Crab Fishing Techniques

Introduction

Crabs are decapod crustaceans of the infraorder Brachyura, which typically have a very short projecting "tail" (abdomen) (Greek: *brachys* = short, *oura* = tail), usually entirely hidden under the thorax. Crabs are distributed all the world's oceans, in fresh water bodies and on land. Crabs are generally covered with a thick exoskeleton and have a pair of claws.

Taxonomic position of crabs

<table>
<thead>
<tr>
<th>Scientific classification</th>
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<tbody>
<tr>
<td>Kingdom: Animalia</td>
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<tr>
<td>Phylum: Arthropoda</td>
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<tr>
<td>Subphylum: Crustacea</td>
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<tr>
<td>Class: Malacostraca</td>
</tr>
<tr>
<td>Order: Decapoda</td>
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<tr>
<td>Suborder: Pleocyemata</td>
</tr>
<tr>
<td>Infraorder: Brachyura</td>
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</tbody>
</table>

World crab fishery

Crab fisheries are fisheries which capture or farm crabs. True crabs make up 20% of all crustaceans caught and farmed worldwide, with about 1.4 million tonnes being consumed annually. The horse crab, *Portunus trituberculatus* accounts for one quarter of that total. Other important species include flower crabs (*Portunus pelagicus*), snow crabs (*Chionoecetes*), blue crabs (*Callinectes sapidus*), edible or brown crabs (*Cancer pagurus*), Dungeness
crab (*Metacarcinus magister*) and mud crabs (*Scylla serrata*), each of which provides more than 20,000 tonnes annually

**Commercially important crabs of the world**

Single species namely *Portunus trituberculatus* accounts for one-fifth of the total crab catch of the world.

**Crabs with the annual production exceeding 20,000 tones/year:**

(i) *Portunus pelagicus*

(ii) *Chionoecetes spp*

(iii) *Callinectes sapidus* (blue crab)

(iv) *Charybdis spp*

(v) *Cancer pagurus*

(vi) *Metacarcinus magister* (Dungeness crab)

(vii) *Scylla serrata*

**Japanese blue crab or horse crab**

*Portunus trituberculatus* is the most widely fished species of crab in the world with over 300,000 tonnes being caught annually, 98% of it off the coast of China. It is found off the coasts of East Asia and is closely related to *Portunus pelagicus*.
Global capture production trend of *Portunus trituberculatus*

Global aquaculture production trend of *Portunus trituberculatus*
Blue swimming crab *Portunus pelagicus*

Widely distributed in eastern Africa, Southeast Asia, East Asia, Australia, Persian Gulf, New Zealand and Indonesia. Distributed in the intertidal estuaries of the Indian and West Pacific Oceans, and eastern Mediterranean Sea. Mainly collected in artisanal traps, trawls, beach seines, cylindrical wire traps, folding traps, pots, hop nets, drop nets and crab gill nets.

Global capture production trend of *Portunus pelagicus*
Global aquaculture production trend of *Portunus pelagicus*

![Graph showing production trend of Portunus pelagicus](image)

**Spider crab, *Chionoecetes spp***

It is caught commercially with traps, although caught as by-catch in demersal trawls in (i) The seas south and west of St. Lawrence Bay, (ii) East and southeast of Newfoundland, (iii) Southern Labrador. The total catch 95,704 tones (FAO, 1999)
Global capture production trend of *Chionoecetes opilio*

![Graph showing global capture production trend of Chionoecetes opilio](image)

**Blue crab  *Callinectes sapidus***

Total catch reported has been 1,05,238 tones (FAO, 1999). Major fishing zones include Northwest Atlantic and Western Central Atlantic. One of the major crab species of USA. A long baited twine namely trotline is the commercial gear set in waters of 5–15 feet deep to target this crab. In the Gulf of Mexico, trotline use drastically declined after invention of the crab pot.
Global capture production trend of *Callinectes sapidus*
**Cancer pagurus**

It is a moderately important, caught usually with traps (in Europe) also as by catch in trawl fisheries. The total catch reported for this species to FAO for 1999 was 41 337 t. The countries with the largest catches were UK (19 988 t) and France (8 498 t). *Cancer pagurus*, commonly known as the edible crab or brown crab.

