

**Report of the Working Group on Incidental Mortality
Associated with Fishing 2023 (WG-IMAF-2023)**
(Hobart, Australia, 5 to 10 October 2023)

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Opening of the meeting

Introduction

1.1 The meeting of the Working Group on Incidental Mortality Associated with Fishing (WG-IMAF) was held in Hobart, Australia, from 5 to 10 October 2023.

1.2 The Co-convenors, Dr M. Favero (Argentina) and Mr N. Walker (New Zealand) opened the meeting and welcomed participants.

Adoption of the Agenda

1.3 The provisional agenda for the meeting was discussed and adopted with minor amendments (Appendix A).

1.4 The participants thanked Dr Favero and Mr Walker for their work in preparing for the meeting.

1.5 Dr D. Agnew (Executive Secretary) welcomed all participants to the CCAMLR Secretariat. He looked forward to seeing the outcomes of the meeting being presented to the Scientific Committee and the Commission and hoped that everyone would also have an opportunity to enjoy the spring weather in Hobart.

1.6 The report was prepared by J. Barrington (Australia), J. Clark (Norway), S. Kawaguchi (Australia), E. O'Shea (Secretariat), E. Pardo (New Zealand), R. Phillips (UK), C. van Werven (Secretariat), and Y.P. Ying (China) and includes a List of Registered Participants (Appendix B) and a List of Documents considered at the meeting (Appendix C).

1.7 In this report, paragraphs that provide advice to the Scientific Committee have been highlighted. A list of these paragraphs is provided in Item 10.

Review of incidental mortality in CCAMLR fisheries

2.1 WG-IMAF-2023/12 presented the important progress achieved by CCAMLR in addressing seabird incidental mortality in longline fisheries, as well as the challenges still to be faced to address seabird and marine mammal incidental mortality to the same level of effectiveness in more complex CCAMLR trawl fisheries. The paper reviews key considerations in addressing incidental mortality of seabirds and marine mammals in CCAMLR fisheries, identifying key issues that may require attention such as underestimations due to cryptic mortality, the need of accounting for spatial and temporal stratification of the fishing effort, incidental mortality analysis at a smaller scale than currently used, the potential concentration of observations in high risk areas/periods and the resultant impacts on extrapolation analyses,

matters requiring further monitoring and advice on urgent issues, such as the use of net monitoring cables in continuous trawlers and cetacean interactions, and mitigation measures.

2.2 The Working Group reflected on the importance of relating observed interactions and incidents to the behaviour and ecology of species, so that this information could be correctly interpreted and used to improve the mitigation of incidental mortality.

2.3 The Working Group noted that information only based on surface observation of pinnipeds' interaction with trawl nets does not necessarily help to understand their interaction underwater, and does not account for cryptic mortality, underscoring the need for underwater observation. The Working Group further noted the importance of recording bird warp strike severity for estimating cryptic mortality and obtaining more accurate extrapolation figures.

2.4 WG-IMAF-2023/02 presented an analysis of bycatch data collected by SISO observers during the 2010-2020 fishing seasons on the Antarctic krill fishery, with 20 ($\pm 9\%$) coverage of fishing activity of total catch of Antarctic krill analysed. The catch increased from 200,000 tonnes to 450 000 tonnes, with the greatest increase over the last 3 years. Except in 2010 (2.2%), the bycatch ratio was stable and ranged 0.1–0.3%. Fish dominated the bycatch, followed by tunicates and other crustaceans. The paper reports that the observer coverage was high, and bycatch levels were generally low across gear types. Given that accurate information on bycatch is important for sustaining developing fisheries, the paper states that maintaining high observer coverage in this fishery will be important for detecting impacts from a warming climate and for moving back into historical fishing grounds.

2.5 The Working Group noted that this study describes bycatch not only of fish and crustacea, but for a wide range of taxa, although excluding incidental mortality of seabirds and marine mammals. While appreciative of the information presented, the Working Group further noted that the subject matter of the paper was of more relevance to WG-FSA and encouraged the authors to present the paper at WG-FSA-2024.

2.6 WG-IMAF-2023/03 Rev. 1 presented a summary of incidental mortalities of seabirds and marine mammals associated with fishing during the 2023 fishing season from data reported by the vessels and SISO observers. It also presented a draft method for the extrapolation of IMAF and warp strikes based on a spatial (40 000 km² or 200 x 200 km grid cells) and temporal (month) aggregation of records rather than on a per-vessel-cruise basis, as has been done previously. The total per-vessel-cruise extrapolated figures for longline fisheries is 132 seabirds caught as of 2 October 2023, higher than 2022 (15), but lower than in 2021 (142). Twelve elephant seals and one unidentified seal were also recorded as marine mammal incidental mortalities in longline fisheries.

2.7 The Working Group welcomed the information presented by the Secretariat, noting the utility of the information presented for understanding where seabird and marine mammal interactions with fisheries were occurring. The Working Group made the following recommendations regarding the draft methods in the paper to the Secretariat for future analyses:

- (i) The spatial scale of 40 000km² used to present the results of the analyses was considered appropriate. The Working Group reflected that it would also be useful to explore a way to query the dataset to allow data to be extracted interactively at different spatial resolutions, as this may provide more detailed information on individual species.

- (ii) Using an extrapolation approach to raise observed cetacean mortalities was not considered to be appropriate, as detection of cetacean entanglements eventually becomes obvious to both vessel crews and observers.
- (iii) The observation period for extrapolating from observed IMAF events (eq. 1) should include the total time the net is in the water, as the Working Group noted the importance of clearly defining the unit of observation effort to undertake extrapolation of IMAF data.
- (iv) Future versions of extrapolations should include estimates of uncertainty and the Working Group recommended the Scientific Committee task WG-SAM with undertaking approaches to estimate uncertainty.

2.8 With regard to the extrapolation of IMAF events (paragraph 2.7 (iv)), the Working Group considered that the temporal period of an IMAF observation is from the net entering the water until the net is retrieved on board the vessel, and noted that for continuous trawl vessels this period can extend for many days, rather than a single two-hour fishing period.

2.9 The Working Group drew attention to the lack of strikes reported for conventional trawlers in recent years and underscored the need to understand reasons for this result.

2.10 The Working Group recommended to the Secretariat that future iterations of the paper include a column indicating (i) the overall percentage of warp strike observation effort for each trawl vessel, and (ii) the total number of hauls for which IMAF data was recorded (defined in paragraph 2.7 (iv)), so that observer coverage is more easily comparable across all vessels in the fleet.

2.11 The Working Group recalled that warp strike severity will be recorded by observers (SC-CAMLR-2022, paragraph 5.11) from season 2024, and requested the Secretariat include these estimates in future paper revisions.

2.12 The Working Group noted possible underestimation of extrapolated strikes, as observers are instructed to only observe the warp on the side of the vessel from which any discharge takes place, and the extrapolated method does not scale up estimates for the total number of warps used by a vessel. However, the Working Group reflected that as observations are made on the warp on the high-risk side (i.e., where offal is discharged), any underestimation may not be as low as 50%. The Working Group further noted that the number of warps per net could be extracted from the gear information submitted with the fishery notifications if any scaling factor were to be applied.

2.13 The Working Group noted that it was complex to account for differing warp strike risk levels. The Working Group considered that it would be too onerous to request observers to track the trawl phases and risk periods throughout fishing activities.

2.14 The Working Group noted that historical data on bird abundance around trawl vessels have been recorded by observers for certain taxa during warp strike observation periods, and such data may be useful to estimate risk levels for species interacting with trawl fisheries and the relative probability of incidents. However, the Working Group reflected that the collection of such data involved considerable time allocation for observers.

2.15 The Working Group further noted the importance of data quality and acknowledged that there are limitations in types of data that can be collected by the current observer program due to its purpose. Therefore, to effectively collect data from the observer program it is important to identify the issues and develop a set of priority research questions to address, which could be tasked to intersessional work programs to develop.

