentioned the animals are butchered right at the landing centres and not at the market place. In Kilakarai before the promulgation of the Indian Wildlife (Protection) Act 1972, the capture of a dugong was required to be informed to all the residents by a town-crier. Obviously it is not possible now and so the information has to be passed by word of mouth with utmost discretion. To keep the demand for meat at a sustained level, when more than one animal is caught they are kept alive in the sea by tethering them to some heavy object. At Periapatnam and Vedalai fishermen ever anticipating law enforcement by officials bring ashore dugongs with heads cut off and thrown into the sea. Thus only the headless carcass is landed with the convenient explanation, if at all one demanded that a headless carcass was floating in the sea and the fishermen himself does not know what it is,

When the price of mutton is as high as Rs. 26 per kg less expensive dugong meat is naturally sought after and this is one more reason for the sudden spurt in the fishing efforts for dugongs. However, this statement does not apply to Kilakarai where the demand for dugong meat is formidable.

PLACES OF CAPTURE

In the Palk Bay region Tondi and Thirupalaikudi are the two places where dugong

patnam in Palk Bay region as dugong fishery centres but now at these places this fishery does not exist. Karangadu emerges now in Palk Bay region as a new marketing centre both for dugongs and sea turtles after 1970. Prior to that, Karangadu was the place which honoured turtles and dugongs owing to religious beliefs. Now changing fishery pattern of this region has attracted migrant fishermen from other parts of Tamil Nadu to this place. These migrant fishermen at Karangadu relish the meat of dugong and so the exploitation

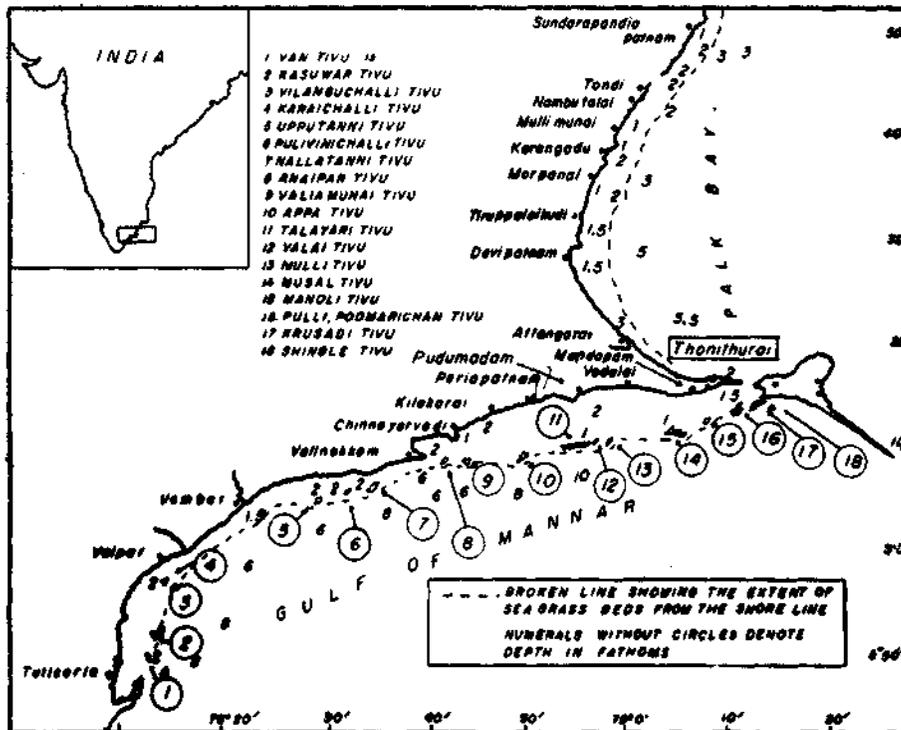


Fig. 1

capture is carried out with nets regularly followed by Karangadu, Nambuthalai, Mullimunai and Morepanai. The catches are either locally consumed or transported to Kilakarai or Tondi or Tiruppalaikudi as the occasion or market trend demands. Nair *et al.*, (1975) include Adirampattinam and Sunderapandia-

of this endangered animal began and continues unchecked.

