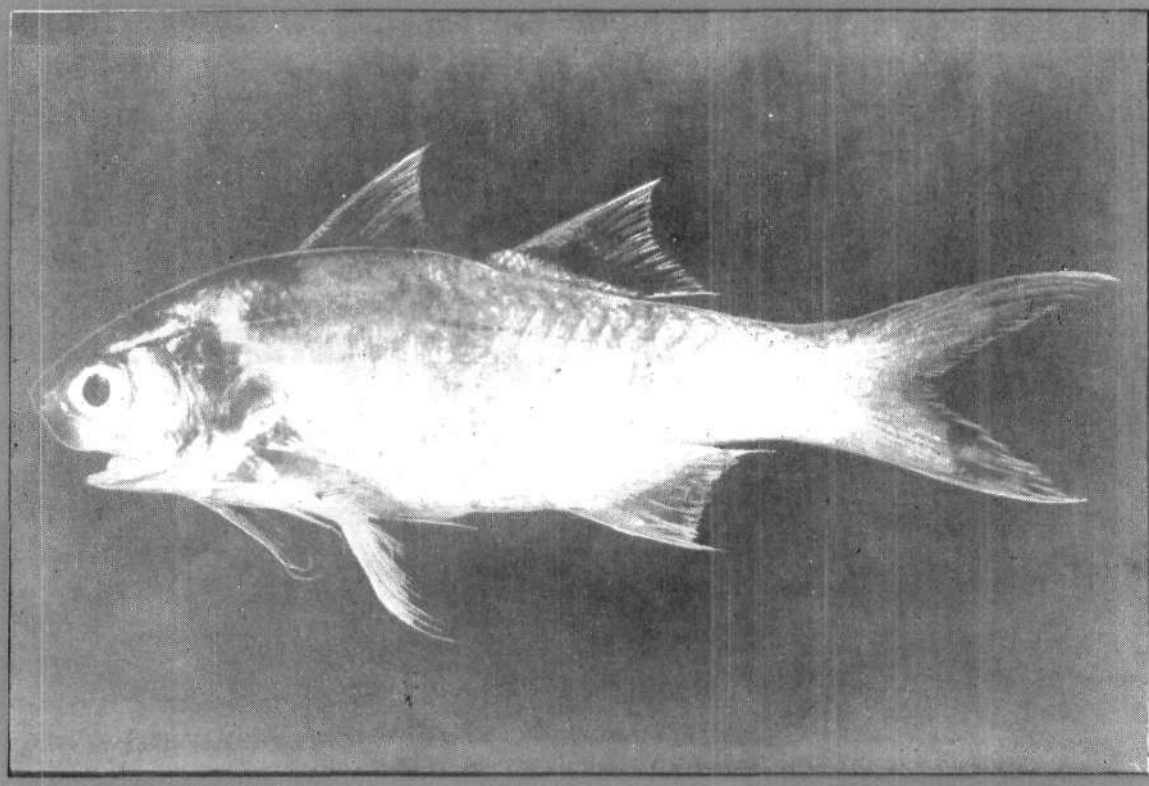
MARINE FISHERIES INFORMATION SERVICE



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Technical and Extension Series

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
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THE MARINE FISHERIES INFORMATION SERVICE: Technical and Extension Series envisages the rapid dissemination of information on marine and brackish water fishery resources and allied data available with the National Marine Living Resources Data Centre (NMLRDC) and the Research Divisions of the Institute, results of proven researches for transfer of technology to the fish farmers and industry and of other relevant information needed for Research and Development efforts in the marine fisheries sector.

Abbreviation – *Mar. Fish. Infor. Serv., T & E Ser.*, No. 86: 1988

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Front cover photo:

Polynemus sextarius ('Dara') commonly occurring along the Gujarat coast.

Back cover photo:

A view of fisheries harbour at Veraval.

MARINE FISH CALENDAR

VIII. VERAVAL*

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Introduction

The coastline of Gujarat, spread around 1,660 km is well known for its bombay duck and pomfret fisheries. In this coast, Veraval which is located in the Saurashtra region forms one of the major fish landing centres. The average annual landing is around 50,000 t, forming about 20% of the catch of the Gujarat State.

In the late 50s fishing was confined to the inshore waters of Veraval. The majority of the boats were of sail type and a very few only were mechanised. These boats were using gill nets and long lines. Stern trawling was unknown and the catch of quality fishes like pomfrets, 'ghol' and eels obtained by long liners and gill netters were iced and transported to Bombay by carrier boats and some quantity by train to Ahmedabad, Baroda and Delhi. The majority of miscellaneous varieties were salted and sun dried. There was poor demand for fish among the local populace.

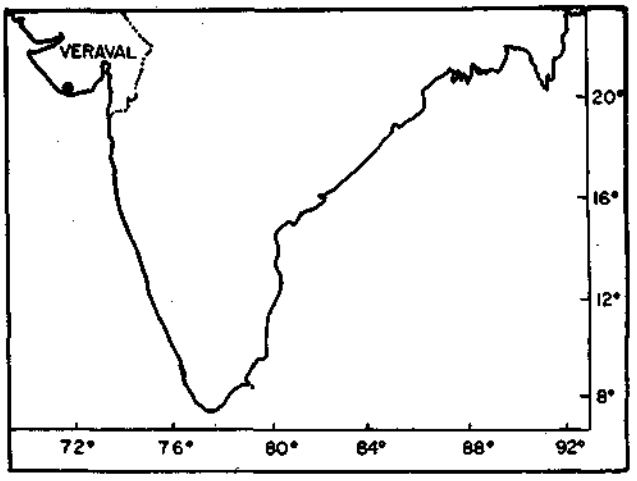
However, after the state was formed in 1960, fisheries developmental activities took a major turn. A new fisheries harbour was planned for Veraval and the fishing pattern underwent a major change with the introduction of stern trawling. At present there are about 800 trawlers, 300 OBM fitted boats and about 50 non-mechanised crafts. The trawlers accounted for about 90% catch and the rest by gill nets and OBM boats. The average monthly catch by trawlers is about 4,000 t (10 months fishing) and by gill netters about 374 t (12 months fishing).

The fishing operations are mainly carried out at about 80 m depth from Dwarka (250 km) towards north to Nawabunder (100 km) towards south. These fishing trips are called 'long trips' which last for about four days and the boats are equipped with long term storage facilities for the quality fishes. The peak landing period is from October to January by the trawlers. The fishing by trawlers remains closed annually for monsoon from 15th of May to 15th of September. During this period maintenance works of vessels are taken up.

During the monsoon period, depending on roughness of sea, gill netters operate to catch pomfrets, 'ghol' and 'dara'. During the fag end of the fishing season many fishermen go for shark hunting, and the oil from the liver of these sharks is used for repair works of the vessels.

During November, the fish catch constituted 15.45% of the total landings and the peak period of October to December accounted for 36% of the annual landings from Veraval. The pelagic resources formed majority of the landings in gill net catch (65.13%); whereas 64% of the demersal resources was landed by trawlers.

By and large the landings of demersal resources are comparatively higher (60.4%) than the pelagic



*Consolidated by N. Gopinatha Menon and K. Balachandran, CMFRI, Cochin.

resources in Veraval area. The sciaenids form 16% of the trawl landings and 3.4% of the gill net landings. The cat fishes constitute 5.8% of the gill net catch and 0.77% of the trawl landings. The threadfin breams form 3.5% of the total catch.

In Veraval it is observed that due to poor handling and storage facilities about 40% of the catch goes as trash fish and is used for manure and fish meal purpose.

CARANGIDAE

Popular English Name	:	Trevally/Scads
Vernacular Name (Gujarati)	:	'Bangdi'/'Khadwo'
Annual average catch	:	953.8 t
Percentage in total catch	:	2.1
Fishing methods and their contribution	:	Trawl net/ Gill net: —

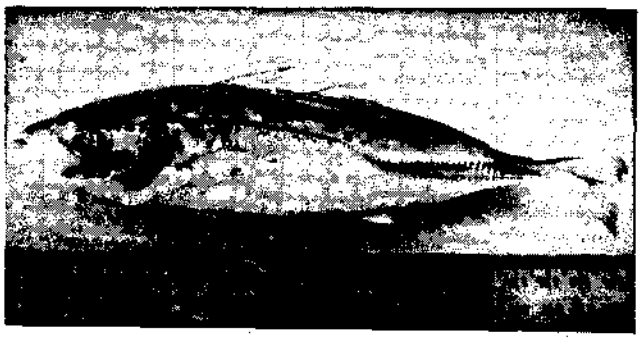


Fig. 1. *Decapterus russelli.*

Scientific Name	:	*Decapterus russelli*
Vernacular Name	:	'Bangdi'
Gear	:	Trawl net/Gill net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Dec. - Mar.
Depth of occurrence	:	20 - 40 m
Length range in commercial fishery	:	50 - 150 mm
Size at first maturity	:	—
Spawning season	:	—

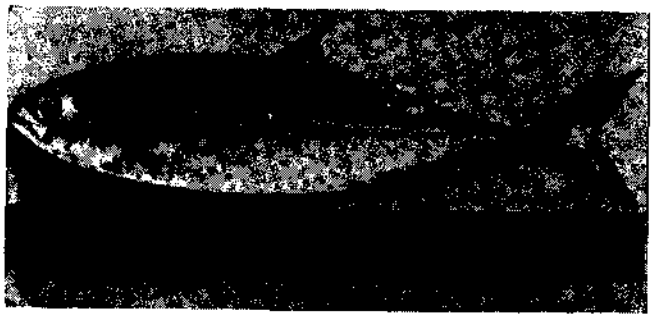


Fig. 2. *Megalaspis cordyla.*

Scientific Name	:	*Megalaspis cordyla*
Vernacular Name	:	'Kati'/'Bangada'
Gear	:	Trawl net/Gill net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Dec. - Mar.
Depth of occurrence	:	20 - 40 m
Length range in commercial fishery	:	50 - 150 mm
Size at first maturity	:	—
Spawning season	:	—

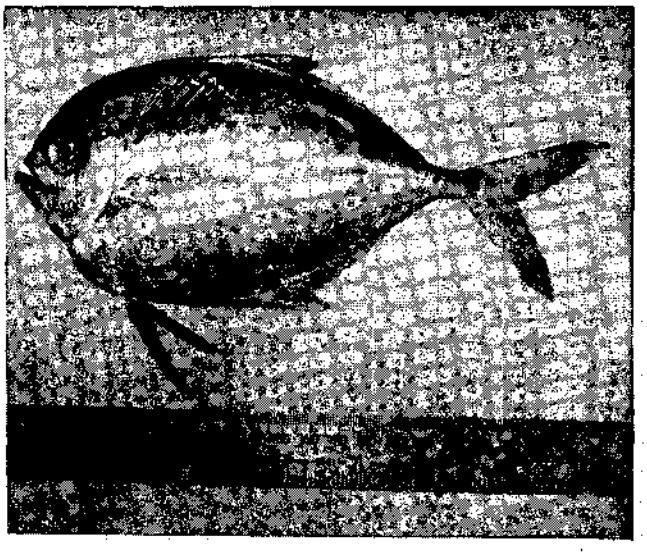


Fig. 3. *Atropus atropus.*

Scientific Name	:	*Atropus atropus*
Vernacular Name	:	'Khadwo'
Gear	:	Trawl net/Gill net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Nov. - Dec.
Depth of occurrence	:	40 - 80 m

Length range in commercial fishery : 100 – 300 mm
Size at first maturity : —
Spawning season : —

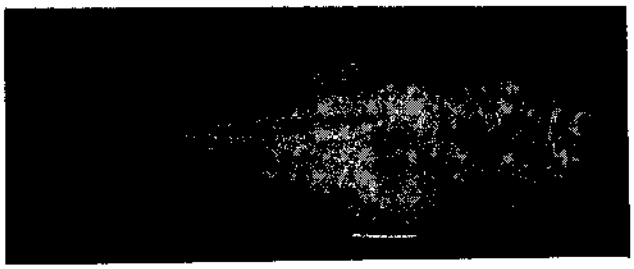


Fig. 4. *Alepes djedaba.*

Scientific Name : *Alepes djedaba*
Vernacular Name : 'Bangdi'
Gear : Trawl net/Gill net
Percentage in the catch of the group : —
Peak period of occurrence : Sep. – Nov.
Depth of occurrence : 40 – 80 m
Length range in commercial fishery : 150 – 300 mm
Size at first maturity : —
Spawning season : —

CHIROCENTRIDAE

Popular English Name : Wolf herring
Vernacular Name (Gujarati) : 'Dai'
Annual average catch : 723.9 t
Percentage in total catch : 1.6
Fishing methods and their contribution : Gill net: —

Fig. 5. *Chirocentrus nudus.*

Scientific Name : *Chirocentrus nudus*
Vernacular Name : 'Dai'
Gear : Trawl net/Gill net
Percentage in the catch of the group : 100
Peak period of occurrence : Oct. – Mar.
Depth of occurrence : —
Length range in commercial fishery : 300 – 600 mm
Size at first maturity : —
Spawning season : —

CLUPEIDAE

Popular English Name : Sardines/Shad/Herring
Vernacular Name (Gujarati): 'Chaksi'/'Palva'/'Kati'/'Tarali'
Annual average catch : 623.5 t
Percentage in total catch : 1.4
Fishing methods and their contribution : Gill net/ Trawl net: —

