

Identification of Protected Corals

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Executive summary

This final research report presents on the requirements of Project DOC103045/ INT2009-03: To identify samples of corals returned through the Department of Conservation (DOC) Conservation Services Programme (CSP) Observer Programme during the 2009/10 fishing year (1 October 2009 – 30 September 2010).

Protected species need to be adequately described to ensure legal obligations of the Wildlife Act are followed. The Wildlife Act (1953) was amended in 2010, and under Schedule 7A now protects additional species in the Cnidaria group. In addition to the black corals (Order Antipatharia) and red hydrocorals (*Errina* sp.), all gorgonians (O. Gorgonacea), stony corals (O. Scleractinia), and hydrocorals (F. Stylasteridae), are now protected.

Samples of any protected coral taxa, or of corals that may appear to be protected coral taxa, that were taken as by-catch by commercial fishing vessels during the 2009/10 fishing year (1 October 2009 – 30 September 2010), were returned by observers as part of the CSP Observer Programme requirements. The coral by-catch samples (213 records comprising 341 specimens), were sorted and identified to the lowest possible taxa (families, genera, or species). International experts confirmed a proportion of the coral identifications.

The data were loaded from the NIWA Central Observer Database (OSD) into the Ministry of Fisheries (MFish) Centralised Observer Database (COD) managed by NIWA. The NIWA Invertebrate Collections (NIC) database (*Specify*) currently stores a proportion of the coral sample information as several coral samples are held in stewardship by NIWA for DOC. *Specify* was also updated.

All fishing event data associated with the coral samples (e.g. target species, depth), are presented in Appendices. Samples returned for identification at NIWA were taken as by-catch from 23 commercial trips, targeting 10 fisheries, and representing eight Fisheries Management Areas (FMAs), and three high seas fishing areas. Fisheries that have had corals recorded as by-catch include those for deepwater and middle depths species such as orange roughy, smooth oreo, white warehou, alfonsino, and hoki,

The deepsea coral samples returned by observers represent a valuable data source. Accurate identification data can be used to assess the incidental catch of corals (Rowe and Tracey 2008), contribute to producing distribution plots for protected or species proposed to be protected (Consalvey et al, 2006; Rowden et al. 2008; Tracey at al., submitted); for systematics and species identification (Sánchez et al. 2008), and to elucidate the relationships between invertebrates and commercial fishing activity. The information will continue to enable researchers and managers to identify areas where deep sea corals are at highest risk of interactions with fishing gear and to assess the value of identifying sub-samples of corals returned by observers and, specifically, whether there is an ongoing need to monitor and quantify the level of interaction between fisheries and protected corals.

1. Overall Objective

To identify samples of corals returned through the CSP Observer Programme during the 2009/10 fishing year (1 October 2009 – 30 September 2010).

Specific Objectives:

1. Samples of corals returned by observers to be identified to lower taxa (families, genera, species).
2. Update the Ministry of Fisheries Centralised Observer Database (COD) as necessary with correct species identifications.

2. Methods and Results

Specific Objective 1

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

During the 2009/10 fishing years, CSP has requested observers to assess fisheries for the presence of corals and to record presence and weight on the Observer Benthic Materials Form (or on Catch Forms prior to the introduction of the Observer Benthic Materials Form). These samples have been collected as an initial step to monitor and quantify the level of interaction between fisheries and protected corals. Fisheries of particular interest include trawl fisheries for the deepwater species orange roughy, smooth oreo and black oreo. Coral specimens are photographed and one sample or a sub-sample of each coral per taxa, referred to as species throughout the text, is returned for identification. Protected corals (or corals that cannot be identified) were returned by observers for accurate identification.

This objective consists of 5 main tasks:

- providing input into the MFish Observer briefing process
- sorting frozen samples to putative identification level
- entering data into the NIWA Observer Samples Database (OSD)
- taxonomists confirm identification
- OSD data exported into NIWA Invertebrate Collection (NIC) *Specify* database, the database that manages data for all invertebrate specimens held at NIWA.

Task 1: Providing input into observer briefing process.

