TERMS OF REFERENCE (TOR) FOR THE PROVISION OF SCIENTIFIC SERVICES TO SIOFA STOCK AND ECOLOGICAL RISK ASSESSMENT WORK GROUP (SERAWG)

Title: Orange Roughy (*Hoplostethus atlanticus*) Age Estimation by Otolith
Project Code: SER2021-02

1. INTRODUCTION and BACKGROUND

The EU has agreed to a 2-year funding arrangement to enable SIOFA to commission a series of scientific studies to support the SIOFA/Scientific Committee's (SC) Work Plan (Report of the Scientific Committee, SC6). These proposed studies will be integrated with SIOFA's ongoing and planned scientific studies. The EU funding arrangements are designed to deliver on five General Objectives and, within each general Objective, a number of specific objectives.

One of the specific objectives is to provide the data and analysis to inform the effective management of the three key target stocks in the fishery, being alfonsino (*Beryx splendens*), toothfish (*Dissostichus spp*) and orange roughy (*Hoplostethus atlanticus*).

This document describes the background for project SER2021-02 that is under General Objective 1 (GO1) of the EU funding grant, being the Support for the Assessment of the Key Target Stocks. Within GO1, there are number of planned studies that, together, will result in better and more robust stock assessments of the three target species. One of these required studies is the ageing of orange roughy from otoliths and the determination of the growth curve for this species based on that ageing for use in stock assessments.

The first stock assessments of orange roughy were conducted in 2018 and a growth curve for orange roughy for Sleeping beauty Bank in the Walters Shoal Region (WSR) (Fig. 1) was estimated by Cordue (2018) using 400 aged otoliths read by Horn et al (2019).

As that growth curve was based on samples from a limited length range of fish (Fig 2), this project will focus on incorporating additional otolith age samples (mainly from fish with lengths below 35 cm and fish with lengths above 50 cm) into the analysis so that the growth curve parameters can be improved and updated.

Dr Peter Horn has provided 10 additional ages from otoliths from fish of length less than 31 cm (sex unknown) as shown in Fig 3.

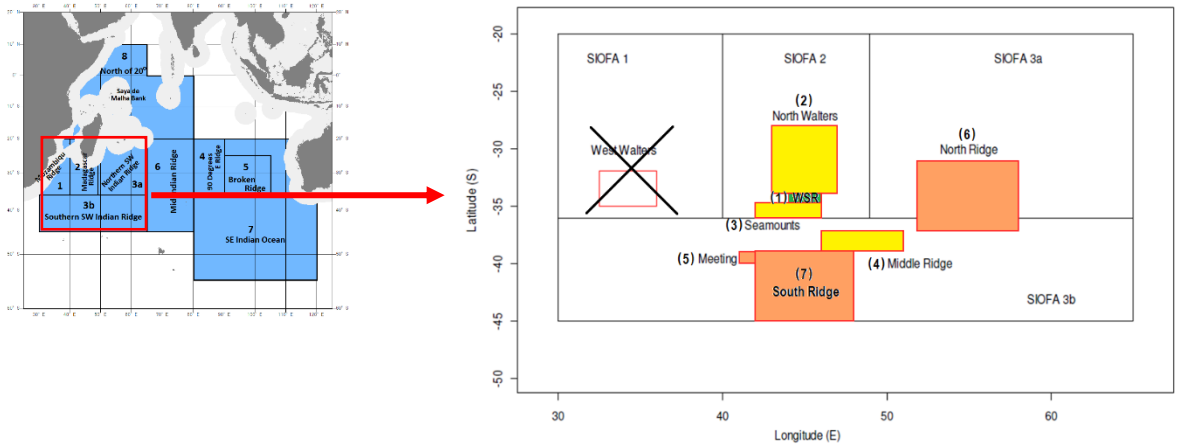

Fig 1. Eight orange roughy stocks in the SIOFA area in the 2018 stock assessments (West Walters was not assessed as the amount of catch from that region was very low)

