HOKI AND MIDDLE DEPTH FISHERIES

PROPOSED PROJECTS FOR 2005/06

Code	Title	Priority
HOK2005/01	Hoki population modelling and stock assessment	High
HOK2005/02	Estimation of hoki and middle depth fish abundance on the Chatham Rise using trawl surveys	High
HOK2005/03	Estimation of spawning hoki biomass using acoustic surveys	High
HAK2005/01	Stock assessment of hake	High
LIN2005/01	Stock assessment of ling	High
MDT2005/01	Estimation of hoki and middle depth fish abundance on the Southern Plateau using trawl surveys	High
MID2005/01	Determination of catch at age in hoki, hake and ling fisheries	High
MID2005/02	Catch sampling and ageing of hoki and ling in the Cook Strait fishery	High
SBW2005/01	Stock assessment of southern blue whiting	High
SBW2005/02	Biomass estimation of southern blue whiting using acoustic surveys	High
OBS2005/03	Research Observer Services – Hoki and Middle Depth Fisheries	High

Project: Hoki population modelling and stock assessment

Project Code: HOK2005/01

Start Date: 1 October 2005

Completion Date: 30 September 2006

Vessel Use: None

Overall Objectives:

1. To determine biomass, long-term sustainable yields and optimum exploitation rates of hoki (*Macruronus novaezelandiae*) stocks and to model the response of hoki stocks to exploitation.

Specific Objectives:

1. To update the stock assessment of hoki in the year 2006, including estimates of biomass, risk and yields.

2. To provide a descriptive analysis of the hoki fishery in the 2004-05 fishing year.

Rationale:

General

Hoki is New Zealand's largest fishery with a current TACC of 100,000 t. This is much less than catch levels in recent years and reflects the current poor status of the western stock estimated in the 2004 stock assessment. Although managed as a single stock, in the past hoki have been assessed as two stocks, western and eastern. The current hypothesis is that juveniles from both stocks mix on the Chatham Rise and recruit to their respective stocks as they approach sexual maturity.

Historically, the main fishery for hoki has operated from mid-July to late August on the west coast of the South Island (WCSI) and in Cook Strait where hoki aggregate to spawn. Largest catches were previously from the western stock, however, in recent years the fishery has been carried out all year on the Chatham Rise and catches from the eastern stock have increased. Industry has attempted to spread the catch to other areas of the fishery in recent years.

Because of the importance of this fishery the hoki stock assessment is updated each year with new information from a wide range of data collection and research programmes. A trawl survey on the Chatham Rise, which measures the abundance of both juvenile and adult hoki, is carried out in January with *Tangaroa* each year. Another trawl survey of the Southern Plateau is planned for December 2005. Catch at age data from the spawning fisheries on the WCSI and Cook Strait and from the non-spawning fisheries on the Chatham Rise and Sub-Antarctic are collected each year. A new assessment of hoki stocks will be completed in early 2005 (project HOK2004/01) to inform management recommendations for 2005-06.

The hoki assessment model has developed from a simple age-based stock reduction approach to a complex two-stock spatially disaggregated model, which incorporates all the available data on hoki abundance over the history of the fishery. This structure is necessary to overcome the problem of the catches from the Chatham Rise where both eastern and western stocks mix.

This project has high priority because of the economic importance of the hoki fishery and the current status of the stock as determined in the 2004 assessment.

Objective 1

It is planned to update the stock status of hoki from an assessment in 2006 and also to evaluate performance indicators for 5 year projections. New abundance indices will be available in 2006 from trawl surveys of Chatham Rise in January 2006 (project HOK2005/02) and of the Southern Plateau in December 2005 (project MDT2005/01). New catch at age data from the spawning and non-spawning fisheries in 2004 will also be available from projects MID2005-01 and MID2004-02. In 2005 another acoustic survey of the Cook Strait spawning grounds will also be completed (HOK2004-03).

Objective 2

The hoki fishery has changed over time in the areas fished, the seasonal distribution of catch and the relative proportion taken from eastern and western stocks. The use of both midwater and bottom trawl and more recently twin–rigged trawls has changed the fishery and made interpretation of the CPUE data difficult. For many years standardised CPUE analysis was used to provide abundance indices for the various hoki spawning and non-spawning fisheries. However, in recent years these have not been used in the stock assessment model. The objective here is to record changes in 2004-05 from previous years in the hoki fishery, for use in stock assessment and management.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstock according to rule 9 (1) (a) of the Fisheries (Cost Recovery) Rules 2001:

- HOK 1.

The project is estimated to cost between $100,000 — $150,000.

Project: Estimation of hoki and middle depth fish abundance on the Chatham Rise using trawl surveys

Project Code: HOK2005/02

Start Date: 1 October 2005

Completion Date: 30 September 2006

Vessel Use: R.V. *Tangaroa*, January 2006

Overall Objectives:

1. To estimate the abundance of hoki (*Macruronus novaezelandiae*) and middle depth species on the Chatham Rise from trawl surveys.