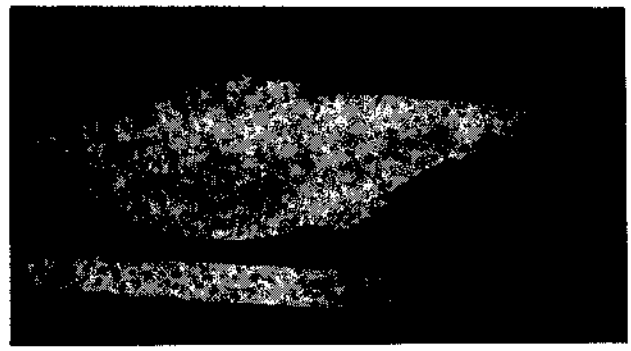


Fig. 6. *Tenualosa toli.*

Scientific Name : *Tenualosa toli*
Vernacular Name : 'Palva'
Gear : Gill net
Percentage in the catch of the group : 92.7
Peak period of occurrence : Oct. – Mar.
Depth of occurrence : 20 – 40 m
Length range in commercial fishery : 150 – 200 mm
Size at first maturity : —
Spawning season : —

CYNOGLOSSIDAE

Popular English Name : Tongue soles
Vernacular Name (Gujarati) : 'Gipti'/'Jeebthi'/'Jeeb'

Annual average catch	:	618.7 t
Percentage in total catch	:	1.4
Fishing methods and their contribution	:	Trawl net: —

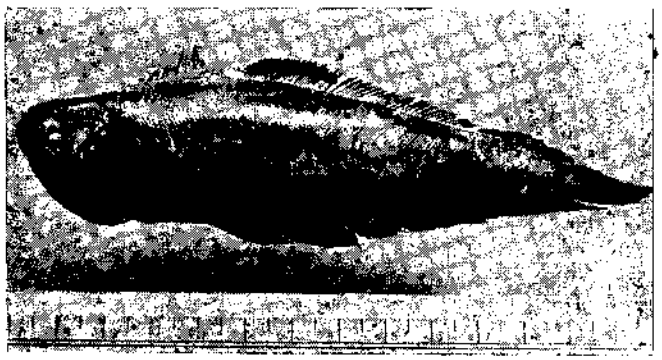


Fig. 7. *Cynoglossus macrostomus.*

Scientific Name	:	*Cynoglossus macrostomus*
Vernacular Name	:	'Gipti'/'Jeebthi'
Gear	:	Trawl net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Mar. – May
Depth of occurrence	:	25 m
Length range in commercial fishery	:	100 – 150 mm
Size at first maturity	:	—
Spawning season	:	—

ELASMOBRANCHS

Popular English Name	:	Sharks/Rays/Skates
Vernacular Name (Gujarati)	:	'Mogra'/'Lalo'/'Lala'/ 'Sandho'/'Mushia'/ 'Patari'/'Kane mushi'/ 'Tarabla'
Annual average catch	:	1,492 t
Percentage in total catch	:	3.3
Fishing methods and their contribution	:	Gill net/ Trawl net: —

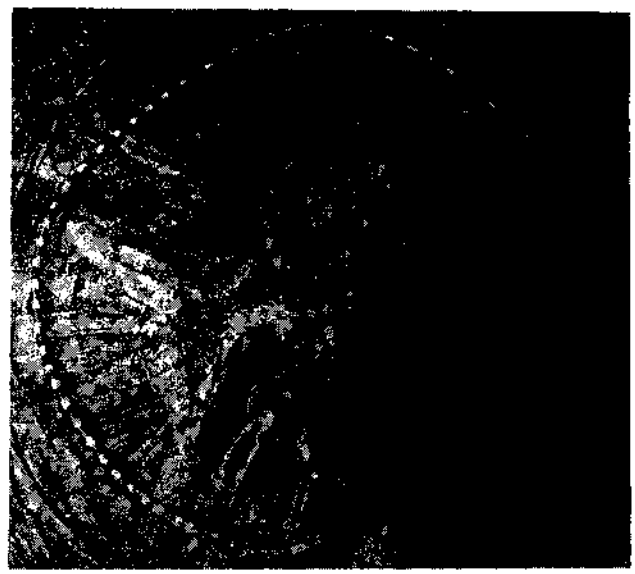


Fig. 8. *Himantura bleekeri.*

Scientific Name	:	*Himantura bleekeri*
Vernacular Name	:	'Tarabla'/'Boor'
Gear	:	Trawl net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Jan. – Jun.
Depth of occurrence	:	—
Length range in commercial fishery	:	1,000 – 1,400 mm
Size at first maturity	:	—
Spawning season	:	—

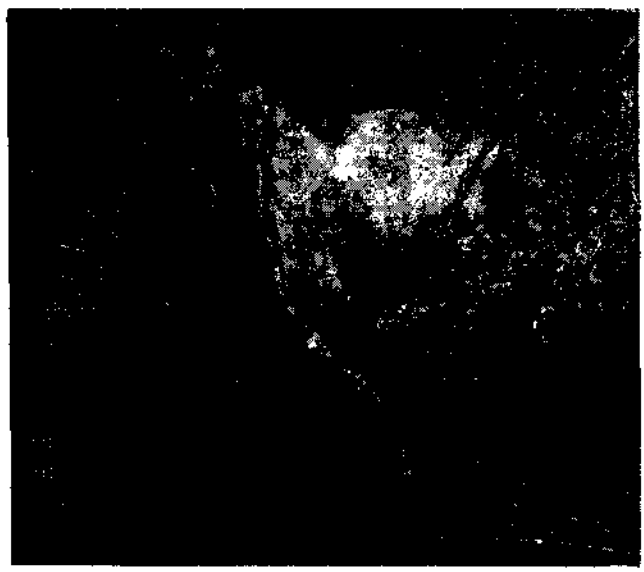


Fig. 9. *Aetobatus narinari.*

Scientific Name	:	*Aetobatus narinari*
Vernacular Name	:	'Wagalin'/'Kodio'
Gear	:	Trawl net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Apr. – May
Depth of occurrence	:	—
Length range in commercial fishery	:	2,000 – 3,000 mm
Size at first maturity	:	—
Spawning season	:	—

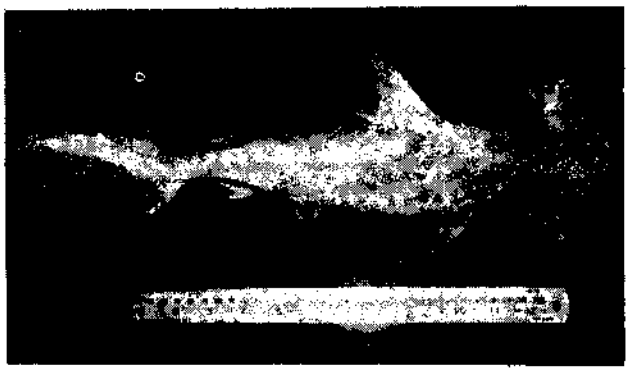


Fig. 10. *Sphyrna mokarran.*

Scientific Name	:	*Sphyrna mokarran*
Vernacular Name	:	'Kane mushi'
Gear	:	Gill net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Apr. – May
Depth of occurrence	:	80 m
Length range in commercial fishery	:	2,000 – 2,500 mm
Size at first maturity	:	—
Spawning season	:	—

Fig. 11. *Sphyrna lewini.*

Scientific Name	:	*Sphyrna lewini*
Vernacular Name	:	'Kane mushi'
Gear	:	Gill net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Apr. – May
Depth of occurrence	:	80 m
Length range in commercial fishery	:	700 - 2,000 mm
Size at first maturity	:	—
Spawning season	:	—

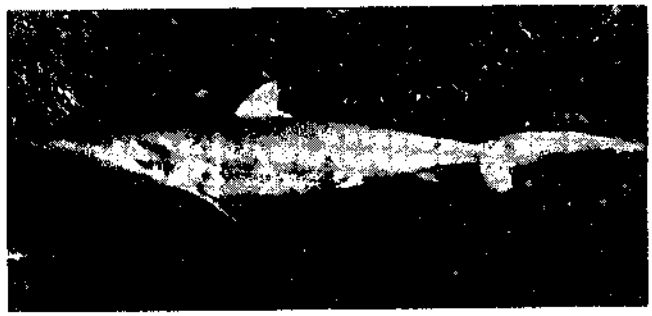


Fig. 12. *Carcharhinus limbatus.*

Scientific Name	:	*Carcharhinus limbatus*
Vernacular Name	:	'Patari'
Gear	:	Gill net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Oct. – May
Depth of occurrence	:	30 – 80 m
Length range in commercial fishery	:	500 – 1,500 mm
Size at first maturity	:	—
Spawning season	:	—

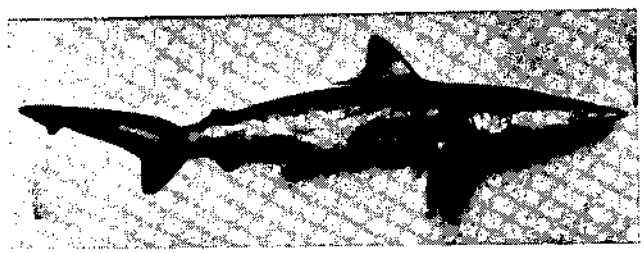


Fig. 13. *Carcharhinus melanopterus.*

Scientific Name	:	*Carcharhinus melanopterus*
Vernacular Name	:	'Patari'
Gear	:	Gill net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Oct. – May
Depth of occurrence	:	30 – 80 m

Length range in commercial fishery : 500 – 1,500 mm
Size at first maturity : —
Spawning season : —

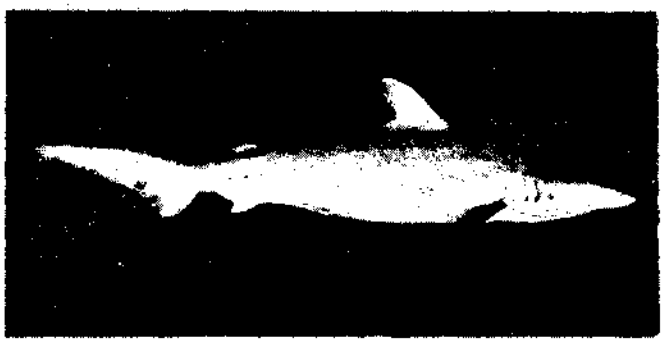


Fig. 14. *Scoliodon laticaudus*

Scientific Name : *Scoliodon laticaudus*
Vernacular Name : 'Sandho'
Gear : Trawl net/Gill net
Percentage in the catch of the group : —
Peak period of occurrence : Oct. – May
Depth of occurrence : 30 – 80 m
Length range in commercial fishery : 300 – 850 mm
Size at first maturity : —
Spawning season : —

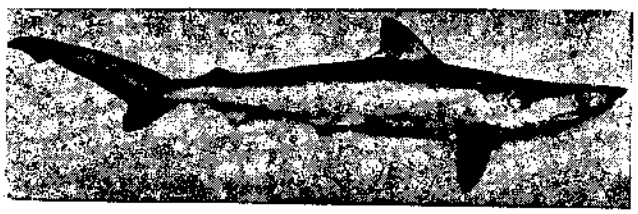


Fig. 15. *Rhizoprionodon acutus.*

Scientific Name : *Rhizoprionodon acutus*
Vernacular Name : 'Sandhi'/'Pisori'
Gear : Gill net/Trawl net
Percentage in the catch of the group : —
Peak period of occurrence : Oct. – May
Depth of occurrence : 30 – 80 m
Length range in commercial fishery : 300 – 750 mm
Size at first maturity : —
Spawning season : —

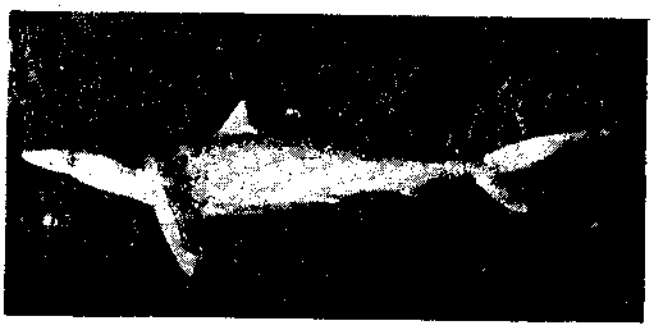


Fig. 16. *Rhizoprionodon oligolinx.*

Scientific Name : *Rhizoprionodon oligolinx*
Vernacular Name : 'Sandhi'
Gear : Gill net/Trawl net
Percentage in the catch of the group : —
Peak period of occurrence : Oct. – May
Depth of occurrence : 30 – 80 m
Length range in commercial fishery : 300 – 750 mm
Size at first maturity : —
Spawning season : —

ENGRAULIDAE

Popular English Name : Anchovies
Vernacular Name (Gujarati) : 'Mandeli'/'Palli'
Annual average catch : 3,592 t
Percentage in total catch : 8.1
Fishing methods and their contribution : Trawl net/ Dol net: —

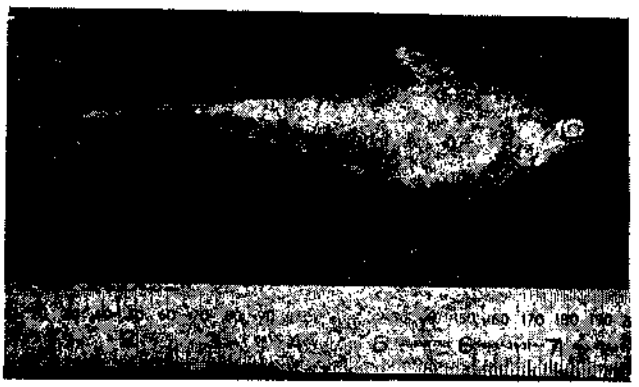


Fig. 17. *Coilia dussumieri.*

Scientific Name : *Coilia dussumieri*
Vernacular Name : 'Mandeli'
Gear : Dol net

Percentage in the catch of the group : 100
Peak period of occurrence : Oct. – Mar.
Depth of occurrence : —
Length range in commercial fishery : 60 – 160 mm
Size at first maturity : —
Spawning season : —

HAEMULIDAE

Popular English Name : Spotted Grunter
Vernacular Name (Gujarati) : 'Kharkara'/'Anther'
Annual average catch : 84.9 t
Percentage in total catch : 0.2
Fishing methods and their contribution : Trawl net: —

