NIWA
Taihoro Nukurangi

Identification guide for deepsea benthic invertebrate species caught in New Zealand trawl fisheries

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Final Research Report for
Ministry of Fisheries Research Project ENV2002-04

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Final Research Report
Ministry of Fisheries Research Project ENV200204, Objective 1

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Authors:	D. M. Tracey, O. F. Anderson, M. R. Clark	
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7. Overall Objective:

1. To quantify and map the benthic invertebrate species incidental catch in commercial and research trawling throughout the New Zealand EEZ.

8. Specific Objective:

1. To produce identification guides for benthic invertebrate species encountered in the catches of commercial and research trawlers.

9. Executive Summary

This final research report presents the benthic invertebrate guide. The species included in the identification guide relate specifically to those deepsea invertebrates commonly caught by commercial and research trawlers in New Zealand waters. The guide is designed to assist reliable identification by fisheries researchers and observers. The main distinguishing features of each species are described, and photographs and / or line drawings included with annotation to help identification. The actual guide is attached in electronic form.

10. Introduction

There is increasing concern worldwide about the composition and extent of bycatch and associated species in commercial trawl fisheries (e.g., Sissenwine & Daan 1991, Dayton et al. 1995, Mace 1996). This bycatch often includes benthic invertebrates.

In New Zealand fisheries, non-fish bycatch has typically been poorly recorded. There have been a few specific studies aimed at identifying invertebrate bycatch (e.g., McKnight & Probert 1997, Probert et al. 1997, Grove & Probert 1998), and others where the invertebrates have been described in detail along with the fish catch (e.g., Cryer et al. 1998, Morrison & Parkinson 2001). However, in general benthic invertebrate species caught by bottom trawling are not reliably identified by fisheries researchers and observers. This has been a major constraint when examining trends over time in the incidental catch of some major trawl fisheries (e.g., Livingston et al, 2003).

The collecting, preserving, and identification of large volumes of material ashore is often not feasible, nor necessary if most common invertebrates can be identified at sea. MFish recognised the value of making better use of research trawl surveys and scientific observer records on commercial fishing vessels in order to improve knowledge of the distribution of benthic invertebrate species, and to assess changes in abundance as well as their presence / absence, over time.

The main aims of this project ENV200204 were to enhance the skills of seagoing researchers and MFish observers, and to produce identification aids to ensure that most organisms are identified correctly. It is hoped that the benthic guide project would provide an improved basis for quantifying and mapping the incidental catches of benthic invertebrate species in commercial and research trawls throughout the New Zealand EEZ. Initially 30 species were to be included in the guide. Subsequently the tender was revised to include 100 species, although excluding certain crab species as these were to be covered in a separate guide (Naylor et al. 2004). The project involved no collection of new data, but compiled material for the identification sheets from existing information.

11. Methods:

11.1 Identification of species for inclusion

The species likely to be encountered as incidental catch in trawl fishing were identified. A species list was constructed from the following: Ministry of Fisheries consultation documents that record invertebrates recently introduced into the QMS as well as species that have been identified for introduction in the near future, specimen collections to date from trawling (NIWA collections), species lists given in research voyage reports (e.g., Clark & Tracey 1993, Bagley & Hurst 1996, Grimes 1996), papers describing trawl bycatch composition (e.g., Probert et al. 1997, Cryer et al. 1999, Stevenson & Beentjes 2001), and observer reports of incidental invertebrate catch on commercial fishing vessels (e.g., Clark et al. 2000, Anderson et al. 2000), as well as common taxa from the taxonomic literature (e.g., Webber et al. 1990, Spencer

& Willan 1995, Child 1998, O'Shea 1999, Forest et al. 2000, McKnight 2000, Clark & McKnight 2001). The list was prioritised to take into account the known common groups from the above data, the experience of seagoing staff at NIWA, the availability of specialist advice, and illustrative material.

As noted in the project guidelines, a comprehensive guide cannot be completed in the first year – the programme will take several years to build towards a final product. Therefore, for this project an initial selection of around 100 common species or groups was made.