Specific Objectives:

1. To continue the time series of relative abundance indices of recruited hoki (eastern stock) and other middle depth species on the Chatham Rise using trawl surveys and to determine the relative year class strengths of juvenile hoki (1, 2 and 3 year olds), with target c.v. of 20 % for the number of 2 year olds.

2. To determine the population proportions at age for hoki on the Chatham Rise using otolith samples from the trawl survey.

3. To collect acoustic and related data during the trawl survey.

4. To collect and preserve specimens of unidentified organisms taken during the trawl survey.

Rationale:

General

Hoki is New Zealand's largest fishery with a current TACC of 100,000 t. This is much less than catch levels in recent years and reflects the current poor status of the western stock estimated in the 2004 stock assessment. Although managed as a single stock, in the past hoki have been assessed as two stocks, western and eastern. The current hypothesis is that juveniles from both stocks mix on the Chatham Rise and recruit to their respective stocks as they approach sexual maturity.

Because of the importance of the hoki fishery a trawl survey is carried out in January each year on the Chatham Rise to measure the abundance of both juvenile and adult hoki. Other middle depth species (particularly hake and ling) are also monitored by this survey time series. The most recent assessment of HAK 4 resulted in a cut to the TACC from 1 October 2004 to xxx tonnes. The TACCs for LIN 3 and LIN 4 were cut in 2000, as the stock appeared to be declining at previous catch levels.

The hoki fishery is now strongly recruitment driven and therefore subject to large fluctuations in stock size. To manage the fishery and minimise potential risks, it is important to have some predictive ability concerning recruitment into the fishery.

Extensive sampling throughout the EEZ has shown that the Chatham Rise is the main nursery ground for hoki aged 2 to 4 years. Abundance estimation of 2+ hoki provides the best index of potential recruitment to the adult fisheries. The survey data from both juvenile and adult abundance is input to the model directly to estimate recruitment parameters and determine current stock status.

This project has a high priority to continue the time series of biomass estimates for the eastern stock and measure the abundance of juvenile hoki on the Chatham Rise.

Objective 1

Random trawl surveys at 200-800 m depths on the Chatham Rise have been carried out annually from January 1992 to 2004 (a further survey will be carried out in January 2005 in project HOK2004/02) to obtain relative biomass estimates of adult and juvenile hoki. Current information on juvenile hoki behaviour suggests that the 2+ cohort provides the best recruitment index. There is a time lag of about 3 years between surveys of the 2 year olds and their full recruitment into the adult fisheries.

Objective 2

The age distribution of the hoki population will be determined from ageing of otoliths sampled throughout the trawl survey. This will be used as input to the stock assessments for hoki.

Objective 3

In most previous surveys of the Chatham Rise acoustic recording has been carried out during each trawl and when steaming between stations to build up a baseline dataset of mark types in the area. This objective was deleted for the 2004 survey (HOK2003/02), however, it is proposed to continue the data collection for the 2005 survey. It is unlikely that acoustics will provide an alternative biomass estimate for the Chatham Rise in the short term. However, these data could provide information on the proportion of fish in midwater and help in interpretation of the trawl survey results.

Objective 4

All catch taken during the trawl survey should be recorded at each station. Specimens of unidentified organisms should be sampled and preserved for future analysis and identification. The analysis of this material will be funded through a project looking at the effects of fishing on the aquatic environment

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstock according to rule 9 (1) (a) of the Fisheries (Cost Recovery) Rules 2001:

- HOK 1.

The project is estimated to cost between $1,000,000— $1,500,000.

Project: Estimation of spawning hoki biomass using acoustic surveys

Project Code: HOK2005/03

Start Date: 1 October 2005

Completion Date: 31 May 2007

Vessel Use: Subject to tender, July-September 2006

Overall Objectives:

1. To estimate the spawning biomass of hoki (*Macruronus novaezelandiae*) using acoustic surveys.

Specific Objectives:

1. To continue the time series of relative abundance indices of spawning hoki in Cook Strait and other eastern spawning grounds using acoustic surveys, with a target coefficient of variation (c.v.) of the estimate of 30 %.

2. To further investigate species composition on the spawning grounds using bottom and midwater trawls.

3. To refine estimates of target strength of hoki.

Note:

The duration of this project will be 20 months, 1 October 2005 to 31 May 2007. This will allow the successful tenderer time to complete the analysis of the acoustic survey and report the results to the fishery assessment meetings in 2007.

Rationale:

General

Hoki is New Zealand's largest fishery with a current TACC of 100,000 t. This is much less than catch levels in recent years and reflects the current poor status of the western stock estimated in the 2004 stock assessment. Although managed as a single stock, in the past hoki have been assessed as two stocks, western and eastern. The current hypothesis is that juveniles from both stocks mix on the Chatham Rise and recruit to their respective stocks as they approach sexual maturity.

Historically, the main fishery for hoki has operated from mid-July to late August on the west coast of the South Island (WCSI) and in Cook Strait where hoki aggregate to spawn. Largest catches were previously from the western stock, however, in recent years the fishery has been carried out all year on the Chatham Rise and catches from the eastern stock have increased.

