as bait by fishermen of this region for hook and line fishing of sharks and tuna.

The species is characterized by slender body with an extremely long, thin beak. The head is also slender at the apex of the melon. The dorsal fin slightly falcate and triangular in shape. The tail stock is deepened, with an elongated post-anal keel of connective tissue. The species generally have tripartite color patterns. The dorsal area is dark gray, side is light gray and underside is white. There is a dark band runs from the dark eye to the flipper, bordered above by a thin, light line. The total numbers of teeth on upper and lower jaw are 42-45 respectively.

The species is listed in Appendix II of CITES (Convention on Interventional Trade in Endangered Species of Wild Flora and Fauna) and CMS (Convention on Migratory Species).

Evolution in fishing crafts and gears of the Saurashtra coast

Veraval Regional Centre of CMFRI, Veraval

Veraval regional centre

Saurashtra coast is situated in the Southwestern part of Gujarat which covers the coastal districts of Porbandar, Junagadh, Rajkot, Dwarka, Bhavanagar, Jamnagar, Amreli, and newly formed Gir somnath. From 1967 to till date there was marked improvement in the fisheries sector of this region. In 1967, trawling was introduced and since then the number of trawlers has increased from 900 to 10,000 (CMFRI, 1978) along the coast.

Crafts used along Saurashtra coast

Trawlers

Trawlers made up of wood are locally known as “halvalii” boat having OAL of 12-16 m with engines of 88-118 hp using nets with a cod mesh size 15-40 mm. Most of the trawlers go for multiday fishing up to 15 days operating along the coast at a depth range of 20-150 m. In 1980s the depth of operation was 20-60 m (Rao and Kasim, 1985). The fishing vessels are operated both northward up to Okha, sometimes in the areas of Kachh and southward off Veraval extending its ground up to Karnataka and Goa. The season of operation starts in September after the 45 days ban from June to August. The cost of a trawler is 25- 30 lakhs.

Gillnetters

OBM (Hodi)

The FRP boats of OAL 8-11 m locally known as “hodi” are operated at a depth of 10-50 m along the coast. They are equipped with outboard motor engines. Each boat carries two engines when they go for long trip fishing as a safety measure. They operate in Veraval, northward off Veraval towards Mangrol and Porbandar and southward towards
Nawabadar and Rajpara. The duration of operation is for 3 days.

Mechanised gillnetters

Mechanized gillnetters made up of fibre locally known as “Bethadi” started operation along the coast in 2008. They exclusively use gillnets (jada jal) targeting tuna and seer fish. At present there are about 150 mechanized gill netters in operation in the region and some trawlers have converted into gillnetters due to less catches in trawls. The depth of operation varies from 150-200 m and duration of voyage is 7 days.

Dolnetters

The dolnetters locally known as “vahan” are of OAL 12-14 m with engine power 85-110 hp. These boats have winch and cold storage facility. The depth of operation varies from 10-60 m. The duration of voyage is 4-8 days. The engine power was used for searching the fishing ground in earlier days but now a days is also used for shooting, piling and hauling.

Time line for the crafts and gears

Trawl net

Trawl nets are locally known as “Oza”. Along the Saurashtra coast, trawl fishing first started in 1965 which was for single day operations. Slowly longer trip trawling for three days started in 1975 and 11 days in 2011 due to increase in storage capacity of the boats. The percentage of long trip fishing increased in 1980 onwards and in the present situation 90% of the trawl fishing extends up to 15 days. The target fishing by trawls was started in 2005 mainly for threadfin breams. Recently the trawlers are targeting ribbon fish and squid due to its increased demand in export market. About 10 to 15 trawl nets are carried by the trawlers in each voyage. Along with it they also keep gillnets and hook and line and operate it as and when required depending upon the species availability. The cod-end mesh size for catching ribbon fishes is 40-50 mm with a top of 2000 to 3000 mm while trawl net for other fish catch is having a cod end mesh size of 30-35 mm and top 180- 250 mm. Single day trawlers are having trawl net of cod end size of 15-20 mm and top with 50-80 mm specifically to catch prawns. Target fishing is done for two hauling and they change the gear immediately upon not getting the target fish. As shrimp catch is poorer in these days and as it require more time and laborers for sorting the by catch and debris, shrimp hauling is limited to only single day trawlers.