2.16 WG-IMAF-2023/10 presented a summarised history of the issue of juvenile humpback whale mortalities in the continuous krill trawl fishery, and of the assistance provided by the IWC's Non-deliberate Human Induced Mortalities subcommittee for the development of a draft data collection form for cetacean incidental mortality events in the krill fishery. The draft data form in this paper reflects the recommendations made by the WS-KFO-2023 and ready for consideration by the Working Group.

2.17 The Working Group noted that many of the data fields for 'Basic Fishery/Haul Data' and 'High-level incident data' in the draft data collection form could be retrieved from data recorded in C1 and/or Observer Form.

2.18 The Working Group recommended the Scientific Committee endorse the inclusion of a dedicated cetacean data collection form for SISO observers to complete in the event of a cetacean mortality.

2.19 The Working Group further recommended the Secretariat engage with the IWC task group (Intersessional task 2.1, WG-IMAF-2022, Table 1) and Members to finalise the form and associated data collection instructions through the SISO e-group.

Marine mammal incidental mortality

3.1 WG-IMAF-2023/15 presented an analysis of the interaction between Antarctic fur seals and krill trawling gear. Antarctic fur seals exhibited distinct behavioural modes when the trawl net was retrieved on sea surface, which is the period of highest incidental mortality risk. Behaviour appeared to depend on the vertical distribution of the krill swarm and level of krill recruitment (proportion of small krill). The paper considers that when krill recruitment is low and krill swarms are mainly in deeper waters, fur seals are more aggressive towards the trawl and hence more vulnerable to incidental mortality.

3.2 The Working Group welcomed the paper and noted the plans for further studies and potential for coordination of studies on fur seal behaviour with other ongoing studies in Subarea 48.3 (WG-EMM-2023, paragraphs 6.1 to 6.6). The Working Group agreed on the advantages of using video monitoring to improve understanding of fur seal interactions with the trawling gear, and encouraged the authors to examine the relationships with fur seal behaviour on a haul-by-haul basis, noting that such analyses are in progress and are taking advantage of new acoustic approaches to characterise krill swarms developed by WG-ASAM.

3.3 The Working Group had a brief discussion on potential move-on rules for vessels if there is a high level of interaction between fur seals and fishing vessels. The Working Group noted that the design and implementation of such rules would be complex.

Incidental mortality and risk assessments of marine mammals in CCAMLR fisheries

3.4 WG-IMAF-2023/P01 (updated since WG-EMM-2023/30; WG-EMM-2023 paragraphs 6.7 to 6.10) presented an evaluation of threats to the subpopulation of Antarctic fur seals at the South Shetland Islands, which is the most southerly breeding population, is genetically distinct, and in steep decline. The decline was attributed largely to predation by leopard seals. Resource competition and potential incidental mortality in krill fisheries were among the threats classified as serious. The authors suggested that consideration be given to how krill fishing could be managed to minimise the threats, including the progression of the CCAMLR Krill Spatial Overlap Analysis, a re-evaluation of the protection provided by the DIMPA, inclusion of the South Shetland Islands fur seal subpopulation in the “harmonisation” discussion, and the adoption of time-area closures of krill fishing in the main area used by dispersing juvenile fur seals from April to September.

3.5 The Working Group welcomed this paper which provided a review of potential risk factors for this declining subpopulation. The authors clarified that the threat of disease from Highly Pathogenic Avian Influenza Virus (HPAI) was not currently affecting the sub-population, but considered it likely to do so in the near future, and that the death of a small number of female fur seals could have a major detrimental impact on the subpopulation. The Working Group noted that a fur seal mortality has not been recorded in Subarea 48.1 since 2010 (Krill Fishery Report 2022, Table 7). The provenance of fur seals killed to date in the Area 48 krill fishery has not been determined, hence it is unknown whether any incidental mortalities are from this subpopulation.

3.6 The Working Group considered whether competition with recovering cetacean populations may have been partly responsible for the seal population decline, and noted that the study indicated that this was unlikely because the fur seal population initially increased at the same time as cetacean numbers. The Working Group also noted the possibility that marine debris may be impacting this subpopulation, given its common occurrence on beaches around the breeding site at Cape Shirreff.

3.7 The Working Group discussed potential threats from the krill fishery, and welcomed the presentation from the authors during the meeting of satellite tracking data to evaluate potential overlap with krill fishery operations. The Working Group noted that the population decrease was not attributed to the krill fishery, but the authors considered that a temporary time-area closure could be instituted on a precautionary basis as the fur seal recruitment rate was very low, indicating high juvenile mortality after weaning. The area proposed by the authors during the meeting is bounded by a polygon from 61.9°S, 66.5°W to 59.2°S, 56.2°W to 60.8°S, 54.0°W to 63.6°S, 64.2°W, with an overall extent of 560 500 km² (Figure 1), with time of closure from April to June.

3.8 Some participants noted that the new krill management plan, when implemented, may result in vessels shifting fishing effort to the north of South Shetland Islands, which would increase the spatial overlap with juvenile fur seals (tracked post-weaning). It was clarified that the proposed temporary closure of the area would be reviewed if the new krill management strategy is implemented, taking account of the potential risk to juvenile fur seals.

3.9 To further inform the discussion on the proposed temporary closure area, the Working Group requested a presentation from the Secretariat on catches and trawling effort both within

and outside of the closure area from 2000 to 2023 (Figure 1). The Working Group noted that catches and effort within the proposed closure area had declined in the last decade, and represented only a small fraction of current overall effort and catches in Subarea 48.1.

3.10 There was considerable discussion in the Working Group on the potential implementation of a temporary krill-fishing time-area closure to minimise overlap with juvenile fur seals from the South Shetland Islands. However, the Working Group could not reach consensus on the proposed closure and requested further discussion on the proposal.

Data collection needs from marine mammal interactions

3.11 WG-IMAF-2023/08 presented draft protocols for pinniped identification, sexing, and length measurement, designed to improve assignment of seal mortalities in fisheries to different species, sexes and age classes, as requested in the WG-IMAF-2022 work program. The authors indicated their intention to expand the guide to other pinnipeds that might be captured incidentally in CCAMLR fisheries, and suggested that once completed, the guide should be provided to all SISO observers, and the sex and length fields be added to the data collection forms.

3.12 The Working Group thanked the authors for the work and made the following suggestions for improvements:

- (i) Photos in the guide should include some of dead animals to aid identification. The Secretariat noted that these could be obtained from previous photographs of seal incidental mortalities in observer reports with permission.
- (ii) Photographs of juveniles and information on how to determine age class (e.g. from body length or other characteristics) should be included.
- (iii) Inclusion of species-specific pictures for sexing seals instead of stylised illustrations, and pictures of teeth from each species and sex, would be helpful for the observers.

3.13. The Working Group recommended to the Scientific Committee that the following changes should be made to the observer data collection forms:

- (i) “Band” on the observer form should be changed to “Band/tag” as seals are marked with flipper tags, and formerly with brands.
- (ii) Additional categories should be added to the “Samples taken” field in the trawl observer forms that are appropriate for seals.

3.14 The Working Group noted advice from the Secretariat that the next opportunity to implement updated observer forms is for the 2025 season. The Working Group recommended that discussion should take place between interested members intersessionally within the SISO e-group to refine both the contents of the guide and the observer forms.

3.15 The Working Group recognised the value of collecting samples for assigning genetic provenance for seals, but noted that this needs to be associated with guidance on minimising

the associated human health risk. This applies to handling of seal carcasses in particular. The Working Group also noted the considerable amount of paperwork required to obtain a permit to import CITES-listed species, and that this may require that samples are stored on vessels for long periods (WG-IMAF-2022, paragraph 4.13).

3.16 The Working Group recommended that guidelines developed by ACAP concerning the risk of transmission of HPAI from seabirds and seals should be provided to fishing vessel crew and observers, and requested that the Secretariat collate and circulate these materials.

