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Delegation of Cook Islands

Abstract

Fish length and age data from this fishery are an important requirement for the stock assessment of orange roughy because there are numerous stocks of this species in the Indian Ocean that have markedly different size and/or age compositions. The purpose of this sampling programme is to facilitate collection of representative length data and biological samples from all fisheries for orange roughy in the Indian Ocean. The instructions for sampling in this manual have been developed on the basis of New Zealand standards of sampling.

Instructions

Collection of Biological Samples from Orange Roughy and Alfonsino Southern Indian Ocean

May 2012

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1. INTRODUCTION

Fish length and age data from this fishery are an important requirement for the stock assessment of orange roughy because there are numerous stocks of this species in the Indian Ocean that have markedly different size and/or age compositions. The expectation is that size distributions will change as a fish stock is fished down. This pattern has not been well documented for orange roughy stocks around the world and consequently there are substantial uncertainties regarding the length and age composition of the catches in many fisheries.

The purpose of this sampling programme is to facilitate collection of *representative* length data and biological samples from all fisheries for orange roughy in the Indian Ocean. Some of these stocks are likely to have been heavily fished during the period 1999-2001 while others should have been only lightly fished. Information, collected from catches throughout the year, will greatly improve the current understanding of the population dynamics and biology of this species, not only for the Southern Indian Ocean, but potentially for orange roughy fisheries worldwide.

In the case of the Indian Ocean, the resulting information will be incorporated into stock assessments for the stocks where acoustic information is available to provide a biomass index, and will also be used to implement fishery management decisions. Not all vessels operating in the fishery have government observers on board to undertake sampling. However, it has been shown in New Zealand that the commercial fleet has the potential to collect a large quantity of biological data from the catches of deepwater species at a reasonable cost.

The collection of biological data can be integrated into the normal operation of a commercial fishing vessel to maximise the coverage of sampling and to provide the assessment programme with the data that are needed to manage the Indian Ocean fishery in a sustainable manner. Industry sampling programmes in the Indian Ocean from 2005-2012 have proven that shipboard personnel are able to collect biological data to a high standard of accuracy.

The instructions for sampling in this manual have been developed on the basis of New Zealand standards of sampling. *It is critical that these instructions are strictly followed.*

2. EXTENT OF SAMPLING PROGRAMME

Sampling of catches of orange roughy and Alfonsino are required from every stock that is fished.

There are at least 35 separate Orange Roughy stocks along the South West Indian Ridge and Walters Shoal, and potentially more than 40 Alfonsino stocks in the Indian Ocean. The sampling details for each area are outlined below. It is important to collect information from every significant stock that is fished. Because there is general lack of detailed information on many stocks, samples should be collected each day. However, if sufficient crew are trained for sampling, it would be most useful to collect samples from as many trawls per day as possible.

It is not necessary to collect biological samples when government Scientific Observers are on board the vessel. These observers should collect sufficient samples to meet the requirements of the monitoring programme. However, the biological sampling regime they use should follow the one outlined below.

3. SAMPLING PROCEDURES

3.1 Selection of a Trawl for Sampling

Biological samples are to be collected from the catch taken from at least *one* trawl for each day of fishing. One of two options should be used:

- i. randomly selecting a trawl for each day or
- ii. sampling every trawl with a catch greater than 5000 kg.

The trawl catch to be sampled should be selected at random from the fishing undertaken on a given day. Selection is to be determined based on a random time of the day for the time the trawl is on deck (i.e. when it is completed). The first trawl retrieved after the random time for that day is to be chosen for biological sampling. However, if the catch from this trawl is too small for a good sample, i.e. the total catch of either species is less than 500 kg then the catch from the next trawl with a total catch larger than 500 kg should be sampled.

3.2 Calculation of Random Time for Trawls

Lists of random times for each day of fishing are provided in **Attachment 1**. For example, for a random time of 04:33 sample the catch from the next trawl landed on deck which has a total catch greater than 500 kg is to be sampled. Remember not to sample the catch from trawls with a catch of less than 500 kg.

For random times later than 2000, it is possible that the next trawl will not be landed on deck until after midnight. However, the next trawl should still be sampled and considered as the sample from the previous day. In such cases where the random time for the next day is early and overlaps with the previous night's sample, select the next random time on the list for the sample from the following day.

3.3 Selection of a Sample from the Catch

A sample of 100 fish is to be measured for each species from the catch. The number of fish comprising the sample does not change in relation to the size of the catch.

The sample of fish to be measured must be selected at random from the entire catch. All samples are to be selected from an appropriate sample point on board the vessel. The sample point should be established at a location that enables all fish in the catch to have an equal chance of being selected in the sample. *The sample point should not change from day to day, but remain fixed for the whole trip. It is important that the sampling point chosen allows sampling before any fish are sorted.*

The position of the sample point will vary depending on the size of the vessel and layout of the processing area and/or fish hold. On larger vessels, an appropriate sampling point would be located at the conveyor in front of the fish ponds, while on small vessels it may be necessary to collect a sample directly from the codend of the trawl.

The sub-sample of 100 fish is to be selected from the catch at one time. Individual fish will be drawn from the sampling point by successively selecting the fish with the eyeball nearest the sampling point. In the Indian Ocean the volume of 100 orange roughy will require about 10-12 35-40 kg fish bins.