A new fishery centred on the Pegasus Canyon has been fished in the spawning season in the last 3 years with annual catches of about 5000 t. In this period Cook Strait catches have averaged about 30,000 t.

The Medium Term Research Plan for hoki proposes acoustic surveys of the spawning grounds at regular intervals to update the biomass indices. Previous surveys of Cook Strait were carried out in 1991 and continuously from 1993-2003 (except 2000). The Research Planning Group agreed that further surveys of Cook Strait should be scheduled, and another survey will be completed in the winter of 2005 (HOK2004-03).

This project has high priority to continue the time series of biomass estimates for the eastern spawning stock in Cook Strait and to measure the relative biomass in other eastern spawning areas.

Objectives 1 and 2

In recent years aggregations of hoki have been fished in other eastern spawning grounds (e.g. Pegasus Canyon). The acoustic survey in 2006 should be extended to these other known spawning areas of the eastern stock.

It is proposed that both bottom and midwater trawling be completed during the acoustic survey to determine the relative abundance of hoki and other species. The abundance of the other species is required in order to estimate the biomass of hoki in the survey area.

Objective 3

The hoki acoustic survey results have been used in hoki stock assessments since 1991as relative abundance indices of spawning biomass. The stock assessment would be greatly improved if the existing time series could be used as absolute abundance indices; estimates of hoki target strength and residence time are needed to convert from relative to absolute abundance indices. Ongoing work will refine the target strength estimates by collection of further *in situ* measurements.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstock according to rule 9 (1) (a) of the Fisheries (Cost Recovery) Rules 2001:

- HOK 1,

The project is estimated to cost between $500,000 — $750,000.

Project: Stock assessment of hake

Project Code: HAK2005/01

Start Date: 1 January 2006

Completion Date: 31 May 2007

Vessel Use: None

Overall Objectives:

1. To carry out stock assessments of hake (*Merluccius australis*) in HAK 1 and 4 including estimating biomass and sustainable yields.

Specific Objectives:

1. To carry out a descriptive analysis of the commercial catch and effort data for hake from HAK 1, 4 and 7.

2. To update the standardised analysis of the commercial catch and effort data for HAK 1 and 4 with the inclusion of data up to the end of the 2004/05 fishing year.

3. To update the stock assessment of HAK 4 including biomass estimates and sustainable yields.

Note:

The duration of this project will be 17 months, 1 January 2006 to 31 May 2007. This will allow the successful tenderer time to present the results to the Fishery Assessment Working Group meetings in 2007.

Rationale:

General

Hake is the most abundant bycatch species in the west coast South Island hoki fishery, and is now being targeted on the Chatham Rise and in the region of the Snares and Auckland Islands. Catches in the last few years have been at the highest levels ever recorded (except for the peak year of 1977 for the west coast fishery) and are at or above the level of the TACC in both HAK 1 and 7. The HAK 4 TACC was cut from 1 October 2004 to xxx t as a result of indications of declining biomass in the stock assessment model.

Stock assessments of hake to date have depended on indices of abundance from commercial catch data and from trawl surveys. Changes in fishing practices during the last decade have made it difficult to interpret CPUE data and prevented the assessment of the hake stocks with any reliability. CPUE is not considered useful for monitoring the abundance of the HAK 7 stock. However, in other areas, commercial catch and effort data from the trawl fisheries is used to monitor abundance and update the stock assessments. Trawl survey time series from Chatham Rise and the Southern Plateau, which run from 1991-92, are used in the HAK 1 and

HAK 4 assessments. No suitable abundance index has been found for the WCSI hake (HAK 7).

Objective 1

A descriptive analysis for all hake fisheries should be updated to 2004-05 using the commercial catch and effort data.

Objective 2

The standardised analyses of CPUE for HAK 1 and 4 will be updated with the inclusion of data from the 2004/05 fishing year. These indices are used in the stock assessment model with trawl survey abundance indices to determine stock status

Objective 3

New estimates of biomass and numbers at age will be available from the trawl survey of the Chatham Rise in January 2006 (HOK2005/02) and catch at age data from the commercial fishery will be available from project MID2005-01 to update the assessment of HAK 4 in late 2006.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- HAK 1 20%;
- HAK 4 75%; and
- HAK 7 5%.

The project is estimated to cost between $50,000 — $100,000.

Project: Stock assessment of ling

Project Code: LIN2005/01

Start Date: 1 January 2006

Completion Date: 31 May 2007

Vessel Use: None

Overall Objectives:

1. To carry out stock assessments of ling (*Genypterus blacodes*) in LIN 3, 4, 5, 6 and 7, including estimating biomass and sustainable yields.

Specific Objectives:

1. To carry out a descriptive analysis of the commercial catch and effort data for ling from LIN 2, 3&4,5&6, 6B (Bounties) and 7.

2. To update the standardised catch and effort analyses from the ling longline and trawl bycatch fisheries in LIN 3 & 4, 5 & 6 and 7 with the addition of data up to the end of the 2004/05 fishing year.