In Gulf of Mannar region the chain of islands comprising Mussel tivu, Talayari tivu, Valai tivu, Appa tivu, Valiamunai tivu and Anaipar tivu and a particular ground near

Sethukarai still offer the right grounds for fishing this animal. South of Vaipar, capture of dugong is unknown now. Nair *et al.* (1975) correctly included all islands near Tuticorin including Pandyan tivu (which is now the part of Tuticorin harbour complex) as fishing grounds of dugongs. But during the past 10 years no dugong was ever captured around islands near Tuticorin namely Van tivu, Kasuwar tivu, Karaicahlli tivu and Vilanguchalli tivu. Excessive exploitation of corals around these islands has very much altered the ecology of the islands resulting in the loss of certain portions of islands. This was followed by the disappearance of sea grass beds around them. Islands such as Vilanguchalli tivu does not exist at all now which was nine years back 3 m high above high water mark and 0.5 ha in area with dugong browsing grounds all around. Fishermen from Kilakarai and Periapatnam regularly visit the islands near Mandapam, namely, Musal tivu, Appa tivu and Sethukarai ground as well as Anaipar tivu and Valiamunai tivu for dugongs.

#### MODE OF CAPTURE

Accidental catches in nets with mesh size of 7 cm to 10 cm meant for large perches is only a myth. These large size perches do not at all occur in good numbers in the shallow water i.e. in 1.5 fathom range (within 2 km from the shore). But fishermen at least now come with a neat fabric of story that they were accidentally caught. Dugongs usually do not stray beyond 5 fathom line from the shore for feeding whereas these gill nets are used within the 5 fathom area only (6 km from the shore). What actually happens is that, when dugongs are sighted as they surface for breathing without much effort they are encircled with nets. Even after capture usually these mammals do not become very much agitated. The animals is tied to the boat by the tail and towed to the landing centre.

Investigations reveal that during the past 5 years when there had been a hectic activity of dugong capture there has not been a single report of net damage caused by dugongs. Fishermen themselves admit that only inexperienced fishermen shall have their nets damaged by dugongs and for such fishermen they have only scorn. In September, 1983 at Thonithurai and in December, 1983 at Mandapam north landing centre close to the shore stray dugongs were sighted. Immediately the fishermen who were idle on the shore deftly slipped into the sea with nets and encircled them without any damage to the nets.

#### SPECIAL DUGONG NETS

At Kilakarai special bottom set gill nets are operated for dugongs. Two families operate 20 of such nets and these nets are made of nylon yarn of 4 mm thickness. They are cast in the sea for a period of one week at a stretch with daily checking for any catches. These nets have weights which also allow the animal to surface for breathing. The fact must be remembered that nets are operated in feeding grounds where the depth is hardly 1 to 1.5 fathoms and the mesh size is 30 to 35 cm when stretched.

#### *Vulivalai*

These drift nets with mesh size of 8 cm to 14 cm when stretched are operated in the shallow water feeding grounds whenever the fishermen decide on capturing a dugong. In the normal course, these nets are operated in 6 fathom deep grounds. In this case also no net damage is reported.

#### *Thirukkavalai* (Ray fish nets)

Tondi is the only place in the region reported where ray fish nets are used to capture dugongs also. These ray nets are nylon nets with a mesh size varying from 30 cm to 45 cm when stretched and height of the net is 3 m

and length, about 12 m. Accidental catch of a dugong in ray fishnets is not a fact because dugongs do not stray to 10 fathom deep area where alone these nets are operated for rays. At Tondi these nets are set for dugongs near the shore within 0.5 km.

