
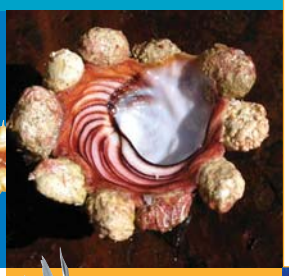
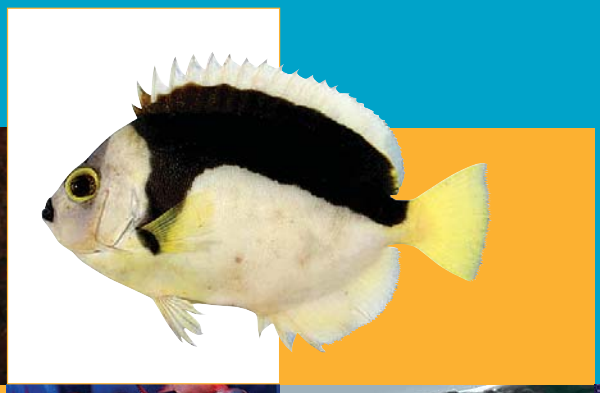



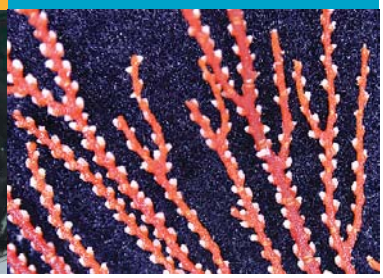

CSIRO

Explore lost worlds of the deep

NORFANZ VOYAGE

10 MAY TO 8 JUNE 2003

Final report to the Department of the Environment and Heritage (National Oceans Office) JUNE 2006

BIODIVERSITY SURVEY OF SEAMOUNTS & SLOPES OF THE NORFOLK RIDGE AND LORD HOWE RISE

MINISTRY OF FISHERIES
Te Tautiaki i nga tini a Tangaroa

NIWA
Taihoro Nukurangi

Australian Government
Department of the Environment and Heritage
National Oceans Office

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Final Report compiled and edited by Alan Williams, Karen Gowlett-Holmes and Franziska Althaus

Contents

Summary

The NORFANZ project aimed to provide a major increase in scientific knowledge of marine biodiversity in the region of the Norfolk Ridge and Lord Howe Rise. It has delivered, to a high standard, one of few regional-scale deep water benthic data sets for Southern Hemisphere waters. These data are primarily an extensive collection of benthic fishes and macro-invertebrate animals from a set of widely distributed sites located on seamounts and deep water ridges in the Tasman and southern Coral Sea between Australia and New Zealand. High resolution seabed maps, photographic images, and some environmental data characterise each sampling site.

The project successfully implemented a multi-disciplinary survey during 30 days at sea in 2003. The initial science progress was coordinated and communicated to the Founding Parties[1] in a set of preliminary reports; the field data were upgraded, managed, collated, documented and distributed to all project participants; a sustained level of international scientific and public interest stemmed from the communication program; and an initial set of science results are reported here. All this has been achieved in under three years from the inception of the project.

The logistical success of the project was underpinned by a survey conducted from a modern, multidisciplinary research vessel (RV *Tangaroa*) with accommodation for a large science team. It was implemented by an international science team with extensive seagoing experience, and a capable and cooperative team of ship's Officers and crew. Importantly, there was a very high level of collaboration and cooperation between administrative staff in the New Zealand and Australian funding and science agencies in the planning stages. The quality and quantity of the data collected stem from a multidisciplinary survey design that used cutting edge technology, most prominently multibeam sonar ('swath') mapping, to optimize the sampling effort (through pre-stratification of sampling sites and minimising failed catches).

The initial results, which include several published taxonomic papers, demonstrate a wealth of new and exciting information which has immediate application to understanding Australia's deep sea biodiversity and planning for

its conservation. Large numbers of species (1,618 macro-invertebrates, 588 fishes, and a large but unknown number of micro-invertebrates) comprise the NORFANZ collection. Collectively, they show that species richness is relatively high in the survey area: at least 11% of the 860 upgraded macro-invertebrate taxa are already confirmed as new species or new records for Australian waters (103 new species plus 35 new records). In addition, as many as 20% of fishes may be new species or new records for the sampling area (Roberts and Clark, 2006). A large proportion of species with restricted distributions ('spot' or 'apparent' endemics) suggests the region may be characterised by generally high levels of intra-regional endemism, demonstrated by sister speciation in biogeographically informative groups. However, this characteristic may be partly explained by undersampling – due primarily to the difficulties of taking physical samples from the often hard, rugged and complex terrains with bedrock outcrops and steep slopes at great depths.

