

Acoustic Biomass Surveys of Orange Roughy in ORH 3B North Chatham Rise

Survey program

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1. CSIRO Oceans and Atmosphere

2. Thalassa

Objectives

Orange roughy spawning biomass within ORH 3B NWCR and ORH 3B ESCR management sub-areas

- To estimate the abundance of spawning orange roughy using an AOS and a hull-mounted acoustic system in the following areas:
 - 180° hills (NWCR)
 - Spawn Plume, Rekohu Plume, Mt Muck (ESCR)
- To undertake targeted trawls on aggregations to collect the biological information required to inform the acoustic data and to collect otolith samples for population age structure determination.

Ancillary objectives:

- To undertake towed camera transects of the seabed on key Underwater Topographical Features (UTFs) to map the nature and extent of their benthic biodiversity.
- Opportunistic test of new modular AOS system

Survey tools for core objectives

<u>Vessel</u>

FV Amaltal Apollo (43 m factory trawler) on full charter

Acoustics

Sealord Acoustic Optical System (AOS): calibrated 38 kHz and 120 kHz EK60 echosounders.

Vessel: ES80 38 kHz echosounder (new installation during June dry dock). Calibration at start of voyage

<u>Optical</u>

Sealord AOS standard definition video Prosilica stereo Gig-E machine vision cameras

Demersal trawl

Catch composition Length, weight, sex, stage, otoliths for orange roughy and other key species

<u>Voyage duration</u> 24 June – 18 July 2021



Methods – Sealord Acoustic Optical system



Key features

- 2 freq acoustics (38, 120)
- SD Video camera
- Gig-E stereo digital stills
- Designed for simplified operation and data handling



Operational modes

- Biomass estimation: grid transects towed at 300-350 m above fish school
- 2. Target strength: standard demersal tow with acoustic and optical measures

Acoustic Optical system – species discrimination

Large positive bias in biomass will occur if co-occurring high signal (gas bladder species) are not excluded

Multiple lines of evidence to robustly identify species including

- Multi-frequency species discrimination
- Echogram school characteristics (depth, structure, 'texture')
- Close-range optical (stereo camera and video)
- Trawl catch
- Single pass transects over aggregations to identify species



AOS Advantages

- High certainty of species id
- Lower range dependant effects
- Stable platform

Disadvantages

- Slow to execute

Methods – Vessel acoustics

- When conditions are calm and aggregations are confidently identified as orange roughy, vessel-based 38 kHz acoustic surveys may complement AOS surveys
- Advantage is ability to conduct surveys more rapidly, covering wider areas which may be important on large areas such as Rekohu and Spawn Plume. Provides observation of temporal spatial dynamic of aggregations allowing AOS surveys to be conducted when they have stabilised (aggregations are typically more mobile in days leading up to full spawn)
- Some disadvantages are
 - Higher uncertainty due to absorption losses
 - Potential for positive bias from gas bladder species
 - Bias due to motion and weather effects
- Will need to consider advantages/disadvantages of both AOS and Vessel depending on weather, fish distribution and behaviour and decide which will give optimal outcome

Survey designs

Interlaced grid – broad distributions –



Star pattern – Localised features -



Biomass as per Doonan 2003, weighting backscatter according to distance from survey centre to allow for different sampling intensity In between surveys, sustained observations of spawning grounds with vessel sampling + trawl id shots to understand spatial & temporal dynamic

Planned activities

Follow similar approach to 2013 and 2016 acoustic surveys.

Timing of spawn expected to be in order of Morgue/Graveyard, Rekohu and Spawning Box/Mt Muck.

Survey activities planned accordingly.

Biological Sampling

- Catch composition by species and weight for all tows
- ORH sample of 100 LFs, sex, gonad stage and fish weight from each catch. A second ORH sample if catch > 10 t
- Target of 500 otolith samples from each spawning ORH aggregation
- LFs, sex and gonad development stage for sharks
- LFs and sex for other abundant species



Planned activities

Date	Location	Activities
24th June	Depart Nelson	Calibrate vessel then transit to Morgue/Graveyard
26th June	Morgue/Graveyard complex	Biological sampling, AOS, vessel surveys of Morgue, Graveyard and potentially nearby features. Minimum 3 AOS surveys at Morgue and Graveyard, pilot deep-camera operations
2nd July	Rekohu	Minimum 3 AOS surveys, complemented by vessel surveys should conditions allow. Biological sampling, AOS and vessel surveys
9th July	Snawn Boy/Mt Muck	Minimum 3 AOS surveys of spawn box, complemented by vessel surveys should conditions allow. Biological sampling, AOS and vessel surveys. Minimum 2 surveys of Mt Muck – AOS only. Deep-camera surveys of Mt Muck (TBD)
Juliy	Spawn Box/ Wit Muck	
13th July	NE hills	Deep camera surveys of Smith's City and Cameron's UTFs (TBD)
17th July		Transit to port
18th July	Arrive Nelson	

Biological sampling will track spawning progression to broadly guide timing of surveys and movement between grounds

Continuous observation using vessel sounder plus CSIRO and skippers' knowledge of the grounds will allow fine tuning of survey timings (e.g. knowledge of day/night behaviour)

Benthic deep-camera tows and trial of Modular AOS to fit around core activities and weather windows.

Survey tools for ancillary objectives

(pilot study for benthic characterization from commercial fishing vessels)

CSIRO Deep camera system + optic fibre winch



Towed camera system connected to CSIRO Optic fibre winch with 2500 m wire.