3. To update the stock assessments of at least two stocks (to be determined by the Middle Depth Species Fisheries Assessment Working Group) including estimating biomass and yields.

Note:

The duration of this project will be 17 months, 1 January 2006 to 31 May 2007. This will allow the successful tenderer time to present the results to the Fishery Assessment Working Group meetings in 2007.

Rationale:

General

Ling is an important middle depth species taken mainly around the South Island. It supports a substantial bottom longline fishery, a target trawl fishery, and is a major bycatch in middle depth trawl fisheries. Some near-shore setnet and longline targeting for ling is also conducted. Recreational and Maori customary take of ling is believed to be negligible in all areas.

Landings have increased in recent years (over 20 000 t per year since 1995-96) with the introduction of large autoliners to the fisheries. This level is more than double that recorded in the late 1980s. Following the stock assessment in 2000, the TACCs for LIN 3 and LIN 4 were cut, as the stock appeared to be declining at previous catch levels. However, assessments for most stocks are still uncertain and further work is required to determine appropriate catch levels. From 1 October 2004 the TACCs for LIN 5 and 6 were increased by 20% as the stock

assessment model indicated that current catches were not having a measurable impact on stock size.

The current status of stock assessment for ling stocks is summarised below:

Summary of ling stock status and timing of latest assessment
AMP = Adaptive management Programme

Stock Management Unit	**2003-04 TACC (t)**	**2002-03 catch (t)**	**Date of most recent assessment**	**Likely to be above B_{MSY}?**
LIN 1 Northern North Island	400	246	AMP (2002)	Yes
LIN 2 ECNI	982	996	-	Unknown
LIN 3&4 ECSI and Chatham Rise	6260	5525	2004	Yes
LIN 5&6 Southland & Sub-Antarctic	12000	9219	2003	Yes
Lin 6B (Bounties)			2001	Probably
LIN 7 WCSI	2225	2917	2003	Yes
LIN 2 and 7 Cook Strait			-	Unknown

Objective 1

A descriptive analysis for all ling fisheries should be updated to 2004-05 using the commercial catch and effort data. However, LIN 1 is managed under the Adaptive Management Programme and will be reviewed separately.

Objective 2

Catch and effort data will be analysed for the target longline and trawl bycatch fisheries and used to update CPUE series where appropriate. In LIN 6 the longline fishery on the Bounty Platform, which is believed to be a separate stock from the rest of the Southern Plateau (including the Stewart-Snares Shelf and the Puysegur Bank) should be analysed separately. The stock affinity of ling in Cook Strait is uncertain but these fish are treated as a separate stock and the trawl bycatch and longline target fisheries should both be analysed.

Objective 3

Abundance indices from trawl surveys and CPUE analyses will be used to update the assessment of some of the ling stocks in 2006. Estimates of biomass and numbers at age will be available from the trawl surveys on the Chatham Rise (LIN 3 & 4) in January 2006 (HOK2005/02) and the Southern Plateau (LIN 5 & 6) in December 2005 (MDT2005/01). Catch at age data will be available from project MID2005/01 and MID2005/02, and CPUE indices will be available from Objective 2 of this project for most areas and stocks.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- LIN 3 15%;
- LIN 4 15%;
- LIN 5 15%;
- LIN 6 15%; and
- LIN 7 40%.

The project is estimated to cost between $50,000 — $100,000.

Project: Estimation of hoki and middle depth fish abundance on the Southern Plateau using trawl surveys

Project Code: MDT2005/01

Start Date: 1 October 2005

Completion Date: 30 September 2006

Vessel Use: R.V. *Tangaroa*, December 2005

Overall Objectives:

1. To continue a time series of relative abundance indices for hoki (*Macruronus novaezelandiae*), hake (*Merluccius australis*) and ling (*Genypterus blacodes*) in the Southland and Sub-Antarctic QMAs.

Specific Objectives:

1. To carry out a trawl survey in December 2005 to continue the time series of relative abundance indices for hoki, hake (HAK 1) and ling (LIN 5 and 6) on the Southern Plateau.

2. To collect data for determining the population age and size structure and reproductive biology of hoki, hake and ling.

3. To determine the proportions at age of hoki taken in the survey using otolith samples.

4. To collect acoustic and related data during the trawl survey.

5. To collect and preserve specimens of unidentified organisms taken during the trawl survey.

Rationale:

General

Hoki is New Zealand's largest fishery with a current TACC of 100,000 t. This is much less than catch levels in recent years and reflects the current poor status of the western stock estimated in the 2004 stock assessment. Although managed as a single stock, in the past hoki have been assessed as two stocks, western and eastern. The current hypothesis is that juveniles from both stocks mix on the Chatham Rise and recruit to their respective stocks as they approach sexual maturity.

Historically, the main fishery for hoki has operated from mid-July to late August on the west coast of the South Island (WCSI) and in Cook Strait where hoki aggregate to spawn. Largest catches were previously from the western stock, however, in recent years the fishery has been carried out all year on the Chatham Rise and catches from the eastern stock have increased.