3.4 Measurement of Fish Length

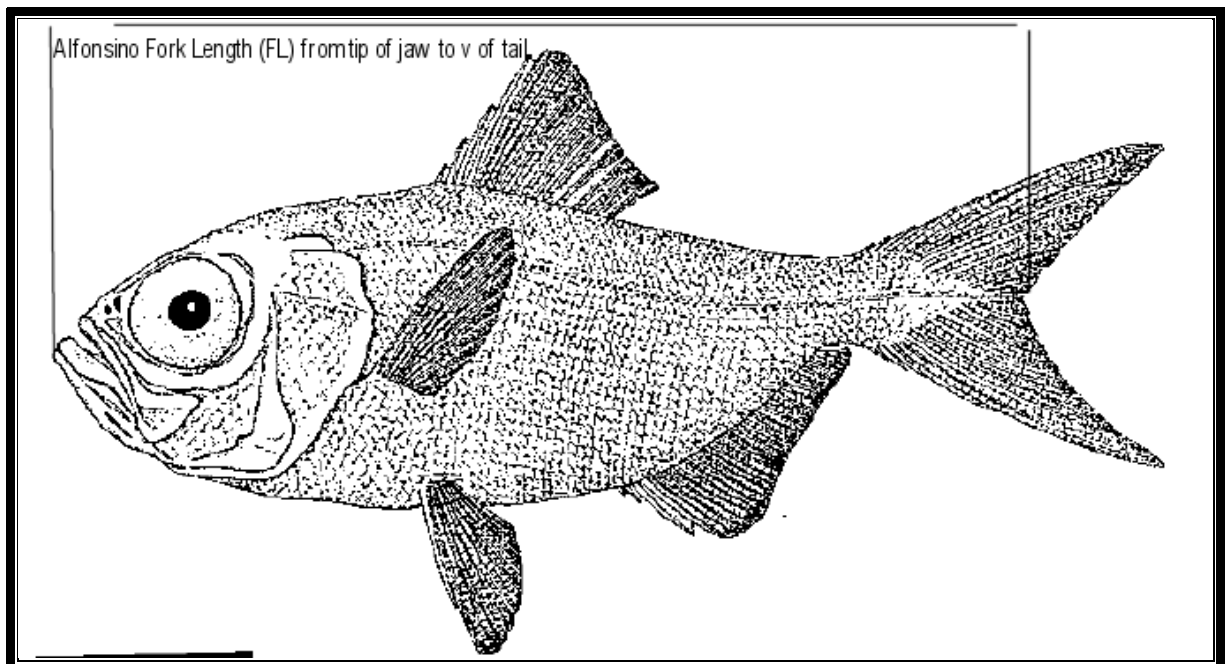
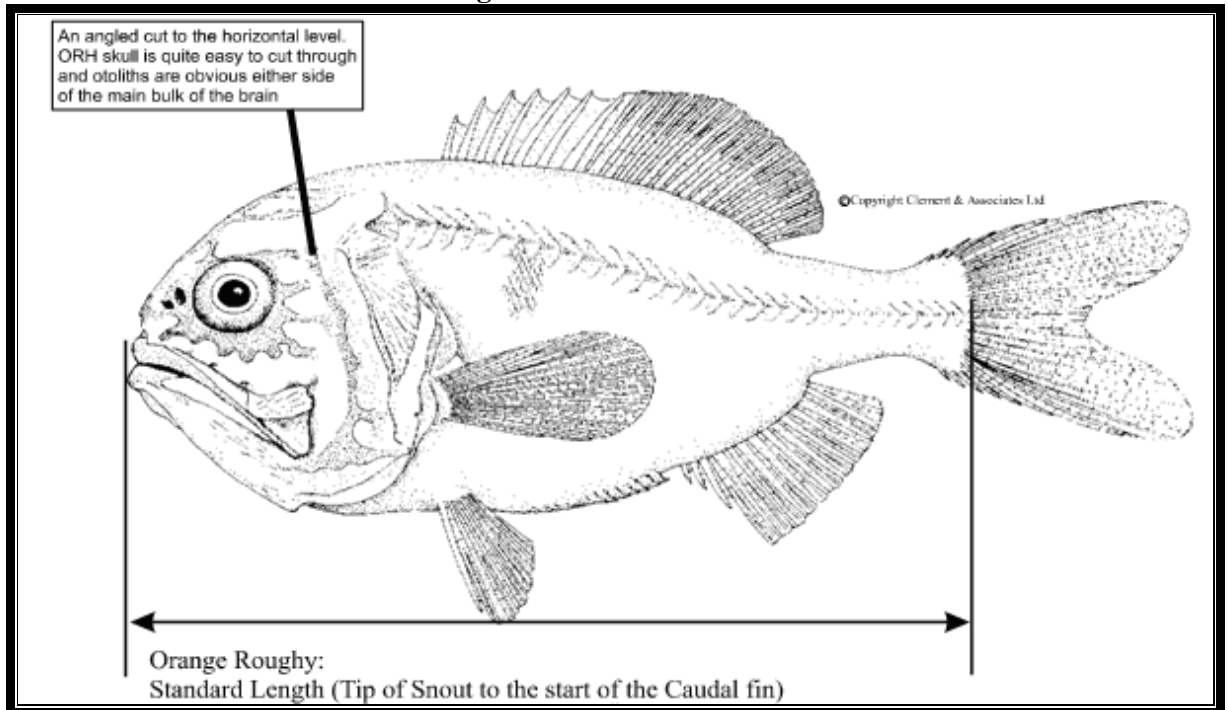
For standard size distribution samples orange roughy are to be measured to the nearest centimetre below the standard length (SL), and Alfonsino to below the fork length (FL). For example, a standard length of 35.8 cm should be recorded at 35 cm. Fish that have incurred damage to the tail during trawling or from previous wounds that prevent that accurate measurement of the fish should not to be included in the length sample.

Ensure that the following procedure is followed for each fish measured:

- Close the fish's mouth so that the snout rests up against the end-stop of the measuring board and straighten the fish out

- Place the cutting edge of your knife over the base of the tail fin (for ORH)
- Check that the knife is being held straight (i.e. at 90° to the long edge of the measuring board), and press the point of the knife down so that it rests on the scale of the ruler
- Record the length to the nearest cm below the true length, on the sampling sheet provided.

Figure V.1



3.5 Sex and Maturity Data

All fish are to be sexed and the gonad state of fish is to be determined using the stage development schemes outlined below. This detailed sampling regime is not normally used by observer programmes, but used is used by the NIWA in New Zealand, the CSIRO in Australia and also in Chile. It is important to determine the gonad state of every female fish included in the sample. If you can not identify the gonad condition do not record the fish in the “Female Tally” column. Instead, record the fish in the “Not sexed” column. This applies to all three species sampled.