3.17 WG-IMAF-2023/10 presented a draft data collection form in the event of incidental mortality of cetaceans in the krill trawl fishery. This is an adapted version of the form provided by the US Marine Mammal Commission, and takes account of further amendments suggested by the IWC-SC and CCAMLR Krill Fishery Observer Workshop (SC-CAMLR-42/05). The paper also confirmed that the Intersessional Correspondence Group of the IWC-SC on cetacean incidental mortality in the krill trawl fishery had been reconvened to assist in refining the cetacean mortality data collection form and, in the longer term, providing advice for krill trawling operators to minimise cetacean entrapments, and refining designs of the marine mammal exclusion cetacean device.

3.18 The Working Group thanked the authors and IWC-SC, specifically, the subcommittee on Non-deliberate Human Induced Mortality of Cetaceans (HIM), for their work in developing the form, and noted the benefit of this collaboration with the IWC. The Secretariat noted that data in the categories of “Basic Fishery/Haul Data”, “High-level Incident Data” were already included in SISO forms, and suggested that the other aspects of data recording and sample collection should be included as a standalone form given the rarity of cetacean incidental mortality.

3.19 Using this guidance, the Working Group discussed a draft form for the collection of cetacean mortality data, and recommended that the Secretariat undertake work through the relevant SISO e-group and experts to finalise forms and training material for the 2024 fishing season.

Mitigation methods for marine mammals

3.20 WG-FSA-2023/72 presented progress in developing the CCAMLR gear library for the collation of detailed information on fishing gear configuration, including marine mammal exclusion devices. Currently just two fields; “type” (two options) and a diagram are available for recording information on the exclusion devices, and the level of detail on those already in use is highly variable. The paper also presented new, generic diagrams that should improve consistency on how aspects of trawl gear are described, and on other aspects of the gear library.

3.21 The Working Group welcomed the development of the gear library, noting the utility of the generic gear diagrams as they highlight which fields are currently reported in the C1 form and gear notifications, and which information is not currently captured.

3.22 The Working Group reflected that although a marine mammal exclusion device is a mandatory requirement in CCAMLR fisheries (Conservation Measure 51-01, paragraph 7), there is no CCAMLR specification of what constitutes a marine mammal exclusion device. The Working Group discussed a list of data fields that would be useful to specify marine mammal

exclusion devices (Appendix D) and requested the proposed trawl vessel workshop (SC-CAMLR-2022, Table 1) consider including such fields in vessel notifications or a revised C1 form.

3.23 The Working Group further noted that observers are requested to verify if notification details on gear are accurate, and considered whether observers may be able to provide details on seal and cetacean exclusion devices to better understand the variety of designs employed by vessels.

3.24 The Working Group recommended to the Scientific Committee that cetacean exclusion devices and seal exclusion devices be described in separate forms within the Fishery Notification, as they represent two distinct mitigation measures.

3.25 The Working Group requested that the proposed trawl vessel workshop (SC-CAMLR-2022, Table 1) consider the addition of fields in any redesigned C1 form, to define and link net configurations and marine mammal excluder devices to the trawl nets used for a particular fishing event.

3.26 WG-IMAF-2023/01 provided an update on the net monitoring cable and cetacean mitigation devices on Norwegian continuous krill trawl vessels. The cetacean exclusion device has been moved to the mouth of the net, the tension has been increased and a seal-exclusion device is also fitted behind the cetacean exclusion net. Banana pingers continue to be used, but whether these are a deterrent or a potential attractant for baleen whales is unknown. The authors concluded that the original design of the cetacean exclusion device was not effective as it was fitted too far into the body of the trawl net. No mortalities were reported during the 2023 season, and there were no observations of marine mammals coming into contact with the net.

3.27 The Working Group welcomed the development of the cetacean exclusion device and noted the discussion in SC-CAMLR-42/BG/34, which indicated that the IWC-SC considered that the cetacean exclusion device currently on the Norwegian vessels may not be effective for humpback whales, as they are known to become entangled in static nets. The Working Group also noted that the IWC-SC had discussed the observation that, during a study in January/February 2023 on board a Norwegian continuous krill trawler around the South Orkney Islands, humpback whales were the most commonly observed species in close proximity to the vessel. These animals were frequently observed actively approaching the vessel or following at distances apparently consistent with the distance from the vessel to the trawl mouth, and all individuals observed following the vessel for extended periods were small, suggesting they were juveniles. These observations are consistent with the entanglements that have been reported in CCAMLR fisheries.

3.28 The Working Group encouraged Members to develop systems such as underwater cameras, mechanical sensors such as a stretch sensor, and acoustic systems to detect cetaceans, as these may determine their proximity and behaviour if encounters with the trawl net occurred. The Working Group also encouraged further research into the behaviour of cetaceans around krill trawl operations, which could include video observations and short-term tag deployments to record high-resolution 3D movement data.

3.29 WG-IMAF-2023/09 presented further development of seal exclusion devices for conventional krill trawlers. This included in situ observation of the device during the high-risk period when the net is on the surface. The paper recommended (i) the use of strengthening ropes

(6 cm thick) to maintain the shape of net openings and enhance visibility of the escape windows for seals, and (ii) that the total area of any escape opening(s) should cover more than 2/3 of the top trawl net panel.

3.30 The Working Group welcomed the developments concerning seal exclusion devices, and requested that video be provided of seals escaping through the net openings if it becomes available to examine seal behaviour.

Seabird incidental mortality

4.1 WG-IMAF-2023/11 presented a global analysis of the overlap of ACAP Priority Populations of albatrosses and petrels with the fisheries of RFMOs and Range States. ACAP covers 31 species of albatrosses and petrels. Among the breeding populations of these species, ACAP has identified nine ACAP High Priority Populations that: (a) represent a sizeable proportion (>10%) of the global total for the species; (b) are declining rapidly (>3% per annum); and (c) are declining mainly because of incidental mortality in fisheries. There are seven ACAP High Priority Populations that overlap with CCAMLR waters: Wandering Albatross, Grey-headed Albatross and Black-browed Albatross (South Georgia), Tristan Albatross (Gough Island), Sooty Albatross (Crozet Islands), Indian Yellow-nosed Albatross (Amsterdam Island), and Antipodean Albatross (Antipodes Islands).

4.2 The Working Group recognised that continued efforts to minimise seabird incidental mortality should remain a high priority, as even small levels of incidental mortality of the affected species can result in population declines.

4.3 The Working Group recommended that the Scientific Committee consider:

- (i) improving engagement and coordination among Members, and with ACAP Parties, before and during relevant regional fisheries meetings
- (ii) emphasising CCAMLR's performance history at relevant regional fisheries meetings, given that CCAMLR's seabird incidental mortality mitigation efforts in demersal longline fisheries are an exemplar of best practice and what can be achieved.

4.4 WG-IMAF-2023/14 presented an analysis of the overlap of White-chinned Petrel, *Procellaria aequinoctialis* and fisheries as a proxy for incidental mortality. The White-chinned Petrel is listed by ACAP and considered as Vulnerable by IUCN. The overlap analysis of the species' populations with CCAMLR fisheries facilitates targeting of mitigation efforts in 'risk hotspots' for this commonly bycaught species.

4.5 The Working Group noted the value of identifying risk hotspots for threatened seabird species, as this may facilitate improved management measures.

Population status of seabirds in the CAMLR convention area

4.6 WG-IMAF-2023/06 presented an update from ACAP about the development of best practice measures and guidelines for fisheries and populations. Species assessments are being updated for the 31 ACAP albatross and petrel species, and ACAP's advice on population levels and trends will be updated in 2024. ACAP High Priority Populations were a focus of discussions, including the analysis provided in WG-IMAF-2023/11. ACAP now strongly discourages the use of high-energy laser technologies for seabird incidental mortality mitigation, as there is currently no evidence of effectiveness, and serious concerns remain in terms of the potential impacts on the health of individual birds. ACAP has developed new protocols about the impact of HPAI on seabirds, and is monitoring the likely spread of this disease to albatross and petrel breeding populations. The disease affects both seabirds and marine mammals, and poses a risk to human health.

4.7 The Working Group noted that best practice mitigation advice is not available for krill continuous trawling, and that CCAMLR is well-situated to provide ACAP with advice about the specification of mitigation measures used in this fishery and the effectiveness of these measures. The Secretariat advised that it was not aware of any use of lasers in CCAMLR fisheries.

