

ALF-2025-01: Age and Growth of Alfonsino

Description:

This project will contribute to the stock assessment and build on the work undertaken by Krusic-Golub. and Robertson (2020), Brouwer et al. (2020), and Brouwer et al. (2021) and Wakefield et al. (2026). This project aims to develop growth curves for alfonsino (*Beryx splendens*) in the Western and Eastern stocks of the Southern Indian Ocean, using otoliths collected and held by the Cook Islands and Japan. The results from the bomb radiocarbon ageing project (SER2022-BYS2) and the 2026 development of a new ageing protocol will be used.

In order to progress this work two things are required 1) section and reading - further analysis of otoliths is needed for a sample of large fish, to clarify some of the variability at the top end of the otolith morphometric regression; and 2) morphometric analysis - measuring a large sample of otoliths across years so that a big age dataset can be included in the stock assessment.

These two work streams can be conducted in parallel with the Cook Islands and Japan undertaking the morphometric analysis and FAS in Australia undertaking the sectioning and reading is a subsample of large otoliths. Both data sets will then be combined at SPC and the final regressions will be developed and applied to the morphometric data to get a final set of length-at-age data for use in the stock assessment.

The aim is to section and age 300 otoliths heavier than 0.32g. The 2026 alfonsino ageing workshop, identified that large fish were underrepresented in the sample and to complete the work a sample of large fish (identified as those with otoliths above 0.32g) was required to more accurately model the older age classes. These otoliths have already had the morphometric measurement completed in the Cook Islands otolith laboratory. The Cook Islands is also using this as a development and training opportunity for one of our junior scientists and our involvement in this work is seen as an important opportunity for her professional development.

The Cook Islands and Japan will aim to collect morphometric information from 500 fish per year in a length and sex stratified sample spread over years and areas in an attempt to span the years of the otolith collection and include samples from the three main fishing areas (Walters Shoal, the South Indian Rise and 90 East). The aim is to cover as many years as possible by working from now to 1 October. Applying the final regression to get the ages estimates will be relatively quick and can be done within a day once all the data have been provided to SPC.

The final analysis will be completed with length-at-age data provided to the assessment team. The growth curves and age length keys will be included in the assessment using the raw length-at-age data provided.

This project follows on from the successful completion of the alfonsino ageing protocol project (ALF-2024-01).

Objectives:

1. Select 300 otoliths that weigh over 0.32g weigh and measure (thickness, length width) each otolith - completed by MMR. Section and age these otoliths - at FAS.
2. Combine the above sample with the 600+ sampled from ALF-2024-01 to produce a finalised regression to estimate age from otoliths morphometrics - at SPC.
3. Select 500 otoliths per year in a length and sex structured manner. See appendix 1 for details - in The Cook Islands and Japan.

4. Provide all the morphometric and section age data to SPC to develop final regressions to estimate age from morphometrics- at SPC.
5. Provide the length-at-age that to the assessment team by 1 October.

Budget:

€11,000 for ageing of otoliths and providing travel for Cook Islands development staff to travel to SPC for final data preparation and report writing.

Itemised budget note costs are estimated in USD and converted to EUR:

Item	Lead	Value
Sectioned and ageing sectioned otoliths	FAS	€5,000
Shipping otoliths to FAS	MMR	CK contribution
Otolith morphometric analysis	MMR JFA	CK and JP contribution
Final analysis and project wright up including travel to SPC for final training of CK scientist	SPC	€6,000
Total		€11,000

Funding source: MoP

Project outputs:

- Meeting documents or papers will be prepared for the SC12 on the final age regressions for future use.
- Length-at-age data for the assessment and provided to SIOFA for future use.
- Final training of Cook Islands ageing scientist.

Intellectual property

- The otolith data are owned by the governments of the Cook Islands and Japan.
- The regression code will be the intellectual property of SPC until such time as the papers are published at which stage the regressions will become public information.
- Papers presented to the SC and any future publications in the scientific literature will be co-authored by SPC, FAS, Japan and the Cook Islands scientists involved in the analysis.