A selection of labelled coral specimen samples were provided to the Observer Programme to aid observers in the identification of easily confused species. Samples included examples of the branching stony corals MOC (*Madrepora oculata*), ERO (*Enallopsammia rostrata*), GOC (*Goniocorella dumosa*), SVA (*Solenosmilia variabilis*), and the endemic species OVI (*Oculina virgosa*).

Tasks 2–5: Sorting frozen samples to putative identification level, entering data into the NIWA Observer Samples Database (OSD), confirming identification, database updates, entry into Specify database.

Methods used follow those already established and detailed in Tracey & Consalvey (2005), Tracey et al (2007), Tracey (2010), and use resources such as the Coral and Invertebrate Guides (Tracey et al. 2007; Tracey et al 2008), and the recently published Biodiversity Inventory (Gordon 2009). The coral species that had been returned by fisheries observers from commercial fishing voyages were thawed, sorted into main groups, identified to the lowest possible taxonomic level, returned to frozen storage, and the data entered into web interfaced NIWA database *OSD*. The *OSD* provides system integrity and security and has linkages with existing databases - *MFish Species Master* for common and scientific names linked to match MFish species codes, *COD* (Central Observer Database), and *Specify* database. Data were loaded from *OSD* into *Specify* and into *COD*.

The data recorded in *OSD* are as follows:

NIWA ID No	(unique NIWA number in <i>OSD</i>)
Trip No.	(Observer trip number)
Station No.	(vessel, observer station number)
Vessel Name	(not always provided)
MFish Sample No.	(when provided Observer's unique number for benthic form or sample)
Obs. Species ID	(when provided MFish code given by Observer)
NIWA Species ID	(NIWA expert code – (MFish code))
Species Sci. Name	(scientific name obtained by linking the MFish code to <i>Species db</i>)
Species Com. Name	(common name obtained by linking the MFish code to <i>Species db</i>)
Species Family Sci. Name	(scientific family name (or Order) obtained by or Order) linking the MFish code to <i>Species db</i>)
Weight	(weighed during sorting process)
No. of Specimens	(count when sorting)
Vitality	(live or dead status of coral given during sorting)
Delivery Date	(date samples arrived at NIWA)
Processed Date	(date samples processed at NIWA)
Storage Location	(where frozen samples held)

NIWA processed 213 CSP observer coral samples collected from October 2009 to September 2010. Due to their condition, some samples could only be identified to a higher taxonomic level – Order, or even Class (Table 1). When possible, hydrocorals (Stylasteridae, HDR) were identified further to either hydrocoral (COR) or hydroid (HDF). Some coral samples were attached to other samples, e.g. to another coral, or a sponge. These specimens were also identified and recorded. The samples identified belong to Classes Anthozoa and Hydrozoa, which includes:

- Anemones
- Zoanthids
- Stony corals
 - Cup corals
 - Branching stony corals
- Black corals
- Soft corals
- Gorgonian corals:
 - Bamboo corals
 - Bubblegum coral
 - Sea fan gorgonian corals
- Sea pens
- Hydrocorals - stylasterids and feathery hydroids

The species identified from the sorted coral samples, and their associated MFish codes, are listed in Table 1. There were 341 specimens in the samples, representing 39 lowest possible identifiable taxa (Class, Order, Family, Genus, or species).

Note that our previous October 2009 and April 2010 preliminary reports for this project presented higher counts of coral samples. This is a timing issue as information on trip and collection data are not available when preparing our preliminary reports. As such our counts in previous report updates included all corals processed, those for the project year, as well as those counts for corals collected from the previous fishing year and held in frozen storage awaiting confirmed identifications by experts. Once data are loaded into *COD* toward the end of the project and the trip data become available, we are then able to provide actual counts for a specified period (e.g., by trip number and fishing year).

