SCIENTIFIC COMMITTEE
TWENTY-SECOND REGULAR SESSION
11-19 August 2026
Apia, Samoa (Hybrid)

A NEW EMERGING TERMINAL DEVICE IN PELAGIC LONGLINE SWORDFISH FISHERIES: A MINI-REVIEW

WCPFC-SC22-2026-EB-IP15
12 July 2026

Submitted by José Carlos Báez[1],*, and Andrés Domingo[2]

[1] Centro Oceanográfico de Málaga, Instituto Español de Oceanografía – Consejo Superior de Investigaciones Científicas (IEO-CSIC), PH4C+Rw, Distrito Centro, 29002 Málaga, Spain; josecarlos.baez@ieo.csic.es
[2] CICMAR Centro de Investigación y Conservación Marina, Canelones, Uruguay; dimanchester@gmail.com

Abstract

Loop lines (also known as traplines) represent a recent innovation in pelagic longline fisheries, particularly targeting swordfish (Xiphias gladius). Originating in Japanese fisheries during the mid-2000s, their use has expanded across the Pacific, Atlantic, and Mediterranean, yet remains poorly documented in fishing gear classifications and scientific literature. Loop lines consist of concentric monofilament loops attached to the branchline, replacing the conventional hook-and-bait terminal component. Available evidence suggests that this device may enhance swordfish catch rates while exhibiting high selectivity and reduced bycatch of non-target species such as seabirds and turtles. Preliminary observations also indicate size selectivity towards medium-sized individuals. Despite these potential advantages, concerns remain regarding fish welfare, meat quality, operational efficiency, and the risk of increased plastic pollution through gear loss. Given their growing adoption and possible implications for stock assessment, ecosystem impacts, and fisheries management, systematic data collection and observer-based studies are urgently needed to properly characterize their performance and environmental effects.

Keywords: Bycatch; fishing device; longline

Key Contribution: Loop lines appear to constitute a highly selective alternative to conventional hook-based pelagic longlines, with preliminary evidence indicating substantially reduced bycatch of vulnerable non-target species.

1. Introduction

The emergence of so-called loop lines/traplines (also spelled as trap-lines) or Meka-rings in pelagic longline fisheries, represents one of the most recent technological developments in the capture of tuna and tuna-like species, particularly in fisheries targeting swordfish (Xiphias gladius) [1-2].

From a technical perspective, loop lines consist of several loops of different sizes, typically seven, although the number may vary from four to eight and occasionally up to thirteen. These loops are made of 2.0–2.5 mm nylon or polyamide monofilament, depending on the availability of material stored on board or materials available at local markets. The diameter of the loops ranges from approximately 30 cm to 50–70 cm within a single device. A loop line typically requires approximately eight fathoms (14.63 m) of nylon monofilament . This line is folded to form a series of concentric loops of increasing diameter. Once the desired configuration has been achieved, the loops are gathered and secured together using adhesive tape, creating a central anchoring point from which an artificial lure, generally resembling either a fish or a squid, is suspended (Figure 1). In addition, battery-powered LED lights or chemical light sticks are commonly incorporated into the device to enhance its visual attractiveness.

