

Introduction

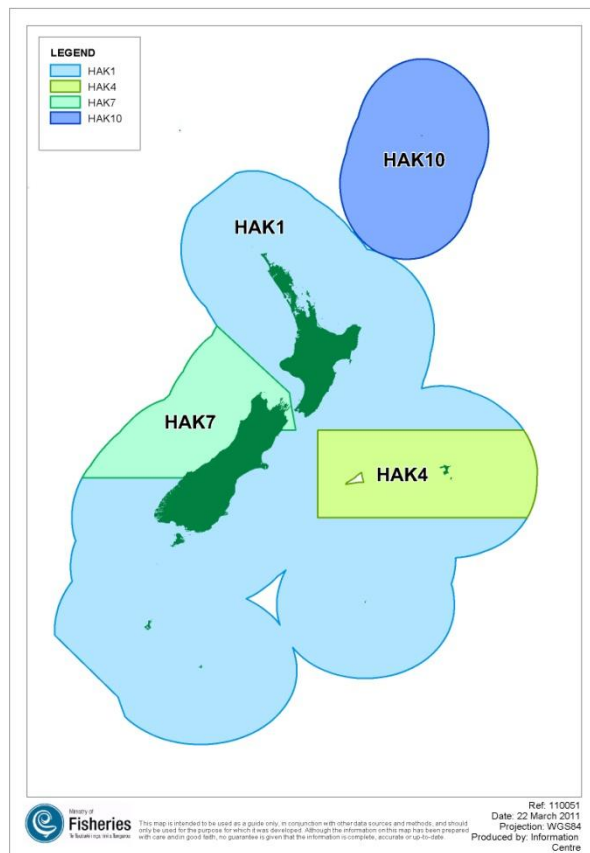
This chapter of the National Deepwater Plan sets the operational objectives and performance criteria for all hake fisheries. This chapter also addresses the management of environmental effects caused by fishing for hake.

This chapter consists of the following sections:

1. Overview of the hake fisheries
2. Overview of non-target (bycatch and incidental) interactions
3. Operational objectives for the hake fisheries
4. Measuring performance

1. Overview of the hake fisheries

Figure 1: Map of hake quota management areas (QMAs)



Biology Overview

Hake (*Merluccius australis*) is widely distributed throughout the middle depths of the New Zealand EEZ, mostly south of 40°S. Adults are predominantly distributed from 250-800m, but have been found as deep as 1200m. Juveniles are found in inshore regions shallower than 250m.

New Zealand hake reach a maximum age of at least 25 years, with females being larger than males and growing up to 120 cm or more. Both sexes reach sexual maturity between about 6 and 10 years of age at lengths of 67-75 cm (males) and 75-85 cm (females).

It is believed that there are at least three main spawning areas for hake. The best known area is off the west coast of the South Island from June to October. Spawning also occurs to the west of the Chatham Islands in September to January, and on the Campbell Plateau from September to February. There have also occasionally been spawning fish recorded at Puysegur Bank with timing similar to that on the Campbell Plateau.

For more detailed information on the biology of hake and the current status of the stocks see the latest Ministry for Primary Industries Stock Assessment Plenary report, available at <http://mpi.govt.nz/news-resources/publications.aspx>.

Fisheries Management Overview

Hake was introduced into the QMS in 1986 with four quota management areas (QMAs) that have not changed (Figure 1). QMAs 1, 4 and 7 reflect the three main spawning areas, biological stocks, and fishing grounds. QMA 10 represents an administrative fishstock with no recorded catches, which is currently closed to demersal trawling.

Under the National Deepwater Plan all non-administrative hake stocks are Tier 1 stocks as they are high volume and/or high value fisheries with catches historically reaching nearly 20,000 tonnes at the peak of the fisheries.

Management approach

The current management approach for all hake stocks is based on frequent stock assessments and leads to regular reviews of the TAC/TACCs. Changes to the TAC/TACCs or any other management measures are implemented to ensure the stocks are managed within the default biological target and limit reference points as specified in the Harvest Strategy Standard (Table 1).

Table 1: Default biological reference points and associated management response used in hake fisheries

Reference point	Management response
Management target of 40% B_0	The stock is permitted to fluctuate around this management target. TAC/TACC changes will be employed to keep the stock around the target (with a 50% probability of being at the target).
Soft limit of 20% B_0	A formal, time-constrained rebuilding plan will be implemented if this limit is reached.
Hard limit of 10% B_0	The limit below which a fishery will be considered for closure.
Rebuild strategy	To be determined.
Harvest control rule	Management actions focussed on adjusting fishing mortality determined following consideration of the results of stock assessments and in some cases, forward projections under a range of catch assumptions, guided by the biological reference points.

Stock assessment models have been accepted for two of the three New Zealand hake stocks. The third has a model, but it has not been accepted by the Fisheries Assessment Working Group because of uncertainties in the data inputs. Stock specific details can be found in the fishery-specific sections later in this document or in the annual Fisheries Assessment Plenary.

The temporal and spatial overlap of hake fishing with the hoki fishery means that management measures implemented in the hoki fishery often affect hake catch and fishing behaviour as well. The changes in fishing behaviour over the last ten years (discussed later in this chapter) have added challenges to determining the status of the hake stocks.

International Context

Species of hake occur around the globe, and support significant fisheries. Hake is a very sought after fish in Europe, most notably Spain. In the past, hake fisheries around the world have been heavily fished and most stocks have declined in the past decade, e.g. Southern African and South American stocks.

Commercial Fishery Overview

The hake fishery was initiated in the 1970s by Japanese trawl vessels which were soon joined by Russian and Korean vessels. Target fishing for hake only really developed off the west coast of the South Island, and to a lesser extent on the Chatham Rise in the early 1980s. After introduction to the QMS, hake were mostly taken as bycatch in the hoki fishery, as low hake quotas were an impediment to the establishment of target fisheries. Hake quotas were increased as the amount of hake caught in hoki target fishing increased. However, when the hoki quota was cut in the early 2000s, hake targeting increased. Currently, about 75% of the total catch of hake is from the hake target fisheries. Hake is caught almost entirely using bottom and midwater trawl gear, with a very small amount caught in bottom longline fisheries for ling. Hake catch from hoki, hake and ling target fishing since 2000-01 is shown in Table 2.

The commercial fisheries for hake have changed measurably over the past ten years, including changes in fleet structure (some major hake fishing vessels left the fishery in the mid-2000s), average tow speed and duration, and in the locations fished.

The hoki fisheries have become more targeted, with the development of techniques to avoid bycatch of hake where ACE availability was previously a constraint (west coast South Island). Additionally, target fisheries for hake may use slightly different fishing gear and operations (e.g. towing speed) than that used to fish for hoki meaning that vessels that target hoki do not have the same efficiency or selectivity in catching hake even when it is targeted.

Hake is known to be somewhat unpredictable with respect to the location and timing of spawning aggregations. There have been reports throughout the history of the fishery of fishers unexpectedly finding large aggregations of hake. An example of this occurred in 2004, when a large aggregation of hake was found west of the Mernoo Bank. Approximately 2,000 tonnes of hake were caught in a four week period that year compared to the normal 100-800 tonnes that was normally taken there.

There are three main fishing areas for hake: the west coast of the South Island (HAK7), the Chatham Rise (HAK4), and the Sub-Antarctic (HAK1). Recent catches have averaged around 8,300 tonnes, although they have been variable, ranging from only 4,700 tonnes in 2009/10 up to 10,592 tonnes in 2006/07.

Table 2: Estimated catches of HAK by target species from 2000/01 to 2011/12 and total landings.

	HAK1			HAK4			HAK7			TOTAL	TOTAL
	Target species			Target species			Target species			Estimated	Landings
	HAK	HOK	LIN	HAK	HOK	LIN	HAK	HOK	LIN	catch	
2000/01	1,194	1,523	107	1,845	601	35	2,906	3,739	9	12,131	14,111
2001/02	858	1,311	63	917	232	9	722	6,029	4	10,333	11,813
2002/03	1,325	1,309	64	355	226	1	2,849	3,902	5	10,187	11,580
2003/04	1,035	1,499	226	1,612	376	2	3,958	3,518	5	12,471	13,686

	HAK1			HAK4			HAK7			TOTAL	TOTAL
	Target species			Target species			Target species			Estimated catch	Landings
	HAK	HOK	LIN	HAK	HOK	LIN	HAK	HOK	LIN		
2004/05	2,405	1,106	636	990	99	2	5,312	1,555	8	12,376	13,377
2005/06	1,705	237	169	118	81	2	4,864	1,563	5	8,916	9,952
2006/07	835	335	356	595	159	16	6,450	845	8	9,730	10,592
2007/08	1,325	314	346	528	149	18	2,204	172	19	5,166	5,930
2008/09	2,161	328	267	619	87	3	5,393	201	18	9,175	10,226
2009/10	1,240	281	141	42	52	5	1,807	241	28	3,946	4,716
2010/11	1,421	231	80	1	90	2	2,479	555	36	5,838	5,837
2011/12	1,286	164	67	1	67	3	2,590	1,001	50	5,441	6,568

Environmental Overview

Hake fisheries interact with a range of protected species, most notably seabirds and New Zealand fur seals. The majority of information on interactions of hake fishing with protected species is from fishing trips that carried a Ministry observer. Further information is available from 1 October 2008 with the introduction of the mandatory non-fish/protected species bycatch reporting form. However analyses and estimates of total interactions with protected species are based only on the information collected by observers.

