Annex 9

Report of the COLTO–CCAMLR Tagging Workshop 2023 (WS-TAG-2023)
(Hobart, Australia, 14 to 17 March 2023)

Contents

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Welcome and introductions

1.1 The COLTO–CCAMLR Tagging Workshop was held at the CCAMLR Secretariat in Hobart, Australia, from 14 to 17 March 2023 as an in-person meeting. The Workshop included both meeting room plenary discussions and a hands-on wet-lab component at the University of Tasmania biological sciences laboratory.

1.2 The Workshop was co-convened by Mr R. Arangio (Coalition of Legal Toothfish Operators (COLTO)) and Dr C. Jones (USA), who welcomed participants (Appendix A) to Hobart and encouraged open engagement to stimulate discussion on the best practices for CCAMLR's tagging program and provide recommendations to be reviewed by the Scientific Committee and its working groups.

1.3 Dr D. Agnew (CCAMLR Executive Secretary) welcomed Workshop participants and thanked COLTO for the opening icebreaker evening and for supporting the Workshop. He noted that the CCAMLR tagging program is a critical component of stock assessments for toothfish and used as a reference for skate abundance, and therefore supports successful precautionary management of multiple stocks by the Commission.

1.4 The Workshop welcomed the participation of two invited experts, Mr D. Snodgrass (NOAA) and Mr D. Evans (Hallprint).

1.5 The Workshop agenda was adopted (Appendix B).

1.6 Documents submitted to the Workshop are listed in Appendix C. The Workshop thanked all the participants and authors for their contributions to the meeting.

1.7 The workshop report was prepared by R. Arangio (COLTO), D. De Pooter (Secretariat), J. Fenaughty (New Zealand), I. Forster (Secretariat), C. Jones (USA), S.V. Ngcongo (South Africa), S. Parker (Secretariat), B. Plum (New Zealand), M. Williamson (South Africa) and P. Ziegler (Australia).

Workshop overview

1.8 WS-TAG-2023/02 presented a brief history of toothfish tagging in the CAMLR Convention Area and discussions leading up to WS-TAG-2023. Toothfish have been tagged in CCAMLR fisheries since the late 1990s, and information from the mark-recapture program has been used to estimate movement, growth and mortality rates, and abundance. Tagging of toothfish from fishing vessels in new and exploratory fisheries started in 2000/01 and has become mandatory since 2003/04. The paper included a summary of trends in toothfish tag releases, recaptures and tagging rates, tagging requirements, tag types, improvements to the tagging program, a case-control study of tagging performance, and a summary of discussions

on tagging practices and issues identified leading to WS-TAG-2023. The paper also identified outstanding recommendations that would improve the tagging program and challenges for best-practice protocols.

1.9 The Workshop thanked the author for the paper and noted that overall more than 380 000 toothfish and over 69 000 skates have been tagged in the Convention Area. The Workshop recognised that the tagging program for toothfish in CCAMLR is one of the most expansive tagging programs in the world, and it provides important and high-quality data for estimates of biological parameters and toothfish stock biomass, which underpin the stock assessments that provide catch limit advice.

1.10 The Workshop noted the economic impact of the tagging program. Mr A. Smith (New Zealand) estimated that the total costs of the CCAMLR tagging program in fish returned at current market value would equate to in excess of US$150 million based on releasing 380 704 tagged toothfish from 1997 to 2023.

Tagging program presentations

1.11 The Workshop received presentations from nine Members (Australia, Chile, France, Republic of Korea, New Zealand, South Africa, Spain, United Kingdom, with Ms Williamson presenting information on behalf of Ukraine) describing the current practices of tagging toothfish and skates on their vessels, including the processes used for (i) choosing which fish to tag, (ii) landing, handling and transporting fish onboard the vessel, (iii) tagging, and (iv) releasing.

1.12 Considerable variation was reported between Members and vessels in the types and designs of fish landing aides, the role of the observer in tagging procedures, factory configurations and the use of holding tanks. However, the vessels all had developed mechanisms to implement the CCAMLR tagging program, including the need to monitor tag-overlap statistics, move fish around the vessel and handle large fish. The participants noted that one of the valuable aspects of the Workshop was to allow the best practices to be shared among vessels with the goal of improving performance of all vessels in the program.

1.13 Additional information presented by Ukraine (delivered by Ms Williamson) recommended that future work should consider the potential influence of colossal squid (*Mesonychoteuthis hamiltoni*) and seabird depredation, as both tend to target the part of the fish body where tags are attached and may therefore influence recapture results.

1.14 WS-TAG-2023/01 presented a summary of the tagging procedures survey conducted by the Secretariat in 2019 and 2020. The results reflected information provided by Workshop participants in paragraph 1.11, that considerable variation in tagging procedures exists among vessels which may impact tagging program performance, and also that new vessels may influence the level of experience and diversity in vessel configurations used as part of the tagging program. The survey indicated that several fish landing and handling procedures could be improved through updated training materials targeting both vessel crew and observers.

1.15 The Workshop noted that the information gained by the survey was based on a subset of vessels in exploratory fisheries, and recommended that collecting information from all toothfish fishing vessels as part of the fishery notification process would aid in documenting and better understanding tagging performance among vessels. Table 1 provides the vessel-specific information that could be collected to inform on tagging practices.

1.16 Mr Snodgrass presented WS-TAG-2023/03, which summarised the Cooperative Tagging Program on Highly Migratory Species in the Atlantic, operating since 1954. The paper summarised lessons learned and the types of information able to be developed from this tagging program, including practices for handling and tagging large fish.

