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New Zealand Annual Report

Ministry for Primary Industries

Ministry for Primary Industries
Manatū Ahu Matua

New Zealand Annual Report on Fishing and Research Activities and Observer Implementation in the SPRFMO Area during 2016

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Growing and Protecting New Zealand

New Zealand Government

Ministry for Primary Industries
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1 Description of Fisheries

1.1 PELAGIC FISHERIES

New Zealand conducted no pelagic fishing for *Trachurus* species in the SPRFMO Area during 2016. Jack mackerel (*Trachurus murphyi)* was first observed in New Zealand waters in 1987, although its distribution in New Zealand waters has changed significantly over time. *T. murphyi* in New Zealand is thought to be a small, and periodically separated component of the larger South Pacific stock which undergoes periodic expansions or migrations. It is unknown whether there has been any spawning of *T. murphyi* in New Zealand waters.

Catches of *T. murphyi* within the New Zealand EEZ were highest in the 1990s, but have decreased significantly since then, and *T. murphyi* catch was estimated to be around 2,000 tonnes in the 2015/16 fishing year (Oct-Sept) (Horn et al. 2017).

1.2 BOTTOM FISHERIES

The New Zealand high seas bottom trawl and line fisheries are described in detail in the impact assessment '*New Zealand Bottom Fishing Activities by New Zealand Vessels Fishing in the High Seas in the SPRFMO Area during 2008 and 2009'* (New Zealand Ministry of Fisheries 2008b) available at http://www.southpacificrfmo.org/benthic-impact-assessments/. Bottom fishing activities conducted during 2016 operated largely as described in that document, and were conducted in accordance with the impact assessment and management measures described in the assessment. New Zealand vessels have been bottom fishing in the SPRFMO Area since before 1990. Specific high seas fishing permits for the SPRFMO Area were implemented in 2007-08, following adoption of the SPRFMO interim measures in May 2007. The number of New Zealand vessels permitted to fish in the SPRFMO Area since 2002; and the number of vessels which actually bottom fished in the Convention Area are shown in Table 1.

Table 1: Summary of the number of New Zealand vessels permitted to bottom fish in the SPRFMO Area and with the capability for bottom fishing, and the number of vessels which actually fished in the Area per year with either bottom trawl or line, since 2002. The data are arranged by permit year, which is a split year from May to April.**

Vessel Permit Year	Number of Vessels Permitted to Fish SPRFMO Area	No. of Vessels that Actively Bottom Fished in the SPRFMO Area	Bottom Trawling	Bottom Lining
2002–2003	*55	22	19	3
2003–2004	*66	24	17	7
2004–2005	*60	28	17	11
2005–2006	*58	22	12	10
2006–2007	*38	12	8	4
2007–2008	25	7	4	3
2008–2009	21	10	5	5
2009–2010	24	9	7	2
2010–2011	27	9	7	2
2011–2012	24	9	6	3
2012–2013	24	8	5	3
2013–2014	24	8	5	3
2014–2015	31	10	6	4
2015–2016	31	9	5	4
2016–2017	21	11	6	5

* There were no specific high seas permits for the SPRFMO Area prior to 2007. These were the numbers of New Zealand vessels issued with general high-seas permits that indicated that they had the capability to bottom trawl.
** Historical numbers in this table have been corrected and differ from those tabulated in New Zealand's 2014 National Report

Trawl fishing effort (bottom and midwater) declined from a peak of 23 vessels in 2002 and has been stable at between 4 and 8 vessels since 2007. The number of vessels line fishing increased from 3 in 2003 to a peak of 11 in 2005 then declined to between 2 and 5 vessels since 2007. The distribution of vessel size of the permitted vessels from 2007-08 is shown in Table 2, with no clear trend in vessel size over time. The main areas of bottom fishing utilised by New Zealand vessels outside of the New Zealand EEZ since 2002 are shown in Figure 1.

Table 2: Distribution of vessel size (length overall in metres) for New Zealand vessels permitted to bottom fish in the SPRFMO Area for permit years (May - April) from 2006-07.

									Length overall (m)	
Permit year	≤ 11.9	12–17.9	18–23.9	24–29.9	30–35.9	36–44.9	45–59.9	60–74.9	≥ 75	Total
2006/07	0	1	6	8	3	8	2	8	2	38
2007/08	0	1	4	3	3	8	0	4	2	25
2008/09	0	0	3	3	4	8	2	6	0	21
2009/10	0	1	3	1	5	6	0	6	2	24
2010/11	0	1	3	3	4	8	2	6	0	27
2011/12	1	1	3	1	2	8	2	6	0	24
2012/13	1	1	3	1	2	8	2	6	0	24
2013/14	0	1	3	2	2	7	2	6	1	24
2014/15	0	1	8	2	3	6	3	7	1	31
2015/16	0	1	7	3	4	7	3	4	2	31
2016/17	0	1	3	2	4	6	3	2	0	21

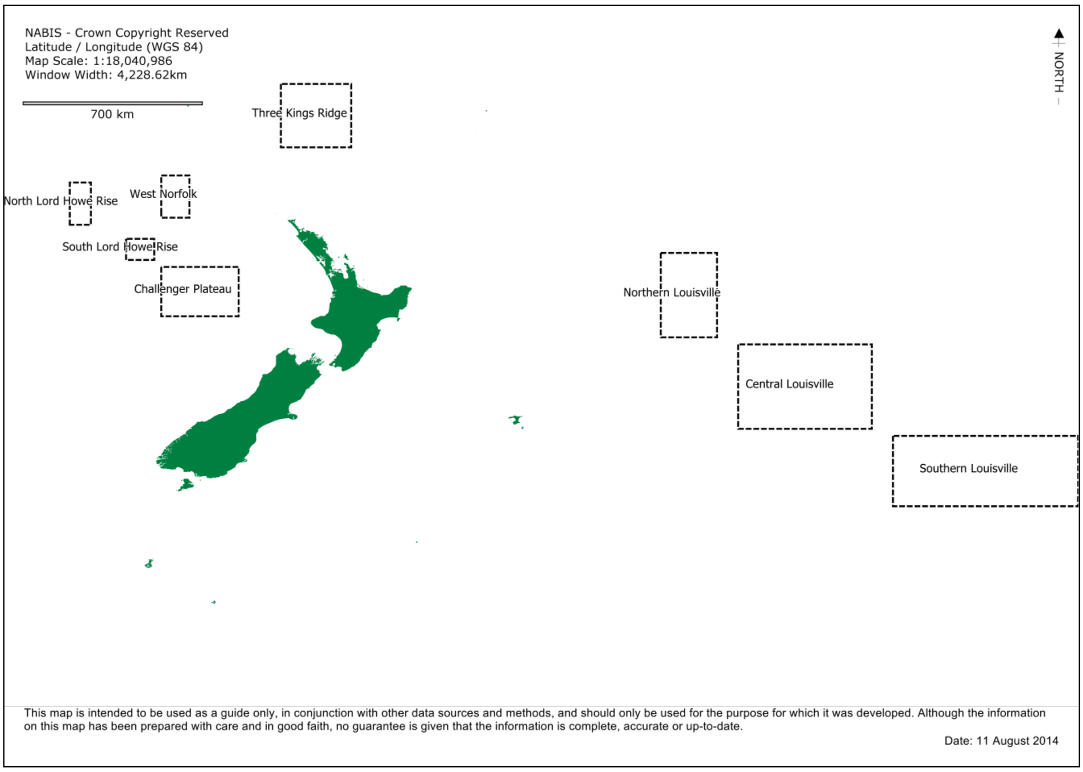

Figure 1: The general areas bottom fished by New Zealand trawlers in the SPRFMO Area since 2002

2 Catch, Effort and CPUE Summaries

2.1 TRAWL BOTTOM FISHERIES

The annual fishing effort (number of vessels and number of bottom trawl tows which recorded a catch) and landed catch of the main bottom trawl target and bycatch species are summarised in Table 3. The number of bottom trawl tows decreased from about 3 000 per year in 2002-2003, to a minimum of about 200 in 2008, then increasing again to about 1 200 in 2010 and 2011. In 2014 the number of bottom trawl tows dropped to their second lowest recorded level since 2000. Over 900 tows were conducted in both 2015 and 2016. This pattern broadly mirrors that in the number of vessels fishing over the same time period.

Orange roughy (*Hoplostethus atlanticus*) continues to be the main bottom trawl target species, contributing over 80% of the total bottom trawl catch since 2002 (varying by year between 67% and 99%) (Table 3). Other species making minor contributions to catches since 2002 include oreos 5% (0–16%), cardinalfish 4% (0–8%), and alfonsino 4% (0–13%). Catches of alfonsino and cardinalfish were high in 2010 and 2011, but made up very little of the total catch between 2012 and 2014. In 2016, cardinalfish contributed less than 1% to the total catch, while alfonsino catch increased to 6.5% of the catch. Catches of ribaldo also increased in 2016, however neither made up more than 2% of the total catch.

2011 saw midwater trawling for bentho-pelagic species for the first time in any quantity (there were 1 and 15 midwater tows in 2009 and 2010 respectively), with three permitted trawlers executing a total of 61 tows principally targeting alfonsino (ALF) close to the seabed. It has been determined that such fishing is included in the SPRFMO definition of bottom fishing. Effort was roughly the same in this fishery for 2011 and 2012 in terms of numbers of vessels and numbers of tows. In 2013 only one vessel fished using a midwater trawl, although there was a marked increase in effort, with 120 tows. The same vessel also fished bottom trawl gear on the same trips as it fished midwater gear. Despite the 2-fold increase in the number of midwater tows in 2013, catches remained similar to previous years. There was no midwater trawling for bentho-pelagic species in 2014 but there were 21 tows by two vessels in 2015 and 42 tows by 3 vessels in 2016. Since 2012, alfonsino has made up the majority of catch from midwater trawl fishing effort, comprising 95% of all midwater catch in 2016.

The trends in orange roughy catch and effort from 2002 in the main fishing areas are summarised in Tables 4 and 5, and also shown in Figure 2. The decline in orange roughy catches from 2002 to 2008 was associated with the decline in fishing effort in the main historical fishing areas of the NW Challenger Plateau and Louisville Ridge (Tables 4 and 5). After 2008, effort on the NW Challenger Plateau increased, as did effort on the Lord Howe Rise and Louisville Ridge. Catches of orange roughy in 2015 and 2016 were significantly higher than previous years in the Challenger area and on the Lord Howe Rise; however, there was a significant decrease in both effort and catch on the Louisville Ridge in 2016 and no effort or catch on West Norfolk.

Table 3: Annual fishing effort (number of vessels and tows) and catch (tonnes) of the main target and bycatch species (identified by FAO species codes – Appendix 1) by New Zealand vessels bottom trawling (top) and midwater trawling for bentho-pelagic species (bottom) in the SPRFMO Area from 2002. Year is calendar year. The number of tows reported here is the number of tows which recorded a fish catch, and excludes tows where there was no catch.

Bottom trawling

Year	No. Vessels	No. Tows	Tows/ Vessel	ORY	ONV	BOE	EPI	ALF	SSO	RIB	RTX	SCK	All Species
2002	23	2 944	128	2 578	–	121	159	17	50	43	61	37	3 180
2003	19	2 928	154	1 973	–	62	226	94	25	92	84	56	2 937
2004	17	1 952	115	1 697	–	90	42	85	91	46	34	8	2 188
2005	17	2 186	129	1 597	–	268	189	26	75	63	67	5	2 395
2006	12	1 135	95	1 415	–	57	21	28	6	33	27	15	1 652
2007	8	415	52	866	–	151	–	2	22	9	5	1	1 076
2008	4	208	52	837	2	–	–	2	<0.1	3	0.1	1	846
2009	6	547	91	928	5	–	16	5	<0.1	7	0.1	2	958
2010	7	1 167	167	1 474	9	12	22	244	10	15	6	13	1 864
2011	7	1 158	165	1 079	16	12	108	176	4	22	7	9	1 486
2012	6	652	109	721	10	4	2	39	3	5	7	2	805
2013	5	760	152	1 164	11	20	3	28	5	6	1	-	1 261
2014	5	403	81	998	6	7	0	0	5	2	0	0	1 028
2015	5	959	192	1 287	11	2	48	9	10	5	0	0	1 513
2016	6	943	157	954	27	0	19	87	0	23	0	0	1 326

Midwater trawling for benthopelagic species

Year	No. Vessels	No. Tows	Tows/Vessel	ALF	EDR	ONV	BWA	All Species
2011	3	61	20	64	76	21	2	164
2012	3	59	20	115	25	0	3	145
2013	1	120	120	122	9	0	10	145
2014	0	0	–	0	0	0	0	0
2015	2	21	11	34	0	0	2	37
2016	3	42	14	82	3	0	0	86

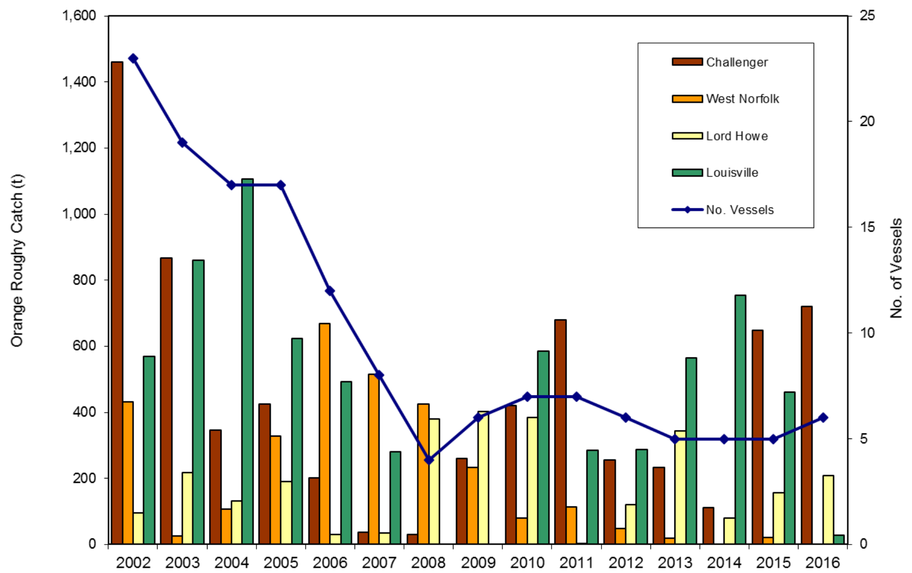

Figure 2: Trends in effort (the number of bottom trawl vessels fishing) and total landings of orange roughy (tonnes) for each of the four main areas fished by New Zealand bottom trawl vessels in the SPRFMO Area by calendar year from 2002.