Global capture production trend of *Cancer pagurus*
**Mud crab, *Scylla serrata***

The south-east Asian countries such as Indonesia (8560 t) and Thailand (3050 t) known for high catches. It is available in India also. The total catch reported for this species to FAO for 2010 was about 39000 t. Collected mainly by trawls, using traps, baited wire mesh pots, hooking and by hand.

![Mud crab](image)

**Global capture production trend of *Scylla serrata***

![Production Trend](chart)
Global aquaculture production trend of *Scylla serrata*

![Graph showing aquaculture production trend of Scylla serrata]

### Dungeness crab, *Metacarcinus magister*

Inhabits eelgrass beds and water bottoms on the west coast of North America. It grows up to 20 cm. It is a popular seafood prized for its sweet and tender flesh.

![Image of Dungeness crab]
**Charybdis spp**

Charybdis is a genus of swimming crabs in the family Portunidae; "Charybdis" is Greek for whirlpool.

### World production of crabs

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Capture</td>
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<td>1,034,898</td>
<td>1,061,697</td>
<td>1,246,889</td>
<td>1,252,260</td>
<td>1,233,523</td>
<td>1,302,069</td>
<td>1,300,559</td>
<td>1,319,953</td>
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<td>Aquaculture</td>
<td>125,501</td>
<td>145,130</td>
<td>171,979</td>
<td>167,533</td>
<td>178,838</td>
<td>195,958</td>
<td>198,258</td>
<td>231,065</td>
<td>240,781</td>
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<tr>
<td>Total</td>
<td>1,171,770</td>
<td>1,180,028</td>
<td>1,233,676</td>
<td>1,414,422</td>
<td>1,431,098</td>
<td>1,429,518</td>
<td>1,500,327</td>
<td>1,531,624</td>
<td>1,560,734</td>
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</tbody>
</table>

Both culture and capture production is on the increasing trend from the year 2000 onwards.
Crab fishing techniques of the world

several types of crab fishing techniques are followed world wide which can be grouped under three categories

1. Crabbing with a Line and Net

2. Trot line fishing

3. Traps/pots

Crabbing with a Line and Net

**Crab lining** is a hand lining technique used to catch crabs. A piece of bait, normally the neck or leg of a chicken, is tied to one end with a weight in order to keep it from floating. The line is then cast by hand to an area approximately five to ten feet from where it is being cast. Once a crab takes the bait, the line will tighten. The line must be slowly retrieved, inch-by-inch, until the crab is visible in the water. Upon visibility, a hand net may be used to capture the crab

![Crab lining illustration](image)

Trot line fishing and its principle

Used exclusively by commercial crabbers from 1870 to 1929 in USA to capture Blue crab *Callinectes sapidus*. It is a baited, hook-less, long line that is usually anchored on the bottom and attached to anchored buoys. After some time, the fisherman pulls the main line up through a rod having ‘U’ shaped bend. Crabs biting on the bait attached to the branch line (trotline) come up which are captured using a scoop net
Construction

The gear has six parts namely (i) Anchor line (6m long) (ii) Indicator float line (6m long) (iv) Anchor chain (short length of galvanized iron chain) (iii) Main Longline (150m to 750 m) (iv) Branch lines or dropper lines (known as *trots*) (100 to 500 Nos at an interval of 0.5 m to 2m) (v) Small sinkers (about 60g) are attached on the main line for every 20 trots to avoid the drifting of main line.

Operation of trot line

A wooden frame /PVC pipe with ‘U’ bend is fixed as an extension from the side of the boat. The trot line is laid on the U’ bend in such a way that it will run over the bend due to the forward movement of the boat due to slow running. As the line slides through, the ‘U’ bend is slowly raised up from the depth. When a crab clinging to a bait is seen, a scooper net is used to catch the crab. Salted eel has been reported to be the best bait for use in trotline.
Crab traps

Trot lines were later replaced by crab pots/traps. Crab traps are used to lure and catch crabs commercially using baits. Trapping is one of the passive fishing techniques of ancient origin. It is an impounding device into which crabs are lured to enter and thereafter the escapement is made difficult.

