

Project: Hoki stock structure

Project Code: HOK2006/05

Start Date: 1 December 2008

Completion Date: 31 December 2009

Vessel Use:

Overall Objectives:

1. To determine stock structure and spawning fidelity of hoki (*Macruronus novaezelandiae*)

Specific Objectives:

1. To further develop methods to determine stock structure of hoki in New Zealand

Reporting Requirements:

Research Reporting

Objective 1

1. To present the results to the Hoki Working Group at meetings in Wellington in September 2009 as required.
2. To submit to the Chief Scientist MFish a Final Research Report as specified in Research Reporting form 5 or a draft Fishery Assessment Report as specified in Research Reporting form 7 by 31 November 2009.

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 December 2009.

Rationale:

Hoki support New Zealand's largest fishery, with a current TACC of 90 000 t. Although managed as a single stock under one TACC, hoki are assessed as two stocks (western and eastern), and there is an industry agreement on the catch split between stocks. Hoki

on the west coast of the North and South Islands and in the area south of New Zealand, including Puysegur Bank, Snares Shelf, and Campbell Plateau, are assumed to be one stock unit, the “western stock”. The east coast of the South Island, Mernoo Bank, Chatham Rise, Cook Strait, and the east coast of the North Island up to North Cape are assumed to contain the “eastern stock”. Immature hoki (2–4 years) from both “stocks” occur together on the Chatham Rise.

Morphometric and ageing studies have found consistent differences between adult hoki from the two main dispersed areas (Chatham Rise and Southern Plateau), and from the two main spawning grounds in Cook Strait and west coast South Island (WCSI). These differences demonstrate that there are two sub-populations of hoki. Whether they reflect genetic differences between the two sub-populations, or are the result of environmental differences between the Chatham Rise and Southern Plateau, is not known. The chemistry of otoliths from the WCSI and Cook Strait stocks is similar (Kalish et al. 1996), and no genetic differences were detected between spawning stocks (Smith et al. 1981, 1996).

It is not known whether mature fish return to their natal spawning grounds. Two pilot studies appeared to provide support for the hypothesis of spawning stock fidelity for the Cook Strait and WCSI spawning stocks. Smith et al. (2001) found significant differences in gill raker counts, and Hicks & Gilbert (2002) found significant differences in measurements of otolith zones, between samples of 3 year-old hoki from the 1997 year-class caught on the WCSI and in Cook Strait. However, when additional year-classes were sampled, differences were not always detected (Hicks et al. 2003). It appears that there are differences in mean number of gill rakers and otolith measurements between stocks, but, due to high variation, large sample sizes would be needed to detect these (Hicks et al. 2003).

There is a range of tools for determining stock relationships within marine fishes. Some tools measure characters that are determined late in the life cycle and are inappropriate for determining natal site fidelity. These methods include morphometrics, growth rates and parasites. Two other methods that have been widely applied to stock discrimination are genetics and otolith microchemistry. Both have been tested in hoki.

Initial genetic approaches using allozymes (Smith et al. 1981) and mtDNA haplotypes (Smith et al. 1996) found no significant regional differentiation in hoki, but a low exchange rate between stocks could reduce genetic differentiation. Lack of genetic differentiation is typical of many marine species with long pelagic juvenile stages and opportunities for gene flow.

Recent advances in microchemistry technology allows the analysis of discrete points within whole otoliths, and it may be possible to determine if hoki produced on different spawning grounds acquire a different chemical signatures.

Objective 1

Identifying the proportion of eastern and western fish in the area of mixing on the Chatham Rise is of great interest to improve the stock assessment of hoki. A method to discriminate between these fish is required with the further need to link these to the various spawning grounds.

References

- Hicks, A.C.; Gilbert, D.J. (2002). Stock discrimination of hoki (*Macruronus novaezelandiae*) based on otolith ring measurements. *New Zealand Fisheries Assessment Report 2002/2*. 31p.
- Hicks, A.C.; Smith, P.J.; Horn, P.L.; Gilbert, D.J. (2003). Differences in otolith measurements and gill raker counts between the two major spawning stocks of hoki (*Macruronus novaezelandiae*) in New Zealand. *New Zealand Fisheries Assessment Report 2003/7*. 23 p.
- Kalish, J.M.; Livingston, M.E.; Schofield, K.A. (1996). Trace elements in the otoliths of New Zealand blue grenadier (*Macruronus novaezelandiae*) as an aid to stock discrimination. *Marine and Freshwater Research* 47: 537–542.
- Smith, P.J.; Bull, B.; McVeagh, S.M. (2001). Evaluation of meristics characters for determining hoki stock relationships. Final Research Report for Ministry of Fisheries Research Project HOK1999/05 Objective 1. (Unpublished report held by Ministry of Fisheries, Wellington.)
- Smith, P.J.; McVeagh, S.M.; Ede, A. (1996). Genetically isolated stocks of orange roughy (*Hoplostethus atlanticus*), but not of hoki (*Macruronus novaezelandiae*), in the Tasman Sea and southwest Pacific Ocean around New Zealand. *Marine Biology* 125: 783–793.
- Smith, P.J.; Patchell, G.; Benson, P.G. (1981). Genetic tags in the New Zealand hoki *Macruronus novaezelandiae*. *Animal Blood Groups and Biochemical Genetics* 12: 37–45.

