Novel mitigation methods:

hook-shielding devices & underwater bait setters



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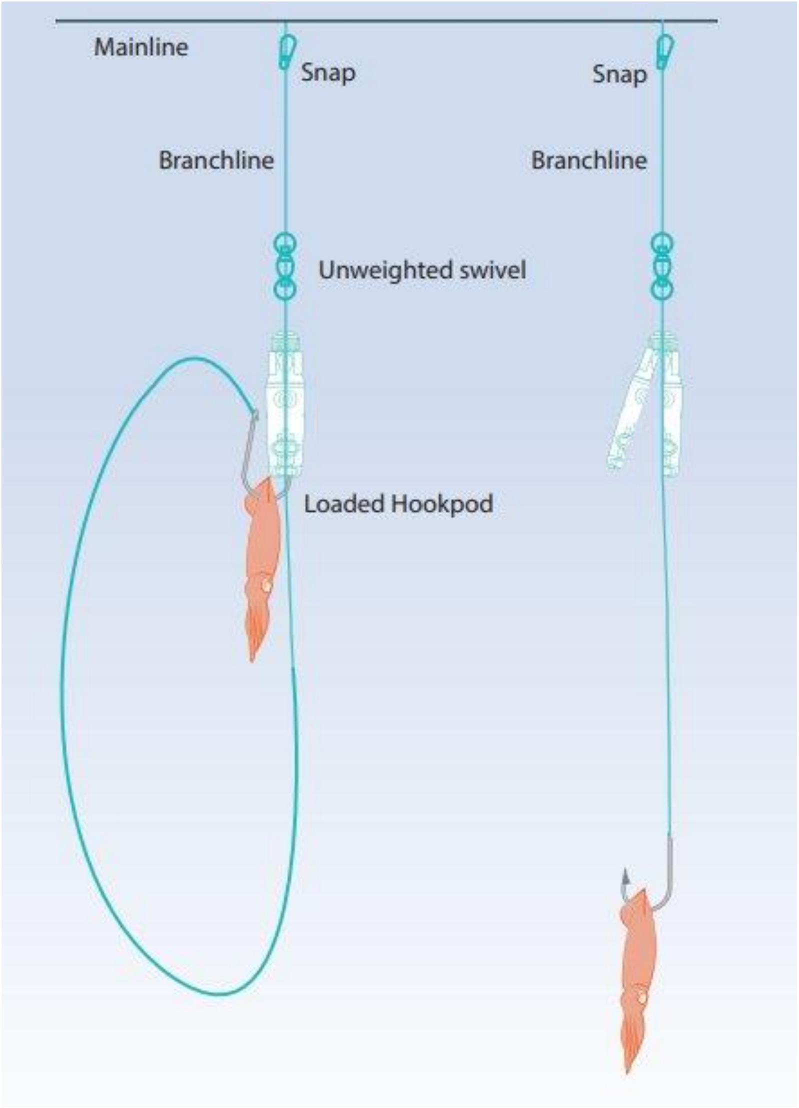
Hook-shielding devices

Hook-shielding devices are “one-stop” mitigation options in both Hemispheres.

Hookpods are the only currently approved hook-shielding device in WCPFC fisheries

Hookpods come in two forms:

- Hookpod-LED (68 g; Sullivan et al. 2018)
- Hookpod-mini (48 g; Goad et al. 2019)



Hook-shielding devices

Effect on fish catch rates	Control	Treatment(s)	Species/groups	Effect size	Location	Source
No effect	Branchlines with 60-75 g weighted swivel, 3.5 m from the hook	Hookpod-mini (48 g) with 60-75 g swivels, 3.5 m from the hook, opening at 20 m depth	Tunas (G) Swordfish (SS) Sharks (G) All other fish catch (G)		Brazil	Gianuca et al. 2021
	Branchlines with 60-80 g weighted swivel, 2-7 m from the hook with light stick; BSL	Hookpod-LED (65 g), 1-7 m from the hook, opening at 10 m depth	Tunas (G) Swordfish (SS)		Australia Brazil South Africa	Sullivan et al. 2018
Decrease	Branchlines with 60-80 g weighted swivel, 2-7 m from the hook, plus light stick; BSL	Hookpod-LED (65 g), 1-7 m from the hook, opening at 10 m depth	Sharks (G)	-0.14*	Australia Brazil South Africa	Sullivan et al. 2018
	Branchlines with 60-80 g weighted swivel, 2-7 m from the hook with light stick; BSL	Hookpod-LED (65 g), 1-7 m from the hook, opening at 10 m depth	All other fish catch (G)	-0.21*	Australia Brazil South Africa	Sullivan et al. 2018