1.17 The Workshop noted that similar practices are used with toothfish and skates, such as cutting hooks for easy removal, and using materials that minimise removal of the mucus layer on fish skin, which can improve the condition of fish at release.

1.18 The Workshop noted a presentation by Mr Ngcongo summarising observer suggestions for the tagging training manual, including reducing repetition of information, separating release and recapture guidance, and developing sections for different stages of the procedure for easy indexing. In addition, the observers recommended that the overall goals for fish handling should be to minimise the time fish are out of water, avoid the use of holding tanks where possible, use a net to land all fish selected for tagging where possible, and develop better incentives for vessel crew such as recognition for good performance, to improve good performance.

1.19 The Workshop thanked the observers and the presenters for best-practice suggestions and agreed that providing information back to vessels on tagging performance statistics would be useful feedback for Members and vessel operators to maintain and improve tagging performance. In addition, development of innovative landing aides, and continuous improvement and use of best practices should be incentivised through mechanisms such as the COLTO tag lottery.

Best practice discussions

2.1 The Workshop reviewed the existing tagging training module as specified in Conservation Measure (CM) 41-01, Annex 41-01/C (www.ccamlr.org/node/85702) that was developed during WG-SAM-2012 in order to assist in developing best practices for the CCAMLR tagging program.

2.2 Aspects of the review included retrieving fish from the line, minimising handling and transport to tagging stations, time out of water, optimising tag placement, fish health and data quality. It was agreed that toothfish and skates be treated separately, and that best practice should be underpinned by the desired outcome of each element of the program.

Toothfish and skate landing

Tagging responsibility

2.3 The Workshop noted that fish tagging is a Flag State responsibility. Generally the vessel would advise when the next fish should be tagged, with the responsibilities of each part of the tagging process clearly defined collaboratively between crew and observer at the start of each voyage.

2.4 The individual responsible for tagging the fish, whether it is a member of the vessel crew or an observer, should have familiarity with the tagging procedure and have undergone tagging training.

2.5 The Workshop agreed that ideally multiple people on board should be trained to tag fish and that the observer can assist in this role.

Tag-overlap statistic

2.6 The Workshop recommended that the method used in selecting a fish to be tagged, whether it be the 'every nth fish' approach, or a batch tagging approach, be recorded in the observer's cruise report.

2.7 The Workshop discussed the requirement of achieving the >60% tag-overlap statistic, and noted that several tools have been developed to determine whether the overlap statistic is being met, including individual Members' different tag-overlap statistic calculators that can be used in real time to monitor performance and inform decisions on which fish to tag.

2.8 The Workshop noted that a 60% tag-size overlap still leads to potential bias in biomass estimates from stock assessments (WG-SAM-12/24). The Workshop recommended that WG-SAM and WG-FSA review an increase in the minimum tag-size overlap statistic.

Handling different size fish

2.9 The Workshop agreed on the importance of using nets or cradles to retrieve fish intended for tagging, particularly for large fish. It was noted that scoop nets used to retrieve fish by vessels are comprised of various materials, as are slings used to transport fish on board, and that some of these materials can be abrasive to the surface of the fish, such as trawl mesh. The Workshop recommended that vessels use materials that ensure that the fish is released in the best condition possible, such as vinyl, knotless netting, etc.

2.10 The Workshop noted the different approaches to handling small fish versus large fish. Above a certain size/weight, a lifting aide such as a cradle will be necessary, and the need for this will be dependent on a number of factors, such as the height to be lifted or weather conditions.

Effects of weather and time out of water on tagging

2.11 The Workshop noted that there were some unique attributes for different toothfish fisheries, such as sea-ice cover and rough seas, that can make the use of cradles difficult and unsafe. In some cases, more damage could be done to a fish by attempting to get it into a net. The Workshop recommended future work that examines the effect of different methods of landing on fish condition that incorporates factors such as size of fish, sea conditions and height of lift.

2.12 The Workshop recommended that there could be benefits to improved cradle designs, and that a prize could be awarded to an improved design as an incentive. Mr Arangio suggested that COLTO would further explore this concept. The Working Group recommended that WG-FSA consider tasking observers to record details on tagging equipment, including cradle designs, which could be helpful in designing improvements (paragraph 2.17).

2.13 The Workshop noted that weather can be an important factor when fish are brought aboard the vessel. Extreme cold and wind can result in the surface of the fish's eyes freezing, with unknown consequences. One method of preventing corneal damage and reducing the effects of light could be to place a wet towel over the fish's eyes. This would be particularly beneficial where tagging is done in an exposed open deck environment.

2.14 The Workshop agreed that minimising the amount of time that the fish is out of any water is essential, and that different conditions will dictate what practices are achievable.

2.15 The Workshop considered a targeted maximum time that the fish could be out of any water, and agreed that any more than three minutes could make the fish less viable for tag and release, however, this must be balanced so that the quality of the tagging event is not compromised. The Workshop recommended that best practice would target the fish being out any water for no longer than three minutes, while noting some fisheries utilise pre- and post-tagging holding tank time to assess that fish condition is not compromised.

2.16 The Workshop agreed that there may be some benefit in stopping hauling in order to land fish for tagging when possible, allowing more crew to focus on a tagging event. However, it was noted that this could significantly slow down fishing operations if done for every fish, particularly for a fishery where there is a high required tagging rate. Further, there could be problems related to increased cetacean depredation of fish on the line if hauling is stopped frequently. The Workshop agreed that decisions in relation to stopping hauling, while beneficial to the tagging process, should be a vessel decision based on conditions.

