HOK

NEW ZEALAND DEEPWATER FISHERIES MANAGEMENT PRACTICES

HOKI

DEEPWATER GROUP LTD
PUBLICATION SERIES 2013/01

deepwater group

DEEPWATER GROUP LTD

A non-profit organisation delivering the vision of New Zealand's deepwater quota owners to be recognised as having the best managed deepwater fisheries in the world, working closely with scientists and in partnership with the Ministry for Primary Industries.

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Introduction

OUR VISION: To be recognised as the best managed deepwater fisheries in the world.

New Zealand seafood products have a strong reputation for consistent high quality and for being harvested using environmentally sustainable practices. Consumers wanting a safe and sustainable food source need look no further than the flagship New Zealand deepwater species, hoki.

Hoki is one of New Zealand's most commercially important deepwater fisheries. Hoki are caught by trawling within four main fishing regions off New Zealand's South Island: on the Chatham Rise, Campbell Plateau, along the West Coast, and in Cook Strait.

New Zealand's seafood industry, including quota owners in the hoki fisheries, is committed to ensuring sustainable utilisation. This is delivered through the business ethos that sound environmental practices make good business sense.

Our role is to supply consumers with safe, nutritious, appetising and affordable seafood. The combined pressures of human population growth, increasing energy costs and the need to ensure sustainable production, mean we need to find ways to produce more seafood, with more certainty, while minimising any environmental effects. By 2030 the world demand for food will double, which will need to be met while still maintaining the environmental integrity that supports this production sustainably.[i]

Our commitment to sustainable utilisation includes the use of independent third party assessments to verify that our management practices reflect international best practice. Since 2001, New Zealand hoki fisheries have been Certified as meeting the very high standards required by the Marine Stewardship Council (MSC) programme. New Zealand hoki is one of the first major white fish fisheries to be Certified by MSC without conditions.

Deepwater Group Ltd (DWG) is an alliance of quota owners in New Zealand's deepwater fisheries. DWG represents the interests of shareholders who collectively own 94% of the New Zealand hoki quota.

CAPE PALLISER LIGHTHOUSE. NORTH ISLAND, NEW ZEALAND. XXXII

Profile

Hoki is one of New Zealand's most commercially important deepwater fisheries.

Common Name

Hoki

Scientific Name

Macruronus novaezelandiae

Ministry Code

HOK

Fishing Method

Mid-water and bottom trawl.

Distribution

Widely distributed throughout New Zealand waters from 34° S to 54° S, from depths of 10 m to over 900 m, with greatest abundances between 200 m and 600 m.

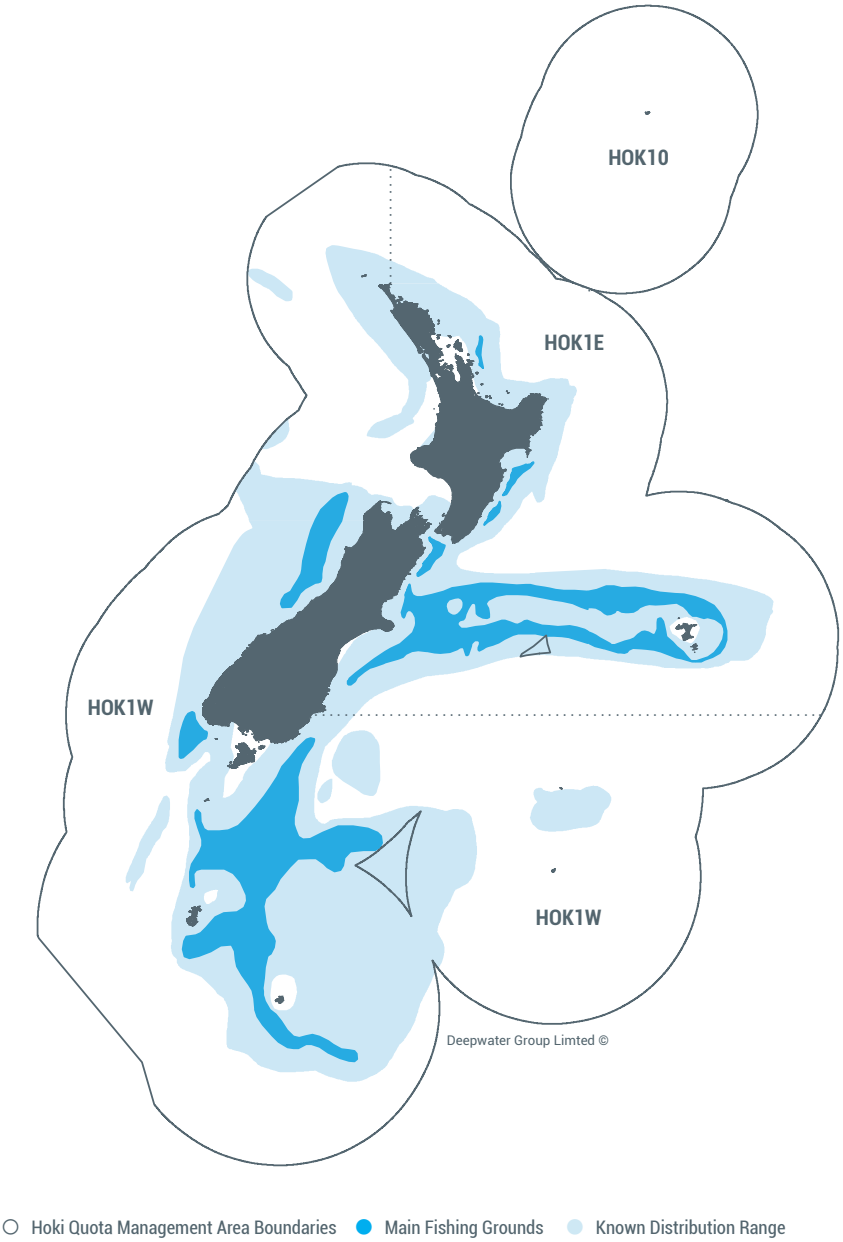
Quick Facts

Hoki is an internationally-accepted prime white fish with moist flaky flesh.

Hoki are fast growing and can reach up to 27 cm within one year.

The hoki fisheries were the first major whitefish fisheries to be certified sustainable by the internationally-recognised Marine Stewardship Council and were Certified for a record third time in 2012.

FIGURE 1
HOKI KNOWN DISTRIBUTION RANGE AND MAIN FISHING GROUNDS[1]



1. 'Known distribution range' provides an indication of where hoki are likely to be found based on all known records of hoki collected from research and commercial activities. They may be found elsewhere. 'Main fishing grounds' is based on the trawl footprint for the last ten years, only a fraction of this is trawled annually (see Habitats & Ecosystems).[xxiv]

Stock Sustainability

"Hoki have the most comprehensive monitoring and research programme of any New Zealand species."

Stock Structure

New Zealand hoki are managed as two separate stocks, an eastern and a western stock. Scientific research and assessments are carried out on each stock and catches from each are managed within separate catch limits under an overall Total Allowable Commercial Catch (TACC)[2] for HOK1, set by the Minister for Primary Industries.

Stock Assessment

Deepwater Group Ltd (DWG), the Ministry for Primary Industries (MPI) and scientists work together to ensure the hoki fisheries are adequately monitored. Hoki have the most comprehensive monitoring and research programme of any New Zealand species with two to four wide-area trawl or acoustic surveys undertaken each year, as well as extensive observer sampling programmes and biological analyses.

The results of all contracted research used in management are presented to MPI's Hoki Fisheries Assessment Working Group (HFAWG), an open scientific forum that provides staged technical guidance and peer review. All research information must meet (or exceed) MPI's Research and Science Information Standard for New Zealand Fisheries prior to being accepted as being of sufficient quality to inform management decisions.[ii]

The HFAWG evaluates relevant research, assesses the status of fisheries and fish stocks, and estimates likely future stock sizes under different catch levels. It does not make management recommendations or decisions, as these responsibilities lie with MPI fisheries managers and the Minister for Primary Industries.

The HFAWG is attended by MPI scientists, research providers, independent scientists, fisheries managers, and representatives from Industry and environmental NGOs. Once accepted by the HFAWG, stock assessments are further peer reviewed through a scientific plenary process and are reported in the annual Fisheries Assessment Plenary Report[iii] (publically available on MPI's website[iv]).