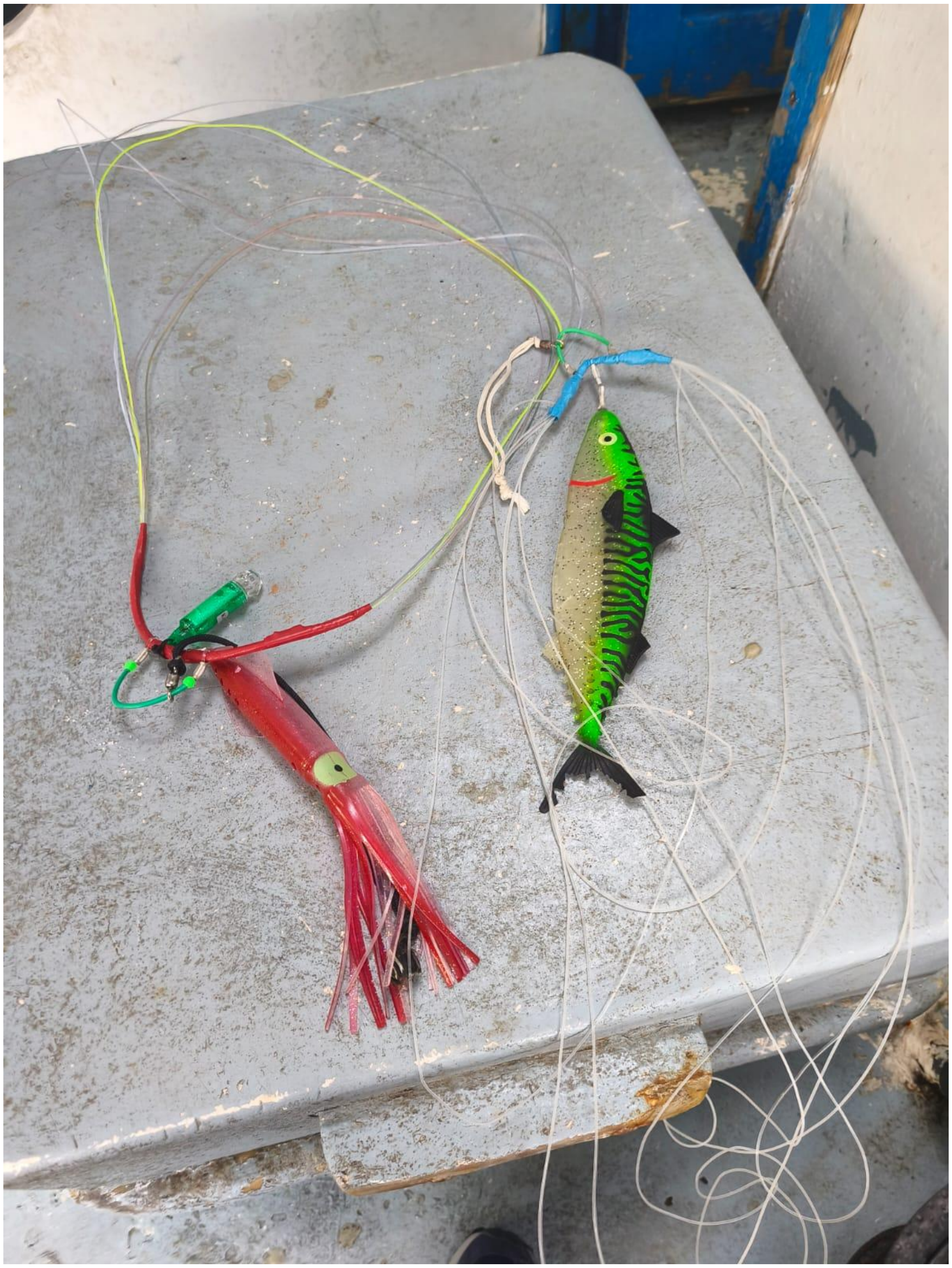

Figure 1. General appearance of two different loop lines with artificial bait.

Immediately above the artificial lure, at the central junction where all loops converge, a short section of monofilament is fashioned into a small attachment loop. This attachment point serves to connect the trapline to the branchline. The attachment loop is secured to the concentric loops using metal crimps and, in some designs, is covered by a protective sleeve to reduce abrasion and improve durability (Figure 2).

Although artificial lures and battery-powered lights are frequently deployed together, some Asian fleets use loop lines equipped exclusively with lights, and no artificial lure. These fleets commonly employ waterproof LED lights of various colours that are automatically activated when in contact with seawater [3].

The finished loop line is attached to the branchline either by means of a swivel snap or, alternatively, by suspending it directly from the hook of an existing branchline. The latter configuration allows conventional pelagic longlines to be rapidly modified into mixed hook–loop line systems without substantial changes to the overall gear configuration.

The loop line device is composed of several components: (1) Multiple nylon or polyamide monofilament loops; (2) artificial bait; (3) battery-powered or chemical light, i.e. an electronic light source attached to the device to enhance attraction of target species, particularly during low-light conditions; (4) a protective lining surrounding the central section where the loops are bundled together, providing reinforcement and reducing abrasion; (5) a fastening structure, often secured with staples, used to connect the device to a swivel, branch line, or other fishing gear components; and (6) a weight incorporated into the device to improve its stability and maintain the desired fishing depth and orientation in the water column (Figure 2). However, this configuration is flexible and may vary from fleet to fleet, with some omitting elements such as the battery-powered light, the protective sleeve, or even the artificial lure. In particular, certain Asian fleets have been observed deploying loop lines equipped just with lights and no lures [4].