Weightings

The weighting for the only objective in this project is 1.0

Project: Characterisation and fishery monitoring of middle depth species

Project Code: MID2008/01

Start Date: 01 December 2008

Completion Date: 31 December 2009

Vessel Use: None

Overall Objectives:

1. To review the status of middle depth Fishstocks not routinely assessed (arrow squid and barracouta are the species chosen for this project for review).

Specific Objectives:

1. To characterise the New Zealand barracouta fisheries by analysis of commercial catch and effort data up to 2007/08 including:
 - To carry our CPUE analyses for the major fisheries (Fishstocks) where appropriate.
 - To review the indices from CPUE analyses, all relevant research trawl surveys and Observer logbooks to determine any trends in biomass estimates, size frequency distributions or catch rates.
 - To review stock structure using data accessed above and any other relevant biological or fishery information.
 - To assess the availability and utility of developing a series of age frequency distributions from trawl survey and Observer collected otoliths.
 - To make recommendations on future data requirements (including recommendations for annual levels of Observer sampling) and methods for monitoring the stocks.
2. To characterise the New Zealand arrow squid fisheries by analysis of commercial catch and effort data up to 2007/08 including:
 - To carry our CPUE analyses for the major fisheries (Fishstocks) where appropriate.
 - To determine the feasibility of in season review of TACC levels using size frequency distributions and catch rates from the commercial fishery.
 - To review stock structure using data accessed above and any other relevant biological or fishery information.
 - To make recommendations on future data requirements (including recommendations for annual levels of Observer sampling) and methods for monitoring the stocks.

Reporting Requirements: Research Reporting

Objective 1

1. To present the results to the Middle Depths Working Group at meetings in Wellington in September 2009 as required.
2. To submit to the Chief Scientist MFish a draft Working Group Report as specified in Research Reporting form 8 by 30 September 2009.
3. To submit to the Chief Scientist MFish a Final Research Report as specified in Research Reporting form 5 or a draft Fishery Assessment Report as specified in Research Reporting form 7 by 30 September 2009.

Objective 2

3. To present the results to the Middle Depths Working Group at meetings in Wellington in September 2009 as required.
4. To submit to the Chief Scientist MFish a draft Working Group Report as specified in Research Reporting form 8 by 30 September 2009.
5. To submit to the Chief Scientist MFish a Final Research Report as specified in Research Reporting form 5 or a draft Fishery Assessment Report as specified in Research Reporting form 7 by 30 September 2009.

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 December 2009.

Rationale:

Many of the middle depth fisheries are of moderate size or value compared to the hoki, hake, ling and southern blue whiting fisheries and are not routinely monitored or assessed. This project is designed to ensure that data available for monitoring the moderately important middle depth species are routinely summarised and assessed on a 5 year rotating schedule. This will allow for research needs relevant to current management issues to be appropriately assessed.

The proposed suite of species to be covered by this project includes arrow squid, barracouta, blue warehou, frostfish, southern gemfish, ghost sharks, lookdown dory, ribaldo, silver warehou, and white warehou. The medium term research plan lists the requirements for future research for each species. Updating the fishery characterisations for 2 species each year will ensure that, as a minimum, they are all updated every 5 years.

The most recent reports on characterisations and other stock assessment research for the species covered by this project are:

Species	Characterisation	Other stock assessment research
Arrow squid	1988,1995 1997 (Japanese)	CPUE 2001 <i>N. sloanii</i> Age and growth 1992 (Japanese)
Barracouta	1988 BAR1 2002	Tagging 1989 BAR 5 CPUE SI stock structure 2002 CPUE BAR1 2002 CPUE BAR5 1999
Blue warehou	2005	Stock assessment 1999 WAR3 Age methodology 1998
Frostfish	2001	Biology, commercial landings 1998
Gemfish – southern	1998	Climate and recruitment 1999
Ghost shark – dark – pale	2003 2003	Ageing technique 2001
Lookdown dory	None	Ageing (LDO2004/01)
Ribaldo	2006 (Up to 2002-03)	Ageing (RIB2007/01)
Silver warehou	MID2007-03	SWA 3 & 4 (only) SWA 1 Stock structure 2001 Ageing methodology 1996
White warehou	2005	Ageing & stock assessment 1999

Based on the information needs required to manage these fisheries in the short-term, arrow squid and barracouta have been chosen for full characterisation in 2008-09 MID2008/01.

Objective 1

Barracouta are caught in coastal waters around mainland New Zealand, The Snares and Chatham Islands, down to about 400 m. Landings have increased over the past three years with total reported landings nearly 30 000 t in 2006–07.

Catches have generally been well below the TACC in BAR 1, which suggests that the current catch levels are sustainable. In BAR 4 the catch increased in 2006–07 to the level of the TACC for the first time since 1986–87. The landings in the previous 4 years were below 1000 t. In BAR 5 and BAR 7 recent catch levels have exceeded the TACC in 2 of the last 3 years. It is not known whether these higher catches are sustainable.