Toothfish and skate handling, station and equipment

2.17 The Workshop recommended that holding tanks should only be used if necessary. Best practice is to release the fish immediately after being tagged. However, if holding tanks are used, then the time fish should remain in the tanks should be minimised. During periods when large predators (e.g. killer whales) are in the area, fish should be kept in the holding tank until it is safe to release them. Where possible, toothfish and skate should be kept separately to reduce potential injury to each other.

2.18 The Workshop noted that specifications of the holding tanks from the current tagging training document could be included in the *Commercial Data Collection Manual – Longline Fisheries* to assist vessels in the design and operation of holding tanks, including considerations of container size, cleanliness, required maintenance, as well as water flow rate and water temperature. It was agreed that holding tanks should not be overcrowded and that water levels should be sufficient to allow complete submersion of the animal.

2.19 The Workshop considered the existing training materials and recommended that a viability assessment of the fish in the holding tank should be included. For example, if a fish is tilting sideways or is belly-up, then these fish should not be tagged and released. The viability assessment guidance should also include the phrase 'Do not tag and release fish if any of the listed conditions are present'.

2.20 The Workshop recommended that the diagram instruction for tagging small and large fish should be the same and that only the figure of the fish showing the location of the tag should remain in the figure.

2.21 The Workshop proposed that the tagging training manual be updated to reflect the categories for fish fate matching those in the electronic logbooks.

Toothfish and skate release operations

2.22 The Workshop noted that most of the material contained in the existing tagging training manual regarding the release of toothfish is still considered to be best practice.

2.23 The Workshop recommended that fish should be gently released headfirst into the water with the minimum vertical distance possible. Depending on the fish size, this should be carried out either manually by the person assigned to tag or by using a sling or stretcher. The Workshop further recommended that vessel operators employ other modifications to assist with fish releases, such as a chute if the height of the release point on the vessel is excessive.

2.24 The Workshop discussed the use of appropriate mitigation devices to prevent predation of tagged fish, and recommended that for fisheries with seabird predation issues, tagged fish should be released within the area protected by a bird exclusion device (see CM 25-02), or water spray from a fire hose be used to deter birds.

2.25 The Workshop noted that release operations on vessels with a moon pool were not well understood. The Workshop recommended that the practice of releasing a tagged fish out of a chute or hatch on the side of these vessels was appropriate, as this allowed for observation of the fate of a tagged fish, and reduced the potential of interaction with a vessel's propellor.

2.26 The Workshop discussed the best practice for releasing skates. The Workshop agreed that the best practice was bringing the animal to the roller, cutting the snood and thoroughly inspecting it for damage on board the vessel before determining if the skate was suitable for release.

2.27 The Workshop considered a video presented from WG-FSA-2022/19, which provided precise and clear instructions for assessing and releasing skates. The Workshop recommended the inclusion of the video on the CCAMLR website as a resource for instructing crews on the correct handling and release of skates.

2.28 The Workshop noted that very large skates were rare and that specific handling practices for these individuals would be determined by the environmental and operating conditions at the time.

Tagging equipment

2.29 The Workshop discussed the issue of tag storage on vessels, noting the recommendation that tags should be stored in a dark, cool environment. The Workshop further noted that tags are often stored on the bridge of a vessel, and despite the tags being UV stabilised, they can become brittle in such dry conditions with time. The Workshop recommended that tag packaging be developed to prevent UV exposure during storage, and noted the advice from Mr Evans that brittle tags can be remoisturised by placing them for some time in a wet environment.

2.30 The Workshop recommended using tagging guns with stainless steel internal components to apply the tags, as these better resist the corrosive effects of salt water. The Workshop further noted that the tagging guns provided by the Secretariat meet this standard.

2.31 The Workshop considered tagging skates and large toothfish with heavy-duty T-bar tags and noted that compared to standard T-bar tags, such tags may be less prone to loss and be more easily detected when fish are recaptured. However, the Workshop noted that such tags are more expensive, need to be applied using different guns and will inflict larger wounds to the tagged fish. The Workshop further considered that having two sets of similar looking tagging equipment on board may cause confusion.

2.32 The Workshop noted the potential use of a three-digit alpha numeric code (a checksum) to verify the sequential tag number, and that this option has recently become available from the current CCAMLR tag manufacturer.

Toothfish and skate release operations

2.33 The Workshop discussed the development of three items which would be important outcomes of this Workshop:

(i) a tagging protocol (Appendix D) to summarise the tagging requirements

(ii) a revised training manual for crew and observers

(iii) posters for reference (Appendices E and F) while on board of vessels.

2.34 The Workshop recommended that the Scientific Committee consider the protocol provided in Appendix D be referenced by CM 41-01, Annex 41-01/C, as the tagging protocol.

2.35 The Workshop noted that fish tagging and recovering and processing of recaptured tagged fish are separate processes, and handled by different people. The Workshop noted that training materials should separate fish tagging guidelines and fish recapture guidelines into different sections.

2.36 The Workshop recommended that the toothfish tagging poster provided in Appendix E and the skate tagging poster provided in Appendix F are translated into the different languages used by crew on board CCAMLR longline vessels. The Workshop recommended that the posters be made available on the vessels so they can be referenced by trained fish handlers at the tagging station. The Workshop welcomed the offer by COLTO to coordinate the translation and distribution of the posters.

2.37 The Workshop further noted that the *Commercial Data Collection Manual – Longline Fisheries* should be updated to include guidance for holding tank design subject to vessel configurational constraints.

