 <p>Agreement on the Conservation of Albatrosses and Petrels</p>	<p><b>Thirteenth Meeting of the Seabird Bycatch Working Group</b></p> <p><i>Swakopmund, Namibia, 27 - 29 May 2026</i></p> <p><b>Final Report on ACAP Small Grants Scheme Project 2023-10 to facilitate development toward commercial availability of Procella, seabird safe hook</b></p> <p><b><i>Nigel Brothers &amp; Igor Debski</i></b></p>
---	--

## SUMMARY

Investigations into the viability of replacing conventional pelagic longline weighting with a more operationally acceptable alternative began in 2020/21. Adequate weight was incorporated into the actual hook which created a 'heavy hook' - named Procella. The aim of Procella was to improve seabird bycatch mitigation by simplifying the business of line weighting for fishermen. Progress of the Procella project, with potential advantages and disadvantages was reported to SBWG10 (SBWG10 Inf 09). Funds to develop, verify operational suitability and reach commercial production and supply, were initially provided by Humane World for Animals (Australia) in 2022 with additional funds in 2024 (ACAP Small Grants 2023-10), allowing these objectives to be largely accomplished by December 2025.

## 1. OBJECTIVES

The main objective of the Small Grants project 2023 -10 was to create a more agreeable and effective line weighting option for seabird bycatch mitigation – a pelagic longline heavy hook. The new hook needed to establish viable product materials and costs, along with providing acceptable operational and catch performance. Establishing these attributes beyond first determining the best hook design option, necessitated production of hooks in sufficient quantity (the project budget) so as to then provide fishing operations information. Such development was made possible by the result of SBWG 11 Doc 15 ie specific revision of best practice weighting guidelines in 2023 and again in 2024. The project evolved along with these guideline changes, from the original 60g version to 50g, then to 40g. It was necessary to first create an acceptable Procella product, then get evidence of adequate performance with the aim of establishing manufacture in large quantity for eventual widespread availability and use.

## 2 OUTCOMES

Two entirely different methods of weighting hooks were identified, one using lead, the other stainless steel. The lead option involved casting in a mould directly onto pre-made hooks, whereas the stainless steel required separate casting into a mould then precise spot-weld attachment of the weight to the hook.

These two processes were the only suitable options. However, there were considerable practical hurdles encountered with the use of stainless steel. Because high quality hook-making itself is a precise process, it proved problematic to disrupt this by using additional processes for incorporating weight.

Procella-catch and general operational performance was monitored over a 15-month period, June 2024 - September 2025 and, ongoing) initially based upon 10,000 of the LP60sc - lead Procella 60 g ceramic safe-coated, distributed amongst four fishing masters and crew of three vessels. During this initial trial period, of 318,797 total hooks set, 242,159 were Procella types. Aside from favourable operator opinion, target species cpue by Procella was the same or a little higher (by 4 target fish species/1,000 hooks) than other hook types and in combination with additional mitigation measures, **caused no line setting seabird deaths** (Table 1). Further Procella performance summary information (Goad & Schweder-Goad 2025) is generally supportive of these results.

Based on such early favourable performance indicators, further hook factory developments focussed on two objectives - a 10 g weight reduction still giving adequate sink rate performance in alignment with the new (Aug 2024) ACAP criterion plus, if at all economically and practically possible, substitute lead material for a more environmentally agreeable similarly dense (heavy) metal option. As a result, there was a trial manufacture of 6,000 SP50 (stainless Procella 50 g), and these helped to verify that there was no operational difference between 50 g and 60 g hook versions. A further 100 Procella of a 50 g lead safe-coated copper, nickel, chrome combination version (P50sc) underwent endurance trials owing to viability issues encountered in successful production of SP50, LP50 and safe coating. In keeping with the pelagic longline sink rate criterion of 5 m depth in under 10 seconds (created in August 2024) this was achieved with 40g inclusive of hook weight and commercial availability was reached in Dec 2025 with the placement of an initial order of a small quantity of 40 g size 14/O (1500) and 16/O (400) hooks. Hook weight reduction from 60g to 50g, then to 40g made smaller hook inclusion in the Procella product range viable. This final stage of development was reached using all remaining project funds (including matching funds from BLI) which allowed supply of hooks to other fisheries with seabird problems.

