

## Aquatic Environment

<b>Code</b>	<b>Title</b>
<b>ENV2009-04</b>	Trends in relative mesopelagic biomass using time series of acoustic backscatter data from trawl surveys
<b>ENV2009-08</b>	Status of the New Zealand ocean environment: update 2009
<b>IDG2009-01</b>	Finfish field identification guide: Part 2

**Project:** Trends in relative mesopelagic biomass using time series of acoustic backscatter data from trawl surveys

**Project Code:** ENV2009/04

**Start Date:** 01 October 2009

**Completion Date:** 30 September 2010

**Vessel Use:** None

**Overall Objectives:**

1. To determine variability in the relative biomass and species composition of the mesopelagic fish community in relation to commercial fishstock abundance and distribution, and to climatic and oceanographic variables.

**Specific Objectives:**

1. To evaluate relative changes in abundance of mesopelagic fish and other biological components from acoustic records collected during Chatham Rise and Sub-Antarctic trawl surveys.
2. To explore links between trends in mesopelagic biomass and climate variables and variations, and condition indices of commercial species in the Chatham Rise and Sub-Antarctic areas.

**Reporting Requirements**

Specific Objectives 1 and 2

1. Complete analyses and submit a Research Progress Report to MFish, as specified in Research Reporting Form 4 with a coversheet as specified in Research Reporting Form 10 by 31 November 2009. Electronic and hard copy formats of the presentation are required.
2. To present the results to MFish Aquatic Environment Working Group by 31 March 2009.
3. Submit a draft Final Research Report as specified in Research Reporting Form 5, or draft AEBR with an agreed format, to MFish, by 30 June 2010. Electronic and hard copy formats of reports are required.

**Project Update Reports**

No Project Update Reporting is required for this project.

## **Work In Progress Reports**

Monthly Work In Progress Reporting is required for this project in accordance with the Conducting Research with the Ministry document.

## **Data Reporting**

To submit any data generated, collected or modified during the course of this project to the Research Data Manager, MFish by 31 October 2010.

## **Rationale:**

### *General*

Understanding change in the marine ecosystem is becoming increasingly important to provide context for fisheries management and decision making about sustainable fishing. Indicators are important for monitoring different types of change, and more than one type of indicator is required, particularly within the context of climate change. This project seeks to further our understanding of natural variability in productivity in relation to climate and how this translates along foodchains to mesopelagic fish and, ultimately to fish that feed on them. Section 13 (2) of the Fisheries Act requires the Minister to “set a total allowable catch that maintains the stock at or above a level that can produce the maximum sustainable yield, having regard to the interdependence of stocks”. In this context, mesopelagic fishes and the commercial species that forage on them can be considered interdependent stocks.

Trends in mesopelagic abundance and distribution in relation to climate and oceanographic conditions, and the role of mesopelagic fish as a food source, are important pieces of information that provide broader insight to interpreting trawl survey trends of fish abundance. This project has links to the Chatham Rise trophic study, Biodiversity Project ZBD2004/02 and planned FRST funded work on links between primary and secondary productivity (*Coasts and Oceans* OBI – plankton, detritus, sediment infauna). The project covers the analysis of existing acoustic data collected at 12 and 38 KHz that has been collected and stored routinely during annual trawl surveys.

The existing acoustic database has the potential to determine both the relative abundance of mesopelagic fish from year to year and the distribution throughout the water column and survey areas. Mesopelagic fish form a major component of the diet of important fishstocks such as hoki, yet little is understood about how the distribution and abundance of mesopelagic fish influences the spatial distribution, abundance and growth of predators such as hoki. The distribution of mesopelagic fish may also influence the distribution of predator species in the water column, in turn affecting both vulnerability and catchability of trawl survey fish species that are assumed to be constant from year to year. The links between mesopelagic biomass and predator-prey consumption estimates are important for input to trophic models.

