

AQUATIC ENVIRONMENT

Code	Title
ENV2008/01	Bycatch and discards in southern blue whiting trawl fisheries
ENV2008/02	Bycatch and discards in hoki, hake, ling trawl fisheries
ENV2008/03	Bycatch of basking sharks in New Zealand fisheries
ENV2008/04	Productivity of deepwater sharks

Project: Estimation of non-target fish catch and both target and non-target fish discards in southern blue whiting fisheries

Project Code: ENV2008/01

Start Date: 1 October 2008

Completion Date: 30 September 2009

Vessel Use: None

Overall Objectives:

- 1 To estimate the level of non-target fish catch and discards of target and non-target fish species in selected New Zealand fisheries.

Specific Objectives:

1. To estimate the quantity of non-target fish species caught, and the target and non-target fish species discarded, in the trawl fisheries for southern blue whiting for the fishing years 2002/03 to 2006/07 using data from Scientific Observers and commercial fishing returns.

Reporting Requirements:

Research Reporting

Objective 1

1. To submit to MFish a Research Progress Report as specified in Research Reporting Form 4, with a coversheet as specified in Research Reporting Form 10, by 31 October 2008. Electronic and hard copy formats of reports are required.
2. To present the report in Reporting Requirement 1 to a meeting of the Aquatic Environment Working Group by 31 December 2008 in Wellington. Presentations to more than one meeting may be required in Wellington.
3. To submit to MFish a draft Final Research Report as specified in Research Reporting Form 5 or a draft Aquatic Environment and Biodiversity Report as specified in Research Reporting Form 6 by 30 June 2009. 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 (form 13) 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 July 2009.

Rationale:

The Ministry of Fisheries has the responsibility to determine the effects of fishing on associated or dependent species, the aquatic environment, and, accordingly to estimate the levels of fishing induced mortality, including discards. This includes both target and non-target fish species. These responsibilities require that estimates of the catch, catch rates and discards of non-target fish are made as they include associated and dependent species. This project is part of an ongoing programme to periodically review discard and non-target fish catch in target fisheries.

Southern blue whiting supports a large trawl fishery in New Zealand and the thousands of trawls carried out each year have the potential to catch a considerable amount of fish species bycatch. Unwanted fish, whether target or non-target species, are often discarded. Previous research showed that the southern blue whiting fishery, at least for the period 1990–91 to 2001–02, took very little bycatch, with about 0.02 kg of discards per kg of southern blue whiting caught (Anderson 2004). Despite this, several hundred to over a thousand tonnes of fish species are discarded annually in this fishery. This project would enable the characterization of bycatch and discards from a further five years of commercial trawling.

Objective 1

As fisheries stock assessments become more sophisticated and management decisions take into account the ecosystem effects of the fishery, there is an increasing demand for better input data, including the catch and mortality of fish species. By estimating the discard rates of the target species, and the bycatch and discards of associated fish species, this project has the potential to provide useful data for incorporation into broader assessment models, and to contribute to an improved understanding of fish communities, and the possible impact of fishing on the long-term sustainability of fisheries.

Strategic Relevance:

This project provides basic biological information for fishery characterisation of trawl fisheries. The data have already been collected and archived and can be analysed at any time to provide summaries of bycatch and discards. This project is consistent with Objective 3.4 of the Biodiversity Strategy (Protect biodiversity in coastal and marine waters from the adverse effects of fishing and other coastal and marine resource uses),

especially those actions for which MFish is identified as the lead organisation. 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...’. This project is therefore consistent with the Aquatic Environment Research and Harvest Levels sections of the Ministry of Fisheries Strategic Research Directions document. Consistent with the 2005 Strategy for Managing the Environmental Effects of Fishing (SMEEF), the information will also be used to develop and refine standards for bycatch. The 2006/11 Statement of Intent (SOI) sets out “Setting standards that define the acceptable level of risk to the health of the aquatic environment from the use of fisheries” as part of its work programme, including “Gathering information required to develop and set standards; including facilitating research on effects of fishing on the marine environment, seabirds and marine mammals”. This research is therefore of a high priority, although less urgent than some others.

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

Project: Estimation of non-target fish catch and both target and non-target fish discards in hoki, hake, and ling trawl fisheries.

Project Code: ENV2008/02

Start Date: 1 October 2008

Completion Date: 30 September 2009

Vessel Use: None

Overall Objectives:

- 1 To estimate the level of non-target fish catch and discards of target and non-target fish species in selected New Zealand fisheries.