#### EXPLOSIVES

This is a new method introduced for dugong capture in the recent past and this is a cause for alarm to anyone interested in conservation. The explosives were introduced for fishing in 1981 in Palk Bay region and is on the increase from day to day. Formerly at Thiruppalaikudi and Devipatnam country bombs were used to kill fish shoals on sighting. Now this is a regular feature adopted by fishermen in general in this region. At Thiruppalaikudi big shrubs and small trees are uprooted and carried to 5 fathom deep area and are laid on the sea floor and are allowed to rot and form a site for fish aggregation. Within a week good aggregation of fish occurs in such areas. Once the fisherman is satisfied with the size of the fish aggregation he explodes a bomb and makes a number of dives to collect the stunned fishes. Once in the vicinity of these submerged shrubs a dugong was killed. Encouraged by this fishermen took to killing dugongs with explosives which seems to be a very easy method. Now country bombs are replaced by factory made dynamite sticks which are brought and supplied by fish merchants from Sivakasi to fishermen at the rate of Rs. 12 per piece. The boats are run with sails in the grazing grounds of dugongs and when the animals is sighted as it surfaces the lighted dynamite stick is thrown at the animal with ease because the sluggish animal remains at the same spot for certain. To facilitate the lighting of the dynamite stick in the open air three match sticks are tied to the wick of the dynamite and struck against a match box. Usually the head of the animal gets mangled

because the aim is so deadly and accurate. Even those who carry dynamite sticks on board for killing large fish shoals on sighting them are easily tempted to kill dugongs which naturally is more lucrative than a day long effort for fishes. For example, in the third week of August, 1984 alone six dugongs were dynamited in a single day off Thiruppalaikudi.

#### SHORE SEINES

Nair *et al.*, (1975) mention the capture of dugongs in shore seines operated in this region. In the past 9 years this has not been reported clearly indicating the absence of dugongs in the near shore waters.

#### MODE OF TRANSPORT

As late as 1982 dugongs caught in Gulf of Mannar were invariably transported whole to Kilakarai either by boats or by motor cars not minding the high cost of transport by taxi which is as high as Rs. 350 from Vembar or Vaippar. Nowadays animals caught around the islands of Gulf of Mannar are either cut into huge chunks of meat or as headless trunk and are transported without ice in taxi cabs or boats. But to Madurai and Madras the meat chunks are sent packed with ice in innocuous looking Thermokool boxes by express trains to those agents who specialise in supplying this meat to connoisseurs.

#### PRICE STRUCTURE

The price of meat varies according the place, the highest being offered at Kilakarai. A full grown animal that is 2 m long is bought by merchants at Kilakarai for at least Rs. 1200 to Rs. 1500 whereas the same would fetch only Rs. 500 from merchants at Tondi and Thiruppalaikudi.

	Price of meat with blubber per kg	Price without blubber per kg
Kailakarai	Rs. 20	Rs. 22
Periapatnam	Rs. 10	Rs. 15
Tondi	Rs. 4	Rs. 6
Thiruppalaikudi	Rs. 5	Rs. 6
Karangadu	Rs. 3	—
Tuticorin	Rs. 8	—
	to 10	

#### FEEDING GROUNDS OF DUGONGS

*Cymadocea serrulata* and *C. isoetifolia* form the main food items on which the dugongs of this region feed. They graze on the sea floor pulling the grasses or they easily pick up the floating sea grasses. It was observed by the authors around islands of Gulf of Mannar and at Tondi that dugongs always prefer picking up floating grasses with other algae which happen to grow there. The beds of these sea grasses as feeding grounds occur within 1 to 2 km from the shoreline at a depth of 1 to 3 fathoms. *C. serrulata* does occur even in places where the depth is 5 fathoms but the growth is sparse and so dugongs are not found in such deep areas. Dugongs seem to prefer the zone of 0.5 fathom only where growth of grass is abundant. As the map given indicates there is luxuriant growth of this grass from 10 km north of Tondi to Attankarai in Palk Bay region and around Mandapam it becomes sparse. In Gulf of Mannar there are patchy grounds near Krusadi island and Thonithurai. On the landward side of islands such as Musal tivu, Talayari tivu and Valai tivu they abound. Near Sethukarai there is a lush ground of sea grass. Then they are good near Anaipar tivu and Valiamunai tivu. Around islands Nallatanni tivu, Uppu tanni tivu and Puluvinichalli tivu the growth of sea grass is sparse.

