ACAP GUIDELINES TO MEASURE THE SINK RATES OF BAITED HOOKS IN PELAGIC LONGLINE FISHERIES USING TIME-DEPTH RECORDERS

AGREEMENT ON THE CONSERVATION OF ALBATROSSES AND PETRELS (ACAP)

Purpose

The purpose of this paper is to present the *ACAP Guidelines for Measuring the Sink Rates of Baited Hooks in Pelagic Longline Fisheries Using Time-Depth Recorders*, endorsed by the ACAP Advisory Committee in June 2026, as set out in **Annex 1**.

Resolution 23/07 requests the Scientific Committee to develop advice to the Commission on best practice branch line weighting. The inclusion of sink rates in the minimum standards for branch line weighting (**Section 1.1**) was considered by WPEB20 to be a positive addition for fisheries that might experience difficulties in implementing certain branch line configurations. WPEB20 requested clear protocols for measuring sink rates and agreed to continue working on this issue, with specific advice expected by 2027 following the necessary studies and the development of guidelines for sink rate measurement (**Section 1.2**). This paper aims to support the WPEB review process by providing the ACAP Guidelines for consideration in the development of advice to the Commission on best practice branch line weighting, as requested under Resolution 23/07.

Recommendations

The paper seeks endorsement of the following recommendations:

That the WPEB consider the ACAP Guidelines for measuring sink rates when continuing its work to provide advice to the Commission on best practice branch line weighting.

That the WPEB also consider ACAP's Best Practice Advice on branch line weighting when developing its advice for the IOTC Commission.

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[IOTC-2026-WPEB22-37]

ACAP Guidelines to measure the sink rates of baited hooks in pelagic longline fisheries using Time-Depth Recorders

Agreement on the Conservation of Albatrosses and Petrels (ACAP)

Abstract

IOTC Resolution 23/07 On Reducing the Incidental Bycatch of Seabirds in Longline Fisheries has tasked the Scientific Committee (SC) to develop advice on best practice branch line weighting. In 2024, the 20th Working Party on Ecosystems and Bycatch Assessment Meeting (WPEB20 AS) addressed this request. The WPEB noted that IOTC's Resolution 23/07 partially aligns with ACAP's advice, but branch line weighting remains a major area of divergence as fisheries might experience difficulties in implementing certain branch line configurations. Noting that ACAP has recently recommended that branch lines achieve a minimum sink rate under experimentally controlled conditions of 0.5 m/s to 5 m depth, WPEB has requested that ACAP develop clear protocols for measuring sink rates. In June 2026 ACAP's Advisory Committee endorsed *ACAP Guidelines for Measuring the Sink Rates of Baited Hooks in Pelagic Longline Fisheries Using Time-Depth Recorders*. This paper provides those ACAP Guidelines for consideration by WPEB when continuing its work to provide advice to the IOTC Commission on best practice branch line weighting. The WPEB is also encouraged to take into account ACAP's Best Practice Advice on branch line weighting when developing the requested advice for the IOTC Commission.

1. BACKGROUND

The incidental mortality (bycatch) of seabirds in longline and trawl fisheries continues to be a serious global concern, especially for threatened albatrosses and petrels, resulting in a Conservation Crisis being declared by the Agreement on the Conservation of Albatrosses and Petrels (ACAP) in 2019. There are currently 31 species listed in Annex 1 of the Agreement. Of the 22 species of albatrosses, 17 breed or forage in the IOTC Area, as do four of the nine listed petrel species (see IOTC-2022-WPEB18-25). Of these species, ACAP's Population and Conservation Status Working Group (PaCSWG) has assessed:

- 11 as *declining* over the last 20 years
- four as *stable*
- two as *unknown*
- four as *increasing*

Given the overlap between ACAP species and IOTC fisheries, ACAP has regularly participated in IOTC meetings and presented updates on ACAP best practice mitigation measures and guidelines, as well as on population status and trends of ACAP species.

In May 2023, IOTC reviewed the mitigation measures to reduce seabird bycatch. At the 27th Session of the Commission (IOTC S27), the Commission adopted Resolution 23/07 On Reducing the Incidental Bycatch of Seabirds in Longline Fisheries. This Conservation and Management Measure (CMM) stipulates that in the area south of 25°S, CPCs shall ensure that all longline vessels use at least two of three mitigation measures (night setting, bird scaring lines and branch line weighting) or, alternatively, use hook-shielding devices as a stand-alone measure.

