2014

HAKE

THE SUSTAINABLE MANAGEMENT OF NEW ZEALAND HAKE

DEEPWATER GROUP LTD
PUBLICATION SERIES 2014/01

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.

ACKNOWLEDGEMENTS

DWG would like to extend their appreciation to all those who supported and contributed to the preparation of this report. In particular, we'd like to thank the Ministry for Primary Industries for their editorial contributions.

DISCLAIMER

DWG has made all reasonable efforts to ensure that information in this publication is accurate and correct. However, DWG does not accept any liability for any errors or omissions of content or fact.

CITATION

Clement, I.T, Gargiulo, S. & Irving, A. (2014). The Sustainable Management of New Zealand Hake (Deepwater Group Ltd Publication Series 2014/01, dated September 2014). Wellington, New Zealand: Deepwater Group Ltd.

ISSN NO.

Print: 2350-3076 Online: 2350-3084

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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 New Zealand deepwater species hake.

This species of hake *(Merluccius australis)* is circumglobal in the southern hemisphere with two distinct groups, a New Zealand population and a Patagonian population. New Zealand hake is harvested mainly by trawl from the South Island, off the east and west coasts and in sub-Antarctic waters. The two main fisheries, off the west coast of the South Island (HAK7) and on the Chatham Rise (HAK4), have traditionally consisted of bycatch in the much larger hoki fisheries but in recent years both have become important target fisheries.

The hake fisheries overlap with the hoki and ling fisheries. As such, they are often considered and managed as a 'complex' due to the influence they have on each other and the additive effects that may result.

New Zealand's seafood industry, including quota owners in the hake 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 adverse 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. In 2014 New Zealand's hake fisheries were certified sustainable, without conditions, against the very high standards required by the Marine Stewardship Council (MSC) programme for sustainable seafood.

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 93% of the New Zealand hake quota.

This report highlights how the hake fisheries are performing in terms of:

- Stock sustainability
- Environmental effects
- Fisheries management.

SOUTHERN BULLER'S ALBATROSS. SNARES ISLAND, NEW ZEALAND. XXIX

Profile

Merluccius australis look similar to other hake but are distinct and are found only in New Zealand and Patagonia.

Common Name

Hake

Scientific Name

Merluccius australis

Ministry Code

HAK

Fishing Method

Bottom and mid-water trawl.

Distribution

Widely distributed throughout the middle depths of New Zealand waters, mostly south of 40 °S. Adults are mainly found at depths of 250 m to 800 m, while juveniles are found in inshore regions shallower than 250 m.

Quick Facts

Hake have white flesh with few bones and a delicate flavour.

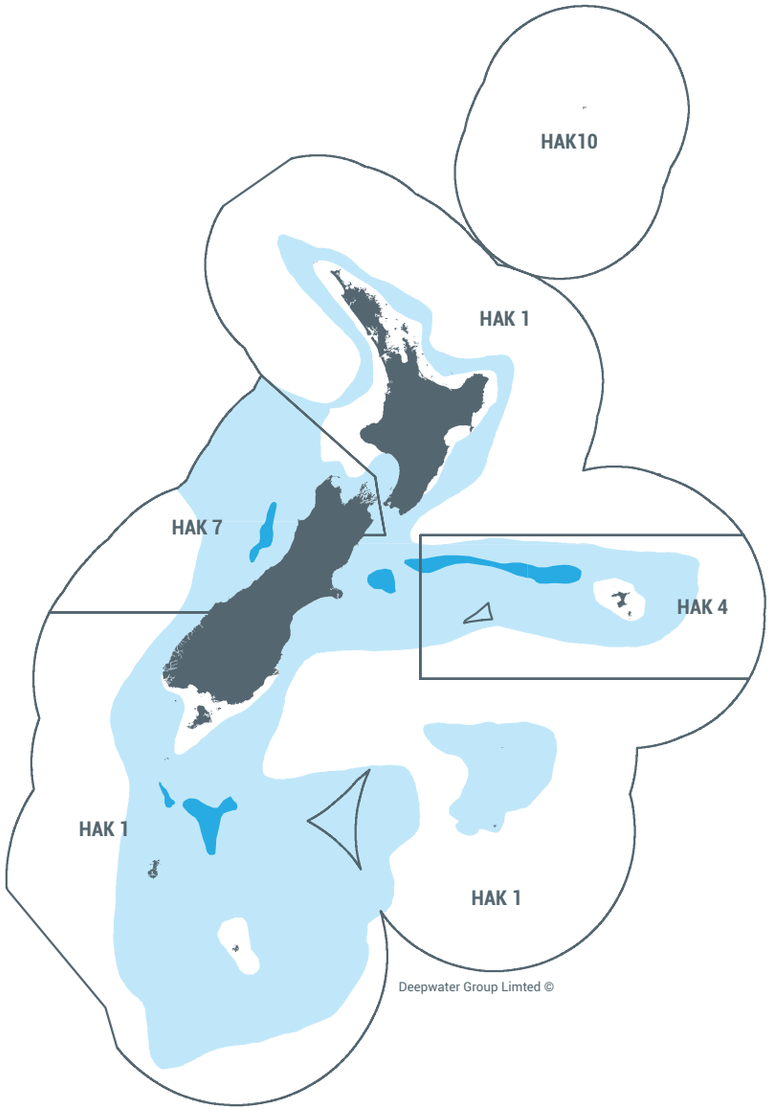
Hake start breeding around 6-10 years old and live to ~25 years.