4.8 The Working Group noted the benefit of collaboration with ACAP to:

- (i) develop and refine mitigation measures to reduce the incidental mortality of seabirds in continuous trawl fisheries
- (ii) provide CCAMLR with guidance for fishing and research vessels operating in the Convention Area about HPAI on handling of bycaught seabird and marine mammal species.

Seabird incidental mortality and risk assessments in CCAMLR fisheries

4.9 WG-IMAF-2023/12 was presented in Agenda Item 2 (paragraph 2.1).

4.10 WG-IMAF-2023/05 presented a review of CCAMLR warp strike protocols against ACAP recommended protocols. The Working Group noted that existing ACAP guidance could be reviewed considering additional variables are collected in CCAMLR fisheries.

4.11 The Working Group recommended that the Secretariat work intersessionally with Members to:

- (i) refine observer the instructions to clarify the definition of aerial or sea surface strikes (as detailed in Appendix E)
- (ii) develop guidance for observation protocols to include other fishing gear used during continuous trawling that may result in seabird strikes
- (iii) cooperate with ACAP to review the existing ACAP guidance about warp (and any other fishing gear) strike observation protocols for conventional and continuous trawl fisheries.

4.12 WG-IMAF-2023/16 presented a power analysis to estimate required observation rates for range of simulated strike rate values, and credible detection limits. The results indicated that for high-frequency warp strike rates (e.g., 0.1 or 0.05 strikes per hour) the current observation rates were adequate to detect changes beyond a presumed strike rate, as well as within the 95% credible limits. However, when the warp strike rates are lower, the current level of observation is unlikely to be sufficient to reliably detect: (1) the true strike rate with any reliability; and (2) a change beyond a critical threshold. The results also indicate that an increase in observation is required to gain better precision when low strike rates are being encountered by the fishery. Additionally, the paper recommends the inclusion of number of cables used on each net (either net monitoring or warp), as well as the number observed in the C1 and Observer data respectively, an increase observation rates to accurately detect, and precisely estimate, low strike rates, and the development a standardised observation procedure that reflects the potential variability in warp strike risks during krill trawling to allow for a better estimation of overall warp strike rates.

4.13 The Working Group discussed the analysis and noted potential biases in the observation process including whether observers were monitoring one or both warps, and that monitoring is focused on ‘high-risk’ periods. The Secretariat advised that observers are instructed to monitor one warp, prioritising ‘high risk’ periods (e.g. vessel turning), and that there is a category for reporting monitoring of ‘non high-risk’ periods. The Working Group further noted that currently only warp and net monitoring cables are observed but not any ropes or additional cables associated with fishing gear (for example ropes supporting the continuous trawling vessels’ pump). The Working Group also noted that electronic monitoring will likely improve the ability to detect warp strikes.

4.14 Some participants reported that in practice the observers may watch both warps on stern trawlers simultaneously because if observers stand at the side of the stern area, their field of view can cover both warps without any need to change their perspective. Some other participants noted that warp strikes are difficult to observe if you do not focus on a single warp.

4.15 At the time of report adoption, the Working Group considered that this topic may need further investigation and has implications for reporting and interpretation of data provided by observers.

4.16 The Working Group recognised that an increased level of observations would be required to improve the precision of estimates of warp strike rates. This increased level of observation can be achieved through a combination of increased rates of direct observations, and video capture and review.

4.17 The Working Group recommended the Scientific Committee consider:

- (i) introducing an increase in the level of warp strike observations to 2.5% of fishing time on a per-vessel basis for the 2023/24 season
- (ii) encouraging the level of warp strike observations to reach a minimum of 5% of fishing time on a per-vessel basis ideally from the 2024/25 season onwards, provided this does not impact on other priority tasks and overall workload of the observers.

- (iii) encouraging the development and use of warp and net cable mitigation measures on trawl vessels during the 2023/24 fishing season (e.g. paired streamer lines on conventional trawl vessels, and warp scarers or ‘socks’ on continuous trawl vessels), and the introduction of mandatory mitigation measures on trawl vessels once suitable mitigation specifications have been developed
- (iv) the development and implementation of a standardised observation procedure that reflects the potential variability in warp strike risks during krill trawling, to allow for a better estimation of overall warp strike rates.

4.18 The Working Group noted that tasking observers to conduct an average of two 15-minute observation periods per day in the krill fishery would achieve approximately 5% coverage rate of total fishing time for conventional trawl vessels.

4.19 The Working Group noted the value of retaining video footage of seabird interactions with warps and net monitoring cables, and the review of this footage for use as training materials to assist observers to differentiate between differing types of bird strikes.

4.20 The Working Group encouraged Members to:

- (i) utilise video monitoring to help quantify bird strikes in trawl fisheries
- (ii) investigate and develop artificial intelligence (AI) systems to automatically review video footage to detect bird strikes with warps and other fishing gears
- (iii) undertake dedicated research to better resolve the underlying environmental factors influencing seabird strikes with trawl fishing gear.

Mitigation methods for seabirds

4.21 WG-IMAF-2023/01 presented an update from Norway on further trials of mitigation measures in krill continuous trawl fisheries where a net monitoring cable was used. Total observation effort across the three vessels of 10.8% was achieved over a period of 188 days. During this time, 89 strikes were observed. Of these, 54 were observed on the net monitoring cable, the majority of which were aerial strikes, and the bird was seen to fly away, apparently unharmed. Fifty of these strikes occurred on a single vessel with half (27) occurring over a five-day period between 29/04/2023 and 03/05/2023. The ‘sock’ mitigation measure was subsequently extended in length to be closer to the sea surface by 2.3 m, with only two bird strikes observed against the warp cables and none against the net monitoring cable (7.5% coverage) recorded thereafter (roughly over a month). Direct monitoring of warp strikes and review of video footage was resource-intensive, and problematic in poor visibility and bad weather conditions.

4.22 During the meeting, the Working Group was presented with a preliminary analysis of the bird strikes per 1 000 hours of continuous trawling that varied between the three vessels involved in the trial: *Antarctic Endurance* 41 strikes/1000 hours, *Antarctic Sea* 19 strikes/1000 hours, and *Saga Sea* 218 strikes/1000 hours. Video observations recorded 147 bird strikes/1000 hours, and direct observations reported 108 bird strikes/1000 hours. From 21 June to 13 September, one strike was recorded on the net monitoring cable and three on the warps

representing 10.5 and 31.5 strikes per 1 000 hours respectively. Total observer coverage was 6.7%.

4.23 The Working Group noted that there was a total of 54 observed bird strikes with the net monitoring cable, that all strikes were Cape Petrels, and although no mortalities were reported, most corresponded to ‘heavy’ strikes which are considered a proxy for mortality (Sullivan et al., 2006). The Working Group additionally noted the number of bird strikes on the warp cable (31), were about half of those on the monitoring cable. During the meeting, an extrapolated total of 747 bird strikes was estimated by the author for the period of the reported trial (188 days).

4.24 The Working Group recommended the Scientific Committee consider:

- (i) maintaining the existing derogation of the prohibition on use of the net monitoring cable in Conservation Measure 25-03, paragraph 1, footnote 2
- (ii) clarifying in the second footnote to paragraph 1 of Conservation Measure 25-03 that “on-vessel observation coverage” includes both on deck observations and review of video footage in meeting the observer coverage requirements.

4.25 WG-IMAF-2023/17 presented information from China on the preliminary results of the trial of a net monitoring cable seabird-strike mitigation measure (‘sock’ with pennants, and streamer lines) for continuous trawling on the vessel *Shen Lan*. Continuous trawl was conducted only during 22 December 2022 to 15 January 2023, and observations occurred (4 x 15 min visual observations and 6 x 15 min review of video footage) over 65.5 h (7.8% of total fishing hours) with no seabird interactions observed. For conventional trawl, standard warp strike observation protocols were followed, which comprised 44.5 h (2.2% of total fishing hours) with no seabird interactions observed. Seabird abundance was generally low, higher levels of abundance were observed during net retrieval. All monitoring video footage have been stored for further analysis. The trial will continue during the 2023/24 fishing season.