For hoki, the specifications of the stock assessment have remained largely unchanged since the 2005 assessment. The most recent stock assessment was carried out in 2013, incorporating new information from the fisheries, from two trawl surveys, and from an acoustic survey.[iv]

Key outputs from the stock assessment are estimates for each stock of: unfished spawning biomass (B_0[3]), current spawning biomass, spawning stock biomass trajectories, fishing mortality, recruitment levels, and probabilities of being at or above the management target.

Stock Status

The current stock size is estimated to be at or above 50% B_0 for each of the two hoki stocks, demonstrating that they are being maintained at or above the management target range (Table 1, Figure 2).

Harvest Strategy

> *"When recruitment levels decline, stock sizes decline. The management response to this is to reduce the TACC..."*

The Fisheries Act 1996 requires stocks managed under the Quota Management System (QMS) to be

> *"maintained at or above the biomass that can produce the Maximum Sustainable Yield (MSY)"*

(i.e. B_{MSY}[5]). MSY is the largest average long-term annual catch that can be taken from a stock under prevailing ecological and environmental conditions.

New Zealand has also adopted a Harvest Strategy Standard (HSS) that provides a technical elaboration of the MSY-related requirements of the Act.[v] It also adds the

TABLE 1
CURRENT STOCK SIZE AND STATUS (FROM RUN 1.7[4])[III]

STOCK	YEAR OF ASSESSMENT	B_0 (t)	$B_{CURRENT}$ (t)	$B_{CURRENT}$ / B_0 (%B_0)
Western Hoki	2013	967, 000	550, 000	56% (41-77%)
Eastern Hoki	2013	518, 000	263,000	50% (36-69%)

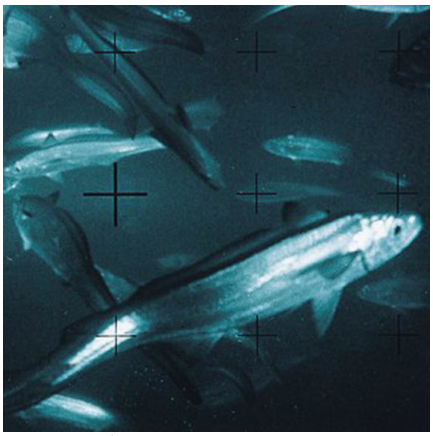
2. The TACC is the amount of fish commercial fishermen are allowed to catch of a particular stock in a given year which has been set by the Minister.
3. B_0 is the estimated biomass that would exist in the absence of fishing.
4. The 2013 hoki stock assessment accepted three final runs, only one of which is shown here, for simplicity. Results from all three are very similar for the eastern stock, but show different patterns for the western stock, with the run shown being between the other two in 2013.
5. B_{MSY} is the estimated biomass that will support the Maximum Sustainable Yield (MSY).

concepts of two minimum biomass levels: a soft limit below which a formal time constrained rebuilding plan is required, and a hard limit, below which fisheries should be considered for closure.

A Management Strategy Evaluation (MSE), which considered the appropriate biomass level that would deliver optimum catch rates, fish sizes, and catch volumes, has been used to set a management target range of 35 – 50% B_0 for both stocks.[vi] This range is above B_{MSY} (estimated to be 25% B_0 for the eastern stock and 27% B_0 for the western stock).[iii]

All fish populations, even those that aren't fished, naturally fluctuate in size. These fluctuations may be driven by variations in recruitment levels (i.e. the number of young fish entering the fishery each year) which are caused by changing environmental factors, such as the availability of plankton as food during the larval stage. For hoki, recruitment is naturally highly variable between years, with up to 19-fold fluctuations in the numbers of hoki recruiting into the fishery being measured between successive years. Periods of prolonged low recruitment have been experienced in the past and the management target range takes this into account, as similar fluctuations will likely reoccur in future years.

When recruitment levels decline, stock sizes decline. The management response to this is to reduce the TACC to ensure that fishing intensity is maintained near optimal levels. Conversely, the TACC and catch limits are increased when stock sizes increase due to higher recruitment levels. Managing within a conservative target range provides a buffer to give time to respond to information on changes in stock size and to make changes to the TACC. Ultimately, it provides greater certainty that both hoki stocks will remain at or above B_{MSY} and within the optimum range for both long-term sustainability and economic harvest levels.



Hoki School [xxxi]

TABLE 2
HOKI FISHERIES HARVEST STRATEGY

REFERENCE POINT	MANAGEMENT RESPONSE
Management Target of 35-50% B_0	Both stocks should fluctuate within this range. TACC changes and agreed catch limits for each of the two stocks are used to maintain stocks within this target range.
Soft Limit of 20% B_0	If the size of either stock is below this threshold, a formal time-constrained rebuilding plan will be implemented to increase the stock size back up to within the management target range.
Hard Limit of 10% B_0	If the size of either stock is below this limit, fisheries on this stock will be considered for closure.
Rebuild Strategy	The rebuild strategy requires a catch limit to be set to enable the stock to rebuild in size to the target range in not more than twice the time period it would take in the absence of fishing.
Harvest Control Rules	Management actions are determined after consideration of the current stock assessment, along with the results of five-year forecasts of stock sizes under a range of catch assumptions, and guided by the management reference points.

Management Reference Points & Responses

"Since 2004 the western stock size is estimated to have nearly tripled."

Management reference points have been established for the hoki fisheries according to the HSS (Table 2).[vii] Management use these to respond to different stock statuses and ensure stocks are maintained at optimum sustainable levels.

As discussed earlier, the status of each hoki stock is assessed annually in a stock assessment model. A combination of biological data (e.g. growth rates and recruitment levels), biomass estimates (from research surveys), and fisheries data (from commercial catches and observer records) are used to estimate stock status against these reference points. Further modelling is used to estimate probable future stock biomass trajectories under different future harvest levels.

Both stocks were progressively 'fished down' from B_0, the unfished biomass, to around B_{MSY} between 1972 and the early 2000s (Figure 2).

Hoki stock sizes are subject to large inter-annual variations in recruitment and, while these fluctuated around the long-term average level between 1972 and 1994, there was a sustained period of below average recruitment between 1995 and 2001. During this seven year period all of the year classes recruiting into the western stock were well below the average size and five of those recruiting into the eastern stock were below average (Figure 3). Most hoki recruit into the fishery at two to three years of age. This period of low recruitment resulted in declines in the size of both stocks. These declines were exacerbated by a lag in

FIGURE 2
SPAWNING BIOMASS TRAJECTORIES (FOR RUN 1.7)[iii]