Table 4: Bottom trawl effort (number of tows) in the main areas fished by New Zealand bottom trawl vessels fishing in the SPRFMO Area by calendar year from 2002. Reported effort for the Challenger Plateau includes effort on the Westpac Bank.

Year	Challenger Plateau	West Norfolk Ridge	Lord Howe Rise	Louisville Ridge	Other Areas	All Areas
2002	2 152	298	181	890	10	3 531
2003	2 072	88	470	774	95	3 499
2004	853	110	449	1 340	14	2 766
2005	1 039	323	256	838	41	2 497
2006	411	264	139	588	18	1 420
2007	76	176	37	126	–	415
2008	26	104	78	–	–	208
2009	156	252	229	–	11	648
2010	409	58	388	303	12	1 170
2011	437	84	379	258	–	1 158
2012	166	58	121	296	11	652
2013	189	27	128	299	7	7 600
2014	64	–	70	263	6	403
2015	582	32	124	221	–	959
2016	706	–	197	40	–	943

Table 5: Total estimated catches (tonnes) of orange roughy from the main areas fished by New Zealand bottom trawl vessels fishing in the SPRFMO Area by calendar year from 2002. Landings from the Westpac Bank area (part of the Challenger Plateau) are reported against New Zealand's ORH7A stock that straddles the boundary of the SPRFMO Area. Catches from there between 2002 and 2010 were largely from research surveys. –, less than 1 tonne

Year	Challenger Plateau	Westpac Bank (ORH7A)	West Norfolk Ridge	Lord Howe Rise	Louisville Ridge	Other Areas	All Areas
2002	1 460	–	432	96	568	22	2 578
2003	868	–	25	218	859	3	1 973
2004	347	–	106	132	1 106	5	1 697
2005	425	–	327	190	623	33	1 597
2006	202	–	670	29	493	22	1 415
2007	36	–	515	34	280	–	866
2008	31	–	426	380	–	–	837
2009	238	23	233	403	–	31	928
2010	415	5	79	385	584	6	1 474
2011	675	5	113	1	285	–	1 079
2012	247	8	49	121	288	8	721
2013	230	3	19	344	565	3	1 164
2014	57	54	0	79	754	54	998
2015	530	118	20	157	462	–	1 287
2016	486	234	0	208	27	-	954

2.2 LINE BOTTOM FISHERIES

The annual fishing effort (number of vessels and hooks fished) and catch of the main bottom line target and bycatch species are summarised in Table 6. The number of active line vessels increased from 3 in 2003, to 11 in 2005, then declined and has fluctuated between 3 and 5 vessels since 2007. The numbers of hooks set rose from 50,000 in 2003 to peak at 500,000 in 2006 and then declined to a low of 48,000 in 2010, after which it increased substantially to a new peak of 780,000 in 2014.

The number of hooks set decreased by more than 75% in 2015 and continued to decrease in 2016 (Table 6).

There have been three bottom line fishing methods used historically in the SPRFMO Area, bottom longline, Dahn line, and hand line. Dahn line and hand line are very similar, both methods employing a vertical line with hooks that is either attached to a float (Dahn line) or remains attached to the fishing vessel (hand line). Given the similarities, Dahn line and hand line are treated as a single fishery, and data reporting by commercial fishers and observers is the same for both methods.

Bottom longline comprises the majority of the fishing effort (110,700 hooks in 2016) and catch (87 tonnes in 2016). Other bottom line methods are more variable, with no Dahn line effort reported in 2016, and 128 hooks set by 3 vessels using hand lines in 2016. This was responsible for 2 tonnes of catch.

Table 6: Effort and estimated catches for New Zealand vessels bottom longlining in the SPRFMO Area by calendar year from 2002. Effort is presented as the number of vessels, trips, and number of hooks set, with catches in tonnes of the target and main bycatch species (codes detailed in Appendix 1).

Year	No. Vessels	No. Trips	No. Hooks (000's)	Hooks/ Vessel (000's)	BWA	HAU	DGS	MOW	RXX	YTC	ROK	TOA	Total catch (t)
2002	–	–	–	–	–	–	–	–	–	–	–	–	–
2003	3	7	53	18	6	7	1	1	–	–	–	-	17
2004	7	18	269	38	116	24	–	6	2	1	–	-	154
2005	11	29	384	35	102	31	13	10	2	3	1	–	163
2006	10	49	502	50	271	95	6	6	2	2	2	–	385
2007	4	29	423	106	144	31	4	5	3	3	1	–	202
2008	3	15	302	101	67	43	1	2	<1	1	8	–	123
2009	5	12	236	47	58	23	7	1	<1	–	<1	–	89
2010	2	5	48	24	15	24	–	1	<1	<1	<1	–	45
2011	2	6	71	36	23	25	6	<1	<1	<1	<1	–	57
2012	3	10	90	30	44	40	2	3	<1	<1	<1	–	95
2013	3	13	479	160	64	41	6	3	<1	1	1	–	124
2014	4	18	784	196	33	45	4	11	<1	<1	2	–	99
2015	4	15	179	45	35	63	4	2	<1	<1	1	–	126
2016	5*	10	111	28	20	54	5	3	<1	1	1	29**	87

* This includes one vessel that only fished using hand lines, and one vessel that only participated in the exploratory fishery for toothfish

** Bottom line catch of TOA from exploratory fishing as per CMM 14-2016

Bluenose BWA (*Hyperoglyphe antarctica*) was historically the main bottom line target species but catches declined from 2006 (Table 6). The annual catch of BWA was similar to that of wreckfish (HAU, *Polyprion oxygeneios* and *P. americanus*) from about 2010 to 2012 (roughly 20–40 t). Together bluenose and the two wreckfish species made up 76–95% of the catch between 2003 and 2016, averaging 84% overall, and they accounted for 78% of the catch in 2015 and 84% in 2016. Other species making minor contributions to bottom line catches include spiny dogfish (DGS), king tarakihi (MOW) and sea perch (ROK). The increase and subsequent decrease in bluenose catches by main fishing areas since 2002 is shown in more detail in Table 7. Figure 3 shows that the moderate catches in the mid-2000s have fallen to much lower levels recently, in line with the reduction in effort over time. There are no clear trends in nominal CPUE (Figure 4).

Table 7: Total catch of bluenose, BWA, from the main areas fished by New Zealand bottom line vessels fishing in the SPRFMO Area by calendar year since 2002

Year	Challenger Plateau	West Norfolk Ridge	Three Kings Ridge	Louisville Ridge	Other Areas	All Areas
2002	–	–	–	–	–	–
2003	–	5	1	–	–	6
2004	103	12	–	–	1	116
2005	38	27	24	–	14	102
2006	91	114	48	–	19	271
2007	59	47	39	–	–	144
2008	24	33	8	2	–	67
2009	13	29	16	–	–	58
2010	2	13	–	–	–	15
2011	–	11	11	–	–	23
2012	11	15	18	–	–	44
2013	31	10	24	–	–	64
2014	8	11	14	–	–	33
2015	23	10	2	–	–	35
2016	5	15	-	-	-	20

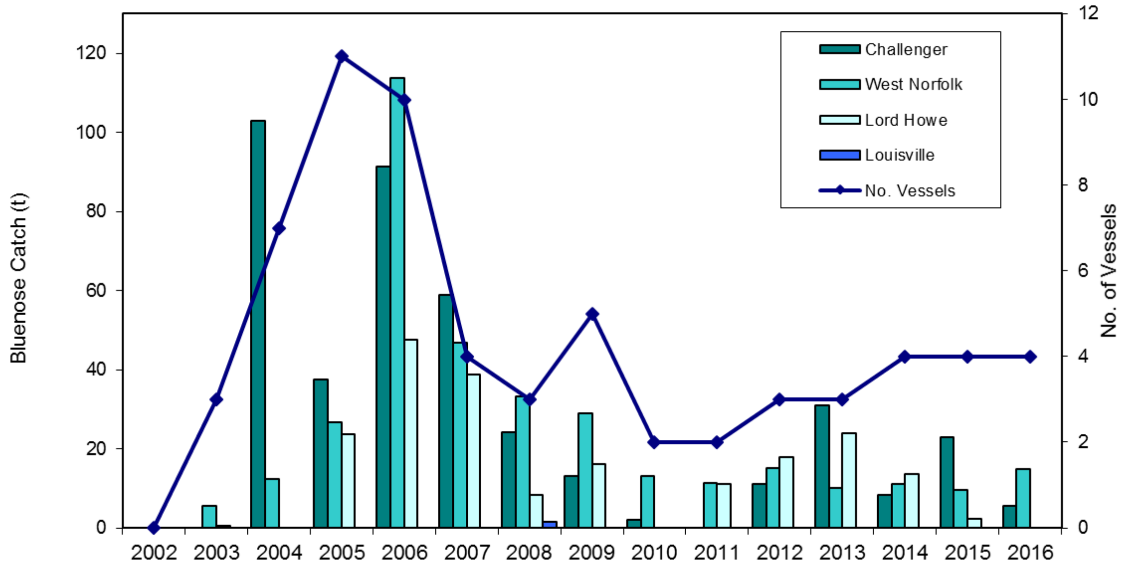

Figure 3: Trends in number of bottom line vessels and total bluenose catch from the four main areas fished by New Zealand bottom line vessels in the SPRFMO Area by calendar year from 2002.

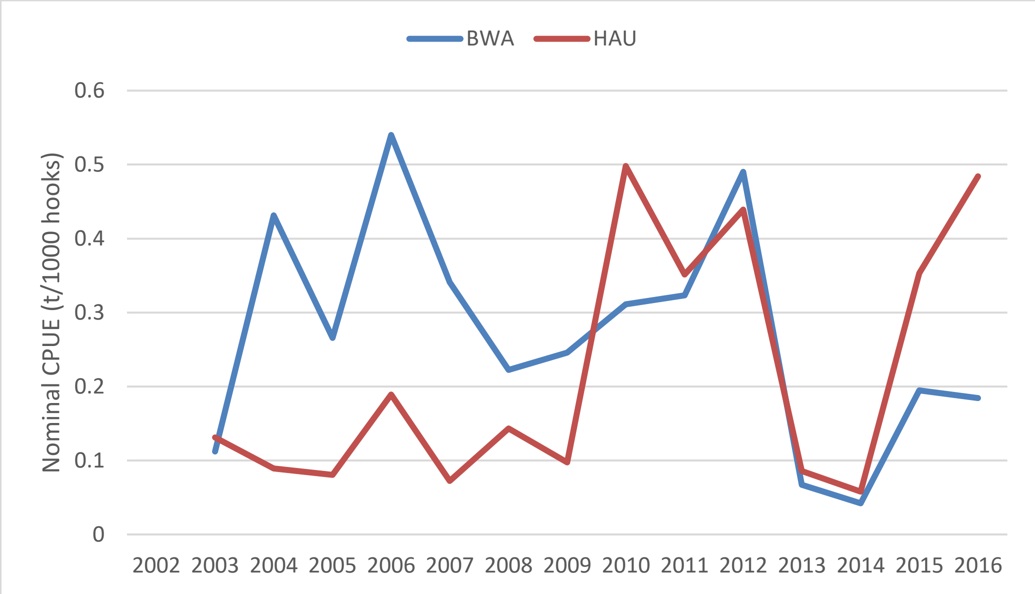

Figure 4: Trends in nominal CPUE (tonnes per 1000 hooks set) for bluenose (BWA) and wreckfish (HAU) by New Zealand bottom longline vessels fishing in the SPRFMO Area since 2002 (effort includes all nominated target species combined).

3 Fisheries Data Collection and Research Activities

3.1 FISHERIES CATCH & EFFORT DATA COLLECTION SYSTEMS

The data collection systems implemented for New Zealand high seas bottom trawl and line fishing vessels have been described in detail (Ministry of Fisheries, 2008b). Detailed tow-by-tow catch and effort data for all high seas fishing operations have been collected since 2007 using the at-sea catch and effort logbooks and landings recording forms. Detailed observer Benthic Materials Forms have been completed for all observed bottom fishing (trawling and lining) to record benthic bycatch to the lowest possible taxonomic level. In addition, Vulnerable Marine Ecosystem (VME) Evidence Forms are used by observers in the move-on areas for trawlers.

3.2 RESEARCH ACTIVITIES

As presented to the fourth meeting of the Scientific Committee (SC-04-DW-04) and the 2017 SPRFMO Commission (COMM5-INF05), New Zealand has worked with Australia to progress a number of workstreams to inform the development of a revised bottom fishing conservation and management measure. Progress updates on many of these were presented to the third workshop of the Scientific Committee, the Deep Water working group in May 2017 (SCW-Doc07, 10, 11, 15-17, and SCW3-INFO1). A brief summary of each aspect of this work is provided below consistent with the paper presented to the 2017 Commission, however more detail is provided in the relevant papers being provided individually to the fifth Scientific Committee.

Updates are also provided below on other work which was completed and/or published during the 2016 calendar year, including a brief update on the exploratory fishery for toothfish, which is also presented as a stand-alone Scientific Committee paper (SC5-DW02).

3.2.1 Identification of fishing footprint and/or impact analysis

New Zealand is progressing a spatially-explicit bottom impact evaluation for bottom fisheries in the SPRFMO Area based on the method used in CCAMLR (Sharp, 2009). This method can be used to estimate the likely cumulative impact of one or more bottom fishing methods on benthic organisms of different levels of fragility, and allow comparisons between fisheries employing different bottom fishing methods. The results of the application of the method also provide an index of the "naturalness" of the benthic community in given locations affected by fishing, and this can be used as an input layer for spatial decision-support software. An initial paper detailing the methods and some indicative results was presented to the Deep Water working group in May 2017 (SC5-DW06) and a more detailed paper is provided to SC-05.

3.2.2 Mapping of vulnerable marine ecosystem distribution

New Zealand has made progress developing predictive models using a variety of approaches and spatial scales given the sparse data available to directly map distribution of VMEs or VME indicator taxa. The most recent modelling generated very fine-scale models for five individual features using both presence and absence records as well as abundance data, as reported to the Deep Water Working Group in May 2017 (SCW3-Doc15). It will not be possible to model all features in this manner until more information has been collected.