History and development of crab traps

From the beginning of 1855 and up to the early 1930’s crab fishing has been conducted mainly with traditional crab pots in estuaries and bays (Hipkins, 1956). Lewis standardized the crab pot design during the year 1920 and it was patented in 1928. The technology was further perfected over ten years later.

Classification of crab traps

1. Lift net type
   (i) Ring net trap
   (ii) Pyramid Traps
2. Foldable type
   (i) Semi-Circular trap
   (ii) Umbrella trap
3. Non-collapsible type
   (i) Maryland pot
4. Vertically Collapsible type
   (i) Collapsible circular trap
      a) with float for lifting mechanism
      b) with pvc tubes for lifting mechanism
   (ii) Collapsible box trap
(iii) Circular trap with semicircular rings

5. Serially collapsible type

(i) Chinese serially collapsible trap

1. Lift net type crab trap

(i) Ring net trap

It is very popular along the Oregon and Washington Coast of USA. Primarily used in river mouths and protected bays. Can also be used off the coast in open waters. A crab ring is a simple piece of device consisting of two wire rings that form the top and bottom of a collapsible basket that made up of webbing. The lower ring is smaller than the upper ring and connected with a strong netting that forms the sides.

(ii) Pyramid Trap

It is flat when lying on the bottom of the seafloor, but when raised to the surface, it forms the shape of a pyramid. This trap is similar to the ring crab trap because there are no walls or cage that prevents the crabs from escaping before pulling it to the surface. The benefit of the pyramid crab trap over the ring crab trap are:
(i) The pyramid crab trap is slightly sturdier and can be used in waters with stronger currents

(ii) The top is closed while lifting the trap

2. Foldable type
   (i) Semi-Circular trap

   Has two semicircular frames covered with webbing and provided with hinges. The frames are spread as a circle on the sea floor and provided with bait. Crabs are attracted by bait on to the circle. On lifting the two semicircular frames are folded up and crabs are entrapped between the frames
(ii) Umbrella trap

Works with the principle of umbrella for folding and spreading. Foldable trap with multiple funnels. Suitable in calm waters. Maintenance and construction is complicated.

3. Non-collapsible type
The Maryland pot

It is an enclosed framework of wire with 2 to 4 funnel openings. Funnel openings serve as Non-return devices and hence the crabs that enter into the trap to eat the bait are entrapped. The Maryland crab pot is cubical in shape with the internal volume of two cubic feet and weigh about 7kg. This trap is baited with several oily fishes and is set at the sea bottom. A gate is provided at the top to remove the catch.
(ii) Collapsible circular trap with semicircular rings

Made up of a circular and two semi circular rings. The circular ring has a cross bar to provide hinges for the movement of semi-circular rings. The two semicircular rings move on hinges both sides. Has two funnel entrances. Webbing mounted to half the arc of the circular ring is temporarily mounted while making the trap ready for operation. After the operation of the trap, the temporarily mounted webbing is released off so as to facilitate the folding of two semi circular frames to flat condition.

4. Vertically Collapsible type

(i,a) Collapsible circular trap with float for lifting mechanism

Has two circular/elliptical rings of identical size. The top ring along with webbing is lifted with floats of required buoyancy. Provided with 2 to 4 funnels. Mainly used to catch the Dungeness crab, *Metacarcinus magister*. When the crabs enter any of the funnel openings, they are unable to exit and hence entrapped.
i.b) Collapsible circular trap with PVC tubes for lifting mechanism

As in previous trap, this trap has two circular rings. The top ring is provided with four foldable PVC tubes. While setting of the trap, the side wall is made to stand erect vertically by attaching the PVC tubes with the bottom ring. Polyethylene webbing is used as covering material.

ii) Collapsible box trap

It is made from strong collapsible webbing and frames. Once the crab enters searching for the bait it cannot escape.