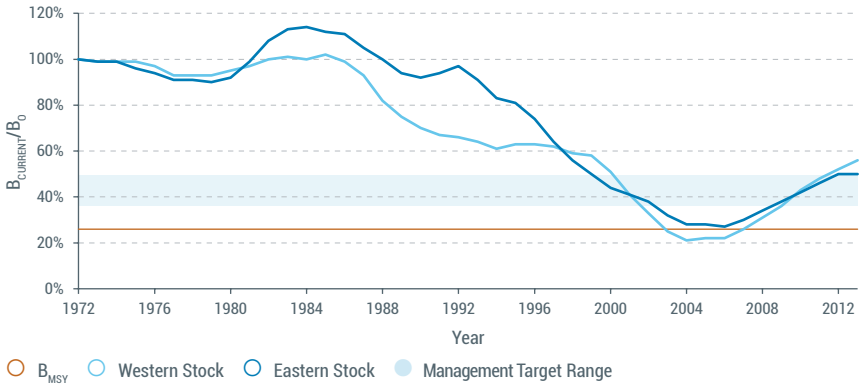


FIGURE 3
ESTIMATED YEAR CLASS STRENGTHS OF TWO YEAR OLD HOKI RECRUITS ENTERING THE FISHERIES

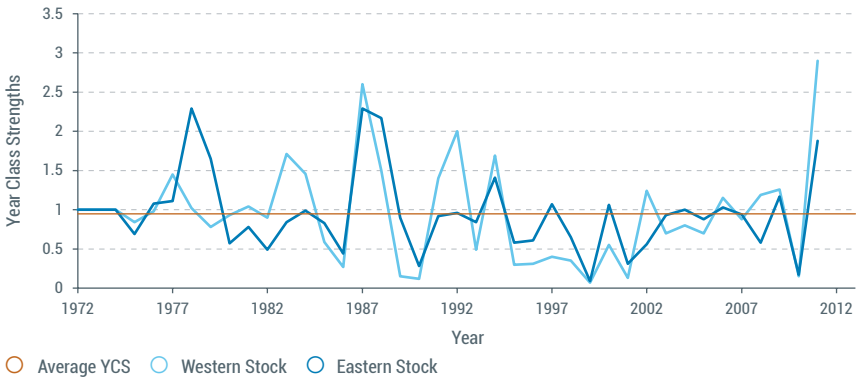
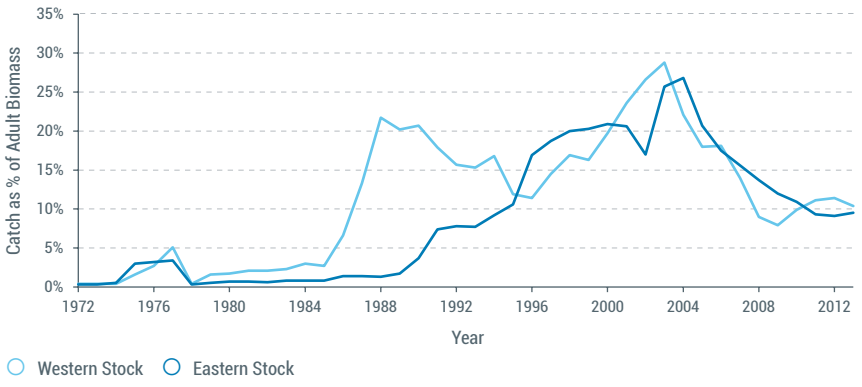


FIGURE 4
ANNUAL EXPLOITATION RATES[iii]



reducing the TACCs, which resulted in higher than desired exploitation rates[6]. Hoki exploitation rates peaked at 32% in 2002 and 2003, well above the desired level of between 12% to 21% required to maintain stock sizes within the management target range (Figure 4).

The QMS provides for TACCs to be adjusted based on best available scientific information. The response to the low recruitment was progressive reductions of the commercial catch between 2002 and 2008. The TACC was reduced from 250,000 t to 90,000 t, separate catch limits for each of the western and eastern stocks were implemented, and areas known to have high abundances of juvenile hoki were closed to target fishing. As a result, coupled with improved recruitment, the exploitation rates have been managed down to 8-12%, rebuilding both hoki stock sizes (Figure 4).

The 2002-08 TACC and catch reductions were heavily weighted towards the western stock as this was estimated to have declined the most. The eastern stock was estimated to have declined in size to around 27% B_0 (i.e. well above the soft limit but below the target range) and annual catches were accordingly reduced from around 70,000 t to 60,000 t. The western stock was estimated to have declined in size to below the 'Soft Limit' (i.e. below 20% B_0), consequently a formal time-constrained rebuilding strategy was implemented, and the western catch limit was set at 25,000 t.

Since 2010, consequent to both stocks increasing in size to within the management target range, the TACC has

6. Exploitation rate is annual catch as a percentage of the vulnerable biomass.

FIGURE 5
TOTAL CATCHES, TACCS AND SUB-AREA CATCH LIMITS[III]

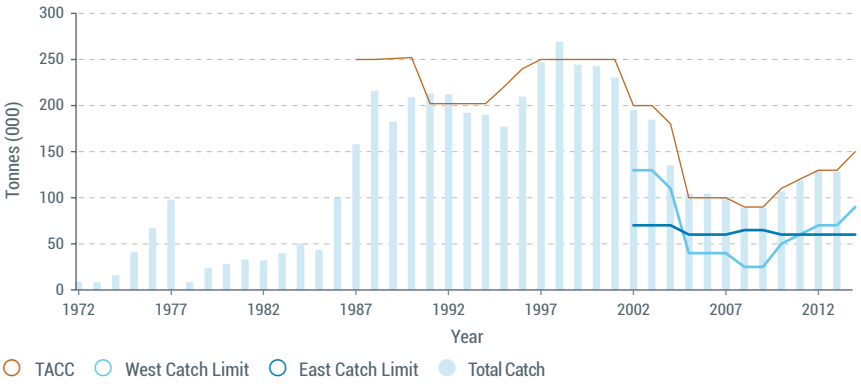


FIGURE 6
CATCHES AND CATCH LIMITS FOR THE WESTERN STOCK[III]

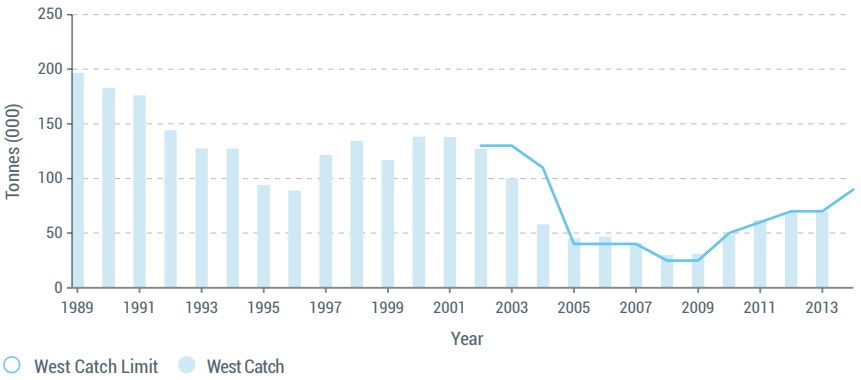
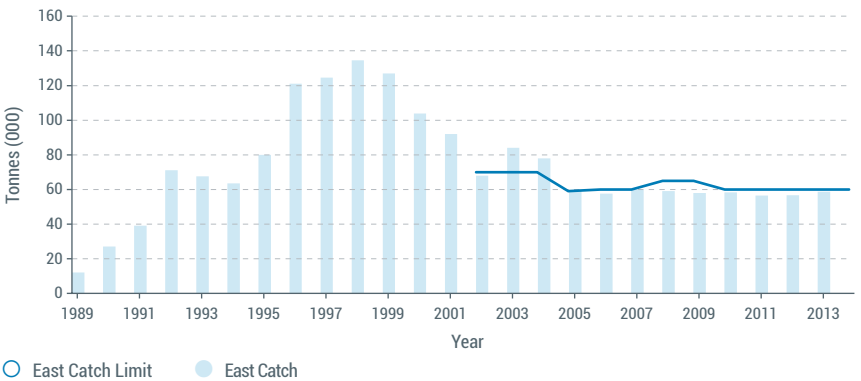


FIGURE 7
CATCHES AND CATCH LIMITS FOR THE EASTERN STOCK[III]



been progressively increased to 150,000 t and the western catch limit has been increased from 25,000 t to 90,000 t (Figures 5 & 7).

The hoki Management Strategy Evaluation (MSE), upon which the current harvest strategy for hoki has been determined, is based on the average annual recruitment levels during the period 1995 and 2009.[vi] This includes the period of low recruitment and excludes periods of high recruitment during earlier years (Figure 3). For this reason, industry accepts the 150,000 t (+/- 20,000 t) optimum TACC as a conservative level and one that has provision for similar low recruitment potentialities. The MSE provided the outcome that, if both stocks were supported by recruitment at the average long-term level, the optimum long-term TACC would be in the order of 180,000 t.

Since 2004 the western stock size is estimated to have nearly tripled.[iii] Future projections of stock size, based on current catch levels and recruitment levels the same as those entering the stocks over the period 1995 to 2010, estimate that the sizes of both stocks are likely to remain unchanged over the next five years (Figure 9).

The historical catches of hoki from 1972 to 2013 are shown in Figures 5-7. Catches track TACCs in New Zealand, formerly within ±10% and, over the last six years within, ±1%.