Vessel acceptance of SP50 performance plus indications of safe-coat viability brought Procella to the stage of commercial fabrication-readiness by August 2025.

Table 1. Vessel Operator Logbook Summary of Procella Hook Performance June 2024 to September 2025. The figures in the shaded area are based on a subset of the total amount of fishing effort.

Description	Amount
Number of trips	66
Number of sets	260
Total hooks set	318,797
Procella hooks set	242,159
Other hook types set	72,880
Total target fish caught	6,211
Seabirds caught due to mitigation failing	0
Seabirds caught NOT due to mitigation failing	3
All hook types lost to bite off	2,415
All hook types lost to cut off	1,703
All hook types - loss to either cut off or bite off	4,377
All hook types - loss rate per 1000	13.7

Target fish caught on Procella hooks	2,983
Target fish caught on other hooks	900
CPUE of Procella (fish per 1,000 hooks)	20.5
CPUE of other hooks (fish per 1,000 hooks)	16.0
CPUE of all hook types combined	18.0
Procella hooks lost to bite off	830
Procella hooks lost to cut off	798
Other hook types lost to bite off	145
Other hook types lost to cut off	89
Procella hooks loss rate per 1,000	17.4
Other hooks loss rate per 1,000	10.2
Procella hooks lost total	2,062
Other hooks lost total	485

Table 2. Summary of Procella hooks manufactured and supplied to fishing industry 2024 - to 2025.

Procella type	Description	Weight inclusive of hook	Quantity
LP60sc	16/O hook lead safe coat ceramic	60g	10,000
SP50	16/O hook all stainless	50g	6,000
LP50sc	16/O hook lead safe coat Ni Cu Cr	50g	100
LP40sc	14/O & 16/O lead safe coat Ni Cu Cr	40g	900

### 3. EXPENDITURE

Expenditure was in accordance with the Small Grants AU\$38,000 allocation, additional to AU\$20,000 commitment by Humane World for Animals (Australia). Majority of the outlay was directly to Segye Fishing Hooks Co Ltd in Busan, Korea, for hook developments, manufacturing and supply.

Budget item expenditure breakdown.

Total Budget available AU\$58,000 - AU\$38,000 (14/03/24), plus AU\$20,000 (23/12/24).

Date	Expenditure item	Amount in AUD
15/03/2024	South Korea hook factory pre-payment security verification	\$120.31
20/03/2024	Pre-manufacture 50% deposit for 10,000 Procella hooks – LP60sc, and ceramic safe coat development in South Korea (less security payment)	\$10,256.22
18/04/2024	Pre-shipping 50% remainder hook payment	\$10,452.34
24/12/2024	Pre-manufacturer 50% deposit for 6000 Procella hooks -SP50, and all stainless process investigations in Sth Korea & China	\$16,963.25

11/04/2025	Pre-shipping 50% remainder hook payment	\$17,073.99
14/04/2025	Customs and handling NZ hook import fees	\$363.43
21/04/2025	Supply of 150 Procella – LP50sc and alternate safe coat product investigations in South Korea	\$358.53
30/04/2025	Postage from Korea to Aust of 150 Procella for safe coat trial (LP50sc)	\$137.50
30/04/2025	Postage from Aust to NZ of 100 Procella for safe-coat trial (LP50sc)	\$98.95
24/12/2025	Supply of 1500 size 14/O and 400 size 16/O LP40	\$2,155.53
24/12/2025	Hook sample LP40 postage to NZ	\$19.95
	TOTAL	\$58,000

#### 4. UNFORSEEN DIFFICULTIES

Initial hook concept was constrained by the ACAP line weighting guidelines to a total weight of 60 g until August 2024 when the revised weighting criterion then allowed 50 g, minimum at-hook weight although a minimum sink performance criterion of 5 m depth within 10 seconds was also created at this time. This meant the best performing and more acceptable product development was delayed (three stages), with extra associated fabrication and shipping costs.