3.2.3 Spatial management open/closed areas

Predicted distributions of VME indicator taxa from habitat suitability models can be combined with the bottom footprint/impact analysis, and a cost layer to design spatial management areas that provide for fishing while avoiding significant adverse impacts on VMEs. Decision-support tools are available to design spatial management measures, and New Zealand has focussed on the use of Zonation software (Moilanen 2007, Moilanen et al. 2012) to demonstrate the utility of the method and explore sensitivity to scenario choices. Preliminary results of this work were reported to SC3 (Cryer 2015, SC-03-DW-04), in New Zealand's National Report to SC4 (SC-04-17), and to the Deep Water Working Group in May 2017 (SCW3-Doc16).

Zonation outputs include maps of prioritisation, where areas are identified from the highest to lowest priority in terms of VME protection for a particular scenario. Other outputs include the mean proportion of each taxon range protected across the full range (i.e. 0-100% of total area protected) of area put into protection under different scenarios.

New Zealand ran a series of stakeholder workshops to collaboratively agree on objectives of, inputs into, and settings for Zonation scenarios to be run. Key aspects considered by the participants of the workshops included:

- Objectives for the analysis
- Analysis masks, including considerations of the scope of the study area, bioregionalisation, depth limits, and the exclusion of EEZs
- Data inputs/layers – including identification of VME indicator taxa, and incorporation of naturalness, 'cost', and uncertainty layers
- Detailed settings of the Zonation software including use of the boundary length penalty, edge removal, core area and additive benefit functions, and the weighting of biodiversity feature and 'cost' layers

The full report of the workshops is presented as a standalone document (SC5-DW05).

3.2.4 Setting of sustainable catch levels for target species

The main target species of bottom fishing in the SPRFMO Area are orange roughy (*Hoplostethus atlanticus)*, bluenose (*Hyperoglyphe antarctica*), and alfonsino (*Beryx* spp.), with orange roughy making up roughly 63% of New Zealand's total catch in the SPRFMO Area. All of these fisheries are relatively data poor; however, there are some data available, including historic catches, various effort data, and some biological data. Effort data, coupled with accurate estimations of catch, open the possibility of CPUE as a tool to examine stock status. New Zealand has focused stock assessment efforts on orange roughy in the first instance, as it remains the primary target of New Zealand and Australia's bottom trawl fisheries.

As presented to the fourth meeting of the Scientific Committee (SC-04-DW-03) and the Deep Water working group (SCW3-Doc07, SCW3-Doc11), New Zealand has continued to develop approaches to estimating stock status and sustainable catch levels for SPRFMO orange roughy stocks including a spatially-structured CPUE analysis which is fed into biomass dynamic models.

Since the Deep Water working group, Australian catch and effort data has been incorporated into the analysis, and the work has been subject to thorough peer review through New Zealand's scientific working group process (SC5-DW03, see also separate paper by Roux and Edwards).

More recently, a catch-only method has been tested to provide indicative estimates of SPRFMO orange roughy stock status assuming New Zealand productivity and selectivity parameters and assumed values of maximum exploitation rate (see separate paper by Cordue).

3.2.5 Estimating orange roughy stock size on seamounts

A General Additive Modelling approach was used considering 23 physical characteristics to estimate unfished biomass for a total of 120 seamounts throughout the New Zealand region and SPRFMO Area. The final model selected latitude, summit depth, SST anomaly, and the level of spawning activity as the characteristics that explained 83% of the deviance for the logarithm of virgin biomass. The authors, Clark et al. (2016a), concluded that the physical characteristics of seamounts can be broadly informative about the likely level of orange roughy biomass across relatively large areas, but predictions for individual seamounts can be inaccurate.

3.2.6 Stock structure indicators

Clark et al. (2016b) updated the available information for fisheries and stocks in the western part of the SPRFMO Area using multiple observational data sets to maximise the likelihood of correctly defining the stocks. Information considered included catch distribution, the location of spawning grounds, life history characteristics including patterns in length frequencies, length/age at maturity, genetic studies using allozymes or mitochondrial DNA, and a variety of other data including otolith composition and shape, morphometric parameters, and parasite composition and load.

The review supported the retention of the existing assessment boundaries for the Tasman Sea fisheries, however recommended a slight amendment to the Louisville Seamount Chain. This area was previously divided into 3 sub-areas, and the concept of this is retained, but the boundaries were revised based on timing of spawning. New areas are indicated in Figure 5 below.

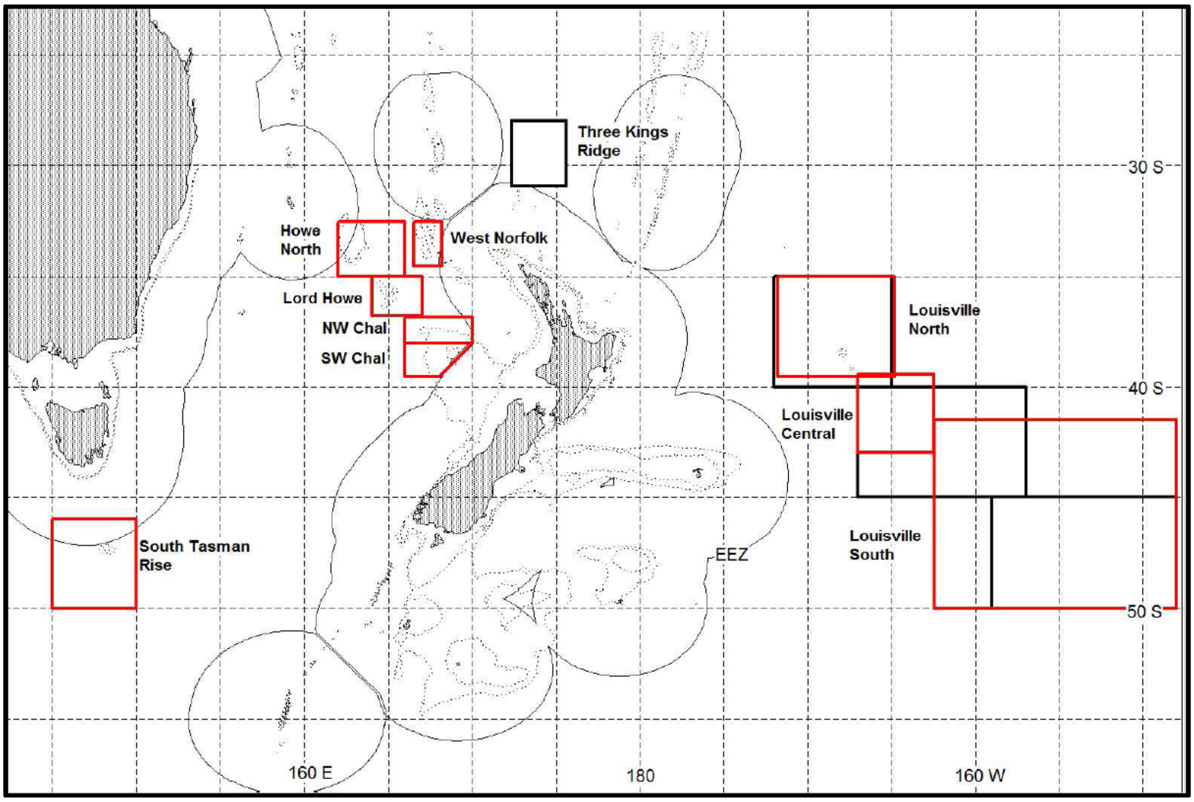

Figure 5: Comparison of new areas assumed for stock assessment purposes (in red) and previous areas (in black). Where both are coincident, red boxes overlie black boxes. There has been no change for the Three Kings Ridge area.

3.2.7 Development of stock assessment or in-season management approaches for squid

New Zealand has been working on methods of assessing its EEZ squid stocks in-season. Hurst et al. (2012) carried out a detailed characterisation of SQU6T (Auckland Islands) and SQU1T (Snares Islands) fisheries and a preliminary evaluation of potential in-season management approaches. McGregor (2013) and McGregor & Tingley (2016) further developed these analyses and the depletion method as described in Roa-Ureta (2012, see also McGregor & Large 2015 paper to SC3).

The depletion method was applied to New Zealand squid fisheries for all years from 1990-2014. The model failed to converge for several reasons, and it was noted that a key input to the models in the Falkland Islands is a pre-season survey which is used to inform the prior on initial abundances. New Zealand does not have a pre-season survey, and it was concluded that for depletion modelling to be successful for New Zealand squid fisheries, further information would be required to inform the prior on initial abundance (McGregor & Large 2016).

3.2.8 New Zealand's risk assessment for southern hemisphere seabirds

New Zealand takes a risk-based approach to managing the impacts of fishing activity on seabird species informed by a quantitative, spatially explicit assessment of risk. The Spatially Explicit Fisheries Risk Assessment framework (SEFRA) (MPI, 2016) estimates risk to individual seabird species which can be further disaggregated by fishery, target species, and/or fishing method.

New Zealand has been intending to extend the risk assessment framework applied to main fishing methods within the New Zealand Exclusive Economic Zone (EEZ) to a broader set of fisheries.

The methodology has been applied to publically available tuna RFMO fishing data throughout the southern hemisphere for the 26 ACAP-listed seabird species that breed in the southern hemisphere.

A separate paper to SC reports on progress, and the data used in this initial iteration contain some deficiencies. In particular, the vulnerability of seabirds to capture was estimated using New Zealand data only; the seabird distributions were simplistic; and effort data was limited. The analysis can readily be updated however, if improved data become available.

3.2.9 Age and Growth of New Zealand corals at high-risk.

There is currently a paucity of information surrounding deep sea coral regeneration times following trawl disturbances or other damage. A key priority in filling this information gap is research that will allow estimation of the age and growth characteristics of key cold-water coral and gorgonian species. This project is developing a methodology to determine the age and growth characteristics of key high-risk New Zealand cold-water coral species.

The first phase of the project is focussed on developing appropriate methodology for a number of high risk coral taxa using existing coral specimens collected by New Zealand fisheries observers. Methodologies will be taxa dependent, but could include radiocarbon dating, radiometric (lead 210) dating and zone counts. The second phase will focus on applying the methodologies to obtain age and growth data for high priority specimens (www.doc.govt.nz/csp).

3.2.10 Identification and storage of cold-water coral bycatch specimens

Accurate identification of coral taxa is vital to understanding benthic impacts. The cryptic nature of many coral species makes at sea identification of corals by observers problematic. This programme of work supports fisheries management by undertaking expert identification of returned bycatch specimens and photographs in order to progressively improve the accuracy of at sea identification by revising observer briefing manuals and training materials. Taxonomic and genetic samples will also be available for appropriate collections and related research programmes (Conservation Service Programme 2017).

3.2.11 Population research into key at-risk seabird species

A series of population studies are underway for key at-risk seabird species. These use aerial and ground count methodologies to collect both population size and demographic data. Seabird species currently under investigation include Flesh-footed Shearwaters, White-capped, Gibson’s, Salvin’s, Chatham and Northern Royal Albatross. All research is reported through the Department of Conservation - Conservation Services Programme website (www.doc.govt.nz/csp).

4 Observer Implementation Report

4.1 OBSERVER TRAINING

MPI requires all observers to successfully complete a three-week training course before they are accepted into the programme. The course outline is as follows. Sessions preceded with a number are unit standards registered on the New Zealand Qualifications Framework:

- Observer Programme overview, Trip Planning.
- Catch effort logbooks (CELB)
- Catch effort logbook exercises
- Overview of the Observer manual
- 12306 – Identify common parts, fittings and equipment on a vessel
- 12310 – Prevent, extinguish and limit the spread of fire on a vessel

- 497 – Protect health & safety in the workplace
- 6213 – Use safe working practices in the seafood industry
- 12309 – Demonstrate knowledge of abandon ship procedures and demonstrate sea survival skills
- 15679 – Demonstrate a basic knowledge of commercial fishing methods
- Volumetric measurement
- Density factors
- Time Sampling
- Catch Assessment
- Mixed tows
- 19847 – Describe the reduction of marine mammal and turtle incidental capture during commercial fishing, including assessment
- 5332 – Maintain personal hygiene and use hygienic work practices working with seafood
- 19877 – Demonstrate knowledge of protection of the marine environment during seafood vessel operations
- Department of Conservation – Marine mammals and seabirds, mitigation devices
- Non-fish bycatch forms
- Benthic form
- Personal clothing and stores
- Communications / Key vessel personnel / Emergency Evacuation codes
- The psychology of deployment – Observer health and safety issues
- Code of conduct / complaint procedure
- QMS overview
- Scales
- Net bursts / discards / Schedule 6 releases
- Product states
- 19846 – Describe the reduction of seabird incidental capture during commercial fishing including assessment
- 23030 – Use basic knife skills as a fisheries observer
- 23027 - Demonstrate knowledge of information displays aboard seafood harvesting vessels
- The Compliance Business and Observer Compliance Contribution
- 20168 – Work on a commercial fishing vessel
- Briefing / Debriefing / General paperwork
- Performance Assessment System
- Conversion factors / practical exercise
- Fish ID book
- Fish ID practical
- Otoliths/Staging
- Biological sampling forms practical
- Biological Manual
- First Aid kits
- Tablets and at-sea data entry
- Observer Powers
- Compliance Investigation Services - Role, Use of Observer data, Profiling, Forensics.
- Employment Agreement
- MPI Science use of observer data
- Examination

Successful recruits are then accepted into the MPI Observer Services programme and deployed with an observer trainer for one to two trips of an average duration of 30 days per trip before they can be deployed independently.

4.2 OBSERVER PROGRAMME DESIGN AND COVERAGE

New Zealand has had an observer programme in place since 1986, operating as a unit within the New Zealand Ministry for Primary Industries (MPI) or predecessor orgnisations. It delivers coverage days for a number of clients, who are provided with some or all or the information collected. These clients are: The Ministry for Primary Industries (Science, Field Operations, Fisheries Management groups), The Department of Conservation through the Conservation Services Levy, The National History Unit of the Museum of New Zealand, the New Zealand Fishing Industry, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), the Ministry of Business Innovation and Employment, Maritime New Zealand, and the Conversion Factors Working Group, which is a joint MPI and industry working group.