Pierre 2023

Hookpods do not decrease catch rates of tunas or swordfish

Target catch rates impacts for other species were mixed and would benefit from further studies

Hook-shielding devices

Location	Bycatch rate per 1,000 hooks		Notes	Source
	With measure	Without measure		
South Africa Brazil Australia	0.04	(with BSL, branchline weighting) 0.8	(u) A single seabird capture occurred when hookpods were deployed.	Sullivan et al. 2018[+]
Brazil	0	0.13	(u) Without measure = vessels without gear containing hookpod-mini units	Gianuca et al. 2021

Pierre 2023

Hookpods substantially decrease seabird bycatch and have lower BPUE than other bycatch mitigation measures

Hook-shielding devices

Hookpods have several practical considerations:

- They are fairly expensive (~$10, but this is potential offsets if light sticks are replaced)
- There is a potential for seabird entanglement in the looped length of the branch line?
- Resetting Hookpods may take additional time (which may be offset when light sticks are used)
- Training is required when using and fitting Hookpods
- Hookpods will need replacements over time
- Hookpods function similarly as a sliding weight in case of a bite-off

As Hookpods are the only currently approved devices in WCPFC, are there any other devices that should be considered for approval within WCPFC?

Underwater bait setter

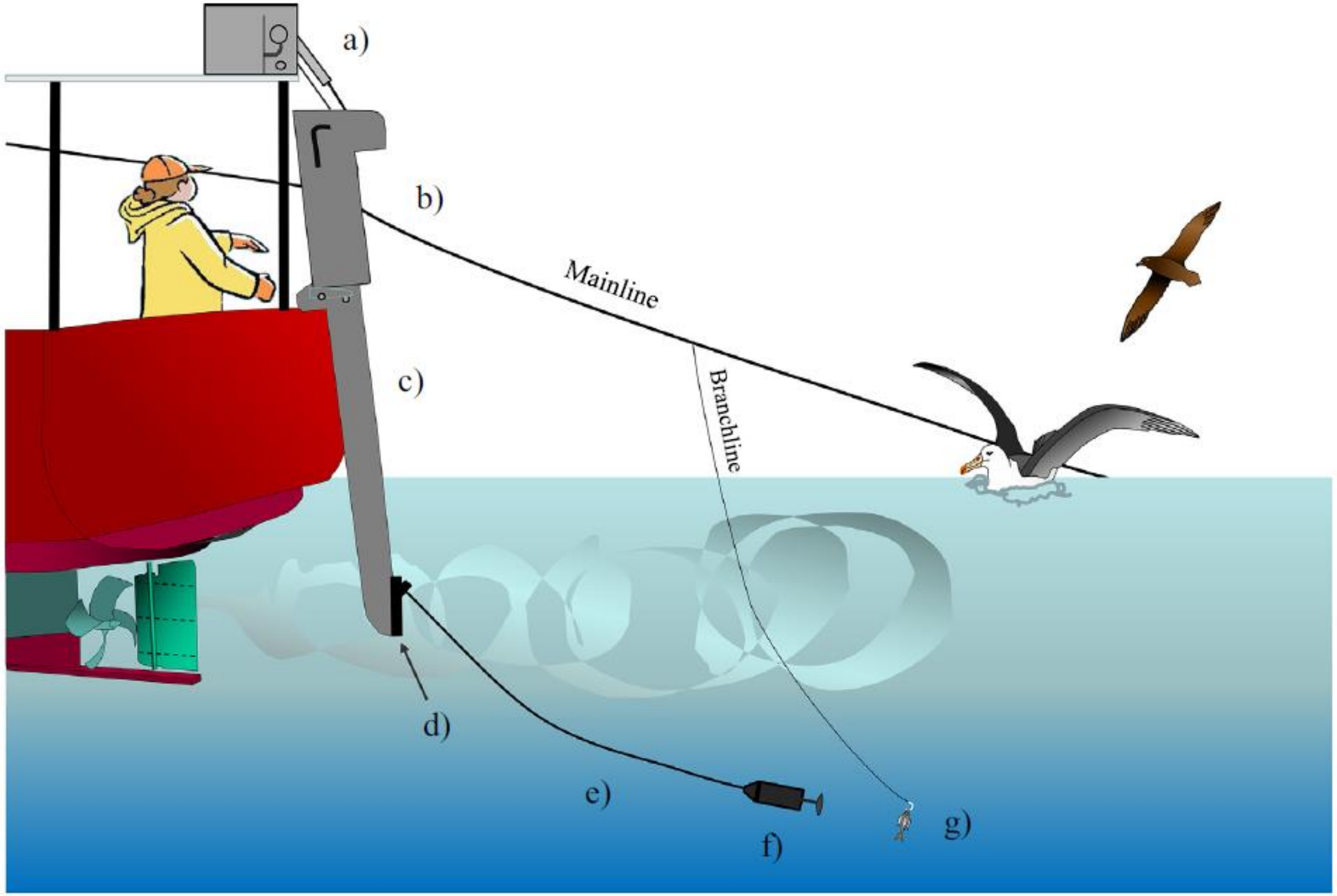


Fig. 1. Schematic showing the main components of the underwater bait setting capsule. Not shown are the systems control units in the wheelhouse and on the back deck. Modified slightly from Robertson et al. (2015).
a) Winch assembly unit – comprises hydraulic motors, winches, Spectra rope and electronics; b) Head section of track assembly – maintains the bait capsule in position prior to bait loading and deployment. Folds inboard when not in use; c) Track assembly – guides the capsule (and capsule docking cart) to bottom of the track where it is hydraulically catapulted to target depth. Raised from water when not in use; d) Capsule docking cart – holds capsule in position on the track; e) Spectra rope - connects capsule to winch assembly unit; f) Bait holding capsule – shown with bait release door extended; g) Baited hook released from the capsule.