Individual groups demonstrated special biodiversity values: for example in sponges (Porifera), there are highly localized species distributions, high levels of 'spot endemism', elevated numbers of 'living fossils' (Lithistids), and representation of highly specialized carnivorous sponges. Exciting aspects of ecology were also revealed, such as the microhabitat relationships between small crustaceans and glass sponges. In one obligate relationship, a male and female pair of the potentially new shrimp species *Spongicaris* sp. 1 are imprisoned in a glass sponge (*Hexactinellida sp. 51*): after settling as larvae inside the sponge's cavity, the shrimps develop to the point where they are unable to escape through the small holes in the sponge matrix. Folds in the body wall of a second, and previously unknown, large glass sponge *Lophocalyx* sp. represent the first habitat recorded for the crab *Miersiograpsus australiensis* and a rare shrimp *Hamiger novaezelandiae*. 'Rare' in this context is the first record of *Hamiger novaezelandiae* (Borradaile) since it was described in 1910, and the first ever record of its host (Bruce 2005).

Overall, spatial distribution patterns of fauna (macro-invertebrates and fishes) were influenced by sampling depth and latitude, and to a lesser extent by longitude. This indicated that the fauna as a whole varied more with depth, and from north to south, than between the two submarine ridges – the Lord Howe Rise and Norfolk Ridge. Based on preliminary analysis of the fish fauna, which

is better known than the invertebrate fauna, Roberts and Clark (2006) recognised four main distribution patterns: (1) Widespread; (2) Southern; (3) Norfolk Ridge; and (4) Restricted, and suggest that potential areas of endemism in the northern Tasman Sea include: (1) the seamount north of Middlesex Bank; (2) Lord Howe Island shelf and slope; (3) Norfolk Island shelf; (4) Norfolk Ridge, Wanganella Bank, and Reinga Ridge. The strongest faunal relationships based on affinities of fish species are: (1) Three Kings shelf, Reinga Ridge, West Norfolk Ridge and Lord Howe Plateau, with the northern New Zealand region; (2) Norfolk Ridge with northern New Zealand region; (3) northern Norfolk Ridge with New Caledonia and Coral Sea; (4) Lord Howe Island shelf with Australian shelf; and (5) seamount north of Middlesex Bank with Queensland shelf and Lord Howe Seamount chain. However, this assessment needs to be corroborated with data from groups that have prospectively high biogeographic information content (e.g. Last et al. 2005), but which have not yet been re-examined, e.g. the sharks and rays.

Despite its successes to date, the project's potential contribution to understanding biodiversity in the Tasman and Coral Seas region is far from complete. A large number of field identifications have not been upgraded (including 47% of the macro-invertebrate OTUs), and perhaps most importantly, more taxa need to be identified and described as *species*, enabling them to be compared to documented distributions. This is required to confirm patterns of true endemism at local or regional scales, and identify key areas for conservation purposes. The need includes reconciling coded identifications of taxa that are presently unique to many individual surveys undertaken in this region; for example, it is not possible to compare the vast majority of deep water benthic invertebrate groups between New Caledonia, New Zealand and Australia. Greater progress could have been made in this project with a longer term planning view beyond the survey itself, including a realistic level of resourcing for the subsequent taxonomic, analytical and coordinating work. Most of what has been accomplished since the survey has not been funded by the NORFANZ project. An attempt should be made to continue the coordinated upgrade of these data and subsequent biogeographic analysis of this data set to maximize return on investment. Ideally this will be to a timeline that enables uptake of the results in the bilateral planning conservation initiatives currently under discussion for the Tasman and Coral Seas regions. The successes and

lessons learned from this cutting-edge survey have been contributed to discussion of future biodiversity surveys at the Census of Marine Life – Australian Marine Science Association workshop on this subject held in Darwin, in July 2005.

Strong evidence for high biological heterogeneity in the northern Tasman Sea – for benthic invertebrates and fishes – is provided by a variety of distribution patterns of major taxa between sites, the possibility of several potential areas of endemism, and the affinities to several regional faunas adjacent to the survey area. High heterogeneity, coupled with the generally high levels of species richness and large numbers of new species and new locational records, demonstrate the area has a high conservation value. Results from NORFANZ have contributed to assessing the conservation value of a prospectively unique marine area of the Australian Commonwealth Marine Jurisdiction – the Norfolk Island Seamounts area (DEH 2004) – in the context of developing Australia's National Representative System of Marine Protected Areas (NRSMPA). The conservation values assessment found the Norfolk Island Seamounts area (NISA) possesses biodiversity values worthy of protection, and would contribute to the representativeness and comprehensiveness of the NRSMPA (Williams et al. 2006). The assessment also found that the NISA area could form a prospectively valuable component of an international deep sea biodiversity conservation initiative in the Tasman Sea that could include areas of another nation's EEZ and/or the high seas (Williams et al. 2006).

[1]**Founding Parties**: Australia's National Oceans Office – NOO; Australia's CSIRO Marine and Atmospheric Research – CMAR; New Zealand Ministry of Fisheries – Mfish; and New Zealand's National Institute of Water and Atmospheric Sciences – NIWA