Table 1: Coral species represented in the sorted Observer samples. Corals were identified to lowest taxon possible, and at times could only be identified to Class. (* Generic coral code used as no code currently available for Gold Coral)

Species code	Scientific name	Common name
ACN	<i>Acanella</i> spp.	Bushy bamboo coral
ACS	Actinostolidae	Deepsea anemone
ARO	<i>Anthomastus (Bathyalcyon) robustus</i>	Gigantic soft coral
ATR	Actiniaria (Order)	Sea anemones
BOC	<i>Bolocera</i> spp.	Deepsea anemone
BOO	<i>Keratoisis</i> spp.	Bamboo coral
BTP	<i>Bathypathes</i> spp.	Black coral
CAY	<i>Caryophyllia</i> spp.	Carnation cup coral
CHR	<i>Chrysogorgia</i> spp.	Golden Coral
COB	Antipatharia (Order)	Black Coral
COF	<i>Flabellum</i> spp.	Flabellum cup coral
COR	Stylasteridae (Family)	Hydrocorals
COU	<i>Savalia</i> spp. (or possibly <i>Gerardia</i> spp.)	Gold coral*
DDI	<i>Desmophyllum dianthus</i>	Crested cup coral
DEN	<i>Dendrobathypathes</i> spp.	Black coral
EPZ	<i>Epizoanthus</i> sp.	Zoanthid
ERO	<i>Enallopsammia rostrata</i>	Deepwater branching coral
GDU	<i>Goniocorella dumosa</i>	Deepwater branching coral
GOC	Gorgonacea (Order)	Gorgonian coral
HDF	Leptomeduseae (Order) and Anthoathecatae (Order) Excluding Family Stylasteridae	Feathery hydroids
HDR	Hydrozoa (Class)	Hydroid
HMT	Hormathiidae	Deepsea anemone
LEI	<i>Leiopathes</i> spp.	Black coral
LLE	<i>Lepidisis</i> spp.	Bamboo coral
LPT	<i>Lepidotheca</i> spp.	Spiny lace Coral
LSE	<i>Leiopathes secunda</i>	Black coral
MOC	<i>Madrepora oculata</i>	Deepwater branching coral
MTL	<i>Metallogorgia</i> spp.	Metallic coral
PAB	<i>Paragorgia arborea</i>	Bubblegum coral
PMN	<i>Primnoa</i> spp.	Sea fan
PNN	<i>Pennatula</i> spp.	Purple sea pen
PRI	Primnoidae	Primnoid sea fan
PTP	<i>Parantipathes</i> spp.	Black coral
PTU	Pennatulacea (Order)	Sea pens
SCY	Scyphozoa (Class)	Jellyfish
SOC	Alcyonacea (Order)	Soft coral
STP	<i>Stephanocyathus platypus</i>	Solitary bowl coral
SVA	<i>Solenosmilia variabilis</i>	Deepwater branching coral
THO	<i>Thouarella</i> spp.	Bottlebrush coral
TLO	<i>Telesto</i> spp.	Encrusting long polyps coral

International experts confirmed a proportion of the coral samples. Stephen Cairns (Smithsonian Institution) identified certain Scleractinia and Stylasteridae; Juan Sanchez (Universidad de los Andes, Colombia), whose visit to NIWA was funded by DOC Project DOC10301 (Tracey 2010), identified all coral groups with a particular focus on the Octocorallia (Gorgonian corals). Some tissue samples were collected by Juan and student Luisa Duenas to confirm identifications to lower taxonomic levels and or to revise species descriptions, and for molecular studies (e.g., for the bamboo corals (Isididae), precious corals (Corallidae), and bubblegum corals (Paragorgiidae)). Frederic Siniger (Bangor University, UK), advised on the identification of the zoanthid gold coral Family: Gerardiidae Genus *Savalia* or possibly *Gerardia* (Figure 1). This large sample was taken on North Hill off Mahia, East Coast North Island.

Any voucher specimens were registered and fixed, and these continue to be maintained in the NIWA Invertebrate Collection (NIC).



Figure 1: Zoanthid gold coral (Family Gerardiidae) collected off North Hill off Mahia.

The samples processed were collected from 23 MFish / CSP Fisheries Observer trips.

The number of coral samples collected species by target fishery is summarised in Table 2. The majority of samples (94%) were collected while targeting orange roughy, black oreo, and smooth oreo.

Table 2: Number of coral samples by target fishery.

Target species	Common name	Numer of coral samples
BAR	Barracouta	1
BOE	Black Oreo	20
BYX	Alfonsino & Long-Finned Beryx	4
HOK	Hoki	4
NOS	NZ Southern Arrow Squid	1
OEO	Oreos	10
ORH	Orange Roughy	116
SQU	Arrow Squid	2
SSO	Smooth Oreo	54
WWA	White Warehou	1
		Total = 213

Table 3 (below) summarises the number of tows from which coral sample were taken by trip and target species. Often more than one commercial species can be targeted during a specific trip (e.g., trip 2955 targeted both orange roughy and smooth oreo).