Both Orange Roughy and Alfonsino spawn multiple batches of eggs each season. For female fish it is important to separate out stage 4 and 5 fish. A stage 5 female is running ripe when light pressure results in eggs being exuded. When the ovary is cut, the eggs should be loose inside, in a liquid mass that flows. Stages 7, 8, and 9, intermediate stages to others, may be confusing and are not illustrated. Stage 8 occurs between stages 5 and 6, as the fish spawns batches of eggs and slowly reduces the total size of the ovary. Some stage 7 fish may be seen and these should be recorded.

Figure V.2



Gonad stages for orange roughy

Females

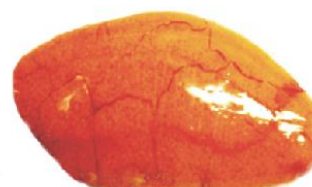
- 1 **Immature or resting**
Ovary clear or pink, small. No eggs visible.
- 2 **Maturing**
Ovary pink, small eggs visible (as orange dots). Ovary small.
- 3 **Mature**
Orange, yolk filled eggs obvious (diameter 0.5-1.5 mm), filling the ovary. Ovary quite large, bright orange.
- 4 **Ripe**
Ovary large. Clear eggs are present (more than just one or two). Ovary has mottled orange appearance, with mixed orange and clear eggs.
- 5 **Running ripe**
Ovary large and thin walled, fragile. Most eggs clear (hydrated). Eggs flow freely when light pressure applied to the abdomen.
- 6 **Spent**
Ovary flaccid and bloody. Some residual eggs often present.
- 7 **Atretic**
Eggs yellow or blackish. Degenerating.
- 8 **Partially spent**
Ovary somewhat flaccid, slightly bloody. Contains substantial numbers of clear freely flowing eggs, may have orange eggs also. Some eggs lost.
- 9 **Immature showing atresia**



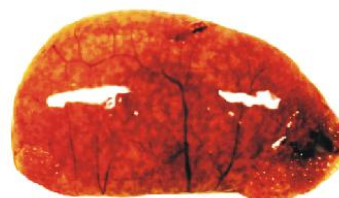
Immature



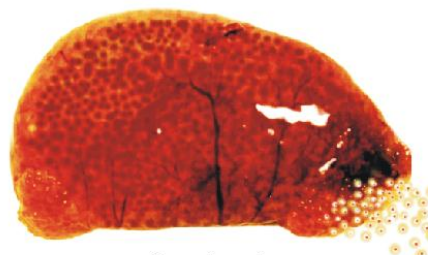
Maturing



Mature



Ripe



Running ripe



Spent

Alfonsino Females

1. Immature

Ovary small, firm, with no eggs visible to the naked eye, GSI less than 1%

2. Maturing virgin or resting

Ovary more extended, firm, small oocytes visible, giving ovary a grainy appearance. GSI less than 2%

2. Developing

Ovary large, starting to swell the body cavity, contains oocytes of two sizes. Well-developed blood vessels. No hyaline oocytes present. GSI 2-8%



4 Mature

Ovary large, filling or swelling the body cavity. Hyaline oocytes present. GSI 8-12%



5 Running ripe

Ovulated oocytes present which flow freely with light pressure on abdomen or free in cavity when ovary cut. GSI 10-15%.



6 Partially spent

Ovary shrunk and bloodshot, some hyaline or ovulated oocytes present, GSI 2-5%

7. Spent

Ovary shrunk, flaccid, contains a few residual eggs and many small ova

Alfonsino Males

1. Immature

Testis small, translucent, whitish, long, thin strips lying close to the vertebral column. GSI less than 1%

2. Developing or resting

Testis white, flat, convoluted, easily visible to the naked eye, about $\frac{1}{4}$ length of the body cavity. GSI 1-2%.

3. Developed

Testis large, white and convoluted, no milt produced when pressed or cut. GSI 2-8%.

4. Ripe

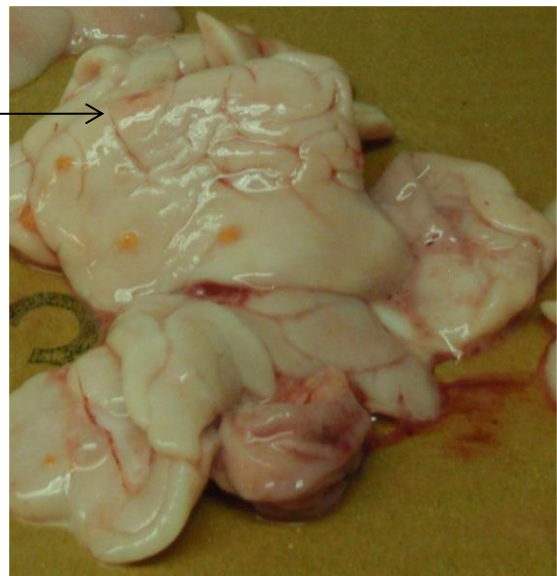
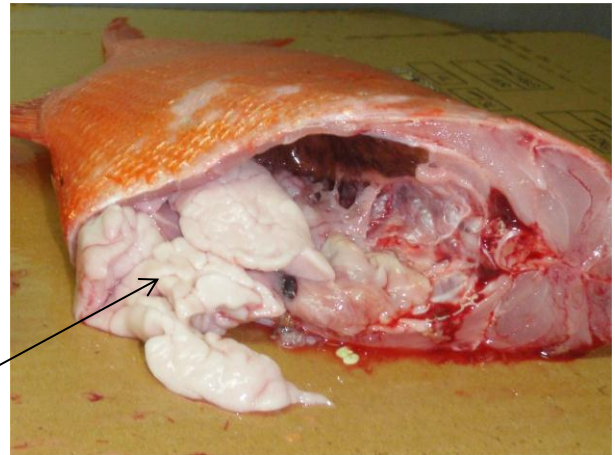
Testis large, opalescent white, drops of milt produced when pressed or cut. GSI >8%

5. Partially spent

Testes are multilobed, but thin, and some milt is extruded with pressure.