New Zealand observers collect a wide range of data to inform scientific analyses including both target stock assessments and quantification of bycatch, monitoring of compliance with requirements including seabird mitigation measures, and the collection of more general biological information. Forms used by New Zealand observers to report on high seas fishing effort are included as Appendix 2.

The MPI observer programme makes provision in its annual plan to meet the observer coverage levels set out in SPRFMO CMM 03-2017 (Bottom Fishing in the SPRFMO Convention Area):

i. for vessels using trawl gear in the Convention Area, ensure 100 percent observer coverage for vessels flying their flag for the duration of the trip.

ii. for each other bottom fishing gear type, ensure that there is at least a 10 percent level of observer coverage each fishing year.

Table 8: Monthly fishing effort by New Zealand vessels fishing in the SPRFMO Area during 2016

Month & year	Trawl: N vessels	Trawl: N days	Bottom longline: N vessels	Bottom longline: N days	Dahn line: N vessels	Dahn line: N days	Hand line: N vessels	Hand line: N days
Jan-16	4	52	1	3	0	0	1	4
Feb-16	1	21	1	3	0	0	0	0
Mar-16	1	21	0	0	0	0	0	0
Apr-16	3	32	0	0	0	0	0	0
May-16	1	10	0	0	0	0	0	0
Jun-16	2	29	0	0	0	0	0	0
Jul-16	2	33	0	0	0	0	0	0
Aug-16	2	6	1	6	0	0	0	0
Sep-16	1	4	0	0	0	0	0	0
Oct-16	2	50	3	24	0	0	1	1
Nov-16	2	42	2	23	0	0	1	2
Dec-16	3	27	1	7	0	0	1	1
Total	**6**	**327**	**4**	**66**	**0**	**0**	**3**	**8**

Overall, the following levels of coverage were attained in 2016:

- Bottom-impacting trawl: 100% (327 days)
- Bottom longline: 19.7% (13 observer days out of 66 commercial days)
- Dahn line: 0% (0 days observed out of 0 commercial days)
- Hand line: 12.5% (1 observer days out of 8 commercial days)

Table 9: Observer coverage achieved in the New Zealand bottom trawl and bottom line fisheries in the SPRFMO Area during 2016

Month & year	Trawl: N vessels	Trawl: N days	Bottom longline: N vessels	Bottom longline: N days	Dahn line: N vessels	Dahn line: N days	Hand line: N vessels	Hand line: N days
Jan-16	4	52	0	0	0	0	0	0
Feb-16	1	21	0	0	0	0	0	0
Mar-16	1	21	0	0	0	0	0	0
Apr-16	3	32	0	0	0	0	0	0
May-16	1	10	0	0	0	0	0	0
Jun-16	2	29	0	0	0	0	0	0
Jul-16	2	34	0	0	0	0	0	0
Aug-16	2	6	1	6	0	0	0	0
Sep-16	1	4	0	0	0	0	0	0
Oct-16	2	50	1	7	0	0	1	1
Nov-16	2	43	0	0	0	0	0	0
Dec-16	3	27	0	0	0	0	0	0
Total	**6**	**329***	**2**	**13**	**0**	**0**	**1**	**1**

*Two days were reported as observed vs. fished, this is likely the result of observers reporting effort based on New Zealand Standard Time whereas the vessel uses UTC Time.

A total of six New Zealand bottom trawlers operated under permit in the SPRFMO Area during 2016 and all 20 trips carried New Zealand observers, representing 327 vessel days and 956 tows. All fishing days were observed and 950 of the 956 tows (99%) were observed. Scientific observers measured fish from 10% of bottom trawl tows (Table 10). A total of 7 493 fish were measured, 83% of which were the principal catch species, orange roughy, the remainder being alfonsinos.

Midwater trawl gear for bentho-pelagic species was used on five trips comprising 16 vessel days and 24 tows. All 24 tows were observed, four of which were sampled resulting in 293 fish, 79% of which were orange roughy, being measured.

Five New Zealand bottom line vessels operated in the SPRFMO Area during 2016, one of which only fished in the exploratory fishery for toothfish. One non-exploratory bottom line trip was observed comprising seven vessel days with all 16 sets on the trip observed. 90 fish were sampled from 9 sets.

The single exploratory bottom longline trip comprised 6 vessel days and 7 sets, all of which were observed.

Table 10: Summary of observer and sampling coverage of bottom and midwater trawl and bottom longlining, handlining fishing effort in the SPRFMO Area during 2016. There were no Dahn line trips observed in 2016. Days and events (trawl tows or line sets) relate to observed trips and days only.

Method	No. obs trips	Obs Vessel days	Total events	Events observed	Events measured	Retained catch (kg)	Measured catch (kg)	No. Fish Measured
Bottom trawl	20	329	956	940	93	1 834 192	8 274	7 493
Midwater trawl	5	16	24	24	4	47 667	325	293
Bottom longline	1	7	23	23	16	36 751	3 494	255
Exploratory	1	6	7	7	7	60 016	3 369	165
Hand lines	1	1	1	1	0	0	0	0

Note: Tows/sets reported here are all tows conducted, including those which made no catch, and so may exceed the tows which made a catch, as reported in the effort summary tables. Landings in this table are in greenweight and include all species caught.

4.3 BIOLOGICAL SAMPLING AND LENGTH/AGE COMPOSITION OF CATCHES

The deepwater fisheries continued to be monitored by scientific observers during 2016 and a summary of the length-frequency sampling is provided in Table 11. A high proportion of all fish measured were orange roughy, the principal demersal trawl target species, with most of the remaining fish measured being alfonsino.

The length-frequency distribution of orange roughy and alfonsino from bottom trawl and Antarctic toothfish from the exploratory fishing in 2016 are shown in Figures 6-8.

Table 11: Summary of length-frequency sampling for those species or species groups with a sample size of 50 fish or more conducted by scientific observers aboard New Zealand vessels conducting bottom fishing in the SPRFMO Area in 2016. Note that sample sizes less than 100 fish are unlikely to be representative of the total catch.

Scientific Name	Method	Common Name	Measure Used	Length (cm) Min	Mean	Max	Number Measured
Hoplostethus atlanticus	Bottom trawl	Orange roughy	Standard	15	32.23	49	6 212
Hoplostethus atlanticus	Midwater trawl	Orange roughy	Standard	27	33.88	41	233
Beryx spp.	Bottom trawl	Alfonsino	Fork	20	35.32	50	1 281
Beryx spp.	Midwater trawl	Alfonsino	Fork	30	37.56	46	60
Hyperoglyphe antarctica	Bottom longline	Bluenose	Fork	61	74.30	90	70
Dissostichus mawsoni	Bottom longline	Antarctic toothfish	Total	95	145.48	175	98
						Total	**7 954**

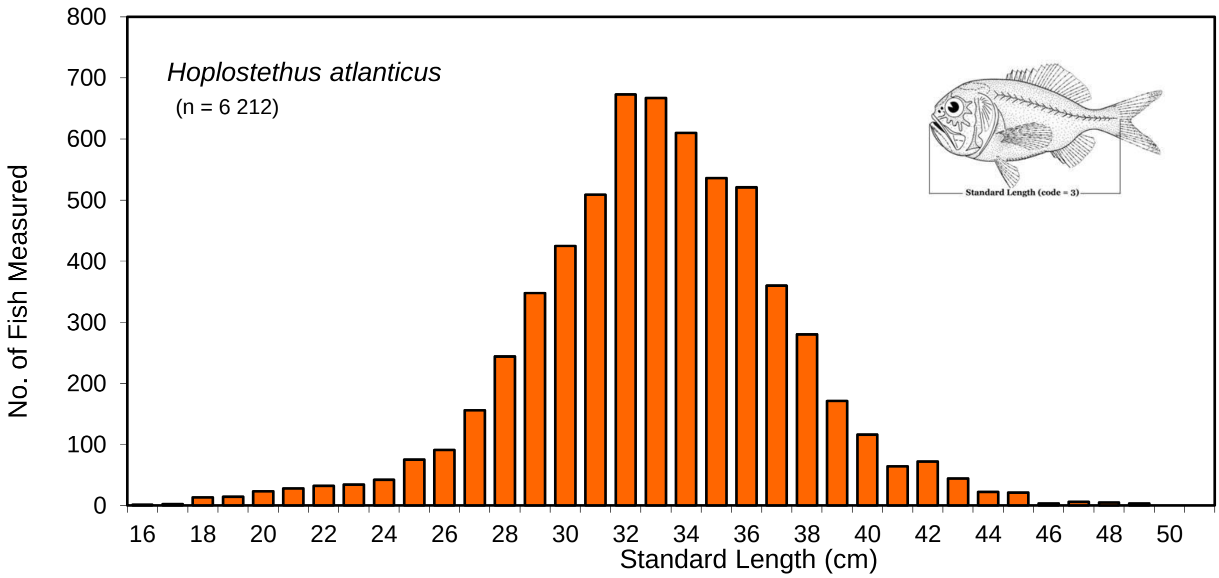

Figure 6: Length frequency distribution (unscaled) for orange roughy (*Hoplostethus atlanticus*) measured by scientific observers aboard New Zealand vessels fishing using bottom trawl in the SPRFMO Area during 2016.

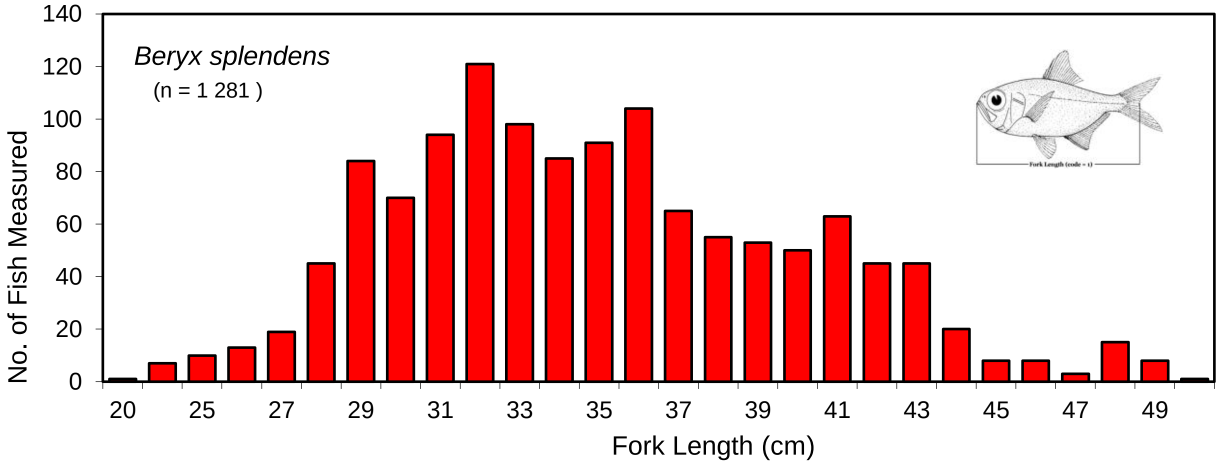

Figure 7: Length frequency distribution (unscaled) for alfonsino (*Bernx splendens*) measured by scientific observers aboard New Zealand vessels fishing using bottom trawls in the SPRFMO Area in 2016.

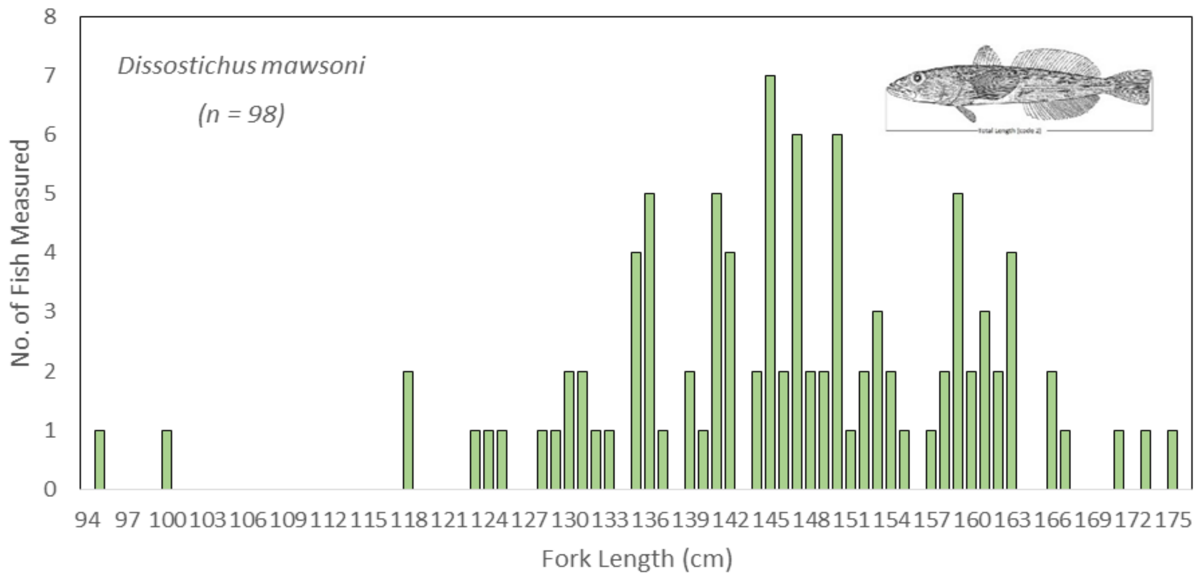

Figure 8: Length frequency distribution (unscaled) for Antarctic toothfish (*Dissostichus mawsoni*) measured by scientific observers aboard the New Zealand bottom longline vessel exploratory fishing for toothfish in the SPRFMO Area in 2016.

Comparison of length frequency distributions from 2010 to 2016 (Figure 9) suggests that the size of orange roughy caught in bottom trawls is relatively consistent from 2010-2014 with the smaller size in the last two years through to be a result of a change in the location of fishing activity.

The recorded sizes of bluenose and wreckfish vary considerably between years (Figure 9, right panel and Figure 10), potentially as a result of small sample sizes or shifts in fishing locations, noting that very few fish of either species were measured in 2016. Length frequency distributions for alfonsino (Figure 11) for midwater and bottom trawl suggest variable distributions, although sample sizes have been very small in some years.