4.26 The Working Group noted the preliminary results and looked forward to receiving further information about the ongoing trial. The Working Group highlighted the importance of assessing the effect of changes in the sock mitigation design.

4.27 The Working Group encouraged continuous trawl vessel operators to continue to develop mitigation devices to protect the area surrounding the end of the trawl booms (where warp and net monitoring cables are deployed), to reduce the risks of seabirds contacting warp and net monitoring cables, and report back to WG-IMAF on the development and effectiveness of such mitigation devices.

4.28 WG-IMAF-2023/07 presented a review of existing seabird mitigation measures and best practices for trawl fishing vessels within the Convention Area. The paper noted that current Conservation Measures provide general and specific measures for finfish and krill trawling, and the development of mitigation for conventional and continuous trawl fishing gear is still evolving. The paper included several recommendations for reducing the attraction of vessels to seabirds, reducing seabird strikes with warps, reducing net entanglements, and reducing seabird strikes with net monitoring cables.

4.29 The Working Group discussed the review noting: (1) streamer lines may not be effective for continuous trawl operations, where speed is under 2 kt, (2) the use of ‘jigglers’ and lighter streamer lines, as used by demersal longline vessels, may have application to trawl vessels, (3) improved drogue designs may help in achieving improved aerial extent of streamer lines, and (4) previous studies into seabird olfactory sense suggest that ‘stick water’ may be attractive to seabirds and further research may be required to understand its attractiveness to seabirds and improve mitigation.

4.30 WG-IMAF-2023/18 Rev. 1 reviewed CCAMLR conservation measures for seabird incidental mortality mitigation in demersal longline fisheries and assessed whether there had been any recent developments concerning seabird incidental mortality mitigation technologies and techniques, particularly those of ACAP, which would have application to CCAMLR’s demersal longline fisheries. The paper identified several mitigation measures, already in use, for consideration by the Working Group that may improve conservation outcomes.

4.31 The Working Group encouraged Members to:

- (i) Consider the refinement of streamer line specifications for demersal longline vessels in consultation with the fishing industry, to include recent additional configurations. This includes use of multiple streamer lines; using boom-bridle setups – where the streamer lines can be moved laterally as required, with the ability to extend coverage beyond the lateral extent of the vessel; and use of ‘jigglers’ – where the streamer line can be ‘jiggled’ back and forth to create an additional element of deterrence.
- (ii) consider whether a ‘moon pool’ meets the operational characteristics of a bird exclusion device (BED) during hauling operations, and include a description of a moon pool as an example of an effective BED on the CCAMLR website.

4.32 The Working Group recommended the Scientific Committee consider:

- (i) the inclusion of a definition of ‘night’ in paragraph 5 of Conservation Measure 25-02 to reduce ambiguity
- (ii) the consistency between paragraphs 3 and 4 of Conservation Measure 25-02 and the indicative figures in Annex 25-02/C.

Observer reports and data collection

5.1 WG-IMAF-2023/04 presented a review of current SISO warp strike data collection protocols with those recommended by ACAP, detailed the full ACAP protocols for recording warp strikes and proposed changes to the current SISO warp strike data collection protocols to align with current guidelines developed by ACAP under their ‘Data collection guidelines for observer programmes’.

5.2 The Working Group noted that the ACAP protocol had been used successfully by observers in the New Zealand trawl fishery for a number of years, and can be conducted in addition to their other tasks.

5.3 The Working Group noted that the paper had reviewed the observer finfish trawl form rather than the krill observer form, and that both heavy and light strike contacts will be recorded from season 2024 in CCAMLR krill fisheries. Other fields such as fishing stage, mitigation used, and offal discharge location can be derived or are included elsewhere. The main missing fields were related to environmental conditions and the angle of the warp cable.

5.4 The Working Group expressed concern about the practicality of measuring the angle of the warp but noted that this could be achieved through measuring the angle of the warp against calibrated markings on the trawl block.

5.5 The Working Group discussed the collection of environmental variables during warp strike observations, and noted that many of these variables could be derived from other sources.

5.6 The Working Group noted that the definition of a ‘heavy strike’ in the current CCAMLR protocols differs from the ACAP definition. While the CCAMLR protocol describes a heavy contact resulting in the bird coming in contact with the water, the ACAP protocol describes which part of the bird contacts the cable. The Working Group further noted that there may be some ambiguity in the definitions of the ‘water’ and ‘sinker’ categories, and that wording should be added to highlight that for the ‘water’ category the bird is on the water when it first comes into contact with the cable.

5.7 The Working Group considered the practicality and value of recording species-specific bird counts around the vessel, the potential timing of conducting such observations, and whether observers were able to do this by species without extensive training. The Working Group also noted that the search area for abundance observations differs between CCAMLR and ACAP guidelines.

5.8 The Working Group recommended that the Scientific Committee consider:

- (i) the addition of fields to the current warp strike recording form indicating the angle of the warp and which warp is sampled
- (ii) species specific estimation of bird abundance around the vessel prior to each observation, noting that this will impact on the observers’ time for other tasks and potentially require additional training
- (iii) the definition of ‘heavy strikes’ be more clearly defined using ACAP guidelines for ‘water’ and ‘sinker’ categories to ensure these are only recorded for birds struck by a cable while the bird is on the water (Appendix E).

Marine debris effects on seabirds and marine mammals

6.1 WG-IMAF-2023/P01 was presented under agenda item 3.2 (paragraph 3.4) and marine debris aspects of the paper were considered by the Working Group.

6.2 The Working Group noted that the CCAMLR marine debris monitoring program started in 1986, and an Intersessional Correspondence Group was formed in 2019. Fishing industry, national programs, tourist vessels, etc. provide data on marine debris under the current program.

6.3 The Working Group noted that marine debris discussions take place in several other Working Groups (e.g., WG-EMM-23, paragraph 4.68). In order to avoid duplication of marine debris considerations, the Working Group requested J. Barrington to summarise and present relevant information from the Intersessional Correspondence Group – Marine Debris (ICG-MD) to future meetings of WG-IMAF.

Light pollution effects on seabirds

7.1 WG-IMAF-2023/13 presented light pollution guidelines for wildlife, and mitigation standards for reducing light-induced vessel strikes of seabirds with fishing vessels developed by Australia and New Zealand. The paper noted that Conservation Measures 25-02 and 25-03 seek to minimise artificial light at night, but specifications are not provided about how minimisation of any light pollution can be applied. Additionally, the paper noted that the guidelines presented are highly relevant for CCAMLR and have been endorsed by ACAP and the Convention for Migratory Species (CMS).

7.2 The Working Group noted that no systematic recording of light-induced vessel strikes currently takes place, and that the level of mortalities from light-induced strikes may be considerable. The Working Group additionally noted that data on light-induced strikes have been collected around South Georgia, and a project quantifying all potential impacts on seabirds is currently ongoing.

7.3 The Working Group noted that the collection of light-induced vessel strike mortality data was more appropriate for vessels rather than observers, and modifications of the data collection forms and instructions would be required to achieve this.

7.4 The Working Group recommended the Scientific Committee consider encouraging Members to:

- (i) apply the light pollution guidelines
- (ii) collect data regarding their effectiveness and report back to CCAMLR working groups
- (iii) present reports on mortalities on light-induced vessel strikes.

7.5 The Working Group noted that the Convention Area is used by many other vessels beyond fishing vessels.

Future work

8.1 The Working Group noted WG-FSA-2023/06, which provided a summary of the status of current vessel and observer forms and associated manuals. The paper highlighted the evolutionary nature of the form development process, recognising the considerable amount of time required to implement the recommendations from the Scientific Committee and its Working Groups across the different data forms.

8.2 The Working Group thanked the Secretariat for compiling this paper, noting the challenges that arise when forms are developed in an ad-hoc manner in response to Member requests. The Working Group considered the relevant proposals in the paper relating to marine debris, further noting that the appropriate forum for proposing changes to the C1 trawl vessel data forms is at the upcoming trawl fishery data workshop.