6. Spent

Testis shrunk, flabby, dirty white in colour



3.6 Collection Of Otoliths

Otoliths will be required from each of the stocks because of the number of different stocks that exist in the Indian Ocean. For orange roughy there may be large potential differences between stocks as suggested by the different size of fish between Walters Shoal and the Southwest Indian Ridge.

Otoliths should be extracted from about 10 of the fish in each 10-12 bin sample. It is important that these fish are **randomly selected** from the 10-12 bin sample and that they are **not** chosen based on individual size. Chose the random, colour-coded lines (yellow) on the Biological Sampling form to guide the selection of fish from the length frequency sample to be processed for otolith extraction (see Figure). The length of fish taken for otoliths are to be measured to the nearest half-centimetre below the standard length. For example, a standard length of 35.8 cm should be recorded as 35.5 cm.

If no otolith envelopes are available, fold the otoliths inside small squares of paper and sellotape them shut. Use of otolith envelopes is preferred and they are usually made of relatively strong brown paper, have gummed flaps, and measure about 10cm by 5cm. Any envelopes that approximate to this design can be used. *Note: All station details and biological information for the otolith-sampled fish should also be recorded on the otolith envelopes.* As an initial step, 100 otoliths should be collected from each stock during the 2006 season.

3.6.1 Procedure for Otolith Extraction

To collect otoliths, a set of forceps and small envelopes are required. Coin envelopes can be used if otolith envelopes are not available. Two people are required for this task - one to do the measuring, cutting and otoliths extraction and another to record the information on the otolith envelopes and to ensure that the envelopes are kept dry.

Procedure

- Hold the fish upright, firmly resting the belly on the measuring board, and cut down to the level of the mid-eye, as illustrated in Figure
 - Lift the fish and bend the head downwards to open up the cut and reveal the brain
 - The otoliths are located slightly behind and below the brain and are nestled within separate cavities, one on either side of the mid-line
 - Further careful cutting away of bone/cartilage may be required before the otoliths are located. Gentle probing with the forceps (tweezers) is often successful in locating unseen otoliths as they are hard and dense and 'feel' different from the bone/cartilage tissue.
 - Carefully remove the pair of otoliths using the forceps. The otoliths are brittle and will break if handled roughly.
-
- Ensure that you work over the measuring board/sampling table at all times so that dropped otoliths do not land on the factory floor where they may be swept away by water flow
 - Carefully wipe the 'jelly' off the otoliths (otherwise the envelopes soak up the moisture, holes develop in the packets and otoliths may be lost) and place both otoliths in the envelope

The otoliths should be kept dry and warm, and retained by the company for future analysis.

4. RECORDING INFORMATION

4.1 Trawl Information

It is important to relate the biological samples to the catch and effort data from the trawl. Whatever catch and effort data recording system is being used by the vessel, be able to link the samples to the trawl shot that was undertaken.

Record the Vessel Name, date and the shot number from that form on the top of the Biological Sampling Data Form(s) for that trawl. You should also include the Position name given by the vessel for that feature, or the latitude/longitude.

4.2 Biological Sampling

Record all sampling data on the attached Biological Sample Data Forms. There are two forms: one is for recording detailed information on gonad state and fish weights to establish the gonadosomatic index. (Figure V.2). This form should be used during the spawning season when detailed information on spawning state is required to use in conjunction with acoustic information for each stock. During this period, 100 fish should be fully sampled each day for full biological information.

Alternatively, the form provided for Length Frequency (Figure V.3), can be used, following the procedure described in Section 3.3. Each of these forms is provided in Excel format and copies can be printed at sea. Use a clip board and pencil to record information. Try not to get the form wet. Store the forms in a secure place. A spreadsheet should be maintained with the data records as shown in. Record the total or standard length to the nearest centimetre below the actual length.

4.3 Guide to Completing the Biological Sample Data Form

- Males and female fish are recorded in separate tally columns. Use a separate row for each 1 cm length class.
- To record individual fish write the gonad stage number in the tally column.
- Once the sample is completed, summarise the number of male and female measured in each length class in the columns headed "Total LF". Sum the total number of male, female fish and record the number in the "TOT" row at the bottom of the form.
- Remember to record the gonad stage for every fish measured.

Figure V.3

Offshore Biological Sampling Form

INDIAN OCEAN ORANGE ROUGHY DATA

Biological data form

Date

Tow

Area

Time

Recorder name

Number	Length	Sex	Stage	Weight	Gonad weight
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
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45					
46					
47					
48					
49					
50					

Figure V.4
Length Frequency Form

ORANGE ROUGHY INDIAN OCEAN				
Length Frequency Data				
Date			Recorder	
Time				
Tow				
Area				
Ln	M	F	Total M	Total F
30				
31				
32				
33				
34				
35				
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41				
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Table V.1
Excel spreadsheet format for biological data

Date	Tow	Area	Length	Sex	Stage	Weight	Gonad	Otolith
8-Jul	1	Saddle	52	F	4	4.72	0.64	Y
8-Jul	1	Saddle	52	F	4			N
8-Jul	1	Saddle	54	F	4			N
8-Jul	1	Saddle	45	M	5			N
9-Jul	2	Saddle	51	M	4	3.5	0.5	N

