Progress report to the Department of Conservation / Te Papa Atawhai

From: Di Tracey NIWA / Taihoro Nukurangi

Project Code: DOC08309 / INT2007-03.

Project Title: Identification of protected corals

Date: 30 June 2008

Overall Objective:

To identify samples of corals returned through the CSP observer programme during the 2007/08 fishing year (1 October 2007 – 30 September 2008).

Specific Objectives:

1) Samples of corals returned by observers to be identified to lower taxa (families, genera, species);

2) Update the observer database (*COD*) as necessary with correct species identifications; and

3) Develop concise educational materials to complement *A Guide to Common Deepsea Invertebrates in New Zealand Waters* for observers on the identification of protected corals known to be caught during trawling.

Overview

This project awarded by DoC has developed from a recognised need to standardise instructions for retaining benthic by-catch material - including protected coral species or species believed to be protected, and sampled at sea by fisheries observers.

Protected species need to be adequately described to ensure legal obligations of the Wildlife Act are followed. The results from this project will provide important knowledge of the region's biodiversity and will improve our understanding of the ecosystem effects of fishing, and may to help avoid, remedy or mitigate any adverse effects of fishing on biodiversity, improve our knowledge of areal and vertical distribution of protected coral taxa within and outside the EEZ, provide a measure of abundance, and help quantify protected species interactions with commercial fisheries. As well the data will add to descriptions of the biodiversity of seamount / non seamount habitats and provide information useful for the consideration of potential marine protected areas. The educational material will further aid coral identification by observers, researchers, and managers (for example there is currently some confusion as to what "red coral" is and how to interpret the description of this coral used in the Act).

This report comprises two sections. *Section A* is a progress report for DOC08309 Project objectives. *Section B* provides a summary of coral records selected from MFish Observer

database *COD* up to November 2007 and shows how the coral collection programme and accurate identification data, can be used to elucidate the relationships between invertebrates and commercial fishing activity.

Section A

Interim progress report for objectives 1-4.
Di Tracey

Specific Objective 1.

The objective consists of 5 main tasks:

- providing input into observer briefing process
- sorting frozen samples to putative identification level
- entering data into Excel spreadsheet
- taxonomists confirm identification
- Excel spreadsheet updated and data entered into *Specify* database

Methods

Task 1: Providing input into observer briefing process
Based on previous experience NIWA have been available to provide input into the design of observer forms and protocols, carry out observer briefings, and participate in MFish observer training courses.

Tasks 2–5: Sorting frozen samples to putative identification level, entering data into electronic spreadsheet, confirming identification, spreadsheet updates, entry into *Specify* database

Methods employed in this Objective follow those already established and detailed in Tracey & Consalvey (2005), and Tracey et al (2007). The coral taxa that have been returned by observers from commercial fisheries have been thawed, sorted into main groups, identified to the lowest possible taxonomic level by para-taxonomist (Di Tracey), entered onto a data recording form, entered into an electronic spreadsheet. Any voucher specimens have been registered and fixed, and these will be maintained in the National Invertebrate Collection (NIC). Any samples retained at NIWA are being catalogued and loaded into the NIC *Specify* database – the database that manages data for all invertebrate specimens held at NIWA. All or sub-samples of all specimens are being retained due to the value of the samples. Where species identification of bubblegum, bamboo, and precious corals requires molecular phylogenetic analyses or genetic analyses, tissue samples have been removed (Juan Sanchez, Universidad de los Andes, Colombia).

The initial identification process is intended to facilitate the next stage of the identification process to be carried out by expert taxonomists. All coral fauna excluding the black corals will be identified further, to the lowest taxa possible, by Juan Sanchez, (June 2008, remaining samples in December 2008). Dennis Opresko, Oak Ridge National Laboratory, USA, will identify the black corals samples in December 2008. As well Tina Molodsova

who identified some black corals in October 2007, and possibly Steve Cairns from the Smithsonian Institute, may be available in December 2008 to carry out additional coral identifications.