FIGURE 8

TRAJECTORIES FOR EASTERN STOCK 1972-2013 (FOR RUN 1.7)[III]

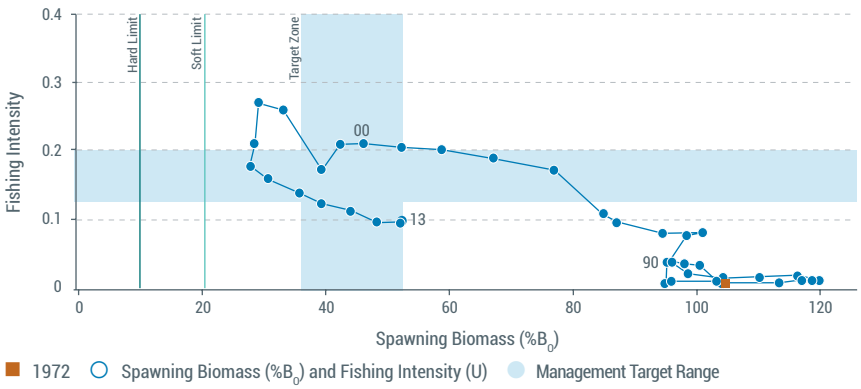


FIGURE 8+

TRAJECTORIES FOR WESTERN STOCK 1972-2013 (FOR RUN 1.7)[III]

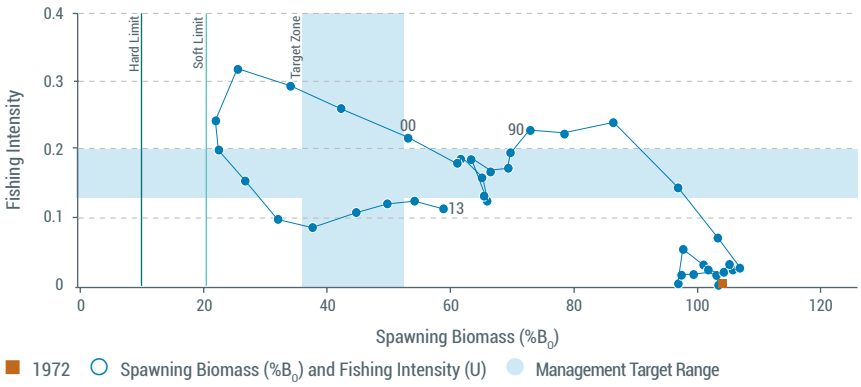
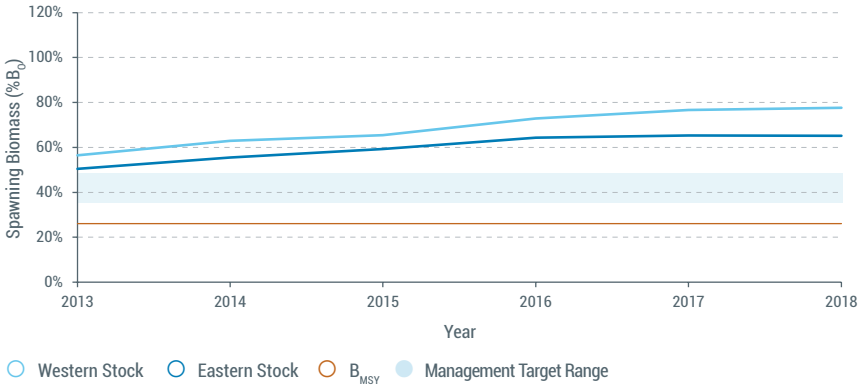


FIGURE 9

FIVE YEAR PROJECTIONS UNDER CURRENT CATCH (15,000 t)




THOMAS HARRISON. SEALORD GROUP LTD.

Managing Environmental Effects

All marine mammals and seabirds, four coral groups, and many shark species are protected by law in New Zealand waters.

White-Capped Albatross

Blue Shark

New Zealand Fur Seal[xxxii]

Bycatch Species

New Zealand's hoki fisheries generally take little non-commercial finfish bycatch and levels are low by international standards.[viii] More than 80% of the catch by weight consists of hoki and most of the remainder of the catch comprises other commercial species sustainably managed under the QMS such as ling, hake, and silver warehou.

Detailed reporting and catch balancing procedures are required by law for QMS species taken within New Zealand's Exclusive Economic Zone (EEZ). All catches of quota species, whether taken as bycatch or as target catch, must be landed and reported against the appropriate catch limit and against Annual Catch Entitlements (ACE).

Due to the generally low catch volumes, species outside of the QMS are considered to be at low risk of being overfished. However, if a sustainability problem is identified for any non-QMS species, these may be introduced to the QMS under the provisions of the New Zealand Fisheries Act 1996 which requires such stocks, or species, be added to the QMS if the existing management is not ensuring sustainability or is not providing for utilisation.

The Fisheries Act, defines 'ensuring sustainability' as

> *"maintaining the potential of fisheries resources to meet the reasonably foreseeable needs of future generations"*

and

> *"avoiding, remedying, or mitigating any adverse effects of fishing on the aquatic environment"*

while 'utilisation' is defined as

> *"conserving, using, enhancing and developing a fisheries resources to enable people to provide for their social, economic, and cultural wellbeing."*

Endangered, Protected & Threatened Species

> *"MPI and DWG have active programmes in place to reduce incidental interactions, including developing and implementing mitigation methods."*

Seabirds and marine mammals are at times attracted to fishing vessels as an opportunistic source of food. In seeking access to this easy source of food, they have demonstrated that they can modify their behaviour to overcome obstacles and may unwittingly put themselves at risk of harm. Patterns of 'at risk' behaviour are observed to vary seasonally and between species, and to be dependent on their eagerness to feed in close proximity to the vessel and net. As such, interactions with fishing vessels are inherent and will continue to occasionally occur. In the same way that other industrial workplaces have hazard management plans in place to reduce accidents, MPI and DWG have active programmes in place to reduce these incidental interactions, including developing and implementing mitigation methods.

All of New Zealand's seabirds, four coral groups, and many sharks are protected under the Wildlife Act 1953. All of New Zealand's marine mammals are protected under the Marine Mammal Protection Act 1978. It is an offence to harass, hunt, or kill any of these protected species without lawful authority. While the accidental or incidental capture of these species by commercial fishing activities is not unlawful, all incidents must be reported.

TABLE 3
MARINE SPECIES FULLY PROTECTED UNDER THE WILDLIFE ACT 1953

PHYLUM	CLASS		
Cnidaria	Anthozoa *(corals and sea anemones)*	Black corals	All species in the order Antipartharia
	Hydrozoa *(hydra-like animals)*	Gorgonian corals	All species in the order Gorgonacea
		Stony corals	All species in the order Scleractinia
		Lamniformes *(mackerel sharks)*	All species in the order Stylasteridae
Chordata	Chondrichthyes *(cartilaginous fishes)*	Lamniformes *(mackerel sharks)*	Basking shark *(Cetorhinus maximus)*
			Deepwater nurse shark *(Odontapsis ferox)*
			White pointer shark *(Carcharodon carcharias)*
		Orectolobiformes *(carpet sharks)*	Whale shark *(Rhincodon typus)*
		Rajiformes *(skates and rays)*	Manta ray *(Manta birostris)*
			Spinetail devil ray *(Mobula japanica)*
	Osteichthyes *(bony fishes)*	Perciformes *(perch-like fishes)*	Giant grouper *(Epinephelus lanceolatus)*
			Spotted black grouper *(Epinephelus daemelii)*

Observer coverage of New Zealand's hoki fisheries is delivered through the government's Scientific Observer Programme, which provides independent monitoring of any interactions that occur between protected species and hoki fishing (Figure 12). On average, around 20% of all tows targeting hoki have been documented by scientific observers in recent years.[ix] Annual reports based on observer information show declining trends in the numbers of interactions between seabirds and marine mammals since 2003. This has resulted from both decreased effort in the hoki fisheries and from the introduction of mitigation measures and improved Operational Procedures to reduce incidental interactions during this period.[x]

Salvin's Albatross

Seabirds

"Hoki fisheries have been found to pose little risk to seabirds (i.e. seabird population growth can sustain the few fishing-related captures)."

MPI uses a risk-based approach to assess and to prioritise seabird species that might require management intervention. This approach is informed by the New Zealand Seabird Risk Assessment[xi], which has quantitatively estimated the potential levels of risk to seabird populations arising from incidental mortalities associated with New Zealand's commercial fisheries. Using this information, further research, education, and seabird mitigation measures can be determined and applied where these are most needed and where they will be most effective.

Hoki fisheries have been found to pose little risk to seabirds (i.e. seabird population growth is able to sustain the few fishing-related captures). With effective mitigation measures in place the risk scores for deepwater fisheries, including those for hoki, have reduced over time.[xii]

Trawlers targeting hoki all employ international best practices to mitigate the risk of interacting with seabirds. Management measures to mitigate interactions with seabirds and New Zealand's deepwater trawl fisheries currently include:

- Mandatory use of seabird mitigation devices during fishing
- Mitigation research
- Education, training and outreach
- Vessel-specific offal management procedures
- Real-time incident reporting.