Table V.2
List of Random Times for Each Day of Fishing

Day	Sample Time	Check	Day	Sample Time	Check	Day	Sample Time	Check
1	23:20	☐	41	17:19		81	01:06	
2	02:43		42	17:30		82	10:04	
3	09:09		43	20:53		83	23:17	
4	05:05		44	09:38		84	16:57	
5	02:41		45	18:57		85	08:34	
6	09:08		46	08:55		86	01:18	
7	19:53		47	09:08		87	12:43	
8	20:11		48	08:51		88	19:40	
9	23:54		49	12:30		89	02:07	
10	01:31		50	16:48		90	20:30	
11	20:32		51	20:19		91	14:54	
12	18:42		52	05:13		92	08:15	
13	04:33		53	11:36		93	18:51	
14	03:03		54	15:08		94	17:29	
15	18:35		55	22:19		95	10:43	
16	12:45		56	18:10		96	12:47	
17	21:41		57	11:39		97	16:21	
18	12:36		58	09:56		98	15:23	
19	11:58		59	00:54		99	11:10	
20	01:27		60	09:57		100	10:56	
21	23:19		61	05:11		101	13:32	
22	21:38		62	21:57		102	05:51	
23	15:12		63	16:26		103	02:32	
24	02:56		64	03:41		104	07:32	
25	13:44		65	05:35		105	00:27	
26	19:39		66	19:34		106	09:18	
27	05:16		67	04:57		107	14:32	
28	14:19		68	02:32		108	13:40	
29	17:42		69	05:10		109	09:01	
30	12:10		70	07:08		110	20:59	
31	01:58		71	21:29		111	08:26	
32	15:43		72	06:49		112	07:58	
33	15:55		73	06:16		113	22:17	
34	20:15		74	18:06		114	23:55	
35	03:02		75	14:37		115	03:46	
36	01:12		76	03:56		116	17:47	
37	09:53		77	15:52		117	01:25	
38	07:27		78	12:55		118	16:34	
39	12:44		79	11:53		119	13:18	
40	18:59		80	11:05		120	03:13	

Appendix VI

Acoustic Data Logging Protocols and Procedures for Commercial Fishing Vessels in the Southwest Indian Ocean Deepwater Trawl Fishery

(Contributed by G. Patchell, Sealord Group, New Zealand)

1. Introduction

Members of the Southern Indian Ocean Deepwater Fisheries Operators Association (SIODFOA) have all undertaken a range of research programmes in this fishery, from wide-area habitat mapping to fisheries acoustic surveys and biological data collection. However, some members have undertaken more work than others, and in 2012 the Association agreed that all vessels in the fishery must undertake at least **two** acoustic surveys on **each** cruise.

Future management of SIO deepwater resources will require setting of annual total allowable catches (TAC), ideally for each stock, but more practically on a defined-area basis; this will require biomass estimates for each of the many deepwater stocks in the Indian Ocean as the TAC will, no doubt, be set as a fraction of the existing biomass. Thus, stock biomass information is needed to show that the Association's vessels are fishing the resource in a sustainable way. This Appendix describes the use of the acoustic survey equipment, survey protocols and how to archive the data properly should additional analysis be needed at a later time. A checklist for addressing problems is included.

2. Principles of Acoustics Survey Methodology

Standard scientific acoustic surveys require the use of rigorously calibrated echo sounders; this is not the case for commercial fish finding where skippers are able to do calibrations, i.e. relate what is seen on the system's display to the fish that are sonified in the water, based on their past experience. The calibration process determines the relation between the acoustic system's output results and the intensity of the echoes received at the system's transducer, which is usually mounted in the ship's hull. Modern commercial echo sounder systems, such as the Simrad ES60, now have a high level of operational performance (i.e. electronic stability) and share most of their components with scientific versions, such as the EK60, and are increasingly being used for quantitative assessment surveys. All vessels operated by the Associations members are equipped with Simrad ES60 acoustic systems.

If the acoustic results are to be used in support of pilot trawl surveys, the need for high-quality acoustic information is low: If the objective is to accurately estimate fish biomass and its absolute areal distribution then the system must give consistent and comparable estimates for the survey area. When a calibrated acoustic system is available it is usually easy to attach an echo-integrator system and thus run a scientific survey. These requirements are summarized in Table 1.

3. Splash or 'Bicycle Wheel' Surveys

Three fisheries in New Zealand and Chile currently use commercial fishing vessels to conduct acoustic surveys to estimate the biomass of orange roughy (*Hoplostethus atlanticus*), southern blue whiting (*Micromesistius australis*), and hoki (*Macururonus novaezelandiae*).

Several studies have evaluated the potential of this approach and how to optimize the use of commercial fishing vessels. The primary approach has been to combine standard fishing operations with scientific surveys, either by allocating time to survey the fishing grounds or an underwater feature using vessel 'down-time' when it is processing catch. This approach has worked successfully without significantly affecting fishing success and has often resulted in increased catches.

Table V6.1

The relationship between survey design/purpose and required data quality
These indicate minimum requirements.

<i>Survey design and purpose</i>	Instrument quality		
	<i>Unstable uncalibrated</i>	<i>Stable uncalibrated</i>	<i>Stable calibrated</i>
Scouting	✓		
Distribution estimation	✓	✓	
Distribution estimation with improved comparability over time		✓	
Abundance estimation. Scientific quality.			✓

The *F.V. Will Watch* has undertaken a large number of opportunistic surveys, or “splash surveys” in the Southwest Indian Ocean, from 2004-2012, which have been analysed in detail, and the conclusions taken into account for this current protocol.. These surveys took 2-6 hours depending on the species distribution, and the size of the area. Figure shows one survey. In this survey approach, the vessel steams transects that are spaced 0.2-0.3 nm apart.

The last transect line **must always be outside** where fish were last encountered. That is, additional transect lines must be added as long as fish are being detected; otherwise the extent of the fish aggregation will be underestimated. Ensuring this does not happen is critical for the assessment; otherwise the biomass will be underestimated.

The spaced-transect method is the most suitable for bottom ridge systems. For individual seamounts and knolls, the ‘star’ or ‘bicycle wheel’ pattern is better. This is especially useful commercially, for detecting on which side of a knoll the fish are aggregating, e.g. in the Indian Ocean orange roughy are highly mobile, and can rapidly move around a knoll. Many successful skippers use this mapping technique during fishing operations.

Figure shows an example of the ‘Star’ pattern undertaken during a commercial voyage on the *Graveyard* knoll in New Zealand. Figure 3 shows the type of data that can be gathered with continuous logging. In this case, the information were of reduced value for stock size estimation as there are no transects beyond where the fish were most abundant. This stock needed one good snapshot of about 7 transects across the ridge; these would have taken about 2 hours to complete.

