Catfish fishery by dolnetters along the Saurashtra coast
Veraval Regional Centre of CMFRI, Veraval.

In Gujarat, dolnets are operated in three regions viz., Umbergaon to Kavi along the southern Gujarat, Siyalbet to Diu along the Saurashtra coast and Takkara to Modhwa in the Gulf of Kutch region. Among these, Saurashtra is the important region and the main fish landing centers are Jaffarabad, Rajpara, Nawabunder and Goghla. Out of these the first three are the most important with more than 250 dolnetters under operation. Dolnet catch consists mainly of Harpodon nehereus, Protonibea diacanthns, penaeid prawns, non-penaeid argentens eprawns, Pampus argenteus, Trichiurus sp., carangids and catfishcs. Bombay duck contributes a major share to the dolnet catches. But, recently there were heavy landings of catfishcs consisting mainly of Arius dussumieri, which used to form only a minor by-catch earlier. Therefore, an attempt was made to study the A. dussumieri landings at these landing centres from 1994 to 2003, with major thrust on the landings at Nawabunder.

The catch and effort data collected on the Dolnetters based at Nawabunder, Rajpara and Jaffarabad landing centres formed the basis of the study. The data on size distribution of A. dussumieri was collected from Nawabandar only. Total length from the snout to the tip of the caudal fin was taken for the length frequency study and the data were grouped in 10 cm intervals for further analysis. Length - weight relationship was calculated using FiSAT (Windows version).

Craft, gear and area of operation
Dolnets are fixed bag nets using two steel poles at a fixed depth. Each boat carries 2-5 nets, which in turn makes 1-10 hauls, with duration of 5 hr/haul. Tidal fishing is done depending on the full moon day at different depths, changing the fishing depth twice in a year.

Jaffarabad is one of the major landing centers with 270-285 dolnet units under operation, out of which 140 are 4 netters, 95 with 3 netters and the rest with 2 netters, operating at a depth of 10-50 m, South-east, South direction. Major landings were observed during April-May and October-December.

At Rajpara, around 230 dolnet units arc operated, of which 120 are 4 netters, 60 are 3 netters and the rest with 2 nets, operating at a depth of 10-50 m, South east, South direction. Peak fishery was noticed from April to May and from September to December.

Nawabunder is the second largest dolnet landing centre, with 250 dolnetters and 40-50 gill netters. Cat fishes are landed in dolnets as well as gillnets operating at this centre at a depth of 30-40m in South east and South west directions.

General trend of catfish landings
The mean annual catfish landings at Nawabandar for 1994-2003 was estimated to be 1478 t for an effort of 27736 units at a catch rate of 55 kg/unit. The landings showed a sharp increase from 271 t at a catch rate of 10 kg/unit in 1994 to 3906 t at a catch rate of 162 kg/unit in 2002. The catch/unit increased from 17.7 kg to 125 kg from 1994 to 2003. The catch rate in terms of number of hauls increased from 2.13 kg/haul in 1994 to 13.2 Kg/haul in 2002, which declined to 7.93 Kg/haul in 2003. The total number of units operated from this centre showed a slight increase from 24,996 units in 1994 to 33058 units in 1997, has subsequently been indicating a marginal declining trend to 24580 units in 2003.
Table 1 Estimated catch (tonnes) and catch/unit (kg) of Arius sp. at dolnet centers