Observer coverage in New Zealand's hoki fisheries enables independent monitoring and reporting of seabird interactions with both Government and industry risk mitigation requirements.

Captures of all bird types combined show a decreasing trend between 2002-03 and 2010-11 across all New Zealand deepwater fisheries.[xii] During the last eight years the average observed capture rate in hoki trawl fisheries has been 2.2 birds per 100 tows, a low rate relative to other trawl fisheries in the same area during the same period.[iii]

Although the numbers of captures have reduced overall, there are substantial differences in the trends between different species. One marked difference is in captures of large surface-feeding birds (e.g. albatrosses) compared to those of smaller diving birds (e.g. petrels and shearwaters). Large surface-feeding birds tend to feed on offal near the stern of trawlers, where, in their competition for food, they may get distracted from the dangers around them and fly into or get caught by trawl warps (i.e. steel cables connecting the submerged trawl gear to the vessel). Smaller seabirds, particularly those that dive for food, tend to feed around the trawl nets when they are near to or on the surface, placing them at risk of getting caught or entangled in the net.

One of the most important factors influencing interactions between seabirds and trawl warps is the presence of offal in the water, which acts as an attractant for foraging seabirds. Middleton and Abraham[xiii] confirmed that discharge of offal was the main factor influencing warp strikes; almost no strikes were recorded when there was no discharge.

Industry has developed and implemented Vessel-specific Management Plans (VMPs) which, through the management of offal discharges, have proved effective at mitigating these interactions. VMPs require all vessels to designate how they will reduce the presence of offal in the water when trawling. One method that has proven to be most effective is to release factory waste in intermittent batches (as opposed to a continuous discharge), reducing the time seabirds are attracted to the 'risk zone' at the stern of the vessel and ahead of the warps. This approach has been accepted as world's best practice by the Agreement on the Conservation of Albatrosses and Petrels, and underpins the VMPs.[xiv] Other best practice includes mitigation methods such as streamer lines, bird bafflers, and warp deflectors which have been mandatory since April 2006.

Notably, during the four fishing years since 2006, when mitigation to reduce warp strikes was implemented, the average capture rates for Salvin's and white-capped albatross reduced significantly. In 2009-10, these rates were 0.20 and 0.21 birds per 100 tows, down from 0.61 and 0.26 birds per 100 tows during the three previous years.[iii]

Although warp captures have reduced significantly, reducing net captures of small diving birds is proving to be more challenging. MPI and industry are continually seeking better ways to deter birds from attending the net.

FIGURE 10

ESTIMATED SEABIRD CAPTURES IN THE HOKI TRAWL FISHERIES WITH 95% CONFIDENCE INTERVALS[IX]

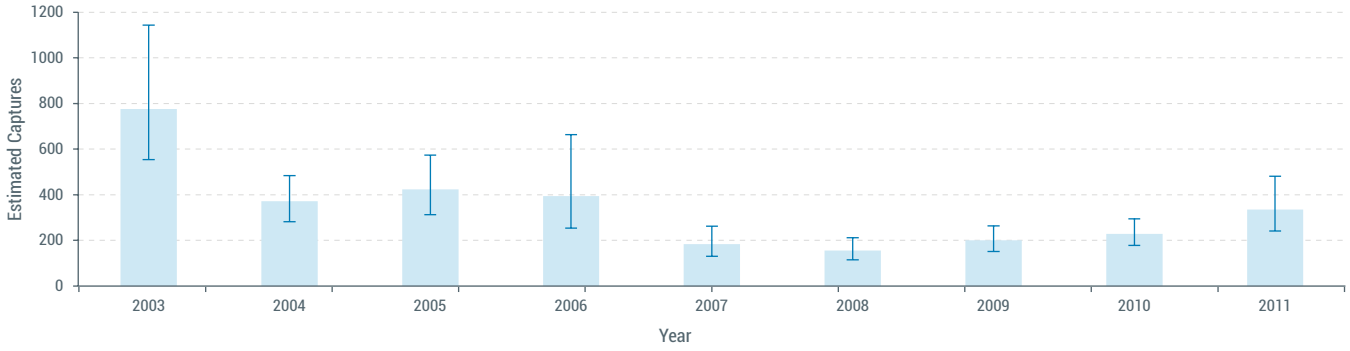


FIGURE 11

OBSERVED SEABIRD CAPTURES IN THE HOKI TRAWL FISHERIES[IX]

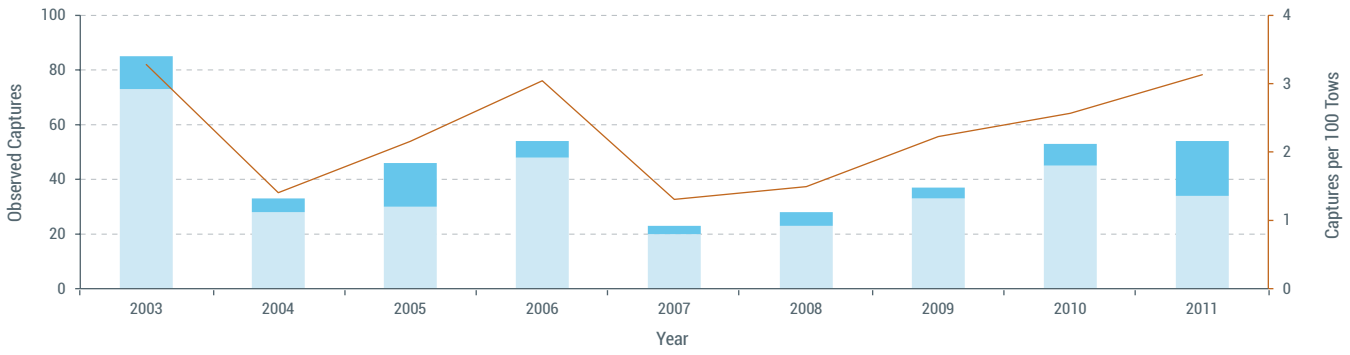


FIGURE 12

EFFORT AND OBSERVED EFFORT IN HOKI TRAWL FISHERIES[IX]

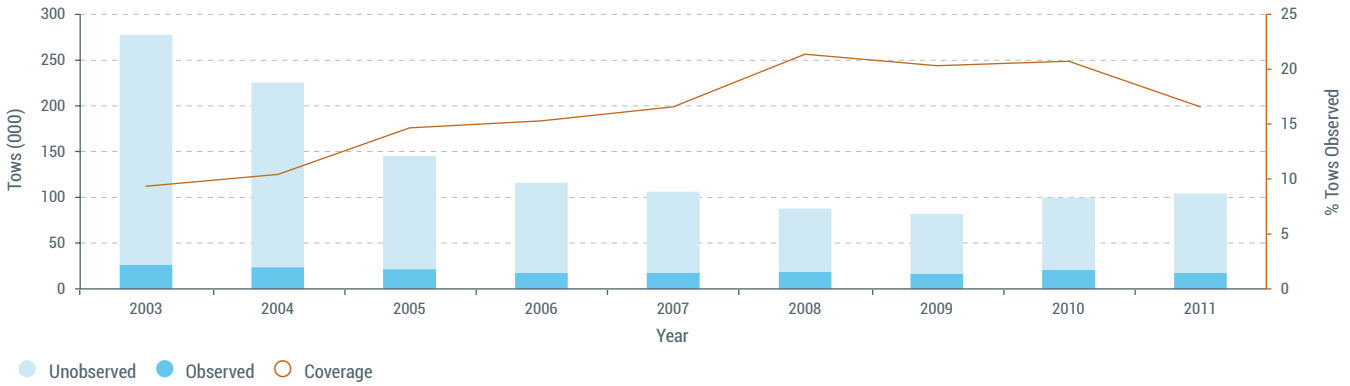


FIGURE 13
ESTIMATED NEW ZEALAND FUR SEAL CAPTURES WITH 95% CONFIDENCE INTERVALS[xx]

