SUNSHINE AGRICULTURE
e-Newsletter

ISSN (E): 2583 – 0821

Sun. Agri.:e- Newsletter, (2026) *6*(10), 34-43

Article ID: 681

Otter Boards in Trawl Fishing: Importance, Types, Advantages and Limitations

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Open Access

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Available online at
www.sunshineagriculture.vitalbiotech.org

Article History
Received: 02. 10.2026
Revised: 07. 10.2026
Accepted: 12. 10.2026

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INTRODUCTION

Trawl fishing is one of the most important commercial fishing methods used to capture demersal, benthopelagic and pelagic fish, as well as crustaceans and other aquatic organisms. In this method, a cone-shaped net is towed through the water by a fishing vessel, directing organisms into the net and retaining them in the cod-end. In a conventional single-vessel otter trawl, the horizontal opening of the net is maintained by a pair of otter boards positioned ahead of the net and connected to it through sweeps and bridles (FAO, 2005).

The otter board is more than a simple plate attached to fishing gear. It is a hydrodynamic device designed to generate an outward force as water flows past its surface. This force separates the two sides of the trawl, helping maintain the required net opening during towing. The performance of the boards depends on their geometry, surface area, angle of attack, weight, centre of gravity, attachment points and interaction with the towing warps.

The Food and Agriculture Organization of the United Nations (FAO) recognizes that otter boards are available in numerous designs, ranging from traditional wooden or flat metal boards to sophisticated curved, cambered, slotted and composite structures (FAO, 2005). Modern designs aim to achieve adequate spreading force with lower hydrodynamic resistance, stable operation and, where applicable, reduced seabed contact (Sala *et al*., 2016).

Understanding the importance and characteristics of different otter boards is therefore essential for fisheries engineers, fishing-vessel operators, gear technologists and fishers seeking to improve fishing efficiency while minimizing operating costs and environmental impacts.

2. Working principle and importance of otter boards

Otter boards operate on the principle of hydrodynamic force generation. When a board is towed through water at an appropriate angle of attack, the pressure distribution around its surface produces a lateral spreading force and hydrodynamic resistance. The outward forces generated by the port and starboard boards help maintain the horizontal opening of the trawl net. The principal forces acting on an otter board include:

- Lateral spreading force: The outward force responsible for maintaining the horizontal opening of the trawl.
- Hydrodynamic drag: The resistance opposing the forward movement of the board through water.
- Weight and buoyancy: These influence the vertical position of board, bottom contact and stability.
- Hydrodynamic moments: These affect the board's orientation and tendency to maintain a stable operating position.

The spreading performance depends on the board's shape, aspect ratio, camber, angle of attack and towing speed. An increase in towing speed generally increases hydrodynamic forces, but it also increases resistance and the power required to tow the gear. Consequently, an appropriate balance between spreading force and drag is essential for efficient operation (Sala *et al*., 2016).

2.1 Major functions of otter boards

2.1.1 Maintaining horizontal net opening

The most important function of otter boards is to keep the trawl mouth open horizontally. Without adequate spreading force, the net wings may move inward, reducing the effective fishing area and compromising the performance of the gear (FAO, 2005).

2.1.2 Improving fishing efficiency

Properly designed and adjusted boards help maintain the intended net geometry and allow the gear to operate consistently. An Indian study comparing three otter-board shapes reported that curved boards produced higher catches per unit effort across the tested net and rigging combinations (Narayanappa, 1968). However, the result should not be generalized to every fishery because catch efficiency depends on several interacting factors.

2.1.3 Supporting fish-herding behaviour

During bottom trawling, the boards and associated sweeps may disturb the seabed and generate sediment clouds that encourage some fish to move toward the approaching net. This herding action can increase the effective fishing width beyond the area directly covered by the net mouth, although its effectiveness varies with species and seabed conditions (FAO, 2005; Valdemarsen *et al*., 2007).

2.1.4 Maintaining gear stability

Stable board operation helps reduce twisting, irregular movement and undesirable changes in net spread. Stability is especially important during deepwater operations, where long towing warps can influence the orientation and movement of the boards (FAO, 2003).

2.1.5 Influencing fuel consumption and operating costs

Boards with high hydrodynamic efficiency generate the required spreading force with comparatively low drag. This can reduce the power demand associated with towing, although the actual fuel savings depend on vessel power, towing speed, net resistance, board dimensions and rigging.

