Progress Report on Conditions 2 and 3 (Protected Corals) of the NZ Orange Roughy MSC Certification
Prepared by Deepwater Group (DWG), in consultation with Fisheries New Zealand (FNZ) and Department of Conservation (DOC), for the 2018 Annual Surveillance Audit (Year 2)

Grey = objectives and plans, as stated in the Client Action Plan presented in Year 1
Green = progress to date on plans to meet the objectives

Objective	Plan	Timescale	Progress
To improve our understanding of protected coral species distribution	1. Review available literature relating to deepwater corals to address: - The definition of what constitutes a 'population' - Aspects of reproductive biology and dispersion of offspring so as to be able to better understand the scale of the population distribution - Knowledge of genetic differentiation of corals, especially in relation to latitude, longitude, substrate and depth - Depth distribution of deepwater corals, especially in New Zealand waters	ToR developed, contractor engaged and a report available by second surveillance audit.	**Research Needs for Protected Corals in New Zealand** In October 2017, the Department of Conservation (DOC) held a workshop on research needs for protected corals in New Zealand waters. Various agencies with an interest in coral research attended the workshop and discussed previous and current research projects, and identified research/knowledge needs for New Zealand corals. This has informed research priorities in 2018. Full details can be found here. **State of Knowledge on New Zealand's Protected Corals: A national literature review** A detailed literature review on the current state of knowledge of deep-sea corals in the New Zealand EEZ, as well as the High Seas and Ross Sea, has been contracted by DOC with additional funding from Fisheries New Zealand (FNZ). This will include information on: - Known species found in New Zealand - Known/predicted distributions - Known reproduction/recruitment - Molecular studies - Known age/growth - Threats - Management efforts NIWA is the contracted service provider and a draft report will be submitted for peer-review through a relevant technical working group early 2019. **Depth Distributions of New Zealand's Protected Coral Species** DWG has contracted NIWA to undertake an additional review of all international literature on the depth distribution of the species groups found within New Zealand, including on the depth ranges where they are most abundant. The results will be available early 2019.

To improve our understanding of gear impacts on protected coral species	1. Review recent developments in approaches to applying risk assessment to fishing gear interactions with benthic habitats within NZ. This review will specifically consider the development and application of a clearer definition of gear impacts and how these differ between different substrates and habitat types, and outcomes in terms of probable impacts and risks to coral taxa. 2. Undertake a more detailed assessment of the nature and extent of incidental interactions between corals and ORH target trawls in the two UoAs.	ToR developed, contractor engaged and a report available by second surveillance audit.	**Annual Trawl Footprint** FNZ continues to monitor the Tier 1 and Tier 2 deepwater trawl fisheries' (including orange roughy and oreo) footprints each year and there are improvements in the methodology and precision. Reporting precision of tow positions on TCEPRs and TCERs is to the nearest arc-minute of latitude and longitude (i.e. one nautical mile or 1.862 km). In the trawl footprint analyses, tow start and end positions are randomly jittered by applying an offset of ± 0.5 minute to approximate a more realistic pattern of start and end positions. The impact of applying tow position offsets is insignificant on a fishery-wide scale but may exaggerate the trawl footprint for fisheries that target specific marks or locations with very short tows, such as in the orange roughy and oreo fisheries. Tow positions have been reported to the nearest minute (i.e. to a precision of 1 nm or 1.852 km). But, under New Zealand's electronic reporting and geopositional reporting regime, trawl tow position reporting for trawlers greater than 28 m from 1 October 2017 is now required to three and four decimals of a degree (i.e. to a precision of 0.016 nm or 31 m). This will improve the precision of individual tow tracks but is unlikely to have much of an effect on the overall trawl footprint given the density of tows on the main trawl grounds. For orange roughy and oreo fisheries the improved plotting precision, which will negate the need for application of a jittered offset, may have the effect of reducing the trawl footprint. **Assessment of the Nature and Extent of Protected Coral Captures** DWG contracted GNS Science to undertake a spatial analysis of protected coral captures from all tows (target and non-target) that caught orange roughy or oreo within the UoAs for the last five years (2012-13 to 2016-17). Data were obtained from FNZ and sourced from TCEPRs and MPI observer records. Records reported as coral rubble (CBD and CBB) were excluded from these analyses. Key findings are presented below and in the attached table. *General* Corals were reported from a total of 264 tows over the 5-year period (2012-13 to 2016-17). This translates to approximately 53 tows per year. The ORH/OEO fisheries in NWCR and ESCR undertake around 1,500 tows per year, which means that around 3.5% of tows were associated with coral catch. The average quantities of coral reported by those tows associated with coral was lower in NWCR than in ESCR – 3 kg on average per tow for those NWCR tows observed catching coral, compared with 10 kg in ESCR. *UTF / Slope:* Corals were caught on both slope and UTF habitats. Of tows that caught coral, 62% (164) were on slope habitat and 38% (100) were on UTF habitat. The quantities of coral caught per tow was higher on UTFs. Coral captures were reported from 31 UTFs (6 in NWCR and 25 in ESCR). Eleven of these UTFs only had one tow assigned to them. A total of 68 UTFs have been fished in recent years (10 in NWCR and 58 in