Ling and hake are important commercial species in the Southland and Sub-Antarctic QMAs (QMAs 5 and 6). Catches of both species have been increasing. From 1 October 2004 the TACCs for LIN 5 and 6 were increased by 20% as the stock assessment model indicated that current catches were not having a measurable impact on stock size. The Southern Plateau is also important as the residence area for the hoki stock that spawns off the west coast of the South Island in winter.

Trawl surveys have been carried out in this area since 1991, initially targeting hoki but also for hake and ling. The timing of the survey has varied with the first series of surveys carried out in December from 1991-93. After a break from 1993 to 1996 further surveys took place in April 1996 and in April 1998. However, from 2000 to 2004 the survey was transferred to December. The change was made for 2 main reasons; uncertainty over recent assessment for hoki stocks and a concern that the hake age structure was not well represented by the small samples taken in the April surveys. The longer daylight hours in December allow more stations to be occupied than in April and therefore more hake samples are likely to be taken, which would improve the determination of the age structure for this species.

This project is a high priority to continue the time series of trawl survey biomass estimates for the western stock of hoki. With the discontinuation of the WCSI acoustic surveys this is the only abundance index available for western hoki.

Objectives 1 and 2

In the Medium Term Research Plan for hoki and middle depth species, it is proposed to monitor the hoki, hake and ling biomass in this area by carrying out trawl surveys. Information on age structure and reproductive biology is also obtained during the survey.

The surveys have previously been completed in April or in December. Ling and hake appear to be in a dispersed phase and most available to trawling during April, at which time the variance in catch rates is expected to be low and the population more available to the trawl. However, the low numbers of hake taken in the April surveys has been of concern to the Middle Depth Working Group (see above).

Objective 3

The otolith samples from the survey should be used to determine an age-length key, which can be used with the length frequency distribution of the hoki catches to determine the proportion at age of fish taken throughout the survey.

Objective 4

Throughout the survey an acoustic recording should be made during each trawl and when steaming between survey stations. The data collected will add to the baseline dataset of mark types on the Southern Plateau.

Objective 5

All catch taken during the trawl survey should be recorded at each station. Specimens of unidentified organisms should be sampled and preserved for future analysis and identification.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- HOK 1 80%;
- HAK 1 10%;
- LIN 5 5%; and
- LIN 6 5%.

The project is estimated to cost between $1,000,000 — $1,500,000.

Project: Determination of catch at age in hoki, hake and ling fisheries

Project Code: MID2005/01

Start Date: 1 October 2005

Completion Date: 31 May 2007

Vessel Use: None

Overall Objectives:

1. To determine the catch at age from the main hoki, hake and ling fisheries as input data to the stock assessment of these species.

Specific Objectives:

1. To determine the age and size structure of the commercial catches of hoki in the main non-spawning fisheries from samples collected at sea by the Observer Programme and from other sources in 2004/05.

2. To determine the catch at age of commercial catches of hoki from the WCSI spawning fishery in winter 2006 from data collected by the Observer Programme and from other sources.

3. To determine the catch at age from hake fisheries in HAK 1, 4 and 7 from samples collected at sea by the Observer Programme and from other sources in 2004/05, with a target coefficient of variation (c.v.) of 30 % for each fishstock (mean weighted c.v. across all age classes).

4. To determine the catch at age from ling fisheries in LIN 3 & 4, 5 & 6 and 7 in 2004/05 from samples collected at sea by the Observer Programme and from other sources, with a target coefficient of variation (c.v.) of 30 % for each fishstock (mean weighted c.v. across all age classes).

Note:

The duration of this project will be 20 months, 1 October 2005 to 31 May 2007. This will allow the successful tenderer time to complete objective 2 (i.e. the reading of the hoki otoliths collected during winter 2006 for the year 2007 hoki stock assessment), and present the results to the Hoki Fishery Assessment Working Group meetings in 2007.

Rationale:

General

Hoki

Hoki is New Zealand's largest fishery with a TACC of 100,000 t. This is much less than catch levels in recent years and reflects the current poor status of the western stock estimated in the

2004 stock assessment. Although managed as a single stock, in the past hoki have been assessed as two stocks, western and eastern.

The current hypothesis is that juveniles from both stocks mix on the Chatham Rise and recruit to their respective stocks as they approach sexual maturity.

Historically, the main fishery for hoki has operated from mid-July to late August on the west coast of the South Island (WCSI) and in Cook Strait where hoki aggregate to spawn. Largest catches were previously from the western stock, however, in recent years the fishery has been carried out all year on the Chatham Rise and catches from the eastern stock have increased.

Because of the importance of this fishery the hoki stock assessment is updated each year with new information from a wide range of data collection and research programmes. Size and age data from the commercial fisheries continue to be crucial inputs into the stock assessment providing information on the strength of recruited cohorts. Catch at age data from the spawning fisheries on the WCSI have been collected every year since 1988. For the non-spawning fisheries on the Chatham Rise and Southern Plateau a time series of catch at age data has also been developed more recently.