Specific Objectives:

1. To estimate the quantity of non-target fish species caught, and the target and non-target fish species discarded, in the trawl fisheries for hoki, hake, and ling for the fishing years 2003/04 to 2006/07 using data from Scientific Observers and commercial fishing returns.

Reporting Requirements:

Research Reporting

Objective 1

1. To submit to MFish a Research Progress Report as specified in Research Reporting Form 4, with a coversheet as specified in Research Reporting Form 10, by 31 October 2008. Electronic and hard copy formats of reports are required.
2. To present the report in Reporting Requirement 1 to a meeting of the Aquatic Environment Working Group by 31 December 2008 in Wellington. Presentations to more than one meeting may be required in Wellington.
3. To submit to MFish a draft Final Research Report as specified in Research Reporting Form 5 or a draft Aquatic Environment and Biodiversity Report as specified in Research Reporting Form 6 by 30 June 2009. 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 (form 13) 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 July 2009.

Rationale:

The Ministry of Fisheries has the responsibility to determine the effects of fishing on associated or dependent species, the aquatic environment, and, accordingly to estimate the levels of fishing induced mortality, including discards. This includes both target and non-target fish species. These responsibilities require that estimates of the catch, catch rates and discards of non-target fish are made as they include associated and dependent species. This project is part of an ongoing programme to periodically review discard and non-target fish catch in target fisheries.

Hoki and other closely associated “middle depth” species support large trawl fisheries in New Zealand and the thousands of trawls carried out each year have the potential to catch a considerable amount of fish species bycatch. Unwanted fish, whether target or non-target species, are often discarded. Previous research (project ENV2003/01) showed that the hoki trawl fishery during 1999–2000 to 2002–03 discarded 11 000–14 000 t of mostly “non-commercial” fish species (Anderson & Smith 2005, FAR2005/03), although up to about 2000 t of hoki was also discarded. Estimates of total discards for this 4-year period were similar to those for the preceding nine years, even though the estimates of total bycatch were higher. This project would enable the characterization of bycatch and discards from a further four years of fishing at a time when the fishery has been changing markedly.

Objective 1

As fisheries stock assessments become more sophisticated and management decisions take into account the ecosystem effects of the fishery, there is an increasing demand for better input data, including the catch and mortality of fish species. By estimating the discard rates of the target species, and the bycatch and discards of associated fish species, this project has the potential to provide useful data for incorporation into broader assessment models, and to contribute to an improved understanding of fish communities, and the possible impact of fishing on the long-term sustainability of fisheries.

Strategic Relevance:

This project provides basic biological information for fishery characterisation of trawl fisheries. The data have already been collected and archived and can be analysed at any time to provide summaries of bycatch and discards. This project is consistent with Objective 3.4 of the Biodiversity Strategy (Protect biodiversity in coastal and marine waters from the adverse effects of fishing and other coastal and marine resource uses),

especially those actions for which MFish is identified as the lead organisation. 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...’. This project is therefore consistent with the Aquatic Environment Research and Harvest Levels sections of the Ministry of Fisheries Strategic Research Directions document. Consistent with the 2005 Strategy for Managing the Environmental Effects of Fishing (SMEEF), the information will also be used to develop and refine standards for bycatch. The 2006/11 Statement of Intent (SOI) sets out “Setting standards that define the acceptable level of risk to the health of the aquatic environment from the use of fisheries” as part of its work programme, including “Gathering information required to develop and set standards; including facilitating research on effects of fishing on the marine environment, seabirds and marine mammals”. This research is therefore of a high priority, although less urgent than some others.

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

Project: Bycatch of basking sharks in New Zealand fisheries

Project Code: ENV2008/03

Start Date: 1 October 2008

Completion Date: 30 September 2009

Vessel Use: None

Overall Objective:

1. To estimate the bycatch of basking sharks taken in New Zealand fisheries.

Specific Objectives:

1. To review the productivity of basking sharks
2. To describe the nature and extent of fishery-induced mortality of basking sharks in New Zealand waters and recommend methods of reducing the overall catch.

Reporting Requirements:

Research Reporting

Objectives 1 and 2

1. To submit to MFish a Research Progress Report as specified in Research Reporting Form 4, with a coversheet as specified in Research Reporting Form 10, by 31 October 2008. Electronic and hard copy formats of reports are required.
2. To present the report in Reporting Requirement 1 to a meeting of the Aquatic Environment Working Group by 31 December 2008 in Wellington. Presentations to more than one meeting may be required in Wellington.
3. To submit to MFish a draft Final Research Report as specified in Research Reporting Form 5 or a draft Aquatic Environment and Biodiversity Report as specified in Research Reporting Form 6 by 30 June 2009. 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 (form 13) 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 July 2009.