2.1.6 Influencing seabed interaction

In bottom trawling, the board design and its contact configuration influence the pressure exerted on the seabed and the area disturbed during fishing. Lighter boards and high-aspect-ratio designs can reduce certain aspects of seabed impact, although their effectiveness depends on the complete gear configuration and operating conditions (Valdemarsen *et al*., 2007).

3. Different types of otter boards

Otter boards are classified according to their shape, construction, hydrodynamic characteristics and intended application. The main designs used in commercial trawling are described below. These categories partly overlap: for example, an oval board may also be curved or cambered, while a V-shaped board may incorporate slots or other flow-control features.



3.1. Flat rectangular otter boards

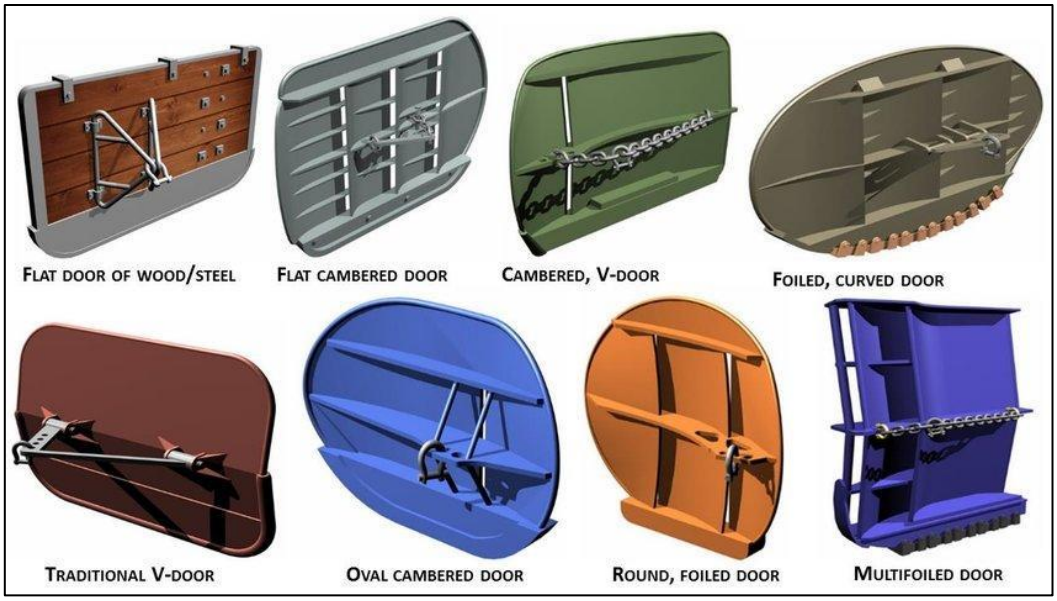
These boards have a relatively flat rectangular plate or frame, usually made of steel or another durable material. They are among the simpler designs used in fishing operations, although traditional rectangular boards may also incorporate reinforcing structures and adjustable attachment points.

Advantages

- Simple construction and comparatively straightforward maintenance.
- Suitable for various small and medium-sized trawling operations when correctly designed.
- Relatively easy to fabricate and repair locally.

Disadvantages

- A basic flat plate may generate less spreading force per unit of drag than a well-designed cambered board.
- Performance can be sensitive to the angle of attack and towing conditions.
- Poorly designed or rigged boards may experience instability and excessive resistance.