8.3 The Working Group recommended that the Scientific Committee consider the progress of the 2023 tasks along with the upcoming potential future tasks for future intersessional work, as described in Table 1.

Other business

Collaboration with relevant organisations

9.1 Dr Favero initiated a discussion on mechanisms to foster engagement between CCAMLR and other organisations outside of the Convention Area, as referenced to in WG-IMAF's terms of reference (Appendix F).

9.2 The Working Group recalled that CCAMLR has a Memorandum of Understanding (MoU) or similar arrangement with many international organisations, including regional fisheries management organisations (RFMOs), ACAP and IWC, further emphasising the importance of collaboration and cooperation between these bodies and noting that many RFMOs take guidance from CCAMLR on assessing IMAF-related issues.

9.3 The Working Group reflected on ACAP's engagement beyond the Convention Area. The Working Group request ACAP provide a summary of their engagement strategy to WG-IMAF for consideration, further noting that this summary would assist in enhancing the MoU between the two bodies and may include reports on any engagement with Members undertaken by ACAP on a periodic basis.

9.4 The Working Group highlighted the importance of effective collaboration with other relevant intergovernmental and industry organisations, noting that the collaboration with invited experts at the meeting had greatly improved the understanding of participants on relevant issues through targeted engagements and had enhanced the provision of advice to the Scientific Committee.

9.5 The Working Group noted that the attendance of invited experts allowed for ongoing feedback through various expert subgroups on outstanding issues (e.g., the Sub-Committee on Non-deliberate Human-Induced Mortality of cetaceans within IWC and ACAP Working Groups and Advisory Committee meetings).

9.6 The Working Group further noted the increasing level and importance of cooperation with other regional organisations to reduce the incidental mortality of seabirds and marine mammals within fisheries bordering the Convention Area.

Review of WG-IMAF terms of reference

9.7 The Working Group reviewed its terms of reference and priorities that were endorsed by the Scientific Committee at SC-CAMLR-41, and recommended the Scientific Committee consider the updated terms of reference in Appendix F.

Meeting modalities

9.8 The Secretariat informed the Working Group on several logistical and management issues concerning the meeting of WG-IMAF currently overlapping with WG-FSA, including:

- (i) considerable difficulties for the Secretariat in resourcing both support and equipment for the meeting
- (ii) difficulties for assigning and managing rapporteurs and presentations, as many attendees switch between meetings depending on the stage of the respective meeting agendas
- (iii) an increased burden on translation for the Secretariat, as both the reports of WG-FSA and WG-IMAF are required to be translated prior to the Scientific Committee meeting.

9.9 The Working Group discussed options including holding WG-IMAF at a separate time, or adjacent to the meeting of WG-EMM, as many of the relevant experts attend both meetings. However, the Working Group noted that holding WG-IMAF at a different time and venue to the current arrangements may result a significant financial impost and time commitment for Members.

9.10 The Working Group recommended the Scientific Committee consider options such as holding WG-IMAF biennially or having a one-year hiatus to allow time for recommended data collection changes and mitigation measures to be implemented, and the collection of such data and subsequent analyses.

9.11 The Working Group noted that if either of these options were to be exercised, the Scientific Committee would need to consider sequencing future meetings of WG-IMAF to ensure that its advice is timely and fit for purpose.

Advice to the Scientific Committee

10.1 The Working Group's advice to the Scientific Committee is summarised below. The body of the report leading to these paragraphs should also be considered:

- (i) determination of uncertainty estimates (WG-SAM) for future IMAF extrapolations (paragraph 2.7 (iv))
- (ii) inclusion of a cetacean data collection form for SISO observers to complete in the event of a cetacean mortality (paragraph 2.18)

- (iii) modify fields on the trawl observer forms to specify “band/tag” and create additional categories in the “Samples taken” field that apply for seals. (paragraph 3.13)
- (iv) specify cetacean and seal exclusion devices separately within Fishery Notifications (paragraph 3.24)
- (v) improving engagement and coordination among Members, and with ACAP Parties before and during relevant regional fisheries meetings (paragraph 4.3).
- (vi) specify a minimum level of observation coverage for warp strike observations to 2.5% of fishing time on a per-vessel basis for the 2023/24 season, encourage the level of warp strike observations to reach a minimum of 5% of fishing time on a per-vessel basis ideally from the 2024/25 season onwards (paragraph 4.17)
- (vii) encouraging the development and use of warp and net cable mitigation measures, and a develop a standardised warp strike observation procedure on trawl vessels (paragraph 4.17)
- (viii) maintain and review the existing net monitoring cable derogation (paragraph 4.24)
- (ix) specify the definition of ‘night’ in Conservation Measure 25-02 and consider more indicative figures in Annex 25-02/C (paragraph 4.32)
- (x) consider additional data collection fields in the current warp strike recording form, and collection of species-specific estimation of bird abundance around the vessel (paragraph 5.8)
- (xi) clarify the definition of ‘heavy strikes’ (paragraph 5.8)
- (xii) encourage Members to apply the light pollution guidelines, collect data regarding their effectiveness and report on associated mortalities (paragraph 7.4)
- (xiii) consider the progress of the 2023 tasks along with the upcoming potential future tasks for future intersessional work, as described in Table 1 (paragraph 8.3).
- (xiv) consider the updated WG-IMAF Terms of Reference (paragraph 9.7 and Appendix F)
- (xv) consider the future modality of the meeting such as holding WG-IMAF biennially or having a one-year hiatus (paragraph 9.10).

Adoption of the report

11.1 The report of the meeting of WG-IMAF was adopted.

Close of the meeting

11.2 At the close of the meeting, Mr Walker and Dr Favero thanked all participants, including invited experts, for their engagement, effective collaboration and patience that had allowed the Working Group to make significant progress in addressing the priorities of the Scientific Committee. They also thanked the rapporteurs and the Secretariat for providing requested analyses and support throughout the meeting.

11.3 On behalf of the Working Group, Mr I. Forster (Secretariat), thanked Mr Walker and Dr Favero for their helpful guidance during the meeting, noting that while there was a reduced agenda to progress significant work, the Co-convenors alongside the participants contributed to the development of a considerable workplan for WG-IMAF.

References

Sullivan B.J., T.A. Reid and L. Bugoni. 2006. Seabird mortality on factory trawlers in the Falkland Islands and beyond. *Biol. Conserv.*, 131:495-504.

Table 1. Intersessional work plan for WG-IMAF. Timeframe periods are short = 1–2 years, medium = 3–5 years and long = 5+ years. AI = artificial intelligence, EM = electronic monitoring, MMED = marine mammal exclusion device.

Theme	Task	Timeframe	Contributors	Secretariat participation
1. Review of incidental mortality	1.1 Presentation of incidental mortality information at a finer scale (spatial and temporal) (supplemental information in addition to Secretariat report to WG-IMAF)	Short	Dr Favero, Mr Walker and Prof. Phillips	Yes
	1.2 Development of a web-based tool to allow examination of interactions and incidental mortality data across CCAMLR fisheries	Medium	Dr Favero, Mr Walker and Prof. Phillips	Yes
2. Marine mammals – incidental mortality	2.1 Refine design of additional data to be collected by observers and crew when whale entanglements occur (see list developed under paragraph 4.17)	Short (to be completed intersessionally 2024)	Dr Kelly and Mr Pardo	Yes
	2.2 Investigate the use of underwater sensor/cameras attached to the net (and AI) to provide information on the occurrence of whale interactions and any subsequent entanglements/capture (continuous)	Short	Dr Kelly, Dr Lowther and Dr Lindstrøm	-
	2.3 Development of data collection protocols for pinniped mortalities and training materials	Short (to be completed intersessionally in 2024)	Mr Pardo	Yes
3. Seabirds and Marine mammals – risk assessment	3.1 Consider developing risk assessment for seabirds and marine mammals	Medium	Dr Lindstrøm, Dr Kelly and Prof. Phillips	-
4. Marine mammals – mitigation	4.1 Review designs of marine mammal exclusion devices and develop specifications for those in use in CCAMLR trawl fisheries (including consideration towards a convex shape to the exclusion mesh to deflect whales (and seals) away from the net mouth)	Ongoing	Dr Kelly, Dr Lowther, Mr Pardo and Dr Lindstrøm	-
	4.2 Undertake experiments into effectiveness of different MMED designs (for various species)	Medium	Dr Kelly, Dr Lowther, Dr Lindstrøm and Dr Ying	-