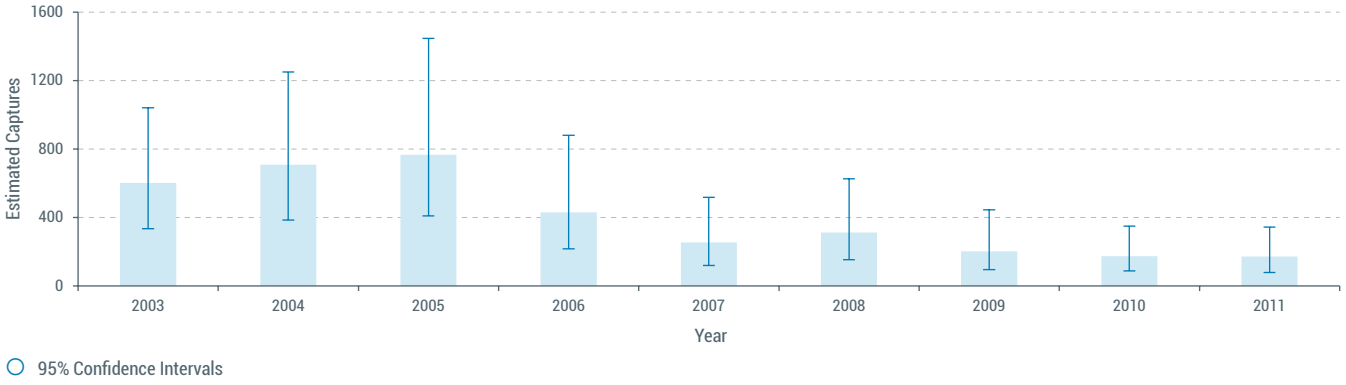
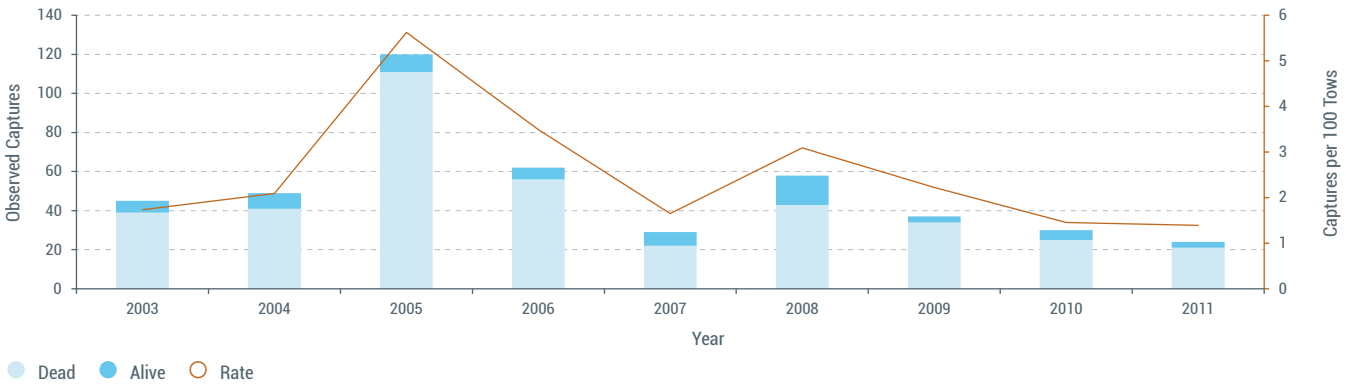


FIGURE 14
OBSERVED NEW ZEALAND FUR SEAL CAPTURES[xx]



New Zealand Fur Seal

"The hoki fishery is not having any unsustainable impacts on the fur seal population..."

The New Zealand fur seal was classified in 2008 as 'Least Concern' by the International Union for the Conservation of Nature (IUCN) and in 2010 as 'Not Threatened' under the New Zealand Threat Classification System.[xv] Their numbers around New Zealand are widely considered to be increasing.

The number and rate of incidental fur seal captures by vessels targeting hoki have reduced over the past years, particularly since 2005 when DWG and MPI implemented procedures to reduce these incidental captures (Figures 13 & 14).[iii]

During recent years, DWG and MPI have worked closely with scientists and eNGOs to develop and implement effective procedures to reduce fur seal interactions to the lowest possible levels. This has resulted in all deepwater vessel operators agreeing to follow the Marine Mammal Operational Procedures (MMOPs) and for each vessel's performance to be audited by MPI.[xvi]

In 2008 MPI, DOC and DWG combined resources to undertake the first census of the New Zealand fur seal population along the west coast of the South Island.[xvii] This area was identified to be of most potential concern because of the number of incidental interactions between hoki vessels and foraging fur seals. The fur seal population estimate from the census was then used to estimate the level of

'Potential Biological Removals' (PBRs, i.e. the number of fur seals that could be removed without detriment to the population size) using internationally-accepted scientific methods. These analyses established that the level of 'captures' was lower than the PBR.[xviii] These analyses have been repeated by independent scientists and their results confirm this outcome.[xix]

Protected Coral & Fish

MPI observers also record the levels of interactions with protected fish and coral species. Among all of the bycatch species for hoki fisheries no finfish or invertebrates are considered to be threatened. Five species of sharks (basking, deepwater nurse, white pointer, oceanic whitetip, and whale sharks) are protected by law in New Zealand waters. Of these, only basking sharks have been reported to be taken in hoki fisheries, although these occurrences are rare.[iii] Further research is in progress to improve our understanding of interactions between basking sharks and hoki fisheries with the view of further reducing these interactions. Few protected coral species are recorded as bycatch in the hoki fisheries[xxi], 4.8% of observed tows recorded coral bycatch between 2007-08 and 2009-10.[xxii]

FIGURE 15
BENTHIC PROTECTION AREAS AND 'SEAMOUNT' CLOSURES

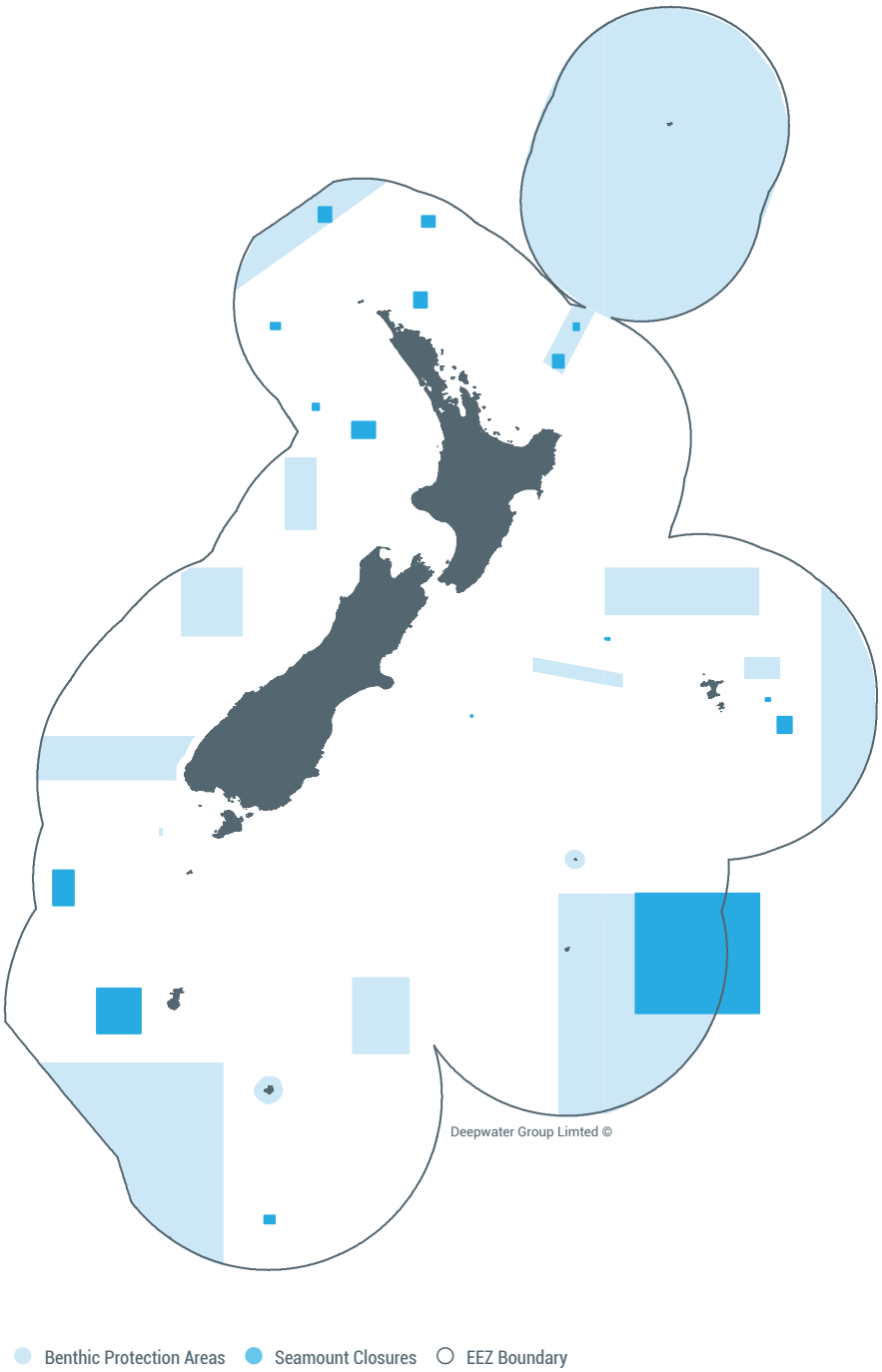


TABLE 4
MARINE SPATIAL MANAGEMENT IN NEW ZEALAND'S EEZ[XXIV XXV]