Table 3: Number of tows with coral samples by Observer trip and target species (MFish species code and common name are listed). One trip can target more than one species.

Target species MFish code	Common name	Number of tows with coral samples
HOK	Hoki	2
ORH	Orange Roughy	49
SSO	Smooth Oreo	19
ORH	Orange Roughy	1
ORH	Orange Roughy	2
OEO	Oreos	9
ORH	Orange Roughy	2
ORH	Orange Roughy	14
SSO	Smooth Oreo	12
BOE	Black Oreo	8
ORH	Orange Roughy	14
SSO	Smooth Oreo	13
WWA	White Warehou	1
BAR	Barracouta	1
ORH	Orange Roughy	1
OEO	Oreos	1
ORH	Orange Roughy	5
SSO	Smooth Oreo	2
SQU	Arrow Squid	2
HOK	Hoki	1
BOE	Black Oreo	5
ORH	Orange Roughy	1
SSO	Smooth Oreo	3
BYX	Alfonsino & Long-Finned Beryx	2
NOS	NZ Southern Arrow Squid	1
BOE	Black Oreo	7
SSO	Smooth Oreo	5
HOK	Hoki	1
ORH	Orange Roughy	7
ORH	Orange Roughy	7
ORH	Orange Roughy	2
ORH	Orange Roughy	6
BYX	Alfonsino & Long-Finned Beryx	2
ORH	Orange Roughy	1
ORH	Orange Roughy	4

From the 23 trips, 255 specimens were retained in NIC, where they are held in stewardship for the Department of Conservation. The samples were catalogued and their associated data loaded into *Specify*. Data for the observer collected corals that were processed, and are currently held in NIC, can now be output from *Specify* with the following data fields:

Trip	
Station	
Phylum/TaxonName	
Class/TaxonName	
Subclass/TaxonName	
Order/TaxonName	
Family/TaxonName	
Genus/TaxonName	
Species/TaxonName	(species name e.g. <i>Madrepora oculata</i>)
Preferred Taxon	
OSD Lot Number	
Count	
Determiner	(e.g. Sanchez, Juan; Cairns, Stephen; Opresko, Dennis)
Remarks	(Opresko, Dennis Sub-sampled from oversized <i>Bathypathes</i> B from freezer for genetics)

Trip_number, station_number, and sample ID are the common data fields linking records in both *Specify* and *COD* (see Objective 2 below). This enables subsequent *COD* updates to be made from *Specify* if a species revision occurs. Scientific names and not MFish species codes are entered into *Specify*.

Appendix 1 contains the output from *Specify* for this reporting period and lists to the lowest possible taxon the corals collected and identified by experts. Note that when any subsequent species revisions are made by experts, data will be updated in *Specify*.

Specific Objective 2

Update the Ministry of Fisheries Centralised Observer Database (*COD*) as necessary with correct species identifications.

This objective was to be reported on at project completion, January 2011. Sorted and identified coral sample data were loaded into *COD*.

The Research Data Manager (RDM) at NIWA, contracted by MFish, was provided with the coral output from *OSD* to enable *COD* to be updated as required under this project, and the Ministry of Fisheries DAT200601E Project. There are often issues that have to be resolved when loading the Observer Benthic Materials Form data. For example there has been some duplication of data when the coral catch for one tow was recorded in both the Observer Benthic Materials Form and in the Catch Form. The issues are addressed as part of the loading data tasks associated with the DAT200601E Project.

The data, including species codes, weights, and sample numbers, were entered into tables in *COD* (213 records; 341 specimens). All data were entered using the common link of trip_number, station_number, and sample ID. As with updating *Specify*, any further revisions from expert taxonomist's identifications can always be made subsequent to loading.

To produce data summaries including target species and position data for the coral samples returned for processing, data were extracted from *COD* by linking 'trip' and 'station'. All associated event data (e.g. position, target species, gear type) for the samples from the 23 commercial trips are shown, along with the coral data, in a summary extract (Appendix 2).