3.2. Curved and oval otter boards

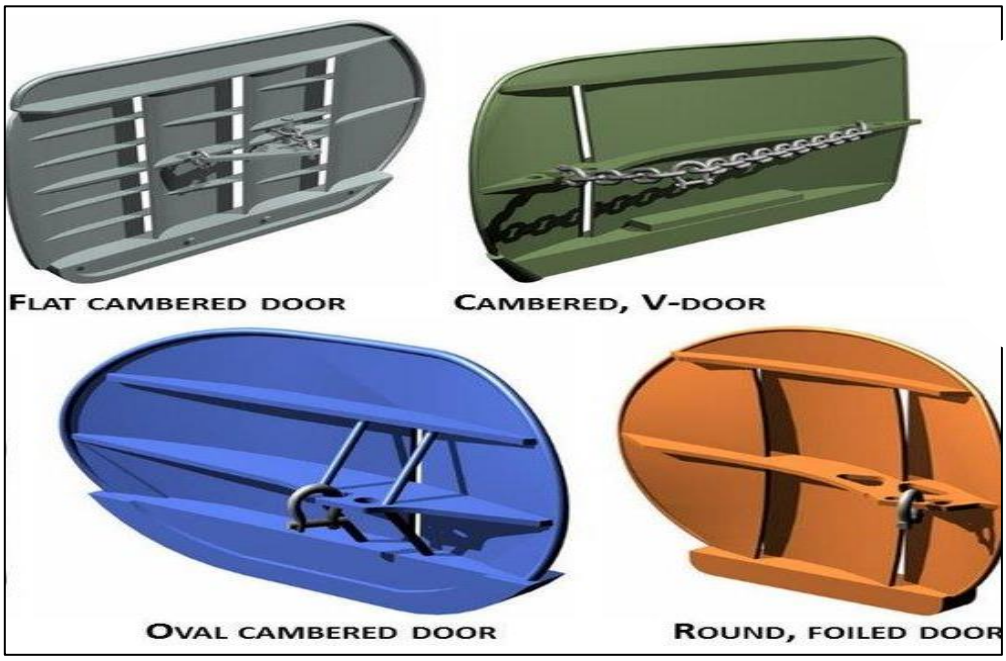
Curved boards have a bent or cambered surface, while oval boards have a rounded overall outline. Their geometry can improve the pressure distribution and spreading performance compared with some conventional flat designs. Narayanappa (1968) reported higher catch per unit effort with curved boards in the combinations tested.

Advantages

- Potentially improved spreading performance.
- Can provide effective net opening under suitable towing conditions.
- May improve catch efficiency when matched to the net and rigging.

Disadvantages

- Performance depends strongly on the board's geometry and operating angle.
- Some designs may have lower stability during shooting or deepwater towing.
- Fabrication and maintenance may be more demanding than for simple flat plates.



3.3. V-shaped otter boards

V-shaped boards use an angular or folded configuration to influence water flow and provide a stable towing orientation. They are of particular interest in deepwater trawling, where stable shooting and resistance to unwanted rotation are important.