2.38 The Workshop noted that the *Commercial Data Collection Manual – Longline Fisheries* and the observer longline manual should be updated to specify the conditions which exclude fish from being tagged and released and to specify the following guidelines regarding the recapture of tagged fish:

(i) record data as required in the observer longline logbook and the C2 logbook. Make sure to include all leading characters, tag type, colour and inscription

(ii) the CCAMLR tagging program requires photographs of all attached tags on fish in situ as well as all tags using the tag photo template, making sure tag numbers can be read; take multiple photos if needed

(iii) store otoliths and recaptured tags using the methods requested by the Flag State, ensuring associated data are recorded.

2.39 The Workshop noted that training materials should include best-practice videos as well as videos showing practices which should be avoided.

2.40 The Workshop thanked COLTO for providing the fish for the hands-on wet-lab component of WS-TAG-2023. The Workshop recognised the usefulness of the hands-on session during which it was shown that in large fish the T-bar tags may not be anchored behind the pterygiophore but can be anchored intramuscularly. The Workshop further noted that incorrectly applied tags can be pulled out easily.

2.41 The Workshop recommended that, where possible, hands-on training be included in tag training programs. The Workshop further recommended that fish handlers practice tagging on board of vessels using damaged fish with low commercial value.

2.42 The Workshop recommended that Members consider further developing the training manual incorporating recommendations from WS-TAG-2023 for vessel crew and observers for consideration by WG-FSA-2023, with the assistance of the Secretariat.

2.43 The Workshop requested that, upon completion, the Secretariat update all relevant documents on the website and ensure that they are well organised and easily accessible.

2.44 The Workshop recalled that tagged and released toothfish which were caught using trotlines were reported to have a lower survival rate compared to those released by autoline and Spanish longline vessels (WG-FSA-2017, paragraph 3.71). The Workshop noted that during 2018, fish handlers on board of some trotline vessels received additional training and that if fish condition criteria were met, there should be no difference in survival rate between fish caught by different gear types.

2.45 The Workshop recommended that tagging performance statistics be calculated which differentiate between data collected prior to 2018 and post 2018. Future analyses should further differentiate between data prior to 2023 and post 2023 to assess the impact of WS-TAG-2023.

2.46 The Workshop noted that colossal squids have been reported to feed on fish during hauling. The Workshop discussed additional data collection by observers on squid markings on caught toothfish and recalled the intention of Ukraine (paragraph 1.13) to present a study to WG-FSA-2023 on potential predation by colossal squids on tagged toothfish and non-tagged toothfish during hauling.

2.47 The Workshop discussed new technologies, including electronic monitoring, which could increase the efficiency of the tagging program and encouraged Members to develop, test and share new technologies as they become available.

2.48 The Workshop recalled that several recommendations by WG-SAM and WG-FSA to improve the tagging program are still outstanding (see paragraph 2.49) and discussed the progress made.

2.49 The Workshop recommended that WG-FSA and WG-SAM consider incorporating the following tasks, which remain outstanding from previous working group meetings, in their workplans to improve the tagging program:

(i) developing spatial overlap diagnostics to index the representativeness of the mark-recapture data in providing an absolute abundance estimate

(ii) develop spatially explicit models for each area to account for lack of complete mixing

(iii) estimate and incorporate depredation effect on tag releases

(iv) develop fishery- and vessel-specific tag shedding rates to identify vessels which can benefit from additional training

(v) experimentally estimate initial tagging mortality rate and variability

(vi) estimate fishery- and vessel-specific survival and detection rates.

Data

3.1 The Secretariat presented a summary of data checks undertaken to improve data quality on tagging and tag recapture data. Data checks were undertaken at several stages, including

within-logbook error checks, during data processing, and during analysis procedures such as when producing the Fishery Reports.

3.2 Several Members presented their tag data quality checks that were undertaken on board vessels. In many cases the procedures were very similar to those of the Secretariat, although the use of real-time data checks was present in areas where non-CCAMLR tagging programs are undertaken.

3.3 The Workshop noted that the provision of information on tag recaptures to observers and crews in real time is very informative and encouraged engagement and interest in the CCAMLR tagging program. The Workshop further noted that the Secretariat cannot release detailed tagging information directly to vessels as this would contravene CCAMLR data confidentiality rules.

3.4 The Workshop recommended that the Scientific Committee consider a mechanism to enable the reporting of a subset of information on tag recaptures directly to vessels upon request, to further engagement in the CCAMLR tagging program. Such information could be limited to the statistical area, time at liberty, distance travelled and length of the fish when tagged, which would prevent the disclosure of sensitive information regarding the deployment or recapture vessel.

3.5 The Workshop encouraged Members to share tag data quality procedures to improve the accuracy of tagging and recapture information. The Workshop noted that the Secretariat's data quality rules are available to Members upon request, and that some Members provided tag data checking rules to the Secretariat.

3.6 The Workshop noted the practice of the Australian tagging program, where tagged fish were re-released provided they were in good condition, and further noted that this was not a standard practice in other CCAMLR fisheries. It was also noted that these re-released tagged fish are given a unique release ID each time, to accompany the tag numbers, which is then used to track the fish.

3.7 The Workshop requested the Secretariat consider developing a list of common tag release and recapture data errors to be included as part of the tag training manual, as this would assist those collecting tagging data in identifying part of the process that were error prone.

Monitoring tagging operations and program administration

3.8 The Workshop discussed ways that the supply of tagging equipment to Members and companies, as well as overall program operations and efficiency, could be improved.