In determining what species or group to include we decided, in consultation with MFish, to select a number of species from a range of taxonomic groups, so that the most common fauna (irrespective of taxon) would be included in the first year, then the next most common the following year, and so on. This approach ensures that the common bycatch species can be immediately identified and recorded accurately, rather than some species only being covered when their taxon is included in a later version of the guide.

11.2. Production of the identification guide

A set of guide sheets have been produced for the species/higher taxonomic groupings selected from the prioritised list generated in 11.1. Where the fauna in New Zealand waters was not well known guides were produced that enable identification at Family or Genus level. The guide to each taxon contains the following information:

- Taxon name
- Higher classification
- 3 letter species code (MFish to approve codes that are new)
- Illustrations (line drawings or clear photographs)
- Main identification features
- Known distribution
- What looks similar to it and how to distinguish it from these
- Instructions concerning specimens to be retained or discarded
- Recommended handling and preservation methods
- Appropriate references

12. Results

12.1 Species for inclusion

The key groups included in the guide are presented in Table 1, and total ~106 species or higher taxa.

We note that the species composition of invertebrates changes with depth. The species commonly recorded inshore (e.g., Cryer et al. 1999, Stevenson & Beentjes 2001) are often different from those taken in middle depth or deepwater trawl surveys (e.g., Bagley & Hurst 1996, Clark et al. 1996), although a number of species do overlap.

The offshore fisheries for species like hoki, oreos and orange roughy are generally younger than the historic inshore fisheries, are still developing new fishing grounds, and are typically higher volume fisheries than inshore. Observers are common on the deepwater fisheries, and rarely cover inshore vessels. Therefore, the guide has focussed initially on deeper species, which makes it more useful for observers and some major offshore research trawl surveys, and enables better descriptions of the faunal composition less affected by fishing, as well as monitoring changes over time. The guide will extend to inshore species in future.

Identification information for four crab species not presented in the original crab guide were prepared under this project (ENV200204) and added to the crab guide. The four species were *Homola orientalis*, *Liocarcinus corrugatus*, *Yaldwynopsis spinimana*, *Paralomis zealandica*. The crab guide complements the benthic guide.

12.2 Production of the identification guide

Identification sheets were produced by staff at NIWA and other institutes where appropriate with expertise in that taxon.

The identification sheets were constructed assuming that they will be used by people with some biological training. It was felt unlikely that accurate identifications will be made by completely untrained people. Some general notes on morphological components needed for identifying species within a taxon are provided where necessary (e.g., labelled parts of a starfish). In addition to the specific guide sheets, descriptions are given that will enable people to distinguish one marine benthic phylum / order from another, and place organisms in the correct higher taxon. Examples of the index and phyla description, as well as 8 sheets are included here (see attached) to illustrate the format of the guide.

Data for each individual species or main group were entered into a species database. The database has been funded by NIWA independently of this project. Automatic extraction routines select the appropriate information from the database and format the guide sheets. Producing a guide in this way means any updates or edits can be made within the database and sheets easily reproduced. Each individual species sheet has been saved as a pdf file for reproduction in A4 size. Where possible, coloured photographs and / or line drawings have been used.

Technical terms are clearly explained in a set of annotated photos/line drawings for the major groups. The guide has an introductory section and a pictorial guide which provides a general description of benthic phyla. More detailed descriptions of the phyla Cnidaria and Echinodermata are included, as are illustrations of the most obvious characters unique to common prawns (Webber et al. 1990). We have attempted to ensure the format of the guide is compatible with the Observer Biological Data Collection manual. The MFish three letter species code format is used. For those species that do not have a code, an appropriate code was chosen and approved by MFish through the usual process.

The final version of the guide is provided in both a 'paper' (3 hard copies) and electronic format (pdf outfile).

13. Acknowledgements

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Table 1: Summary of species prepared for the benthic guide, listed by phylum and family. (n= 106). Common names; s, species; g, genus; f, family; f+, several families; c, class; o, order.