Gillnets

The use of gillnets started in 1975 which is known as “Kandari jal”, made up of cotton and nylon was used extensively along the coast. Slowly jada jal (big mesh gillnets) and chokla jal (small mesh gillnets) were introduced in 1975 onwards and dominated in the fishery due to less catch of seer fish and black pomfret in Kandari net. Nylon monofilament gill nets were introduced in 1976. Mavol jal (thick nylon monofilament) was introduced in 2000 in place of Jada jal. In 2009, chokla jal was modified into Ghaghara jal expanding its width up to 9 to 10 m. Recently, a new gillnet called “ Khatri jal” which is a modification of Chokla jal was introduced. The technical details of these nets has been given in table 1.

Prior to 1975 all the gill netters of OAL 8 m were made up of wood. Fiber boat was introduced in 1975 and gillnetters of OAL 11m was introduced in 2001. From 1995 onwards the gillnetters started long trip fishing.

Dolnet

Locally known as “Dor” along the Saurashtra coast these bag nets are about 70-100 m long and each boat carries 3-5 nets. The cod end mesh size...
Table 1. Different types of gillnets used along the Saurashtra coast with their operational details

<table>
<thead>
<tr>
<th>Name of Gill nets</th>
<th>Materials used</th>
<th>Length (mt) (each piece)</th>
<th>Mesh size (mm)</th>
<th>Depth of operation (mt)</th>
<th>Total pieces carried/boat</th>
<th>Fishes caught</th>
<th>Season of operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khandari</td>
<td>Cotton + nylon thin monofilament</td>
<td>4-5</td>
<td>85-90</td>
<td>30-50</td>
<td>40-60</td>
<td>Hilsa, Chirocentrus dorab, S. guttatus, Thryssa and other clupeids</td>
<td>Post monsoon</td>
</tr>
<tr>
<td>Mavol</td>
<td>Nylon thick monofilamentnet</td>
<td>7-8</td>
<td>85-95</td>
<td>80-120</td>
<td>50-80</td>
<td>Tuna, S. guttatus, S. commerson and Sphyraena jello</td>
<td>Post monsoon</td>
</tr>
<tr>
<td>Jada</td>
<td>Nylon multifilament</td>
<td>8-10</td>
<td>140-260</td>
<td>50-100</td>
<td>50-250</td>
<td>Sharks, Tuna, Protonibea diacanthus, Otolithoides blauritus, Polynemus etc.</td>
<td>Post monsoon</td>
</tr>
<tr>
<td>Chokla</td>
<td>Nylon thin monofilament</td>
<td>4-5</td>
<td>55-60</td>
<td>10-50</td>
<td>25-60</td>
<td>Trichiurus lepturus, Megalaspis cordyla, Sciaenids and Rastrelliger kanagurta</td>
<td>Throughout year</td>
</tr>
<tr>
<td>Point (monsoon)</td>
<td>Nylon thin monofilament</td>
<td>7-8</td>
<td>100-110</td>
<td>20-40</td>
<td>30-80</td>
<td>Pampus chinensis (small size)</td>
<td>Monsoon</td>
</tr>
<tr>
<td>Pankha</td>
<td>Nylon thick monofilamentnet</td>
<td>8-10</td>
<td>140-160</td>
<td>10-50</td>
<td>40-80</td>
<td>Pampus chinensis and Parastromateus niger (bigger size)</td>
<td>Monsoon</td>
</tr>
<tr>
<td>Khatri</td>
<td>Nylon thin monofilament</td>
<td>4-5</td>
<td>85-95 and 100-125</td>
<td>10-60</td>
<td>20-45</td>
<td>Hilsa, smaller sized tuna, Mackerel, Catfish</td>
<td>Throughout year</td>
</tr>
</tbody>
</table>

is 25-35 mm and top mesh size 110-240mm. They also go for long trip fishing of 4 to 8 days taking 15-25 hauls. During 1975 the length of dolnet was 40 feet and it became 100 ft in 2001. The dolnet mechanization started in 1966 and 100% mechanization happened in 1995. Winch and pulley system started in 2001 and dolnetters started to carry ice in 2006.

Oysters improve growth of fish in an integrated aquaculture system in a tropical estuary

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Aquaculture generates large amounts of wastes in the form of uneaten food, faeces, and excretory metabolites. Increased environmental concern about the rapid expansion of aquaculture systems has resulted in integrated techniques where more than one species are cultured simultaneously, as a means...