Resolution 23/07 also contained elements that call on the Scientific Committee (SC) to undertake specific tasks. There is a request to the SC that specifies (para 8): "The Scientific Committee will continue to review and make recommendations to the Commission on advancements and best practice in seabird bycatch mitigation as they become available. This will include, by 2024 at the latest, developing advice to the

Commission on best practice branch line weighting." In 2024, the 20th Working Party on Ecosystems and Bycatch – Assessment Meeting (WPEB20 AS) addressed this request.

Much of the work of ACAP's Seabird Bycatch Working Group (SBWG) focuses on routinely reviewing and updating best practice mitigation advice for industrial fishing gear types (principally pelagic and demersal longline, and trawl gear). The ACAP review process recognises that factors such as safety, practicality and the characteristics of the fishery should also be taken into account when considering the efficacy of seabird bycatch mitigation measures and consequently in the development of advice and guidelines on best practice.

ACAP recommends that the most effective way to reduce seabird bycatch in pelagic longline fisheries is to use the following three best practice measures simultaneously: (1) branch line weighting, (2) night setting and (3) bird scaring lines. In addition, three hook-shielding devices and one underwater bait setting device may be used as alternative stand-alone mitigation measures.

At WPEB20, ACAP presented updates on the minimum standards for branch line weighting in pelagic longline fisheries based on the review that took place in August 2024, at the 12th meeting of the Seabird Bycatch Working Group (SBWG12), with updates endorsed by the 14th meeting of ACAP's Advisory Committee (AC14) (IOTC-2024-WPEB20AS-36).

The updated ACAP Advice on Branch line Weighting included changes defining a sink rate criterion for best practice branch line weighting and providing further clarification around the use of weight attached to or integrated into the hook as well as weighting materials (see IOTC-2024-WPEB20AS-36).

In June 2026, ACAP again reviewed the best practice mitigation advice for pelagic longline fisheries with no changes made to the ACAP advice on minimum standards for branch line weighting.

1.1. Minimum standards for the ACAP advice on branch line weighting for pelagic longline fisheries

Current minimum standards for the ACAP advice on branch line weighting for pelagic longline fisheries are as follows:

> Best practice branch line weighting should achieve a sink rate of 0.5 m/s to 5 m depth. The following configurations have been demonstrated, under controlled conditions and with metal materials, to meet this standard:

40 g or greater attached within 0.5 m of the hook; or

60 g or greater attached within 1 m of the hook; or

80 g or greater attached within 2 m of the hook.

> When weighting is attached to, or integrated into the hook, a minimum of total weight of 50 g is sufficient to achieve a sink rate of 0.5 m/s to 5 m depth. Branch line weighting is integral to the fishing gear and, compared to bird scaring lines and night setting, has the advantage of being more consistently implemented, hence facilitating compliance and port monitoring. It is recommended to avoid the use of lead when the lead may be ingested (e.g. attached to or integrated into the hook). The use of lighting devices or other fishing accessories as weights is not recommended unless they achieve the sink rate criterion.

The *ACAP 2026 Summary Best Practice Advice for Reducing the Impact of Pelagic Longline Fisheries on Seabirds* [PDF 208 KB] and the *ACAP 2026 Review of Seabird Bycatch Mitigation Measures for Pelagic Longline Fisheries* [PDF 499 KB] are available on the ACAP website. ACAP has also produced *Advice on Improving Safety when Hauling Branch lines during Pelagic Longline Fishing Operations* [PDF 726 KB].

1.2. Discussion at WPEB20 on best practice branch line weighting

WPEB20 noted that IOTC's Resolution 23/07 partially aligns with ACAP's advice, but branch line weighting remains a major area of divergence. The inclusion of sink rates in the minimum standards for branch line weighting was considered by the WPEB to be a positive addition for fisheries that might experience difficulties in implementing certain branch line configurations. A request was made for clear protocols for measuring sink rates, with the WPEB expressing openness to reviewing branch line weighting configurations after such protocols are developed and tested. The WPEB did not provide advice to the IOTC Commission on best practices for branch line weighting at that meeting. However, the WPEB agreed to continue working on this issue, with specific advice expected by 2027 after the necessary studies and the development of guidelines for sink rate measurement.

In June 2026, after being reviewed by SBWG13, AC15 adopted the *ACAP Guidelines for Measuring the Sink Rates of Baited Hooks in Pelagic Longline Fisheries Using Time-Depth Recorders* [PDF 238 KB]. The Guidelines are presented in ANNEX 1.