4. Survey Speed

The best survey speed will depend on sea state, vessel trim, and potential and actual noise characteristics of the vessel (See Section 8). Most fishing boats produce more (or less) noise that can potentially scare fish and increase the noise-to-signal ratio of acoustic results, under different operating conditions. The officer in charge must find the highest speed that still enables relatively noise-free acoustic data to be obtained – in this way the maximum area will be covered, of the time minimized to survey the fish aggregation. In general, 7-9 knots has proven to be a suitable speed for surveying for several vessels.

If there are heavy seas, the concern is with air bubbles under the hull: these may give the false impression of fish, will result in acoustic noise and will attenuate the power of the output acoustic transmission, i.e. echo intensities will be lower than they would otherwise be and fish aggregations will seem smaller. Thus, different survey speeds may be appropriate depending on whether you are steaming into, or with the swell.

Figure V6.1

Transect Acoustic Survey - Southern Indian Ocean

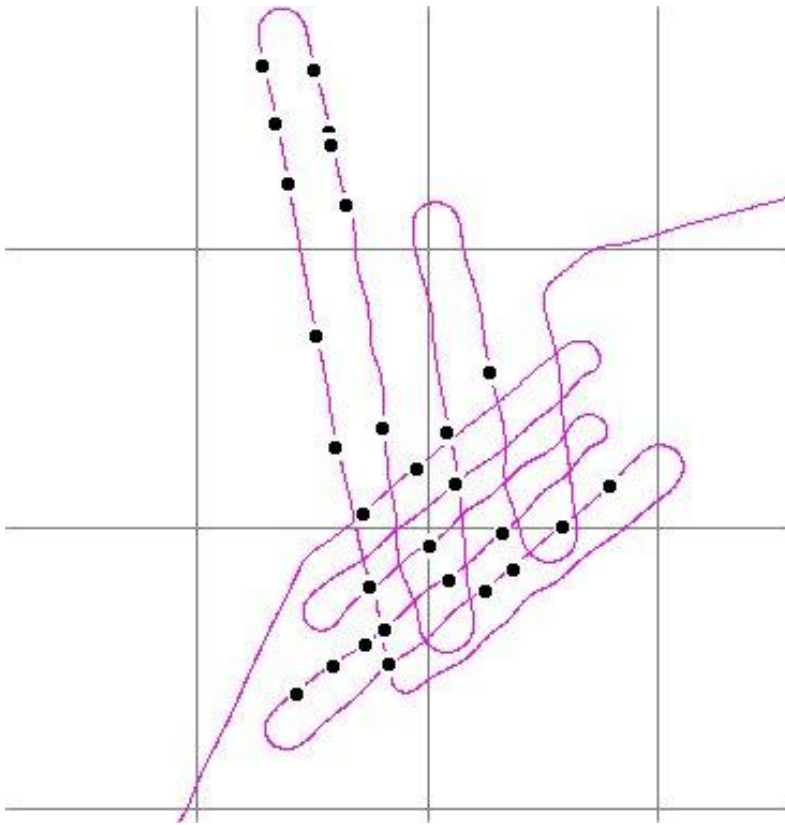


Figure V6.2
Star Pattern Survey

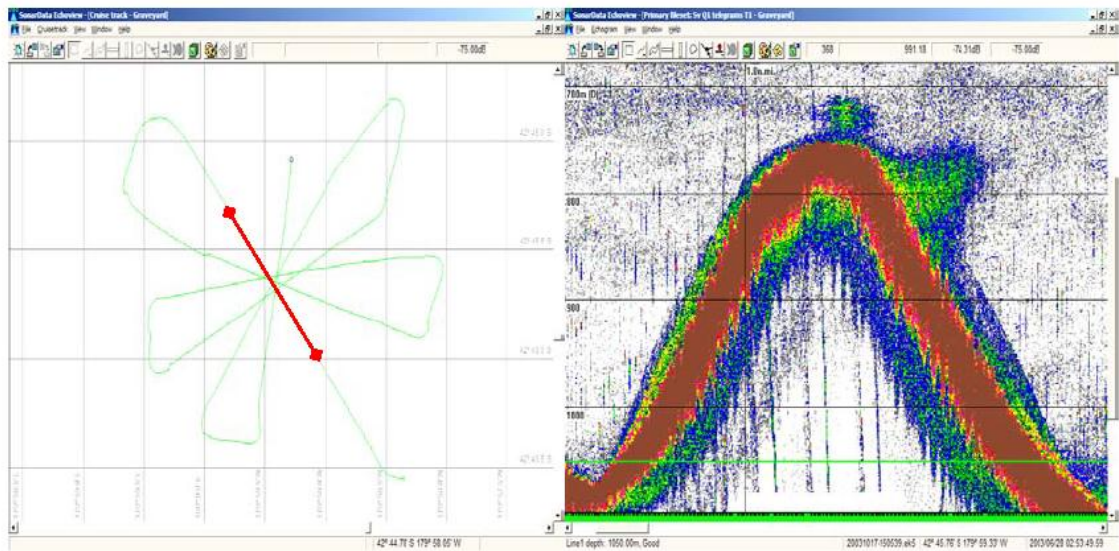
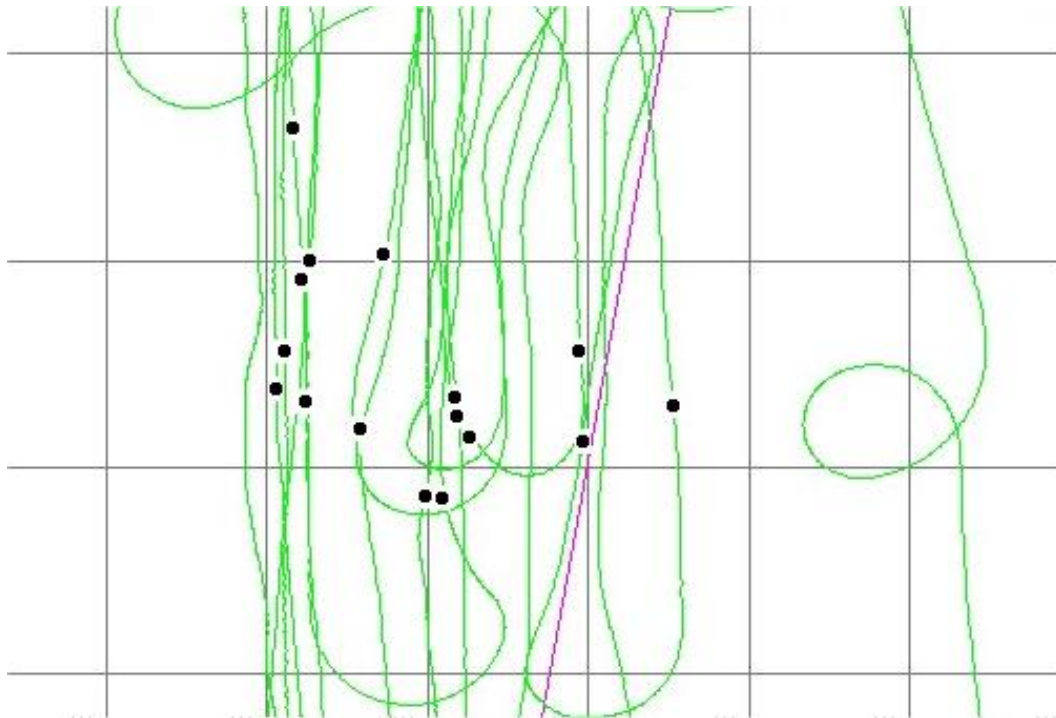