Hake is harvested mostly using bottom trawl gear which interacts with the benthic environment during fishing. However, research indicates that this impact is low with only 0.03% of the New Zealand Territorial Sea and EEZ and 0.07% of the fishable area in New Zealand being trawled between 1989 and 2010.

Where interactions with protected species and/or the marine environment are determined to be having an adverse effect, management intervention is required to avoid, remedy or mitigate such effects. A key focus of the National Deepwater Plan is to ensure that adverse effects are avoided or mitigated. This is currently being achieved both through regulations and the range of non-regulatory measures that are implemented by industry and monitored and audited by the Ministry.

Section 2 provides more detailed information on the nature and extent of environmental interactions in hake fisheries.

Economic Overview

Eighty one percent of hake quota is held by five companies. In September 2009, the market value of hake quota was estimated to be \$135.5M. In 2012, 3,350 tonnes of hake product was exported with a value of \$14.7 million.

The destination for most hake exports is Spain and Japan. It is mainly exported in frozen form, and mostly as headed and gutted product.

Due to decreased demand in recent years from the Spanish market, both export volume and value have been decreasing in recent years (Table 3). The drop in average price per tonne is another factor affecting fisher behaviour in the hake fisheries.

Table 3: Total export volume and value of hake for calendar years 2007-2012

Calendar year	Export volume (tonnes)	Export value (millions NZ\$)	Average price per tonne
2007	4,207	\$26.7	\$6,347
2008	2,536	\$21.2	\$8,360
2009	3,382	\$27.7	\$8,190
2010	2,962	\$14.7	\$4,963
2011	2,973	\$15.7	\$5,281
2012	3,350	\$14.7	\$4,388

Source: New Zealand Seafood Exports – Seafood New Zealand

The hake fisheries are currently under review as possible candidates for Marine Stewardship Council certification as sustainably managed fisheries. Certification would provide access to some markets that only buy certified seafood and may lift the value of New Zealand hake and would actively demonstrate New Zealand’s effectiveness in the sustainable management of its fisheries.

Compliance Overview

Hake fisheries are subject to a number of regulatory measures aimed at ensuring the fisheries are managed to achieve long-term sustainability. All vessels fishing in New Zealand waters that are greater than 28 m total length (or fishing for orange roughy or scampi) are required to carry an automatic location communicator. Signals from each vessel are then monitored in near real-time for positional data through the vessel monitoring system (VMS). Further work will be undertaken through the implementation of the National Deepwater Plan to further identify and assess compliance risks specific to hake fisheries. However, the following compliance risks have been identified as potentially being of particular relevance to hake fisheries and these are described in more detail below:

1. Area misreporting
2. Illegal discarding
3. Compliance with environmental mitigation regulations

Area misreporting

Area misreporting, known colloquially as ‘trucking’, occurs when catch taken in one quota management area (QMA) is deliberately misreported as caught in a different QMA. The primary motive behind this type of offence is typically to minimise the cost of acquiring Annual Catch Entitlement (ACE) or to avoid paying deemed value charges if ACE is unavailable. There have been a few prosecutions regarding area misreporting in the hake fisheries, most notably between 1994/95 and 2000/01 when some catches reported from HAK4 were actually taken from HAK7. The risk of area misreporting is now considered to be lower due to improved technology to monitor the location and timing of catches, increased observer coverage, and an increased availability of ACE for all QMAs reducing incentives to misreport catch by areas.

Illegal Discarding

In this context, discarding is the unauthorised dumping of QMS species at sea and is prohibited under s 72 of the Fisheries Act 1996 (the Act). Several incentives exist for fishers to discard QMS species:

- Avoidance of the cost of utilising or sourcing ACE to cover the catch or paying deemed value charges if ACE cannot be obtained
- Some fishers choose to deliberately discard smaller or less valuable fish (e.g. damaged catch) to maximise economic return from their catch (highgrading).

The Ministry strives to minimise the opportunity for these and other types of offending to occur through careful risk analysis of the fisheries with cooperative input from the industry. Information sharing with industry allows the Ministry to adapt compliance efforts to focus on current risks.

Compliance with environmental mitigation measures

Regulation requires that all deepwater trawl vessels over 28 m in length deploy seabird scaring devices to ensure that fishing activity does not pose an unnecessary risk to protected species. This is especially important in hake fisheries as the majority of target hake fishing is carried out by vessels that do not have fishmeal plants or offal holding tanks and thus have an increased risk of seabird interactions.

Social and cultural overview

The Act requires that, prior to setting management measures for hake, the Minister with responsibility for fisheries shall consult with persons having an interest in the stock or the effects of fishing on the aquatic environment in the area in which the fishery takes place, including Maori, environmental, commercial and recreational interests. In addition, the Act requires that in setting a Total Allowable Catch (TAC) under section 13, the Minister shall have regard to such social, cultural and economic factors (s)he considers relevant.

Social and cultural factors include those related to the harvesting of hake by all parties; commercial, recreational and customary. However, there is little recreational or customary fishing for hake and there are no recreational or customary allowances for any hake fishstock.

Social and cultural factors also include the non-extractive value of healthy hake and key bycatch stocks and the values associated with an aquatic environment that is not adversely impacted by hake fishing activity. These intrinsic values must also be considered when determining the appropriate management measures for a fishery.

Overview by fishery

The following section provides a description of each hake fishery and an outline of their current status. A graph of catch over time is included for each fishery. Figure 2 shows important areas for hake fisheries.

Historical fishery information

Records of hake catches in New Zealand begin in 1975, when the catch was taken entirely by Japanese-flagged vessels. Over the next few years, catches increased markedly up to nearly 20,000 tonnes in 1977. Catches dropped off sharply the following year and then remained around 2,000 tonnes until the introduction of hake to the QMS in 1986. The overall Total Allowable Commercial Catch (TACC) was initially set at a total of 6,510 tonnes, which was gradually increased over the next four years as a result of quota appeals. In 1991, HAK1, HAK4, and HAK7 had TACC increases that

increased the total TACC from 6,930 tonnes to 13,780 tonnes. The total TACC as of 1 October 2012 was 13,211 tonnes.