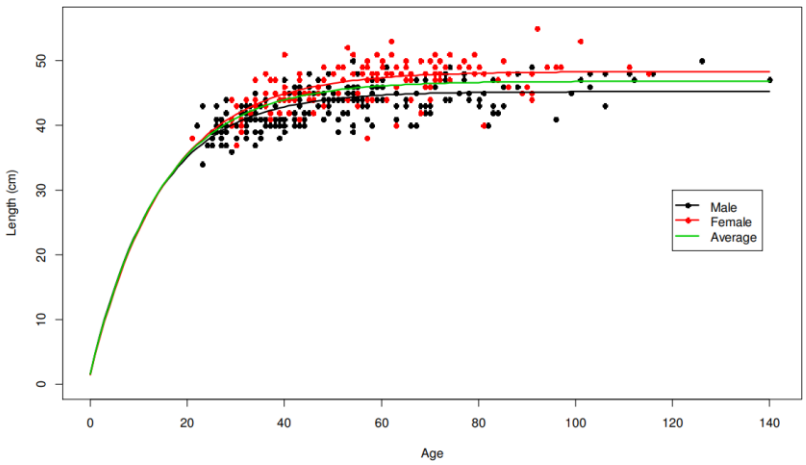

Figure A5: Sleeping Beauty: age-length data for males and females with fitted curves. The average relationship for a single-sex model is also plotted (green).

All relationships assumed t_0 = -0.5. The average relationship was derived by averaging the male and female L_{inf} and using least squares to estimate the k (which coincidentally just came out at the average of the male and female ks):

	k	L_{inf} (cm)
Male	0.073	45.2
Female	0.065	48.3
Average	**0.069**	**46.75**

Fig. 2 Estimated growth curves for Walters Shoal orange roughy by Cordue (2018) based on the age data from Horn et al, (2019)