In addition, because the viability of heavy hook concept had always been based upon the premise that incorporation of lead material would be unacceptable or inappropriate, considerable R&D effort and project expense was incurred in pursuit of viable alternatives. More cost-effective and practical use of ostensibly the most economically viable material, lead, was initially first used only to prove aspects of acceptable operational performance. This was necessary to justify any further exploration of more expensive but preferred materials, still though, at hopefully an economically viable cost. And although initially a trial safe-coat was applied to the hooks incorporating lead, this proved inadequate, giving further impetus to the pursuit of all-stainless option. However successful manufacture of all-stainless Procella revealed two viability issues, too high production cost and inferior quality, which left no alternative other than return to the use of lead and eventual success in safe-coating R&D. While a combination of 10 g weight reduction with higher metal density lead use has resulted in optimal product dimensions and performance, safe-coat product costs of around 24% more than uncoated, is still thought though to be within an overall acceptable price and is 43.5% less than the all-stainless version. The cost of the stainless-steel version could possibly be lowered by 30% if Korea collaborated with China on manufacture, but this option was considered too high risk by Korea.

#### 5. REMAINING QUESTIONS AND ISSUES

Having established acceptable Procella performance, it remains to be seen whether progressive uptake will occur once commercial availability is established, for which additional funding had been secured elsewhere by Southern Seabirds Trust (NZ) in September 2025 and a further 10,000 LP50sc ordered for use in NZ by December 2025. While development has been completed, the final version Procella 40 g remains to be tested and commercially accepted. Although unavoidably more costly than standard hooks, Procella at between US\$1.39 and US\$1.43 (depending on hook size) is nevertheless price-competitive with comparable products, and multiple performance gains can substantially offset the cost differences.

The successful application of a particular safe coating product, a layered combination of Cu, Ni, Cr, can be an important new safety progression for lead fishing equipment generally, although it remains to be seen whether the cost difference (24.3% more) is going to be the ultimate sales determinant, given that uncoated products tend to be the fishery norm. In certain fisheries with relatively small hook loss rates, safe coat durability with greater hook longevity, remains to be measured.

Current Procella is based on the larger size Circle hook (16/O) which is believed to be safer for turtles, with minimum dimension (4.2 mm) shank strength, supposedly within regionally required cetacean escapement parameters and it was necessary to then accommodate product availability to suit alternate preferred hook sizes. This is a relatively simple progression, with target hook sizes of 14/O and 15/O obvious priorities. It still needs to be ascertained whether for smaller hook sizes or indeed all hook sizes, performance of a further 10 g weight reduction will still be acceptable as discussed in SBWG 13 Doc 12. Preparations were instigated with Korea hook factory in October 2025 to produce test samples of two hook sizes (14/O and 16/O) each with a total weight of 40 g, the least amount that meets the 2024 ACAP baited hook sink criterion, at least cost and arguably lower flyback risk, by comparison to the heavier Procella versions. Noteworthy also is that, despite uncertainty over the interpretation of current NZ line weighting regulations, 40 g inclusive of hook weight is already the minimum permissible at-hook configuration.

There is more to optimal performance than the simple replacement of a conventional hook with Procella. Other minor but important gear adjustments are believed to have already proven beneficial but require further understanding so as to improve successful transition across different gear configurations. Undoubtedly the most convincing evidence of Procella acceptance has been the opinion of trial operators and their progressive full conversion to Procella by choice. However, numerical performance data which will be reported elsewhere (Goad & Schweder-Goad 2025) is necessary validation of the operational gains asserted by fishing masters and indicated by their performance data records.