Figure VI.3
Example of an incomplete acoustic survey

The repetition of survey lines over the same area vastly complicates the analysis of the data that is collected. Data collected on repeated lines is of much lower value in making abundance estimates.



5. Power Settings and Transmission (Ping) Rate

It is desirable to use the ES60 with a **fixed transmission rate**¹. When the ping rate is set to maximum we sometimes see a false bottom echo in midwater, and in Alfonsino surveys this must be removed before the data can be used. However it also increases the uncertainty in the estimated biomass. In Orange Roughy fisheries, go into “File/Operation...” menu to bring up the “Operation Dialog” box, select “Interval” under “Ping Rate” and set to 2 s. For Alfonsino

Although the ES-60 can operate at power settings up to 4000 W, at such high power settings the cavitation that occurs at the transducer face, caused by excessive movement of the transducer such that it forms bubbles on its surface, will reduce the echo-sounder’s performance as there is less energy in the sound pulse. Echoes will be weaker and some fish echoes will be masked by ambient noise. Thus, the system’s power should be set at 2000 W. Studies in New Zealand on vessels such as the *San Waitaki* have shown that there is less noise, and better fish detection at this setting compared even with 2400 W.

6. Other Sounders

Acoustic interference may occur if other sounders of similar frequency are operating at the same time, even if they are synchronized. This is because extra sound is put into the water and the ES-60 treats the returning echoes from both sounders as though it is from its own transmission, thus fish may be double counted.

When collecting survey acoustic data for assessment work, only run the ES60. Further, when an ES60 is triggered externally by a wide beam Furuno echosounder, the Furuno slows down the transmission rate of the ES60 and reduces the amount of information collected. This may not be

¹ The transmission rate is ultimately determined by the water depth. The following transmission must wait for the bottom echo of the preceding transmission to return to the transducer – the deeper the water, the longer the wait and the slower the possible transmission rate.

apparent on the ES60 screen, but is obvious when the acoustic data is analysed. With the two sounders synchronised, you are actually missing fish!

7. Acoustic Data Logging for Orange Roughy and Alfonsino Surveys

7.1 Background

It is useful to have the ES60 logging data even if the vessel is not surveying as unexpected fish aggregations may be encountered. However, it is advised that when moving between bottom features more than 3 hours apart and over deepwater (>1800 m), there is little benefit in logging data. *All it takes is a “click” with the mouse to start and stop logging.*

When the vessel arrives on the fishing grounds, begin logging acoustic data by clicking on the file serial number (the LXXXX number at the bottom of the screen). If data were not being logged, this changes the color of the serial number from black to red. (NOTE: a red serial number indicates that acoustic data are being logged, black serial number indicates that data are NOT being logged).

7.2 Surveys

When beginning a survey, create a new acoustic file. Close the current file by clicking on the file serial number (LXXXX) at the bottom of the screen, changing the color of the serial number from red to black. Click on the serial number again so that the color changes back to red. Note that the new serial number has advanced by one unit. When the survey has been completed, click on the serial number to change it to black, and stop logging. Record the name of the file, the date and the area in a hardcopy logbook.

7.3 Checking Marks

Identification of fish marks is critical for correct analysis of the acoustic results. Following an acoustic survey, if you fish the marks that were observed, log the depth of these marks on the logbook and the depth of other marks that were not considered to be orange roughy. This information is critical for analysis of the results.

7.4 Biological Sampling

Detailed biological sampling of the target catch should be done according to the Deepwater Sampling Instructions (See Appendix). The full species composition should be noted, whenever an acoustic survey is undertaken. It is important to know what other species were represented in the acoustic marks.

SUMMARY OF PROTOCOLS

- i. Map significant aggregations before they disperse or move, preferably after the first significant successful shot (30 tonnes).
- ii. Adopt a survey strategy appropriate to the feature you are working.
- iii. Cover the full extent of any aggregation, to ensure full biomass measured.
- iv. Collect biological data and mark identification information in logbooks.
- v. If you are still fishing the aggregation after 2 days, or if processing constrained, do more surveys.
- vi. Set power at **2 kW** only.
- vii. Only have the ES60 running. No other sounders should be used when surveying.
- viii. Ensure logging of raw data occurs.
- ix. Leave the ping filter off when surveying, so you can identify noise problems.
- x. Ensure maximum depth set is 1800 m.

8. Detailed ES60 Instructions for setting up system

This Section provides an ES60 data-logging operator with detailed instructions for ensuring that the acoustic data are properly recorded and stored.

Hardware Requirements and Setup of Portable Hard Drives

To archive data collected by a Simrad ES60 echo-sounder requires a USB port, an operating system that recognizes the USB port (typically Windows 2000) and a GPS unit connected to the echosounder. A keyboard attached to the echosounder is desirable.