HARPADONTIDAE

Popular English Name : Bombay duck
Vernacular Name (Gujarati) : 'Bumla'
Annual average catch : 5.2 t
Percentage in total catch : —
Fishing methods and their contribution : Dol net: —

Fig. 18. *Harpadon nehereus.*

Scientific Name : *Harpadon nehereus*
Vernacular Name : 'Bumla'
Gear : Dol net
Percentage in the catch of the group : —
Peak period of occurrence : Mar., May and Nov.
Depth of occurrence : —
Length range in commercial fishery : 30 – 330 mm
Size at first maturity : —
Spawning season : —

LACTARIIDAE

Popular English Name : White fish
Vernacular Name (Gujarati) : 'Dhangari'/'Katli'
Annual average catch : 2,555.3 t
Percentage in total catch : 5.7
Fishing methods and their contribution : Trawl net: —

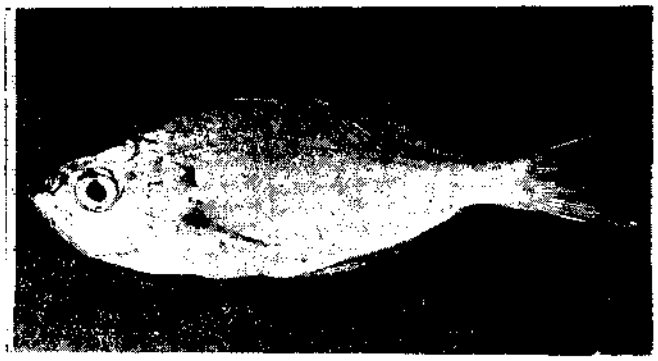


Fig. 19. *Lactarius lactarius.*

Scientific Name : *Lactarius lactarius*
Vernacular Name : 'Dhangari'/Katli'
Gear : Trawl net
Percentage in the catch of the group : 100
Peak period of occurrence : Oct. – Jun.
Depth of occurrence : 60 – 80 m
Length range in commercial fishery : 60 – 120 mm
Size at first maturity : —
Spawning season : —

LETHRINIDAE

Popular English Name : Pig face bream
Vernacular Name (Gujarati) : 'Dhamil'/'Chunco'
Annual average catch : 31.8 t
Percentage in total catch : 0.1
Fishing methods and their contribution : Trawl net: —

LEIOGNATHIDAE

Popular English Name : Pony fish/Silver bellies
Vernacular Name (Gujarati) : 'Kitali'

Annual average catch	:	16.6 t
Percentage in total catch	:	0.1
Fishing methods and their contribution	:	Trawl net: —

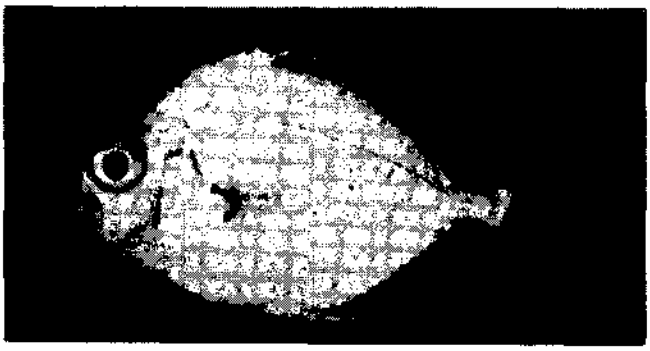


Fig. 20. *Leiognathus splendens.*

Scientific Name	:	*Leiognathus splendens*
Vernacular Name	:	'Kitali'
Gear	:	Trawl net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Sep. – May
Depth of occurrence	:	20 – 80 m
Length range in commercial fishery	:	75 – 100 mm
Size at first maturity	:	—
Spawning season	:	—

LUTIANIDAE

Popular English Name	:	Red snapper/Snapper
Vernacular Name (Gujarati)	:	'Ratado'
Annual average catch	:	95 t
Percentage in total catch	:	0.2
Fishing methods and their contribution	:	Trawl net: —

MULLIDAE

Popular English Name	:	Goat fishes
Vernacular Name (Gujarati)	:	'Chiri'
Annual average catch	:	139.6 t
Percentage in total catch	:	0.3
Fishing methods and their contribution	:	Trawl net: —

Fig. 21. *Upeneus sulphureus.*

Scientific Name	:	*Upeneus sulphureus*
Vernacular Name	:	'Chiri'
Gear	:	Trawl net
Percentage in the catch of the group	:	100
Peak period of occurrence	:	Oct. and Dec.
Depth of occurrence	:	80 m
Length range in commercial fishery	:	100 – 150 mm
Size at first maturity	:	—
Spawning season	:	—

MURAENESOCIDAE

Popular English Name	:	Eel
Vernacular Name (Gujarati)	:	'Wam'
Annual average catch	:	715.1 t
Percentage in total catch	:	1.6
Fishing methods and their contribution	:	Trawl net: —

Fig. 22. *Muraenesox talabonoides.*

Scientific Name	:	*Muraenesox talabonoides*
Vernacular Name	:	'Wam'
Gear	:	Trawl net
Percentage in the catch of the group	:	—

Peak period of occurrence	:	Oct. – Jun.
Depth of occurrence	:	60 m
Length range in commercial fishery	:	500 – 2,500 mm
Size at first maturity	:	—
Spawning season	:	—

NEMIPTERIDAE

Popular English Name	:	Threadfin breams
Vernacular Name (Gujarati)	:	'Rathamachla'/ 'Lalmachla'
Annual average catch	:	2,232 t
Percentage in total catch	:	3.5
Fishing methods and their contribution	:	Trawl net: —

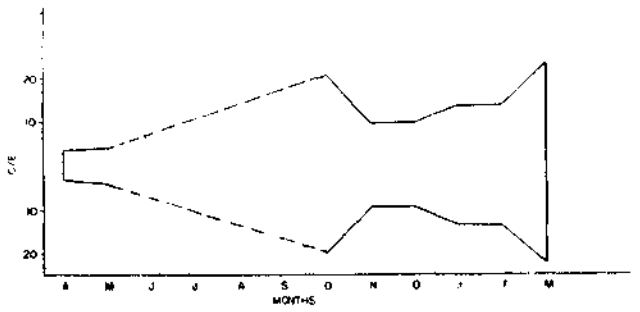


Fig. 23. Seasonal abundance of threadfin breams landed by trawl net.

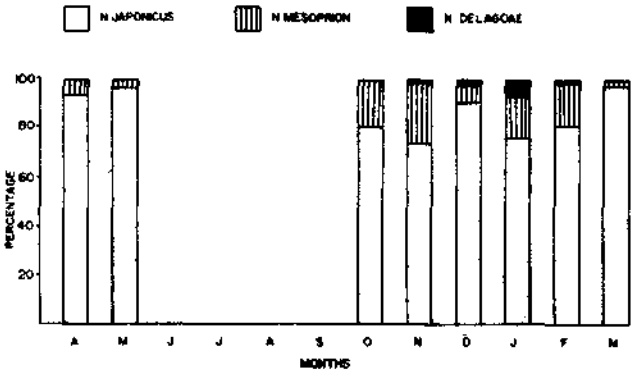


Fig. 24. Monthly species composition of threadfin breams in the trawl catch.

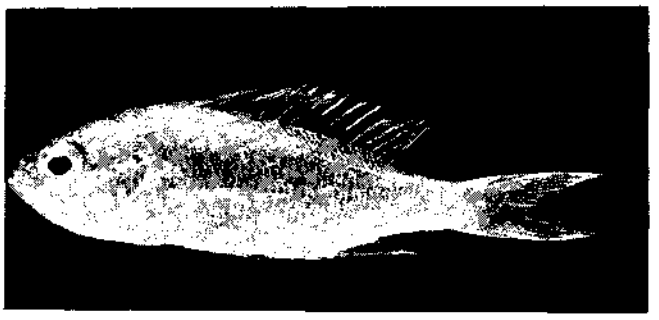


Fig. 25. *Nemipterus mesoprion.*

Scientific Name	:	*Nemipterus mesoprion*
Vernacular Name	:	'Rathamachla'
Gear	:	Trawl net
Percentage in the catch of the group	:	17.2
Peak period of occurrence	:	Nov. – Dec.
Depth of occurrence	:	80 m
Length range in commercial fishery	:	120 – 200 mm
Size at first maturity	:	135 mm
Spawning season	:	Oct. and Apr.

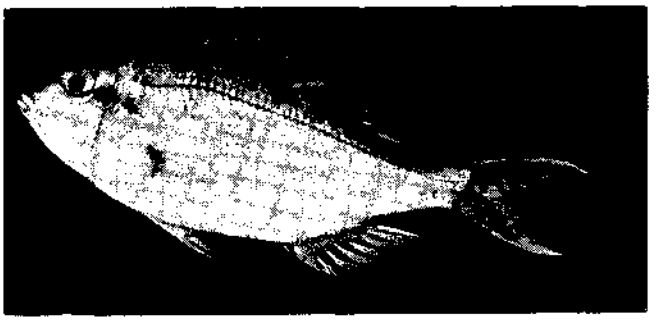


Fig. 26. *Nemipterus japonicus.*

Scientific Name	:	*Nemipterus japonicus*
Vernacular Name	:	'Lalmachla'
Gear	:	Trawl net
Percentage in the catch of the group	:	81.2
Peak period of occurrence	:	Apr. – Mar.
Depth of occurrence	:	80 m
Length range in commercial fishery	:	140 – 250 mm
Size at first maturity	:	157 mm
Spawning season	:	Oct. and Apr.

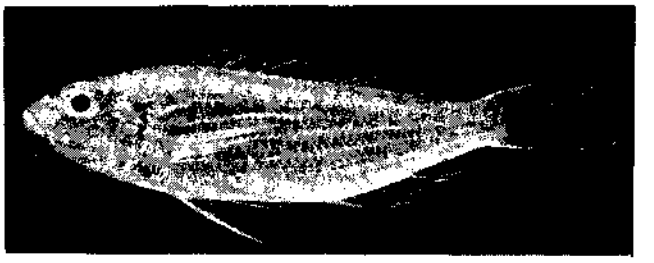


Fig. 27. *Nemipterus delagoae.*

Scientific Name	:	*Nemipterus delagoae*
Vernacular Name	:	'Rathamachla'
Gear	:	Trawl net
Percentage in the catch of the group	:	1.6
Peak period of occurrence	:	Jan.

Depth of occurrence : 80 m
Length range in commercial fishery : 50 - 500 mm
Size at first maturity : —
Spawning season : —

POLYNEMIDAE

Popular English Name : Indian Salmon/ Threadfin
Vernacular Name (Gujarati) : 'Rawas'/'Dara'/'Shin'
Annual average catch : 214.3 t
Percentage in total catch : 0.5
Fishing methods and their contribution : Gill net/ Trawl net: —

Fig. 28. *Polynemus sextarius.*

Scientific Name : *Polynemus sextarius*
Vernacular Name : 'Dara'
Gear : Trawl net
Percentage in the catch of the group : —
Peak period of occurrence : Jan.
Depth of occurrence : 60 m
Length range in commercial fishery : 150 - 200 mm
Size at first maturity : —
Spawning season : —

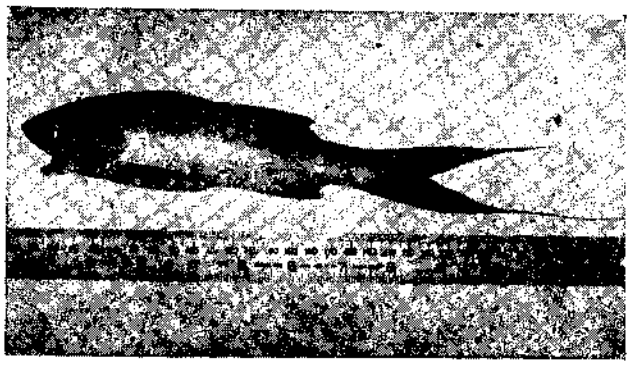


Fig. 29. *Polynemus indicus.*

Scientific Name : *Polynemus indicus*
Vernacular Name : 'Dara'
Gear : Gill net
Percentage in the catch of the group : —
Peak period of occurrence : Jan. - Feb.
Depth of occurrence : 40 m
Length range in commercial fishery : 50 - 100 mm
Size at first maturity : —
Spawning season : —

PRIACANTHIDAE

Popular English Name : Bull's eye
Vernacular Name (Gujarati) : 'Kashi'
Annual average catch : 52.4 t
Percentage in total catch : 0.1
Fishing methods and their contribution : Trawl net: —

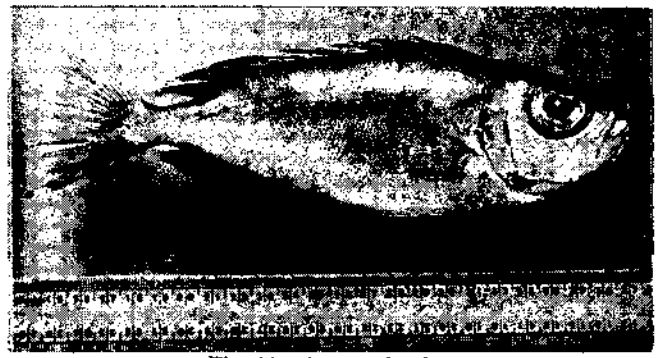


Fig. 30. *Priacanthus hamrur.*

Scientific Name : *Priacanthus hamrur*
Vernacular Name : 'Kashi'
Gear : Trawl net
Percentage in the catch of the group : 100
Peak period of occurrence : Nov. - Dec.
Depth of occurrence : 80 m
Length range in commercial fishery : 200 - 250 mm
Size at first maturity : —
Spawning season : —