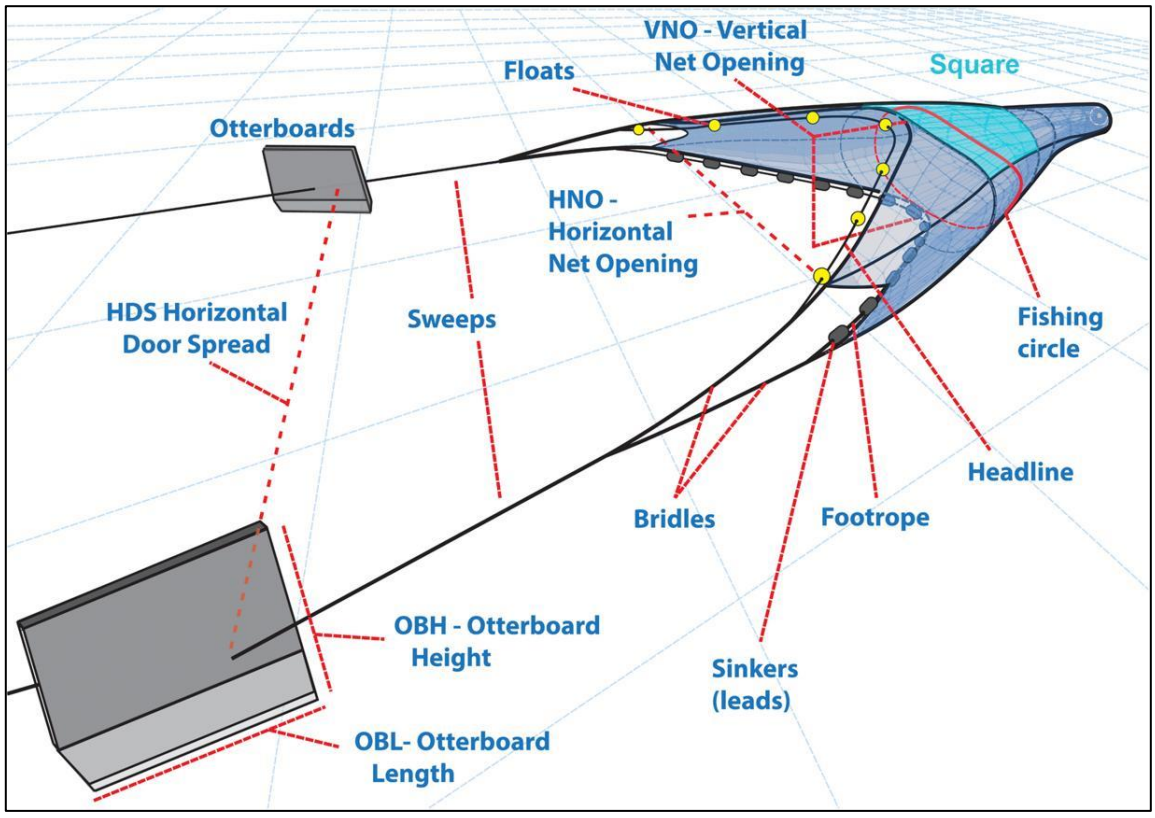
Advantages

- Can provide good directional and static stability.
- May achieve a favourable spreading-force-to-drag ratio.
- Suitable designs can reduce operational problems associated with unstable gear deployment.

Disadvantages

- Spreading force may be lower than that of some alternative designs of comparable size.
- Correct adjustment of attachment points and towing warps is essential.
- Manufacturing requires accurate geometry and structural reinforcement.

FAO's technical literature on deepwater trawling describes V-shaped designs as an option where stable operation and low resistance are priorities (FAO, 2003).



3.4. Cambered or hydrodynamic otter boards

These boards have a deliberately curved cross-section or hydrofoil-like profile that produces a useful lateral force as water flows around the surface. Their geometry is developed to obtain adequate spreading force without unnecessarily increasing drag.

Advantages

- Potentially high hydrodynamic efficiency.
- Can reduce the towing resistance required for a specified spreading force.
- May improve operating stability when the profile and rigging are properly matched.

Disadvantages

- Greater design and manufacturing complexity.
- Performance may deteriorate if the board operates outside its intended range of angles or speeds.
- Repairing a damaged hydrodynamic profile may be more difficult than repairing a simple plate.

Hydrodynamic testing is important because board performance depends on the interaction between geometry, flow velocity and angle of attack (Sala et al., 2016).



3.5. Slotted or perforated otter boards

These boards contain openings or slots through which some water can pass. The openings alter the flow around the board and may influence drag, lift, turbulence and stability. Their effectiveness depends on the size, arrangement and proportion of open area.