<table>
<thead>
<tr>
<th>Year</th>
<th>Nawabunder</th>
<th>Rajpara</th>
<th>Jaffarabad</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Catch</td>
<td>Catch/ unit</td>
<td>Catch</td>
<td>Catch/ unit</td>
</tr>
<tr>
<td>1994</td>
<td>271</td>
<td>10.55</td>
<td>0.144</td>
<td>4.96</td>
</tr>
<tr>
<td>1995</td>
<td>742</td>
<td>24.84</td>
<td>0.455</td>
<td>14.30</td>
</tr>
<tr>
<td>1996</td>
<td>277</td>
<td>10.39</td>
<td>0.156</td>
<td>4.96</td>
</tr>
<tr>
<td>1997</td>
<td>1648</td>
<td>46.82</td>
<td>0.278</td>
<td>8.24</td>
</tr>
<tr>
<td>1998</td>
<td>547</td>
<td>18.57</td>
<td>0.480</td>
<td>16.17</td>
</tr>
<tr>
<td>1999</td>
<td>1110</td>
<td>36.76</td>
<td>0.661</td>
<td>22.57</td>
</tr>
<tr>
<td>2000</td>
<td>1662</td>
<td>63.18</td>
<td>0.666</td>
<td>20.70</td>
</tr>
<tr>
<td>2001</td>
<td>2166</td>
<td>77.00</td>
<td>0.563</td>
<td>22.00</td>
</tr>
<tr>
<td>2002</td>
<td>3907</td>
<td>162.00</td>
<td>0.665</td>
<td>27.47</td>
</tr>
<tr>
<td>2003</td>
<td>2455</td>
<td>99.90</td>
<td>0.609</td>
<td>20.01</td>
</tr>
<tr>
<td>Average catch</td>
<td>1479</td>
<td>55.00</td>
<td>0.467</td>
<td>16.14</td>
</tr>
</tbody>
</table>

in 2003. However, the actual fishing effort expended in terms of number of hauls increased from 127561 hauls in 1994 by 143 %. The contribution of catfishes to the total dolnet landings increased from 1.7 % in 1994 to more than 16.0 % in 2002.

The average catfish landing at Rajpara for the period was estimated at 467 t (Table 1) for an effort of 29709 units at catch rate of 16 kg/unit. Though the annual production exhibited random fluctuations, it had indicated an increasing trend from 144 t in 1994 to 661 t in 1999 after which the production has leveled off. The CPUE also showed an almost identical trend increasing from 4.96 to 22.57 kg/unit in 1999 and plateauing subsequently. The catch rate per number of hauls was 1.09 and 2.59 kg/haul respectively. The percentage of catfish in the dolnet catch increased from 0.52 in 1994 to 3.25 in 2002.

The mean annual catfish landings at Jaffarabad for the period 1994-2003 was 490 t for an effort of 23880 units at catch rate of 21 kg/unit. The landings after increasing from just 172 t in 1994 to 907 t in 1997 had been indicating downtrend reaching 408 t in 2003, though the maximum production was recorded in 2002. Though there were random annual variations, the catch rate also indicated an almost identical trend increasing from 6.64 in 1994 to 31.94 kg/unit in 1997. The catch rate per number of hauls varied from 1.09 kg to 3.49 kg for the respective years.

The mean annual total catfish production for the dolnet centers was estimated to be 2436 t, which formed 13.53 % of the catfish landings in the State. The production increased from 839 t in 1994 to 6490 t in 2002. The total catfish landings of Gujarat increased from 10,942 t to 22908 t.

**Seasonal trend in production**

The maximum landings of catfishes at Nawabandar were during (Fig. 1) the post monsoon months of October December during the entire period of observation. The fishery was very poor during January-March in most of the years except in 2000 and 2002. The fishery picked up in April -May, especially from 1998 onwards. However, in the year 1997 highest catfish landings were recorded at Nawabunder (10461) and also at Jaffarabad (221 t). The dolnetting operations were restricted during June-August due to monsoon and the catch realized was also the minimum during this period.

**Species composition**

The catfish landings in Gujarat is composed predominantly of Arius Jussumieri (48%) followed by A. tenuispinis (17%), A. caelatus (13%), Osteogeneiosus militaris (9%) and A. thalassinus (12%) (Fig. 2).

**Size distribution**

The size distribution of A. dussumieri at Nawabandar showed that fishes in the size group between 40 and 79 cm mainly supported the fishery, with the dominant mode at 50-59 cm.

**Length weight relationship**

The length weight relationship of A. dussumieri was calculated following the exponential formula $W = aL^b$, where $W$ = weight in Kg, $L$ = length in cm and
a, b = constants. The following regression equation represent the length-weight relationship of the species.

\[ \log W = -3.95 + 2.59 \log L \]

Where, \( r = 0.81 \) (\( p = 0.05 \)), \( R^2 = 0.65 \)

The catfish production was the maximum during the post-monsoon months of October-December, with the peak landings occurring either in November or in December in most of the years at all the dolnet centres. It appears that the catfishes undertake shoreward migrations for feeding/spawning during the monsoon and post-monsoon periods and they are caught by dolnetters during the post-monsoon months.