In the late 1960's the fishermen of Palk Bay region used to bitterly complain about the disappearance of large beds of sea grasses and algae (sea weeds) owing to the cyclone of December 1965. At that time huge quantities of sand brought by floods were deposited over those seaweed beds completely destroying them and this area ceased to be the feeding grounds of dugongs and turtles. Therefore there was near total absence of turtles and dugongs and their fishery in the late 1960s and early seventies. Now fishermen gladly inform that the same beds have sprung up once again with luxuriant growth of sea grass extending upto Meemisal in Palk Bay. The reappearance of seaweed beds has turned to be a double blessing for fishermen of this region because they support dugongs as well as small prawns such as *Penaeus indicus* and *P. semisulcatus*.

#### FACTORS AFFECTING THE FEEDING GROUNDS OF DUGONGS

Enacted laws specify that mechanised boats should not operate within 5 km from the shore. But almost throughout the year some 500 mechanised boats churn the most important dugong feeding grounds in Gulf of Mannar namely (i) ground between Vedalai-Periapatnam shoreline and Valai-Appa tivu, (ii) ground near Chinna yervadi. Both day and night fishing is carried out in shifts with a steady throbbing of engines of the mechanised vessels. This is a fact which should not be ignored because the feeding grounds are not extensive and number of boats have quadrupled in the past five years and fishing time is not restricted to a part of the day. Dugongs hit by the propellers of these boats are not uncommon. Usually dugongs hit by the propellers are small measuring 100 to 150 cm in length. The reason is not clear. Perhaps the smaller ones are too sluggish to avoid an approaching trawl boat or they are more curious than the adults or do not sound deep enough to avoid the propellers.

In the recent past, beginning from 1972 sail boat trawls are operated in the shallow water zone close to the shore viz., 1 to 1.5 fathom range, for small sized prawns *Penaeus indicus* and *Penaeus semisulcatus* which usually abound among sea grasses especially in Palk Bay. In Tondi-Tiruppalaikudi area when winds are favourable some 320 sail-boats operate trawls in these grounds. To gain more catches each boat operates two trawl nets instead of the usual one, tied together. This trawl fishing also to a great extent disturb the browsing dugongs and trawl nets uproot the rhizomes of sea grasses. The argument that the dugongs may safely graze when there is no trawling operations cannot be welcomed because this trawling is not restricted to certain hours of the day but whenever there is a favourable wind. However, there has been no report of dugongs being caught in these trawl nets.

#### CONSERVATION

Dugongs are not prolific breeders. They give birth to only one young at a time. The fact that all captured animals in 1983-84 measured more than 1.5 m must cause grave concern to us. Thus nearly more than 250 adult dugongs have been exterminated in this one year period. We are not certain that there could be a large population of dugong in this small area. Moreover the destruction of grazing beds has confined the animals to a not-so extensive belt of sea grass. As indicated earlier, hardly 40 animals per year were captured upto 1975. Thus it is the direst need of the hour in our efforts to conserve marine mammals that dugongs must be given top-priority over all the other marine vertebrates.

Existing laws alone cannot save dugongs owing to certain loopholes and constraints in its execution. When huge chunks of dugong meat without head or flippers are brought ashore it may be difficult for the law-enforcing official to book an offender who himself declares

to be ignorant of the identity of the animal. A confiscated turtle can be produced alive in a court of law easily as evidence and it can be identified by a competent official but not a chunk of meat.

Therefore the consumers must be educated of their colossal mistake and they must be persuaded to give up eating dugong meat. This can be effectively done by requesting the elders of village councils like those in Tondi and Thiruppalaikudi. At Kilakarai and Periapattanam religious leaders can play an important role in saving dugongs. If the leaders of the mosques are persuaded to exhort the people to avoid eating dugongs this measure may certainly prove successful.