MANAGEMENT TOOL	LEGISLATION	RESTRICTIONS	AREA (KM^2)
Benthic Protection Areas (BPAs)	Fisheries Act 1996 Fisheries (Benthic Protection Areas) Regulations 2007	Prohibition on use of dredge and restrictions on use of trawl net within 100 m of the seabed	1,124,539
'Seamount' Closures	Fisheries Act 1996 Fisheries Regulations	Prohibition on trawling	78,466
Total Area Closed (km^2)[7]			1,200,741
Total Area as a Percentage of New Zealand's EEZ			30%

Habitats & Ecosystems

"New Zealand's Benthic Protection Area network is over four times the area of New Zealand's landmass."

Hoki are widely distributed throughout New Zealand waters, are most abundant at depths of 200 m to 600 m, and are considered to be a major component of the ecosystems they inhabit.[iii]

Hoki are taken by both mid-water and bottom trawls. Mid-water trawls dominate during the spawning fisheries when hoki are found in dense aggregations off the bottom, particularly in Cook Strait and along the west coast of the South Island. Bottom trawling for hoki occurs year-round, particularly over flat ground in the Chatham Rise and Sub-Antarctic fisheries regions. Bottom trawling is known to impact fragile benthic (or seabed) invertebrate communities.

Concerns have been expressed about the effects bottom trawling may be having on benthic communities. The impacts of bottom trawling on soft sediment habitats at depths of 400-800 m have not been extensively studied, although Oceans Survey 20/20 (a collaborative project developed by officials from 18 government organisations, including MPI and NIWA) is undertaking research that may shed more light on the effects of fishing on the benthic environment.

As part of the 10-Year Research Programme, the trawl grounds of the hoki fisheries are mapped and audited annually. This allows the extent of trawl interactions with the seabed to be monitored and provides a mechanism to identify if and where further management measures might be necessary.

MPI and DWG have also developed and implemented a programme of spatial management (Figure 15), which includes:

- Closed areas – where fishing is excluded or subject to gear restrictions
- Benthic Protection Areas (BPAs) – where bottom trawling is prohibited[xxiii]
- 'Seamount' closures – where fishing is prohibited.

BPAs are large, broadly representative areas closed to set aside and protect the full range of benthic marine biodiversity. Their selection was based on the best available scientific knowledge, the Marine Environment Classification, to encompass pristine areas that for the most part have not been impacted by trawling, to provide large and untouched refuges for benthic communities.

In total, 30% of New Zealand's EEZ is closed by law to bottom trawling. This New Zealand marine spatial management programme continues to constitute one of the largest bottom trawl closures within any EEZ in the world and when introduced comprised 24% of the total area under Marine Protection Areas (MPAs) in the world.

Over 85% of the seabed within the hoki known distribution range has either been closed to bottom trawling or has never been contacted by trawls targeting hoki.[xxiv] Annually around 1-2% of the known distribution range is contacted. By these measures, the extent of the hoki bottom trawl grounds is only a very small part of the known distribution range and the extent of these trawls has continued to decline over the years.

The hoki fishing grounds have been progressively developed over the past two decades and there is now relatively little exploratory fishing over new grounds. Because of the healthy stock sizes and relatively high abundances of hoki, most hoki catches are taken from the same fishing grounds each year, and the fisheries are now primarily supported by relatively small, localised areas which sustain high catch rates year on year.

7. In some areas, BPAs and 'seamount' closures overlap. Therefore, this is based on the footprint area.

Effective Fisheries Management

"New Zealand was ranked first for managing marine resources among the 53 major fishing nations that were assessed."

Governance & Policy

Legal & Customary Framework

New Zealand's fisheries management regime is centred on the Quota Management System (QMS), a system introduced in 1986 based on Individual Transferrable Quotas (ITQ, quota) and Total Allowable Commercial Catches (TACCs). The QMS ensures sustainable utilisation of fisheries resources through the direct control of harvest levels based on best available scientific assessments.

Within the QMS, ITQ have been allocated in perpetuity providing each quota owner with a proportional share of the TACC. At the commencement of each year, ITQ give rise to Annual Catch Entitlements (ACE), the annual harvesting right expressed in tonnes. The QMS is administered by MPI through the Fisheries Act 1996.

Quota is an asset that provides owners with incentives to increase returns from their property rights by reducing harvest costs and increasing product values. Improved economic efficiencies have also resulted in alignment between fishing capacities and the sustainable catches from QMS fish stocks, thereby avoiding over-capitalised fisheries (i.e. too many vessels competing for available fish stocks).

Quota provides a property right to access commercial fisheries and has been allocated to Maori as part of the Treaty of Waitangi Settlements that acknowledge the Treaty guaranteed Maori

> *"full exclusive and undisturbed possession of their...fisheries".*

Maori interests are now significant participants in the New Zealand Seafood Industry.

New Zealand has implemented the most extensive quota-based fisheries management system in the world, with over a 100 species or species-complexes of fish, shellfish and seaweed now being managed within this framework. Almost all commercially targeted fish species within New Zealand's waters are now managed within the QMS. The status of the stocks of each species within the QMS is determined using the best available scientific information and each stock is managed independently.

MPI employs fisheries managers (to advise the Minister on the appropriate level at which to set catch allowances) and fisheries scientists (to oversee the collection and analysis of scientific information to inform management advice). Fisheries managers and scientists work closely to ensure the management advice provided to the Minister is consistent with the best available scientific information. TACCs are set by the Minister based on advice provided by fisheries managers, in consultation with quota owners and other external stakeholders.

At an operational level, hoki is managed in accordance with the National Fisheries Plan for Deepwater and Middle-depth Fisheries.[vii]

New Zealand recently became one of only two fishing jurisdictions to achieve a top ranking in a review of fisheries management systems around the world.[xxvi] In a second study, New Zealand was ranked first for managing marine resources among the 53 major fishing nations that were assessed.[xxvii]

Collaborative & Participatory Processes

In 2006, DWG and MPI entered into a formal partnership to enable collaboration in the management of New Zealand's deepwater fisheries, including the hoki fisheries.[xxviii] This partnership has been updated in 2008 and 2010 and has directly facilitated improved management of the hoki fishery in almost all respects through:

- A close working relationship under a shared and agreed vision, objectives and collaborative work plan
- Real-time open communication between DWG and MPI on information relevant to management measures, particularly from the Ministry's Scientific Observer Programme and commercial catching operations
- Agreement on a strategic plan for the management of New Zealand's EEZ fisheries
- Development and implementation of clear and agreed management objectives for all New Zealand's deepwater fisheries, including hoki, through fisheries plans
- Increased dialogue with the Department of Conservation (DOC).

Nugget Point[xxxiii]

New Zealand by Satellite[xxxiv]

Compliance & Enforcement

MPI maintains a comprehensive compliance programme, which includes both encouraging compliance through support and respect for the fisheries management regime, and creating effective deterrents.