Some digital images of some of the samples have been taken and these will be used in the Coral Guide (Objective 3) and stored and accessible through NIWA's web-map based "Atlas" image management system. The photographic procedures developed by NIWA for fishes as for project IDG200601 have been followed. The limited budget on this project means that the number of sample images that can be processed is limited. Observer collected images will be used as required.

Results

Task 1: Providing input into observer briefing process
A clear briefing for observers with regard to sample identification and a method to sample corals has been further developed by DoC and NIWA as part of this current project. Along with the CSP staff, NIWA has provided input to the at-sea collection procedures and helped brief and train the observers on methods used to sample, sub-sample, label, and code species to be returned for identification. Involvement in the CSP observer programme briefing and training process has helped ensure that consistent standards apply to collection of samples at sea.

Tasks 2–5: Sorting frozen samples to putative identification level, entering data into electronic spreadsheet, confirming identification, spreadsheet updates, entry into *Specify* database
Currently NIWA has processed all CSP observer coral samples collected between October 2007 and June 2008. The number of corals species collected exceeds 460.
33 trips have been processed and data entered into an electronic spreadsheet. N = 296

An additional 10 trips have been processed and data entered onto paper forms, but not entered into electronic spreadsheet. N =172 samples

Taxonomists confirm identification:
To date all coral fauna collected up to June 2008 and excluding the black corals, have been identified further, to the lowest taxa possible, by Juan Sanchez. Spreadsheets will be updated to reflect the final identification to lowest possible taxon. We are hoping that the remaining corals collected post July will have their identity confirmed by Juan Sanchez in December 2008. Black corals will be identified in December 2008 by expert taxonomist Dennis Opresko.

Once the expert taxonomists have confirmed the species identification, the electronic spreadsheet will be updated and data entered into the NIC *Specify* database and the Ministry of Fisheries Observer database "*COD*" (Central Observer Database (previously named *observer (obs)*, and maintained by NIWA for the Ministry of Fisheries.

Specific Objective 2.

To be reported on at the end of project completion.

In summary: The final stage of this project is to update the *COD.* Once the identifications of coral samples are completed, the species codes, weights, and sample numbers will be added to the associated event data in *COD*. All data needs to be entered in *COD* using the common link of trip_number and station_number.

In order to update the sample information, the Ministry of Fishery's Research Data Management (RDM) group will also be provided with the coral spreadsheet data to enable the Centralised Observer Database *(COD)* to be updated as required under the DAT200601E Project.

All associated event data returned by observers (e.g. target species, gear type) will be included in spreadsheet summaries. The compiled data will be made available to DoC as stipulated in the tender, in order to help monitor and quantify protected species interactions with commercial fisheries.

Specific Objective 3.

Develop concise educational materials to complement *A Guide to Common Deepsea Invertebrates in New Zealand Waters* (Tracey et al; 2007) for observers on the identification of protected corals known to be caught during trawling.

A draft "Coral Identification Guide" document has been produced (Tracey et al. in prep.) and contains adequate educational material to ensure that the identification of corals is accurate and concise. The guide has been produced by both staff at NIWA and experts in coral identification such as Juan Sanchez and Dennis Opresko.

The coral guide complements the deepsea invertebrate guide and similar methods to produce the coral guide have been followed. Descriptive information and photographs (those taken during the identification process as well as those already available), have been compiled. Additional aids in the form of two user friendly coral keys to help with species identification have been prepared and will be available if required or appended to the Coral Identification Guide. All material will be additional to but complement the coral sections in Tracey et al (2007).

The use of the coral guide is intended to improve observer's coral specimen identification to family, genus, or species level, and help ensure that the species can be identified and recorded as accurately as possible. As well researchers will benefit from the production of this coral guide. Some new species codes are required and these will be sought through the Data manager with consultation with MFish.

Section B

Summary of coral records from MFish Observer database *COD* up to November 2007 - application of coral collection programme data.

