

Labour shortages were faced by several factories. Where there were in-house staff they were able to operate, but in most units the local staff were not able to reach work places. The direct labour costs were also very high considering very low raw material availability and low exports. When the migrant labour in the sector from Assam, Jharkhand, Karnataka etc. will leave there is also a situation that there may be difficulty in bringing them back. As this may warrant testing and quarantine costs. Exports to countries like China are facing issues of virus detection on consignments. While this could be an issue of handling after the processing and packing, this needs to be sorted out as China is banning imports from such countries in the short term.

The initial days of the lockdown also opened up opportunities for online sale of fish. Owing to the inability of people to access markets and the general fear of the spread of the pandemic, there was a shift to online purchases. This could be a trend for the near future as the fear continues to persist and this offers an opportunity that can be exploited. Buying behavior is affected by several aspects, and this may be a short-time

panic response. But atleast a small percentage of the consumers may continue with this for the convenience it offers.

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Technical guidelines for sustainable small-scale gillnet fishing in India

Saly N. Thomas*, K. M. Sandhya and Leela Edwin

ICAR-Central Institute of Fisheries Technology, Cochin - 682 029

*Email: salynthomas@gmail.com

Background

Gillnet is the most popular fishing gear in the small-scale fishing sector due to its simplicity in design, construction, operation and its low investment. The gear is highly versatile as it can be operated in marine as well as freshwater with or without the aid of a vessel. Besides, it can be operated in any area of the water column viz.,

surface, column or bottom layers as drift, set or encircling gillnets. Gillnets of varying mesh sizes, target a variety of fishes ranging from small anchovies to large fishes such as seer fish and tunas. The gillnet vessels constitute about 67% of the total fleet of the country, consisting of 19,850 mechanized, 61,873 motorised and 49,435 non-motorised vessels (Thomas *et al.*, 2020) and that gillnets constitute 83% of the 5.1

million fishing units operated in India (DAHDF, 2005) underline the importance of this fishing gear in the Indian fishing sector. Gillnets were considered as resource specific, eco-friendly and responsible fishing gears without imparting any damage to the ecosystem. However, the unscrupulous expansion of the gear, use of very small mesh sizes and very thin monofilament material in recent time make gillnets a threat to the ecosystem and the environment. This necessitates monitoring and intervention in the design and operation of the gear.

Small scale gillnet fishing in India

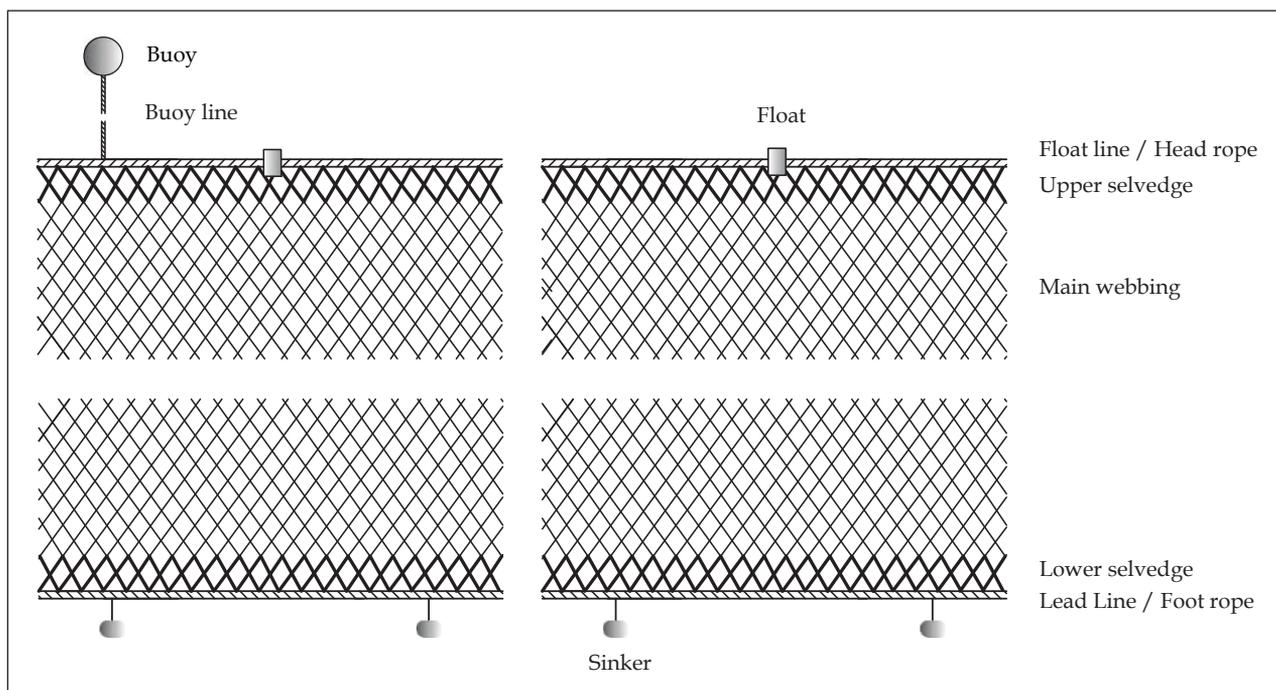
In India gillnets are mainly operated in three sub-sectors, the non-motorised where vessels do not use any mechanical device for propulsion and fishing; the motorised sub-sector where vessels are smaller, engine is fitted outside the boat (outboard motor) and used only for propulsion while the gear is operated manually and mechanized where vessels are relatively larger with the engine fitted inside the vessel (inboard engine) and used for propulsion and gear operation. The sub-sectors, non-motorised