There are a range of external hard drives, using Laptop hard disks that can be connected to the ES60 computer via the USB port. The size of these drives range from 80-120 Gb, and a drive with a capacity in this range should be chosen. A 80 Gb disk is generally sufficient to store detailed information collected over 4 months.

Some of the operations described below require basic file management operations using the ES60 computer – see the “Troubleshooting and Helpful Keystrokes” section at the end of the document.

Destination Folder on Portable Drive

A destination folder for the ES60 data should be created on the hard drive. Two file types generated by the ES60 will be stored: (a) a *.RAW file and (b), a *.OUT file. Verify that a destination folder called “Vessel name datagram year” exists; if not, create one using your vessel name and the year.

Creating a file path for ES60 data storage and ES60 settings

The ES60 software requires that a destination file path be specified in order for ES60 data to be stored on the portable drive. To specify a file path, make the following menu selection: FILE STORE. Then,

- Check the “Save Raw Data” box (raw data from the transducer saved as *.raw files)
- Check the “Save Output Data” box (bottom data saved as *.out files)
- Set “Line Number” to 1 (only at the beginning of the survey)-this controls the serial/file numbers of the raw data files.
- Do not check the “Local Time” box as this affects the time stamp in the file.
- Set “Maximum file size” to 100 MB.
- Finally, under “Survey” specify the file path corresponding to the destination folder that was created on the drive. The path reflects the appropriate drive letter, and the folder reflects area, year, and vessel (e.g, E:\Will Watch datagram 2006)

Other settings

Bottom Detector Settings

Right-click on the depth display at the top of the echogram window. In the depth dialog window, do the following:

- i. Set the “maximum depth” to 1800 m.
- ii. Check the “bottom smoothing” box
- iii. It is important to set the “Minimum depth” at 200-400 metres, to ensure that any plankton layers do not prevent bottom detection. These settings do not affect the echogram that you see on the screen, but are important for the acoustic analysis.
- iv. The backstep minimum level should also be set at -50 dB, the default setting.
- v. NOTE: Do NOT check the “alternative bottom detector” box

Right-click anywhere inside the echogram window. When the echogram dialog window appears:

- iv. Check Surface – Manual (the ES60 will use the range setting in the Surface Range menu, above)

- v. Check “Event”

It doesn't matter whether the TVG is set to schools or fish - this does not affect the logged raw data. Then:

- vi. Select “variable depth”
- vii. Set “Bottom” to “on”
- viii. Uncheck the Ping Filter (**turn it off**)

9. Other ES60 Settings

Recording ES60 parameter settings

To record all ES60 settings:

- Right-click on the frequency “38 kHz” near the top and left of center of the screen
- In the Transceiver Settings dialog box, ensure the power setting is appropriate for your combination of GPT and transducer:
 - typically 1000 W to 2000 W for 38 kHz
 - A pulse length of 1.024 ms
- Set Mode to ACTIVE (except when creating “noise files”-see below)
- Click on the “ADVANCED” button to display the ES60 settings. Record all settings (e.g., frequency, beam type, gain, S_a correction, etc.) on the log form.
- Alternatively, you can make a screen shot of the settings window:
 - Click CTRL+ALT+PRINT SCREEN
 - open a program such as Paint, and Paste.
- Save the file on the on the portable drive cruise folder and record date and file name on log form.

How to Verify you're the Version of ES60 software on your Vessel's System

Record the version of the ES60 software on the log form. To do this, go to “HELP ABOUT THIS ECHOSOUNDER”.

Verifying that a GPS unit is connected to the ES60

To verify that a GPS unit is connected to the ES60 and functioning properly check for latitude and longitude data at the bottom of the screen in the ES60 software.

Creating “noise files”

If the opportunity arises, collecting measures of the vessel-generated background noise may facilitate processing of the acoustic data after the survey. Collect noise files in 2 locations: (a) when the vessel is over deep water, e.g. >500 m depth and (b), when the vessel is on station. At each location, create one “noise file” while the vessel is running at cruising speed (e.g. ~10 knots), and one file while the vessel is sitting still or drifting. When on station, create an additional noise file when the vessel is trawling. Record file information in log form.

To create noise files: Right-click on “38 kHz” in the upper left hand corner of the screen. Check “PASSIVE” in the dialog box. This puts the transducer in a passive “listening” mode (i.e. no acoustic transmissions). Next, assuming a data file is being logged, close the current file by clicking on the file number (i.e., LXXXX) at the bottom of the screen (color should go from red to black), and click again to start a new “noise file” (color should switch back to red and the LXXXX number should increase by one). Log data for approximately 10 minutes and then close the file (click on LXXXX). Note the file number and record it along with the vessel speed as a noise file on the log form (use file type “N”). Next, right-click “38 kHz” and activate the transducer by checking “ACTIVE”. Finally,

resume normal data logging operations by clicking on LXXXX so that it turns red. Record propeller speed, RPM and weather conditions on log form.

Helpful Shortcuts

Closing ES60 software without shutting down the ES60 computer

To avoid shutting down the ES60 computer every time you shut down the ES60 software, execute the following keystroke combination: Simultaneously press the SHIFT+ALT keys, and then go to FILE Shutdown. If the sounder does not have a keyboard, it is also possible to shutdown the sounder software by going to the File menu, pressing the right mouse button, then pressing the left button and scrolling to 'shutdown' holding both mouse buttons, then releasing the left button before the right button.

Toggling between Windows Explorer and ES60 screen

To check disk space and make sure files are transferring properly have the Windows Explorer and the echosounder running simultaneously. Striking the "Tab" key while holding the "Alt" key down will toggle between the icons of the programs currently running. Selecting the Windows Explorer icon will bring up this program. If the Windows Explorer icon is not present, it may be necessary to shutdown the echosounder without shutting down the processor (see above), open Windows Explorer, then restart the ES60 software from the icon on the desktop.

Figure VI.4
Noise Examples



Fig. 5 ES60 echograms in Echoview (Sonardata) software showing interference from another sounder or instrument.