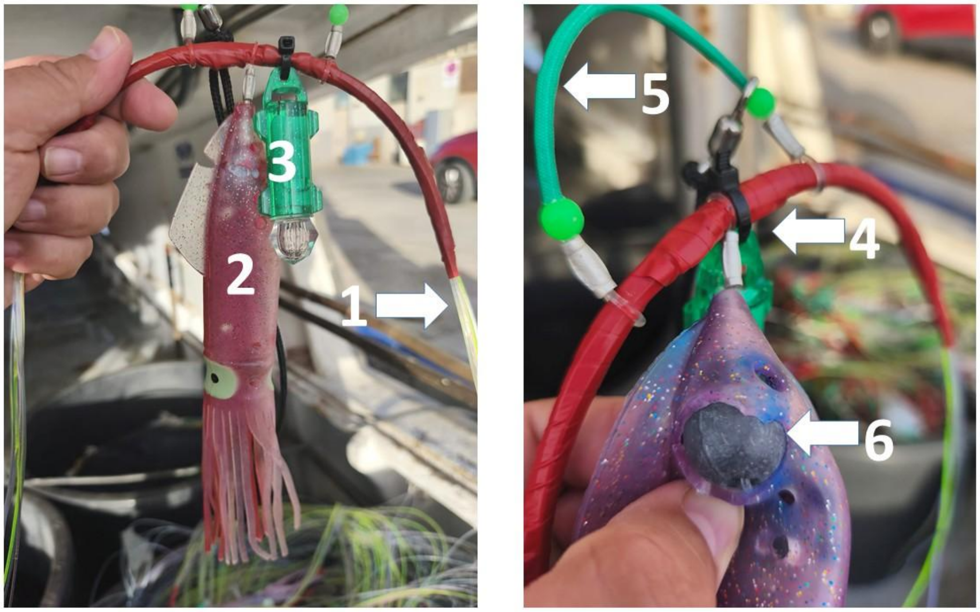

Figure 2. Main components of loop lines: (1) monofilament nylon loops (rings); (2) artificial bait (lure); (3) battery-powered light; (4) loop covering or protective sleeve; (5) attachment piece (connector); and (6) lead weight (sinker),.

The loop line device is designed to increase swordfish catches in pelagic longline fisheries. Although the mechanisms underlying its apparent effectiveness remain poorly understood, it is hypothesized that swordfish are attracted to the artificial lure and attempt to strike it with their bill. During this interaction, the bill, head, or front part of the body becomes entangled in the multiple concentric monofilament loops. Once entangled, the fish is unable to free itself, resulting in its capture without the need for a conventional hook.

Although they were initially developed by Japanese fishermen to catch swordfish in diamond squid (*Thysanoteuthis rhombus*) fisheries in the mid-2000s [3], these concentric ring traps (loop lines) have spread from the Pacific Ocean to the Mediterranean and the Atlantic [3, 5-6]. Though some researchers have noted the use of this device in their fleets since 2018, it was only in 2024 that the Standing Committee on Research and Statistics of the International Commission for the Conservation of Atlantic Tunas (ICCAT) documented its use [3, 5-6].

Scientific knowledge about the characteristics and use of this device is very limited. At present, loop lines are not deployed as independent fishing gear but rather as a modification of conventional pelagic longlines. Existing longline configurations have been progressively adapted to incorporate loop lines alongside conventional baited hooks, with the proportion of hooks to loop lines typically ranging from approximately 3:1 to 1:1. Consequently, most commercial fisheries currently employ mixed terminal configurations in which both capture devices are deployed simultaneously within the same fishing set. This operational characteristic is critical for assessing catch rates of mixed gear versus only hooksbecause loop line deployment inevitably reduces the number of baited hooks and modifies the overall fishing stimulus generated by the gear. Therefore, observed differences in CPUE, catch composition, and selectivity cannot be attributed solely to the terminal capture device but also reflect changes in the configuration and fishing dynamics of the entire longline system.

The apparent improvement in the catchability of swordfish, particularly adult and sub-adult individuals, together with a potential reduction in the capture of juveniles and non-target species, highlights two important considerations [2, 7-10]. First, it raises important management challenges regarding how fisheries should be regulated when terminal devices with markedly different selectivity profiles are deployed, particularly given the currently limited information on the proportions and configurations in which loop lines are incorporated into pelagic longlines. Second, this emerging terminal device may offer significant opportunities to improve the selectivity and environmental sustainability of pelagic longline fisheries by increasing target-species catches while reducing bycatch.