On considering the urgency of the matter wildlife protection officers should be posted immediately at Kilakarai-Periapattanam sector and Tondi-Tiruppalaikudi sector. Daily visit of the official to these places will certainly act as deterrent both on consumers and fishermen, especially on the former.

By all means fishing with dynamite also must be stopped. Existing laws provide adequately for preventing the fishermen from buying, possessing, trafficking and using dynamite sticks. Therefore stringent measure in this line also must prove effective.

While we mention this specific action plan, it is time that we develop a national action programme for the conservation and management of the dugong. This is particularly so in view of the international implications of this resource as it is likely that the dugongs in the Palk Bay and Gulf of Mannar may also be migrating the shores of Sri Lanka and back. In addition, we have indications of stray occurrence of dugongs in the Andaman Nicobar Islands which also need immediate attention. Sporadic occurrence of stray animals as incidental catch or strandings along the mainland coast has been reported in the past

even as northwest as Saurashtra. Hence we propose the following action programme for immediate follow up :

1. Aerial surveys may be conducted in Palk Bay and the Gulf of Mannar region for delineating the sea grass beds and carry out a census of the dugongs with repeat surveys from time to time. The census may be aimed at recording not only herds, but the number of cows with calves, feeding actively and noting whether they are swimming or idling. A good amount of information on aerial survey and the type of useful information to be obtained had already been standardised over a long period in Australia mainly through the efforts of Heinsohn and his collaborators. We should take advantage of this experience to carry out such surveys.
2. The carcasses of dugongs wherever they are found or when occurring as accidental catch in fishing operations should be available for detailed scientific study. Major gaps still exist in our knowledge about the dugong and such studies would help to bridge some of these. The type of studies that could be undertaken and the standard procedures for examining carcasses have already been well documented by Heinsohn at the 1979 Workshop on the Dugong held at Townsville, Australia. The standard procedures may be adopted so that eventually uniform data becomes available from the entire range of distribution of the dugong in the Indo-Pacific.
3. There is a need for tagging of the dugong so that its movements, growth and other parameters could be studied. This would also involve considerable effort of search and capture and the cooperation of the fishermen could also be enlisted in such operations where live animals could be obtained if accidentally caught in fishing operations. Along with tagging, photo identification of dugongs should also be encouraged. We may here cite the work of Dr. Paul K. Anderson in Australian waters where he has shown that photo identification of individual animals is possible which also tell a lot about the movements and life habits of the animals.
4. Captive rearing helps in studying some aspects of the animals physiology and behaviour. In the present context we could also maximise focusing attention on the dugong for creating a greater awareness for the conservation of this animal to the people living in the coastal sector. Its educational value to the people especially children should not be lost sight of. This has to be closely linked with issue of suitable illustrated literature.
5. There is an urgent need to study the extent and ecology of the sea grass beds in the Gulf of Mannar and Palk Bay and Andaman Nicobar Islands. Since this is the major habitat of the dugong, the environmental factors which affect this should also be investigated. Factors such as siltation and industrial pollution are matters of serious concern in maintaining and upgrading this habitat. Efforts should be made to organise suitable environment monitoring programmes in such areas.
6. The historical importance of dugong and its cultural significance should not be lost sight of. All earlier records on dugongs should

be collected and collated and brought out which should also create a public awareness and interest in the subject.

7. The aspect of legislation should once again be looked at carefully to see to what extent loopholes could be plugged and the legislation could be constructive involving taking into confidence the coastal population.
8. The proposed National Marine Park in the Gulf of Mannar should become a reality as early as possible so that human interference in the grazing grounds of the dugong could be minimised or phased out. The Park would also afford protection to the animals and as such the delineation of the park to embrace all the 21 islands between Rameswaram and Tuticorin should be taken up. Other perturbations such as mechanised fishing and allied activities which disturb the animals should be phased out in the park area. A major threat is likely to come if the proposed Sethusamudram Project comes through.

This cut in the coral reef areas between and through the islands would certainly affect the dugong population and their local movements. It is known that dugongs are hit and maimed or killed by boats or impaled by their propeller.