3.9 The Workshop noted that some numeric sequences on CCAMLR tags overlapped with those used in some Members programs. The Workshop further noted that CCAMLR tags have a single-letter prefix before the serial number which is not present in tags of those Members' programs, and that tag inscriptions were different between all tagging programs.

3.10 The Workshop encouraged that the CCAMLR and Members' tagging programs be combined, as this would remove the issue of duplicate numeric sequences on the tags and may

improve tag data quality. Alternatively, the Workshop encouraged direct coordination between Members and the Secretariat to develop mechanisms to avoid duplication of tag number sequences.

3.11 The Workshop noted that the most common errors encountered by the Secretariat when trying to match tag recoveries with releases were transcription errors because of base 10-digit changes to the tag number sequences, likely occurring when a new series of tags are used. The Workshop encouraged investigating the use of shortened alpha-numeric sequences on future tags as this could potentially reduce transcription errors.

3.12 The Secretariat noted that most of the unlinked tag recaptures that were remaining in the CCAMLR database were from Members' tagging programs (generally pre-2005). The Workshop noted that investigating links for these tags is a time-intensive process which involves tasks such as re-matching tags that may have been recorded without an alpha-prefix, cross referencing tags with supplied photographs, or investigating tag numbers individually. The Workshop agreed that improving historic data would be beneficial and encouraged the Secretariat and the Scientific Committee to explore options to achieve this, such as an internship.

Looking forward

4.1 The Workshop reflected that progress made both at this Workshop and historically was due to the excellent relationship between CCAMLR and the fishing industry, and encouraged the collaboration between Members, the Secretariat and industry to continue.

Workplan for future improvement

4.2 The Workshop discussed potential improvements to tag design and automated tag reading devices to increase tag detection rates, and reduce tag data errors. The Workshop noted that that the development of emerging technologies such as radio-frequency identification (RFID) fish tags, and close kin mark recapture (CKMR), should be monitored by Members, and promising techniques be introduced through papers to working groups of the Scientific Committee.

4.3 The Workshop noted that several presentations of tagging operations by Members included electronic tag data entry tablets and applications, and encouraged Members and the Secretariat to investigate options to reduce pencil and paper recording of data by crew and observers, as this would streamline workloads, allow automation of effort checking during the tagging process and reduce transcription errors.

4.4 The Workshop encouraged Members to engage with the Secretariat to enable direct training sessions with observers, vessel officers and crew to introduce CCAMLR's tagging and data collection requirements and best practices, and requested that the Scientific Committee consider a mechanism to efficiently organise and fund such training events.

Pop-up satellite archival tags

4.5 The Workshop noted that CM 91-05, which covers the Ross Sea region marine protected area (RSRMPA), specifies in paragraph 8(iii) that within the special research zone (SRZ) of the Ross Sea, 'Tags shall include pop-up or implanted archival tags that shall be deployed based on advice from the Scientific Committee'.

4.6 The Workshop noted that many configurations of pop-up satellite archival tags (PSATs) were available and that the appropriate configuration was dependent on the specific question being asked. The Workshop further noted that the environmental conditions in the Southern Ocean, and especially related to toothfish and skate deployments were typically outside the operational specifications of currently available archival tags, especially for questions relating to movement patterns. The Workshop encouraged Members to test the performance of PSATs as the technology develops under realistic conditions before large-scale deployments.

4.7 The Workshop reflected that the Scientific Committee had not provided direct advice on the deployment of pop-up or implanted archival tags in the SRZ of the RSRMPA, and that the successful deployment rate of pop-up or implanted archival tags throughout CCAMLR fisheries was currently very low. The Workshop requested that the relevant working groups and the Scientific Committee consider advice relative to archival tagging in the SRZ.

Future work

5.1 The Workshop identified the following topics as potential future tasks:

(i) increase engagement of vessel crew in the tagging program by:

  (a) providing tagging performance statistics to vessels (paragraph 1.19)

  (b) encouraging vessels to develop innovative handling aides (paragraph 2.12)

  (c) considering a mechanism for vessels to obtain information about the tagged fish they recapture (paragraph 3.4)

(ii) examine effects of different hauling methods on fish condition (paragraph 2.11)

(iii) develop a tagging training manual (paragraph 2.42), which includes best-practice videos (paragraph 2.39)

(iv) consider mechanisms to efficiently organise and fund tagging training sessions for vessel crew and observers (paragraph 4.4)

(v) investigate options to reduce pencil and paper recording of data by crew and observers (paragraph 4.3)

(vi) explore options to improve historic tagging data (paragraph 3.12)

(vii) develop, test and share emerging technologies as they become available (paragraph 2.47), including

(a) RFID fish tags (paragraph 4.2)

(b) CKMR (paragraph 4.2)

(c) PSATs (paragraph 4.6).

Outputs and report

6.1 The report of the Workshop was adopted.

6.2 At the close of the meeting, Dr Jones and Mr Arangio thanked all participants for their contributions of ideas to the Workshop and considered that significant progress was made in developing best-practices guidance, documentation and directions for future work to support CCAMLR's tagging program for both toothfish and skates.

6.3 The Co-conveners noted that the Workshop was unprecedented in having a hands-on practical session for tagging fish in a laboratory. They encouraged the participants to discuss options with their delegations to further develop the tagging training manual.

6.4 Mr Fenaughty and Dr Ziegler, on behalf of the Workshop, thanked the Co-conveners for their guidance, COLTO for funding the meeting venue, support and logistics, and the Secretariat team for their support in conducting the Workshop.