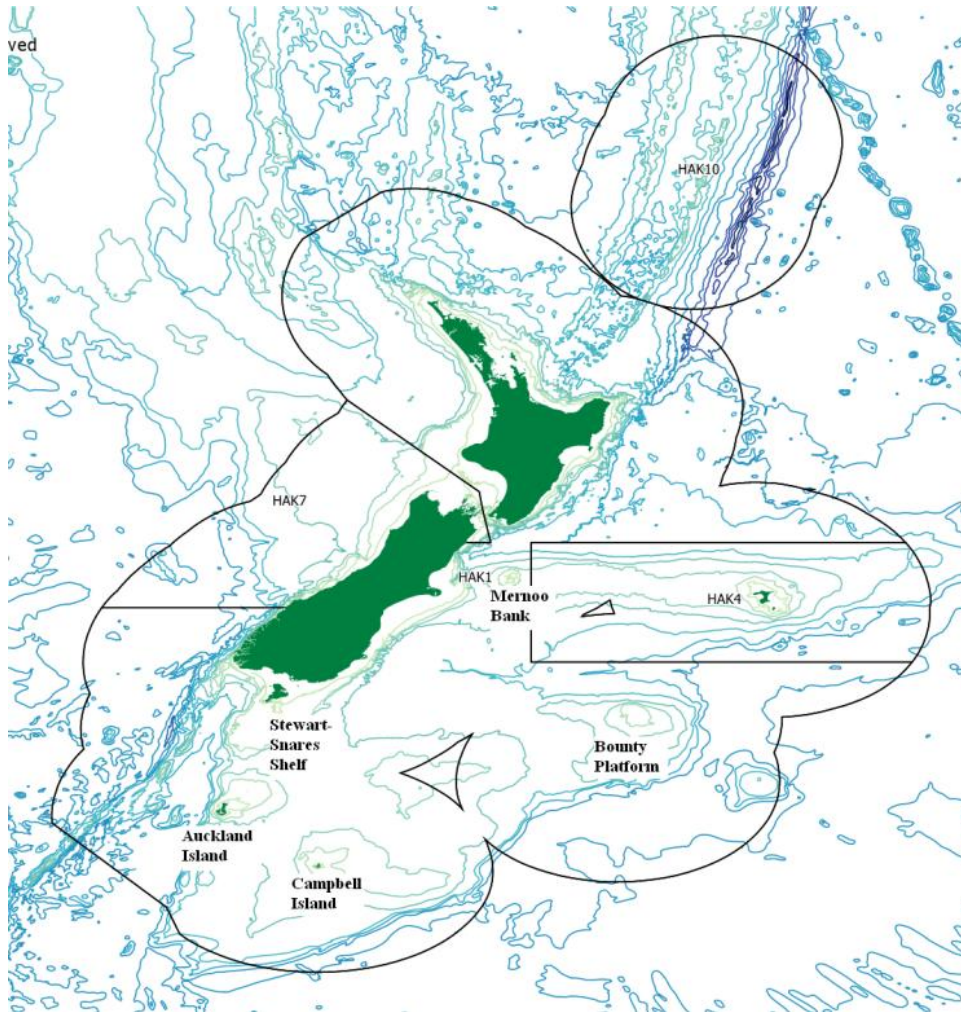


Figure 2: Map of the New Zealand EEZ and the main features pertinent to hake fishing.

HAK1 – Sub-Antarctic Fishery

HAK1 covers all parts of the EEZ other than the Chatham Rise and the west coast of the South Island. The main fishing areas in HAK1 are the sub-Antarctic area, mainly around the southwestern tip of the Snares Shelf, and the area west of Mernoo Bank, just off the east coast of the South Island. The fishery in the Mernoo Bank area is based on part of the Chatham Rise biological stock, and is not covered by the sub-Antarctic stock assessment.

Historically, HAK1 was predominantly taken as a bycatch in the hoki fisheries, however in recent years the majority of catches have come from hake target fishing. The sub-Antarctic fishing fleet has changed over this time with a shift away from hake caught as a bycatch of New Zealand vessels fishing for hoki, and towards Japanese or Korean vessels targeting hake.

The TACC for HAK1 has not been changed for any sustainability reasons since its introduction into the QMS in 1986 and is set at 3,701 tonnes. The TACC has been overcaught occasionally, most recently in the 2004/05 fishing year (Figure 3).

The most recent stock assessment for the sub-Antarctic stock was completed in 2011 and covers the biological stock in the sub-Antarctic area, which is defined as all areas south of latitude 46°S. The assessment was based on trawl survey abundance data, age data from commercial fisheries and trawl surveys, and estimates of biological parameters.

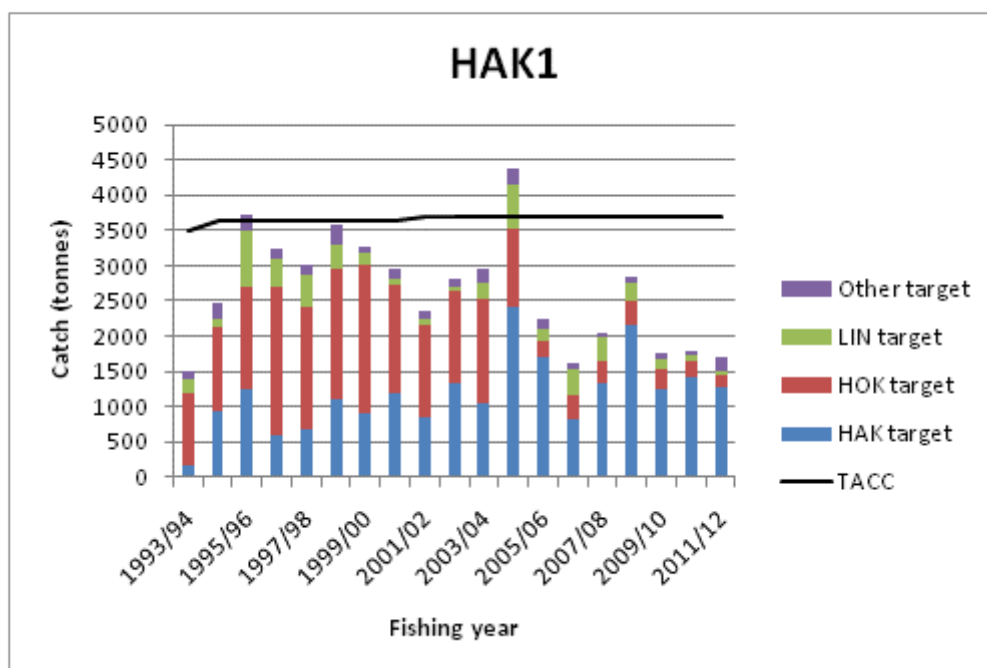


Figure 3: HAK 1 TACC and estimated catch by target species for 1993/94 to 2011/12

- The most recent stock assessment (2011) indicated that the stock biomass was about 50%B₀, which is Very Likely (>90% probability) to be at or above the default management target of 40%B₀.

HAK 4 – Chatham Rise Fishery

The Chatham Rise hake fishery reached its peak in 1996/97 when catches reached 3500 tonnes. The fishery has declined markedly since then, with only 161 tonnes reported in 2011/12 (Figure 4).

The TACC for HAK4 was initially set at 1,000 tonnes but was increased in 1991 to 3,500 tonnes to allow for more utilisation of the stock. In 2004, the HAK4 TACC was nearly halved to 1,800 tonnes based on decreasing catches and indications of reduced recruitment to the fishery which created sustainability concerns. Since this time, catches have not reached the TACC.

The HAK4 fishery is dominated by Korean vessels targeting hake, which have taken over 60% of the HAK4 catch in the last three years. The remainder of the catch is mainly taken as bycatch by New Zealand vessels targeting hoki.

The HAK4 biological stock includes the fish that spawn on the Chatham Rise, some of this biological stock extends to the west of the HAK4 QMA and into HAK1 on the Mernoo Bank, which supports one of the main hake fisheries. This overlap has the potential to cause difficulties as reducing the HAK4 TACC to limit catches on the Chatham Rise biological stock may not be effective if catches are still taken on Mernoo Bank in HAK1.

Stock assessments of the Chatham Rise stock are based on regular trawl surveys, catch-at-age information from the commercial fisheries, and estimates of biological parameters. Assessments are scheduled to be undertaken every four years.

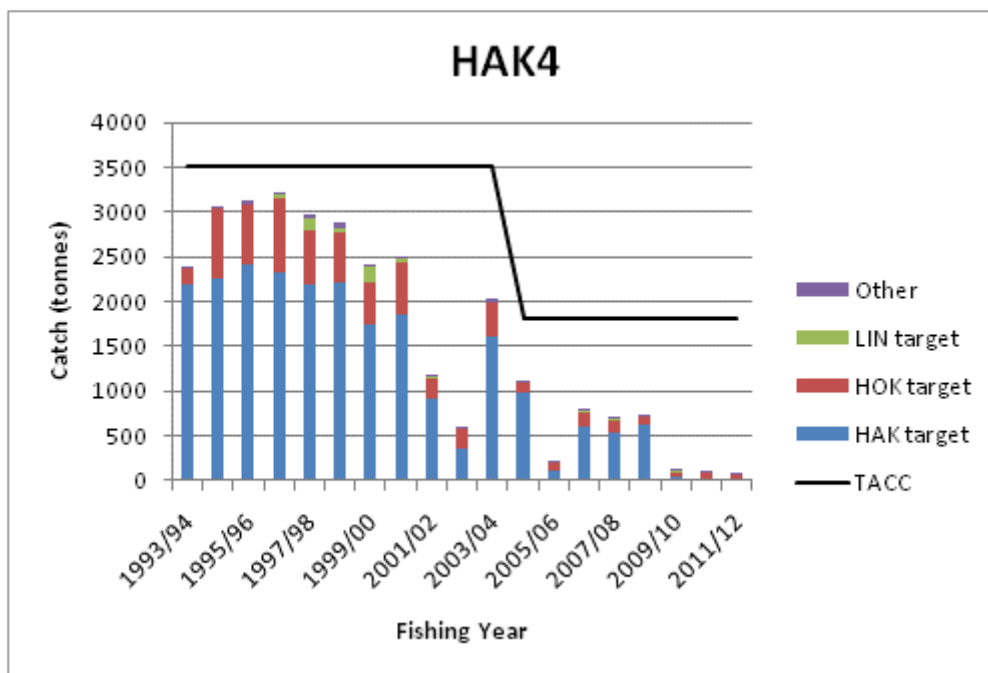


Figure 4: HAK 4 TACC and catches by target species from 1993/94 to 2011/12

- The most recent stock assessment (2012) indicated that the stock is at about 47%B₀, which is Likely (>60% probability) to be at or above the default management target of 40%B₀.