The catfish fishery is exploited at Nawabandar, Rajpara and Jaffarabad near the mouth of the Gulf of Khambhat along the Saurashtra coast mainly by mechanized dolnetters and to a lesser extent by gill-netters. The characteristic reproduction, shoaling and migration of many species of marine catfishes make them susceptible to over exploitation. More than 70 - 80% of the landings of \( T. \) thalassinus and \( T. \) tenuispinis by trawl nets at various centers along the southwest and southeast coasts consisted of juveniles/sub-adults (7-20 cm). Similarly purse seines caused heavy mortality of gestating males/female-shoaling spawners of \( T. \) tenuispinis, \( T. \) dussumieri and \( T. \) serratus along the Karanataka coast in eighties. These have resulted in the collapse of the fishery in the southern states. Northern sectors (NE and NW) remain isolated and the breeding stocks are not threatened by mass exploitation and hence continue to contribute to the fishery; moreover the circulation pattern during the SW and NE monsoon clearly shows that the monsoon current flow is strong from 17°N downwards during SW monsoon and in the North bound NE monsoon, the drift weakens and partly moves away from the coast with the same
Methods for seed production of the blue swimming crab *Portunus pelagicus* have been developed at the Mandapam Regional Centre of CMFRI and grow-out techniques are being developed. The major constraints observed in the culture of these crabs are the high rate of cannibalism and the lack of an appropriate feed to accelerate growth under controlled conditions. A compounded pellet feed developed using locally available ingredients at the Kovalam Field Laboratory, Research Centre of CMFRI, Chennai, was used in experimental studies for rearing of the blue swimmer crabs in larger holding systems.

**Feed composition and properties:**

The main ingredients of the feed were animal protein meal-30% (paste shrimp powder 15%; shrimp head powder-15%, sardine meal-20%. and silver belly, lizard fishes, flat fishes, trash crabs etc. mixture-50%), plant source-soya meal-40% and wheat gluten 20%, lipids. mineral and vitamin mix-6% and binders-4%. The pellets were extruded and sized uniformly into 4.0 cm long and 2 mm diameter. The colour of the feed was brownish mottled leaf yellow with a strong flavour. The sinking rates of the pellets were very good and the binding tests showed that the pellets remain in shape for 20 minutes after being broadcast into the rearing system.

**Feed Preparation**

All the ingredients after sufficient grinding and sieving were mixed thoroughly using a mixer (only wheat gluten was made into a paste and then added). The mixture was then blended properly with the gluten paste and heated slightly and immediately extruded by pressing through a manual pelletiser. The pellets thus prepared were dried in hot air oven at 60°C and stored in air tight polythene bags.

**Rearing system**

The crabs were stocked in a square cement tank (3.5x3.5m) with fluidized bed substrate filter recirculatory system having a water height of 0.7 metres and filter bed height of 0.25 m. The bed filter comprised of layers of shells, charcoal, sea sand and nylon screens. The surface of the filter bed was provided with enough hide outs (vertical standing black meshed nylon screens with sinkers on the base and floats on the top line) and sea sand 2" depth for the crabs to burrow during day. The water column above the substrate was maintained at 75 cm. The tank was housed in a shed with asbestos roofing. The gap between the roof of the shed and the tank was covered with suspended opaque FRP sheets and thereby a dark environment was maintained. Water was exchanged at the rate of 20-30% daily and weekly once 70% was replaced.

**Water quality**

The mechanically graded and sand filtered sea water was stored in an over head tank and used as and when required. The following water quality parameters were maintained throughout: salinity 36±1 ppt; temperature 27-29°C; pH 8-8.2; dissolved oxygen 4-5mg/l; ammonia <0.1 ppm; nitrite <0.01 ppm. The pH was maintained using dry lime, zeolite and sodium carbonate.