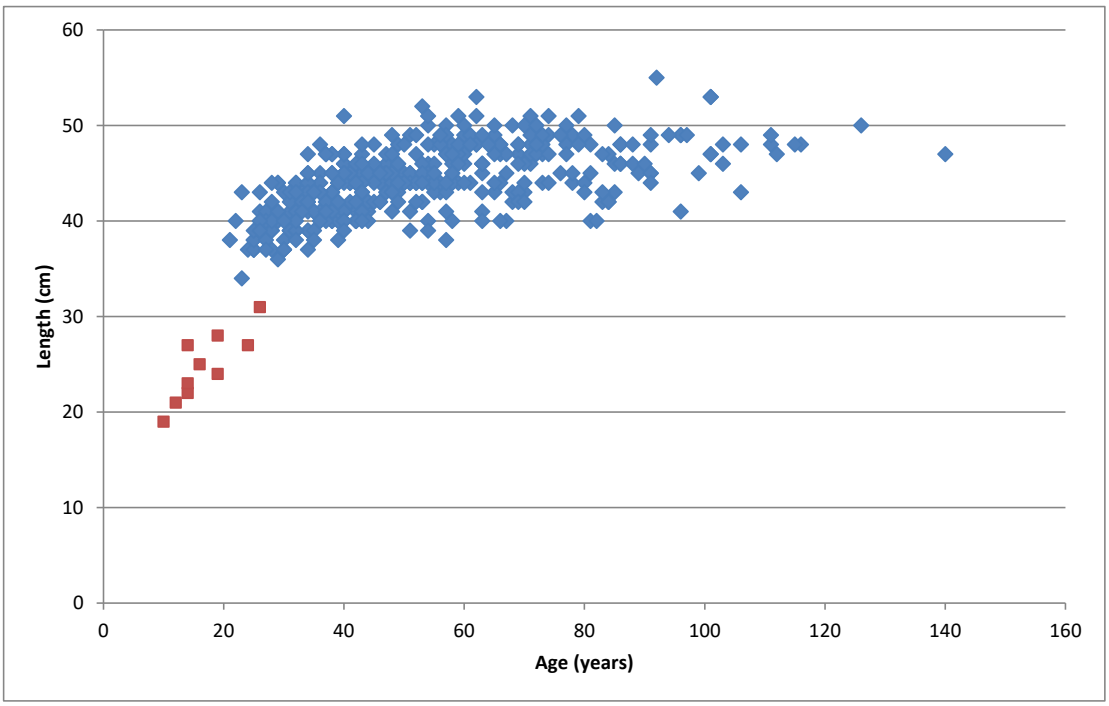

Fig.3 Additional ages from otoliths from orange roughy with lengths less than 35 cm (red) provided by Dr Peter Horn (pers. comm., June 2021) for this project, which is overlaid with the ages (blue) used for the growth curve estimates in Cordue (2018).

This document includes the Terms of Reference (ToR), work plan, budget allocation, and other administrative matters for the project to undertake aging of orange roughy otoliths in the SIOFA Area. Once appointed, the consultant should direct any questions and clarifications to the Executive Secretary (Thierry Clot on thierry.clot@siofa.org) for administrative matters and on technical matters to the SERAWG Chair and the manager of this project (Dr Tom Nishida) on aco20320@par.odn.ne.jp.

2. TERMS of REFERENCE

To improve the estimates of the orange roughy growth curve parameters, ages from the entire length range of orange roughy for each sex are required. Based on the previously collected data, the maximum length of orange roughy (standard length) is typically less than 60 cm and the available minimum length is greater than 15 cm. Assuming a requirement for 20 minimum number of otolith to be aged for fish of each sex in each 5 cm length bin, a total of 360 aged otoliths would be required (i.e., 20 fish for each sex within each of the 9 length bins to cover the range from 15 cm to 60 cm) (see Table 1). To date, 409 otoliths have been aged by Peter Horn (Horn et al, 2019, and Horn pers. comm), but do not fully cover the length range for orange roughy observed from Walters Shoal. Additional ages of fish from the lengths not previously aged are therefore a priority for this project. Thus, in this project, about ages for 233 otoliths for orange roughy

with lengths less than 35 cm and greater than 50 cm from the Walters Shoal region are required. Table 1 illustrates this situation showing the number of samples needed for orange roughy with smaller (< 35 cm) and larger (> 50 cm) lengths.

Table 1 Illustrative explanation on number of otoliths needed to be aged in this project for Walters Shoal region based on number of the available aged otoliths and the minimum sample size (n=20) by sex and 5 cm size bin (cm).

L_class (cm)	Smaple size of previously aged by Horn			Minimum sample size		# of otolith need to be aged in this project		
	Female	Male	Unknown	Female	Male	Female	Male	
15			1	20	20	20	20	
20			4	20	20	20	20	
25			4	20	20	20	20	
30		1	1	20	20	20	19	
35	4	36		20	20	16		
40	38	149		20	20			
45	76	73		20	20			
50	19	2		20	20	1	18	
55	1			20	20	19	20	(total)
Total	138	261	10	180	180	116	117	233

The Cook Islands (the otolith data owner) will provide an update of Table 1 from available (unaged) otoliths in their inventory. However, the number of otoliths available in each length bin for Walters Shoal has not be finalised at this time.

This project is to prepare and age up to 300 otoliths for orange roughy, with most for those collected from the Walters Shoal region. The remaining otoliths (if required) will be from orange roughy from other regions in the SIOFA to allow preliminary comparisons of growth rates between regions. The exact proportion of otoliths to be aged from Walters Shoal or from other regions will be determined at the onset of the contracted project in consultation with the Chair of the SERAWG and the data owners (Cook Islands).

Based on this, the Terms of Reference for this project are

a) to prepare and read orange roughy otoliths collected from the Walters Shoal region to determine their ages and fulfill, if possible, the minimum sample numbers for each sex and 5 cm length bin as shown in Table 1 (high priority); and
b) to prepare and read orange roughy otoliths collected from other regions in the SIOFA Area (as determined by the Chair of the SERAWG and the data owners in collaboration with the consultant) (medium priority).