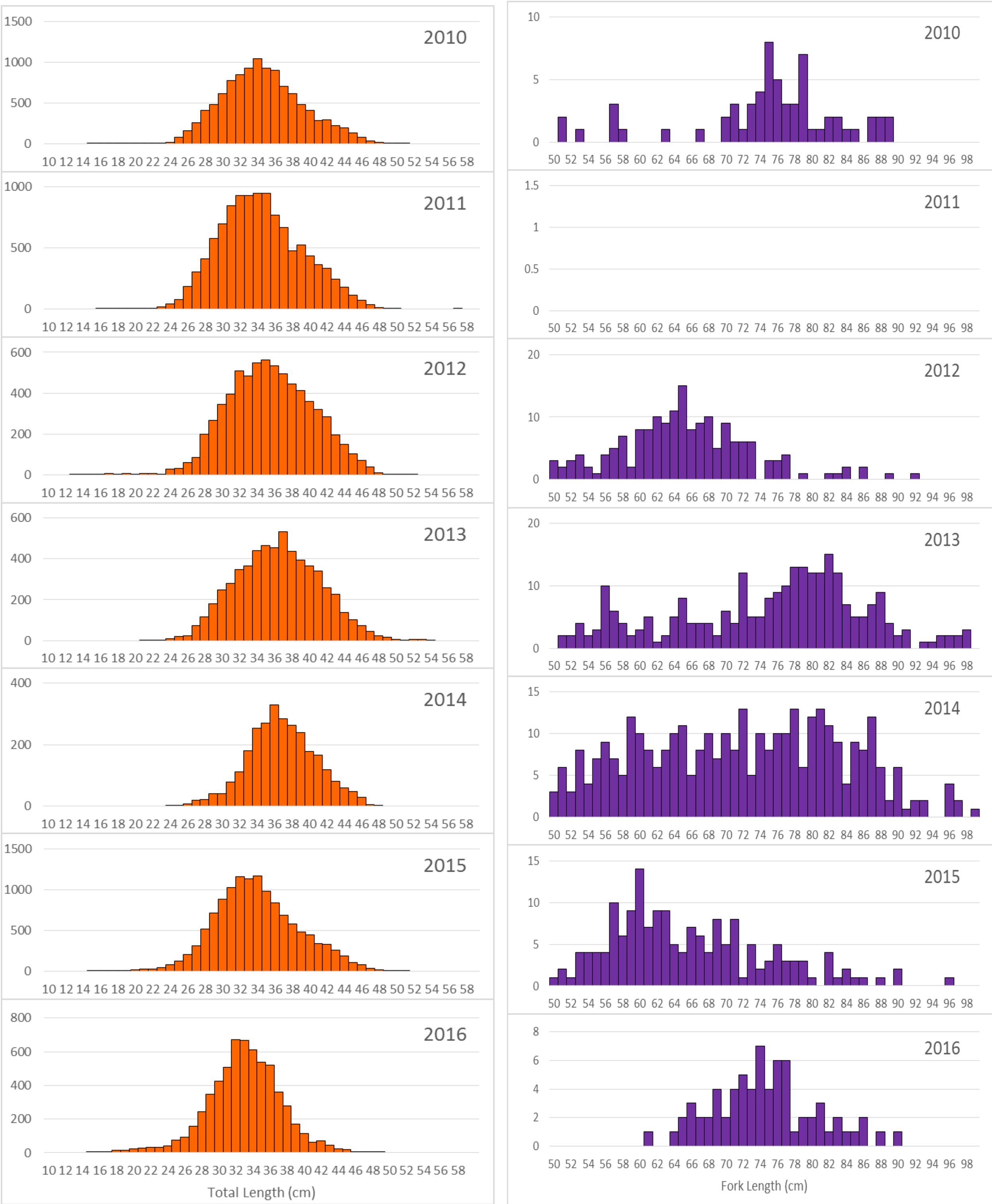

Figure 9: Length frequency distributions (unscaled) for the main demersal target species measured by scientific observers aboard New Zealand vessels fishing between 2010 and 2016 in the SPRFMO Area. Left panel, orange roughy from bottom trawls; right, bluenose from bottom longlines.

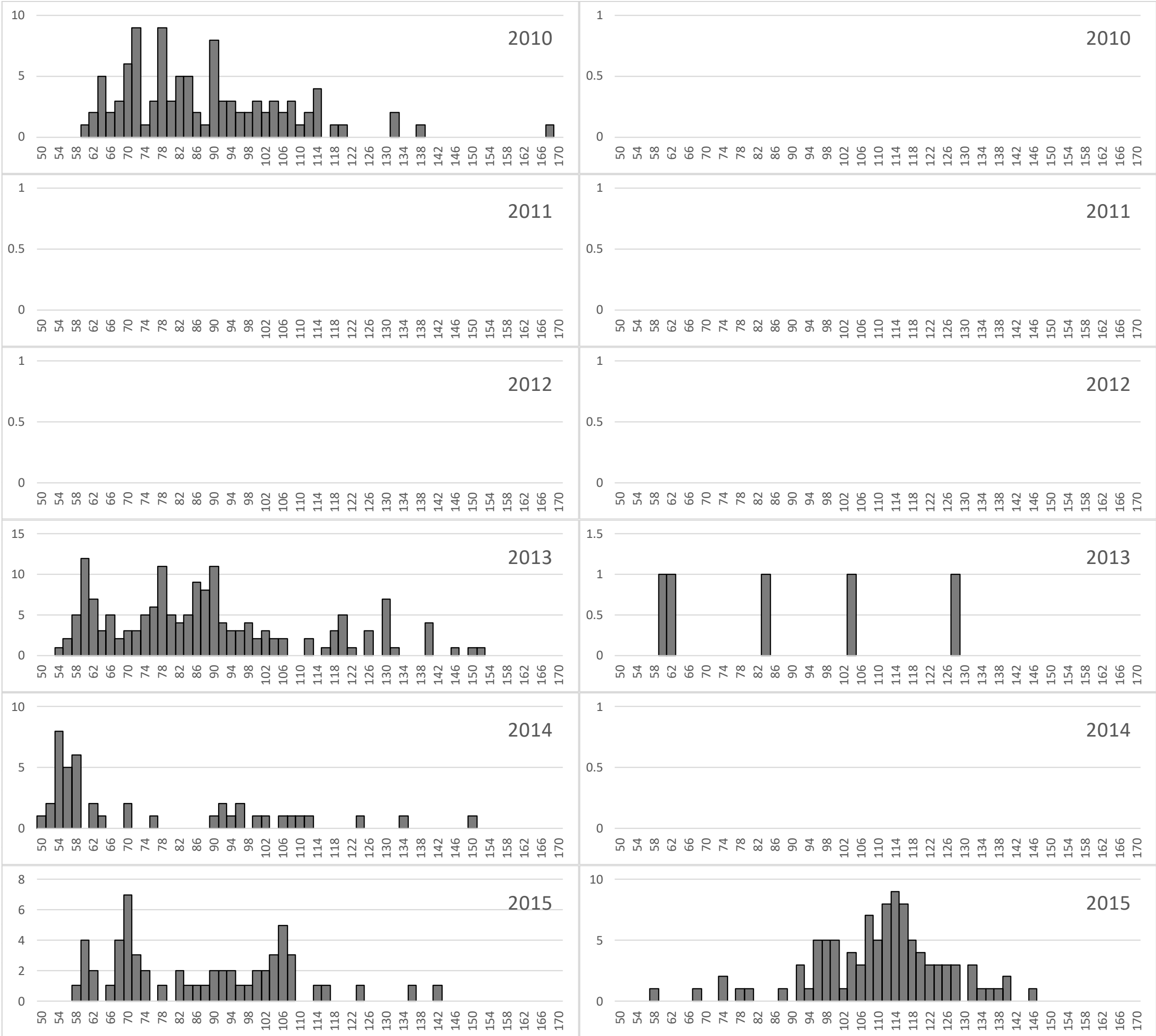

Figure 10: Length frequency distributions (unscaled, 2 cm bins) for wreckfish measured by scientific observers aboard New Zealand vessels bottom longlining between 2010 and 2015 in the SPRFMO Area. Left panel, bass, *Polyprion americanus*; right, hapuku, *Polyprion oxygeneios*. Insufficient fish were measured in 2016 to produce length frequency distributions for either species.

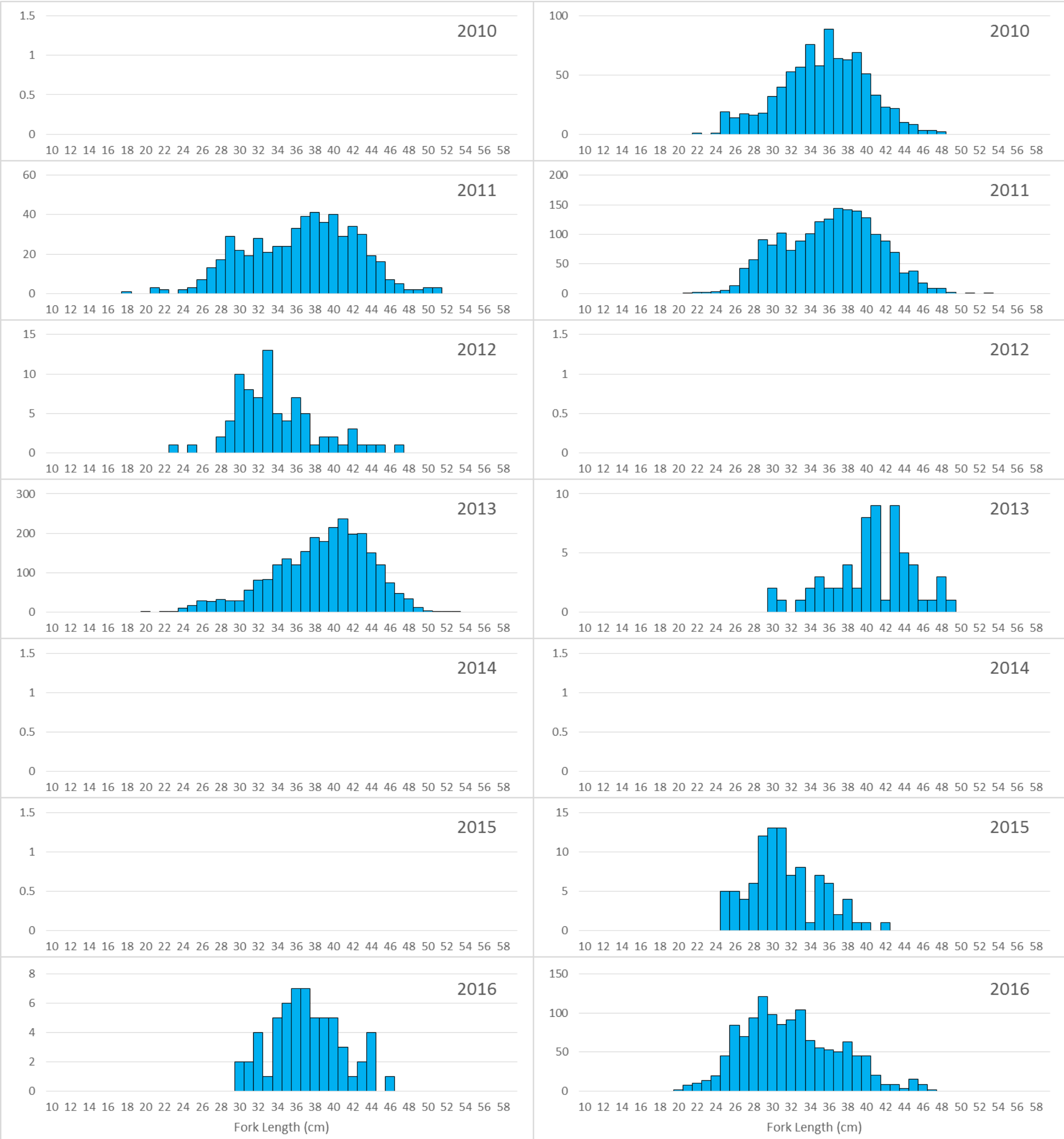

Figure 11: Length frequency distributions (unscaled) for alfonsino (*Beryx splendens* and *B. decadactylus* combined) between 2010 and 2016 measured by scientific observers aboard New Zealand trawl vessels fishing in the SPRFMO Area. Left panel, from midwater trawls; right, from bottom trawls.

Observers also collected information on the bycatch of benthic fauna, whether or not a vessel is fishing in a move-on area. Bycatch of benthic fauna in a move-on area may require the rapid assessment of VME indicator taxa for the purpose of assessing whether the move-on rule is triggered. In total, over 600 such records of benthic bycatch, almost half of which were of corals, have been made from a wide range of fishing locations since 2010 (Table 12). This information has been used to inform the development of the comprehensive bottom fishing measure to be proposed in 2018.

Table 12: Number of records of distinct species from observer benthic bycatch forms for the following classifications; corals, sponges, other invertebrates, fish, detritus and substratum, taken by New Zealand vessels since 2010.

	Coral	Sponge	Invert	Fish	Detritus	Substratum	Challenger
2010	14	4	10	0	2	2	32
2011	14	6	21	1	1	1	44
2012	11	3	5	1	1	1	22
2013	13	3	3	0	1	1	21
2014	3	2	4	0	0	1	10
2015	24	16	20	2	15	2	79
2016	28	11	20	1	18	1	79
Subtotal	107	45	83	5	38	9	287
							Lord Howe Rise
2010	20	3	12	0	0	1	36
2011	16	4	20	0	2	2	44
2012	9	1	8	0	1	1	20
2013	16	3	7	0	1	1	28
2014	7	2	2	0	0	0	11
2015	14	2	12	0	1	1	30
2016	24	3	6	0	1	1	35
Subtotal	106	18	67	0	6	7	*204
							Louisville Ridge
2010	14	3	8	0	0	2	27
2011	12	2	4	0	0	2	20
2012	12	0	7	0	0	1	20
2013	10	4	2	0	0	1	17
2014	8	1	1	0	0	1	11
2015	12	0	3	0	0	2	17
2016	7	1	1	0	0	1	10
Subtotal	75	11	26	0	0	10	122
							West Norfolk
2010	17	6	10	0	0	1	34
2011	14	9	7	0	0	1	31
2012	8	3	0	0	1	1	13
2013	13	4	3	0	1	2	23
2014	0	0	0	0	0	0	0
2015	9	3	1	0	1	1	15
2016**	-	-	-	-	-	-	-
Subtotal	61	25	21	0	3	6	116
Grand total	349	99	197	5	47	32	729

* Of the 169 records on benthic bycatch forms from the Lord Howe Rise, 27 (16%) were from blocks closed to bottom fishing by trawl methods since 2015 (ref paper SC-03-DW-03)
**there was no trawling in West Norfolk for 2016

5 Ecosystem Approach considerations

5.1 SEABIRD MITIGATION MEASURES

New Zealand vessels fishing in the SPRFMO Area are required to deploy seabird mitigation commensurate with CMM 09-2017.