and motorised with the area of operation limited to coastal and nearshore areas are considered exclusively as small-scale gillnet sector.

Based on mesh size, gillnets are classified into small (<45 mm), medium (45-70 mm) and large mesh (>70 mm). The non-motorised sub-sector operates small and medium mesh gillnets, from wooden and FRP canoes and fishing is confined to single day operations. The motorised gillnet sub-sector includes two categories, first category where vessels are fitted with outboard engines of up to 15 hp and undertake single day trips and usually carry small and medium mesh gillnets and trammel nets onboard, targeting mainly mackerel, sardine, anchovy, shrimp and pomfret. The second category of motorized sub-sector includes vessels of larger size which undertake multiday fishing of 3-5 days and fitted with 15 to 28 hp outboard engines targeting seer fish and tuna, using large mesh gillnets.

Design & operation

Gillnet basically is a long wall of netting kept erect in water by having floats at the upper side



Design of a typical simple gill net

and sinkers at the lower side. The net consists of a main netting panel of specific dimension, twine size and mesh size, selvedge, head rope, foot rope, float line, lead line, gavel line/ side ropes, floats, sinkers, buoys and buoy lines depending on the target fishery. Main netting material is either polyamide/nylon (PA) monofilament or multifilament. Selvedge, generally of thicker material than the main netting is provided along the edges to give protection to the main webbing during handling and operation. The netting is mounted to the ropes by a continuous hanging twine which is passed through the meshes and tied to the headrope using staples or loops. Netting is rigged to the head rope based on particular hanging ratio which determines the looseness of the netting and thereby the shape and opening of the mesh as well as hung depth of the net. Nets have a hanging coefficient varying from 0.4 to 0.7 but mostly at 0.5. Floats are attached either directly to the head rope or to a separate float line, which runs along with the head rope and sinkers are attached either directly to the footrope or to a separate sinker line. Required number of gillnet units are tied end to end depending on the size of the vessel, availability of fish and area of operation.

Nets are operated as drift, set or encircling while drift nets are the most common. Driftnets drift freely as one end of the net is tied to a fishing vessel or to a buoy while the other end flows freely and are deployed to catch fishes swimming in mid-water or near surface layers. Set gillnets are fixed to the bottom by using anchors, heavy weights or are tied to poles or sticks fixed to the ground. Surface set gillnets target surface dwelling fishes and are operated in shallow coastal waters where current is negligible. Bottom set gillnets are used for capturing bottom dwellers and the nets are rigged with more sinkers and fewer floats so as to balance the net in water without falling to the ground. In encircling nets, the fishes are surrounded by the net and are driven from the centre by making

noise and other means. Encircling type of nets are rarely seen nowadays probably due to the widespread use of efficient surrounding nets like ring seines targeting shoaling fishes.