The *COD* extract excel spreadsheet with appended coral data contains the following data fields:

trip_no.	
station_no	
fishing_method	trawl, long-line, etc
target_species	the commercial fish species being targeted
Start_seabed_depth	
End_seabed_depth	
event_start_date	
Start_obs_fma	Fishing Management Area e.g., SOE Chatham Rise (FMA 4)
end_obs_fma	
trunc_start_latitude	
trunc_start_longitude	
trunc_end_latitude	
trunc_end_longitude	
sample_id	MFish ID number; often not provided
species_obs	the coral code given by the Observer
species sort	the coral code given by NIWA
scientific name	
common name	
family scientific	
species true	when possible this is the overseas expert's species identification – (groundtruthing NIWA identifications), or the NIWA expert's identification)
expert name	name of overseas or NIWA expert
life_status	specimen live or dead - observer
life_status_niwa	specimen live or dead - NIWA
est_weight	estimated weight in kg obtained when sorting
species _number	number of specimens

Within the MFish species codes, links are made to *Species Master* database to obtain the species, scientific, and common names. Some depth data are missing, as they were not recorded by the Observer.

Samples returned for processing were collected from the FMAs AKE, AKW, CEE, SEC, SOE, SOI, SOU, and SUB, and from the three high seas fishing areas (CET, HOWE, and LOUR).

The overall recorded catch for Cnidaria species for the 2009/2010 fishing year from all fishing vessels was 18,354 kg. This weight total included Orders Anthozoa, Hydrozoa, Scyphozoa – corals, anemones, jellyfish, and hydroids (Appendix 3). Contributing to a large proportion of the total weight were the branching stony corals (~10 t), deepsea anemones (~4 t), and bubblegum coral (0.8 t).

3. Summary

Data from this project will contribute to the CSP Project MCSINT2010/03, which NIWA is currently carrying out, to analyse the spatial distribution of coral samples returned through the CSP Observer Programme in relation to fishing effort between 2007 and 2010.

Coral by-catch and target fish catch data will be plotted, and the spatial and temporal patterns in the three years of data will help researchers and managers to identify where corals and their associated fauna are at the highest risk of interactions with fishing gear.

In addition to mapping coral distributions, the value of identifying sub-samples of corals returned by observers will be quantified. This will enable an assessment to be made as to whether there is an ongoing need to monitor and quantify the level of interaction between fisheries and protected corals. We note that the coral identifications carried out by the Observers have appeared very good overall but some species have continued to be confused, including the stony branching corals (e.g. *M. oculata*, *E. rostrata*, *G. dumosa*, *S. variabilis*, and *O. virgosa*), black corals (a difficult group to identify to genera, but has also been confused with members of other groups e.g. hydroids), some hydrocorals, and gorgonian corals (e.g. the sea fan Primnoidae has been confused with other gorgonian corals species). Updates to the Deepsea Coral Identification Guide (Tracey et al. 2008) should improve at-sea identifications.

4. Acknowledgements

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Appendix 1. *Specify* Cnidaria export_Final Report DOC10304_Jan2011.xls

This Appendix provides a summary of Cnidaria by-catch sampled by Observers and processed by NIWA as part of the DOC10304 Project, and catalogued at NIWA. Species were confirmed by expert taxonomists/ Note that no MFish species codes are entered into the *Specify* database.

(Appendix 1 available only to Client)

Appendix 2. COD Cnidaria extract Final Report DOC10304_Jan2011 (processed samples)

This Appendix provides a summary of Cnidaria (Anthozoa, Hydrozoa, Scyphozoa – corals, anemones, jellyfish, and hydroids) by-catch returned by Observers and processed by NIWA with the corresponding station data as part of the DOC10304 Project. A high proportion of the samples had their identification confirmed by expert taxonomist Juan Sanchez. Some samples could only be identified to a higher taxonomic level – Order, or Class.

(Appendix 2 available only to Client due to the confidentiality of the station position data)

Appendix 3. Sum of observer recorded Cnidaria catch grouped by species code, from all vessels for the 2009/2010 fishing year.