For bottom line vessels, this includes the combined use of a line weighting system, streamer (tori) lines, setting at night (between nautical dark and nautical dawn), and controlling/avoiding the discharge of any biological material during shooting or hauling wherever possible.

For trawl vessels, this requires the deployment of streamer (tori) lines or a bird baffler where it is not operationally feasible to deploy streamer lines, and management of the discharge of biological material. Trawl vessels must, where possible, prohibit the discharge of biological material during shooting and hauling; convert offal into fish meal; retain all waste material related to fish processing; and restrict discharge to liquid discharge/sump water.

All New Zealand trawl vessels >28 metres in length have a vessel specific ‘Vessel Management Plan’ (VMP), which sets out the practices and processes that the vessel will follow to minimise the risk of seabird interactions. VMPs include a commitment to manage the discharge of biological material, to clean nets after every shot to remove ‘stickers’, and to minimise the time the net is on the water during hauling. VMPs also identify contingency plans in the case of gear or equipment malfunction which may otherwise result in increased risk of seabird interactions (e.g. meal plant breakdown or winch malfunction).

5.2 REPORTING AND SUMMARY OF OBSERVED INTERACTIONS WITH SEABIRDS AND OTHER SPECIES OF CONCERN

New Zealand observers report captures of all seabirds, marine mammals, reptiles, and sharks protected under New Zealand’s Wildlife Act 1953, and other species of concern, on the ‘non-fish and protected species bycatch’ form. In addition, all non-targeted marine invertebrates, marine plants, or benthic organisms are reported on the Observer Benthic Materials Form (Appendix 2). This information is recorded to a high standard and includes information on the species, the application of mitigation devices, adherence to other mitigation practices, and situational details about the capture where possible including where and how it was captured.

Observer coverage of the trawl fisheries in the SPRFMO Area has historically been high (70 - 100% of tows observed. New Zealand observers are present on about 10% of bottom line fishing trips by New Zealand vessels and typically observe 10–15% of all line sets each year.

Over the last five years, four seabird captures have been observed: one great-winged petrel captured dead on a bottom longline, the remaining captures, of two great-winged petrels and one white-faced storm petrel, were all released alive from trawl fisheries.

In relation to other species of concern as specified in Annex 14 of CMM 02-2017, observers reported 50 kg of porbeagle shark (*Lamna nasus*) in 2015 from the Challenger area. No information on number of individuals or life status is currently available.

Table 13: All records from observer non-fish bycatch forms for seabirds, marine mammals, reptiles, and other species of concern captured by New Zealand vessels since 2011 include life status or catch weight as appropriate

Year	Area	Fishing method	Species	Dead/alive	Catch weight
2014	Three Kings Ridge	Bottom longline	Great-winged petrel	Dead	
2015	Lord Howe Rise	Trawl	Great-winged petrel	Alive	
2015	Lord Howe Rise	Trawl	Great-winged petrel	Alive	
2015	Challenger	Bottom longline	Porbeagle shark (*Lamna nasus*)		50 kg
2016	Challenger	Trawl	White-faced storm petrel	Alive	

5.3 VME ENCOUNTERS AND STATE PROCESSES

The VME Evidence Process and move-on rule implemented within move-on blocks in the bottom trawl fishing footprint are described in Ministry of Fisheries (2008b) and Parker *et al*. (2009). Scientific observers deployed on New Zealand bottom trawling trips in the SPRFMO Area are required to complete VME Evidence Process forms for each tow conducted within a move-on area.

The move-on-rule has been triggered in the demersal fishery seven times in the 307 trawl tows in move-on areas conducted since 2008 (Table 14). This average rate of less than 3% of tows triggering a move-on is less than the expected rate of about 8% predicted by Penney (2014), probably because the catch rates of VME taxa in the SPRFMO Area are lower than from inside the New Zealand EEZ. The move-on-rule was triggered mostly by exceeding one or more of the weight thresholds of individual VME taxa (six occasions) and less by capturing three or more different indicator taxa from the list of such taxa (two occasions). In the 2016 year, the move-on event was triggered in one trawl with both the threshold weight for a single species being exceeded and three indicator taxa being present in the catch (Table 14).

Table 14: Data relating to the implementation of the move-on-rule within the New Zealand bottom trawl fishery. The numbers of tows are those fished in the move-on-rule areas only.

Bottom trawling in move-on-rule areas							
Year	No Tows	Observed tows.	Percentage observed	No of move-on events	Exceeded thresholds	Exceeded biodiversity count	Percentage of tows moved-on
2008	3	2	67%	0	–	–	0.0%
2009	18	18	100%	1	1	0	5.6%
2010	56	50	89%	2	2	0	4.0%
2011	79	77	97%	2	2	0	2.6%
2012	22	22	100%	1	0	1	4.5%
2013	14	14	100%	0	–	–	0.0%
2014	2	2	100%	0	–	–	0.0%
2015	44	44	100%	0	–	–	0.0%
2016	69	69	100%	1	1	1	1.5%
Total	307	298	97%	7	6	2	2.3%

In the midwater trawl fishery for bentho-pelagic species the move-on-rule has never been triggered but there have been relative few tows (Table 15). New Zealand conducted no midwater trawling for bentho-pelagic species in move-on areas in 2014 or 2015 and only 3 tows in move-on areas in 2016.

Table 15: Data relating to the implementation of the move-on-rule within the New Zealand midwater trawl fishery for bentho-pelagic species. The numbers of tows are those fished in the move-on-rule areas only.

Midwater trawling for bentho-pelagic species in move-on-rule areas							
Year	No Tows	Observed tows.	Percentage observed	No of move-on events	Exceeded thresholds	Exceeded biodiversity count	Percentage of tows moved-on
2008	0	0	–	–	–	–	–
2009	0	0	–	–	–	–	–
2010	6	6	100%	0	–	–	0.0%
2011	16	16	100%	0	–	–	0.0%
2012	7	7	100%	0	–	–	0.0%
2013	5	5	100%	0	–	–	0.0%
2014	0	0	–	0	–	–	–
2015	0	0	–	0	–	–	–
2016	3	3	100%	0	-	-	-
Total	37	37	100%	0			0%

6 Implementation of Management Measures

6.1 DESCRIPTION OF MANAGEMENT MEASURES

A detailed description of New Zealand's implementation of the SPRFMO interim conservation and management measures adopted in 2007 can be found in Ministry of Fisheries (2008b) and Penney *et al*. (2009). The management approach is summarised below:

High seas bottom trawling measures were established in the SPRFMO Area in the form of high seas fishing permit conditions, imposed from 1 May 2008. The key elements of these permit conditions include:

- Schedules designating open, move-on and closed bottom trawling areas within the historical (2002–2006) New Zealand high seas bottom trawl fishing footprint, and prohibiting bottom trawling within closed areas and everywhere else in the SPRFMO Area. These areas were last modified in 2015.
- The move-on rule VME Evidence Process for bottom trawling within move-on areas, with the requirement to report to the Ministry for Primary Industries and move-on 5 nautical miles from where the VME Evidence threshold is reached.
- A requirement to carry at least one observer on all bottom and midwater trawl trips. Observers are provided by the Ministry for Primary Industries and the costs are recovered from industry.
- Requirements for the deployment/implementation of seabird mitigation measures as per CMM 09-2017.
- Prohibition of fishing for *Trachurus* species or using set nets in the SPRFMO Area, including notice to the Ministry for Primary Industries in advance of transiting the SPRFMO Area with a set net onboard.

The effect of these measures has been to close bottom trawling in 41% of the total 217 463 km^2 New Zealand bottom trawl footprint surface area, with 30% made subject to a move-on rule, and 29% left open to bottom trawling. The open area represents 0.13% of the entire SPRFMO Area. Maps showing all open areas and those open areas subject to the move-on rule are included in Appendix 3.

6.2 MANAGEMENT OF THE CHALLENGER PLATEAU STRADDLING STOCK ORANGE ROUGHY FISHERY

The fishery on the straddling orange roughy stock on the Challenger Plateau (which was closed from 2000 to 2009), was re-opened on 1 Oct 2010 following assessments that indicated that the biomass had increased above the reference level for re-opening of the fishery (at least a 70% probability that the biomass has rebuilt above 20% B_0, Ministry of Fisheries 2008a). The straddling orange roughy stock was assessed again in 2014, with the stock estimated to be well above the bottom of the management target range of 30-50% B_0. The TAC was subsequently increased in 2014 to 1,600 tonnes. Since 2014, the New Zealand bottom trawl footprint has included two open blocks (of six) on the Westpac Bank in the SPRFMO Area where the stock straddles the New Zealand EEZ.

New Zealand vessels fishing on the Westpac Bank in the SPRFMO Area are required to report all catches against New Zealand's SPRFMO catch limit and also balance those catches with New Zealand Annual Catch Entitlement to ensure catches are accounted for within the New Zealand Total Allowable Catch for the stock.

6.3 EXPLORATORY FISHERY FOR TOOTHFISH

New Zealand presented a proposal to the third meeting of the Scientific Committee in 2015 (MPI 2015, SC-03-DW-01) for a 2-year exploratory fishery for toothfish (Patagonian toothfish, *Dissostichus eleginoides*, and Antarctic toothfish, *Dissostichus mawsoni*) using the method of bottom longlining. This proposed fishery was outside New Zealand's existing bottom line fishing footprint (Figure 28) and in excess of average catches during the criterion years 2002–2006. The Scientific Committee assessed New Zealand's proposal and confirmed that the proposal was acceptable under Article 22 (then CMM2.03, now CMM 03-2017) and the Bottom Fishery Impact Assessment Standard. The Compliance and Technical Committee and Commission considered the proposal in early 2016 and the Commission approved a 2-year exploratory fishery with a retained catch limit of 30 tonnes of *Dissostichus* spp. (both species combined) each year (see CMM-14-2016).

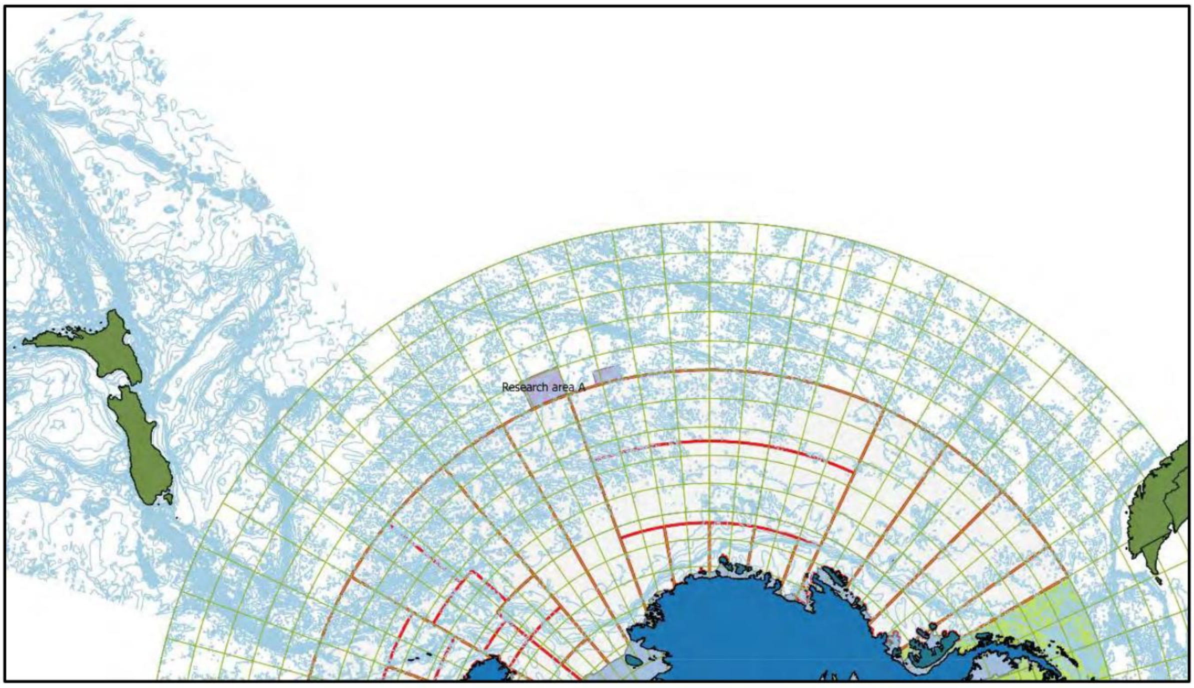

Figure 12: General location of the research fishing blocks for New Zealand's exploratory fishery for toothfish.

Two exploratory fishing voyages have now been completed, the first on 2-9 August 2016, the second in August/September 2017. Preliminary results of the first voyage were presented to SC-04 (Fenaughty & Cryer 2016, SC-04-DW-02), and an update, including preliminary results of the second voyage will be presented to SC-05 (Fenaughty & Cryer 2017, SC5-DW02).

Because of the timing of the second voyage, comprehensive reporting on the results of the exploratory fishery is not yet available. It is intended that the final results and a proposal for the future of the exploratory fishery for toothfish will be presented to SC-06 in 2018.