Serially collapsible crab trap

Serially Collapsible trap for capturing crabs is practiced on commercial scale in China. A serial trap consists of several chambers and can stretch to a few kilo meters. Each chamber is provided with...
funnel. Frames facilitate to provide funnel to each chamber. All chambers are interconnected. Both ends of the trap assembly has collection bag which can be opened and the entire catch can be taken out from the bags

Status of crab fishery in India

Crab fishery in India is yet to be recognized as a organized fishery with exclusive design of vessel despite their abundance all along the Indian coast. There are about 600 crab species in Indian waters. Only few of them are used for human consumption. Scylla serrata, S. tranquebarica, Protunus pelagicus, P. sanguinolentus, Charybdis crusiata, C. feriata. Crab fishery is a small scale fishery with major contribution form capture fishery only. Annual crab landings- 50,000 tones/ year. Marine sector contribution- 33,000 tones /year. Brackish water contribution- 17,000 tonnes /year. On weight basis Mud crab accounted for more than 75% of crab landing. Crab meat and live crabs are exported to countries like Japan, USA, France, Hong Kong & Malaysia. Kerala -- major export trader of crab meat. Chennai -- main centre of live mud crab exports to Singapore and Malaysian
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<td>Crabs (t)</td>
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<td>44820</td>
<td>34,152</td>
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<td>40900</td>
<td>37,182</td>
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<td>47,897</td>
<td>52,243</td>
<td>50,847</td>
<td>52,467</td>
<td>44,586</td>
<td>46,061</td>
<td>47,464</td>
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**State wise contribution (2010)**

Gujarat-43%, Tamil Nadu-28%, Kerala-12%, Andhra Pradesh-6%

**Region wise contribution**

Northwest region -45%, Southeast region-34%, Southwest region- 17%, Northeast regions-5%

**Gear wise contribution**

In Gujarat, Mechnanized long-voyage trawlers contributed 94.5%, mechanized trawlers which made one-day trips, 4%. In Tamil Nadu, mechanized trawlers landed 59%, non-mechanized bottom-set gill nets 20% and the out-board engine bottom-set gill nets 11%. In Kerala, mechanized trawlers making single-day fishing, mechanized multi-day trawlers and out-board engine trawlers contributed 68%, 19% and 7% respectively
<table>
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<tr>
<th>STATE/TERRITORY</th>
<th>GEAR EMPLOYED</th>
<th>FISHERY SEASON</th>
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<tr>
<td><strong>MARINE SECTOR</strong></td>
<td></td>
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<tr>
<td>Gujarat</td>
<td>Gillnet, stake net, cast net, line with bait, pair of tongs, iron rods</td>
<td>June-August</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>Seinenet, hoopnet, hooked iron or steel rods, line with bait</td>
<td>August-October</td>
</tr>
<tr>
<td>Goa</td>
<td>Gillnet, line with bait, handpicking</td>
<td>June-September</td>
</tr>
<tr>
<td>Karnataka</td>
<td>Gillnet, trawl net, scoop net</td>
<td>October-May</td>
</tr>
<tr>
<td>Kerala</td>
<td>Gillnet, boat seine, shore seine, trawl net</td>
<td>May- November</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>Boat seine, shore seine, gillnet, cast net, trawl net</td>
<td>March-June and October-December</td>
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<tr>
<td>Pondichery</td>
<td>Gillnet, boat seine, shore seine, trawl net</td>
<td>October-December</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>Gillnet, trawlnet</td>
<td>April-December</td>
</tr>
<tr>
<td>Orissa</td>
<td>Gillnet, seinet</td>
<td>October-December</td>
</tr>
<tr>
<td>West Bengal</td>
<td>Gillnet, seinet, stakenet</td>
<td>July-December</td>
</tr>
<tr>
<td>Andaman &amp; Nicobar</td>
<td>Gillnet, boat seine, shore seine, catsnet, handpicking</td>
<td>December-April</td>
</tr>
<tr>
<td>Islands</td>
<td></td>
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Crab fishing techniques used in brackish water bodies of India