Species code	Scientific name	Common name	Total greenweight (kg)
ACN	<i>Acanella</i> spp.	Bushy bamboo coral	5.4
ACS	Actinostolidae	Deepsea anemone	2957.7
ANT	Anthozoa	Anemones	599.6
ARO	<i>Anthomastus</i> (<i>Bathyalcyon</i>) <i>robustus</i>	Gigantic soft coral	0.4
ATR	Actiniaria (Order)	Sea anemones	58.9
BOC	<i>Bolocera</i> spp.	Deepsea anemone	77.9
BOO	<i>Keratoisis</i> spp.	Bamboo coral	135
BTP	<i>Bathypathes</i> spp.	Black coral	17.2
CAY	<i>Caryophyllia</i> spp.	Carnation cup coral	9.7
CBB		Coral rubble	2
CBD		Coral rubble - dead	35
CBR	Dendrophylliidae, Oculinidae (Families) and some spp. in Caryophyllidae (Family)	Stony branching corals	1
CHR	<i>Chrysogorgia</i> spp.	Golden coral	217.7
CLL	<i>Corallium</i> spp.	Precious coral	4.7
COB	Antipatharia (Order)	Black coral	51.6
COF	<i>Flabellum</i> spp.	Flabellum cup coral	29.5
COR	Stylasteridae (Family)	Hydrocorals	3
COU	Alcyonacea, Gorgonacea, Scleractinia, Antipatharia (Orders) & Stylasteridae (Family)	Coral (unspecified, includes the Gold coral <i>Savalia</i>)	84.8
CRE	<i>Calyptopora reticulata</i>	White hydrocoral	1.6
DDI	<i>Desmophyllum dianthus</i>	Crested cup coral	70.2
DEN	<i>Dendrobathypathes</i> spp.	Black coral	0.2
EPZ	<i>Epizoanthus</i> sp.	Epizoanthus sp.	79.6
ERO	<i>Enallopsammia rostrata</i>	Deepwater branching coral	302.4
ERR	<i>Errina</i> spp.	Red coral	0.3
GDU	<i>Goniocorella dumosa</i>	Bushy hard coral	1294.8
GOC	Gorgonacea (Order)	Gorgonian coral	148.5
GYS	<i>Gyrophyllum sibogae</i>	Siboga sea pen	12.2
HDF	Leptomeduseae (Order) and Anthoathecatae	Feathery hydroids	17.1

	(Order) excluding family Stylasteridae		
HDR	Hydrozoa (Class)	Hydroid	2.3
HMT	Hormathiidae	Deepsea anemone	751.5
IRI	<i>Iridogorgia</i> spp.	Iridescent coral	0.1
ISI	Isididae	Bamboo corals	30.1
JFI	Scyphozoa (Class)	Jellyfish	477
LEI	<i>Leiopathes</i> spp.	Black coral	
LLE	<i>Lepidisis</i> spp.	Bamboo coral	10.9
LPT	<i>Lepidotheca</i> spp.	Spiny lace coral	0.1
LSE	<i>Leiopathes secunda</i>	Black coral	8.1
MIN	<i>Minuisis</i> spp.	Worm-commensal bamboo coral	140
MOC	<i>Madrepora oculata</i>	Stony branching corals	1203.2
MTL	<i>Metallogorgia</i> spp.	Metallic coral	0.4
PAB	<i>Paragorgia arborea</i>	Bubblegum coral	760.9
PMN	<i>Primnoa</i> spp.	Sea fan	49.5
PNN	<i>Pennatula</i> spp.	Purple sea pen	91.4
PRI	Primnoidae	Primnoid sea fan	0.1
PTP	<i>Parantipathes</i> spp.	Black coral	0.6
PTU	Pennatulacea (Order)	Sea pens	96.8
SCY	Scyphozoa (Class)	Scyphozoa - jellyfish	0.1
SEN	<i>Actinia</i> spp.	Sea anemone	1
SIA	Scleractinia	Stony corals	8053.3
SOC	Alcyonacea (Order)	Soft coral	11.9
SPN		Sea pen	12.7
STP	<i>Stephanocyathus platypus</i>	Solitary bowl coral	85.1
SVA	<i>Solenosmilia variabilis</i>	Stony branching corals	331.5
THO	<i>Thouarella</i> spp.	Bottlebrush coral	6.9
TLO	<i>Telesto</i> spp.	Encrusting long polyps, coral	10.7
		Total = 18354.1 kg	