HAK 7 – West coast South Island Fishery

The west coast South Island fishery is the largest hake fishery in New Zealand. Catches of up to 17,000 tonnes were recorded by foreign fishing vessels in the late 1970s before the establishment of the EEZ. HAK7 was introduced into the QMS in 1986 with a TACC of 3,000 tonnes, which rose quickly as a result of quota appeals to 6,855 tonnes for the 1 October 1994 fishing year. The TACC was regularly overcaught throughout the 1990s, and in 2005 the TACC was increased to its current level of 7,700 tonnes. From 2007, catches in HAK7 have been lower and variable, with a low of 2,351 tonnes in 2009/10 (Figure 5). Catches decreased markedly in 2007/08 when the Japanese hake vessels left the fishery, they had historically caught between 300 and 1,200 tonnes of hake from HAK7.

From its introduction to the QMS, hake catches on the west coast South Island were primarily bycatch in the hoki trawl fishery, although prior to 2001, fishers were not allowed to catch hake without holding the relevant quota first unless they were able to prove that it was only a bycatch in another target fishery. As hake TACCs were often overcaught, fishers would not be able to source appropriate ACE, and therefore would sometimes report hoki as the target species when fishing for hake. Regulation changes and decreasing hoki TACCs led to the development of a clear hake target fishery. From 2003, catches in hake target trawls have exceeded those from hoki targeting, with only 172 tonnes taken from hoki targeting in 2007/08. As the fishery still contains some catch from hoki targets, this interaction should be noted, as the hoki TACC has recently increased again.

The west coast South Island fishery is dominated by a few Korean charter vessels that focus on targeting hake.

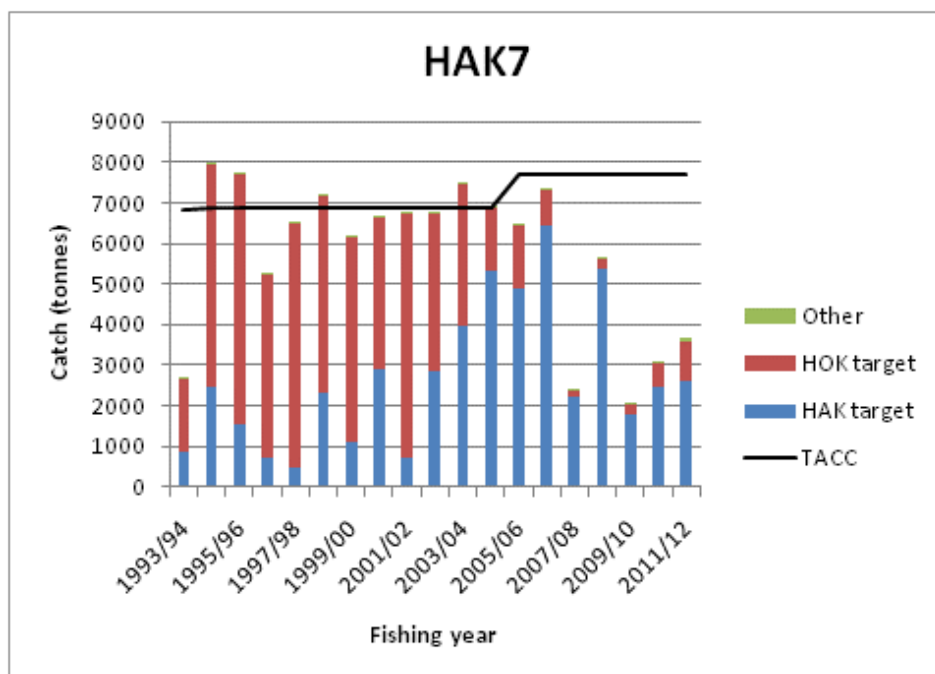


Figure 5: HAK 7 TACC and estimated catches by target species 1993/94

- The most recent stock assessment for HAK7 (2012) indicated that the stock is about 58%B₀, which is Very Likely (>90% probability) to be at or above the default management target of 40%B₀.

2. Overview of Non-target Interactions

This section describes in more detail the relevant non-target bycatch (see Table 2) and incidental interactions and captures¹ that occur in the hake fisheries. The bycatch and incidental captures are categorised as follows:

1. **Associated species:** These are QMS species which are caught as a bycatch in hake and are not managed in another fishery-specific chapter. There are no associated species managed in conjunction with hake.
2. **Incidental bycatch (Tier 3) species:** These are non-QMS species which are usually discarded or reduced to fish meal and are considered to be of little commercial value.
3. **Incidental interactions with endangered, threatened and protected (ETP) species:** This category relates to the incidental interaction, capture, and mortality (or release) of protected species such as seabirds, marine mammals, protected corals and protected shark species.
4. **Benthic interactions:** This category includes benthic habitat and invertebrate species that are captured by or that are known to interact with trawl gear. This information is based on Ministry observer reports.

Fish and invertebrate species taken as bycatch or incidental catch in target hake fisheries for the last three complete fishing years are shown in Table 5 below. This information is based on data collected by Ministry observers.

The table is colour coded as follows:

- Those species highlighted in orange are **key** bycatch species managed through another chapter in the National Deepwater Plan.
- Those species highlighted in green are **key** bycatch species managed through the National Fisheries Plan for Highly Migratory Species (HMS).
- Those species highlighted in yellow are **key** bycatch species managed through the National Fisheries Plan for Inshore Finfish.
- Remaining species (uncoloured) are **incidental** bycatch species which will be monitored annually as part of the implementation of the National Deepwater Plan.

¹ Captures refers to all animals live or dead that are brought on deck or animals that are observed killed by the fishing activity. It excludes any animals that were decomposing (i.e. not killed in fishing interaction), and those that land on deck or collide with the vessel superstructure.

Table 5: Catch weight by species name for the top 50 species (listed in order of decreasing catch volume over the period 2000-2012) caught in hake target fishing and details from observer records for the period 1 October 2009 to 30 September 2012. Total % is based on all catch information from 2000-2012.

Common name	2009/10		2010/11		2011/12		2000-2012
	Sum of observed catch (t)	% of catch	Sum of observed catch (t)	% of catch	Sum of observed catch (t)	% of catch	Total % of catch
Hake	1519.7	58.54	1215.8	46.67	1633.7	61.40	62.10
Hoki	505.3	19.47	877.0	33.66	500.4	18.81	20.08
Ling	235.9	9.09	218.3	8.38	281.2	10.57	5.58
Ribaldo	32.4	1.25	32.0	1.23	34.0	1.28	1.65
Javelinfish	27.6	1.06	48.6	1.87	18.3	0.69	1.57
White warehou	54.3	2.09	8.6	0.33	63.0	2.37	1.30
Silver warehou	41.5	1.60	28.8	1.10	29.9	1.13	1.28
Rattails	22.2	0.86	32.5	1.25	12.9	0.48	1.14
Spiny dogfish	52.9	2.04	14.0	0.54	9.3	0.35	0.56
Sea perch	9.2	0.36	6.0	0.23	6.0	0.23	0.46
Lookdown dory	9.0	0.35	11.8	0.45	5.4	0.20	0.43
Arrow squid	11.0	0.42	18.7	0.72	5.8	0.22	0.32
Conger eel	5.1	0.20	4.3	0.17	5.5	0.21	0.25
Banded bellowsfish	0.9	0.03	0.3	0.01	0.2	0.01	0.17
Shovelnose dogfish	2.1	0.08	6.3	0.24	1.3	0.05	0.17
Smooth skate	4.3	0.17	4.9	0.19	5.2	0.19	0.17
Leafscale gulper shark	6.7	0.26	2.4	0.09	6.3	0.24	0.15
Hagfish	0.1	0.00	3.2	0.12	0.1	0.00	0.15
Pale ghost shark	2.1	0.08	8.3	0.32	2.4	0.09	0.14
Other sharks and dogfish	2.0	0.08	0.3	0.01	0.2	0.01	0.12
Seal shark	0.3	0.01	0.5	0.02	1.1	0.04	0.11
Basking shark	6.0	0.23	7.0	0.27	0.0	0.00	0.10
Alfonsino	0.1	0.00	0.1	0.00	0.0	0.00	0.09
Rudderfish	3.9	0.15	1.8	0.07	3.0	0.11	0.09
Giant stargazer	4.0	0.15	2.7	0.11	2.5	0.09	0.08
Deepsea flathead	1.4	0.05	1.7	0.07	0.4	0.02	0.08
Scabbardfish	0.1	0.00	0.2	0.01	0.0	0.00	0.08
Swollenhead conger	0.1	0.00	6.5	0.25	0.3	0.01	0.07
Deepwater dogfish	1.0	0.04	2.1	0.08	0.0	0.00	0.06
Unicorn rattail	0.0	0.00	1.1	0.04	0.9	0.03	0.05
Warty squid	3.1	0.12	1.5	0.06	0.8	0.03	0.05
Dark ghost shark	1.1	0.04	0.9	0.03	2.1	0.08	0.05
Common roughy	3.4	0.13	0.6	0.02	0.9	0.03	0.05
Spiky oreo	0.1	0.00	0.1	0.00	0.4	0.01	0.04
Dealfish	0.1	0.00	0.1	0.00	0.0	0.00	0.04
Umbrella octopus	0.2	0.01	0.6	0.02	2.0	0.08	0.04
Starfish	0.5	0.02	0.2	0.01	0.3	0.01	0.04
Gemfish	1.4	0.05	1.5	0.06	1.3	0.05	0.04
Ray's bream	3.6	0.14	0.6	0.02	1.1	0.04	0.04
Slickhead	0.4	0.01	0.4	0.02	1.0	0.04	0.03
Orange roughy	0.0	0.00	0.0	0.00	0.0	0.00	0.03
Toadfish	1.1	0.04	0.8	0.03	0.9	0.03	0.03