Di Tracey, Matt Dunn, Brian Sanders

Overview

The invertebrate samples returned by observers represent a valuable data source that can be used to elucidate the relationships between invertebrates and commercial fishing activity. Samples collected to date can enable researchers and managers to help identify where corals and their associated fauna are at the highest risk of interactions with fishing gear. Section B of this report provides a summary of coral catch data obtained from *COD* up to Jan 2008, along with plots that include deepwater commercial catch effort data from the Chatham Rise.

The data summarised in Table 1 represent by-catch from fishing vessels targeting 33 fish species. The corals were recorded primarily from inside the NZ EEZ and the data are summarised from 1986 to 2007. A total of 5907 Cnidaria by-catch records currently exist on *COD*. The number of corals and anemones specimens = 5029 comprising a total weight of 600,898 kg. Scyphozoa (jellyfish) belong to the Cnidaria Phylum but are not included in the summary table. There have been 874 records of jellyfish since 1986 equating to a total weight of 39,312 kg. Note the samples identified at sea need to be ground-truthed by experts, but overall we have confidence in the data summaries to higher level – corals, gorgonians, stony corals, black corals.

Total numbers and weight are presented by the main groups in Table 1.

Data errors:

Some data grooming has been carried out as recorded weights for some species appear unrealistic e.g. the total weight data for two solitary cup corals may have been recorded or entered incorrectly as a total weight of 4,000 kg for the cup coral *Caryophyllia* spp. samples would likely be incorrect. When recorded weight for a particular species was deemed to be too high / unrealistic, an estimated weight was used. More data grooming will be required of *COD* before we are totally confident with this dataset. Data grooming is beyond the scope of this current project.

Codes:

Historically the code COR could have been used as the generic code for corals, even though the correct general coral code is COU and the code COR is for Hydrozoan. As a result the numbers and weights for COR records are included with the general coral code summary, not with the Hydrozoan group. The code COR may have also been used to code red corals, which could be either the red hydrocoral *Errina* spp. or the red/orange bubblegum coral, *Paragorgia* spp., or possibly other 'red' coral forms. Because of this it also makes sense to group the COR records with the generic corals.

It has been only since about 2006 and the subsequent publication and extended use of the two Deepsea Invertebrate Guides (Tracey et al 2005; 2007), that the code entries in *COD* reflect regular use of the new coral codes. Because it has only been recent that more specific codes are being allocated to corals, it is not appropriate to estimate proportions for each coral species from the dataset.

To date corals have been caught as a by-catch form 33 target fisheries including those for orange roughy, black oreo, smooth oreo, squids, cardinalfish, scampi, hoki, hake, and southern blue whiting.

Cnidaria catch weight (kg) and trip position data recorded by MFish observers were extracted for all fisheries and all years (May 1986 to Jan 2008) from *COD*. A 'coral only' subset of the data were then selected where the target fishery in the New Zealand region matched deepsea species orange roughy, oreo, black oreo, and smooth oreo. Jellyfish, Anemones and Zoanthids were excluded from this data subset. The coral catch weight (kg) data for the New Zealand region sampled during deepsea commercial trawling operations between 1986 and 2008 are shown in Figure 1.