PSETTODIDAE

Popular English Name : Indian halibut
Vernacular Name (Gujarati) : 'Hairo'/'Dataro'
Annual average catch : 87 t
Percentage in total catch : 0.2
Fishing methods and their contribution : Trawl net: —

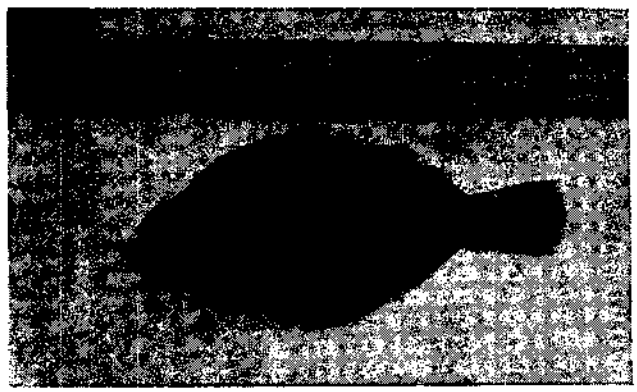


Fig. 31. *Psettodes erumei.*

Scientific Name	:	*Psettodes erumei*
Vernacular Name	:	'Hairo'/'Dataro'
Gear	:	Trawl net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Oct. – Jan.
Depth of occurrence	:	80 m
Length range in commercial fishery	:	200 – 400 mm
Size at first maturity	:	—
Spawning season	:	—

SCIAENIDAE

Popular English Name	:	Croakers/Jew fish
Vernacular Name (Gujarati)	:	'Dhoma'
Annual average catch	:	6,579 t
Percentage in total catch	:	14.8
Fishing methods and their contribution	:	Trawl net/ Gill net: —

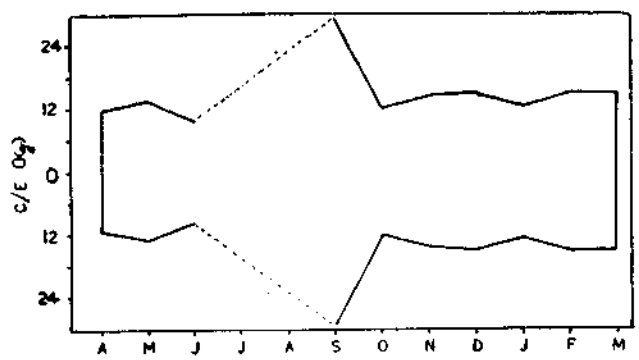


Fig. 32. Seasonal abundance of sciaenids landed by trawl net.

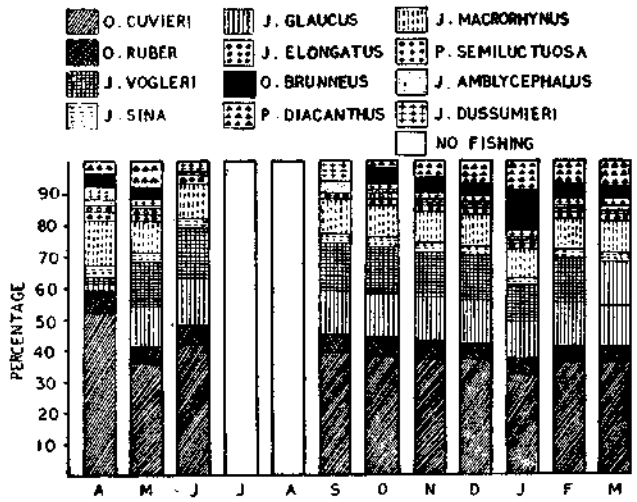


Fig. 33. Monthly species composition of sciaenids in the trawl catch.

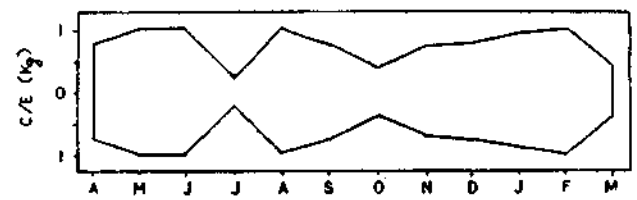


Fig. 34. Seasonal abundance of sciaenids landed by gill net.

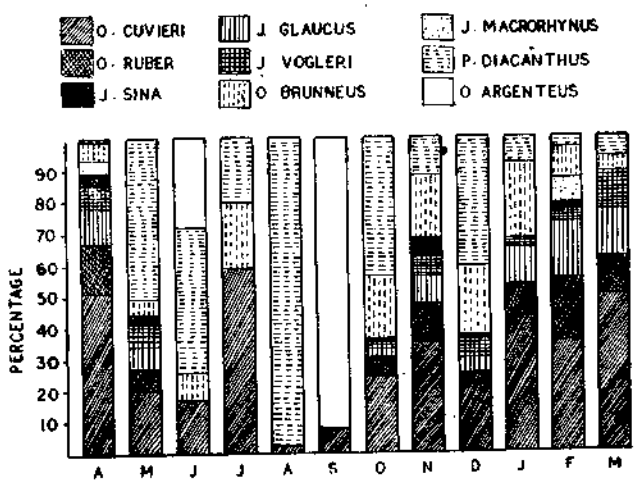


Fig. 35. Monthly species composition of sciaenids in the gill net catch.

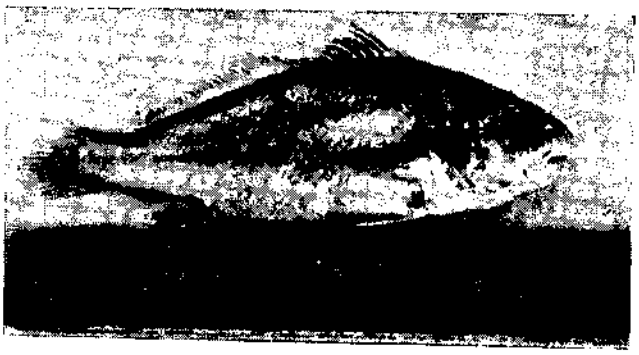


Fig. 36. *Johnieops sina.*

Scientific Name	:	*Johnieops sina*
Vernacular Name	:	'Dhoma'
Gear	:	Trawl net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Oct. – Apr.
Depth of occurrence	:	60 m
Length range in commercial fishery	:	150 – 200 mm
Size at first maturity	:	—
Spawning season	:	—

Fig. 38. *Johnius vogleri.*

Scientific Name	:	*Johnius vogleri*
Vernacular Name	:	'Dhoma'
Gear	:	Trawl net/Gill net
Percentage in the catch of the group	:	Trawl net : 10.2 Gill net : 8.2
Peak period of occurrence	:	Oct. – Mar.
Depth of occurrence	:	10 – 40 m
Length range in commercial fishery	:	150 – 200 mm
Size at first maturity	:	170 mm
Spawning season	:	Jun. – Jul. and Oct. – Nov.

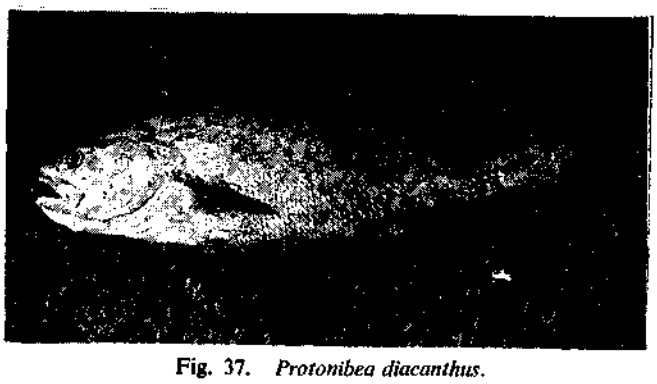


Fig. 37. *Protonibea diacanthus.*

Scientific Name	:	*Protonibea diacanthus*
Vernacular Name	:	'Ghol'
Gear	:	Trawl net/Gill net
Percentage in the catch of the group	:	Trawl net : 8.2 Gill net : 9.6
Peak period of occurrence	:	Dec. – Jan.
Depth of occurrence	:	30 – 40 m
Length range in commercial fishery	:	200 – 400 mm
Size at first maturity	:	—
Spawning season	:	—

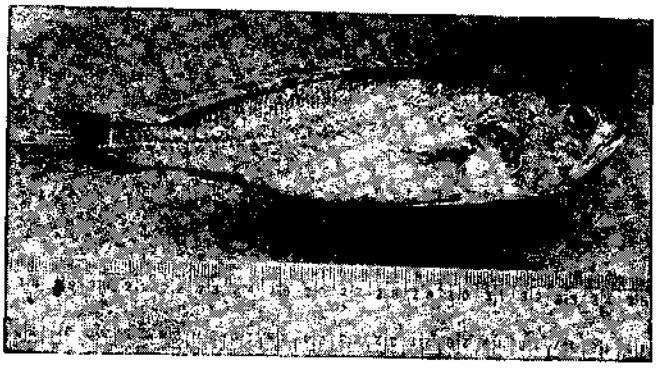


Fig. 39. *Otolithes ruber*

Scientific Name	:	*Otolithes ruber*
Vernacular Name	:	'Dhoma'
Gear	:	Trawl net/Gill net
Percentage in the catch of the group	:	Trawl net : 6.2 Gill net : 18.1
Peak period of occurrence	:	Oct. – Mar.
Depth of occurrence	:	10 – 40 m
Length range in commercial fishery	:	150 – 240 mm
Size at first maturity	:	—
Spawning season	:	—

Fig. 40. *Otolithes cuvieri.*

Scientific Name	:	*Otolithes cuvieri*
Vernacular Name	:	'Dhoma'
Gear	:	Trawl net/Gill net
Percentage in the catch of the group	:	Trawl net : 35.5 Gill net : 30.6
Peak period of occurrence	:	Oct. - Jan. and Mar. May
Depth of occurrence	:	10 - 40 m
Length range in commercial fishery	:	150 – 250 mm
Size at first maturity	:	150 – 180 mm
Spawning season	:	Nov. – Apr.

SCOMBRIDAE

Popular English Name	:	Seer fishes/Tuna/ Sail fish/Mackerel
Vernacular Name (Gujarati)	:	'Chopri'/'Surmi'/ 'Gedara'/'Goda'/ 'Kunga/'Bangada'
Annual average catch	:	905.7 t
Percentage in total catch	:	2.1
Fishing methods and their contribution	:	Gill net/ Trawl net: —

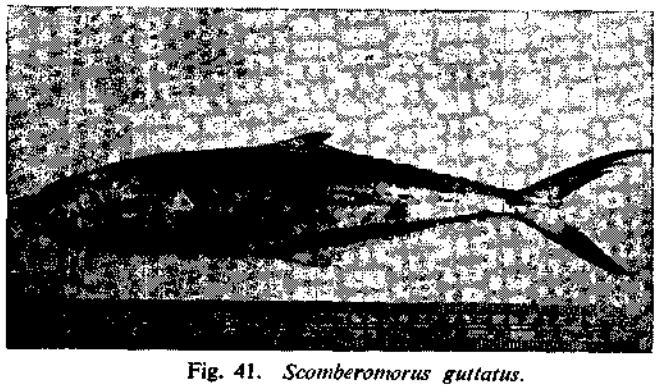


Fig. 41. *Scomberomorus guttatus.*

Scientific Name	:	*Scomberomorus guttatus*
Vernacular Name	:	'Chopri'
Gear	:	Gill net/Trawl net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Jul. – Mar.
Depth of occurrence	:	40 – 80 m
Length range in commercial fishery	:	200 – 500 mm
Size at first maturity	:	—
Spawning season	:	—

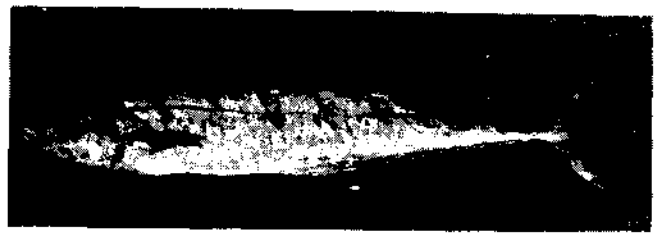


Fig. 42. *Scomberomorus commerson.*

Scientific Name	:	*Scomberomorus commerson*
Vernacular Name	:	'Surmi'/'Chopri'
Gear	:	Gill net/Trawl net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Jul. – Mar.
Depth of occurrence	:	40 – 80 m
Length range in commercial fishery	:	300 - 900 mm
Size at first maturity	:	—
Spawning season	:	—

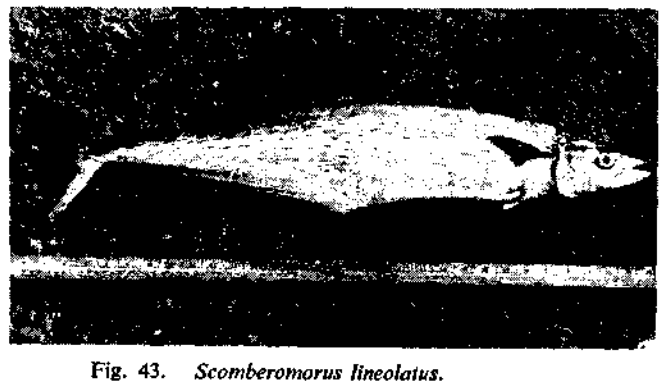


Fig. 43. *Scomberomorus lineolatus.*

Scientific Name	:	*Scomberomorus lineolatus*
Vernacular Name	:	'Chopri'
Gear	:	Gill net/Trawl net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Jul. – Mar.
Depth of occurrence	:	40 – 80 m
Length range in commercial fishery	:	400 – 700 mm
Size at first maturity	:	—
Spawning season	:	—