2. DISCUSSION AND RECOMMENDATIONS

The detailed specification of individual bycatch mitigation options is crucial to their effectiveness and performance. The WPEB should note that among the seabird bycatch mitigation methods stipulated in the IOTC Res 23/07, the branch line weighting specifications are those that show the greatest divergence from ACAP advice. This resolution specifies branch line weighting options that have been demonstrated to be less effective at sinking baited hooks beyond the reach of seabirds, when compared to those recommended by ACAP.

It is recommended that the WPEB consider the ACAP Guidelines for measuring sink rates when continuing its work to provide advice to the Commission on best practice branch line weighting. The WPEB is also encouraged to consider ACAP's Best Practice Advice on branch line weighting when developing its advice for the IOTC Commission.

ANNEX 1. ACAP Guidelines to Measure the Sink Rates of Baited Hooks in Pelagic Longline Fisheries Using Time-Depth Recorders

Agreement on the Conservation of Albatrosses and Petrels

ACAP Guidelines to measure the sink rates of baited hooks in pelagic longline fisheries using Time-Depth Recorders

Reviewed at the Fifteenth Meeting of the Advisory Committee
Swakopmund, Namibia, 1 – 5 June 2026

1. Introduction

The incidental capture of seabirds in pelagic longline fisheries is a global concern, particularly for threatened albatrosses and petrels. Addressing this issue was a central motivation for establishing the Agreement on the Conservation of Albatrosses and Petrels (ACAP), which aims to secure a favourable conservation status for these species.

ACAP's Seabird Bycatch Working Group (SBWG) regularly reviews and updates ACAP's best practice mitigation advice for industrial fishing gear types, including pelagic and demersal longline and trawl gears. ACAP's review process considers safety, practicality, and fishery-specific characteristics when evaluating mitigation measures and developing best-practice guidance. For pelagic longline fisheries, ACAP recommends the simultaneous use of three best-practice measures—branch line weighting, night setting, and bird scaring lines—as the most effective approach to reduce seabird bycatch. Alternatively, an assessed hook-shielding device or an underwater bait-setting device can be used as a standalone mitigation option (ACAP 2026)[1].

2. Branch line weighting

Branch lines should be weighted to sink the baited hooks rapidly out of the diving range of feeding seabirds. Studies show that placing more weight closer to the hooks makes them sink faster and consistently, and reduces seabird attacks on baits, as well as seabird mortalities (ACAP 2026)[1].

SBWG12 reviewed the minimum standards for branch line weighting, defined a sink rate criterion for best practice branch line weighting, and provided further clarification on the use of weight attached to or integrated into the hook, as well as on weighting materials.

[1] *ACAP 2026 Summary Best Practice Advice for Reducing the Impact of Pelagic Longline Fisheries on Seabirds* [PDF 208 KB]

Best practice branch line weighting should achieve an average sink rate of 0.5 m/s to 5 m depth. The following configurations have been demonstrated, under controlled conditions and with metal materials, to meet this standard:

a) 40 g or greater attached within 0.5 m of the hook; or
b) 60 g or greater attached within 1 m of the hook; or
c) 80 g or greater attached within 2 m of the hook.

When weight is attached to the branch line, or integrated into the hook, a minimum added weight of 50 g is sufficient to achieve a sink rate of 0.5 m/s to 5 m depth. Branch line weighting is integral to the fishing gear and, compared to bird-scaring lines and night setting, has the advantage of being more consistently implemented, thereby facilitating compliance and port monitoring. It is recommended to avoid using lead when it may be ingested (e.g. attached to or integrated into the hook). Using lighting devices or other fishing accessories as weights is not recommended unless they meet the sink rate criterion.

With the inclusion of a defined sink-rate criterion for best-practice branch line weighting, it became necessary to establish guidelines on how to measure the sink rates of baited hooks. This document provides a step-by-step protocol for conducting these measurements using time-depth recorders (TDRs), ensuring that data collected are accurate and comparable.

3. Scope and intended users

The protocol is intended for use by scientific observers and researchers in a variety of contexts, including on research vessels or commercial fishing vessels operating under normal fishing conditions or under charter for research purposes.

4. Time-depth recorders

The TDRs must be small, lightweight (ideally less than 3 grams in seawater), robust, easy to set up and download at sea and not appreciably affect sink rates. Various manufacturers produce TDRs that meet these criteria, including, but not limited to the following manufacturers:

- Cefas Technology (www.cefastechnology.co.uk/products/data-storage-tags/g5)
- Star-Oddi (www.star-oddi.com/products/archival-tags)
- Lotek (www.lotek.com/products/lat1000-series/)

Due to a range of factors, the sink rates of pelagic longlines can vary significantly. Studies should aim to complete at least 10 replicates of *each weighting regime* in a sampling session. This can be achieved by deploying 10 TDR branch lines in *a single set* of the longline. The exercise can be repeated over multiple sets (days) if larger sample sizes are required or if between-set variation – due to changing sea states or other factors – is an important part of the research plan.