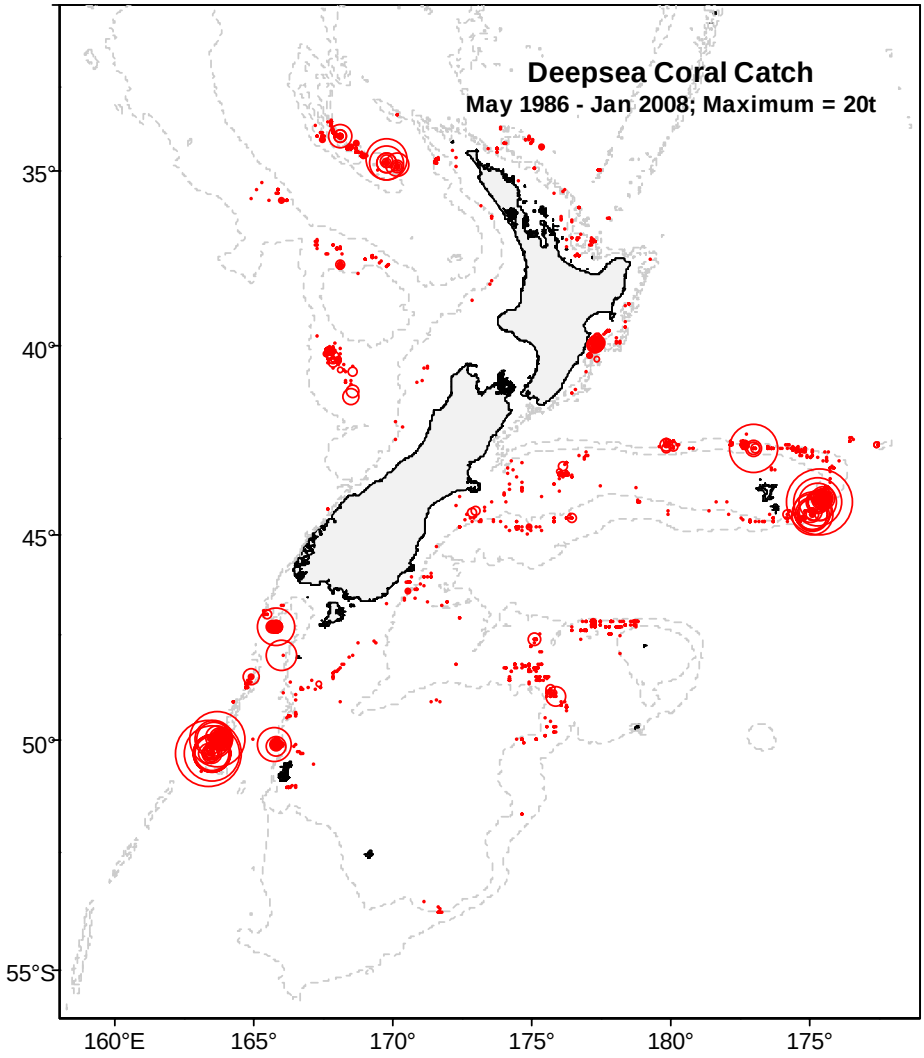

Figure 1: Deepsea coral catch (kg) and position data for the New Zealand EEZ collected between May 1986 and Jan 2008 from commercial vessels where the target species were orange roughy, oreo, black oreo, and smooth oreo. The largest circle denotes 20 tonnes. Depth contour lines represent 750 and 1500 m.

Further analyses were carried out for the same period (May 1986 to Jan 2008), and for more recent years (Jan 2005 to Jan 2008), where we compared the coral catch data with deepsea tow data on the Chatham Rise. Commercial tow data for orange roughy, oreos, black oreo, smooth oreo were selected from the Ministry of Fisheries commercial tow database. Areas of high fishing density are very localised, (Figure 2), and show that high incidences of coral catches plotted from *COD* and overlain with the tow data, have been caught in the heavily fished areas, and continue to be taken as by-catch in more recent times (Figure 3). Again these plots exclude jellyfish, anemones and Zoanthids.