<table>
<thead>
<tr>
<th>BRACKISHWATER SECTOR</th>
<th>Technique Description</th>
<th>Season</th>
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</thead>
<tbody>
<tr>
<td>Zuari &amp; Mandovi estuaries</td>
<td>Gillnet, line with bait, scoopnet, bamboo pot, handpicking</td>
<td>June-September</td>
</tr>
<tr>
<td>Kundapur estuary and Natravati-Gurpur estuaries</td>
<td>Gillnet</td>
<td>June-September</td>
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<tr>
<td>Vembanand backwaters</td>
<td>Stake net, cast net, dragnet, line with bait, scoop net, trap</td>
<td>May-September</td>
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<tr>
<td>Mudflat areas at Tuticorin</td>
<td>Scoop net</td>
<td>August-February</td>
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<tr>
<td>Killai backwaters</td>
<td>Gillnet, line with bait, cast net, scoop net, dragnet</td>
<td>March-September</td>
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<tr>
<td>Kovalam backwaters</td>
<td>Dragnet, scoopnet</td>
<td>January-September</td>
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<tr>
<td>Adyar estuary</td>
<td>Dragnet, cast net, scoop net</td>
<td>June-October</td>
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<tr>
<td>Ennore estuary</td>
<td>Dragnet, cast net, scoop net</td>
<td>April-November</td>
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<tr>
<td>Pulicat Lake</td>
<td>Shore seine, dragnet, line with bait, scoopnet</td>
<td>March-October</td>
</tr>
<tr>
<td>Godavari estuary</td>
<td>Dragnet, stakenet</td>
<td>November-March</td>
</tr>
<tr>
<td>Chilka Lake</td>
<td>Gillnet, scoopnet, crab trap, line with bait</td>
<td>August-October</td>
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<tr>
<td>Sunderbans</td>
<td>Line with bait, hooked iron or steel rods</td>
<td>April-June</td>
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</tbody>
</table>
Major Crab fishing gears of India

(i) Gill nets

(ii) Crab Long line

(iii) Lift net type Ring trap

(iv) Hook and line

(i) Gill nets

(a) Crab gill net of Gulf of Mannar

Apart from trawl net, Crab gill net is one of the most important fishing gear used for the capture of crabs in India. Mono filament nylon gill nets are mainly used on the seabed to capture crabs.

Design and operation details of crab gill nets of Gulf of Mannar

<table>
<thead>
<tr>
<th>Parameters</th>
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<th>Therespuram</th>
<th>Vellapatti</th>
<th>Mandapam</th>
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<td>Twine thickness</td>
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<td>1 - 2mm (nylon)</td>
<td>0.75 – 2 mm (nylon)</td>
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<td>Colorless</td>
<td>Colourless and green</td>
<td>colourless</td>
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<td>Length</td>
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<td>280 – 900 m</td>
<td>800 m</td>
<td>900-1,300 m</td>
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<td>Hung Depth</td>
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<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
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<td>Mesh size</td>
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<td>90mm</td>
<td>80-90 mm</td>
<td>85- 90mm</td>
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<tr>
<td>Meshes in length</td>
<td>6,500</td>
<td>4,180-11,000</td>
<td>11,700</td>
<td>13,000-19,500</td>
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</table>
(b) Crab Gillnet of Chilka Lake (Noli jal)

This Crab gillnet is mainly used in the Chilika Lake. In Chilika Lake the gillnet (400m x 2m), locally called Noli jal is made of sun hemp and has a mesh size of 10-15 cm. The nets are stretched between bamboo poles and kept without sinkers. The number of floats used depends on the water depth and the length of the net. Bait are hung at the bottom of the net. Crabs are attracted by the baits attached at regular intervals to the foot rope.
C) Crab gill net of Killai backwaters

The gillnet used in the Killai backwaters is locally called Nandu valai. It is a small wall net made of synthetic fiber (60 m x 2-2.5 m) with mesh size 75 mm and head rope of 5 mm in dia). Small wooden floats (25 x7 x 3 cm) are attached at intervals of 1.5 m. The foot rope is 5 mm in diameter and has stone sinkers attached to it.
Demerits of Crab gill netting

Life span of the crab gill net is the major problem. Mending the monofilament twines cannot be attempted after every fishing operation. The worn out portion of gill net accounts for about 10% of the initial webbing of the net. Removal of crabs from the net is very difficult due to entangling. Sometimes twine has to be cut to remove the entangled crab. Often carapace and legs of the crab get break while removing and this reduces the market price. Webbing can be used only for about ten fishing operations. Have to replace the webbing 25 to 30 times in a year.