Table 1: Details of vessel configurations and procedures associated with toothfish landing, handling, tagging and release that could be collected in fishery notifications.

Category	Definition
Landing	
Lifting aide used	Is a lifting aide used to support fish that are chosen for tagging?
Type of aide	Cradle/scoop net/basket. Provide diagram with specifications
Fish size for lifting aide (cm)	What is the minimum size of fish that require use of lifting aide?
Vertical lift (m)	Height from water surface to landing
Tagging responsibility	Does the observer or vessel crew typically conduct the tagging procedure?
Tag overlap monitoring tool	Is tag overlap statistic monitored using a tool?
Distance to tag station (m; range)	How far is the transport between landing and tagging station?
Aide material	What material used in transport aides touches the fish?
Holding tank used	Is a holding tank used?
Size (L)	How many litres of water are maintained in the holding tank?
Flow rate	What is the flow-through rate (litres per minute) of water supplied?
Temperature (°C)	How is tank temperature monitored and controlled?
Tank cleaned (days)	How often is the tank drained and cleaned?
Recuperation	Are fish held for a recuperation period after tagging?
Tagging operation	
Number of people	How many people tag the fish (including recording data)?
Weight recorded	Is weight recorded?
Equipment maintenance	
Needle cleaned (days)	How often is the tagging gun needle cleaned?
Tagging needle replaced (days)	How is needle condition monitored and maintained?
Station cleaned (days)	How often is the tagging station cleaned?
Release method	How are fish released from the vessel?
Release height (m)	From what height are fish released to the sea?
Tagging time monitoring	Does someone periodically measure the time out of water used for the tagging operation?
Time out of water	What is the typical measured time (minutes) out of water required for the tagging operation?

Appendix A

List of Registered Participants

COLTO–CCAMLR Tagging Workshop
(Hobart, Australia, 14 to 17 March 2023)

Co-conveners	Mr Rhys Arangio Coalition of Legal Toothfish Operators
	Dr Christopher Jones National Oceanographic and Atmospheric Administration (NOAA)
Invited Experts	Mr Darren Evans Hallprint Pty Ltd
	Mr Derke Snodgrass NOAA / NMFS / SEFSC / PEM
Australia	Dr Philippe Ziegler Australian Antarctic Division, Department of Climate Change, Energy, the Environment and Water
	Mr James Devenport Australian Fisheries Management Authority
	Mr Martijn Johnson Australian Longline PL
	Ms Justine Johnston Australian Fisheries Management Authority
	Mr Tim Lamb Australian Antarctic Division, Department of Agriculture, Water and the Environment
	Mr Dale Maschette Institute for Marine and Antarctic Studies (IMAS), University of Tasmania
Chile	Dr Juan Carlos Quiroz Espinosa AOBAC – Asociación Gremial de Operadores de Bacalao de Profundidad de Magallanes
	Mr Leonardo Danilo Caballero González Instituto de Fomento Pesquero – IFOP

France	Mr Nicolas Gasco Muséum national d'Histoire naturelle
	Ms Charlotte Chazeau Muséum national d'Histoire naturelle
Korea, Republic of	Mr Hyun Joong Choi TNS Industries Inc.
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	Mr Jack Fenaughty Silvifish Resources Ltd
	Ms Brodie Plum Talley's Ltd
	Mr Andy Smith Smith Fishing Consultancy
	Mr Hamish Tijsen Talley's Ltd
South Africa	Mrs Melanie Williamson Capricorn Marine Environmental (CapMarine)
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	Isaac Forster Fisheries and Observer Reporting Coordinator
	Dr Steve Parker Science Manager

Appendix B

Agenda

COLTO–CCAMLR Tagging Workshop
(Hobart, Australia, 14 to 17 March 2023)

1 Welcome and introductions

- 1.1 Workshop overview
- 1.2 Tagging programs presentations

2 Best practice discussions (including wet lab work)

- 2.1 Toothfish and skate landing
- 2.2 Toothfish and skate handling, station, and equipment
- 2.3 Toothfish and skate release operations
- 2.4 Review of current tagging protocol

3 Data

- 3.1 Tag release data
- 3.2 Tag recapture data and recording
- 3.3 Monitoring tagging operations and program administration

4 Looking forward

- 4.1 Workplan for future improvement
- 4.2 PSAT tags

5 Outputs and report

- 5.1 Agreement on what approaches and outputs will be best suited
- 5.2 Summary/Report adoption.

Appendix C

List of Documents

COLTO–CCAMLR Tagging Workshop
(Hobart, Australia, 14 to 17 March 2023)

WS-TAG-2023/01	Summary of tagging procedures survey data received by the Secretariat from 2019 and 2020 Secretariat
WS-TAG-2023/02	A brief history of toothfish tagging in the CAMLR Convention Area and discussions leading up to WS-TAG-2023 C.D. Jones
WS-TAG-2023/03	Overview of the conventional tagging program of the Cooperative Tagging Center, Atlantic Highly Migratory Species (1954–2021) D. Snodgrass and E. Orbesen
Other Documents	
WG-FSA-13/54	Further review of CCAMLR tagging programmes S. Parker and J. Fenaughty (New Zealand)
WG-FSA-2022/11	Tag linking – 2022 report CCAMLR Secretariat
WG-FSA-2022/19	A condition assessment and handling guideline for skate (Rajiforms) by-catch in longline fisheries: Lessons from the Southern Indian Ocean J. Faure, R. Jones, M. Grima, C. Péron, N. Gasco, T. Lamb, P. Ziegler and J. Cleeland
WG-SAM-12/23	Measures to avoid bias in abundance estimates of Dissostichus spp. based on tag-recapture data D.C. Welsford and P.E. Ziegler (Australia)
WG-SAM-12/24	Influence of tag numbers, size of tagged fish, duration of the tagging program, and auxiliary data on bias and precision of an integrated stock assessment P.E. Ziegler (Australia)
WG-SAM-12/26	Drawing on international experience to improve performance of CCAMLR tagging programs S. Parker and S. Mormede (New Zealand)