Phylum	Class	Family	Common name	Genus	Species	Code	Page
Porifera (sponges)	Demospongiae	Scleritodermiidae	Maroon pimpled ear sponge (s)	*Aciculites*	*pulchra*	APU	20
		Geodiidae	Convoluted ostrich egg sponge (s)	*Geodinella*	*vestigifera*	GVE	21
		Pachastrellidae	Chipped fibreglass matt sponge (s)	*Poecillastra*	*laminaris*	PLN	22
		Irciniidae	Rubbery brown thick fan sponge (s)	*Psammocinia*	cf. *hawere*	PHW	23
		Callyspongiidae	Airy finger sponge (s)	*Callyspongia*	cf. *ramosa*	CRM	24
		Crellidae	Orange frond sponge (s)	*Crella*	*incrustans*	CIC	25
	Hexactinellida	Euretidae	Lacey tube sponge (s)	*Eurete*	cf. *simplissima*	ESI	26
		Rossellidae	Floppy trumpet sponge (s)	*Bathydorus*	*fimbricatus*	GLS	27
Cnidaria (hydroids, corals, anemones)	Hydrozoa	Stylasteridae	Red hydrocoral (g)	*Errina*	spp.	ERR	32
		Stylasteridae	Spiny white hydrocoral (g)	*Lepidotheca*	spp.	LPT	33
	Anthozoa	Actiniidae	Smooth deepsea anemone (g)	*Bolocera*	spp.	BOC	34
		Actinostolidae	Deepsea anemone (f+)			ACS	35
		Hormathiidae	Warty deepsea anemone (s)			HMT	36
		Liponematidae	Deepsea anemone (f+)	*Liponema*	spp.	LIP	37
		Clavulariidae	Long polyp soft coral (g)	*Telesto*	spp.	TLO	38
		Order: Antipatharia	Black corals (o)			COB	39
		Corallidae	Precious coral (g)	*Corallium*	spp.	CLL	40
		Paragorgiidae	Bubblegum coral (s)	*Paragorgia*	*arborea*	PAB	41
		Chrysogorgiidae	Golden coral (f)	*Chrysogorgia*	spp.	CHR	42
		Isididae	Bamboo corals (f)			ISI	43
		Caryophyllidae	Crested cup coral (s)	*Desmophyllum*	*dianthus*	DDI	44
		Caryophylliidae	Bushy hard coral (s)	*Goniocorella*	*dumosa*	GDU	45
		Caryophylliidae	Deepwater branching coral (f+)	*Solenosmilia*	*variabilis*	SVA	46

Phylum	Class	Family	Common name	Genus	Species	Code	Page
Cnidaria (continued)		Dendrophylliidae	Deepwater branching coral (f+)	*Enallopsammia*	*rostrata*	ERO	47
		Flabellidae	Flabellum cup coral (g)	*Flabellum*	spp.	COF	48
		Oculinidae	Madrepora coral (s)	*Madrepora*	*oculata*	MOC	49
		Oculinidae	Deepwater branching coral (f+)	*Oculina*	*virgosa*	OVI	50
Annelida (sea worms)	Polychaeta	Eunicidae	Eunice sea-worm (g)	*Eunice*	(undescribed)	EUN	51
		Onuphidae	Quill worm (g)	*Hyalinoecia*	*tubicola*	HTU	52
		Polynoidae	Thermiphione scaleworm (g)	*Thermiphione*	(undescribed)	THE	53
Mollusca (snails, sea slugs, chitons, bivalves, octopus)	Amphineura		Chiton (c)			CHT	54
	Bivalvia	Limidae	Giant file shell (s)	*Acesta*	*maui*	AMA	55
		Pectinidae	Bivalve (c)	*Zygochlamys*	*delicatula*	ZDE	56
		Euciroidae	Bivalve (c)	*Euciroa*	*galatheae*	EGA	57
	Cephalopoda	Bathypolypodinae	Deepwater octopus (f+)	*Benthoctopus*	*tegginmathae*	BTE	58
		Octopodidae	Yellow octopus (s)	*Enteroctopus*	*zealandicus*	EZE	59
		Octopodidae	Deepwater octopus (f+)	*Graneledone*	spp.	DWO	60
		Octopodidae	Deepwater octopus (f+)	*Pinnoctopus*	*cordiformis*	OCT	61
		Opisthoteuthididae	Umbrella octopus (g)	*Opisthoteuthis*	spp.	OPI	62
	Gastropoda	Order: Nudibranchia	Sea slug, nudibranch (o)	Generic nudibranch		NUD	63
		Ranellidae	Gastropod (c)	*Fusitriton*	*magellanicus*	FMA	64
		Buccinidae	Gastropod (c)	*Aeneator*	*recens*	AER	65
		Buccinidae	Gastropod (c)	*Austrofusus*	*glans*	KWH	66
		Turbinellidae.	Gastropod (c)	*Coluzea*	*mariae*	CMR	67
		Volutidae	Volute (f)	*Alcithoe*	*larochei*	ALL	68
		Volutidae	Golden volute (s)	*Provocator*	*mirabilis*	GVO	69
		Calliostomatidae	Gastropod (c)	*Calliostoma*	*turnerarum*	CTN	70