Rationale:

Basking sharks are caught as bycatch in fisheries around New Zealand. MFish observers reported over 200 individuals caught by commercial trawlers between 1986 and 1999 (Francis and Duffy 2002). Most captures were associated with the east coast South Island hoki and barracouta fisheries, the west coast South Island hoki fishery, and the Snares Island – Auckland Island shelf squid fishery. Observer coverage of those fisheries was low, suggesting that substantial numbers of basking sharks were caught annually. Basking sharks are also caught by inshore set net fisheries.

Basking sharks have very low productivity. Target fisheries and extermination programmes elsewhere in the world have caused very rapid declines in populations, and some of these populations have never recovered. Because of the high risk of population decline, the species is listed as Vulnerable on the IUCN redlist; it is also listed on Appendix II of CITES, and Appendix I of the Convention on Migratory Species. Basking sharks give birth to live young, but only three pregnant females have been reported worldwide, and none has been scientifically examined. Young appear to be born at about 1.5–2.0 m total length, and the only reported litter had six embryos. The reproductive cycle probably lasts several years, so annual fecundity is extremely low. Growth rates have not yet been empirically estimated although studies are underway overseas.

The stock range of basking sharks is unknown. Australia has few reported sightings, and there are rare observations from driftnets in the Tasman Sea and central South Pacific. It is possible that New Zealand supports the bulk of the basking shark stock in the South Pacific Ocean. Based on the very low productivity of basking sharks and the concentration of the species in New Zealand, the stock may be at strong risk of depletion by fisheries bycatch.

New Zealand is currently developing a National Plan of Action for sharks (NPOA-sharks). Information gathered during this project will greatly inform the management of basking sharks under the NPOA-sharks.

This research is necessary because:

- Basking shark is a low productivity species with a high risk to over-exploitation and is taken predominantly as bycatch in trawl and set net fisheries. There are no current catch limits and no monitoring of catches or stocks.
- New Zealand is likely the coastal state with the largest impact on the stock; and
- Elsewhere this species has been shown to be vulnerable to overexploitation so there is an urgent need to collate all available biological and fishery data to allow a more detailed analysis of the status of basking shark.

Objective 1

This objective will review worldwide information on the biology and productivity of basking sharks, and the response of basking shark populations overseas to target and bycatch fisheries, enabling the development of a risk profile for the species.

Objective 2

The previous review of basking shark bycatch in New Zealand fisheries (Francis & Duffy 2002) should be extended to the end of 2006/07. This will entail updating (a) the assessment of which fisheries are catching basking sharks, and when and where they are caught; (b) the nominal CPUE time series in three major fisheries; (c) any size and sex composition data collected by observers. The project will also determine the fate of observed sharks (whether alive or dead, discarded or processed, finned or other). An estimate is required of the total New Zealand catch of basking sharks, probably based on observed captures scaled up to total fishing effort using methods appropriate to the data (e.g., large numbers of zero catches). These estimates will be compared with catches, landings and discards reported to MFish on fishing returns. Recommendations will be made on the best ways to monitor New Zealand basking sharks, and on possible mitigation or management measures to reduce bycatch.

Strategic Relevance

This project is consistent with Objective 3.4 of the Biodiversity Strategy (Protect biodiversity in coastal and marine waters from the adverse effects of fishing and other coastal and marine resource uses), especially those actions for which MFish is identified as the lead organisation. 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...’. This project is therefore consistent with the *Aquatic Environment Research* and *Harvest Levels* sections of the *Ministry of Fisheries Strategic Research Directions* document. Consistent with the 2005 Strategy for Managing the Environmental Effects of Fishing (SMEEF), the information will also be used to develop and refine standards for bycatch and associated or dependent species. The 2006/11 Statement of Intent (SOI) sets out “Setting standards that define the acceptable level of risk to the health of the aquatic environment from the use of fisheries” as part of its work programme, including “Gathering information required to develop and set standards; including facilitating research on effects of fishing on the marine environment, seabirds and marine mammals”. Therefore, this research is of a high priority.

Reference

Francis, M.P.; Duffy, C. (2002). Distribution, seasonal abundance and bycatch of basking sharks (*Cetorhinus maximus*) in New Zealand, with observations on their winter habitat. *Marine Biology* 140: 831-842.

