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SC7-DW08

Approach to Updating Stock Assessments for the Tasman Sea Stocks of Orange Roughy

New Zealand

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1. Purpose of paper

This paper summarises the anticipated development of stock assessment models for Tasman Sea stocks of orange roughy. Consistent with SC-05's advice, an updated stock assessment for one or more Tasman Sea stocks is expected in time for SC-08 in 2020.

2. Existing stock assessments and management advice for the Tasman Sea

Low information stock assessments were conducted for Tasman Sea stocks by Roux & Edwards (2017) using a spatial CPUE analyses and a cohort-aggregated Bayesian state-space biomass dynamics model and by Cordue (2017) using a catch history-based age-structured model with constraints on the maximum exploitation rate and assumed biological parameters borrowed from five New Zealand EEZ orange roughy stocks.

In the report from SC-05 (paras 98–100), the SC considered that, although none of the methods presented to that meeting provided a definitive assessment of SPRFMO orange roughy stocks, the SC considered them to be collectively indicative of stock status and potential yields. The development of advice on catch limits for individual stocks was considered but, because of the level of uncertainty in estimates of status and yield by stock, it was considered better to group the stocks for the development of advice.

The SC used the lower 95% CIs of estimated stock status to inform the level of precaution that might be appropriate. The group of stocks to the west of New Zealand (in the Tasman Sea) have a greater potential for low stock status than those to the east (Louisville Ridge) and a more precautionary approach was considered by SC to be appropriate there.

With respect to the assessment of SPRFMO orange roughy stocks and ensuring sustainable fisheries, the SC:

- **Noting** that the stocks on the Louisville Ridge (Louisville North, Central and South) have a lower potential of having low stock status, **recommends** a catch limit for the whole of the Louisville Ridge based on the sum of the 50th percentile yield estimates provided in SC5-DW14, the CHA stock assessment method, of 1,140 tonnes to apply for the area for no more than 2 years. A significantly more precautionary approach is recommended if insufficient advancement is made in data collection and stock assessments for the relevant stocks within 2 years. The SC recommends that, within this group, the Louisville Central stock should be prioritised for improved data collection and stock assessment.
- **Noting** that the stocks in the Tasman Sea (Lord Howe Rise, Northwest Challenger Plateau, and West Norfolk Ridge) are estimated to have a higher potential of being depleted, **recommends** a catch limit for the Tasman Sea stocks based on a 0.5 scaling of the 50th percentile yield estimates provided for relevant stocks in SC5-DW14 (690 tonnes) from the CHA stock assessment method, resulting in a catch limit of 346 tonnes for the area to apply for no more than 3 years. A significantly more precautionary approach is recommended if insufficient advancement is made in data collection to support stock assessments for the relevant stocks in 3 years. The SC

recommend that, within this group, the Lord Howe Rise and Northwest Challenger Plateau stocks should be prioritised for improved data collection and stock assessment.

The Commission subsequently agreed catch limits of 346 and 1140 tonnes, respectively, for Tasman Sea and Louisville groups of stocks, as part of CMM-03a-2019.

Following the above advice from SC-05 and consistent with the agreed multi-year workplan for the Scientific Committee, New Zealand conducted a stock assessment for the Louisville Central stock and updated the catch history-only assessments for Louisville North and South stocks. These are reported separately in Cordue (2019, paper SC-07-DW-05). This updated assessment showed the significant increase in precision that could be attained, even in the absence of biomass indices, if age compositions are available from near the start of the fishery and from recent fishing. Length compositions were also available to Cordue (2019) but omitting them from the model did not greatly change the conclusions.

3. Data available to update stock assessments

Catch history

Roux and Edwards (2017) summarised the catch histories for eight putative stocks of orange roughy in the SPRFMO Area (Table 1, Roux & Edwards' Table 3). The South Tasman Rise is currently closed to fishing. Fisheries are currently occurring on the Lord Howe Rise (two areas), the northwest Challenger Plateau, and the West Norfolk Ridge. Of the extant Tasman Sea fisheries, those on the main Lord Howe Rise and the northwest Challenger Plateau are by far the largest.

Given both Australia and New Zealand fish the open Tasman Sea stocks, some work would be required to check and update these catch histories for the years 2016–2018, but this would not be a major impediment to updating the stock assessments.

Table 1 (Table 3 from Roux & Edwards 2017). Finalised catch series for orange roughy in the SPRFMO Convention Area, 1981-2015, including five management areas in the Tasman Sea (LHN = North Lord Howe Rise; LHR = Lord Howe Rise; NWC = Northwest Challenger; WNR = West Norfolk Ridge; STR = South Tasman Rise); and three management areas on the Louisville Ridge (Louis north (LOUIS.N), central (LOUIS.C) and south (LOUIS.S). Annual figures include orange roughy catches from New Zealand vessels (all forms), Australian vessels and NZ-chartered vessels (1981-1999), as well as catches reported to FAO Area81 by Belize, China, EU, Ukraine (2000-2009) and Korea (1999-2007).