(ii) Crab Long line

Long line with bait is the most widely used gear in the Mud crab fishery along the east coast of India and Kerala. The long line consists of a main line of coir rope (300 m) and branch lines at intervals of 1-2 m. The baits are tied to the ends of the branch lines. The long line is operated at depths of 1 to 4 m. Bait: Kerala - fish head and gills, Tamil Nadu - catfish, eel, shark, and ray, Andhra Pradesh - dried bits of eel.
iii) Crab trap
Crab trap of Pulicat lake
(Lift net type ring net)

Nandu katcha are traps mainly used in Pulicat Lake and the Killai backwaters in Tamil Nadu. Comprises a small bag net made with a piece of nylon net of 70 mm mesh size attached to an iron ring of about 155-165 cm diameter. The depth of the bag is about 20 cm. Bait, usually pieces of eel, skate or catfish. The ring has three bridles (60-80 cm long) and these are tied to a long rope, which is attached to a wooden float. Line length varies from 4 to 6 m.

iv) Hook and line

This consists of a single line made of nylon filament with a hook attached at its end. The line, with bait is cast into the water to attract the crab. As soon as a crab grabs the bait, the line is slowly hauled in and the crab collected with a scoop net. This gear is operated in intertidal areas exposed during low tide and at 3-4 m depths when operated in water.
Studies carried out on crab trapping technique at FC&RI, Thoothukudi

First attempt in India was made to develop serial collapsible traps similar to Chinese crab traps to capture crabs (Karthiy, 2014). The collapsible trap was found have an estimated life span of one year against 10 days for mono filament crab gill net. The catch rate of 14 m trap assembly with 40 trap units was 17 Nos/soaking day. The catch rate of crab gill net of 14m long was 7 Nos/soaking day. The developed serial collapsible trap design was found to be successful. However, further studies are required on suitable material for serial collapsible crab traps as the frames fabricated PVC tubes could not withstand heavy force during operations.

1. Covering webbing (nylon/Pet) 25 Tex x 3 x 3 (Black colour): 40 mm mesh size
2. Trap entrance webbing (Polyethylene): 30 mm mesh size
3. Trap entrance (Rear mouth)
4. PVC (Poly Vinyl Chloride) frames
5. Collection bag
6. Lacing twine (Nylon PA) 33 Tex x 3 x 3
7. Hauling rope (Nylon PA) 33 Tex x 6 x 3


Baits for crab trapping

(a) Natural baits

Chicken necks are used as bait for recreational crab trapping. Frozen fish are used as it tends to break down (decompose) faster than fresh fish which seems to attract more crabs. Crabs go mad for Rotten fish in a net bag. Rotten fish generates more "smell" thus attracting more crabs!. Turkey Neck, Meat, Prawn heads, raw chicken leg, clams, Eel are also used as baits in crab traps. Wastes from Fish processing industries can be used as bait in crab traps (Miranda and Viana, 2000). Minced heads of Mackerel (*Scomber japonicus*) and Greenling (*Pleurogrammus azonus*) packed in teabag are used Japanese crab traps (Archadale et al., 2011). In Australian waters chopped sea mullet (*Mugil cephalus*) are used as bait in traps to capture *scylla* spp rs (Butcher, et al., 2012)

Artificial baits

Artificial baits have been developed for edible crab *Cancer pagurus* in pots (Mackie et al., 1980). Synthetic bait development could reduce the large take of live baitfish from the sea. In Department of Fish Processing Technology of FC& RI, Thoothukudi, studies on the development of dry artificial fish bait using fish processing wastes and chicken wastes is being attempted by Mr.K.Masilan. Similar research works can be initiated for crab traps also
Research Gap with respect to crab fishing technology in India

Limited studies have been made in India on the design and operational aspects of crab traps. Mainly crabs are captured in trawls as bycatch and in entangling type of gill net. Various designs of trapping techniques successfully used in developed countries have not yet been introduced in India. In-depth research need to be carried out to introduce appropriate crab trapping technique in Indian waters. Studies on artificial bait development for crabs need to be initiated.

Conclusion

Considering good resource potential of crabs in India, trap fishing techniques may be introduced in Indian waters replacing the detrimental entangling type of crab gill nets. Artificial crab baits may be developed to reduce the wastage of bait fishes during crab trapping.

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