WG-SAM-12/27	Viability criteria for tagging toothfish S. Parker (New Zealand)
WG-SAM-12/31	Recommendations for CCAMLR tagging procedures S. Parker, J. Fenaughty (New Zealand), E. Appleyard (Secretariat) and C. Heinecken (South Africa)
WG-SAM-13/25 Rev. 1	An overview of tagging skates (Rajiformes) and CCAMLR skate tagging data S.R. McCully, D. Goldsmith, G. Burt, R. Scott and J.R. Ellis (United Kingdom)
WG-SAM-2019/10	Chemical marking protocols for Antarctic starry skate age validation M. Francis and S. Parker

Appendix D

Tagging Protocol

1. The Flag State of the vessel is responsible for all tagging procedures and tagging equipment, including sourcing of tags for vessels.

2. Vessels are encouraged to work with observers to ensure that tagging and sampling procedures, specified in the *Scientific Observer's Manual – Finfish Fisheries* and the *Commercial Data Collection Manual – Longline Fisheries* are conducted in an efficient manner.

3. Fish that are selected for tagging should be landed on the vessel using a lifting aide that supports the weight of the fish from underneath (e.g. cradle, stretcher, dip net, or sling) to minimise potential injury.

4. Fish that are selected for tagging shall not be lifted using a gaff.

5. Fish that are selected for tagging must be assessed to be in good condition and free from injuries as specified in the Scientific *Observer's Manual – Finfish Fisheries* and the *Commercial Data Collection Manual – Longline Fisheries*.

6. Vessels are encouraged to configure the distance between the hauling bay, the tagging station and the release point to be as short as practicable, and to minimise obstacles that may hinder fish transportation.

7. Fish handling between the hauling bay, tagging station and release point should follow the methods recommended in the *Scientific Observer's Manual – Finfish Fisheries* and the *Commercial Data Collection Manual – Longline Fisheries*.

8. The tagging station should be protected from the weather, and ensure the safety of the fish handlers and the health of the fish.

9. Fish handling time, from landing to release, is encouraged to be as short as possible.

10. The total time fish are out of any water should be less than three minutes.

11. The time fish are held in a holding tank should be minimised.

12. Recommendations on holding tank design are specified in the *Commercial Data Collection Manual – Longline Fisheries*. The percentage of fish volume to volume of water in the holding tank should not exceed 10%. Toothfish and skates should be held separately.

13. Tagged toothfish should be released headfirst, ensuring that the distance between the release point and the sea surface is as short as practicable.

14. Tagged skates should be released dorsal side up, ensuring that the distance between the release point and the sea surface is as short as practicable.

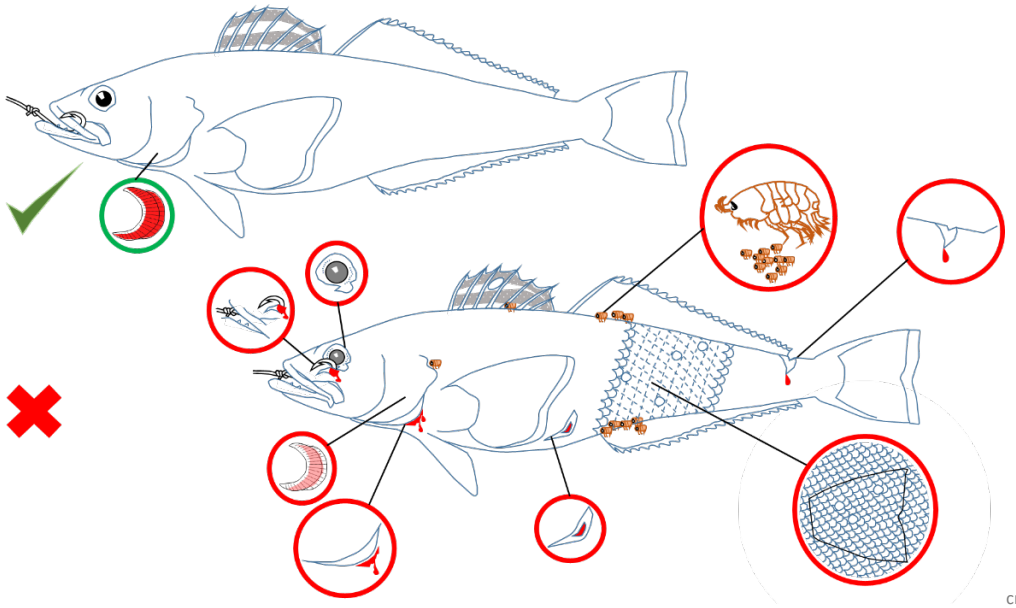
Toothfish Tagging Poster

Tag deployment

1. Use handling procedures outlined in the training manual, minimise time out of water.

2. Use more than one person for large fish, transport fish using a transport aide.

3. Carefully remove the hook. Assess suitability for tagging. Do not tag fish if any of the conditions listed below are present.



credit:
Alan Hart, NIWA

Suitability assessment

Assessment category	Do not tag
Hook injuries	Hook injury outside the mouth area (outside the lips, jaw, or cheek), or in the back of the mouth.
Gills	Gills pink or white
Bleeding	Any visible bleeding from gills, or excessive bleeding elsewhere
Body	Visible damage to fish body with open wounds
Organs	Visible damage to eye or penetration of body cavity, including by crustaceans (amphipods/lice)
Scales	Abrasions or single area of recent scale loss equal to or exceeding the area equivalent to the fish tail

4. Double-tag fish using tags with sequential numbers if possible.

5. Confirm tag is anchored with a gentle tug.

6. Record data as required in the observer longline logbook and the C2 logbook. Make sure to include all leading characters, tag type, colour and inscription).