Phylum	Class	Family	Common name	Genus	Species	Code	Page
Arthropoda (sea spiders, isopods, amphipods, prawns, lobsters, hermit crabs, barnacles)	Crustacea	Aristaeidae	Royal red prawn (s)	*Aristaeomorpha*	*foliacea*	AFO	72
		Aristeidae	Scarlet prawn (s)	*Aristaeopsis*	*edwardsiana*	PED	73
		Campylonotidae	Sabre prawn (s)	*Campylonotus*	*rathbunae*	CAM	74
		Glyphocrangonidae	Goblin prawn (s)	*Glyphocrangon*	*lowryi*	GLO	75
		Nematocarcinidae	Omega prawn (s)	*Lipkius*	*holthuisi*	LHO	76
		Nematocarcinidae	Spider prawn (g)	*Nematocarcinus*	spp.	NEC	77
		Nephropidae	Scampi (s)	*Metanephrops*	*challengeri*	SCI	78
		Oplophoridae	Subantarctic ruby prawn (g)	*Acanthephyra*	spp.	ACA	79
		Oplophoridae	Deepsea prawn (f+)	*Oplophorus*	spp.	ONO	80
		Palinuridae	Deep-water rock lobster (s)	*Projasus*	*parkeri*	PPA	81
		Pandalidae	Golden prawn (s)	*Plesionika*	*martia*	PLM	82
		Pasiphaeidae	Deepsea prawn (f+)	*Pasiphaea*	aff. *tarda*	PBA	83
		Polychelidae	Deep-sea blind lobster (s)	*Polycheles*	*suhmi*	PSU	84
		Scyllaridae	Prawn killer (s)	*Ibacus*	*alticrenatus*	PRK	85
		Solenoceridae	Jack-knife prawn (s)	*Haliporoides*	*sibogae*	HSI	86
		Gnathophausiidae	Mysid (o)	*Neognathophausia*	*ingens*	GNA	87
		Galatheidae	Krill, squat lobster (f)	*Munida*	spp.	MNI	88
		Galatheidae	Squat lobster (f)	*Uroptychus*	spp.	URP	89
		Scalpellidae	Acorn barnacle (s)	*Smilium*	*zancleanum*	BRN	90
		Paguridae	Hermit crab (f+)	*Diacanthurus*	*rubricatus*	DIR	91
		Parapaguridae	Hermit crab (f+)	*Sympagurus*	*dimorphus*	SDN	92
	Malacostraca	Lysianassidae	Amphipod (o)	*Eurythenes*	*gryllus*	EUG	93
		Aegidae	Fish biter (s)	*Aega*	*monophthalma*	AMO	94
		Serolidae	Spiny serolid isopod (s)	*Acutiserolis*	sp.	ACU	95
	Pycnogonida	Colossendeidae	Giant sea spider (s)	*Colossendeis*	sp.	PYC	96