Common name	2009/10		2010/11		2011/12		2000-2012
	Sum of observed catch (t)	% of catch	Sum of observed catch (t)	% of catch	Sum of observed catch (t)	% of catch	Total % of catch
Barracouta	0.4	0.02	0.6	0.02	0.4	0.02	0.03
Red squid	1.8	0.07	2.0	0.08	0.0	0.00	0.03
Wood	0.6	0.02	3.5	0.13	0.9	0.03	0.03
Lucifer dogfish	0.9	0.03	1.4	0.05	1.5	0.06	0.03
School shark	2.0	0.08	0.4	0.01	0.5	0.02	0.02
Bellowsfish	0.5	0.02	0.1	0.00	0.0	0.00	0.02
Basketwork eel	0.1	0.00	0.8	0.03	0.1	0.00	0.02
Rubbish-fishing other	0.0	0.00	0.0	0.00	0.0	0.00	0.02
Long-nosed chimaera	0.2	0.01	1.2	0.05	0.3	0.01	0.02

Category 1: Associated species

There are no key bycatch stocks from hake fishing that will be managed through this fishery-specific chapter. Of the top bycatch species in hake fisheries, eight of the top ten species are managed through other chapters of the National Deepwater Plan.

Category 2: Incidental bycatch species

Incidental bycatch species are those that are not in the QMS and typically have little or no commercial value. They are not the focus of fishing effort and are frequently discarded or processed into fishmeal, although all catch must be recorded on landing returns. In hake fisheries, the main incidental bycatch species are javelinfish and rattails. Catch levels will continue to be monitored annually using data collected by observers. A risk assessment framework will be used to determine species that may be at increased risk and guide prioritisation of research and/or management interventions. Interventions could include section 11 measures or the species being assessed for possible introduction to the QMS.

The QMS Introduction Standard requires the Ministry to carry out an annual process to determine which species or stocks may be considered by the Minister for introduction into the QMS. The first step of the process is to identify candidate species or stocks. Candidate species are those which meet one of six criteria. Key criteria include variation in catch of a species or where there is information to suggest a sustainability or utilisation concern exists.

Category 3: Incidental captures of ETP species

As described previously, the hake fisheries interact with a range of seabird and marine mammal species. The Fisheries Act requires that when an environmental impact is adverse, this effect should be avoided, remedied or mitigated. Notwithstanding this legal requirement, MPI and DWG have taken the approach of reducing risk where practicable regardless of whether effects on ETP species constitute an adverse impact.

Table 6 below describes the extent of interactions with seabirds (all species) and marine mammals observed on vessels targeting hake over the last eight complete fishing years. These data are analysed more thoroughly in the following sections using information from: <http://data.dragonfly.co.nz/psc/>.

Table 6: Observed seabird and fur seal captures from hake target fisheries.

Year	No. Observed captures	
	Seabirds	New Zealand fur seals
2003/04	6	0
2004/05	8	2
2005/06	1	11
2006/07	8	4
2007/08	4	28
2008/09	9	5
2009/10	4	4
2010/11	1	1

Seabirds

Seabird captures in trawl fisheries occur in two main ways. Seabirds either collide with or are struck by the trawl warps (often larger seabirds such as albatrosses), or are caught in the net when it is on the surface during shooting or hauling (often smaller seabirds such as shearwaters and petrels). Current research to quantify seabird interactions in New Zealand fisheries uses a model-based approach to estimate total numbers of seabird captures based on observer information and the amount of effort. Estimates for the most recent eight years for which data are available are shown in Table 7.

Table 7: Estimated seabird captures in hake fisheries 2003/04 to 2010/11.

Year	Number of tows	Observed captures (numbers of seabirds)	% observer coverage	Capture rate based on observer data (n per 100 tows)	Model-based estimate of total captures & 95% confidence interval
2003/04	1651	6	8.5	4.29	33 (18-55)
2004/05	1556	8	6.2	8.33	52 (29-88)
2005/06	1359	1	31.0	0.24	11 (4-22)
2006/07	1606	8	18.4	2.70	20 (12-31)
2007/08	1554	4	25.4	1.02	19 (10-31)
2008/09	1779	9	19.7	2.56	46 (26-76)
2009/10	822	4	40.1	1.21	10 (5-18)
2010/11	869	1	26.1	0.44	9 (3-19)

Regulations were passed in 2005 that require trawl vessels to deploy bird scaring devices, such as tori lines, to scare birds away from the warp danger zone around the stern of the vessel. In addition to these mandatory mitigation methods, industry and the Ministry work collaboratively to ensure all trawlers over 28 metres in length have, and follow, a Vessel Management Plan (VMP). VMPs specify the measures that must be followed onboard each vessel so as to reduce the risk of incidental seabird captures. These measures can include holding offal while shooting and hauling fishing gear and making sure all fish are removed from the net before it is put back in the water. The Ministry monitors vessel performance against its VMP and if a vessel is not complying with the guidelines, the Director General of the Ministry has the option of putting vessel-specific regulations in place to improve seabird mitigation practices.

The Ministry is currently finalising the National Plan of Action to reduce the incidental catch of seabirds in New Zealand Fisheries (NPOA-Seabirds). The NPOA-Seabird puts in place a risk based approach to managing fishing interactions with seabirds. A risk assessment identifies seabird species that may be at risk from the cumulative effects of commercial fishing activity in New Zealand, and also identifies those fishing practices that contribute to the risk for a particular seabird species. Six seabird species were identified as being at very high risk of impacts from fishing activity². Table 8 shows observed captures of five of these high risk species in hake fisheries from 2003/04 to 2010/11. Based on these data, hake fisheries do not presently pose any material risk to these seabird species.

² Richard, Y. And Abraham, E.R. (2013) Risk of commercial fisheries to New Zealand seabird populations. New Zealand Aquatic Environment and Biodiversity Report No. 109. 61 p.

Table 8: Observed captures and average annual captures of high risk seabird species in hake target fisheries 2003/04 to 2010/11 (listed in order of decreasing risk).

Species	Fishing year							
	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11
Black petrel	0	0	0	0	0	0	0	0
Salvin's albatross	3	0	0	1	0	2	0	0
Flesh-footed shearwater	0	0	0	0	0	0	0	0
Southern buller's albatross*	2	3	0	1	0	0	0	0
Chatham Island albatross	0	0	0	0	0	0	0	0
White-capped albatross	1	3	0	2	0	1	1	0

* Southern and Northern buller's albatross are reported together

Table 9 shows observed and modelled captures of white-capped albatross in hake fisheries for the 2003/04 to 2010/11 period.

Table 9: Observed and modelled captures of white-capped albatross from hake target fisheries 2003/04 to 2010/11.