Appendix 1

SIOFA Otolith selection and sampling

Sample 500 per year . Noting that we may not be able to sample all yours there is a sample plan provided in the table below. The aim is to get 500 per year spread across areas. If only one area was fished in a year then use the area you have for the full sample. 500 per year in 10 year bins once filled fill in 5 year gaps etc .

The sample should be length structured but biased for the larger size classes. Length structured sample biased high e.g. 2/3 from 35cm + and 1/3 >35cm.

Sampling table 500 in each year spread over areas if available (final aim is 500 in each year across areas): noting that 90E is not fished every year.

Sample selection year order	Area 2 (Walters shoal)	Areas 3a and 3b (Mid Indian Ridge)	Areas 5, 4 and 7 (90E)
2025	200	200	100
2015	200	200	100
2007	200	200	100
2020	200	200	100
2024	200	200	100
2010	200	200	100
2017	200	200	100
2012	200	200	100
2021	200	200	100
2008	200	200	100
2022	200	200	100
2019	200	200	100
2014	200	200	100
2023	200	200	100
2011	200	200	100
2018	200	200	100
2016	200	200	100
2013	200	200	100
2009	200	200	100

For the length structured sample select otoliths using the tables below. If you can't fill a length class from that year it's ok.

Stratified Sampling Plan — Target n = 500 (1 cm length bins)

Design logic

- Length range: 15–55 cm, split into 1 cm bins (41 bins total)
- 2/3 of total sample (333 fish) from ≥ 35 cm (21 bins: 35–55 cm)
- 1/3 of total sample (167 fish) from < 35 cm (20 bins: 15–34 cm)
- Each bin split as evenly as possible between Male (M) and Female (F)

<35 cm group (target 167 fish)

Length (cm)	Male	Female	Total
15	5	4	9
16	4	4	8
17	4	4	8
18	5	4	9
19	4	4	8
20	4	4	8
21	5	4	9
22	4	4	8
23	4	4	8
24	5	4	9
25	4	4	8
26	4	4	8
27	5	4	9
28	4	4	8
29	4	4	8
30	5	4	9
31	4	4	8
32	4	4	8
33	5	4	9
34	4	4	8
Subtotal	87	80	167

≥35 cm group (target 333 fish)

Length (cm)	Male	Female	Total
35	8	7	15
36	8	8	16
37	8	8	16
38	8	8	16
39	8	8	16
40	8	8	16
41	8	8	16
42	8	8	16
43	8	8	16
44	8	8	16
45	8	7	15
46	8	8	16
47	8	8	16
48	8	8	16
49	8	8	16
50	8	8	16
51	8	8	16
52	8	8	16
53	8	8	16
54	8	8	16
55	8	7	15

Subtotal	168	165	333
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Grand Total

Group	Male	Female	Total	% of sample
<35 cm	87	80	167	33.4%
≥35 cm	168	165	333	66.6%
Overall	255	245	500	100%

Notes

- Most 1 cm bins target 8 fish (<35 cm group) or 16 fish (≥35 cm group); a handful of bins carry one extra or one fewer fish to make the totals land exactly on 167 and 333.
- If sex can't be reliably determined for smaller/juvenile fish (more likely in the <35 cm bins), consider adding an "Unknown/Juvenile" category rather than forcing a sex call, and reduce the M/F targets proportionally.
- At 1 cm resolution, some individual bins (e.g., very large or very small fish) may be genuinely hard to fill from real catch. If a bin is short, reallocate the shortfall to an adjacent bin within the same group (<35 or ≥35 cm) to preserve the overall 1/3–2/3 split — don't borrow across the 35 cm threshold.
- This plan assumes a roughly flat (uniform) target across bins within each group. If you'd rather weight bins to match expected population length-frequency, the allocation can be reworked accordingly.

Otolith data to record

For each otolith record the fish data and otolith in a spreadsheet. Each otolith should have 4 measurements (weight, length width and thickness). Scales and callipers should be calibrated prior to the work session starting.

For the otolith weigh measure in grams to 4 decimal places. For the otolith measurements (length, width and thickness) measure in millimetres to two decimal places.