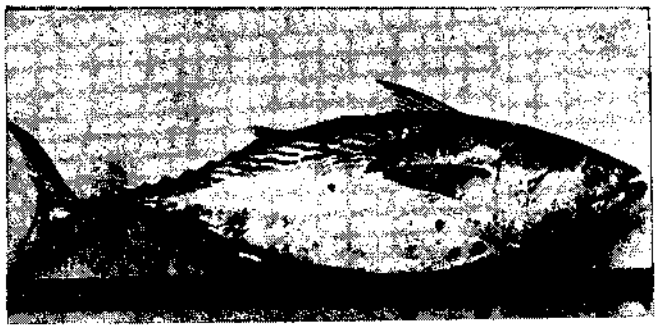


Fig. 44. *Euthynnus affinis.*

Scientific Name	:	*Euthynnus affinis*
Vernacular Name	:	'Gedara'
Gear	:	Gill net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Oct. – Mar.
Depth of occurrence	:	40 m
Length range in commercial fishery	:	400 – 600 mm
Size at first maturity	:	—
Spawning season	:	—

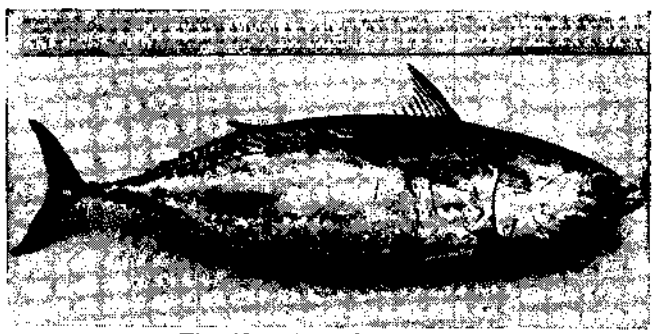


Fig. 45. *Auxis thazard.*

Scientific Name	:	*Auxis thazard*
Vernacular Name	:	'Gedara'
Gear	:	Gill net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Oct. – Mar.
Depth of occurrence	:	40 m
Length range in commercial fishery	:	300 – 400 mm
Size at first maturity	:	—
Spawning season	:	—

Fig. 46. *Katsuwonus pelamis.*

Scientific Name	:	*Katsuwonus pelamis*
Vernacular Name	:	'Gedara'
Gear	:	Gill net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Oct. – Mar.
Depth of occurrence	:	40 m
Length range in commercial fishery	:	400 – 800 mm
Size at first maturity	:	—
Spawning season	:	—

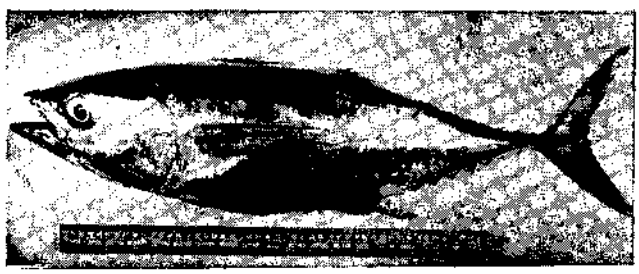


Fig. 47. *Thunnus albacares.*

Scientific Name	:	*Thunnus albacares*
Vernacular Name	:	'Gedara'
Gear	:	Gill net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Oct. – Mar.
Depth of occurrence	:	40 m

Length range in commercial fishery	:	1,000 - 1,500 mm
Size at first maturity	:	—
Spawning season	:	—

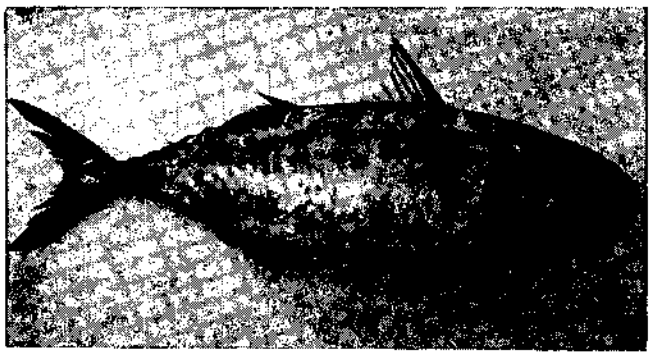


Fig. 48. *Rastrelliger kanagurta.*

Scientific Name	:	*Rastrelliger kanagurta*
Vernacular Name	:	'Bangada'
Gear	:	Trawl net/Gill net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	—
Depth of occurrence	:	40 - 60 m
Length range in commercial fishery	:	—
Size at first maturity	:	—
Spawning season	:	—

SERRANIDAE

Popular English Name	:	Rock Cods/Grouper
Vernacular Name (Gujarati)	:	'Wehali'/'Wekhra'
Annual average catch	:	115.4 t
Percentage in total catch	:	0.3
Fishing methods and their contribution	:	Gill net/ Trawl net: —

Fig. 49. *Epinephelus malabaricus.*

Scientific Name	:	*Epinephelus malabaricus*
Vernacular Name	:	'Wehali'
Gear	:	Trawl net/Gill net
Peak period of occurrence	:	Nov. - Dec.
Depth of occurrence	:	20 - 80 m
Length range in commercial fishery	:	1,000 - 1,500 mm
Size at first maturity	:	—
Spawning season	:	—

Fig. 50. *Epinephelus diacanthus.*

Scientific Name	:	*Epinephelus diacanthus*
Vernacular Name	:	'Wehali'
Gear	:	Trawl net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Nov. - Dec.
Depth of occurrence	:	20 - 80 m
Length range in commercial fishery	:	150 - 350 mm
Size at first maturity	:	—
Spawning season	:	—

Fig. 51. *Epinephelus tauvina.*

Scientific Name	:	*Epinephelus tauvina*
Vernacular Name	:	'Wekhra'
Gear	:	Trawl net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Nov. - Dec.
Depth of occurrence	:	20 - 60 m
Length range in commercial fishery	:	400 - 650 mm
Size at first maturity	:	—
Spawning season	:	—

SPARIDAE

Popular English Name	:	Silver breams
Vernacular Name (Gujarati)	:	'Kishi'
Annual average catch	:	118.9 t
Percentage in total catch	:	0.4
Fishing methods and their contribution	:	Trawl net: —

SPHYRAENIDAE

Popular English Name	:	Barracuda
Vernacular Name (Gujarati)	:	'Bhugar'/'Zeera'
Annual average catch	:	6.3 t
Percentage in total catch	:	0.01
Fishing methods and their contribution	:	Trawl net: —

STROMATEIDAE

Popular English Name	:	Pomfrets
Vernacular Name (Gujarati)	:	'Paplet'/'Vichuda'/ 'Alwa'/'Pathi'/'Kafri'
Annual average catch	:	684.9 t
Percentage in total catch	:	1.5
Fishing methods and their contribution	:	Gill net/ Trawl net: —

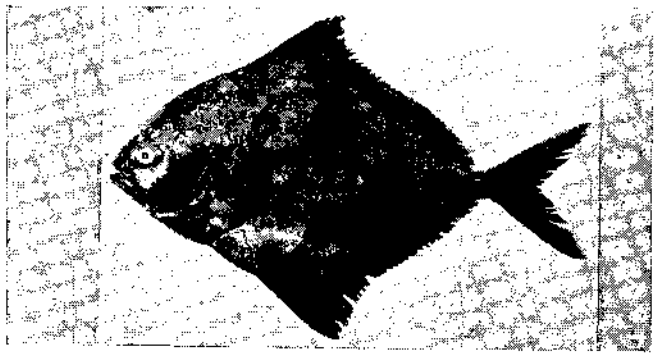


Fig. 52. *Parastromateus niger.*

Scientific Name	:	*Parastromateus niger*
Vernacular Name	:	'Alwa'
Gear	:	Gill net/Trawl net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Apr. - Jun.
Depth of occurrence	:	20 - 40 m
Length range in commercial fishery	:	100 - 400 mm
Size at first maturity	:	—
Spawning season	:	—

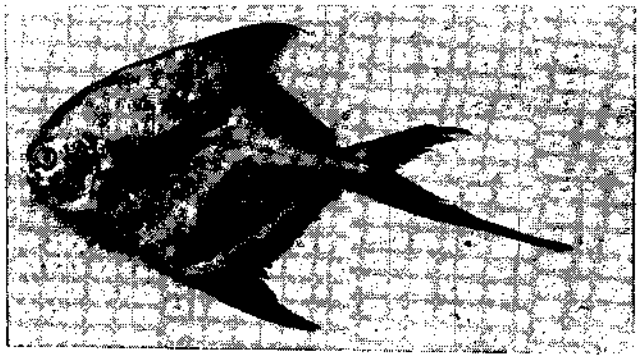


Fig. 53. *Pampus argenteus.*

Scientific Name	:	*Pampus argenteus*
Vernacular Name	:	'Paplet'/'Vichuda'
Gear	:	Gill net
Percentage in the catch of group	:	—
Peak period of occurrence	:	May - Jun.
Depth of occurrence	:	20 - 30 m
Length range in commercial fishery	:	100 - 300 mm
Size at first maturity	:	—
Spawning season	:	—

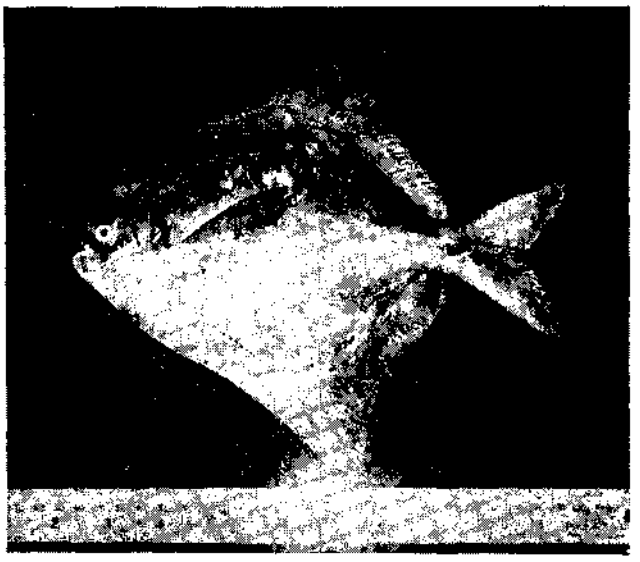


Fig. 54. *Pampus chinensis.*

Scientific Name	:	*Pampus chinensis*
Vernacular Name	:	'Pathi'/'Kafri'
Gear	:	Gill net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	—
Depth of occurrence	:	20 – 40 m
Length range in commercial fishery	:	250 – 350 mm
Size at first maturity	:	—
Spawning season	:	—

SYNODONTIDAE

Popular English Name	:	Lizard fishes
Vernacular Name (Gujarati)	:	'Chor bumla'
Annual average catch	:	115.5 t
Percentage in total catch	:	0.3
Fishing methods and their contribution	:	Trawl net: —

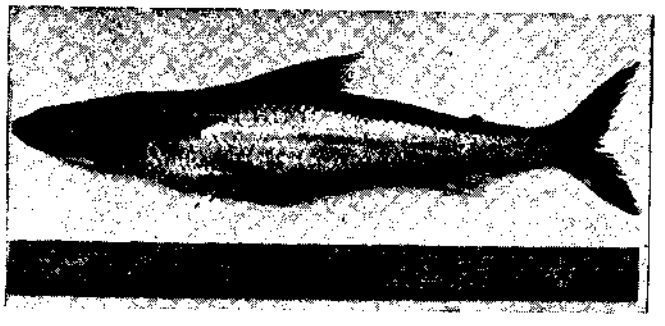


Fig. 55. *Saurida tumbil.*

Scientific Name	:	*Saurida tumbil*
Vernacular Name	:	'Chor bumla'
Gear	:	Trawl net
Percentage in the catch of the group	:	100
Peak period of occurrence	:	Nov. – Jan.
Depth of occurrence	:	40 – 80 m
Length range in commercial fishery	:	300 – 400 mm
Size at first maturity	:	—
Spawning season	:	—

TACHYSURIDAE

Popular English Name	:	Cat fishes
Vernacular Name (Gujarati)	:	'Khaga'
Annual average catch	:	722.1 t
Percentage in total catch	:	1.6
Fishing methods and their contribution	:	Trawl net : 1.1%
		Gill net : 0.5%

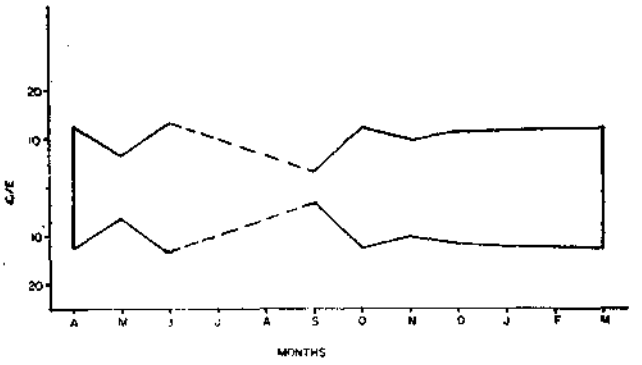


Fig. 56 Seasonal abundance of cat fish landed by trawl net.

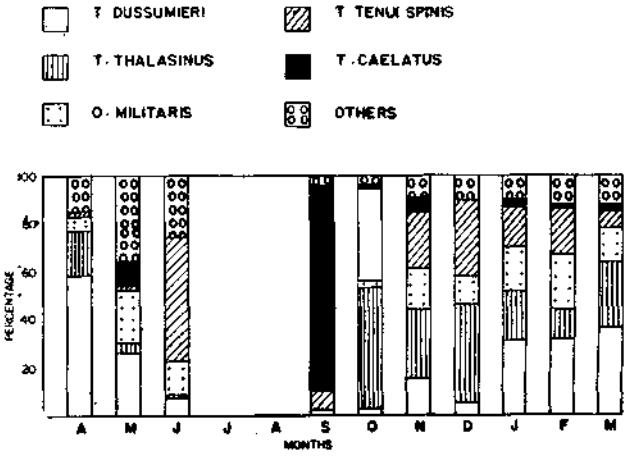


Fig. 57. Monthly species composition of cat fish in the trawl catch.