Calendar year	LHN	LHR	NWC	WNR	STR	LOUIS.N	LOUIS.C	LOUIS.S	Total (annual)
1981	0	0	19	0	0	0	0	0	**19**
1982	0	0	50	0	0	0	0	0	**50**
1983	0	0	84	0	0	0	0	0	**84**
1984	0	0	0	0	0	0	0	0	**0**
1986	0	0	5	0	0	0	0	0	**5**
1987	0	0	3	0	0	0	0	0	**3**
1988	0	0	4	0	2	0	0	0	**6**
1989	0	933	113	0	1	0	0	0	**1047**
1990	0	127	25	0	11	0	0	0	**163**
1991	0	52	1	0	0	0	0	0	**53**
1992	0	484	230	0	0	0	0	0	**714**
1993	61	1942	2512	0	0	1	25	0	**4541**
1994	0	744	1698	1	0	1	657	29	**3130**
1995	0	70	888	0	0	213	9566	1416	**12153**
1996	0	21	475	0	4	3842	1889	2639	**8870**
1997	0	125	378	0	1813	684	1277	1178	**5455**
1998	2	46	489	0	3447	354	760	313	**5411**
1999	45	463	1083	0	3475	222	712	2138	**8139**
2000	4	82	633	0	829	495	332	602	**2977**
2001	0	467	1451	217	169	1023	371	537	**4235**
2002	0	130	2358	593	102	261	251	421	**4116**
2003	16	330	1212	38	11	841	443	542	**3433**
2004	34	392	896	198	49	739	509	1254	**4070**
2005	94	434	598	497	12	316	630	1314	**3894**
2006	4	221	262	1023	0	246	272	465	**2494**
2007	6	59	231	741	0	21	117	294	**1470**
2008	0	380	31	426	0	0	0	0	**837**
2009	0	518	336	300	0	0	0	0	**1154**
2010	0	385	420	79	0	0	371	212	**1467**
2011	1	280	342	65	0	13	101	172	**974**
2012	0	173	257	51	0	3	185	100	**769**
2013	0	393	231	19	0	5	215	344	**1207**
2014	7	150	124	10	0	0	571	183	**1045**
2015	0	162	550	20	0	7	341	113	**1193**
Total (time series)	**274**	**9563**	**17989**	**4278**	**9925**	**9287**	**19595**	**14266**	**85178**

Length compositions

New Zealand and Australian observers routinely measure samples of orange roughy. For example, New Zealand's annual report in 2018 included raw (unscaled) length frequency distributions by year, indicating that >5000 fish are measured in most years, largely in proportion to the catch by stock. Selecting the measurements to include in an updated stock assessment, pooling them with data from Australian observers, and scaling to catch by tow would be straightforward.

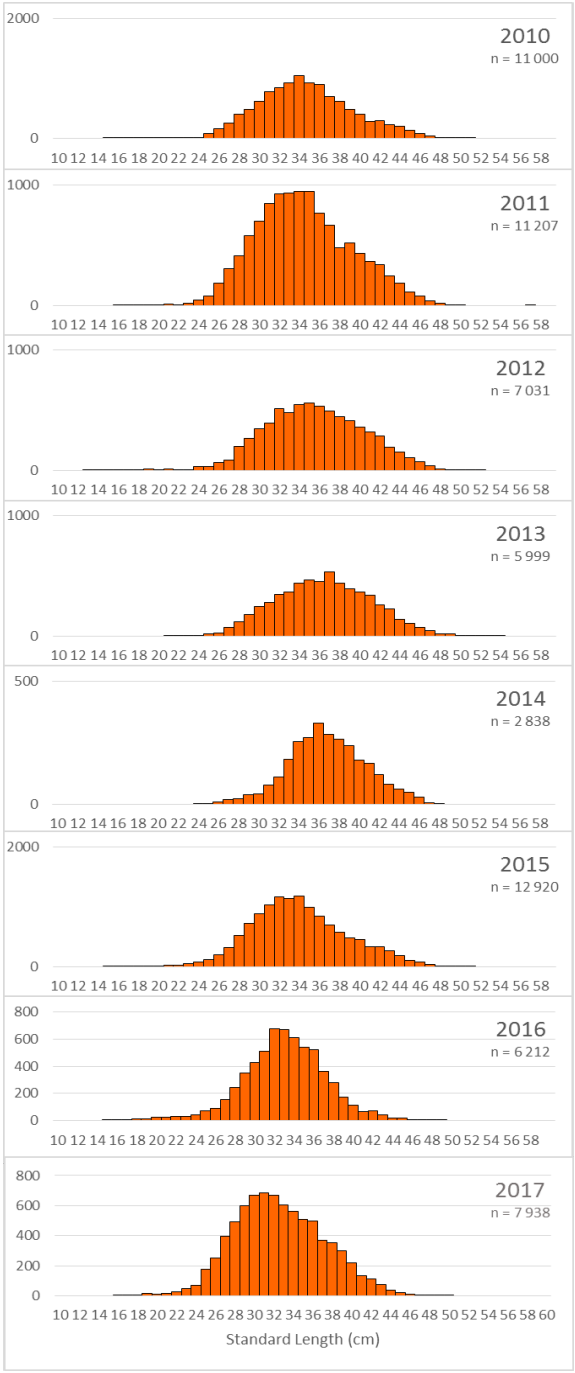

Figure 1 (Figure 9 from NZ Annual Report to SC in 2018): Length frequency distributions (unscaled) for orange roughy measured by scientific observers aboard New Zealand vessels fishing between 2010 and 2017 in the SPRFMO Convention Area. Measurements from both Tasman Sea and Louisville fisheries are included, largely in proportion to landings.