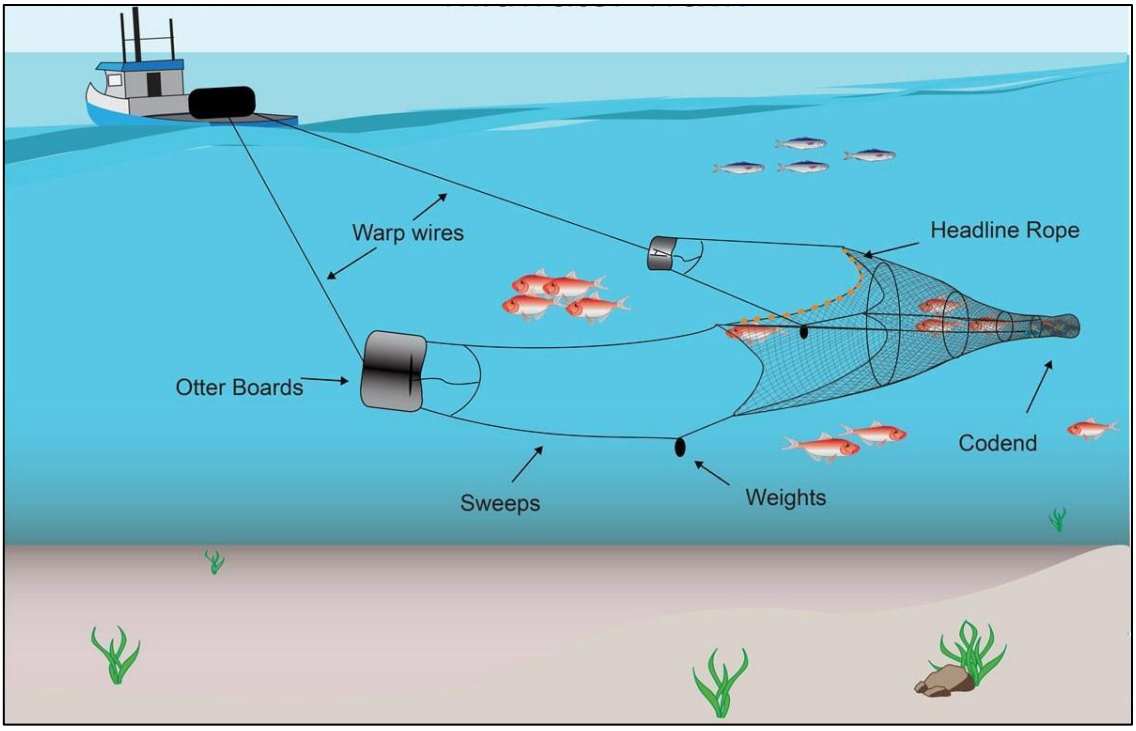
Advantages

- May improve flow characteristics and reduce undesirable pressure differences in selected designs.
- Can be engineered to balance spreading force and drag.
- Offer opportunities for design optimization and specialized applications.

Disadvantages

- Excessive open area may reduce the spreading force.
- Openings and structural members may collect debris or suffer damage.
- The benefits cannot be assumed without testing the complete board design.

Slotted and perforated designs should be assessed experimentally rather than treated as universally more efficient than solid boards.



3.6. Pelagic or midwater otter boards

Pelagic boards are designed for towing a trawl within the water column rather than continuously along the seabed. They are generally configured to provide horizontal spread while allowing the gear to operate at a controlled depth.

Advantages

- Suitable for targeting pelagic and semi-pelagic species.
- Can reduce direct seabed contact when operated correctly.
- Allow fishing depth to be adjusted through gear configuration, towing speed and other operational controls.

Disadvantages

- Require careful control of depth, speed and gear geometry.
- Accidental seabed contact may damage the gear and disturb bottom habitats.
- Their design and operating requirements differ from those of conventional bottom-trawl boards.

Pelagic boards should not be confused with bottom boards: the two are designed for different operating conditions and contact requirements (FAO, 2020).

Note: The images above are illustrative visual references to the named designs; they are not engineering drawings or comparative test results.

4. Advantages of otter boards in trawl fishing

The use of appropriate otter boards provides several operational and economic benefits.

Enhanced net opening and fishing coverage: Otter boards maintain the lateral spread of the trawl, allowing the net to cover a wider fishing path than it could without a spreading mechanism.

Potential improvement in catch per unit effort: Effective spreading and stable gear geometry can improve fishing performance. The magnitude of improvement depends on target species, stock availability, net design and operating conditions.

Improved control of trawl geometry: Properly selected boards help maintain consistent door spread and wingspread, which are important for repeatable fishing operations.

Potential fuel savings: Hydrodynamically efficient boards may reduce resistance for a given spreading force. However, the reduction in fuel consumption must be established under comparable fishing conditions.

Adaptability to different fisheries: Different board designs allow the gear to be adapted to bottom trawling, midwater trawling, deepwater operations and different vessel capacities.

Opportunities for reducing environmental impact: Carefully designed and rigged boards may reduce seabed pressure or the area disturbed. These benefits are most meaningful when evaluated alongside sweeps, bridles, ground gear and overall fishing effort (Valdemarsen et al., 2007).

5. Disadvantages and operational limitations

Despite their importance, otter boards have limitations that must be considered during gear selection and operation.

Additional towing resistance: Boards produce drag as well as spreading force. Excessive drag increases the power required to tow the net and may raise fuel consumption.

Seabed disturbance: Bottom-trawl doors can disturb sediments and benthic organisms. The extent of disturbance depends on board weight, contact geometry, sediment type, towing speed and fishing frequency (Valdemarsen *et al*., 2007).

High initial and maintenance costs: Heavy-duty metal boards, specialized hydrodynamic designs and associated rigging may require substantial investment, inspection and repair.

Sensitivity to incorrect rigging: Incorrect attachment-point positions, unequal warp lengths, unsuitable angles of attack or damaged components can cause unstable operation, asymmetric spreading and poor net performance.

Risk of gear damage: Contact with rocks, uneven seabeds or submerged obstacles can damage boards and associated towing components. Such failures can also create operational and safety risks.

Limited suitability across fishing conditions: A board optimized for deepwater bottom trawling may not perform well in a shallow-water pelagic fishery. Board selection must therefore be based on the intended application rather than shape alone.