The adoption of loop lines is so recent that they have not yet been formally described or classified in the most recent international fishing gear catalogues or gear classification systems [11-12]. This lack of formal recognition further emphasizes the need to standardize their description, improve data collection protocols, and explicitly incorporate their use into fisheries monitoring and observer programs, and stock assessment systems.

2. Current knowledge on loop lines

To date few studies have analyzed actual data from scientific observers. However, the few existing studies agree in pointing out that loop lines have the potential to substantially modify catch dynamics by improving swordfish selectivity while reducing bycatch [2, 7-10].

A study by Italian researchers shows that loop lines almost doubled swordfish CPUE and LPUE while capturing significantly larger fish and dramatically reducing bycatch [7]. Despite representing only about 30% of the deployed terminal gear, looplines accounted for approximately half of all marketable swordfish captured, suggesting substantially greater fishing efficiency than conventional hooks.

A study by Portuguese researchers study considerably expands this evidence using a much larger dataset collected from commercial fisheries in the eastern Atlantic [8]. More than 560 fishing sets and over 640,000 hook and loop lines were monitored, allowing statistical comparisons between hooks and loop lines. The results from the Portuguese fleet largely confirm the findings of Italian scientists, showing significantly higher swordfish CPUE, greater size selectivity, and pronounced reductions in bycatch, particularly for pelagic sharks such as blue shark (Prionace glauca) and shortfin mako (Isurus oxyrinchus) [8]. Unlike the Italian researchers' study, which focused on a single vessel and season, the Portuguese researchers study shows that these advantages persist across multiple vessels and fishing trips, providing stronger quantitative support for the ecological benefits of loop lines [8].

A study by Spanish researchers complements these findings by recognizing that trapline performance depends strongly on fishing strategy and gear configuration. Thus, while loop lines consistently increased the proportion of swordfish within total catches and reduced incidental catch, responses varied among métiers depending on deployment depth, loop lines placement on the gear, and operational practices [2, 9]. These findings suggest that loop lines should not be evaluated as an isolated terminal device but as part of an integrated fishing system whose performance depends on overall gear configuration.

A study by Japanese researchers addressed a different but equally important question by evaluating whether the use of Meka-rings—the Japanese equivalent of loop lines—could bias the standardized CPUE indices used in Atlantic swordfish stock assessments [10]. Unlike the others studies, its primary objective was not to assess fishing performance but to quantify the adoption of this terminal device by the Japanese longline fleet. More recent preliminary results presented by Matsushita et al. [13] indicate that the use of Meka-rings varies markedly among ocean basins, representing approximately 2.0–2.1% of deployed terminal devices in the Atlantic, 0.1–10.1% in the eastern Pacific, 0.1–33% in the northwestern Pacific, 1.2–20% in the southwestern Pacific, and 0.8–9.1% in the Indian Ocean. These findings show that, although the technology remains relatively uncommon in the Atlantic and is therefore unlikely to have a significant influence on standardized CPUE indices in this region [10], its use is already substantial in several Pacific fisheries and is progressively expanding across multiple ocean basins. Consequently, the systematic recording of loop-line deployment, together with the development of gear-specific CPUE standardizations, should be considered a priority before increasing adoption compromises the comparability of historical abundance indices used in swordfish stock assessments by tuna Regional Fisheries Management Organizations (tRFMOs).

Taken together, the four studies reveal a remarkable consistency in their main conclusions. All report improved swordfish selectivity, reduced interactions with non-target species, and evidence of enhanced catch efficiency associated with loop lines [2, 7-10]. Differences among studies primarily reflect variations in fishing métiers, fleet characteristics, and study objectives rather than contradictory biological responses.

In any case, it is necessary to obtain more information, such as datasets collected by scientific observers, to better understand and robustly assess this device.

3. Conclusion

In conclusion, the available evidence suggests that loop lines constitute an emerging and potentially transformative terminal device in pelagic longline fisheries targeting swordfish. Preliminary observer-based studies consistently indicate higher catch efficiency for the target species, reduced catches of juveniles, and substantially lower bycatch rates of vulnerable non-target taxa, including pelagic sharks, sea turtles, and seabirds. However, important uncertainties remain regarding their operational performance, long-term ecological consequences, and their implications for fisheries-dependent data used in stock assessments.