Objective 1

Observer Programme coverage will provide samples of length frequency, spawning state and otoliths from the following hoki fisheries: Chatham Rise, Southern Plateau, and west coast, South Island (WCSI). In the last 4 years, sampling at-sea by industry throughout the year has also provided length frequency samples from the commercial catch with much wider coverage than the Observer Programme. This objective requires that catch at age data be produced for the non-spawning hoki fisheries on the Chatham Rise and Southern Plateau as input to the stock assessment in 2006. The sampling design has a target coefficient of variation (c.v.) of 20 % (mean weighted c.v. across all age classes). (Note: the WCSI catch at age data for winter 2005 will be produced within project MID2004/02)

Objective 2

Catch at age data from the WCSI spawning fishery are required as input to the stock assessment in 2007. The tenderer is required to process and read the otoliths and determine the catch at age for male and female hoki from the 2006 winter fishery. The sample design has a target c.v. of 20 % (mean weighted c.v. across all age classes) for catch at age.

<u>Hake</u>

Hake is the most abundant bycatch species in the west coast South Island hoki fishery, and is now being targeted on the Chatham Rise and in the region of the Snares and Auckland Islands. Catches in the last few years have been at the highest levels ever recorded (except for the peak year of 1977 for the west coast fishery) and are at or above the level of the TACC in HAK 1 and 7. The HAK 4 TACC was cut from 1 October 2004 to t.

Objective 3

Catch at age data from the commercial fishery is used in age-structured models to estimate the year class strength of recent recruitment and the selectivity pattern of the fishery. Samples of otoliths from the Observer Programme will be aged for the main hake fisheries.

Aged samples from the trawl surveys may also be used to describe the age structure of the populations on the Chatham Rise and the Southern Plateau.

Ling

Ling is an important middle depth species taken mainly around the South Island. It supports a substantial bottom longline fishery, a target trawl fishery, and is a major bycatch in middle depth trawl fisheries. Some near-shore setnet and longline targeting for ling is also conducted. Recreational and Maori customary take of ling is believed to be negligible in all areas.

Landings have increased in recent years (over 20 000 t per year since 1995-96) with the introduction of large autoliners to the fisheries. This level is more than double that recorded in the late 1980s. Following the stock assessment in 2000, the TACCs for LIN 3 and LIN 4 were cut, as the stock appeared to be declining at previous catch levels. However, assessments for most stocks are still uncertain and further work is required to determine appropriate catch levels. From 1 October 2004 the TACCs for LIN 5 and 6 were increased by 20% as the stock assessment model indicated that current catches were not having a measurable impact on stock size.

Objective 4

If otolith samples are available from the main longline fisheries in LIN 3 & 4 and LIN 5 & 6, these should be used to determine the catch at age data from these fisheries for 2004-05. Alternatively, age-length keys should be produced for the most recent trawl surveys in these areas. Observer samples from the bycatch of the WCSI trawl fisheries should also be aged to provide data for the LIN 7 stock assessment.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- HOK 1 50%;
- HAK 1 6%;
- HAK 4 6%;
- HAK 7 6%;
- LIN 3 4%;
- LIN 4 4%;
- LIN 5 4%;
- LIN 6 4%; and
- LIN 7 16%.

The project is estimated to cost between $150,000 — $200,000.

Project: Catch sampling and ageing of hoki and ling in the Cook Strait fishery

Project Code: MID2005/02

Start Date: 1 October 2005

Completion Date: 31 May 2007

Vessel Use: None

Overall Objectives:

1. To determine the catch at age from the main hoki, hake and ling fisheries as input data to the stock assessment of these species.

Specific Objectives:

1. To collect otolith samples in the fish processing sheds and determine the age and size structure of the commercial landings of hoki from Cook Strait during winter 2006.

2. To collect the otoliths required for determining the catch at age from the Cook Strait ling fishery in winter 2006 and determine the length frequency distribution of this catch (LIN 2 & 7).

Note:

The duration of this project will be 20 months, 1 October 2005 to 31 May 2007. This will allow the successful tenderer time to complete the reading of the hoki otoliths collected during winter 2006 for the year 2007 hoki stock assessment), and present the results to the Hoki Fishery Assessment Working Group meetings in 2007.

Rationale:

General

Hoki

Hoki is New Zealand's largest fishery with a TACC recently decreased to 100,000 t. This is much less than catch levels in recent years and reflects the current poor status of the western stock estimated in the 2004 stock assessment. Although managed as a single stock, in the past hoki have been assessed as two stocks, western and eastern. The current hypothesis is that juveniles from both stocks mix on the Chatham Rise and recruit to their respective stocks as they approach sexual maturity.

Historically, the main fishery for hoki has operated from mid-July to late August on the west coast of the South Island (WCSI) and in Cook Strait where hoki aggregate to spawn. Largest catches were previously from the western stock, however, in recent years the fishery has been carried out all year on the Chatham Rise and catches from the eastern stock have increased. Industry has agreed in the last year to spread the catch to other areas of the fishery.