The stock status was reported in the 2008 Plenary as follows:

Estimates of current and reference biomass are not available for any barracouta stocks and therefore it is not known if current TACCs and recent catches are sustainable or whether they are at levels which will allow the stocks to move towards a size that will support the maximum sustainable yield.

The objective of this project is to describe the main fisheries for barracouta and determine by what means the stocks can be monitored in the long term to determine whether the TACCs are appropriate in each area. The working group report should also be updated to reflect the latest information available.

Objective 2

The objective of this project is to describe the main fisheries for arrow squid and determine whether in-season management can be used to better exploit the available resource in years when the stock is more abundant. The current system of increasing TACCs is fairly *ad hoc* and not based on a scientific assessment of the prevailing catch rates and size distribution data from the fishery. The working group report should also be updated to reflect the latest information available.

The last characterisation of this fishery was completed by Langley (2001) using catch and effort data from trawl and squid jig vessels.

Reference

Langley, A.D. 2001: Summary of catch and effort data from the SQU 1J, SQU 1T, and SQU 6T fisheries for 1989-90 to 1999-2000. *NZ Fisheries Assessment Report* 2001/51 45p.

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: Stock assessment of southern blue whiting

Project Code: SBW2008/01

Start Date: 1 December 2008

Completion Date: 30 September 2009

Vessel Use: None

Overall Objectives:

1. To carry out stock assessments of southern blue whiting (*Micromesistius australis*) including estimating biomass and sustainable yields.

Specific Objectives:

1. To determine catch at age from the commercial fisheries at Campbell Island, Auckland Island, Bounty Platform, and Pukaki Rise for 2007/08 from samples collected at sea by the Observer Programme and other sources, with a target coefficient of variation (c.v.) of 20 % (mean weighted c.v. across all age classes).
2. To update the stock assessment of the Bounty Platform stock, including estimating biomass and sustainable yields.

Reporting Requirements:

Research Reporting

Objective 1 & 2

1. To present the results to the Middle Depths Working Group at meetings in Wellington in March-April 2009 as required.
2. To submit to the Chief Scientist MFish a draft Working Group Report as specified in Research Reporting form 8 by 30 April 2009.
3. To submit to the Chief Scientist MFish a Final Research Report as specified in Research Reporting form 5 or a draft Fishery Assessment Report as specified in Research Reporting form 7 by 30 September 2009.

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 December 2009.

Rationale:

General

This fishery was developed in the early 1970's by the Soviet fleet. Landings have fluctuated considerably, peaking at 75,000 t in the 1991/92 fishing year, when almost 60,000 t was taken from the Bounty Platform stock. From 1992/93 to 1995/96 an annual catch limit of 32 000 t applied, but this was increased for the 1996/97 fishing year to 58 000 t, as the stock assessment indicated higher yields were available. Southern blue whiting was introduced into the QMS in 1999 with separate TACs for each of the four main stocks in SBW6. TACCs have been set at the level of the estimated CAY in most stocks each year resulting in fluctuating total catch limits. The TACC for Bounty Platform was increased to 10 000 t from 1 April 2008.

There is uncertainty over the estimates of current stock size for all four stocks. This is due to imprecision in the acoustic data and to uncertainty over recent and future recruitment. The fishery is strongly recruitment driven and is currently dependent on less than 5 year classes, compared with up to 15 year classes in the past. The most recent stock status for the Bounty Platform stock is described as follows in the 2008 Plenary report:

A survey carried out by the fishing industry in August 2007 indicated that there has been a very large increase in biomass in this stock since 2004. Catch-at-age data suggest that a strong year class (born in 2002) has recently entered the fishery. However, the stock assessment model was unable to reconcile the very large biomass increase with the series of observed catch-at-age data, and so estimates of the size of this year class and the current biomass are very uncertain.

The 2004 stock assessment estimated a virgin stock size of 86 000 t based on the mean recruitment estimated from 1988 to 2000. The range of estimates of biomass from the 2007 acoustic survey are above that level. The most conservative estimate is about 60% of the estimated virgin stock size and leads to the conclusion that the biomass of this stock is well above B_{MSY} .

Without a formal stock assessment it is not possible to quantify the size of the SBW 6B stock and to determine a CAY for the fishery. However, conservative estimates of CAY were made by applying the reference fishing mortality to a conservative estimate of current vulnerable biomass based directly on the acoustic survey. The range of CAY was 15 000 to 20 000 t. The Working Group concluded that the risk that the biomass would drop below $20\%B_0$ in 2008 would be negligible, if the TACC was based on these yield estimates.

Objective 1

A time series of catch at age data has been developed for all the fisheries using otolith samples collected by the Observer Programme. Catch at age data provides information on the year class strength of recent recruitment to the fishery. These are important in future predictions of stock biomass and yield.

Objective 2

In 2009, another year of catch at age data will be available from objective 1. For the Bounty Platform stock an estimate of biomass from the 2008 industry acoustic survey may also be available to update the assessment.

Weighting of Objectives:

Weightings indicate the relative importance of each of the objectives. The weightings for the objectives in this project are (in order): 0.3, 0.7