Year	Number of tows	% observer coverage	Observed captures (numbers of seabirds)	Capture rate based on observer data (n per 100 tows)	Model-based estimate of total captures & 95% confidence interval
2003/04	1651	8.5	1	0.71	4 (1-8)
2004/05	1555	6.1	3	3.16	7 (3-12)
2005/06	1360	31.0	0	0.0	2 (0-6)
2006/07	1606	18.4	2	0.68	4 (2-7)
2007/08	1549	25.4	0	0.0	2 (0-5)
2008/09	1779	19.7	1	0.28	4 (1-9)
2009/10	823	40.1	1	0.3	2 (1-4)
2010/11	870	26.1	0	0.0	1 (0-2)

Marine Mammals

New Zealand fur seals are the only marine mammal known to interact with hake trawl fisheries. The New Zealand fur seal is a protected species under the Marine Mammals Protection Act 1978, however, the species has been classified by the Department of Conservation as not threatened³. In addition, it is thought that the fur seal population has been expanding around the coast of New Zealand in the last twenty to thirty years. Estimates of total fur seal captures are modelled based on information collected by observers and the percentage of tows that were observed. Table 8 shows the number of New Zealand fur seal captures in hake fisheries for the period 2003/04 to 2010/11.

³ Baker, CS., Chilvers BL, et. Al. (2010) Conservation status of New Zealand marine mammals (suborders Cetacea and Pinnipedia), 2009, New Zealand Journal of Marine and Freshwater Research, 44:2, p. 101-115.

Table 8: Observed and modelled New Zealand fur seal captures in hake target fisheries from 2003/04 to 2010/11.

Year	Number of tows	% tows observed	Observed captures	Observed capture rate	Model-based estimate of total captures and 95% confidence interval
2003/04	1641	8.5	0	0.00	14 (2-41)
2004/05	1549	6.1	2	2.13	33 (8-85)
2005/06	1359	30.8	11	2.63	35 (15-84)
2006/07	1604	18.4	4	1.36	19 (6-46)
2007/08	1542	25.6	28	7.11	50 (32-95)
2008/09	1764	19.9	5	1.42	21 (7-53)
2009/10	821	40.1	4	1.22	12 (4-33)
2010/11	867	26.2	1	0.00	10 (1-34)

The fishing industry has developed a Marine Mammal Operating Procedure (MMOP) which is generic across all trawlers greater than 28 m in length. The MMOP describes a range of procedures that a vessel and crew should follow to reduce the risk of marine mammal captures. These measures include managing offal discharge and to steam away from large aggregations of marine mammals before shooting or hauling fishing gear. The Ministry monitors and audits vessel performance against the MMOP via the Ministry observer programme. The Ministry reports the results of these audits annually via the Deepwater Annual Review Report (ARR).

Sharks (elasmobranchs)

Sharks can be classified into two broad administrative categories, protected species and others. Protected shark species are those that are domestically protected under the New Zealand Wildlife Act 1953. Table 9 shows which shark species are currently included in the protected species category.

Table 9: Protected elasmobranch species and historical observed captures in hake fisheries in records from 2000-2012

Species	Captures in hake fisheries
Great white shark	0
Basking shark	4*
Whale shark	0
Smalltooth sandtiger shark	0
Manta ray	0
Spine-tailed devil ray	0
Oceanic whitetip shark [†]	0

* Captures were in 2003/04 (2), 2009/10 and 2010/11

[†] Protected from January 2013

While not specifically mentioned in the National Deepwater Plan, New Zealand has responsibilities under the FAO International Plan of Action (IPOA) for Sharks to ensure conservation of sharks and management of all fisheries that catch sharks. In 2008, the Minister of Fisheries approved a National

Plan of Action (NPOA) for the Conservation and Management of Sharks⁴ which establishes a range of actions to ensure that fisheries management in New Zealand satisfies the objectives of the IPOA-Sharks. The NPOA focuses on a series of management actions to enable New Zealand to meet its international obligations with respect to the management of shark interactions. These actions focus on four broad areas:

- Eliminating live shark finning (currently illegal in New Zealand under the Animal Welfare Act 1999)
- Ensuring appropriate conservation of threatened and endangered shark species
- Reviewing fisheries shark management where sharks are the target or a bycatch; and
- Improvement of information on shark captures

The hake fishery has limited interactions with protected shark species, but does interact with other shark species more regularly. However, the information on the nature and extent of these interactions, and species involved, is incomplete. A key objective of the National Deepwater Plan is to improve monitoring and information collected regarding interactions with shark species across all deepwater fisheries. If the results of this monitoring indicate that further research into particular shark species is needed then this research will be delivered through the 10 Year Research Programme as required. In addition to this, an ecological risk assessment is under development that will be applied to understand the risks to the different shark species from all fishing and specific fishing activity.

Protected coral species

An amendment to the Wildlife Act 1953 in July 2010 resulted in most hard coral species in New Zealand being protected under that Act. During the last ten fishing years, observers have reported a total of less than 70 kgs of hard corals being taken in hake fisheries (see Table 10).

Category 4: Benthic interactions

Hake is fished with both mid-water and bottom trawl gear. Contact by components of trawl gear (doors, ground rope, etc.) with the seafloor results in the capture of benthic invertebrates and impacts on both physical and biological components of the benthic habitat.

The Ministry acknowledges that benthic bycatch data do not provide information on the nature and extent of benthic interactions from hake fishing activity. Table 10 below details the benthic bycatch that has been recorded from observed tows targeting hake over the last 12 fishing years.

Table 10: Benthic bycatch from hake target tows from observer records for 2000/01 to 2011/12 fishing years

Phyla	Common name	Total amount recorded (kg)
Cnidaria	Corals (protected species)	46.4
	Corals (generic code & non-protected species)	17.5
	Anemones	3,217.8
	Sea pens	33.1
	Hydroids	0.1
Porifera	Sponges	1,000.2

⁴ The 2008 NPOA-Sharks will be updated in 2013.

The footprint of all hake target trawl fishing has been calculated as having covered 17,681 km² between 1989/90 and 2009/10. Figure 6 below shows the 1989/90 to 2009/10 trawl footprint for hake target fishing and details of the hake habitat depth range.

The current management approach to address the effects of deepwater trawl activity is focused on avoiding effects prior to any designation of effects being adverse. This has been achieved by closing areas of the New Zealand EEZ to bottom trawling; first with seamount closures and then with Benthic Protection Areas (BPAs). The implementation of BPAs in 2007 effectively closed over 30% of the New Zealand EEZ to bottom trawling. The Ministry also implemented a monitoring regime to ensure these closures were adhered to. The BPA closures were based on the best available marine environmental classification information at the time and over 10% of each environment class was closed.⁵ BPA closures cover 10.8 % of the full reported range of hake, trawl footprint information suggests only 30 km² of this had ever been trawled.

The current BPAs will be reviewed after 2013 and if that review or other research suggests that the existing BPAs are not protecting a representative range of marine habitats then further closures will be considered. Figure 7 below details the BPAs.

⁵ The exception was environment class 55, where only 3% was closed, because a third of this area is included in the Territorial Sea and most bottom trawling in that area is for coastal rather than deepwater species.