A maximum of 300 otoliths will be required to be read for (a) and (b) combined.

Note that the growth curves will be updated and estimated by the data owner (Cook Islands) using results of this ageing study and the previously aged orange roughy for presentation to SERAWG4. The age data and the resulting growth curves will need to be available in time to allow SIOFA to contract and complete

an updated assessment for orange roughy for SERAWG4.

3. SOURCE of INFORMATION (References)

The following is a summary of resources, information, and references that are available on the SIOFA website, https://www.apsoi.org.

- Horn P. *et al* (2019) AGE DISTRIBUTION OF ORANGE ROUGHY HARVESTED FROM THE SLEEPING BEAUTY SEAMOUNT, SOUTHERN INDIAN OCEAN (SERAWG-01-INFO-03). https://www.apsoi.org/sites/default/files/documents/meetings/SERAWG-01-INFO-03%20AGE%20DISTRIBUTION%20OF%20ORANGE.pdf
- Cordue, P. (2018) Stock Assessment of Orange Roughy in the Walter's Shoal Region. https://www.apsoi.org/sites/default/files/documents/meetings/SC-03-07.1.1%2804%29%20Rev1%20Stock%20assessment%20of%20orange%20roughy%20Walter%27s%20Shoal.%20Cordue%2C%202018_0.pdf
- SIOFA (2021) Scientific Committee Working Plan available in the report of the 6th Scientific Committee, March 2021. https://www.apsoi.org/sites/default/files/documents/meetings/SIOFA%20SC6%20final%20report%20and%20annexes.pdf
- Nishida T. and Krusic-Golub*, K. (2018) Progress on splendid alfonsino age determination works using otoliths from the SIOFA member countries (SERAWG-02-INFO-05). **Fish Ageing Services (FAS), Australia.* https://www.apsoi.org/sites/default/files/documents/meetings/SERAWG-02-INFO-05%20Alfonsino%20age%20determinaton.pdf

4. SUBMISSION of the INFORMATION and CONFIDENTIALITY

The Consultant shall submit all the information collected to the SIOFA Secretariat (including that sourced from the Secretariat) before the final payment of the contract is made to the consultant. Such information includes electronic data files, analysis codes, biological samples, and other relevant data if applicable. Any arrangements for ownership, storage, or disposal of physical samples shall be agreed by SIOFA as a part of the contract. All Intellectual Property generated as a part of this contract shall become the property of SIOFA unless otherwise excluded in the proposal and agreed by SIOFA in the contract. The consultant shall not release confidential data provided for conducting this study to any persons nor any organisations, other than SIOFA Secretariat. The consultant shall delete all the confidential data upon the completion of the contract.

5. REPORTS

The Consultant shall provide a draft report describing the ageing outcomes, including descriptions of samples, methods, results, and recommendations to the SIOFA Secretariat for the Scientific Committee to review; and a final report to the SIOFA Secretariat addressing any revisions or comments following review. A presentation to the SERAWG4 will also be required. Refer to Table 2 on the submission schedule,

6. SUBMISSION of APPLICATIONS

The applicants should have relevant experience of ageing otoliths, especially for long-lived species such as orange roughy.

The applicant(s) should submit a proposal that contains the following items:

- A current CV that summarises the applicant(s) relevant educational background and professional experience (maximum 3 pages).
- A brief proposal outlining the proposed methods and analyses, including a description of how the objectives of the ToR will be achieved (maximum 3 pages).
- Any proposed exclusions to the intellectual property clause.
- Identification of any project risks and associated mitigation and management required to successfully complete the project.
- A statement that identifies any perceived, potential, or actual conflicts of interest of the applicant(s), including those described in paragraph 4 of the SIOFA recruitment procedure (see Box 1); and
- Any additional information the applicant(s) wish to submit.