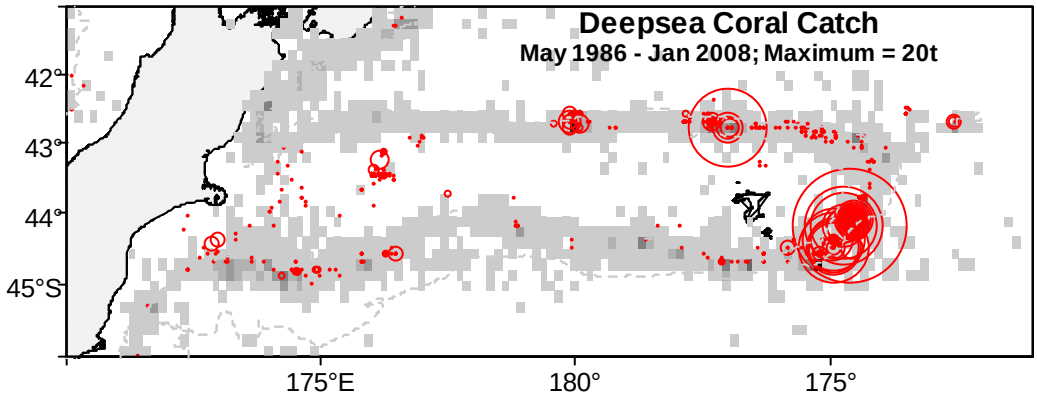

Figure 2: Deepsea coral catch data (in red) compared with commercial tow data (grey scale) on the Chatham Rise between May 1986 and Jan 2008. Orange roughy, black oreo, smooth oreo, and oreo tow position data are shown in grey half degree grid squares (each cell is 0.15x 0.15 degrees). The maximum number of tows per cell is greater than 3,700 tonnes. Areas of high fishing density are very localised, e.g. *see* Graveyard Complex 180°, Spawning Box region Northeast Rise, Andes seamount and hill complex Southeast Rise, and seamount and hill features on the South Rise. Coral catches are shown in red. The largest circle for coral catches denotes 20 tonnes. Depth contour lines represent 750 and 1500 m.

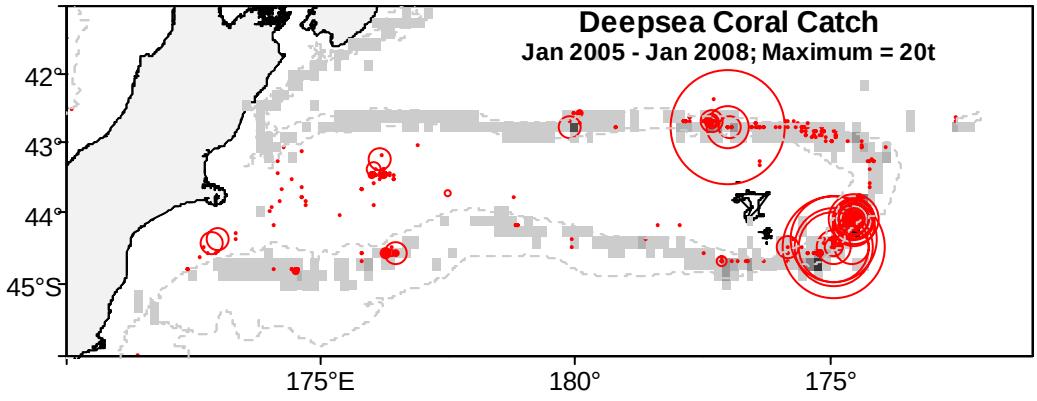

Figure 3: Deepsea coral catch data (red) compared with commercial tow data (grey scale) on the Chatham Rise, between Jan 2005 and Jan 2008. Orange roughy, black oreo, smooth oreo, and oreo tow position data are shown in half degree grid squares (each cell is 0.15x 0.15 degrees). The maximum number of tows per cell is greater than 611 tonnes. As with Figure 2, Areas of high fishing density are very localised, e.g. *see* Spawning Box region Northeast Rise and Andes seamount and hill complex. The largest circle for coral catches denotes 20 tonnes. Depth contour lines represent 750 and 1500 m.

Acknowledgements

Special thanks to NIWA staff particularly Dean Stotter for his input into the sample sorting, along with Sadie Mills, Dan MacGibbon, and Peter Notman. We are most grateful to Juan Sanchez (Universidad de los Andes, Colombia) who certainly made a huge effort in June 2008 to complete the identification of all observer collected corals. Finally thanks to Stephanie Rowe (DoC) for supporting the development of coral educational material and for her on-going interest in coral by-catch in the New Zealand fisheries.

References

Tracey, D.M.; Anderson, O.F.; Clark, M.R.; Oliver, M.D. (Comps.) 2004. A guide to common deepsea invertebrates in New Zealand waters. *New Zealand Aquatic Environment and Biodiversity Report No. 1*. 160 p.

Tracey, D.M.; Anderson, O.F.; Naylor, J. R. (Comps.) 2007. A guide to common deepsea invertebrates in New Zealand waters. *New Zealand Aquatic Environment and Biodiversity Report No*. 10. 282 p.