Trawl surveys conducted for input to stock assessment collect data on relative abundance and growth rates of key species which are directly used in stock assessment models. However, a range of peripheral information is also collected that should be

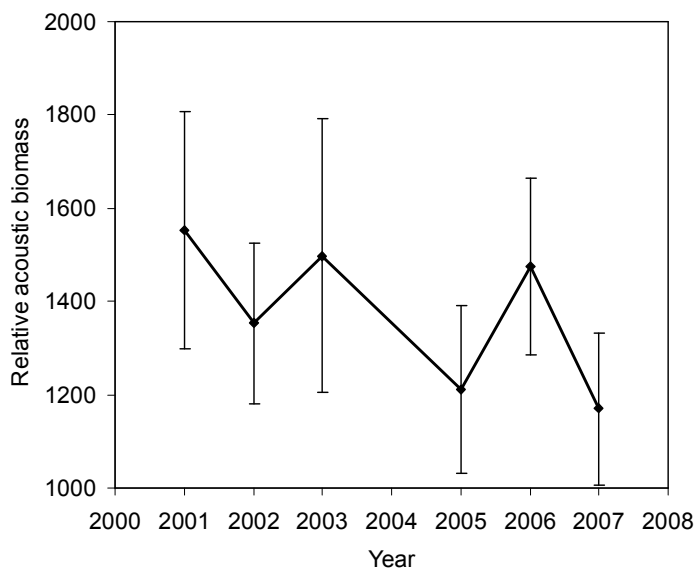
analysed to determine what other environmental and biological signals are relevant to the interpretation of changes in biomass, and also improve understanding of how the system functions as a whole. Acoustic data collected from the water column during trawl surveys provides an invaluable data source on annual variations in catchability, spatial distribution of prey, and variations in productivity. By exploring these data in conjunction with hydrographic data collected during the surveys (e.g. temperature, conductivity, water mass location) and remotely sensed data available from the survey time periods (e.g. SST, chlorophyll a), links to climate and hydrographic conditions may also be discernible.

Mesopelagic biomass provides an indicator of food availability to piscivorous fishstocks. Trends and changes in mesopelagic biomass may be linked to climate cycles and influence fish condition. This provides background information in which to make assessments about the status of fishstocks and changes in ecosystem indicators.

### *Objective 1*

Acoustic data have been collected during annual trawl surveys of both the Chatham Rise and Sub-Antarctic since 2000/01. These acoustic data could yield useful information on variability or trends in the biomass of mesopelagic prey in these areas. Work conducted in 2006/07 under NIWA's *Coasts and Oceans* OBI successfully developed relative indices of mesopelagic biomass for Chatham Rise trawl surveys from 2001 to 2007 (excluding 2004 when no data were collected, Figure 1). The results from a FRST-funded voyage in May–June 2008 are being used to improve our knowledge of species composition and distribution of mesopelagic species contributing to the acoustic backscatter on the Chatham Rise (previously Objective 2 for ENV2006/06). This will help refine acoustic estimates of abundance for use in trophic modelling, in conjunction with results from the feeding study ZBD2004/02.

Similar acoustic data exist for the Sub-Antarctic trawl series but have not been analysed in any detail and are not covered by the *Coasts and Oceans* OBI. Analyses of all Sub-Antarctic data from December 2000 to December 2007, and extension of the Chatham Rise time-series to include the January 2008 survey would be covered by this project.



**Figure 1: Time-series of estimated mesopelagic fish biomass from acoustic data collected during Chatham Rise trawl surveys 2001–07. Unpublished NIWA data.**

*Objective 2:*

Changes in mesopelagic fish abundance and distribution should be assessed within the context of climatic and oceanographic variation in the survey areas. Willis et al. (2007) suggested that Net Primary Production has been decreasing in New Zealand, and climate trends and cycles are being reviewed under project ENV2007-04. The findings from these two projects should be considered in this assessment. Data collected during surveys from CTDs and remote satellite derived data should be analysed in conjunction with the acoustic data. Trends in the condition of fish (e.g., length weight relationships and liver condition index) should also be assessed spatially and temporally in relation to catch rate and mesopelagic prey abundance and distribution.