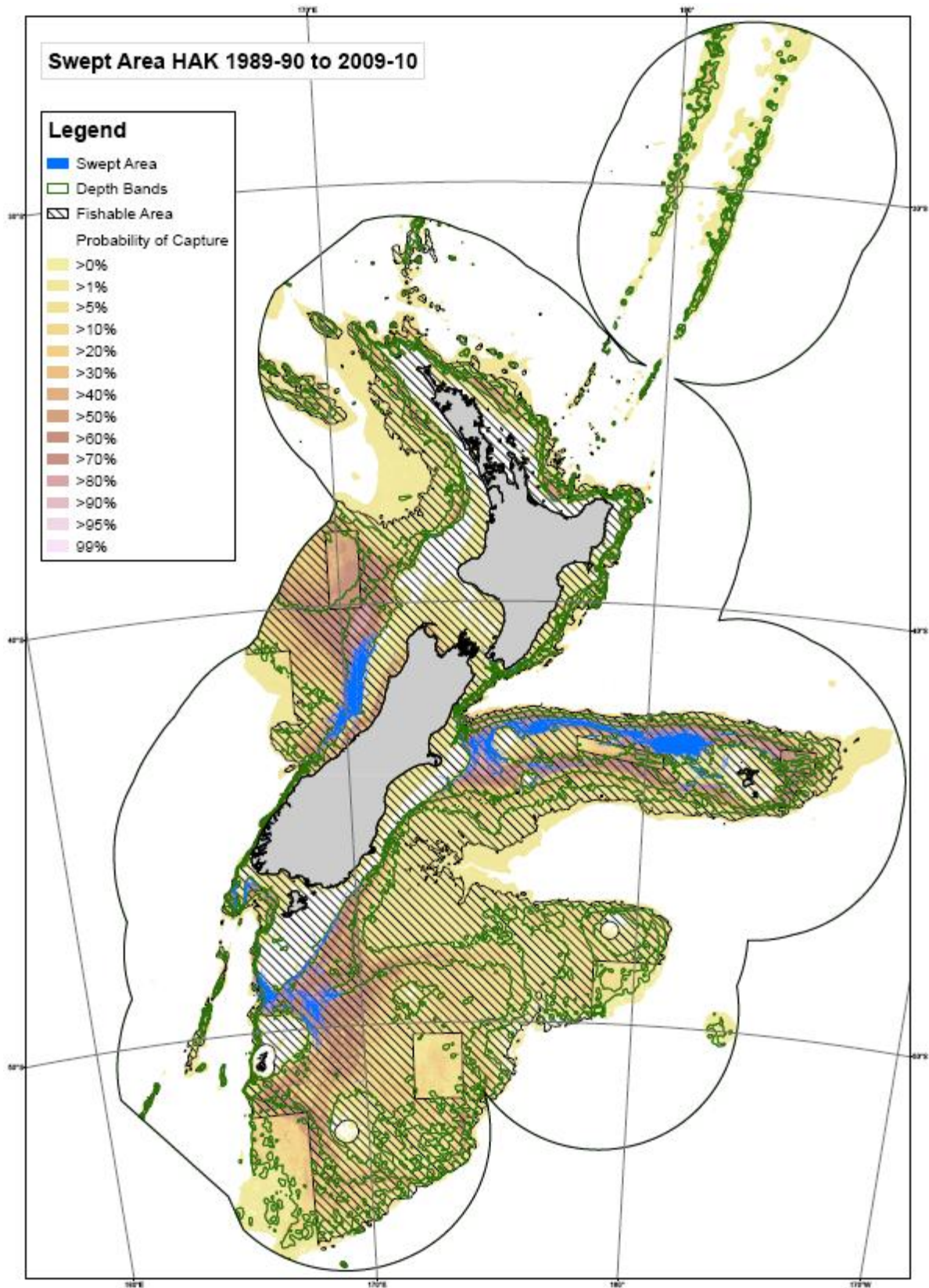


Figure 6: Hake bottom trawl footprint 1989/90-2009/10

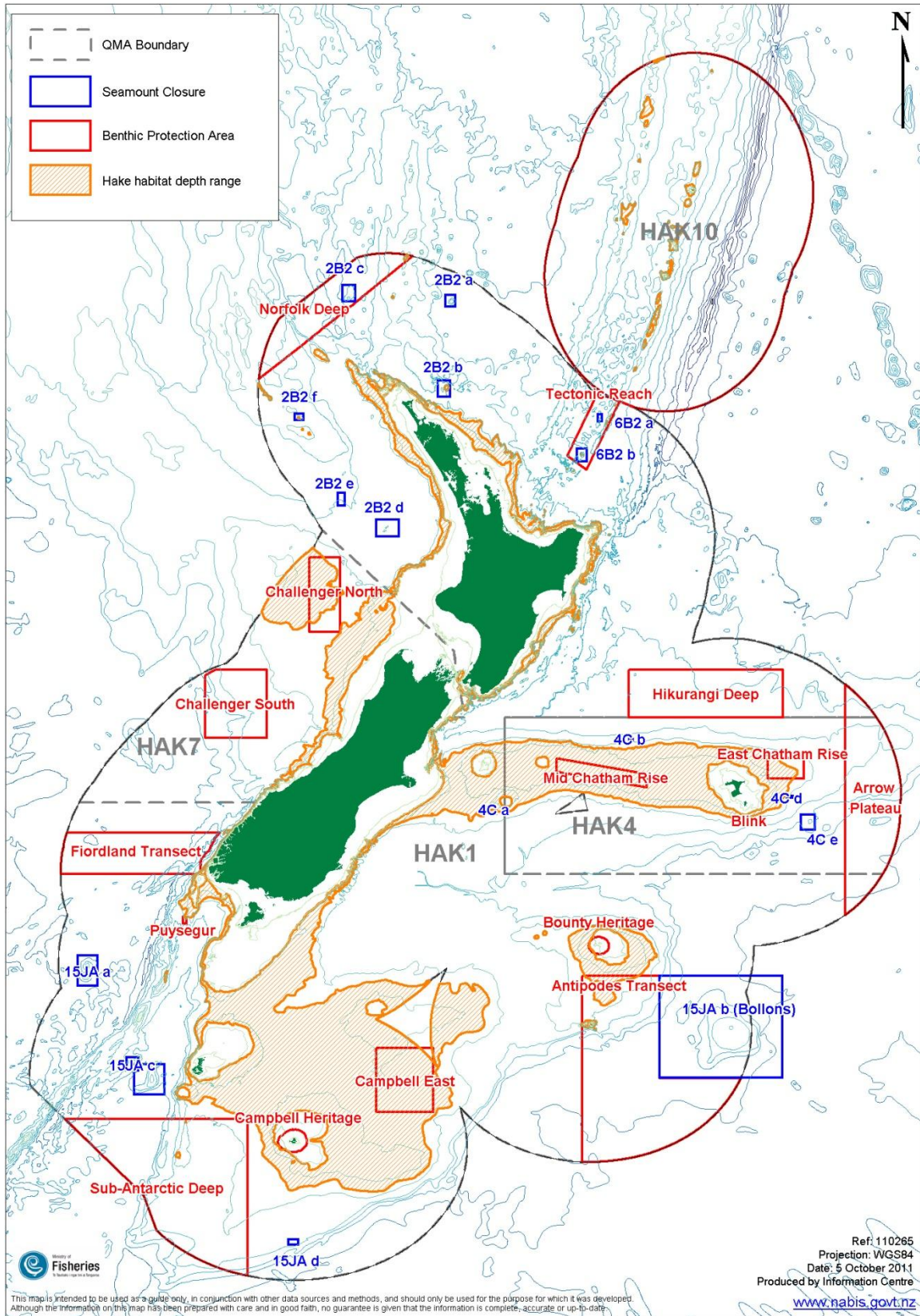


Figure 7: The areas of hake habitat currently closed to bottom trawling activity through BPAs and seamount closures.

3. Operational Objectives for hake fisheries

This section describes the operational objectives that will drive the management of hake fisheries through the five-year timeframe of the hake chapter of the National Deepwater Plan. Each operational objective is described in terms of the high level management approach that will be taken to address these key issues and the Performance Indicators that will be used to indicate progress towards achievement of them.

Operational objectives are specific, measurable and time bound. The actions (and services) required to meet these operational objectives will be specified each year in the Annual Operational Plan.

Also described in this section is the expected timeframe for delivery of the work that will contribute to achievement of the stated Performance Indicators. Timeframes are presented by financial year (1 July – 30 June), and to enable readers to interpret these timeframes correctly, the following guidelines are included below:

- Where the timeframe is “**by** 20xx/xx”, it is expected that work will be **completed** by the **end** of the stated financial year
- Where the timeframe is “**from** 20xx/xx”, it is expected that work will **commence** during the stated financial year, and will likely be ongoing across one or more financial years
- Where the timeframe is “**during** 20xx/xx”, it is expected that work will be completed **during** the stated financial year.
- “Annual delivery” requires work to be reported annually throughout the duration of this Plan.

Utilisation-focused Operational Objectives

OO1.1 Support the hake fisheries in achieving and maintaining credible third party certification and ensure any Conditions of Certification are met within the required timeframe

New Zealand hake fisheries are currently being evaluated as possible candidate fisheries for certification under the Marine Stewardship Council (MSC) sustainability scheme. This Operational Objective aims to ensure the adequate and timely provision of documentation required for all steps in the MSC assessment process and recognises that Conditions of Certification (CoCs) that may be placed on the hake fisheries may require additional management actions that have not been specified in this chapter. Should any CoCs refer to issues not incorporated in the other Operational Objectives, work towards completion of the CoC will be specified in the Annual Operational Plan and driven through this objective.

Contributing to Management Objectives	Performance Indicators	Timeframe
MO 1.1 MO1.5 MO1.6 MO2.3	1. Hake fisheries are successfully certified by a credible third party certification body 2. Any Conditions of Certification placed on a fishery are effectively incorporated into management actions through Annual Operational Plans	1. By 2013/14 2. From 2013/14

OO1.2 Enable quota owners to develop and implement a harvest regime that will maximise the value obtained from hake fisheries within sustainability limits

This Operational Objective aims to assist quota owners in developing a list of principles and guidelines that can inform fisheries management decisions provided stock sustainability is assured. These guidelines will help give effect to the economic considerations of quota holders when TAC reviews occur. Principles will likely consider factors such as:

- The rate of change of the TAC
- Changes to associated fisheries, such as hoki or ling fisheries that may affect catch levels of hake.