Efforts to find a non-toxic, technically and economically viable lead replacement has contributed to the ACAP 2023 - 2028 Work Programmes as indicated for Tasks 3.17 and 3.8 in AC14 Annex 5 and 6 respectively. Only economic pressure brought about by agreed international lead standards applicable to fisheries products, is likely to make lead replacement materials viable, irrespective of the current legitimate but problematic ACAP advice. With improved techniques more suited to the specifics of hook fabrication, along with high volume manufacture, stainless steel was identified as the only potentially satisfactory option. Although lead replacement was found to not be viable under existing circumstances, a future for weighted hooks will either entail a disregard for the perceived drawback of lead, acceptance of safe-coated lead and further product development to deliver satisfactory performance or, abandonment of the heavy hook concept along with the multiple seabird bycatch mitigation performance advantages.

Fishing master preference to operate without added weight overshadowed all perceptions of Procella benefits above alternate methods of weighting, following a serious flyback event on 14 Aug 2025. While flyback prevention options are now under review, as mandatory line weighting requirement still applies in the fishery, Procella has nevertheless preferentially remained in use, including by the highly experienced and competent fishing master who was injured under somewhat atypical circumstances.

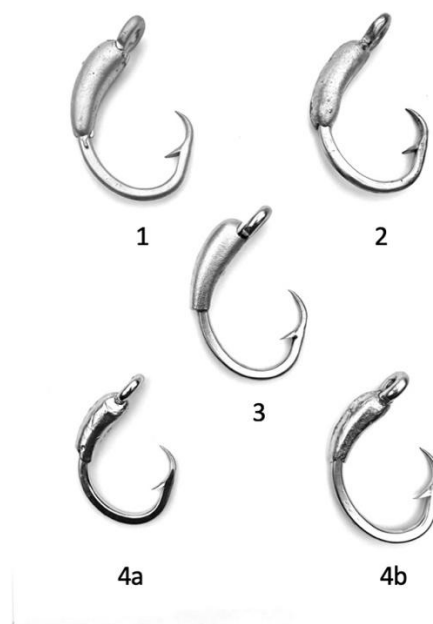


Fig 1. Procella development stages which conform to the ACAP line weighting changes.

- 1 60g ceramic safe-coated lead (22g hook+40g = 62g)
- 2 50g mixed-metal safe-coated lead (22g hook+28g = 50g)
- 3 50g all-stainless (22g hook+28g =50g)
- 4a 40g mixed-metal safe-coated lead (size14/O 16g hook+24g =40g)
- 4b 40g mixed-metal safe-coated lead (size 16/O 22g hook+18g =40g)

## REFERENCES

Brothers, N (2026) Sink rate variability in pelagic longline hook weighting regimes and methodology to demonstrate acceptable performance against the ACAP 2024 sink rate criterion SBWG13 Doc 12.

Brothers N (2023) Procella Hook development update and heavy hook inclusion in ACAP best practice pelagic longline seabird bycatch mitigation advice. In: ACAP - 11th Meeting of the Seabird Bycatch Working Group. SBWG11 Doc 15, Edinburgh, UK

Brothers N (2021) In Pursuit of Procella – a Heavy Hook for Pelagic Longlines to Reduce Procellariiforme Bycatch. In: ACAP - Tenth Meeting of the Seabird Bycatch Working Group. ACAP SBWG10 Inf 09, Electronic Meeting

Goad, D.; Schweder-Goad, C. 2025. Assessment of weighted hooks as a seabird bycatch mitigation option for surface longline fisheries. MIT2024-03. Final Report prepared by Vita Maris 9 p.

Robertson, Graham, Steven G. Candy, and Steve Hall. (2013) New branch line weighting regimes to reduce the risk of seabird mortality in pelagic longline fisheries without affecting fish catch. *Aquatic Conservation: Marine and Freshwater Ecosystems* 23.6 (2013): 885-900.

Brothers, N. (2009). Analysis of factors that affect pelagic longline fishing hook sink rate and practical safe options for making hooks sink faster to minimise risk of seabird capture. NMFS Project Number AB133F07SE5293/NFFR 7400-7-18718.