*Weighting of Objectives:*

Weightings indicate the relative importance of each of the objectives. The weightings for the objectives in this project are (in order): 0.5, 0.5.

**Project:** Status of the New Zealand ocean environment: update 2009

**Project Code:** ENV2009/08

**Start Date:** 01 October 2009

**Completion Date:** 30 September 2010

**Vessel Use:** None

**Overall Objectives:**

1. To summarise trends in climatic and oceanographic conditions that may affect ocean productivity, fish distribution and fish abundance in New Zealand.

**Specific Objectives:**

1. To update climatic and oceanographic indices on appropriate time scales that characterise the marine environment and identify trends or changes of potential significance to fisheries sustainability.
2. To develop and validate indices of ocean productivity that may improve the prediction of fisheries productivity
3. To assess relationships between indices of ocean productivity and recruitment for fisheries where such data are available

**Reporting Requirements**

Specific Objectives 1, 2 and 3

4. Complete analyses and submit a Research Progress Report to MFish, as specified in Research Reporting Form 4 with a coversheet as specified in Research Reporting Form 10 by 31 November 2009. Electronic and hard copy formats of the presentation are required.
5. To present the results to MFish Aquatic Environment Working Group by 31 March 2009.
6. Submit a draft Final Research Report as specified in Research Reporting Form 5, or draft AEBR with an agreed format, to MFish, by 30 June 2010. Electronic and hard copy formats of reports are required.

**Project Update Reports**

No Project Update Reporting is required for this project.

## **Work In Progress Reports**

Monthly Work In Progress Reporting is required for this project in accordance with the Conducting Research with the Ministry document.

## **Data Reporting**

To submit any data generated, collected or modified during the course of this project to the Research Data Manager, MFish by 31 October 2010.

### **Rationale:**

#### *General*

Climate change and climate variability are key drivers in New Zealand's oceanic environment, and both are likely to affect fisheries productivity. If these effects are to be taken into account in fisheries management, timely information on regime shifts, natural cycles, and long term trends are required. Most of New Zealand's most important fisheries are managed under the QMS. For these stocks, s13 (2) of the Fisheries Act 1996 mandates that "the Minister shall set a total allowable catch that maintains the stock at or above a level that can produce the maximum sustainable yield, having regard to the interdependence of stocks". For stocks below  $B_{msy}$ , rebuilding periods should have regard to any environmental conditions affecting the stock.

Distinguishing natural variability brought about by climatic cycles, regime shifts and other climate driven processes from long term trends associated with climate change is part of a study to assess variations in oceanographic conditions that are relevant to fisheries in New Zealand waters (ENV2007/04). Some of the new indices presented to the Aquatic Environment Working Group through the ENV2007/04 project, such as the upwelling index, have yet to be validated. Other potential tools include direct measures of primary productivity from ocean colour.

#### *Objective 1*

It is proposed here that the analysis done under project ENV2007/04 be updated, and include a summary section that provides an overview of the status of the marine environment backed up with full descriptions of each index and how these have individually changed over time.

#### *Objective 2*

While general predictions about the effects of climate variation on marine resources have been made for New Zealand fisheries through correlative studies with physical factors such as wind speed, surface temperature and so on (SAM2005/02), the key drivers and mechanisms underpinning processes such as reproductive success or larval survival remain poorly understood. The development of high resolution remote sensing capability in New Zealand in recent years means that time series which allow investigation of phenomena such as localised upwelling, and net primary productivity can now be carried out. This project will seek to explore such options, validate them and develop productivity indices in one or more key fisheries.