Tracey, D. Consalvey, M. 2006. Archived benthic by-catch Final Research Report submitted to the Ministry of Fisheries for Research Project IPA200508, Objective 1. 8p. (Unpublished report held by the Ministry of Fisheries, Wellington.)

Tracey, D. Gauthier, S. Consalvey, M. 2007. Archived benthic by-catch Final Research Report submitted to the Ministry of Fisheries for Research Project IPA200604, Objective 1. 26p. (Unpublished report held by the Ministry of Fisheries, Wellington.)

Table 1: Summary up to 23/11/2007 of coral by-catch from COD (MFish Observer database)

Code	Scientific name	Common name	Number	Weight (kg)
COU		Coral (Unspecified)	1592	478160
COR			74	8216
			Total	**486376**
Anemones				
ACS	Actinostolidae	Deepsea anemone	457	1878
ANT		Anemone	1373	40221
BOC	*Bolocera* spp.		70	144
HMT	Hormathiidae	Deepsea anemone	242	1067
LIP	*Liponema* spp.	Deepsea anemone	7	13
SEN	*Actinia* spp.	Sea anemone	6	49
			Total	**43372**
Stony corals (branching)				
SIA	Scleractinia	Scleractinia	21	2820
CBB		Coral rubble	122	42199
CBD		Coral rubble - dead	42	3009
GDU	*Goniocorella dumosa*	Bushy hard coral	190	17259
MOC	*Madrepora oculata*	*Madrepora oculata*	10	25
ERO	*Enallopsammia rostrata*	Deepwater branching coral	18	45
SVA	*Solenosmilia variabilis*	*Solenosmilia variabilis*	14	292
OVI	*Oculina virgosa*	*Oculina virgosa*	2	2
			Total	**65651**
Stony corals (cup)				
DDI	*Desmophyllum dianthus*	Cup coral	25	10
Code	**Scientific name**	**Common name**	**Number**	**Weight (kg)**

CAY	*Caryophyllia* spp.	Cup coral	7	5
STS	*Stephanocyathus spiniger*	Cup coral	1	71
COF	*Flabellum* spp.	Cup coral	37	91
			Total	**177**
Zoanthids				
EPZ	*Epizoanthus sp.*	*Epizoanthus sp.*	25	25
			Total	**25**
Black corals				
COB	Antipatharia (Order)	Black coral	220	977
LSE	*Leiopathes secunda*	Black coral	35	49
			Total	**1026**
Soft corals				
SOC	Alcyonacea (Order)	Soft coral	1	1
TLO	*Telesto* spp.	Encrusting long polyps, coral	38	8
			Total	**9**
Gorgonian corals				
GOC	Gorgonacea (Order)	Gorgonian coral	1	1
PAB	*Paragorgia arborea*	Bubblegum coral	89	2980
CLL	*Corallium* spp.	Precious coral	4	4
ISI	Isididae	Bamboo corals	120	376
LLE	*Lepidisis* spp.	Bamboo coral	4	5
BOO	*Keratoisis* spp.	Bamboo coral	36	51
MIN	*Minuisis* spp.	Worm-commensal bamboo coral	1	1
CHR	*Chrysogorgia* spp.	Golden coral	82	757
THO	*Thouarella* spp.	Bottlebrush coral	5	5
PNN	*Pennatula* spp.	Purple sea pen	25	30
GYS	*Gyrophyllum sibogae*	Siboga sea pen	10	21
			Total	**4231**

Code	Scientific name	Common name	Number	Weight (kg)
Hydrozoans				
COR	Stylasteridae (Family)	Hydrocorals	*	*
COO	*Conopora* spp.	*Conopora* spp	1	1
CRE	*Calyptopora reticulate*	White hydrocoral	4	7
ERR	*Errina* spp.	Red coral	3	7
LPT	*Lepidotheca* spp.	Spiny lace coral	2	2
HDR	Hydrozoa (Class)	Hydroid	13	14
			Total	**31**