9. A proper data acquisition system of the biological and other aspects of the dugong should be developed and this could be closely linked to a computerised system. The Marine National park should develop such an input system.
10. An international effort is necessary to understand the population structure of the dugong and this calls, for cooperation between India and Sri Lanka. Modalities will have to be developed for such a programme.
11. The Indian Ocean Alliance Meeting Recommendation made at Seychelles in 1981 may be followed up to carry out an Indian Ocean Survey of the dugong populations and their present status.

## REFERENCES

- ANNANDALE, N. 1905. Notes on the species, external characters and habitats of the dugong. *J. Proc. Asiat. Soc. Bengal (NS)*, 1 : 238-243.
- HEINSOHN, G. E., A. V. SPAIN AND P. K. ANDERSON 1976. Populations of dugong (Mammalia : Sirenia) : Aerial survey over the inshore waters of Tropical Australia. *Bull. Conser.*, 9 : 21-23.
- 1981. Aerial survey techniques for dugongs. In : MARSH, H. (Ed.) *The Dugong*. Proc. Seminar/Workshop held at James Cook Univ. 8-13 May, 1979, pp. 217-227.
- JAMES, P. S. B. R. 1974. An osteological study of the Dugong *Dugong dugon* (Sirenia) from India. *Marine Biology*, 27 : 173-184.
- JONES, S. 1959. On a pair of captive dugongs *Dugong dugon* (Erxleben). *J. Mar. Biol. Ass. India*, 1(2) : 198-202.
- 1967. The dugong or sea cow—its present status in the seas around India with observations on its behaviour in captivity. *Int. Zoo. Yearb.*, 7 : 215-219.
- 1976. The present status of the dugong, *Dugong dugon* (Muller) in the Indo-Pacific and problems of its conservation. FAO Advisory Committee on Marine Resources Research, Scientific Consultation in Marine Mammals, Bergen, ACMRR/MM/SC/26, 46 pp.
- 1980. The dugong or the so-called mermaid, *Dugong dugon* (Muller) in the Indo-Sri Lanka waters —problems of research and conservation. *Spl. Zeylyn.*, 36 : 211-242 (Colombo Museum Centenary Volume)
- 1981. Distribution and status of the *Dugong dugon* (Muller) in the Indian waters. In *The Dugong*, Marsh, H (Ed.) Proc. Seminar Workshop held at James Cook University, 8-13 May, 1979, pp. 43-54.

- MARSH, H. 1981. Life history parameters of the dugong and their implications for conservation. *Ibid.*, pp. 88-90.
- MANI, S. B. 1960. Occurrence of the Sea Cow *Halicore dugong* (Erx), off Saurashtra Coast. *J. Bombay nat. hist. Soc.*, 57(1) : 216-217.
- MOHAN, R. S. LAL 1963. On the occurrence of *Dugong dugon* (Muller) off the Gulf of Cutch. *J. Mar. biol. Ass. India*, 5(1) : 152.
- MOSES, S. T. 1942. The Fisheries of the Gujarat Coast. *J. Gujarat Res. Soc.*, 4(2) : 75.
- NAIR, R. V., R. S. LAL MOHAN AND K. S. RAO 1975. The dugong, *Dugong dugon*. *Bull. Centr. Mar. Fish. Res. Inst., Cochin* 26 : 1-44.
- PURCOCK, R. I. 1940. Some notes on the dugong. *Ann. Mag. nat. Hist.*, 5(11) : 229-245.
- PRATER, S. H. 1928. The dugong or Sea Cow (*Halicore dugong*). *J. Bombay nat. Hist. Soc.*, 33(1) : 84-99.
- SILAS, E. G. 1961. Occurrence of the sea cow *Halicore dugong* (Erxl.) off Saurashtra coast. *J. Bombay Nat. Hist. Soc.*, 58 : 263-266.
- THOMAS, D. 1966. Natural history of dugong in Rameswaram waters. *Madras J. Fish.*, 2 : 80-82.