### *Objective 3*

Recruitment indices for some species are available from models or trawl surveys. The trends provide an indication of spawning success in a range of fisheries that is assumed to be driven by environmental conditions in some way, even though the specific driving mechanisms are not well understood. Even in the case of fisheries such as snapper and red cod where sea surface temperatures are good predictors of recruitment, the mechanism which results in good recruitment is not well understood. Nevertheless, as time series lengthen, patterns of recruitment and patterns in oceanic indices may become clearer and it is useful to be aware of them. This exercise, if repeated on a regular basis, may also provide a basis for hypothesis testing and the development of case specific studies to investigate the linkages between the marine environment and fisheries success. The work under this objective will take account of relevant developments in project SAM2005/02 (*Effects of climate on commercial fish abundance*) but will not duplicate that study.

### *Weighting of Objectives:*

Weightings indicate the relative importance of each of the objectives. The weightings for the objectives in this project are (in order): 0.5, 0.3, 0.2

**Project:** Finfish field identification guide: Part 2

**Project Code:** IDG2009/01

**Start Date:** 1 July 2009

**Completion Date:** 30 September 2010

**Vessel Use:** None

**Overall Objectives:**

1. To produce a field guide for fish species in New Zealand

**Specific Objectives:**

1. To complement the field identification guide under IDG2006/01 with the remaining 120 fish species caught by commercial fishers in New Zealand waters.

**Reporting Requirements**

Specific Objective 1

7. Agree requirements, species list, and format with MFish, by 31 August 2009.
8. To present a draft template of lay-out to MFish, by 31 October 2009.
9. Submit a Research Progress Report to MFish, as specified in Research Reporting Form 4 with a coversheet as specified in Research Reporting Form 10 by 31 November 2009. Electronic and hard copy formats of the presentation are required.
10. Submit a draft Final Research Report as specified in Research Reporting Form 5, and draft Guide in the agreed format, to MFish, by 30 June 2010. Electronic and hard copy formats of reports are required.

**Project Update Reports**

No Project Update Reporting is required for this project.

**Work In Progress Reports**

Monthly Work In Progress Reporting is required for this project in accordance with the Conducting Research with the Ministry document.

**Data Reporting**

To submit any data generated, collected or modified during the course of this project to the Research Data Manager, MFish by 31 October 2010.

## **Rationale:**

### *General*

This project provides basic biological information for fishery characterisation of trawl and other fisheries. It is consistent with the Aquatic Environment Research and Harvest Levels sections of the Ministry of Fisheries Strategic Research Directions document. It is also consistent with the 2005 Strategy for Managing the Environmental Effects of Fishing (SMEEF).

This work is high priority for several groups within the Ministry and is also considered urgent. In the past, priority has been given to other groups of organisms (e.g., deepsea invertebrates; offshore crabs) in support of other projects, but there is a clear need within the Ministry's Observer, Research Data Management, and Fisheries Operations groups, as well as to fishers, for a definitive fish identification guide aimed at non-specialists.

The crown funded project IDG2006/01 is developing identification sheets for common trawl species (248 species) and for surface fishes and sharks (97 species) and is nearing completion. Discussion with stakeholders and MFish Observers during the early development of the project indicated that for the guide to be comprehensive, there were approximately 500 fish species in total that should be in the guide. This has since been revised to ~450 species. Here it is proposed to complete the task and develop ID Sheets for the remaining 120 species (latest estimate of numbers). Options for naming this 'Part 2' of the guide would be explored so as not to delay publication of the species already included under IDG2006/01. This guide will include lesser known rattail and shark species, as well as numerous larger midwater species, but will exclude all myctophids.

### *Objective 1*

This pictorial field guide of all QMS species, and fish species encountered in commercial trawling. This guide would not replace any plans for formal taxonomic description and publication of these species. Images and information should be held in a national database that permits electronic access as well as producing a hard copy field guide. It would be difficult to obtain colour images for many of these species. The biggest challenge will be to obtain images of these species.

### *Weighting of Objectives:*

Weightings indicate the relative importance of each of the objectives. The weightings for the objectives in this project are (in order): 1.0