7. Check that tag numbers are recorded correctly.

8. Release fish headfirst into water where release conditions are appropriate.

9. Observe and record fate of fish in the logbook.

Appendix F

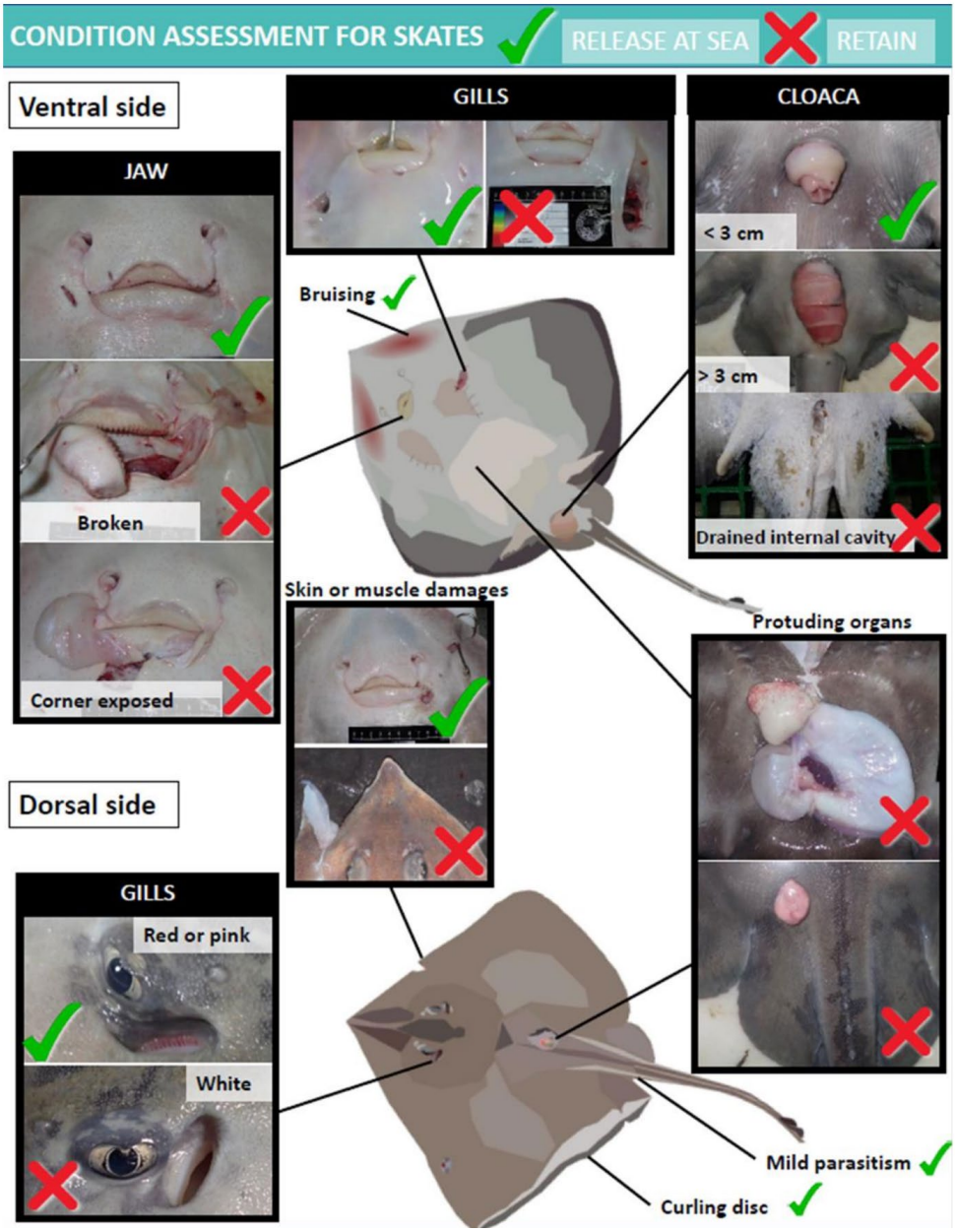
Skate Tagging Poster

Tag deployment

1. Use handling procedures outlined in the training manual, minimise time out of water

2. Use more than one person for large skates, transport skate using a transport aide.

3. Carefully remove the hook. Assess suitability for tagging. Do not tag the skate if any of the 'retain' conditions listed below are present.



4. Double-tag the skate using tags with sequential numbers if possible.

5. Confirm that tags are anchored with a gentle tug.

6. Record data as required in the observer longline logbook and the C2 logbook. Make sure to include all leading characters, tag type, colour and inscription.

7. Check that tag numbers are recorded correctly.

8. Release skate dorsal side up into water where release conditions are appropriate.

9. Observe and record fate of the skate in the logbook.

If a tagged skate is recaptured, retain it for the observer.