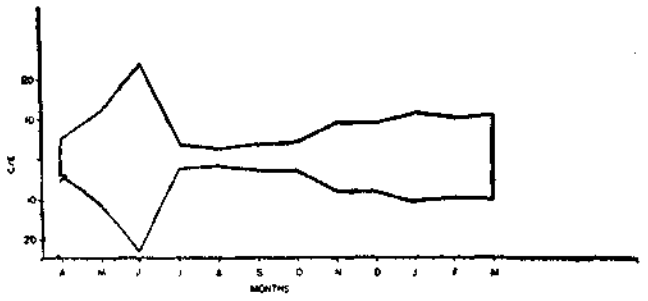


Fig. 58. Seasonal abundance of cat fish landed by gill net.

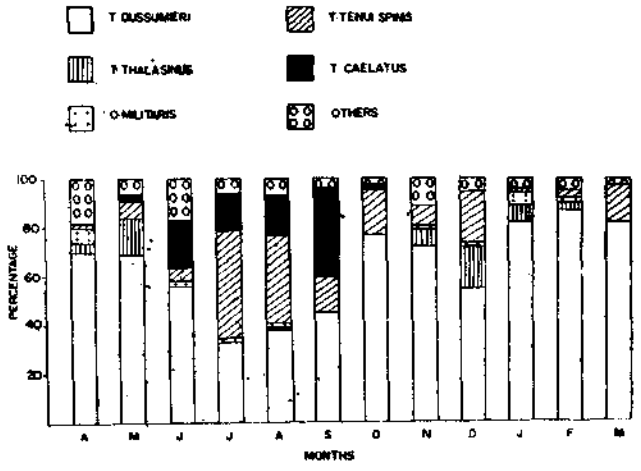


Fig. 59 Monthly species composition of cat fish in the gill net catch.

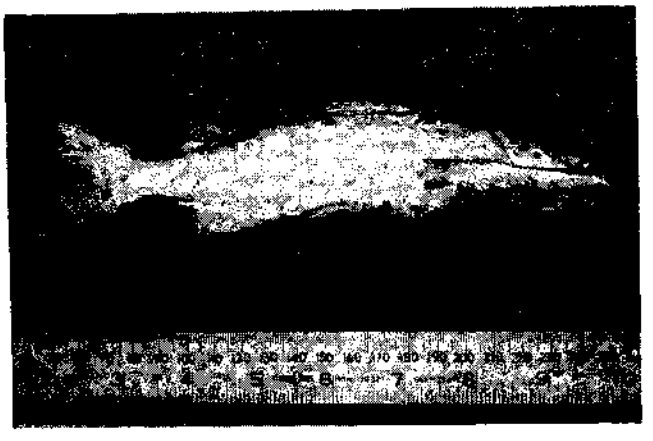


Fig. 60. *Osteogeneiosus militaris.*

Scientific Name	:	*Osteogeneiosus militaris*
Vernacular Name	:	'Khaga'
Gear	:	Trawl net/Gill net
Percentage in the catch of the group	:	Trawl net : 13.3 Gill net : 2.0
Peak period of occurrence	:	Jan. – May
Depth of occurrence	:	20–60 m
Length range in commercial fishery	:	240–490 mm
Size at first maturity	:	—
Spawning season	:	—

Fig. 61. *Tachysurus sona.*

Scientific Name	:	*Tachysurus sona*
Vernacular Name	:	'Khaga'
Gear	:	Trawl net/Gill net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	—
Depth of occurrence	:	30 - 60 m
Length range in commercial fishery	:	600 – 700 mm
Size at first maturity	:	—
Spawning season	:	—

Fig. 62. *Tachysurus tenuispinis.*

Scientific Name	:	*Tachysurus tenuispinis*
Vernacular Name	:	'Khaga'
Gear	:	Trawl net/Gill net
Percentage in the catch of the group	:	Trawl net : 17.9 Gill net : 9.5
Peak period of occurrence	:	Jan. – Apr. and Jun.
Depth of occurrence	:	20 – 60 m

Length range in commercial fishery	:	260 - 590 mm
Size at first maturity	:	—
Spawning season	:	Dec. - Apr.

Fig. 63. *Tachysurus thalassinus.*

Scientific Name	:	*Tachysurus thalassinus*
Vernacular Name	:	'Khaga'
Gear	:	Trawl net/Gill net
Percentage in the catch of the group	:	Trawl net : 26.5 Gill net : 5.8
Peak period of occurrence	:	May - Dec.
Depth of occurrence	:	20 - 30 m
Length range in commercial fishery	:	260 - 550 mm
Size at first maturity	:	—
Spawning season	:	Oct. - Mar.

Fig. 64. *Tachysurus dussumieri.*

Scientific Name	:	*Tachysurus dussumieri*
Vernacular Name	:	'Khaga'
Gear	:	Trawl net/Gill net
Percentage in the catch of the group	:	Trawl net : 37.5 Gill net : 72.4
Peak period of occurrence	:	Jan. - May
Depth of occurrence	:	20 - 60 m
Length range in commercial fishery	:	300 - 750 mm
Size at first maturity	:	—
Spawning season	:	—

TRICHIURIDAE

Popular English Name	:	Ribbon fish
Vernacular Name (Gujarati)	:	'Pathi'/'Baga'
Annual average catch	:	11,081.8 t
Percentage in total catch	:	24.8
Fishing methods and their contribution	:	Trawl net/ Dol net: —

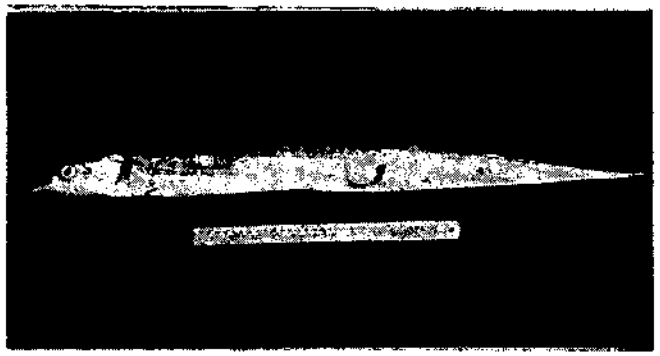


Fig. 65. *Trichiurus lepturus.*

Scientific Name	:	*Trichiurus lepturus*
Vernacular Name	:	'Baga'
Gear	:	Trawl net/Dol net
Percentage in the catch of the group	:	—
Peak period of occurrence	:	Dec. - Feb.
Depth of occurrence	:	40 - 80 m
Length range in commercial fishery	:	300 - 1,200 mm
Size at first maturity	:	—
Spawning season	:	—

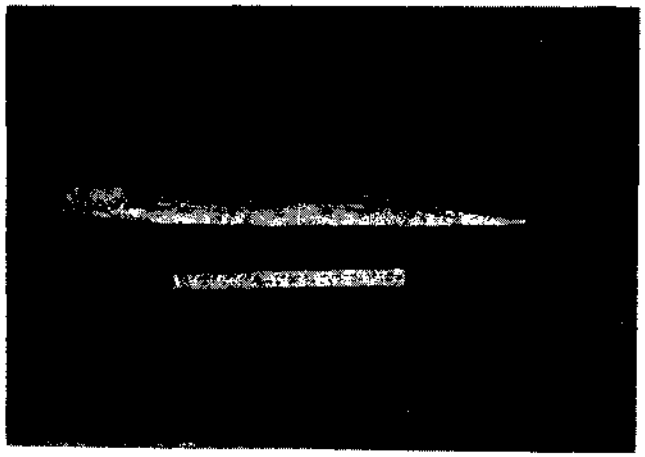
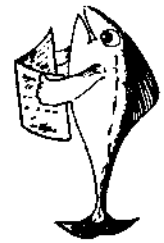


Fig. 66. *Lepturacanthus savala.*

Scientific Name	:	*Lepturacanthus savala*	Depth of occurrence	:	40 – 80 m
Vernacular Name	:	'Pathi'	Length range in commercial fishery	:	300 – 900 mm
Gear	:	Trawl net/Dol net	Size at first maturity	:	—
Percentage in the catch of the group	:	—	Spawning season	:	—
Peak period of occurrence	:	Dec. – May			



SPONGE-GENERATED BIOEROSION IN LAKSHADWEEP

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Introduction

The discovery of *Cliona celata* by Grant in 1826 from characteristic galleries made inside the oyster shell triggered off a long-lasting debate on the role played by sponges in bioerosion. Subsequent investigations on this species as well as its congeners have proved beyond doubt that not only species belonging to the genus *Cliona* but also species belonging to the genera such as *Thoosa*, *Spirastrella*, *Halina* and *Samus* are capable of excavating into calcium carbonate material such as shell, coral, calcareous algae *etc.* The part played by sponges in the destruction of gregarious molluscan beds and coral reefs has been well documented in the past, and as understood at present, the sponges constitute a major group among 12 different taxa of marine plants and animals that cause considerable damage in the marine environment.

Calcibiocavitological investigations made in the past indicate that various borers resort to various methods in gaining entry into the hard calcareous substrate. In some it may be by chemical means and in others, by mechanical means. In yet others it is effected by a combination of both the above means. The present article gives an account of the author's findings on sponge generated bioerosion in the coral islands of Lakshadweep.

Factors influencing bioerosion

It has been shown that when a coral piece infested with boring sponge is cut into two bits it will stimulate the boring activity in the resultant bits considerably. Boring animals and also human intervention by way of cutting channels across the reef *etc.* in Lakshadweep may accelerate the boring activity of sponges already existing.

Illumination plays an important role in the boring activity of sponges. It has been experimentally proved that calcite blocks infested with *Cliona* sp., when illuminated by low voltage microscope lamp started producing calcareous chips at a higher rate. The clarity of water in the various lagoons of Lakshadweep is exceptional (euphotic zone is about 90 m) when compared with any other coastal areas of the mainland and this may be taken as one of the reasons for the abundance of boring sponges in Lakshadweep. Besides the factors mentioned above, water movement and also the temperature conditions have some effect on the activity of boring sponges.

Structure and composition of the boring sponge population in Lakshadweep

An interesting aspect noted with regard to the sponge fauna of the various islands in the Lakshadweep is the abundance of boring species over nonboring species. This is not only with regard to the total number of species represented in each island but also with the number of species collected from each collection site along the various morphozones investigated. In some collection spots only boring species were represented. The percentage distribution of boring species in relation to the total number of species collected from each island is given in Table 1.

Table 1. *Distribution of boring sponges in the various islands surveyed (in %)*

Island	Boring sponges
1. Kavaratti	46.4
2. Kalpeni	36.1
3. Suheli	48.3
4. Androth	66.6
5. Minicoy	50.0
6. Amini	38.4
7. Kiltan	20.0
8. Agathi	60.0
9. Kadamath	58.3

The total number of boring species recorded from the various islands in Lakshadweep is 18 and these may be classified under 4 orders, 5 families and 9 genera of the Phylum Porifera. The genera represented and the number of species under each may be summarised as follows: *Rhabderemia* (1); *Spirastrella* (4); *Amorphinopsis* (1); *Aka* (2); *Cliona* (6); *Thoosa* (1); *Jaspis* (1); *Halina* (1) and *Samus* (1). Of the above 18 species those falling under the genus *Cliona* are widely distributed in the coral reefs of Lakshadweep and is followed by the genus *Spirastrella.*

In order to get a clear picture of the abundance of each species the total incidence by various species in each island was calculated for five islands. From this the percentage incidence of each species was found out and the same is furnished below graphically (Fig. 1).

The graphs indicate that *Cliona celata* is the dominant species in two islands (Kavaratti and Suheli), *C. ensifera* in Kalpeni and *C. mucronata* in Androth. The Minicoy Island offers an altogether different picture since both *C. celata* and *C. vastifica* are equally abundant.

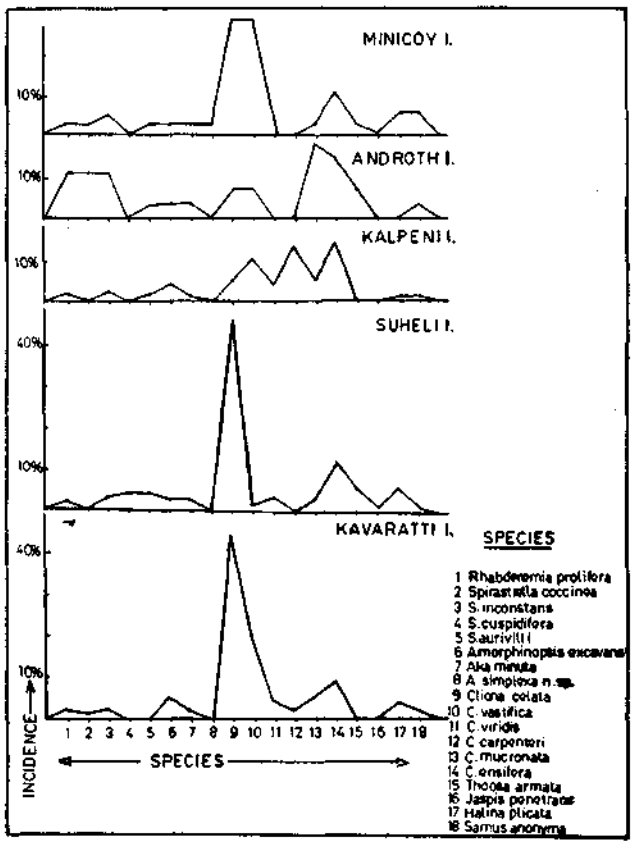

Fig. 1. Incidence indices (%) of 18 species of boring sponges from five islands in the Lakshadweep.