Phylum	Class	Family	Common name	Genus	Species	Code	Page
Echinodermata (sea stars, brittle stars and basket stars, sea urchins, sea cucumbers, feather stars and sea lillies)	Asteroidea	Brisingidae, Hymenodiscidae, Novodiniidae, Freyellidae	Arm-less star (s)			BRG	99
		Asteriidae	Cat's-foot star (s)	*Cosmasterias*	*dyscrita*	CDY	100
		Asteriidae	Cross-fish (s)	*Sclerasterias*	*mollis*	SMO	101
		Zoroasteridae	Rat-tail stars (s)	*Zoroaster*	spp.	ZOR	102
		Benthopectinidae	Five-spined star (s)	*Benthopecten*	*pikei*	BPI	103
		Astropectinidae	Magnificent sea-star (s)	*Dipsacaster*	*magnificus*	DMG	104
		Astropectinidae	Abyssal star (s)	*Plutonaster*	*knoxi*	PLT	105
		Astropectinidae	Geometric star (s)	*Psilaster*	*acuminatus*	PSI	106
		Goniasteridae	Pentagon star (s)	*Ceramaster*	*Patagonicus patagonicus*	CPA	107
		Goniasteridae	Trojan star (s)	*Hippasteria*	*phrygiana*	HTR	108
		Goniasteridae	Rock star (s)	*Lithosoma*	*novaezelandiae*	LNV	109
		Goniasteridae	Sladen's star (s)	*Mediaster*	*sladeni*	MSL	110
		Odontasteridae	Pentagonal tooth-star (s)	*Odontaster*	*benhami*	ODT	111
		Solasteridae	Sun-star (f)	*Crossaster*	*multispinus*	CJA	112
		Solasteridae	Chubby sun-star (s)	*Solaster*	*torulatus*	SOT	113
	Crinoidea	Order: Comatulida	Feather star (o)			CMT	114
		Order: Isocrinida	Sea lily, stalked crinoid (o)			CRN	115
		Order: Millericrinida, Cyrtocrinida	Sea lilies, stalked crinoids (o+)			CRN	116
	Echinoidea	Cidaridae	Parasol urchin (s)	*Goniocidaris*	*parasol*	GPA	117
		Cidaridae	Umbrella urchin (s)	*Goniocidaris*	*umbraculum*	GOU	118
		Echinidae	Deepsea urchin (s)	*Dermechinus*	*horridus*	DHO	119
		Echinidae	Deepsea kina (s)	*Gracilechinus*	*multidentatus*	GRM	120
		Echinothuriidae	Tam-o-shanters (f+)			TAM	121
		Pedinidae	Banded-spine urchin (s)	*Caenopedina*	*novaezelandiae*	CNO	122
		Spatangidae	Microsoft mouse (s)	*Paramaretia*	*peloria*	PMU	123
		Spatangidae	Matheson's heart urchin (s)	*Spatangus*	*mathesoni*	SMT	124
		Spatangidae	Purple heart urchin (s)	*Spatangus*	*multispinus*	SPT	125
		Temnopleuridae	Fleming's urchin (s)	*Pseudechinus*	*flemingi*	PFL	126

Phylum	Class	Family	Common name	Genus	Species	Code	Page
Echinodermata (continued)	Holothuroidea		Sea cucumber (c)			HTH	127
	Ophiuroidea	Gorgonocephalidae	Waite's snake-star (s)	*Astrothorax*	*waitei*	AWA	128
		Gorgonocephalidae	Gorgons head basket-star (g)	*Gorgonocephalus*	spp.	GOR	129
		Ophiodermatidae	Deepsea brittle-star (s)	*Bathypectinura*	*heros*	BHE	130
Tunicata (sea squirts and salps)	Tunicata	Styelidae	Tunicate (c)	*Cnemidocarpa*	*bicornuta*	ASC	131
	Thaliacea	Salpidae	Salp (c)	*Pyrosoma*	*atlanticum*	PYR	132