Once set-in water, nets are soaked for periods varying from 30 min to 24 h depending on the targeted fishery and size of the net. Set gillnets on the other hand have long soaking time extending from 12 to 24 h. Setting and hauling of the nets are done manually in all types of gillnets operated in the small-scale sector.

Issues

Gillnet considered as a responsible gear, lost its reputation in early 1980s due to its large-scale operation in the high seas. Bycatch and incidental catch of non-targeted species including endangered species such as marine mammals, turtles etc and the incidence of gillnets or its part becoming ALDFG (abandoned, lost, or otherwise discarded fishing gear) leading to ghost fishing are serious problems alleged to gillnets.

Switching over of gillnet material from natural to synthetics resulted in an increased fishing effort as the volume of gear that can be carried onboard increased considerably and correspondingly the size of the vessel also increased to accommodate the large volume of gear. This gives more chances of gear loss and these lost gears cause financial loss to fishers as well as negative impacts in environment. Regulations on volume of gear to be taken are not available in many states of India except Kerala under the amendment of KMFRA rules & Act, 2018.

Commercial fishers often use gillnets consisting of units of different mesh sizes attached end to end, even though the optimum mesh sizes are suggested for several fishes. Besides, fishers use mesh size smaller than the optimum for a particular target species. These practices led to capture of juveniles and non-target species in coastal waters of India (Thomas, 2010). Also fishers rig the nets loosely which increases

incidental capture of juveniles incidence and non-target organisms.

Introduction of nylon monofilament in late 1990s and its wide spread use is another matter of concern. This material lasts hardly for one fishing season spanning 3-6 months and unlike nylon multifilament netting, it is difficult to mend monofilament netting of very thin diameter. Abandoning or discarding causes considerable threat to marine species (Ayaz *et al.*, 2006). ALDFG has detrimental impacts such as destruction of habitats, entangling with marine turtles, seabirds, dolphins, whales, seals etc, introduction of invasive species, hazards to navigation, adverse effects on tourism, human health, and safety. First study from India on ALDFG reported annual gillnet loss rate as 24.8% of the total gear per vessel per year (Thomas *et al.*, 2020). Considering the enormous number and quantity of gillnets operated in the Indian fisheries, this is an indicator of a serious problem requiring attention of the authorities and become a major contributor to plastic debris and to ghost fishing in the coastal environment.

Thus, the several issues associated with small-scale gillnet fishing, in the Indian fisheries sector demand technical interventions with regard to design and operational modifications as well as administrative and enforcement level measures.

Guidelines for sustainable small-scale gill net fishing

Technical and operational guidelines

- Maximum allowable dimension (length x depth) for the netting has to be specified for each fishery/state and the maximum dimensions to be followed for small scale gillnet fishing are 2000 m length x 10 m depth.
- Mesh size regulation would help to a considerable extent in sustainable harvesting of resources. The minimum mesh

size recommended for specific fishery are; sardine (33 mm), mackerel (50 mm), croaker (40 mm), pomfret (126 mm), tuna (80 mm) and prawn (38 mm).

- Reduction in height of the net, setting the net just below the surface, use of aquatic pingers, increasing the reflectivity of net by treating with barium sulphate (BaSO₄) and use of stiff ropes are some mitigation measures to reduce mammal interaction with nets thereby reducing their incidental catches.
- Use of biodegradable materials in rigging floats on the nets would reduce ghost fishing ability of lost nets as once the material is degraded, the nets lose its configuration or collapse, thereby preventing further capture.
- Avoidance of operation in very rough weather/ areas with bottom obstructions, usage of materials with standard quality specification as the use of low quality and old/damaged netting give more chances for gear loss.

Administrative and enforcement level guidelines

- Restrictions for uncontrolled increase in volume of gear are required.
- Implementation of mesh size regulation and enforcing minimum legal size of fish to be caught would help in reducing juvenile capture as well as bycatch.
- Providing proper disposal facilities at the harbour and landing centres for damaged nets would be useful for reducing plastic pollution by these nets.
- Incentives to fishers would encourage them to bring back damaged and retrieved nets to shore.
- Awareness creation among fishers to address these issues through meetings and workshops.

Strict adherence to appropriate gear dimensions as well as incorporation of suitable measures to reduce bycatch and associated mortality in gillnets would be helpful for sustainable gillnet fishing in the small-scale sector.

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