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: Productivity of deepwater sharks

Project Code: ENV2008/04

Start Date: 1 October 2008

Completion Date: 30 September 2010

Vessel Use: None

Overall Objectives:

1. To determine the productivity of deepwater sharks taken as bycatch in New Zealand trawl and bottom longline fisheries

Specific Objectives:

1. To determine the growth rate, age at maturity, longevity and natural mortality rate of shovelnose dogfish (*Deania calcea*) and leafscale gulper shark (*Centrophorus squamosus*)

Reporting Requirements:

Research Reporting

Objective 1

1. To submit to MFish a Research Progress Report as specified in Research Reporting Form 4, with a coversheet as specified in Research Reporting Form 10, by 31 October 2008. Electronic and hard copy formats of reports are required.
2. To present the report in Reporting Requirement 1 to a meeting of the Aquatic Environment Working Group by 31 December 2008 in Wellington. Presentations to more than one meeting may be required in Wellington.
3. To submit to MFish a draft Final Research Report as specified in Research Reporting Form 5 or a draft Aquatic Environment and Biodiversity Report as specified in Research Reporting Form 6 by 30 June 2009. 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 (form 13) 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 July 2009.

Rationale:

General

Deepwater sharks are vulnerable to the effects of fishing because of their low productivity and increasing exploitation for liver oils and fin-products.

Deepwater sharks are caught in considerable numbers as bycatch in trawl fisheries and some bottom longline fisheries in the New Zealand Exclusive Economic Zone (NZ EEZ). Reported catches are about 2500 t per year, but this probably underestimates the total catch as many sharks are discarded and not recorded. Shark populations off the New South Wales shelf have declined dramatically in abundance as a result of fishing and there is concern that New Zealand stocks may be equally vulnerable. Although trawl survey data in the NZ EEZ suggest that the relative abundance of most deepwater sharks are reasonably stable, many trawl surveys do not estimate abundance for their full depth distribution.

The development and application of a precise and reliable ageing technique is fundamental to any study of fish population dynamics. The most common applications of age data are the derivation of growth curves and estimation of growth rates. Other important applications are the estimation of ages at maturity and recruitment, longevity, population age structure, natural and fishing mortality rates, and recruitment strength and variability. The ability to estimate fish ages is thus a requirement for most fish stock assessment models and also for monitoring population responses to exploitation. In the absence of a quantitative stock assessment model that allows current and reference biomasses and sustainable yields to be estimated, information on age at maturity, longevity, and natural mortality can still provide important information on the ability of a species to withstand fishing exploitation. In sharks, age at maturity has been shown to be a particularly important indicator of productivity. However, these data do not yet exist for even the most commonly-caught deepwater shark species in the NZ EEZ.

Shovelnose dogfish, leafscale gulper shark, and seal shark (*Dalatias licha*) are among the most common of the New Zealand deepwater shark fauna. The feasibility of estimating ages of these species was investigated using small samples collected during research trawl surveys of the Chatham Rise and Sub-Antarctic plateau 2002–03 as research project ENV2001-05 (Francis & Ó Maolagáin 2004). This study concluded that the first two species could be aged using sections of dorsal fin spines viewed under transmitted white light. No feasible ageing technique was found for seal shark, which lacks dorsal fin spines. All three species lack a strongly-calcified vertebral column. Preliminary results suggested that New Zealand shovelnose dogfish and leafscale gulper shark grow at similar rates and have similar longevities to those of the same species in the north-east Atlantic Ocean, where these species live to 35 and 70 years respectively. Further developmental work was also recommended, especially examination of larger samples, closer study of the process of spine band

formation, development of ageing protocols, and ageing validation. In this project, these recommendations will be pursued, and estimates of growth, maturity, longevity and natural mortality obtained for these two species to provide indicators of their productivity. The project will last two years to enable time to gather sufficient dorsal fin spines from a representative size and age range of the population.

Objective 1

This project will age larger samples of shovelnose dogfish and leafscale gulper sharks using dorsal fin spines, develop an ageing protocol for these species based on an examination of dorsal spine development, and provide estimates of growth rate, age at maturity, longevity and natural mortality. Tenderers should consider possible methods to validate the ageing methods using cost-effective techniques.

Strategic Relevance

All the objectives in this project are consistent with the *Middle Depths Fisheries Medium Term Research Plan* and the *Strategic Framework and Directions for Fisheries research Contracted by the Ministry of Fisheries* document. Sharks generally have low productivity and are vulnerable to overexploitation. The SMEEF mandates that we identify the species and habitats most at risk from the effects of fishing and this work will contribute to that process. This study will contribute management of sharks under the NPOA-sharks.

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