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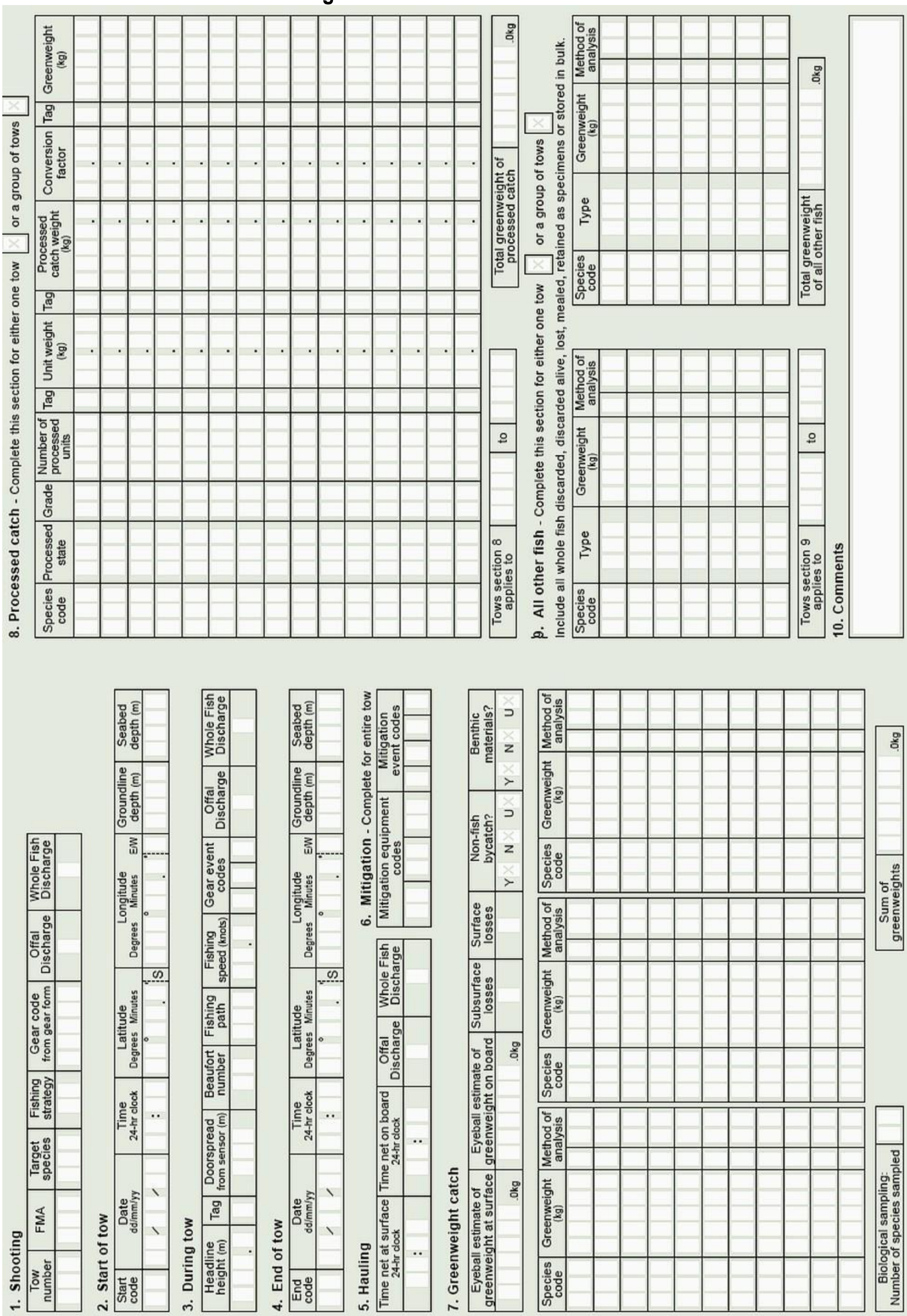
Appendix 1. List of Species Codes, Scientific Names and Common Names Used

FAO Code	NZ Code	Scientific Name	Common Name
ALF	BYX	*Beryx splendens, B. decadactylus*	Alfonsino & Long-finned beryx
BOE	BOE	*Allocyttus niger*	Black oreo
BWA	BNS	*Hyperoglyphe antarctica*	Bluenose
DGS	SPD	*Squalus spp.*	Spiny dogfish, northern spiny dogfish
EDR	SBO	*Pseudopentaceros richardsoni*	Southern boarfish
EPI	CDL	*Epigonus telescopus*	Deepsea cardinalfish
HAU	HPB	*Polyprion oxygeneios, P. americanus*	Wreckfish (Hapuku & Bass)
MOW	KTA	*Nemadactylus sp.*	King tarakihi
ONV	SOR	*Neocyttus rhomboidalis*	Spiky oreo
ORY	ORH	*Hoplostethus atlanticus*	Orange roughy
RIB	RIB	*Mora moro*	Ribaldo
ROK	SPE	*Helicolenus spp.*	Sea perch
RTX	RAT	*Macrouridae (Family)*	Rattails
RXX	SKI	*Rexea spp.*	Gemfish, southern kingfish
SCK	BSH	*Dalatias licha*	Seal shark
SEM	WAR	*Seriollela brama*	Common warehou
SEP	SWA	*Seriollela punctata*	Silver warehou
SNK	BAR	*Thyrsites atun*	Barracouta
SSO	SSO	*Pseudocyttus maculatus*	Smooth oreo
TOA	TOT	*Dissostichus mawsoni*	Antarctic toothfish
TOP	PTO	*Dissostichus eleginoides*	Patagonian toothfish
YTC	KIN	*Seriola lalandi*	Kingfish

Appendix 2. Observer data collection forms used to monitor New Zealand high seas fisheries

- **Observer Trawl catch Effort Logbook**



- ***Observer Benthic Materials Form***

Observer Benthic Materials Form (Version 1 - October 2007)

1. Benthic Material includes all **Non-targeted** marine invertebrates, marine plants and/or structures that are connected with the seafloor. You should complete a **separate row** for each individual identifiable item.

2. Write the trip number [ ] and Observer code/s (*first letter of first name then first three letters of surname*) [.] and [.]

Sample number	Tow/Set number	MFish code	End Type	Weight (kg)	Method of analysis	Life status	Links	Quantity (code)	Number (optional)	Comments
B				.						
B				.						
B				.						
B				.						
B				.						
B				.						
B				.						
B				.						
B				.						
B				.						
B				.						
B				.						
B				.						
B				.						
B				.						
B				.						

3. This form is page number [ ] for this trip. Is this form the last page for this trip? → Yes [ ] No [ ]

- **Bottom Longline Catch Effort Data**

Bottom Longline Catch Effort Data

Page ☐ of ☐

Trip Number	Method	Target Species	FMA	Vessel	Observer

Start of Set

Set No.	Date of Set Day	Month	Year	Time NZST	Latitude. DEG MIN	S	Longitude. DEG MIN	E/W	Bottom Depth (m)	Topography	Number of Hooks Set	Bait 1	Bait 2	% Hooks Baited
						S	1							

End of Set

Latitude. DEG MIN	S	Longitude. DEG MIN	E/W	Bottom Depth (m)
	S	1		

Start of Haul

Date of Haul Day	Month	Year	Time NZST	Number of Hooks Lost	LF Y / N	Catch Assessment.

Catch Details

Species Name	Species Code	Number of Fish	Greenweight (kg)	Weighing Method	Species Name	Species Code	Number of Fish	Greenweight (kg)	Weighing Method	Species Name	Species Code	Number of Fish	Greenweight (kg)	Weighing Method

Comments:

- **VME Identification Form and associated VME Species Identification Guide implemented on New Zealand high seas bottom trawlers**

Vulnerable Marine Ecosystem Evidence Process (Version 1.0 - Apr 08)

1. Trip, tow, and vessel information

Trip number	Tow number	Observer/s	Name of vessel master
		. .	

2. Date, time, and position that hauling of the gear commenced

Date dd/mm/yy	Time 24-hr clock	Latitude Degrees Minutes	Longitude Degrees Minutes E/W
/ /	:	° . ' S	° . '

3. Instructions

Assess the total weights of all organisms whether dead or alive in each of the relevant taxonomic groups and record in Section 4.

If the Observed Weight of a taxonomic group is **greater than** (not equal to) the Threshold Weight, write the VME Indicator Score for that group in the "Score" Column.

If a taxonomic group is present, but the Observed Weight is **not** greater than the Threshold Weight, tick in the "Tick" column.

Sum the scores and count the ticks. Record these totals at the bottom of the columns. Add the Sum of scores to the Count of ticks and record it as the Total VME Indicator Score.

If the Total VME Indicator Score is 3 or greater, the area is considered to have Evidence of a Vulnerable Marine Ecosystem.

The taxonomic groups recorded on this form may not be a complete record of all benthic material present in the tow.

4. Relevant taxonomic groups, weights, and scores

Taxonomic Group	Code	Method of Weighting	Observed Weight (kg)	Threshold Weight (kg)	VME Indicator Score	Score if Threshold Weight exceeded	Tick if not scored but present
PORIFERA	ONG		.	50	3		✓
CNIDARIA							
Anthozoa (class)							
Actiniaria (order)	ATR		.	0	1		
Scleractinia (order)	SIA		.	30	3		✓
Antipatharia (order)	COB		.	1	3		✓
Alcyonacea (order)	SOC		.	1	3		✓
Gorgonacea (order)	GOC		.	1	3		✓
Pennatulacea (order)	PTU		.	0	1		
Hydrozoa (class)	HDR		.	6	3		✓
Unidentified Coral	COU		.	0	1		
ECHINODERMATA							
Crinoidea (class)	CRI		.	0	1		
Brisingida (order)	BRG		.	0	1		

Sum these scores + Count these ticks

Total VME Indicator Score → Sum of scores + count of ticks =

5. Vessel notification

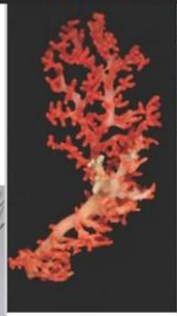
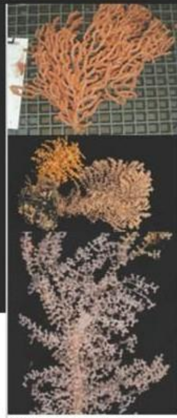
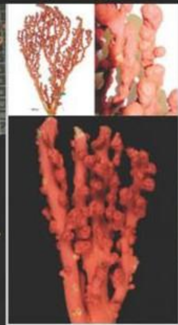
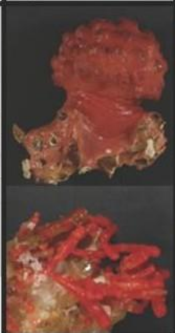
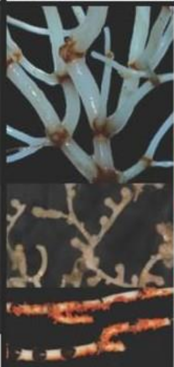
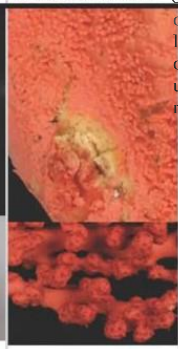
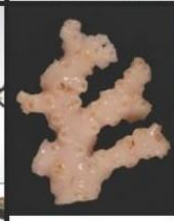
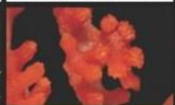
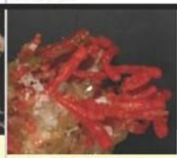
As soon as the form is completed for any tow provide a copy to the person in charge of the vessel.

Name (if not vessel master)	Received by person in charge (signature)	Date received (dd/mm/yy)	Time received (24-hr clock)
		/ /	:

DRAFT version 1.0
Note these are MFish codes

Classification guide for potentially vulnerable invertebrate taxa in the SPRFMO Area

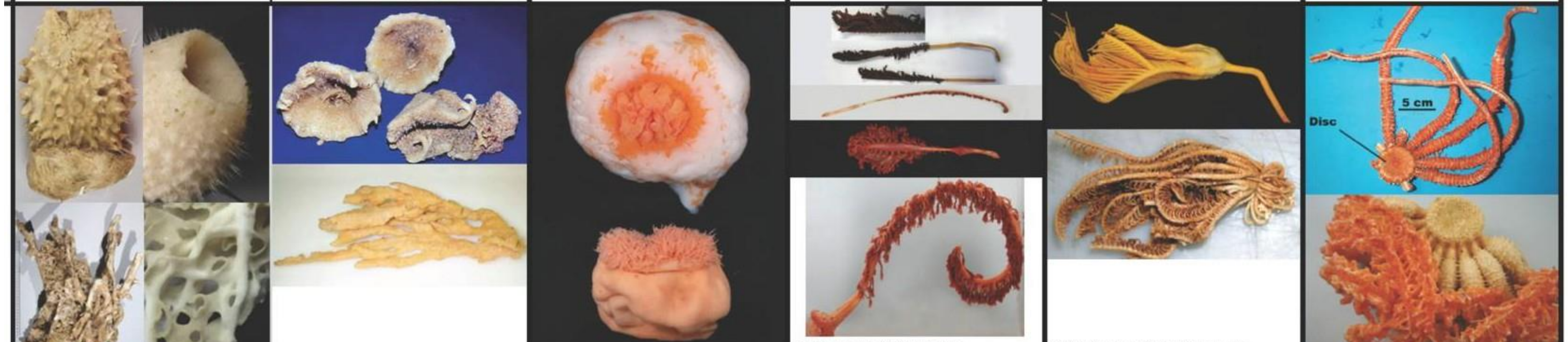
Thes. groups art notInduded: Bryozoan, Snails, Sea Stars, Clams, Urchins, Worms, Crabs