(continued)

Table 1 (continued)

Theme	Task	Timeframe	Contributors	Secretariat participation
5. Seabirds – incidental mortality	5.1 Power analysis of required observer sampling required for warp strikes	Update if required	Dr Kelly, Dr Hinke and Mr Walker	-
	5.2 Redesign the warp strike observation protocols	Short	Dr Debski	Yes
	5.3 Exploration of approaches to undertake warp strike extrapolations	Short	Dr Favero, Dr Hinke and Mr Walker	Yes
	5.4 Review required levels of observer sampling for seabird incidental mortality with longline fishery	Short	Mr Zhu, Dr Kawaguchi	Yes
6. Seabirds – mitigation	6.1 Consider performance of trawl warp/cable strike mitigation approaches utilised by continuous trawl vessels (including environmental conditions and other factors) including the improvement and specification development for the ‘sock’ design.	Short	Dr Debski and Dr Arata	-
	6.2 Review existing use of and consider mitigation requirements in conventional trawl vessels and develop specifications for suitable mitigation	Short	Dr Debski and Dr Arata	-
	6.3 Review developments in demersal longline mitigation	Update if required	Mr Barrington, Dr Debski and Mr Arangio/ Mr McNeill	-
7. Observer reports and data collection	7.1 Consider IMAF-related tasks for observers in the various CCAMLR fisheries	Ongoing	Mr Clark	Yes
	7.2 Consider use of EM and AI to improve the efficiency of data collection to aid observers	Medium/ Long	Mr Clark	-
8. Marine debris effects on seabird and marine mammals	8.1 Review information on the effect of marine debris on marine mammals and seabirds in the Convention Area	Short	Mr Barrington	Yes
9. Light pollution effect on seabirds	9.1 Consider options for the management of light pollution for vessels fishing in the Convention Area	Update if required	Mr Barrington	-

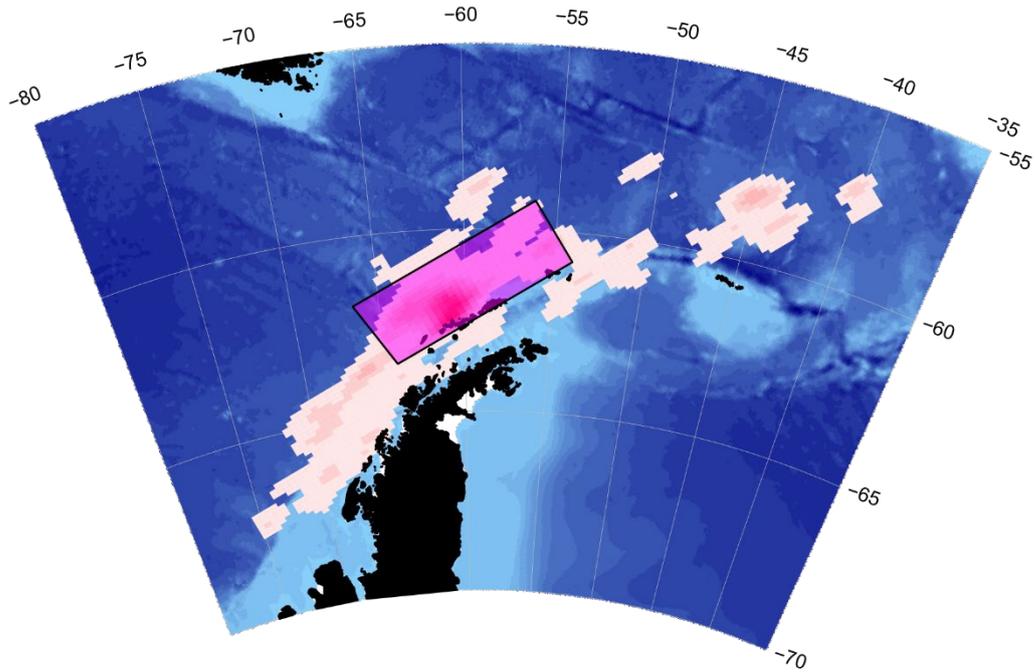


Figure 1. Proposed April–June temporary fishery closure area to mitigate risks to South Shetland Antarctic Fur Seals (pink polygon) sub-population, overlaid on the utilisation distribution of tracked juvenile fur seals from this population.

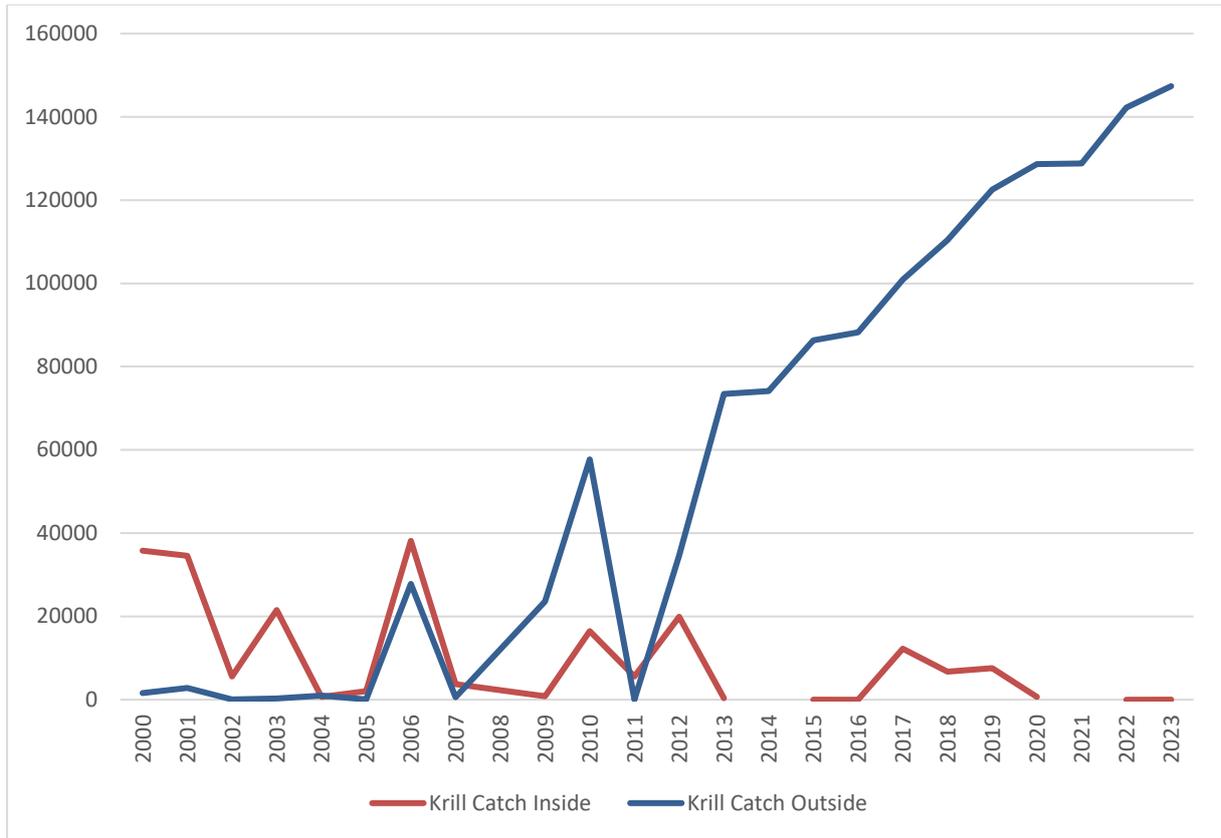


Figure 2. Annual catches of krill both within and outside of the proposed temporary fishery exclusion area in April – June from 2000 to 2023.