This strategy is underpinned by the VADE compliance operating model, which focusses on all elements of the compliance spectrum. Enforcement is but one of the tools utilised, however it is the intervention that sets the conditions and incentive for voluntary compliance. The VADE spectrum takes the following form:

1. Voluntary Compliance – outcomes are achieved through education, engagement and communicating expectations and obligations
2. Assisted Compliance – reinforces obligations and provides confidence that these are being achieved through monitoring, inspection, responsive actions and feedback loops
3. Directed Compliance – directs behavioural change and may include official sanctions and warnings
4. Enforced Compliance – uses the full extent of the law recognising that some individuals may deliberately choose to break the law and require formal investigation.

Since 1994 all vessels over 28 m have been required by law to be part of the Vessel Monitoring System (VMS) which, through satellite telemetry, enables MPI to monitor all deepwater vessel locations at all times. In combination with at-sea and air surveillance, supported by the New Zealand joint military forces, the activities of deepwater vessels are fully monitored and verified to ensure compliance with regulations and with industry-agreed operating procedures.

All commercial catches from QMS stocks must be reported and balanced against ACE at the end of each month. Catches may only be landed at designated ports and sold to Licensed Fish Receivers (LFRs). Reporting requirements for deepwater trawl vessels include logging the location, depth and main species caught for each tow and the total landed catch for each trip undertaken.

MPI audits deepwater vessel's catch-effort and landing reports, reconciles these against multiple sources including VMS records, data collected by onboard MPI observers, and catch landing records from LFRs to ensure that all catches are reported and documented correctly. Around 20% of all tows targeting hoki are observed each year and MPI has plans in place to increase this coverage further (Figure 12).[x] Quayside inspections are also undertaken to verify reported landings.

Commercial fishermen face prosecution and risk severe penalties, including vessel or quota forfeiture, upon conviction of breaches to the fisheries regulations. Financial penalties are also imposed, in the form of deemed values, to discourage commercial fishermen from over-catching their ACE holdings. For every kilogram of catch above the available ACE held, MPI invoices the permit holders a deemed value charge. Deemed values are set at a level to remove the commercial value from sale of any catch above the level of ACE held. This provides incentive for the permit holders to acquire or maintain sufficient ACE to cover all their catch.

It is illegal to discard or to not report catches of QMS species. For some high value stocks, such as hoki, differential deemed values apply such that the rate that is charged increases depending on the proportion by which catches exceed ACE holdings.

The deepwater fishing industry in New Zealand works closely with the government to ensure compliance with all agreed management measures. A co-management approach to New Zealand's deepwater and middle-depth fisheries has been in place since 2006, encouraging open collaboration between quota holders and MPI.[xxix]

This collaborative approach to management has enabled the development of shared reporting and monitoring processes that allow both parties to utilise their own operational expertise to ensure ongoing adherence to the agreed non-statutory management measures. In the hoki fisheries, these management measures include the management of catches within the eastern and western stock catch limits and monitoring fishing activity within the Hoki Management Areas (HMAs, where fishing for small hoki is restricted). DWG works directly with vessel managers and skippers to administer the reporting and monitoring of catches against the sub-QMA[8] catch limits as well as vessel entry to and from the HMAs, while MPI performs an auditing and verification role to ensure that reliable data are being reported by industry vessels.

Total hoki catches taken in recent years have been within ±1% of the HOK1 TACC.

Fishery Management Plans

Fisheries Plan

MPI and DWG, in consultation with other interested parties, have developed a National Fisheries Plan for Deepwater and Middle-depth fisheries, including those for hoki. This Fisheries Plan (the Plan) is a statutory document, approved by the Minister of Fisheries in 2010.[vii] The Plan provides an enabling framework, outlining agreed management objectives, timelines, performance criteria and review processes, and has a life of five years between reviews.

The Plan specifies that the hoki fisheries will be assessed against agreed reference points for the management of hoki harvest. It specifies a range of objectives and measures for bycatch management and for the mitigation of incidental interactions with protected species (e.g. seabirds, marine mammals, and certain sharks).

The actual management measures and delivery outcomes in the Plan are specified in MPI's Annual Operational Plan (AOP), which will be reviewed and updated annually. In addition, an Annual Review Report (ARR) assesses performance against the AOP, and the Plan in general, and is available to all stakeholders and interested parties.

Non-Regulatory Management

"...regulations are complemented by additional industry-agreed non-regulatory measures."

Extensive regulations govern the hoki fisheries including regulations detailing the minimum allowable net mesh size, bottom trawl area closures and a ban on the use of cables for net sounders to reduce incidental interactions with seabirds. These regulations are complemented by additional industry-agreed non-regulatory measures, known as the New Zealand Deepwater Fisheries Operational Procedures. The Minister relies on the effectiveness of both regulatory and non-regulatory measures to ensure the sustainable management of these fisheries.

In 2001 hoki quota owners introduced a 'Code of Practice' for hoki trawling to reduce fishing mortality on spawning hoki and on small hoki. These measures included:

- Restrictions on fishing in waters shallower than 450 m
- Requirements to change fishing location if small hoki exceeded 10% of the catch
- Seasonal and area closures in spawning fisheries.

In 2009 this Code of Practice was revised and updated. These new measures are contained in the New Zealand Deepwater Operational Procedures (OPs) which cover all deepwater fisheries, including those for hoki. These OPs update the agreed measures to restrict fishing mortality on small hoki and set out industry best practice measures to minimise interactions with seabirds and marine mammals. These measures include:

- Hoki Management Areas (HMAs) – these are areas where there are high abundances of juvenile hoki (Figure 15)
- Trawlers >28 m are not permitted to target hoki within HMAs.

8. A Quota Management Area (QMA), e.g. HOK1, generally defines the stock boundaries and TACCs are set at the QMA-level.

Research Plan

"...programme to improve both the information to underpin management decisions and the efficiencies in science service provision."

In 2009 DWG proposed that the industry's science and research programme should be integrated with that being undertaken by MPI to form a single and integrated 10-Year Research Programme that would be:

- Management Lead – ensure we obtain adequate science-based information to underpin sustainable management decisions
- Comprehensive – increase the annual investment by MPI in deepwater science and information by 50% including more research surveys, more stock assessments, more stock characterisations, and greater observer coverage
- Environmentally Sound – including enhanced monitoring of interactions between the deepwater fleet and protected species, regular Ecological Risk Assessments to scientifically determine where fishing activities are causing risk of harm to the marine environment, and assessments of trophic interactions
- Cost Efficient – reduce service delivery costs through public tender and multi-year contracts.

In 2010 MPI implemented this 10-Year Research Programme to improve both the information to underpin management decisions and the efficiencies in science service provision.

FIGURE 16
HOKI MANAGEMENT AREAS

Certified Sustainable

"These fisheries have used good management practices to safeguard jobs and secure these precious renewable resources into the future. I congratulate the fishers and MPI on their achievement."

MSC Chief Executive, Rupert Howes[xxx]

New Zealand's hoki fisheries were not only the first major whitefish fisheries in the world to gain certification against the Marine Stewardship Council's (MSC) standards (in 2001); they are now the first to be re-certified for a third time.

The MSC's fishery certification programme sets the highest independent standards for sustainable fishing practices. MSC is a global organisation working with fisheries, seafood companies, scientists, conservation groups and the public to promote the best environmental choices in seafood.

The MSC standards are based on three principles:

1. Are the fish stocks healthy?
2. Is the fishery damaging the marine ecosystem?
3. Is there ongoing effective management of that fishery?

Fisheries are assessed by third-party accredited auditors and their findings are peer-reviewed.

New Zealand's hoki fisheries were re-certified in 2012 without objection and subject to a single condition.

MSC re-certification is a testament to the industry's commitment to continuous improvement and to the collaborative partnership with MPI. That commitment has seen DWG and MPI actively developing and applying new methods and strategies to reduce interactions with seabirds, marine animals, and the broader marine ecosystem, and to align strategic and operational objectives, resulting in a long-term science and information plan and more investment in monitoring and research.

The single Condition of Certification requires DWG and MPI to improve:

> *"...the management of habitat impacts of the hoki fishery, such that by the end of the third surveillance audit it can be shown that the fishery is highly unlikely to further reduce habitat structure and function to a point where there would be serious or irreversible harm."* [viii]

DWG and MPI established an Action Plan to address this condition and during the 2013 Surveillance Audit this Condition was closed.

To track a fishery's certification progress go to: *www.msc.org/track-a-fishery/fisheries-in-the-program*

BAY OF ISLANDS. NORTH ISLAND, NEW ZEALAND.[XXXV]

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