Robertson et al. 2015, 2018

Underwater bait setter

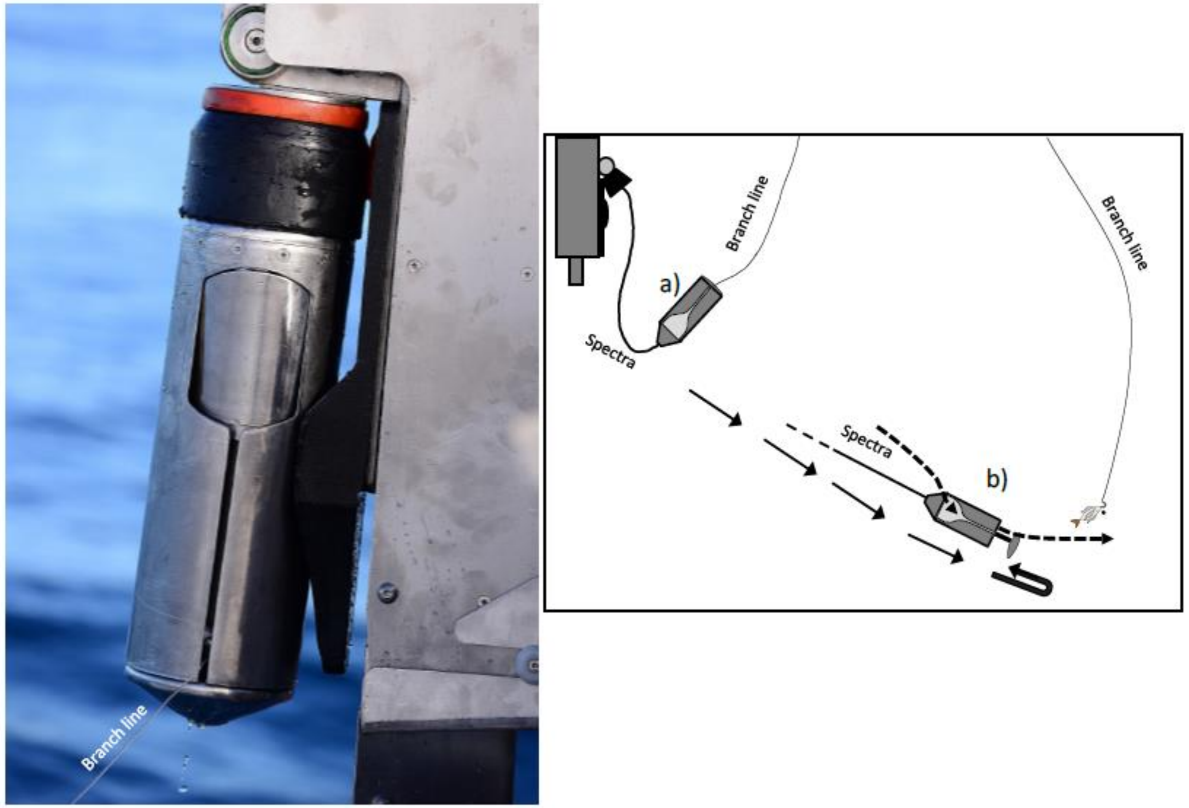


Figure 2. Left: The capsule and capsule docking cart in the home position in the head section of the track assembly. The bait loading window (with spring-loaded flaps) is shown at the top section and the bait exit door is shown at the bottom of the capsule in the closed position. The stainless steel capsule can be powder coated matt black in colour to reduce visibility underwater. Right: Stylised diagram of the behaviour of the capsule underwater. The capsule is catapulted free of the docking cart a), flips upside-down and free-falls to target depth. The recovery motor then engages, reversing the profile of the capsule and opening the spring-loaded flaps over the bait windows b). Water travels through the capsule (curving dashed line) opening the bait release door at the base of the capsule, releasing the baited hook. Diagram not to scale.

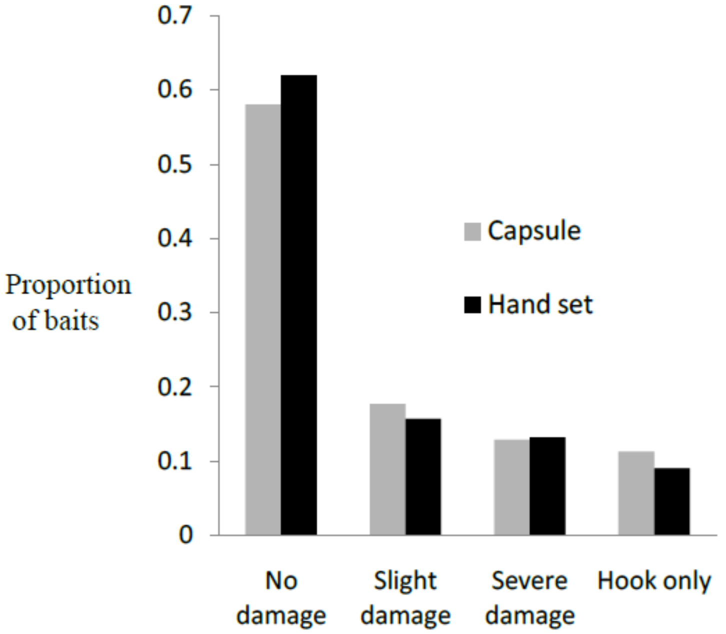


Figure 4. Proportion of baits in bait damage classes as a function of branch line setting method. See text for interpretation of damage classes. N = 130 deployments for each method.

Robertson et al. 2015

Underwater bait setter

Robertson et al. 2018

Taxa	Surface set catch rate (per 1000 hooks)	Underwater set catch rate (per 1000 hooks)	% Change