The precise estimation of baited hook sink rates relies on strict adherence to the following procedures and practices.

5. Determining depth offsets at the sea surface

All TDRs exhibit errors in depth readings at the sea surface, known as 'zero offsets' by TDR manufacturers. These offsets usually fall within the range +0.5 m to -0.5 m. Clearly, zero must be zero, meaning that the depth at the sea surface must always read 0 m.

To measure sink rates accurately, particularly at the surface (e.g. 0-2 metres) where baits are most visible and where small errors can lead to erroneous interpretations, the zero offsets need to be determined for each TDR, and the TDR data corrected during the data analysis to account for the offset. To determine the offsets, simply turn the TDRs on (as described below) and maintain them at the sea surface for about 20 seconds, which equates to 20 records at a one-second sampling rate. This procedure should be performed in calm seawater before leaving port, ensuring that the water temperature is stable. As zero offset refers to a depth of 0 m, the TDRs must be held at the sea surface during this procedure. Document the calculated zero offsets for each TDR for later reference.

6. Setting up procedure (at sea)

Equip yourself with a digital wristwatch that displays the time at one-second intervals. Synchronise the time on your wristwatch with the time on your computer. This synchronised time will be programmed into the TDRs when they are connected to the computer, ensuring that your watch, computer, and TDRs all operate on the exact same time. This synchronisation allows water entry times to be accurately recorded.

Program the devices to record depth at 0.5 m increments and time at one-second intervals. Program them to turn on at a convenient time *before* the scheduled deployment time. You can choose to have them switch off *after* reaching estimated fishing depth, or let them run for all, or part of, the soak period. The latter option, however, comes at the expense of lifetime battery longevity.

7. Attaching the TDRs

The TDRs can be attached to the branch lines using multiple cable ties or an equivalent method. If cable ties are used, tighten them with a tensioning device like that shown in **Figure 1**. To ensure that the TDRs sink at the same rate as the baited hooks, and to reduce the likelihood of shark bite-offs, TDRs should be attached within 30 cm from the hooks. Finally, wrap the TDRs in waterproof tape (such as electrical tape) and label each one (using a waterproof felt-tipped pen) with a unique number that corresponds to your deployment schedule.

As a practical aid during hauling, consider marking the snap of each TDR branch line with coloured tape and the corresponding TDR number, to help the crew identify and separate these lines promptly and avoid accidental impacts that may damage the device.

8. Deploying the TDR branch lines

Instruct the crew to deploy the TDR branch lines in accordance with their normal practice concerning the bait landing distance behind the vessel and its position relative to the vessel's wake. This means either over the centre line of the propeller, in the vessel's wake on either side, or outboard of the wake zone on either side. *Consistency in the branch line deployment method is essential.*

Use your digital wristwatch to record the exact time to the nearest second *when baited hooks land in the water.* This record is crucial, as it serves as the starting point for calculating sink times and rates to target depths. Inferring water entry times from the time-depth files when downloaded is not as precise as time-synchronised visual observations made during the set.

9. Downloading the files

When the longline is hauled, retrieve the TDRs, rinse them in fresh water, and download the CSV files from each TDR into separate spreadsheets. The downloaded data will be presented in columns for date, sampling time and depth in the water column, as shown in **Table 1** below. Locate the water entry time and highlight it in the data. Retain about 15 rows of TDR records before the water entry time so others can assess the extent of the TDR offsets *prior* to the time of water entry. Delete all data rows before these 15 rows. Add a new column ("number of seconds" or simply "seconds") beside the depth column, with the first entry (0 sec) corresponding to the time of water entry and fill down as shown in the table.

Copy the raw values collected by the TDRs, which are listed in the "Depth" column of **Table 1**. Paste them into a separate column titled "Corrected depth". Using the scores in the "Corrected depth" column, write a formula in Excel to adjust the raw scores based on the offset from your still water determinations for each TDR mentioned above.

Importantly, the depth offsets derived in still water should be the same or very close to the offsets shown in the downloaded data before water entry (0.5 m, as shown in **Table 1**). *If discrepancies occur, prioritise the offsets obtained from your still water tests. Apply the formula to correct the raw depth scores collected by the TDRs.*

Add your name, the date, the vessel name, the TDR number and any other relevant information to the rows of the spreadsheet immediately above the data rows.