A particularly important concern is that loop lines appear to have been progressively adopted by several fleets over at least the last decade without being systematically recorded in fisheries statistics, observer programs, or logbooks. Consequently, historical CPUE series used by tRFMOs may already include unaccounted changes in catchability associated with this modified fishing métier. If left undocumented, such changes could compromise the comparability of historical abundance indices and potentially influence stock assessment outputs for swordfish. For this reason, the development of standardized descriptions, dedicated observer protocols, and harmonized data collection systems should be considered a priority by tRFMOs and national fisheries administrations. Information on the presence, configuration, and proportion of loop lines within commercial longline sets should be collected as soon as possible to support the development of independent CPUE standardizations for fisheries using this technology. Early implementation of these measures will reduce uncertainty in future stock assessments while ensuring that management decisions continue to rely on robust and comparable fisheries-dependent data.

References

1. Domingo, A.; Báez, J. C.; Forselledo, R.; Jiménez, S. Longline, Chapter 3.1.2. ICCAT Manual. Ed. International Commission for Conservation Atlantic Tuna. 2025, Available from website: https://www.iccat.int/en/iccatmanual.html

2. Macías, D.; Moreno de la Rosa, J.; García-Barcelona, S.; Alegría, A.; Rueda, L.; Báez, J. C. Spatiotemporal distribution and bycatch associated with surface longlines using traplines in the western Mediterranean. Collect. Vol. Sci. Pap. ICCAT 2025, 82(6), 1-16.

3. Ochi D.; Shiode D.; Ijima H.; Kai M.; Semba Y. “Ring-shaped branchline” in Japanese longline fisheries. 2025, ICCAT Working document SCRS/2025/091.

4. Anonymous. Report of the 2025 Meeting of the Subcommittee on Ecosystems and Bycatch (SC-ECO). Collect. Vol. Sci. Pap. ICCAT 2025, 82(6), 1-95.

5. Garibaldi, F.; Di Natale, A.; Zava, B. A new challenge for assessing the swordfish fishery: the use of an innovative fishing gear. Collect. Vol. Sci. Pap. ICCAT 2024, 81(7), 1-9.

6. Anonymous. Report of the 2024 intersessional meeting of the Swordfish Species Group (including MSE). Collect. Vol. Sci. Pap. ICCAT 2024, 81(7), 1-59.

7. Tiralongo, F.; Giovannelli, F.; Zambetti, A.; Dimichino, B.; Baiata, P.; Pignalosa, P. Trap-Line: An Innovative Fishing Gear for Mediterranean Swordfish Fisheries. Biol. Mar. Mediterr. 2026, 30(1), 192–195.

8. Coelho, R.; Lino, P.; Barbosa, C.; Rosa, D. The Use of Traplines in the Portuguese Pelagic Longline Fleet Operating in the Eastern Atlantic. ICCAT working document SCRS/2026/001

9. Rueda, L.; Macías, D.; Moreno, J.; Borrego-Santos, R.; Alegría, A.; Salmerón, F.; García-Barcelona, S.; Ortiz de Urbina, J.M.; Báez, J.C. Preliminary Results on the Use of Traplines in the Swordfish Longline Spanish Fishery in the Mediterranean Sea. ICCAT working document SCRS/2026/047

10. Kai, M.; Ochi, D.; Tsukahara, Y.; Sato, K.; Semba, Y. Influences of Using Ring-Shaped Branch-Line (Meka-Ring) on Atlantic Swordfish CPUE in Japanese Longline Fisheries. ICCAT working document SCRS/2026/035.

11. He, P.; Chopin, F.; Suuronen, P.; Ferro, R.S.T.; Lansley, J. Clasificación y definición ilustrada de los artes de pesca. Documento Técnico de Pesca y Acuicultura de la FAO 2022, 672. Roma, FAO, pp 87. https://doi.org/10.4060/cb4966es.

12. Popescu, I.; Breuer M. Research for PECH Committee - Handbook of fishing gears used by the EU fleet, European Parliament, Policy Department for Structural and Cohesion Policies, Brussels, 2024, pp 37.

13. Matsushita, H.; Ochi, D.; Okamoto, K. Preliminary Analysis of Meka-Ring Effects on Bycatch in Japanese Longline Fisheries Based on Scientific Observer Data. ICCAT Standing Committee on Research and Statistics (SCRS), Sub-Committee on Ecosystems and Bycatch, Working Document SCRS/2026/091, 2026.