6. Factors governing otter-board selection

Selecting an appropriate board requires consideration of the vessel, net, target species and fishing environment.

Selection factor	Why it matters
Vessel engine power	Determines the available towing power and permissible gear resistance.
Trawl-net dimensions	Influences the spreading force required to achieve the intended net opening.
Target species	Determines whether bottom, off-bottom or midwater operation is appropriate.
Fishing depth	Affects warp length, gear geometry and the stability required during deployment.
Seabed conditions	Determines the suitability of bottom-contact arrangements and the need to limit disturbance.
Towing speed	Influences hydrodynamic forces, drag and operating stability.
Construction and maintenance	Affects service life, repair requirements and total operating cost.

Board selection should be supported by design calculations, manufacturer specifications and, where feasible, flume-tank or other hydrodynamic testing. Comparative sea trials should measure door spread, wingspread, towing resistance, catch per unit effort and fuel consumption under comparable conditions. Where bottom contact occurs, the evaluation should also consider seabed interaction.

7. Towards efficient and responsible trawl fishing

Future improvements in otter-board technology should focus on combining high hydrodynamic efficiency with reliable operation and reduced environmental impact. Computational fluid dynamics, controlled model testing and onboard gear-monitoring systems can help researchers evaluate board geometry and operating conditions.

High-aspect-ratio boards, lighter constructions and configurations that reduce unnecessary seabed contact are potential approaches to mitigating environmental impacts. However, reducing bottom contact can also affect the herding of target species and, consequently, catch efficiency. This trade-off must be assessed for the specific fishery rather than assumed to have the same outcome in every situation (Valdemarsen *et al*., 2007).

In addition, correct rigging, regular inspection, appropriate towing speed and the use of gear-monitoring instruments can improve operational consistency. Sustainable fishing requires attention not only to the board itself but also to mesh selection, bycatch reduction, fishing-ground management and compliance with applicable fisheries regulations.

CONCLUSION

Otter boards are indispensable components of conventional otter-trawl systems because they maintain horizontal net opening and influence the efficiency, stability and operating cost of fishing gear. Flat rectangular, curved or oval, V-shaped, cambered, slotted and pelagic boards provide different combinations of spreading force, drag, stability and suitability for specific fishing conditions.

No single design is best for every fishery. An appropriate choice depends on the vessel's towing capacity, net dimensions, target species, depth, seabed conditions and operational requirements. While improved designs can enhance hydrodynamic efficiency and potentially reduce fuel use and seabed disturbance, their benefits must be verified through appropriate testing and field evaluation.

For fisheries professionals and fishing-vessel operators, the objective should be to select and rig otter boards that deliver reliable net spread and effective fishing performance while controlling operating costs and environmental impacts. Continued collaboration among fisheries engineers, researchers, manufacturers and fishers will be essential for developing efficient and responsible trawl-fishing systems.

REFERENCES

FAO. (2003). Deep Sea 2003: Conference on the Governance and Management of Deep-sea Fisheries. Part 1: Conference reports. Food and Agriculture Organization of the United Nations, Rome. FAO publication.

FAO. (2005). Cephalopods: Octopus, cuttlefish bottom trawling. Fisheries and Aquaculture, Fishing Techniques. Food and Agriculture Organization of the United Nations. FAO technical fact sheet.

FAO. (2020). Hake bottom trawling. Fisheries and Aquaculture, Fishing Techniques. Food and Agriculture Organization of the United Nations. FAO technical fact sheet.

Narayanappa, G. (1968). On the relative catch efficiency of different shaped otter boards in bottom trawling. Fishery Technology, 5(1). Society of Fisheries Technologists (India). ICAR journal record.

Sala, A., Prat, J., Antonijuan, J., & Lucchetti, A. (2016). Testing otter board hydrodynamic performances in wind tunnel facilities. Ocean Engineering. ScienceDirect article.

Valdemarsen, J. W., Jørgensen, T., & Engås, A. (2007). Options to mitigate bottom habitat impact of dragged gears. FAO Fisheries Technical Paper No. 506. Food and Agriculture Organization of the United Nations, Rome. Full publication.

7. FAO. (2001). Fishing gear types: Otter trawls. In A fishery manager's guidebook (2nd ed., see also relevant technical chapters). Food and Agriculture Organization of the United Nations. FAO fisheries management reference.