Seabirds	**1.34 (0.60, 2.40)**	**0.16 (0.01, 0.55)**	**-87.0 (-58.0 - -99.0)**
Swordfish	9.50 (6.59 - 13.70)	9.42 (6.54 - 13.57)	-0.82 (-23.84 - 29.1)
Yellow-fin Tuna	0.78 (0.24 - 1.54)	0.80 (0.25 - 1.63)	9.57 (-50.19 - 118.37)
Albacore	2.72 (1.14 - 6.49)	2.82 (1.18 - 6.71)	3.49 (-20.98 - 32.54)
Blue Shark	45.89 (30.31 - 69.49)	43.59 (28.78 - 66.03)	-5.02 (-14.15 - 5.09)
Other commercial fish	4.92 (2.75 - 8.79)	5.35 (3.00 - 9.53)	8.81 (-19.69 - 47.42)
Non-commercial fish	1.23 (0.53 - 2.82)	0.77 (0.32 - 1.83)	-37.5 (-62.79 - 5.00)

Trials in Uruguay illustrate that:

- Underwater bait setters reduce seabird bycatch substantially
- Underwater bait setters do not reduce target catch
- Change in other bycatch rates was absent
- Bait loss in underwater bait setters was absent & the operation was considered practical

Underwater bait setter

Considering that:

1. The underwater bait setter is a proven mitigation method,
2. The underwater bait setter does not reduce target catch,
3. The underwater bait setter is a practical method, and
4. Innovation should be encouraged throughout WCPFC,

Should the underwater bait setter be considered an effective mitigation method, in both the Northern and the Southern Hemisphere?

References

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