			ESCR) (Black et al., 2015; O'Brien et al., 2015), indicating that 60% of fished NWCR UTFs and 43% of fished ESCR UTFs have produced coral catches in the 5-year period. *Coral taxa:* There are only 4 protected coral groups with more than 50 kg caught in the last five years. These are: COR (hydrocorals), CBR (stony branching corals), CUP (stony cup corals), and PAB (bubblegum corals). Over half of the coral caught were hydrocorals, which are considered "low risk" by Clark et. al (2014) due to their relatively high productivity. These results will be used to focus our work programme in Year 3.
To improve our confidence in predictive coral distribution models	1. Prepare a review of recent developments in approaches to the application of mathematical models to predict coral distribution, incorporating new methodological approaches, additional benthic survey data and improved bathymetric data. This review will specifically consider these developments with regard to the accepted understanding of fishery impacts and the level of uncertainty associated with those impacts on protected coral within the two UoAs as described in the Final Certification Report.	ToR developed, contractor engaged and a report available by second surveillance audit.	**Quantifying Benthic Biodiversity (Bowden et al. 2015)** A survey was contracted by FNZ to acquire quantitative data about benthic habitats and fauna across Chatham Rise using towed camera system with HD digital video and still image cameras and a multicorer. Effort was concentrated in areas substantially under-sampled in previous comparable surveys of the area, with the aim of generating data that would improve future predictive models of benthic species distribution including protected coral. Photographic transects of 1km were completed for 142 sites, effectively doubling the number of sites on Chatham Rise from which high-resolution seabed photographic data are available. Data from the voyage will yield finer-level taxonomic identifications and more precise population density estimates. **BPA Biodiversity (ZBD2014-01)** This project contracted to NIWA by FNZ will improve our knowledge of coral distribution by: - Updating the inventory of benthic samples and biodiversity data available within the Benthic Protection Areas and Seamount Closure areas - Processing and identifying undescribed samples and material in selected BPAs and for selected taxonomic groups - Identifying gaps in sample coverage, evaluate priority areas and design a sampling programme to collect appropriate data. The final report is as yet unpublished. **DOC Conservation Services Programme Coral Projects in 2018-19** DOC have three coral population projects in their CSP programme for 2018-19. These are: - The age and growth of New Zealand protected corals at high risk, specifically Antipatharian black coral genus Bathypathes - Improved habitat suitability modelling for protected corals in New Zealand waters, which will include: - an updated protected coral dataset using new records now available from identified / verified / revised identifications of Observer and research trawl coral samples (Tracey et al. 2017; Macpherson et al. 2017; Mills et al. 2018)

			- new protected coral data records from identified / verified / revised identifications from NIWA led biodiversity research surveys - previously unavailable sediment data layers – based on a large amount (>30 000) of sediment type data points for the region (% mud; % sand, etc.) - the latest trawl footprint data (Baird & Wood 2018) - new environmental layers from the NIWA earth-system models, for current and future environmental conditions, developed as part of the Deep-South Programme - potential use of an ensemble of predictive modelling methods e.g., Boosted Regression Tree (BRT), Random Forest (RF), and / or linear regression (GAM) - Protected coral connectivity in New Zealand, which DOC is still in the process of procuring. For full details refer to the CSP Annual Plan 2018-19. All final reports are or will be available [here]().
To ensure fishing is highly unlikely to create unacceptable impacts to ETP corals	Use the reviews and data to assess the potential impacts of fishing on protected coral within each of the two UoAs. The improved understanding derived from the detailed review of available literature coupled with improvements in technical analysis and incremental availability of data related to coral distribution will provide a better interpretation of the uncertainties surrounding the impact of these fisheries on protected corals. Collectively, these reviews will be used, together with updated scale and intensity data for each fishery, to inform on the relative scale and intensity and the uncertainty of the potential impacts of fishing on protected coral within each fishery area.	An update on analyses will be provided at the third surveillance audit and a final report available by the fourth surveillance audit.	The above project outcomes will be reviewed during years 3 and 4, with a final report presented in Year 4 describing how these have contributed to assessing with more certainty the potential impacts of orange roughy fishing in these two UoAs on protected coral.