Four species of the genus *Spirastrella* are found to occur in the different islands surveyed, of which two *viz. S. inconstans* and *S. cuspidifera* show the tendency to overgrow the substratum after disintegrating it totally. These two species usually infest massive corals; both dead and alive, which may not project out much from the sea floor. When the substratum is totally disintegrated the upper part of the sponge grows into massive lobate structure bearing excurrent and incurrent openings. This overgrowth may be compared with the gamma stage in the growthform of *C. celata.* (But this growthform is never seen for *C. celata* in Indian waters.)

S. inconstans exhibits the habit of producing asexual bodies from the surface as well as from the tip of tubular branches in advanced stages. These asexual bodies get nipped off from the parent sponge and float in water indefinitely. On reaching a suitable substratum these bodies may get anchored to it and form new colonies.

The abundance of coralline sand in lagoons is an added advantage to this species for its spreading in the various lagoons surveyed.

Summarising the distribution of *C. ensifera* and *C. mucronata* it may be stated both in the light of present investigation as also from the data amassed in the past from the coral reefs of the Gulf of Mannar, Palk Bay and southwest coast of Kerala that these two species are typical coral boring species and are seldom encountered in molluscan shells. In Lakshadweep lagoons also these species are widely distributed and in Androth *C. mucronata* forms the dominant species incidence-wise, while in Kalpeni *C. ensifera* dominates. In these two lagoons the activity of *C. celata* and *C. vastifica* is seen at a lower level. It is not sure whether the activity of *C. mucronata* and *C. ensifera* is checking the activity of *C. celata* and *C. vastifica* or not, but a careful examination of the incidence pattern for various islands presented in Fig. I clearly indicates that there is severe competition for space between these two groups of species.

The other boring species represented in Fig. I are of no significance at present from the point of incidence. But judging from the behaviour pattern of boring sponges in general it is possible that any species can enter into a quiescent stage after an outburst and as such any species which is inactive today can prove to be dangerous after a few years.

It is quite interesting to note that both *Cliona margaritifera* and *C. lobata*, which have reappeared in the molluscan beds of the southwest coast of India around 1980 after a very long quiescent stage, have not yet made their appearance in the Lakshadweep group of islands. Since their first appearance at Vizhinjam around 1980, these two species have migrated to almost all the important gregarious molluscan beds of that area (Thomas *et al.*, 1983. *Mar. Fish. Infor. Serv., T & E Ser.*, **49**, 1-13). Both these species are potentially dangerous as they can cause wide spread depletion of the molluscan beds as has been reported from Ceylon (Sri Lanka) around 1902. There is every possibility that the larvae of these species may get swept off to Lakshadweep through the currents prevailing off the west coast of India. But such a migration will be very slow and hence is not a matter of immediate concern. On the contrary any attempt on the part of man to transport a few infected live specimens of pearl oyster, edible oyster, mussel or any other molluscan species to Lakshadweep for cultivation can cause immediate and far reaching repurcussions in the ecological equilibrium which is prevailing there at present. Hence, any consignment of cultivable mollusc from mainland or elsewhere to Lakshadweep must be screened properly before it is despatched.

Damage caused to corals

Details pertaining to the rate of mortality of corals in five islands (Kavaratti, Suheli, Kalpeni, Androth and Minicoy) were collected on a transect/morphozone basis and are furnished elsewhere in this paper. Examination of the sample collected from different lagoons indicates that sponge plays an important role in the death of corals everywhere.

It has been found that sponges can bore into both dead and living corals. Since boring sponges obtain their food from sources other than the host, the death of coral (host) will never affect the sponge adversely. And as such the chipping of calcium carbonate matter can go on incessantly even after the death of coral. The galleries formed inside the coral by the removal of calcareous particles weaken the entire reef framework making it more susceptible to the wear and tear caused by waves. Such a weakened substratum may also accelerate the activity of secondary borers such as polychaetes, molluscs, sipunculids and echinoderms.

Boring sponges make extensive galleries inside the substratum, but the upper stratum of corals and both upper and lower strata of shells remain practically untouched and more or less intact except for a few pores for the incurrent and excurrent papillae to project out. Hence the actual damage caused to shell or coral cannot be assessed by external examination alone. When the inroads of *Cliona* reach the climax stage the interior of the coral becomes practically hollow except for a few pillars of calcium carbonate matter stretching across the cavities. In branching corals a continuous cavity running length-wise, may even be seen (Fig. 3 E, F.) inside every branch infected.

Continuous chipping of calcium carbonate matter from the substratum can cause a decrease in the total weight of the substratum. It has been experimentally shown that in new colonies the boring activity of sponge will be quite intense but subsequently the substratum limitation and competition for food retard the activity considerably. Besides these, the sponge will have to set apart some energy for nutrient storage and reproduction also. It is calculated that in such cases

the calcium carbonate removed from the original calcareous object is only about 50% of the total. In such species the question of disintegrating the substratum totally does not arise, but in species such as *Cliona celata, Spirastrella inconstans* and *S. cuspidifera,* the sponge at a later stage, becomes massive and overgrow the substratum (gamma stage) just like any other sponge. Hence, the capacity to disintegrate the substratum fully or partly in the early stage of its life history is a factor which governs its future morphology.

In order to evaluate the damage caused to coral colonies by boring sponges, data were collected separately for branching and massive forms. In the case of branching species boring intensity, in both stalk portion and branches, was assessed and the conclusion arrived at may be given as follows:

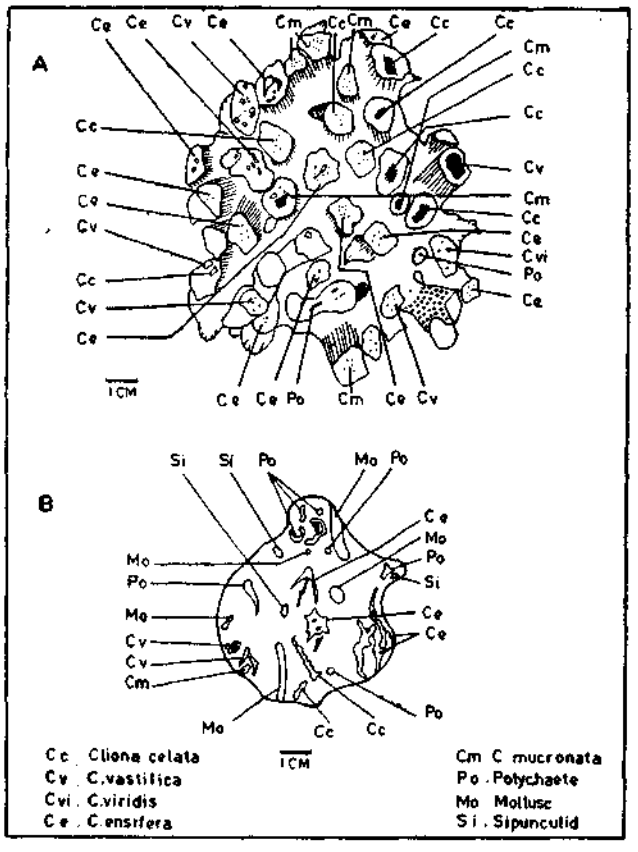

Fig. 2.

A. Diagramatic representation of a branching coral *(Acropora* sp.) collected from morphozone E3 of Kavaratti Island to show the distribution and boring pattern of the various boring organisms.

B. Diagramatic representation of the stalk of a branching coral *(Acropora* sp.) collected from morphozone J5 in Kavaratti reef system to show the distribution and boring pattern of the various boring organisms.

A. Branching coral *(Acropora* sp.*)*

(a) *Branches of* Acropora *sp.*

An *Acropora* colony (Fig. 2A) weighing 600 g with a maximum diameter of 15 cm bearing 48 upright branches arising from a flat basal portion was collected from Kavaratti (E_3) and was studied in detail for the species composition and intensity of boring. Branches were in a partly dead condition and when broken it was noted that most of them harboured boring sponge inside. Out of 48 branches, 34 (70.8%) were found infected with boring sponges. Other borers, mainly polychaetes and sipunculids, could also be noticed on some of these branches. The total number of boring organisms occupying the cut end of each branch was calculated and from this the incidence index of each species/group was prepared (*i.e.* percentage in total incidence). Sponge represented belonged to five species, and the distribution of various species/groups is given in Table 2.

Table 2. *Incidence indices of various boring organisms on the branches of* Acropora *sp.*

Species/groups	Number		% of incidence	
Sponge				
C. ensifera	12		30.7	
C. celata	11		28.2	
C. mucronata	6	34	15.4	87.2
C. vastifica	4		10.3	
C. viridis	1		2.6	
Polychaete	2		5.1	
Mollusc	2		5.1	
Sipunculid	1		2.6	
Total	39*			

* Multiple infection in some

The above Table indicates that sponge, as a group, dominated (87.2%) among the various groups of boring organisms that destroy coral colonies in Lakshadweep. The above Table also shows that the incidence noted for different species of boring sponges on this coral colony is not in full agreement with that seen for the whole island (compare Fig. 1 giving the incidence index for the island Kavaratti). In the projection for the entire island *Cliona celata* and *C. vastifica* ranked first and second respectively, while in the coral colony now

investigated, species such as *C. ensifera, C. celata* and *C. mucronata* occupied the first three ranks respectively.

Based on the area occupied by different species of sponges on coral branches it may be stated that the etchings of *C. celata* occupy a larger area when compared to those made by other boring sponges. This species can fully fill the interior of any branch with its tunnels and chambers, and in this respect the damage done to coral is much more intense than that caused by any other species of sponge. The cavities made by both *C. mucronata* and *C. ensifera* assume the shape of an irregular tunnel inside the branch with little or no ramification sideways. Hence, the branches of coral infested by these two species of sponges may live for a comparatively longer period.

Pattern of boring

Based on the data collected from branching corals the pattern of boring seen in the case of *C. celata* has been studied in detail. The larva, soon after its settlement on the coral, flattens to form an encrusting mass. This is followed by the etching out of calcium carbonate particles to form an initial chamber. Further spreading of the sponge inside the coral is effected through chambers originating from the initial chamber and thus a mass of chambers is formed just inside the point of larval entry. These chambers may be seen filling the entire thickness of the branch and may open out at the other side (sometimes at several points) of the branch through the excurrent and incurrent papillae (Fig. 3A). The number of papillae increases gradually on all sides of the branch. The death of branch actually occurs from this point onwards and as a result the polyps above this point get decayed gradually. Algae may get attached to such dead branches and grow. It is noted that in all islands surveyed some filamentous algae of black colour usually colonise these dead branches giving a black, furry appearance to the branches underwater.

Further spreading of the sponge inside the coral branch takes place in a characteristic pattern. From the mass of chambers formed inside the coral (at the point where the larva gained access into the coral branch) some actively growing branches are formed by the sponge (usually 3 to 8 numbers). These branches are usually located at the periphery of the branch (of coral) very close to its outer surface. These branches (Fig. 3 B, C) usually take a linear course through the periphery of the coral possibly because of the added advantage of communicating with the surface through incurrent and excurrent papillae. Such branches of sponge may come closer to each other at a point where the diameter of the branch becomes less or at a point where the branch of coral divides to form a branchlet. Partial or total fusion of one or more of such branches of sponge may also be seen (Fig. 3 D). In an advanced stage of boring, all the peripheral branches (of sponge) become enlarged (Fig. 3 D, E) resulting in the breakdown of the calcareous material separating adjacent canals. This will produce a peripheral cavity filled with sponge encircling a central core of calcareous material (Fig. 3 E). This central core also may get disintegrated gradually resulting in a continuous central cavity filled with sponge (Fig. 3 F). At this stage the number of openings which lodge incurrent and excurrent papillae may also increase to meet the additional requirement of water for the entire colony of sponge. Since dimentional growth is not impossible inside the coral branch the sponge overcomes this situation by increasing its surface area in the following ways.

a) Papillae of similar function growing close by will fuse together forming a compound and more conspicuous structure.

b) After attaining this stage all the papillae irrespective of function get interconnected by a plate of sponge.

Further growth in this line may give rise to a massive growth outside the substratum (gamma stage). But the gamma stage is never attained in the Indian seas.

It is noted that *C. celata* prefer to grow upwards (negatively geotropic), that is, towards the distal end of each branch. The larva, when enters at the middle of any branch the disintegration and death of the branch occur from that point onwards, while the part of branch below this point remains unaffected. Coral colonies bearing distally dead branches further corroborate this point.

(b) Stalk of Acropora *sp.*

In order to get a clear picture on the magnitude of damage caused to the stalk portion of branching corals, the stalk of a branching coral *(Acropora* sp.*)* collected from Kavaratti (J_8) was studied in detail. The average diameter of the stalk is 5 cm, and the distribution of the various boring species/groups at the cut end of the stalk is diagramatically represented in Fig. 2 B. It is found that nearly 40% of the area of coral (in cross section) is being damaged by an array of boring organisms drawn

up from different phyla of animal kingdom. Four species of sponges were present. The percentage incidence of various species/group is indicated in Table 3.

Table 3. *Incidence indices of various boring organisms on the stalk of* Acropora *sp.*

Species/groups	Number		% of incidence	
Sponge				
C. ensifera	3		13.6	
C. celata	2	8	9.1	36.4
C. vastifica	2		9.1	
C. mucronata	1		4.5	
Polychaete	6		27.4	
Mollusc	5		22.7	
Sipunculid	3		13.6	
Total	22			

The above Table and Fig. 2B indicate that in assessments, both incidence-wise and area-wise, sponges dominate among the various groups of boring organisms.