Potential age compositions

Considerable numbers of otoliths have been collected from orange roughy by New Zealand observers working on bottom trawlers operating in the Tasman Sea fisheries. Additional otoliths are held by Australia but these have not yet been characterised for the purposes of assessment of Tasman Sea stocks. For the two main (and open) Tasman Sea stocks, about 2500 and 1500 otoliths, respectively, are available for the spawning season fisheries on the northwest Challenger Plateau (Table 2) and the main Lord Howe Rise (Table 3).

Table 2: The number of orange roughy otoliths collected during the June-July spawning season fishery in the "CET" area defined by New Zealand fisheries observers (primarily northwest Challenger Plateau) since 1988

Calendar year	June tows	June otoliths	July tows	July otoliths	Total tows	Total otoliths
1988	0	0	20	388	20	388
1989	0	0	25	202	25	202
1992	0	0	6	47	6	47
1993	17	170	6	59	23	229
1996	0	0	2	35	2	35
1998	5	25	6	30	11	55
2012	0	0	4	40	4	40
2013	20	314	4	52	24	366
2014	2	24	0	0	2	24
2015	14	267	0	0	14	267
2016	12	160	14	131	26	291
2017	35	333	28	177	63	510
Total	105	1293	115	1161	220	2454

Table 3: The number of orange roughy otoliths collected during the June-July spawning season fishery in the "HOWE" area defined by New Zealand fisheries observers (primarily Lord Howe Rise) since 1989

Calendar year	June tows	June otoliths	July tows	July otoliths	Total tows	Total otoliths
1989	5	65	4	38	9	103
1990	0	0	5	66	5	66
1992	8	70	10	46	18	116
1993	5	50	0	0	5	50
2012	5	50	0	0	5	50
2013	6	121	7	120	13	241
2014	4	75	4	64	8	139
2015	11	179	2	29	13	208
2016	3	48	5	71	8	119
2017	8	126	16	237	24	363
Total	55	784	53	671	108	1455

Not all otoliths will come from within key fishery locations where a stock assessment might be constructed, and only a proportion will be readable (e.g., Horn & Ó Maolagáin (2019) attained successful readings of 85% of otoliths collected in 1995 and 94% of those collected in 2013–15 from the Louisville stocks). However, Tables 2 and 3 show that numbers of otoliths collected early and late in the fishery development, and the number of tows sampled for otoliths, for the two main Tasman Sea fisheries are comparable with the numbers available for Cordue's (2019) Louisville assessments (Tables 4 and 5).

Table 4 (Table 2 of Cordue's Louisville Central stock assessment, see paper SC-07-DW-05): The number of tows by New Zealand vessels in Louisville Central in June and July sampled for otoliths by scientific observers by year and cluster. Clusters 1-4 are respectively associated with the UTFs Mt. Ghost, Mt. Whales, Valerie, and 1485.

	Cluster			
Year	**1**	**2**	**3**	**4**
1995	5	4	5	0
2013	10	3	5	0
2014	8	4	6	3
2015	12	9	4	3

Table 5 (Table 3 of Cordue's Louisville Central stock assessment, see paper SC-07-DW-05): The number of fish aged by Horn & Maolagáin (2019) from Louisville Central in June and July by year and cluster. Clusters 1-4 are respectively associated with the UTFs Mt. Ghost, Mt. Whales, Valerie, and 1485.

	Cluster			
Year	**1**	**2**	**3**	**4**
1995	86	67	85	0
2013	179	52	81	0
2014	156	78	121	60
2015	195	135	75	57

4. Suggested development

Based on the availability of data and the guidance in SC-05's report and the Scientific Committee's multi-year workplan, it is proposed that age-based stock assessment models be developed for the northwest Challenger Plateau as a priority and, as time and resources permit, for the Lord Howe Rise. In the year after the development of models for the key Tasman Sea stocks, further work could be conducted on Louisville stocks, including the collection of acoustic indices following the generic design agreed by SC-06 (Cordue 2018).

5. Recommendations

It is recommended that the Scientific Committee:

- **Agrees** that sufficient data appear to be available to develop age structured models for orange roughy on the northwest Challenger Plateau and the Lord Howe Rise, the two largest Tasman Sea stocks;
- **Recommends** that, consistent with the multi-annual workplan, a stock assessment for the northwest Challenger Plateau be developed as a priority in 2020 for review by SC8 and, as time and resources permit, for the Lord Howe Rise.

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