Because of the importance of this fishery the hoki stock assessment is updated each year with new information from a wide range of data collection and research programmes.

Size and age data from the commercial fisheries continue to be crucial inputs into the stock assessment providing information on the strength of recruited cohorts. Catch at age data from the spawning fisheries on the WCSI and Cook Strait have been collected every year since 1988. For the non-spawning fisheries on the Chatham Rise and Southern Plateau a time series of catch at age data has also been developed more recently.

Objective 1

Sampling will continue in the fish processing sheds in winter 2006 (Cook Strait fishery) and the otolith samples should be processed to estimate catch at age data for input to the stock assessment in 2007. The tenderer is required to provide a sample design that will result in a target coefficient of variation (c.v.) of 20 % (mean weighted c.v. across all age classes).

Ling

Ling is an important middle depth species taken mainly around the South Island. It supports a substantial bottom longline fishery, a target trawl fishery, and is a major bycatch in middle depth trawl fisheries. Some near-shore setnet and longline targeting for ling is also conducted. Recreational and Maori customary take of ling is believed to be negligible in all areas. In Cook Strait ling is an important bycatch of the hoki trawl fishery.

Objective 2

Shed sampling of the Cook Strait ling catch has been carried out in previous years to supplement the small number of otoliths collected by Observers. This will continue in winter 2006 in order to provide samples for processing for the 2007 assessment.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- HOK 1 80%;
- LIN 2 10%; and
- LIN 7 10%.

The project is estimated to cost between $100,000 — $150,000.

Project: Stock assessment of southern blue whiting

Project Code: SBW2005/01

Start Date: 1 October 2005

Completion Date: 30 September 2006

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 2004/05 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 assessments of the Campbell Island and Bounty Platform stocks, including estimating biomass and sustainable yields.

Note:

Objective 2 of this project may not be required if there are no new abundance estimates available from Campbell or Bounty stocks.

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 the two major stocks each year resulting in fluctuating total catch limits.

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 these stocks is described as follows in the 2004 Plenary report:

SBW 6I – Campbell Islands – model results indicate that biomass in 2002 was more than double the biomass in the reference year (1991). This year was chosen as a reference threshold biomass because biomass in 1991 was the lowest observed but gave rise to good recruitment and subsequent stock recovery. The TACC was reduced to 25 000 t from 1 April 2003; at catches at this level the biomass is projected to decline.

SBW 6B – Bounty Platform – biomass has declined since 1993 with poor recruitment to the stock. The TACC was reduced to 3500 t from 1 April 2003. The stock will only increase when there is good recruitment.

This project is high priority to update the assessments of SBW stocks for provision of management advice.

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 2003, the assessment of the Campbell Islands stock was updated using Bayesian estimation with the modelling program CASAL, which gave similar results to the previous model. A new acoustic survey in 2004 will be reported on in 2005 (SBW2004/01). In 2006, another year of catch at age data will be available from objective 1. The assessments should be updated to provide estimates of current annual yield.

The possibility of using CPUE data from the Bounties fishery will also be considered to update the assessment of this stock, if no acoustic estimates of abundance are available.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001:

- SBW 6I 60%;
- SBW 6B 30%; and
- SBW 6R 10%.

The project is estimated to cost between $100,000 — $150,000.

Project: Biomass estimation of southern blue whiting using acoustic surveys

Project Code: SBW2005/02

Start Date: 1 January 2006

Completion Date: 31 May 2007

Vessel Use: Subject to tender, winter 2006

Overall Objectives:

1. To estimate the biomass of southern blue whiting (*Micromesistius australis*) using acoustic surveys.

Specific Objectives:

1. To estimate pre-recruit and spawning biomass at Campbell Island during September 2006, using an acoustic survey, with a target coefficient of variation (c.v.) of the estimate of 30 %.

2. To refine estimates of acoustic target strength from *in situ* measurements.

Note:

The duration of this project will be 17 months, 1 January 2006 to 31 May 2007. This will allow the successful tenderer time to present the results to the Fishery Assessment Working Group meetings in 2007.

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. The TACC for the Campbell Island stock is currently 25 000 t.

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.

A time series of acoustic surveys was started in 1993. The acoustic surveys have been used to measure relative abundance of adult SBW and also to predict pre-recruit numbers in each stock. As the fish recruit at 2 and 3 years to the fishery, surveys are required every 2 years to keep the assessment up to date. The movement of fish during the survey period has required the development of an adaptive survey design to increase efficiency; alternative survey designs

result in different biases in the estimate of biomass. The last acoustic survey of the Campbell Island stock was completed in September 2004.

Objectives 1 and 2

In September 2006 the Campbell Island stock will again be surveyed. The time series of acoustic surveys are providing fishery independent monitoring of both the recruited part of the population as well as predicting the strength of year classes about to enter the fishery. Further *in situ* data on target strength will be collected during the survey. Refining the estimates of target strength will allow the absolute abundance of separate age classes to be determined. The catalogue of target strength signatures and target identification information and results should be updated as part of Objective 2. This continues the work being carried out in SBW2003/02.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstock according to rule 9 (1) (a) of the Fisheries (Cost Recovery) Rules 2001:

- SBW 6I

The project is estimated to cost between $1,000,000— $1,500,000.