10. Data presentation

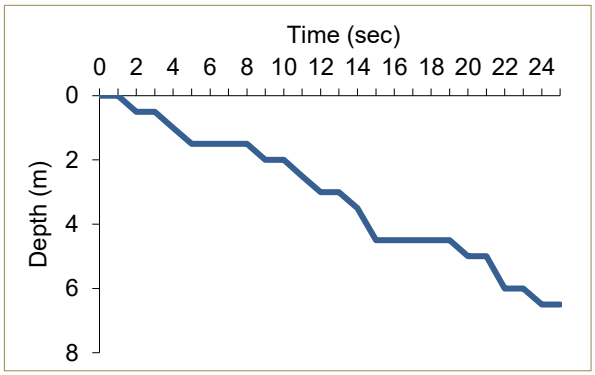
Present the data in **Table 1** below for each individual TDR in your report. Include the time taken to reach both 2 m and 5 m depths, along with the associated sink rates. Also include a graph of the sink profile to a depth of 5 m, as illustrated. Finally, along with the individual records, your report should present the average values (with 95% confidence limits) for the results shown in the table for all TDRs deployed in a sampling session. The report should also include a description of how the zero offset was calculated.

Table 1. Example of how the data and results are to be presented for each TDR, showing the observed water entry time, a column (third from the left) of the elapsed time since water entry, the depth data from the TDR and the corrected depths based on individual TDR zero offsets.

Date	Time (sec)	Number of seconds	Depth (m)	Corrected depth (m)
19/03/2015	10:37:36		0.5	
19/03/2015	10:37:37		0.5	
19/03/2015	10:37:38		0.5	
19/03/2015	10:37:39		0.5	
19/03/2015	10:37:40		0.5	
19/03/2015	10:37:41		1	
19/03/2015	10:37:42		0.5	
19/03/2015	10:37:43	**0**	0.5	**0**
19/03/2015	10:37:44	**1**	0	0
19/03/2015	10:37:45	**2**	1	0.5
19/03/2015	10:37:46	**3**	1	1
19/03/2015	10:37:47	**4**	1.5	1
19/03/2015	10:37:48	**5**	2	1.5
19/03/2015	10:37:49	**6**	2	1.5
19/03/2015	10:37:50	**7**	2	1.5
19/03/2015	10:37:51	**8**	2	1.5
19/03/2015	10:37:52	**9**	2.5	2
19/03/2015	10:37:53	**10**	2.5	2
19/03/2015	10:37:54	**11**	3	2.5
19/03/2015	10:37:55	**12**	3.5	3
19/03/2015	10:37:56	**13**	3.5	3
19/03/2015	10:37:57	**14**	4	3.5
19/03/2015	10:37:58	**15**	5	4.5
19/03/2015	10:37:59	**16**	5	4.5
19/03/2015	10:38:00	**17**	5	4.5
19/03/2015	10:38:01	**18**	5	4.5
19/03/2015	10:38:02	**19**	5	4.5
19/03/2015	10:38:03	**20**	5.5	5
19/03/2015	10:38:04	**21**	5.5	5
19/03/2015	10:38:05	**22**	6.5	6
19/03/2015	10:38:06	**23**	6.5	6
19/03/2015	10:38:07	**24**	7	6.5

	RESULTS
Depth range (m)	**0-2**
Time (sec)	8
Rate (m/sec)	0.25

Water entry time here



11. Supporting information

To ensure your recordings are interpreted correctly, include the following details for each completed round of TDR deployments.

1. Name and location of fishery.
2. Vessel name and length.
3. Vessel setting speed.
4. Vessel setting direction in relation to the direction of the current.
5. Sea state.
6. Branch line length, construction material (e.g. 1.8 mm monofilament) and length.
7. Hook type, size (e.g. 15/0 circle hook) and weight.
8. Bait (species, size / weight, frozen / defrosted).
9. Use of lightsticks / electric lights / hook-shielding devices, and location in the branch line.
10. Mainline configuration – surface set tight configuration or with slack astern to create a catena between the floats (e.g., with the use of a line shooter).
11. Line weighting regime – weight type (leaded swivel, sliding lead, leaded hook), amount of added weight additional to the mass of the hook, and distance from the hook.
12. Bait landing position astern – over the centre line of the propeller, edge of the wake on either side of the vessel or outboard of the wake zone on either side.

Figure 1. Example of a professional cable tie gun shown for illustrative purposes only. Any comparable brand can be used.