Code	SIA p71-79	COB p 57-58	SOC pg 55-56	GOC p 59-65					COR p 9; 66-68	HYF p 9
Level	Scleractinia (Order)	Antipatharia (Order)	Alcyonacea (Order)	Gorgonacea (Order)					Anthoathecate (Family)	Hydroida (Order)
Taxon	Stony corals	Black corals	Soft corals	Isididae (Bamboo)	Coralliidae (Red / Precious)	Primnoidae (Bottle brush, Sea fans)	Paragorgiidae (Bubblegum)	Chrysogorgiidae (Golden)	Stylasterids (Hydrocorals)	Hydroids
Form, Size	 **Branching:** Can form large matrices, often forms thickets **Cups:** usually small (<20cm), solitary or in small clusters	 Semi-rigid, woody, not very dense, dark brown or black skeleton, can be large (>2m). Branch tips can look like hydroids or small gorgonian	 Can be mushroom shaped. Floppy or soft, leather-like surface texture. Usually multiple large polyps, body not symmetrical, no foot or stalk	 Solid calcified trunk with brown joints (nodes), rings in x-section, branching 2D or 3D, fine tips, tree like branch tips	 Calcified skeleton, no spines. Thick, stubby stems with fine side branches	 Dark or metallic tree-like branches, flexible	 Large (up to 2m), red, thick stems, breaks when flexed	 Gold, black or green metallic lustre. Semi-rigid single, main axis with semi-soft tissue cortex. Small specimens can be feathery like hydroids or bushy like black coral	 Calcified, no rings in X-section, often pink or white. Often uniplanar, side branches lattice from obviously thicker main stems	 Entire organism small, <30cm, flexible and plant-like, often feathery, no soft tissue covering
Detail (Texture, colour, polyps)	 Calcified, very hard or brittle **Branching:** Often smooth stems **Cups:** Can be ridged Polyp calyces well formed with ridged edges, large, hard polyps	 Slimy flesh on branches. Surface with minute spines, may appear smooth. 3D, fine or bushy tips	 Similar polyps to seapens, but soft corals are not stalked	 Can scrape off surface tissue, skeleton surface smooth between nodes	 Can scrape surface tissue off. Smooth (not sandpapery) with knobbly ends. No pores on skeleton	 Usually no spines, some metallic lustre on skeleton, 3D Bushy branches, obvious polyps	 Chalky material, not hard. No spines, can scrape off surface. Bulbous ends with polyps	 Can be non-branching and whip-like. Usually no spines, metallic lustre. Fine or sparse 3D branching	 Coarse sandpaper texture, can't scrape off surface tissue. Has minute pores	 Indistinct polyps, feathery tips
Commonly mistaken for:	 Branching form can look like hard sponges but sponges are light with spicules	 Hydroid if small, or small pieces of dead Gorgonacea	 Small pieces of Corallidae. Can also resemble Demosponges, which have no polyps	 Other gorgonians if in small pieces, but won't break easily	 Soft corals, which always have soft stems	 Hydroids, small pieces	 Small pieces of Corallidae	 Antipatharia, but tips are not slimy	 Small, hard Bryozoans or pieces of Coralliidae	 Small specimens of Gorgonacea or Antipatharia

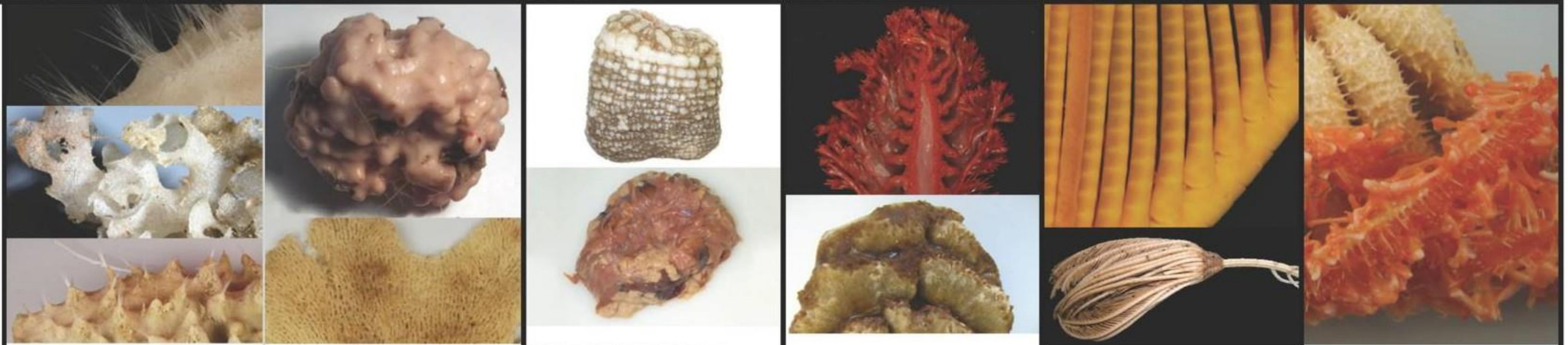
Images used copyright of NIWA, MFish, CCAMLR, LINZ

Developed by: D Tracey, S Parker, E Mackay, O Anderson, C. Ram, (2008)

ONG p 30-45		ATR p 51-54	PTU p 69-70	CRI p 230-232	BRG p 207
Porifera (Phylum)		Actiniaria (Order)	Pennatulacea (Order)	Crinoidea (Class)	Brisingida (Order)
(Glass sponges)	Demospongiae (Siliceous sponges)	Anemones	Sea pens	Crinoids	Armless stars



(Glass sponges)	Demospongiae (Siliceous sponges)	Anemones	Sea pens	Crinoids	Armless stars
Often hollow central chamber can be vase like. Diverse shapes; fibrous or crystalline hard forms	Many shapes, some small & hydroid-like to round hard solid masses	Rubbery bottom with single polyp with lots of tentacles. Usually in retracted hardened cylinder form when captured	Feather-shaped with fleshy polyps. Non-branching to whip-like cartilaginous stalk. Fleshy foot or anchor present, body symmetrical. Can be tall, >1 m	Stalked. Small cuplike body. Arms usually branched. Crinoids are generally fragile, often only fragments. A long stalk, some bearing whorls of hooklike cirri	At least 6 arms, usually more than 10. Arms easily separated from central disc and often all that is taken



(Glass sponges)	Demospongiae (Siliceous sponges)	Anemones	Sea pens	Crinoids	Armless stars
Pores often visible, glass spicules visible or fibre-glass like texture in hard forms	Fleshy, slimy or rubbery. Textures stony, woody, fibrous or airy	Knobbly, slimy, with tentacles. Tentacles sometimes look like worms when detached	Fleshy polyps. Flower or feather like polyp mass	Fragile, not flexible. Brittle and segmented	Long spines on ventro-lateral margin

(Glass sponges)	Demospongiae (Siliceous sponges)	Anemones	Sea pens	Crinoids	Armless stars
Bryozoans or scleractinians that are small and of a hard matrix	Alcyonaceans or ascidians, which are not spongy and have polyps or siphons	Alcyonaceans, which usually have several polyps or the Corallmorpharia a coral called jewel anemone	Alcyonaceans or some Gorgonians due to large polyps and size	Arm fragm brisingids	

Appendix 3. Areas open to New Zealand flagged vessels for bottom fishing

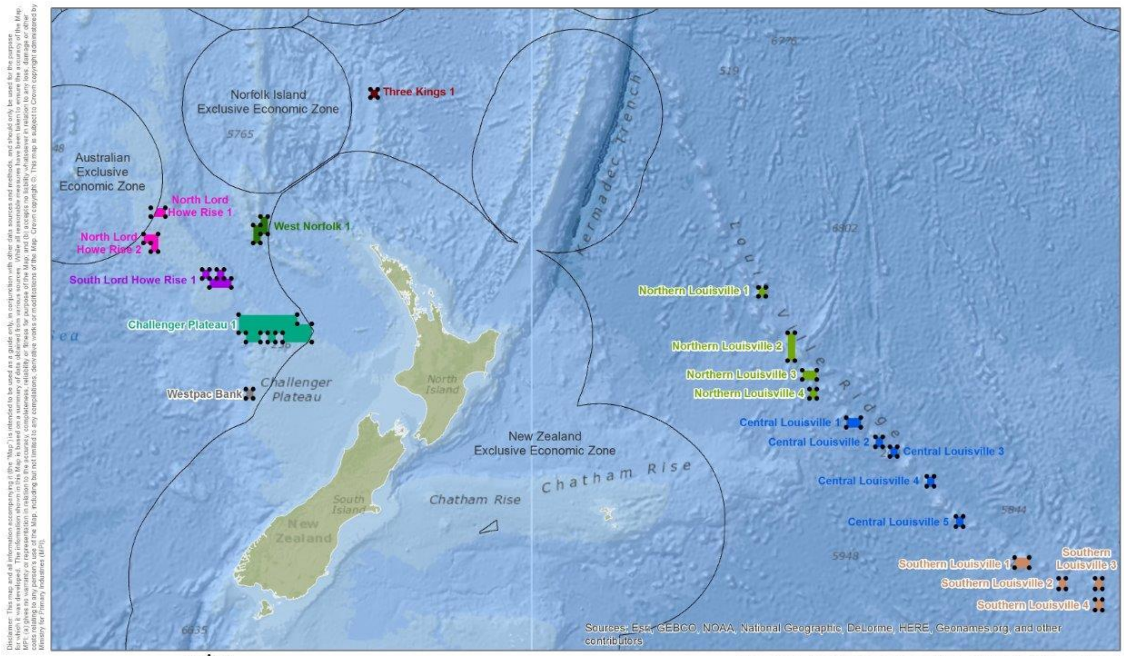


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Figure 1: Indicative Location of the Bottom Trawl Open Area Coordinates as Described in Annex A

0 250 500 km 0 125 250 nm
1:15,000,000 @ A4
Data Coordinate System: WGS84
Map Coordinate System: WGS Mercator 41

Data Attribution: This map uses data sourced from LINZ under CC-BY

• Coordinate locations

Date: 20/04/2016
Produced by: Spatial Analysis Solutions
Ref: r160094

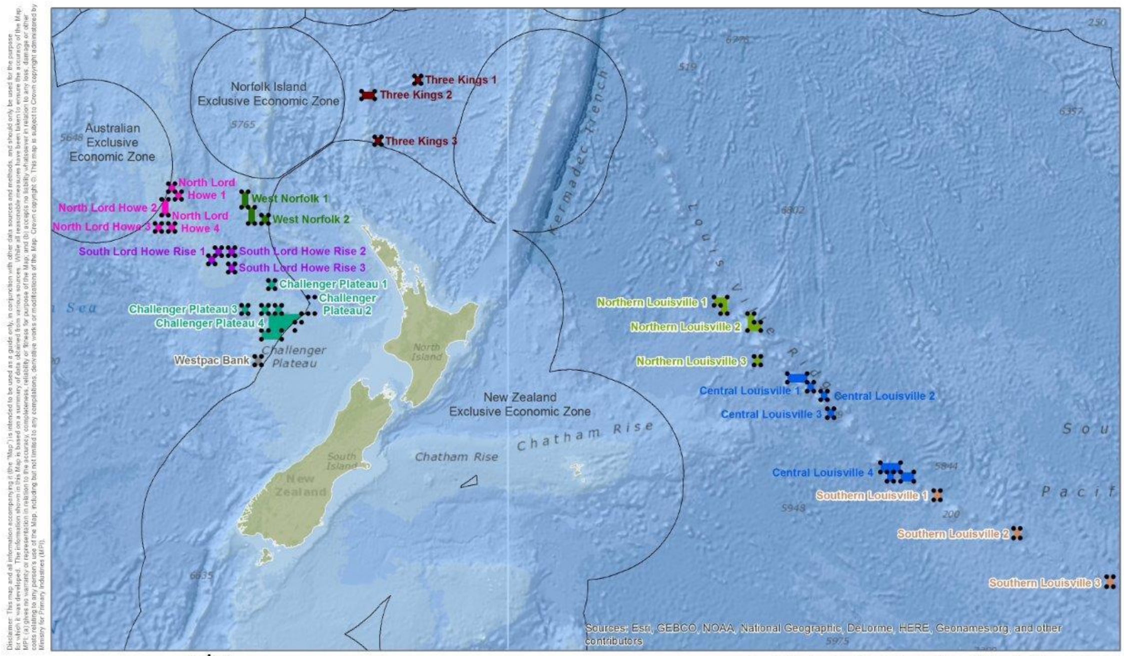

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Figure 2: Indicative Location of the Bottom Trawl Move On Coordinates as Described in Annex B

0 250 500 km 0 125 250 nm
1:16,500,000 @ A4
Data Coordinate System: WGS84
Map Coordinate System: WGS Mercator 41

Data Attribution: This map uses data sourced from LINZ under CC-BY

• Coordinate locations

Date: 20/04/2016
Produced by: Spatial Analysis Solutions
Ref: r160094

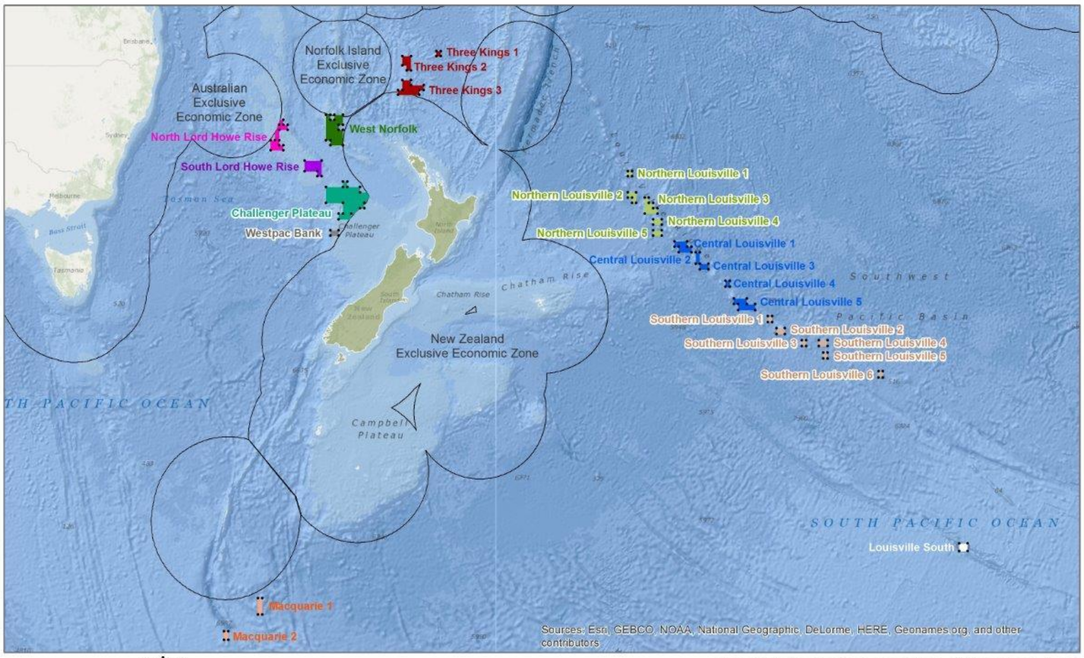

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Figure 3: Indicative Location of the Open Area Coordinates for Bottom Longline as Described in Annex C

0 400 800 km
0 200 400 nm
1:26,000,000 @ A4
Data Coordinate System: WGS84
Map Coordinate System: WGS Mercator 41

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Date: 19/04/2016
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