Project Title: Research Observer Services – Middle Depths Fisheries

Project Code: OBS2005/03

Start Date: 1 July 2005

Completion Date: 30 September 2006

Vessel Use: Deployments on commercial fishing vessels

Overall Objectives:

1. To collect specified data for hoki and middle depth fisheries research.

2. To collect specified data describing the effects of fishing in hoki and middle depth fisheries.

Specific Objectives:

1. To record the catch and collect biological data for hoki and other middle depth species as directed from the hoki target trawl fisheries.

2. To record the catch and collect biological data for southern blue whiting as directed from the southern blue whiting target trawl fisheries.

3. To record the catch and collect biological data for ling as directed from the ling longline fisheries.

4. To record the catch and collect biological data for hake as directed from the hake target trawl fisheries.

Observer Services Required:

1822.5 days required for hoki and middle depth fisheries, 1380 for HOK, 260 for SBW, 152.5 for LIN and 30 for HAK in 2005/06. See the rationale section below for further details of the sampling plans.

Note:

The services specified in the sampling plan are subject to ongoing review and revision by the Ministry. This project will also provide descriptive data for Aquatic Environment research. The days specified for 2005/06 are Ministry of Fisheries required days. It is likely that there will be additional Department of Conservation CSP days required in some of these fisheries.

Rationale:

General

Observer data represent the only detailed quantification of catch on a tow-by-tow basis available to scientists. Observer data provide valuable insight into fishery dynamics through

time. Observers collect catch effort data, biological data and biological specimens for a variety of science purposes. As the catch is processed at sea for almost all middle depth fisheries, the at-sea sampling presents the only opportunity to sample the catch for biological data, otoliths for age studies and other requirements of fisheries research.

History

The observer coverage of these fisheries since 2001/02 is detailed in Table 1 below.

	2001/02		2002/03		2003/04	2004/05	2005/06
	Plan	**Actual**	**Plan**	**Actual**	**Plan (CSP)**	**Plan**	**Plan**
HOK	1380	942	1380*	1393	1180 (200)	1380	1380
SBW	400	394	350*	315	250 (100)	260	260
LIN	150	150	150	150@	150 (850)	152.5	152.5
HAK	-	-	30	30@	30 (30)	30	30
Total	1930	1486	1910	1888	1610 (1180)	1822.5	1822.5

* Includes DOC CSL days

@ Additional DOC CSL days occurred in this fishery

Table 1: Observer sea days planned and sea days achieved from 2001/02 – 2003/04, and proposed sea days for 2004/05 and 2005/06 (Note: this table does not include DOC requested days in the ling longline fishery). For 2003/04 the CSP planned days additional to the MFish days are given in brackets.

Sampling Plan for 2005/06

For HOK:

Note: With the reduction in TACC for hoki from 1 October 2004 there is an urgent need to review the observer coverage from the fishery. The provisional coverage below is proposed for 2005-06 until this review is completed.

Spawning fisheries

- WCSI – 650 days;
- Cook Strait – 80 days;
- Pegasus Bay – 40 days;

Non-spawning fisheries

- Chatham Rise – 320 days; and
- Sub-Antarctic – 290 days.

For SBW:

- SBW 6I, 6B, & 6R – 260 days.

For LIN:

- LIN target longline fisheries in LIN 3, 4, 5 & 6 – 152.5 days.

For HAK:

- HAK – target spawn fishery 30 days.

The biological samples required in the target fisheries are detailed in the Observer Biological Manual. The other sampling priorities in these fisheries are the full and accurate quantification of the catch, the biological sampling of other targeted middle depth species, and other sampling as notified to the Observer Programme. Alterations to sampling plans and additional data requests will be by way of a request for the collection of samples or a request for the collection of data.

This project provides basic biological information for stock assessment and fishery characterisation of the major hoki and middle depth fisheries (HOK, SBW, HAK and LIN).

Observer data collection at sea is an integral part of the hoki and middle depths fisheries medium term research plans. This project also forms a part of the Aquatic Environment research theme '…to determine the direct effects of fishing on associated or dependent species…', a part of the research topic '…the effects of fishing on associated or dependent species…', and a part of the research programme '…to assess the effects of fishing on non-target fish catch by obtaining accurate estimates of the size and distribution of commercial catch and estimates of fishery-induced mortality…'.

Cost Recovery Information:

The percentage allocation for this project will be attributed to the following Fishstocks according to rule 8 of the Fisheries (Cost Recovery) Rules 2001:

- HOK 1 (1380 days);
- SBW 6B, 6I, 6R (260 days combined);
- LIN 3, 4, 5 & 6 (152.5 days combined); and
- HAK 1, 4 & 7 (30 days combined).