Pilot control of system with real time vision (look-ahead camera). Maintain 2-4 m height above seafloor

Calibrated Canon 1DX MKII paired digital stills camera (stereo measurements)



HD video with paired laser

Records CTD, platform depth, pitch/roll, wire out

Geoposition informed via layback estimate + bathymetry (on sloping features)

Deep camera tows

Objectives:

Investigate the nature and extent of biogenic habitats on key fished UTFs not previously surveyed

Survey 3-4 UTFs each year over the next 5 years during ORH acoustic biomass surveys

In 2021

- Pilot transects on Graveyard
- Candidate sites: Mt Muck, Smith's, Cameron's

Methodology:

Well established, as described by Williams et al.

- Radial, downslope transects from peak to beyond base
- Aim for 8 transects per UTF feature
- Spatially-balanced design:
 - Randomised start points around peak
 - Random starting points (typically ~ 16) generated to enable adaptations to conditions, mostly so that we can tow headto-wind
 - Order of transects follow randomisation order, i.e. skipping those that cannot be completed.



True Size Matters for Conservation: A Robust Method to Determine the Size of Deep-Sea Coral Reefs Shows They Are Typically Small on Seamounts in the Southwest Pacific Ocean

🔄 Alan Williams", 🕵 Franziska Althaus', 🖆 Mark Green', 🔤 Kylie Maguire', 🔄 Candice Untiedt', 🔄 Nick Mortimer', 🚊 Chris J. Jackett', 🌊 Malcolm Clark', 🚮 Nicholas Bax^{1,4}, 🔄 Roland Pitcher^s and 🏹 Thomas Schlacher^s

Survey tools for ancillary objectives (next generation AOS – Modular AOS)



Trial deployments

- Test operation
- Noise performance
- Camera image optimisation

Simrad WBT Tube 38 and 120 kHz echosounder

Biomass module

- 38 kHz and 120 kHz 7 degree transducers
- Good signal to noise, low deadzone, long range survey (300 m above seafloor)

Target strength module

- Close-range measures for fish target strength
- 38 kHz 18 degree transducer, 120 kHz 18 degree transducer (on order)
- Wide-beam transducers for improved TS measures (lower nearfield, larger sampling volume
- Sony Alpha9 (top of range) DSLR stereo cameras
- HD video

M-AOS as backup system should issues arise with Sealord AOS

April 2021 equipment trials

Four day voyage on Tasmania's east coast on Maritime college MV *Bluefin*

- Sealord AOS <u>38kHz acoustics calibrated</u>.
- Modular AOS <u>38 kHz and 120 kHz calibrated</u>.
- Deep-cam system trialled with deployment to 1450 m depth.
 High quality digital stills and video obtained.
- Winch operation trialled with correct spooling confirmed.
- Deep-cam pilot gained key experience during trial deployments.
 Winch system highly responsive but with excellent fine-scale control enabled safe operation of the camera at ~ 2-3 m above seafloor
- Systems tested and ready to go
- Equipment shipped to NZ



Special Permit Application

Exemptions requested

- 1. To take by trawl a quantity of orange roughy in ORH 3B NWCR and ORH 3B ESCR for research purposes
- 2. Within the Morgue Seamount Closure, to undertake:
 - Acoustic survey transects above the seabed using a net-mounted AOS
 - Non-seabed-contacting target identification trawl tows
- 3. To deploy a towed video camera system using a fibre-optic cable.

An MPI observer will be aboard for the survey.

Notice to vessels

Companies have been requested to avoid the survey areas prior to and during the survey period.

Notice to Vessels: Acoustic Biomass & Benthic Surveys in ORH3B North Chatham Rise, June-July 2021)21						
DWG v	DWG will undertake AOS acoustic biomass surveys of orange roughy spawning aggregations in ORH3B Northwest Chatham Rise and North East																			
Chatha	Chatham Rise from 25 June - 17 July 2021 (blue shading). To facilitate the best possible measurements for input into stock assessments, vessels															essels				
are req	uested	to rest t	he surve	ey areas	prior to	and du	ring this	period	as sugg	s suggested below (green shading).										
		<u>.</u>	Survey period						Gro	unds re	sted		When/where vessels can operate							
													Before 19 June - can fish anywhere							
ORH3B NWCR Biomass Survey (The Hole to 180° Hills)													Up to 24 June - can fish NECR							
Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed		From 1 July - can fish NWCR							
19-Jun	20-Jun	21-Jun	22-Jun	23-Jun	24-Jun	25-Jun	26-Jun	27-Jun	28-Jun	29-Jun	30-Jun		Up to 7 July - can fish NE hills							
													From 14 July - can fish Plume/Rekohu/Cr							
													After 16 July - can fish anywhere							
	ORH3B NECR Biomass Survey (Rekohu Pl										n Plume	; Mt M	uck/The	Crack)						
Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue		
25-Jun	26-Jun	27-Jun	28-Jun	29-Jun	30-Jun	1-Jul	2-Jul	3-Jul	4-Jul	5-Jul	6-Jul	7-Jul	8-Jul	9-Jul	10-Jul	11-Jul	12-Jul	13-Jul		
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ORH3B NECR Benthic Surveys (Smith's City; Cameron's)																				
Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri												
8-Jul	9-Jul	10-Jul	11-Jul	12-Jul	13-Jul	14-Jul	15-Jul	16-Jul												