Box 1 Conflicts of interest: Paragraph 4 of SIOFA's Recruitment Procedure

To ensure that situations relating to potential and actual conflict of interests are avoided, persons falling into the following categories may not normally be considered for SIOFA consultancy: (i). any person designated as a designated representative or alternate representative of a CCP to the Meeting of Parties (MOP) as per Rule 3.1 of the Rules of Procedure, and to the SC and any other subsidiary bodies of the MOP, as per Rule 21.3 of the Rules of Procedure; (ii). any person fulfilling the function of Chair or Vice-Chair of the MOP or Chair or Vice-Chair of a SIOFA subsidiary body or working group; (iii). any person acting as a member of a delegation involved in the SIOFA decision-making process resulting in recommendations and/or approval for the SIOFA work requiring the engagement of a consultant; and (iv). individuals who were SIOFA Secretariat staff members at the time when the recommendations and/or approval for the SIOFA works were adopted or who are members of immediate family (e.g., spouse or partner, father, mother, son, daughter, brother, or sister) of any Secretariat staff member or of the persons identified in 4 (i), (ii), and (iii).

Announcement of Call for the consultant will be placed in the SIOFA home page in June 29, 2021 and will be circulated to all Cooperating and Contacting Partiers (CCPs) and otolith reading agencies. The application must be submitted to Thierry Clot, Executive Secretary, Thierry.clot@siofa.org, by July 16 2021 (1 pm UTC time).

7. WORK PLAN and PAYMENT SCHEDULE

Table 2 describes the work plan and the payment schedule. The consultant shall follow this work plan.

Table 2: Work plan and the payment schedule

Work Period	Duration	Activities
June 29 - July 19 (2021)	3 weeks	Call for the consultant through the SIOFA web site and also through the circulation to Cooperating and Contacting Partiers (CCPs) and age reading agencies.
July 19 -21 (2021)	3 days	Selection of the consultant by the evaluation panel.
July 22 (2021)		Project Inception and the Secretariat will make **the initial payment (EURO 500).**
July 22 - July 28 (2021)	1 week	Cook Islands will send otoliths to the Consultant.
July 29 - Oct. 15 (2021)	3.5 months	The consultant will read otolith to estimate age.
October 15-30 (2021)	2 weeks	Submit the draft report to the SC members through the Secretariat by Oct 15. SC will review and send comments including re-works. Then the final report shall be submitted by Oct 30. After the final report is submitted, the Secretariat will pay the **2nd payment** to the consultant. (The amount in Euro will be finalised in this contract following acceptance of a proposal by SIOFA and will depend on the number of otoliths read – up to a maximum of 300).
March 1–Mar 20 (2022)	3 weeks	Present the final report to SERAWG4. In the unlikely event that SERAWG4 is a face-to-face meeting and travel to attend the meeting is required by SIOFA, reasonable travel related costs will be covered by SIOFA. After the presentation is completed, the Secretariat will make **the 3rd payment (EURO 500).**

8. CONTACT PERSONS

SIOFA Secretariat (administrative matters) Thierry Clot, SIOFA Executive Secretary, thierry.clot@siofa.org. and on technical matters to the SERAWG Chair and the manager of this project (Dr Tom Nishida) aco20320@par.odn.ne.jp.

9. EVALUATION CRITERIA for the SELECTION of CANDIDATES

The selection criteria will be developed by the evaluation panel along with the project manager, the Secretariat, and the Chairpersons of the relevant subsidiary bodies. The criteria may include following items:

- Adequate submission of information to allow the panel to evaluate the candidate;
- Evaluation of the proposal from the candidate;
- Ability to undertake and complete the analyses or work required in the ToR;
- The candidate's agreement with confidentiality provisions required for the project;
- Acceptable conflict of interest statement;
- Agreement with the data submission and intellectual property terms required in this ToR; and
- Financial and resourcing considerations.