Contributing to Management Objectives	Performance Indicators	Timeframe
MO 1.1 MO1.2 MO1.6 MO1.7 MO2.1	<ol style="list-style-type: none"> Guidelines that maximise the value obtained from hake fisheries within sustainability limits are agreed by quota owners Agreed guidelines are an integral component of hake management decisions, provided no sustainability concerns are present 	<ol style="list-style-type: none"> During 2013/14 From 2013/14

OO1.3 Ensure satisfactory levels of compliance are achieved in hake fisheries

Compliance indicators have been developed for deepwater fisheries in general to support the Voluntary Assisted Directed and Enforced (VADE) compliance model which focuses on “informed and assisted” compliance. Fishery-specific compliance information is not readily available for any of the hake fisheries. Initially, the Ministry will profile the levels of fisher compliance with the range of regulatory and non-regulatory management measures currently in place in the fishery. A risk assessment will then be undertaken to identify compliance risks specific to hake and associated fisheries. The risk assessment will be used to identify any areas that may need focussed compliance monitoring. Levels of compliance will then be assessed annually against generic performance indicators and reported to stakeholders and tangata whenua through the Annual Review Report.

Contributing to Management Objectives	Performance Indicators	Timeframe
MO 1.1 MO1.3 MO1.5 MO2.1 MO2.5	<ol style="list-style-type: none"> The performance of hake fisheries is assessed against the specified compliance performance indicators The results of each annual assessment demonstrate high levels of compliance and no consistent patterns of noncompliance in all hake and associated fisheries 	<ol style="list-style-type: none"> From 2013/14 From 2013/14

OO1.4 Ensure all research planned under the 10 Year Research Programme which is used to inform the management of hake fisheries continues to be peer reviewed, meets the requirements of the Research Standard, and is delivered in time to inform management decisions before the start of each October fishing year

The 10 Year Research Programme for deepwater fisheries sets out the research and monitoring approach for hake over the next 10 years. The research and monitoring approach differs by fishery based on the available information. All three hake fisheries have stock assessments based on trawl surveys, age data from commercial fisheries and biological parameters. Over the period of the 10 Year Research Programme it is planned to conduct and update assessments for all hake fisheries. Within the five-year timeframe of this National Deepwater Plan, the following research projects are scheduled for hake fisheries:

Year	Trawl survey			Stock assessment		
	HAK1	HAK4	HAK7	HAK1	HAK4	HAK7
2011-12	✓	✓		✓		
2012-13	✓	✓	✓		✓	✓
2013-14			✓			
2014-15	✓	✓		✓		

Contributing to Management Objectives	Performance Indicators	Timeframe
MO 1.4 MO1.2 MO1.5 MO2.2 MO2.4 MO2.5 MO2.6 MO2.7	<ol style="list-style-type: none"> All research projects scheduled through the 10 Year Research Programme are delivered in time to inform the annual management process for the start of the October fishing year All research delivered through the 10 Year Research Programme meets the agreed Ministry Research Standard and is independently peer reviewed through the Ministry Fisheries Assessment Working Group process Any other necessary information requirements are contracted and planned appropriately through the 'Additional Research' component of the 10 Year Research Programme and are also appropriately peer reviewed 	<ol style="list-style-type: none"> Annually Annually Annually

Environment-focused Operational Objectives

OO2.1 Develop an agreed harvest strategy for hake fisheries including a stock rebuild strategy that is consistent with the Harvest Strategy Standard

Hake fisheries are currently managed using the default harvest strategy including generic reference points specified in the Ministry's Harvest Strategy Standard. As part of the development of a species/stock specific harvest strategy, appropriate biological reference points for hake will be agreed. Reference points will then be used to underpin the management of hake fisheries and the development of the harvest regime.

The hake harvest strategy will incorporate all components detailed in the Harvest Strategy Standard, but will tailor them specifically to the biological characteristics and productivity of hake. The following components will therefore be developed and agreed:

- Reference points, including a target (range) and soft and hard limits;
- A formal, time constrained rebuilding strategy; and
- A harvest control rule component that will guide management action.

The rebuilding strategy would be implemented should stock biomass fall below the soft limit to drive an increase in the stock biomass back to the management target.

Contributing to Management Objectives	Performance Indicators	Timeframe
MO 2.1	1. An agreed harvest strategy for each hake stock is in place including a rebuild strategy	1. From 2013/14
MO1.2		
MO1.3		
MO1.5		2. From 2013/14
MO1.6	2. Details of the harvest strategies are publicly available	3. From 2013/14
MO2.2		
MO2.6	3. Stock status is reported against specific reference points	4. From 2013/14
	4. Agreed harvest strategies underpin management responses	

OO2.2 Implement appropriate spatial management measures to address any adverse effects of fishing for hake on the benthic habitat

The management of benthic interactions across hake fisheries will focus on monitoring the extent of the bottom trawl component of hake fishing each year. Ongoing monitoring of the hake trawl footprint is scheduled under the 10 Year Research Programme which will update the trawl footprint annually. This will enable the Ministry to assess any changes to the impacted area. The footprint will also be assessed against the best available marine habitat classification, which is currently the Benthic Optimised Marine Ecosystem Classification (BOMECE).

Contributing to Management Objectives	Performance Indicators	Timeframe
MO 2.7 MO1.2 MO1.6 MO2.6	<ol style="list-style-type: none"> 1. Maps of hake trawl footprint produced annually 2. The extent of the trawl footprint is assessed against the BOMEAC each year to consider whether benthic interactions are considered to have an adverse impact 3. If the hake trawl impacts are found to be having an adverse impact on the benthic habitat additional management measures are transparently developed and implemented 	<ol style="list-style-type: none"> 1. Annually 2. Annually 3. Annually

OO2.3 Ensure that incidental seabird mortalities in hake fisheries are mitigated and minimised

As discussed previously, interactions occur between hake fisheries and some species of seabirds. Initial results from the seabird risk assessment indicate that no species are at risk from large trawl vessels. To maintain this low risk level, current seabird mitigation measures will continue to be monitored and assessed to ensure continuing effectiveness.

The risk assessment did indicate some potential risk to seabird populations from inshore trawl fishing activity, which makes up a small proportion of hake catches. Where necessary, these risks will be addressed in collaboration with the Ministry's Inshore Fisheries Management Team and DWG.

If the risk assessment indicates an increased or unacceptable risk to seabird populations from hake fishing activity, a four-step approach will be implemented to ensure that risks are addressed appropriately:

1. The context around the risk rating will be assessed to gauge if it is the result of a gap in information or if it is based on actual observed captures;
2. Ongoing monitoring will identify any trends in seabird interactions with hake fisheries;
3. Trends will be reviewed to indicate if any management intervention is required; and
4. Where necessary, management measures will be developed and implemented in a timely manner to address the impact/

Contributing to Management Objectives	Performance Indicators	Timeframe
MO 2.5 MO1.2 MO1.6 MO2.6	<ol style="list-style-type: none"> 1. Observed seabird captures are reported annually for hake fisheries, including analysis of captures by species, area and vessel size, with appropriate peer review 2. Additional management measures are developed and implemented if/when deemed necessary 	<ol style="list-style-type: none"> 1. Annually 2. From 2013/14

OO2.4 Ensure that incidental marine mammal mortalities in hake fisheries are mitigated and minimised

The only marine mammal known to interact with the hake fisheries is the New Zealand fur seal. This operational objective aims to ensure that interactions with marine mammals in all trawl fisheries including hake are monitored and if interactions are deemed to be adverse, appropriate management measures are put in place.

Contributing to Management Objectives	Performance Indicators	Timeframe
MO 2.5 MO1.2 MO1.6 MO2.6	<ol style="list-style-type: none"> 1. Observed marine mammal captures are reported annually for hake fisheries, including analysis of captures by species, area and vessel size, with appropriate peer review 2. Additional management measures are developed and implemented if/when deemed necessary 	<ol style="list-style-type: none"> 1. Annually 2. From 2013/14

OO2.5 Monitor incidental bycatch of Tier 3 species in hake fisheries

As described earlier, the hake fisheries catch some non-QMS (Tier 3) species during fishing activity, most notably rattails (including javelinfish). A risk assessment will be completed to identify any Tier 3 species (or species groups) which may be at risk from fishing activity. Any species or species group deemed to be at risk from fishing activity will then be assessed against the QMS introduction standard and subject to appropriately increased monitoring.

Contributing to Management Objectives	Performance Indicators	Timeframe
MO 2.4 MO1.6 MO2.2 MO2.6	<ol style="list-style-type: none"> 1. Any bycatch species deemed to be at risk for hake fishing is assessed against the QMS introduction standard and results reported in the Annual Review Report 2. Additional monitoring is implemented for any bycatch species identified as being at risk from hake fishing.. 	<ol style="list-style-type: none"> 1. Annually 2. From 2013/14