Agenda

Working Group on Incidental Mortality Associated with Fishing (Hobart, Australia, 5 to 10 October 2023)

1. Opening of the meeting
 - 1.1 Introduction
 - 1.2. Adoption of the agenda
 - 1.3 Review of terms of reference and the work plan
2. Review of incidental mortality in CCAMLR fisheries
3. Marine mammal incidental mortality
 - 3.1 Population status of marine mammals in the CAMLR Convention Area
 - 3.2 Incidental mortality and risk assessments of marine mammals in CCAMLR fisheries
 - 3.3 Data collection needs from marine mammal interactions
 - 3.4 Mitigation methods for marine mammals
 - 3.5 Advice to the Scientific Committee regarding marine mammals and CCAMLR fisheries
4. Seabird incidental mortality
 - 4.1 Population status of seabird species in the CAMLR Convention Area
 - 4.2 Seabird incidental mortality and risk assessments in CCAMLR fisheries
 - 4.3 Mitigation methods for seabirds
 - 4.4 Advice to the Scientific Committee regarding seabirds and CCAMLR fisheries
5. Observer reports and data collection
6. Marine debris effects on seabirds and marine mammals
7. Light pollution effects on seabirds
8. Future work

9. Other business
10. Advice to the Scientific Committee
11. Adoption of the report and close of meeting

List of Participants

Working Group on Incidental Mortality Associated with Fishing (Hobart, Australia, 4 to 10 October 2023)

Chair	Dr Marco Favero National Research Council (CONICET, Argentina)
Chair	Mr Nathan Walker Ministry for Primary Industries
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Invited Expert	Dr Javier Arata Association of Responsible Krill harvesting companies (ARK)
Invited Expert	Dr Igor Debski Agreement on the Conservation of Albatrosses and Petrels (ACAP)
Invited Expert	Dr Mike Double Agreement on the Conservation of Albatrosses and Petrels (ACAP)
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Claire van Werven
Research, Monitoring and Compliance Analyst

List of Documents

Working Group on Incidental Mortality Associated with Fishing
(Hobart, Australia, 5 to 10 October 2023)

WG-IMAF-2023/01	Update on Net Monitor Cable and whale mitigation devices on krill vessels Moir Clark, J., B. Viney, K. Mackey, U. Lindstrøm and B. A. Krafft
WG-IMAF-2023/02	Bycatch in the Antarctic krill (<i>Euphausia superba</i>) trawl fishery Krafft, B.A., A. Lowther and L.A. Krag
WG-IMAF-2023/03	Summary of Incidental Mortality Associated with Fishing activities data collected during the 2023 season, and a draft method for the extrapolation of IMAF and warp strikes Secretariat
WG-IMAF-2023/04	Developing a protocol to assess seabird strikes in the krill fishery Arata, J. and I. Debski
WG-IMAF-2023/05	Seabird warp strike observation protocols for trawl fisheries Debski, I.
WG-IMAF-2023/06	Update on ACAP activities and advice ACAP
WG-IMAF-2023/07	Review of Mitigation Measures for reducing Seabird interactions with fishing gear in trawl fisheries Arata, J. and I. Debski
WG-IMAF-2023/08	CCAMLR protocols for pinniped identification, sexing, and length measurement Pardo, E., D. Krause, R. Borrás-Chavez and H. McGovern
WG-IMAF-2023/09	Develop efficient and robust Escape-Opening of Seal Exclusion Device for conventional Antarctic krill midwater trawl Ying, Y., H. Huang and X. Zhao
WG-IMAF-2023/10	Draft data collection form for whale incidental mortality events in the krill trawl fishery Kelly, N., R. Leaper and L. Leach

WG-IMAF-2023/11	Global political responsibility for the conservation of ACAP Priority Populations of albatrosses and petrels of relevance to CCAMLR Phillips, R.A., P. Catry, M. Dias, S. Opper, D.J. Anderson, K. Delord, G. Elliott, D. Nicholls, K. Walker, R. Wanless, H. Weimerskirch and M. Beal
WG-IMAF-2023/12	Key considerations in addressing seabird and marine mammal bycatch in CCAMLR fisheries Favero, M., N. Walker, I. Debski and R.A. Phillips
WG-IMAF-2023/13	Light pollution guidelines and their application in CCAMLR fisheries Barrington, J.
WG-IMAF-2023/14	Metapopulation distribution shapes year-round fisheries bycatch risk for a circumpolar seabird Rexer-Huber, K., T.A. Clay, P. Catry, I. Debski, G.C. Parker, R. Ramos, B.C. Robertson, P.G. Ryan, P.M. Sagar, A. Stanworth, D.R. Thompson, G.N. Tuck, H. Weimerskirch and R.A. Phillips
WG-IMAF-2023/15	Observation on the interaction between Antarctic fur seal and krill fishing operation in Subarea 48.3 during the fishing season in 2020 Ying, Y., J. Zhang, X. Wang, X. Zhao, X. Yu, J. Zhu and Z. Huang
WG-IMAF-2023/16	Power and precision of warp strike observation rates in the Area 48 krill fishery Maschette, D., S. Wotherspoon, N. Walker, M. Double, P. Ziegler and N. Kelly
WG-IMAF-2023/17	Preliminary results of the trial on net monitoring cable/warp seabird-strike mitigation measures conducted by the Chinese F/V SHEN LAN during the 2022/23 fishing season Wang, Z., B. Su, G. Fan, H. Huang, Y. Ying, H. Hua and X. Zhao
WG-IMAF-2023/18 Rev. 1	Review of seabird bycatch mitigation in CCAMLR demersal longline fisheries Barrington, J., R. Arangio, I. Debski and M. McNeill

Other documents

WG-IMAF-2023/P01

Evaluating threats to South Shetland Antarctic fur seals amidst population collapse

Krause, D.J., R.L. Brownell Jr., C.A. Bonin, S.M. Woodman, D. Shaftel and G.M. Watters

*Accepted for publication at Mammal Review. DOI: 10.1111/MAM.12327.

Suggested data fields for the specification of marine mammal exclusion devices

Seal exclusion mesh

- Material/diameter
- Mesh size
- Position in net

Seal exclusion grid

- Bar material/diameter
- Bar spacing
- Position in net

Seal escape holes/hatches

- Number
- Position/s
- Size of holes

Whale exclusion mesh

- Material/diameter
- Mesh size
- Position in net
- Comments

Suggested changes to heavy warp strike definitions

Air: Bird strikes warp in the air and hits the water with little to no control of its flight.

Water: [*The bird is on the water and the*] warp strikes bird driving any part of the body beneath the surface of the water, but not fully submerged.

Sinker: [*The bird is on the water and the*] warp strikes bird and the entire body is submerged.

Working Group on Incidental Mortality Associated with Fishing (WG-IMAF) Terms of Reference ¹

1. The purpose of the Working Group on Incidental Mortality Associated with Fishing (WG-IMAF) is to contribute to the conservation of Convention Area seabirds and marine mammals through the provision of advice to the CCAMLR Scientific Committee and its working groups, including consideration of the impacts of climate change on its advice. To achieve this, WG-IMAF will address the following terms of reference:

- (i) the level and significance of direct impacts of interactions and incidental mortality associated with fishing
- (ii) the efficacy of mitigation measures and avoidance techniques currently in use, and improvements to them, taking into account experience from both inside and outside the Convention Area
- (iii) the level and significance of direct impacts of marine debris originating from fishing activities on seabirds and marine mammals within the Convention Area
- (iv) improvements ~~and/or additions~~ to the reporting and data collection requirements regarding incidental mortality
- (v) approaches to improve the conservation status of seabirds and marine mammals directly impacted by fishing outside the Convention Area, by Collaborating and coordinating with relevant organisations that the Commission has a cooperative arrangement with, including with invited experts as required—~~including cooperation with adjacent regional fisheries management organisations (RFMOs).~~

2. ~~Collaborate and coordinate with relevant organisations that the Commission has a cooperative arrangement with, including with invited experts as required.—~~

3. ~~—~~To provide any other advice, within its area of expertise, to the Scientific Committee and its working groups as directed by the Scientific Committee.

¹ 202~~32~~