Species-wise analysis of sponges indicates that *C. ensifera* outnumber others in total incidence in the stalk portion followed by *C. celata.* In terms of total area excavated by each species it may be seen that *C. ensifera* ranks first at this portion. The data obtained on total incidence for the entire island Kavaratti (Fig. 1) show that *C. celata* is the dominant one followed by *C. vastifica.* While comparing the incidence and excavating capacity of the various species of boring sponges in both branches and the stalk portion of a branching coral (here *Acropora* sp.) it becomes evident that *C. ensifera* and *C. celata* are in severe competition for space and in this competition *C. celata* has succeeded in colonising the interior of branches while *C. ensifera,* inside the stalk portion.

B. Massive coral

A massive coral collected from Kavaratti (C_3) having an average diameter of 7 cm has been studied in detail for the various organisms that cause damage to them in the island. The various boring species/groups and their percentage of incidence are given in Table 4.

Table 4. *Incidence indices of various boring organisms on a massive coral*

Species/groups	Number	% of incidence
Sponge		
C. celata	3	33.3
Polychaete	2	22.2
Mollusc	1	11.1
Crustacea	1	11.1
Sipunculid	1	11.1
Alga	1	11.1
Total	9	

The above Table indicates that sponge forms a major group among the various groups that cause damage to massive corals in Lakshadweep and is followed by polychaete. Incidence-wise all the other groups of boring organisms represented here are of no significance. It could also be noted from Fig. 3 G that *C. celata* is responsible for the breakdown of a sizable part of the massive coral presently investigated, and the larva prefer the under surface of massive coral to settle and grow. Their growth, as seen from Fig. 3 G, is always upwards inside the coral block (negatively geotropic) and in this respect it is quite similar to that noted inside the coral branch (Fig. 2 A).

Conclusion

Damage caused to corals by boring sponges is rather wide spread in all the morphozones of the reefs investigated. In many cases it could even be noted that sponge infection may kill the colony either partly or fully. Any localised death of a colony may not produce far reaching results unless considerable damage occurs to the stalk portion. In a branching colony, that too when it occupies the reef front zone, a partially dead and disintegrated stalk can result in the sliding away of the entire colony into deeper areas where it will be buried by sediments. Branching colonies that occupy level bottom will never experience such a fate since the interlocking of the branches of adjacent colonies will keep them in position even after the total disintegration of the stalk. And in such cases colonies which do not have such interlocking, the tilting to one side will produce a result comparable to that seen in colonies growing along the reef front zone. Goreau and Hartman (*Am. Ass. Advmt. Sci. Publ.,* 75: 25-54, 1963), who made extensive survey of the reefs off Jamaica, came to the conclusion that too much accumulation of fouling

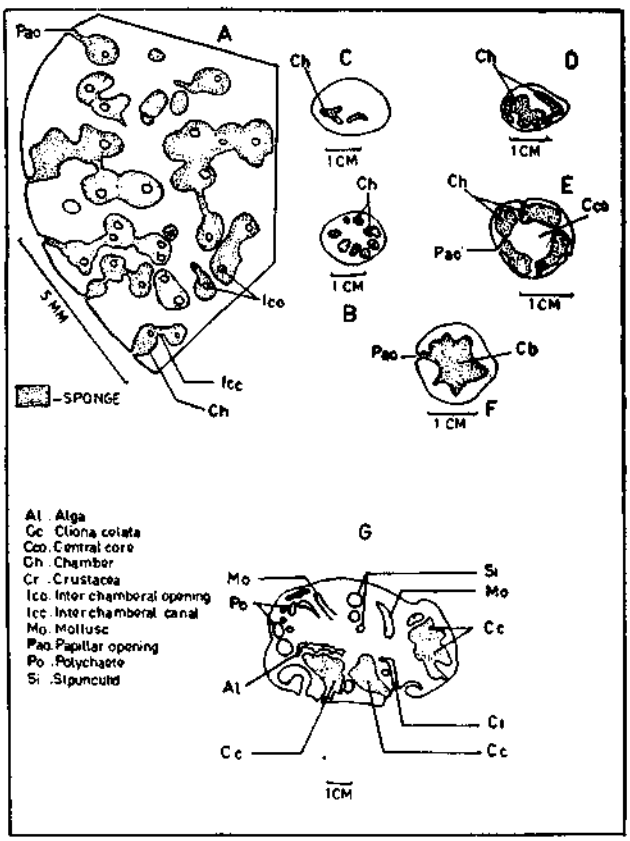

Fig. 3.

A. Cross section of a coral branch (in part) to show the nature of chambers formed inside after the penetration of larva *(C. celata)*. At this point the chambers formed inside (Ch) are more compact and fill the interior almost completely. Icc-Inter chamberal canals, Ico-Inter chamberal openings, Pao-Papillar opening.

B. Cross section of a coral branch infected with *C. celata*. Eight branches are seen originating from the mass of chambers marked in A.

C. Cross section of a coral branch with two branches (of sponge) originating from the mass of chambers marked in A.

D. Cross section of a coral branch. Canals enclosing the branches of sponge are getting widened and partly fused.

E. Cross section of a coral branch. Canals enclosing boring sponge is getting widened due to increased boring activity. These canals, at a later stage, fill the peripheral part of the coral (Ch) leaving a central core of calcareous material (Cco). These canals communicate with the exterior through papillar-openings (Pao).

F. Cross section of a coral branch. The central core of calcareous material (Cco) is completely destroyed resulting in a wide central cavity filled with sponge.

G. Section of a massive coral collected from morphozone C_3 of Kavaratti Island. Diagramatic representation of the coral showing the various species/grounds of boring organisms and their distribution.

organisms may cause considerable strain on the coral colony in which the stalk has already been weakened by borers. But they have suggested that such situation often turn out to be a blessing for corals because massive sponges that grow across adjacent colonies will help to keep any coral colony, which is in distress, in position. In the case of massive corals the question of getting themselves dislodged in such a manner, is quite remote. In such cases partial death is only possible and at Kavaratti lagoon it is seen that boring algae flourish in the upper, well lighted side of massive corals killing the polyps totally. But the coral colony compensates for the situation by accelerating its growth along the periphery producing a circular rim around the zone of dead polyps. In some cases it could even be noted that this overgrowing outer rim may curl in and completely cover the central area of dead polyps. If this is not possible it is seen that sedentary organisms attach themselves and grow in this area of dead polyps. *Tridacna* sp. may be seen attached to this area generally.

Goreau and Hartman (1963 *op. cit.*) concluded that mass transport of loosened corals and coarse detritus from the upper reef to the deep fore-reef slope is due to (a) talus fall, (b) slides and avalanches and (c) reef subsidence and slump. The fore-reef slope which is often covered with soft sediments becomes more stable and well drained when coarse coral bits get deposited over it. This situation will indirectly encourage the colonisation of corals. The minute calcium carbonate particles etched out from coral by the activity of boring sponges constitute a major ingredient of the sediment fraction in any reef system. These particles have important lubricating and fluidizing properties which speed up the drainage of skeletal sediments from the reef.

INTRODUCTION OF 43 FOOTER MECHANISED BOATS FOR COMMERCIAL TRAWLING ALONG THE COAST OF ANDHRA PRADESH*

Along the coast of Andhra Pradesh commercial fishery started in 1964 with small mechanised boats ('pablos') and subsequently in a short period of three years two more types of boats ('Royya' and 'Sorrah') were introduced. Since then, these three types of boats were engaged in fishing in the region without any modification. Among these three types, the 'Royya' category is most dominant in the fleet. Recently, in January, 1988 another type of 43 footer boat popularly known as 'Sona' (Fig. 1) was added to the existing fleet. Out of fifty boats constructed at Kakinada by private boat builders, 30 boats are registered at Visakhapatnam and they have been conducting fishing there. On enquiry with boat-owners and boat-builders, it is understood that these boats are introduced to conduct fishing for about 15 days. Use of 43 footer vessel for commercial fishing is new to the northeast coast. Therefore the details of boat and the catch obtained are given in this note. The particulars of the boat and engine are shown in Table 1 and those of the nets used along with those

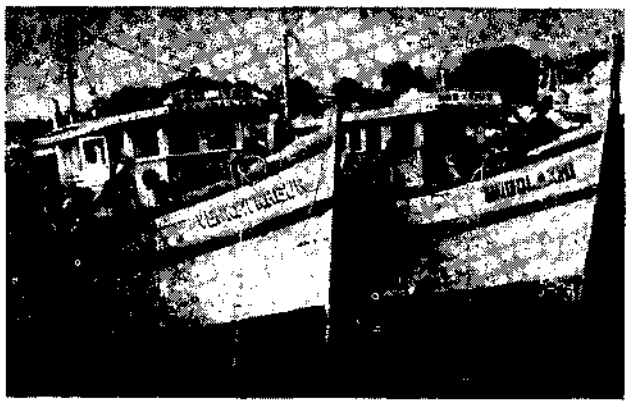

Fig. 1. A view of two 'sona' boats moored at the Kakinada Fisheries Harbour.

already in use by existing boats are shown in Table 2. The catches of those boats already fishing in this region are compared with those of 'Sona' boats (Table 3).

The introduction of costly bigger boats in the commercial fleet at a time when most of the resources in the presently fished areas have reached MSY levels appears significant. The introduction of these boats is primarily to go for fishing for a period of 10–15 days without returning to the base daily thereby cutting expenditure on oil. The information on depth of operation and the catches obtained during January – March period shows that unlike the smaller boats these boats

Table 1. *Specifications of 43 footer boats newly introduced along AP coast*

1. Name of the boat	:	'SONA'
2. Place of construction	:	KAKINADA
3. Dimensions of the boat		
a) Length	:	13.1 m
b) Beam	:	4.1 m
c) Draught	:	2.8 m
d) Depth	:	2.0 m
e) Speed	:	9 km
f) Endurance	:	15 days
4. Tonnage of vessel		
a) Gross tonnage	:	18
b) Net tonnage	:	5.5
5. Materials		
a) Type of material	:	Teak wood
b) Quantity of material required	:	800 cubic feet
c) Cost of the material	:	Rs. 220/- per cubic foot
6. Type of construction	:	Carvel
7. Type of protection for under water surface of hull	:	Fibre glass & aluminium sheeting
8. a) Type of engine	:	Ashok Leyland
b) Horse power	:	102
9. No. of persons can be accomodated	:	9
10. Winches	:	1 mechanical winch with GI wire rope
11. Capacities		
a) Fish hold	:	Nil (6 fibre-glass tanks with ice)
b) Fresh water capacity	:	2,000 litres (F. tanks)
c) Fuel capacity	:	5,000 litres
12. Cost of the boat	:	Rs. 8 lakhs
13. Navigational aid	:	Compass
14. Communication system	:	Nil
15. Life of the boat	:	15–20 years (approximately)

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are fishing in relatively deeper areas (Table 3). The catches and catch rates, however, do not seem to be better than those obtained by the boats already existing. However, collection of data on the effort, catch, species composition from these newly introduced boats together with information on economics of operation for at least a period of 1-2 years can only help to understand the economic viability of these boats in the present context of shrimp oriented trawling. Since it is known that certain important fin-fishes like thread-fin breams are abundant in relatively deeper waters of 75–100 m depth, deployment of bigger boats to fish in these areas appears reasonable. This will help in exploiting the under-exploited areas while allowing the smaller boats to continue to fish in the presently fished areas. Further, almost the entire mechanised fishing industry along Andhra coast is concentrating only in bottom trawling. It is believed that a beginning can be made for mechanised gill netting in deeper areas and purse-seining particularly in view of the increasing demand for quality fish.

Table 2. *Details of craft and gear used at Kakinada*

Particulars of the vessel					Particulars of the gear operated					
Type of Boat	Length (m)	Beam (m)	Draught (m)	Engine (H.P.)	Type of net	Length of head rope (m)	Mesh size (cm)	Otter boards	Rigging	Net operation
Pablo	9.14	2.49	0.87–0.97	40–45	4-beam trawl made of synthetic mono-filament of 0.5–1.0 mm diameter	11.89 & 12.95	Wings: 6–7.5 Body: 3.8–4.5 Cod end: 1.5–2.0	Rectan-gular 35 kgs	Double expanded legs upto a length of 5–10 m	Mecha-nical winch with G.I. wire rope
Royya	9.75 & 10.0	2.9	1.07	45–60	–do–	14.94, 16.5 and 18.29	–do–	40–45 kgs	–do– upto a length of 15–20 m	–do–
Sorrah	11.4	3.2	1.25	60–80	–do–	–do–	–do–	45–60 kgs	–do– upto a length of 10–20 m	–do–
Sona	13.1	4.1	2.8	100–120	–do–	20–22	Wings: 6–7.5 Body: 3.8–5.2 Cod end: 2.5–3.0	60–80 kgs	–do– upto a length of 15–25 m	–do–

Table 3. *Fishing details of various types of boats*

Type of Boat	Number of boats operated	Trawling hours	Av. depth of operation (m)	Average catch per boat (kg)	Catch per hour (kg)	Average catch of shrimp per boat (kg)	Catch of shrimps per hour (kg)
			January, 1988				
Sona	4	200	45	3,621	72.4	789	15.8
Sorrah	228	3,632	25	717	45.0	166	10.4
Royya	2,144	29,164	20	550	40.4	127	9.3
Pablo	204	2,056	20	269	26.7	72	7.2
			February, 1988				
Sona	36	2,439	42	1,972	29.1	399	5.9
Sorrah	234	3,108	25	593	45.0	121	9.1
Royya	1,704	18,514	20	325	30.0	98	9.1
Pablo	152	914	15	150	25.0	65	10.8
			March, 1988				
Sona	47	1,527	45	1,471	45.3	271	8.4
Sorrah	229	2,651	25	430	37.1	72	6.3
Royya	1,988	18,433	20	365	39.3	62	6.7
Pablo	236	1,418	10	167	27.8	35	5.8
			Average for three months				
Sona	29	1,389	44	1,777	37.1	348	7.26
Sorrah	230	3,130	25	580	42.7	120	8.8
Royya	1,945	22,037	20	421	37.2	97	8.5
Pablo	197	1,463	15	198	26.7	56	7.5

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