Hake live near the seabed but move up in the water column to feed at night.

M. australis look similar to other hake but are distinct and are found only in New Zealand and Patagonia.

The New Zealand hake fisheries have been certified, without condition, against the internationally-recognised Marine Stewardship Council standards for sustainable seafood.

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



1. 'Known distribution range' provides an indication of where hake are likely to be found based on all known records of hake 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).[xxi]

Performance Summary

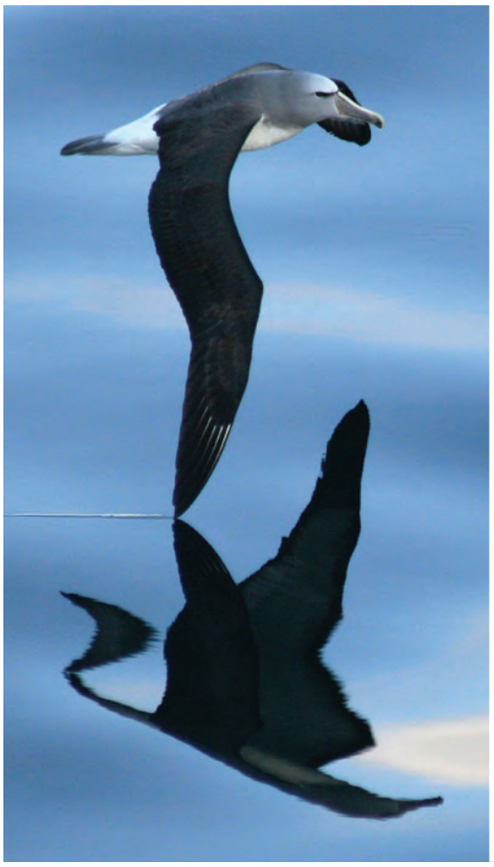
In 2014 New Zealand hake were certified sustainable against the Marine Stewardship Council standard.

STOCK SUSTAINABILITY

HAK1 was last assessed in 2011, HAK4 in 2012, and HAK7 in 2013.

All stocks are healthy, productive, and are above the management target of $40\%B_0$.

HAK1 is scheduled for reassessment in 2015.



MANAGING ENVIRONMENTAL EFFECTS

All seabirds, all marine mammals, all corals, and a number of shark species are fully protected by law in New Zealand.

It is illegal to intentionally harm or kill any protected species, and all accidental captures must be reported to the Department of Conservation and Ministry for Primary Industries.

The main environmental interactions are with seabirds and fur seals.

To reduce interactions we use mitigation devices to deter animals, and have operational procedures which include special training for crew on the risks, and monitor, report and audit each vessels' performance.

These management measures have proven successful with only 10 seabird captures and only 8 fur seal captures estimated in 2012.

The hake fisheries are not known to interact with any other marine mammals, including sea lions, dolphins or whales.

THIRD-PARTY CERTIFICATION

The New Zealand hake fisheries are certified sustainable against the internationally-recognised Marine Stewardship Council (MSC) standards for sustainable seafood.

No conditions (or areas requiring improvement) have been raised by the assessment body, Intertek Fisheries Certification (IFC).

EFFECTIVE MANAGEMENT

Hake was introduced into the Quota Management System in 1986.

A formal partnership exists between the Ministry for Primary Industries and DWG to aid ongoing collaboration and cooperation.

Regular stock assessment models lead to regular catch limit reviews based on the best available science.

Over 90% of deepwater vessels undertook environmental training in 2013.

Government observers independently audited 35% of all trawls targeting hake in 2012.

A new National Plan of Action for Seabirds was published in 2013 and a new National Plan of Action for Sharks was published in 2014, these set out approaches to reduce seabird and shark interactions over the next five years.

Illegal activity is minimal to none with no prosecutions since 2005.

Stock Sustainability

Hake stocks are healthy and productive with each of these well above management targets that have been set by the government.

Bringing the catch in

Stock Structure

Research indicates there are three biologically distinct hake populations in New Zealand, known as 'stocks'. These are Chatham Rise (HAK4), Challenger (HAK7) and the rest of New Zealand's Exclusive Economic Zone (HAK1) (Figure 1). We manage the fisheries according to these stocks and their status.

Scientific research and assessments are carried out regularly on each stock. The Quota Management Areas (QMAs, i.e. the administrative boundaries as seen in Figure 1) align with each stock and commercial catches are managed within a Total Allowable Commercial Catch (TACC)[2] for each QMA. TACCs are set by the Minister for Primary Industries based on the best available scientific information.

Stock Status

The current stock sizes for all of the hake stocks are estimated to be above 45% B_0[3], demonstrating that they are being maintained at or above the management target (Table 1).[ii]

Stock Management

When recruitment levels decline, stock sizes decline. The management response to this is to reduce catch levels.

There are a number of management measures available to ensure stock sizes remain healthy and productive these are outlined below.

Harvest Strategy

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.

When these populations or 'stocks' decline in size, the management response is to reduce catch levels or what is known as TACCs. Conversely, when stock sizes increase TACCs are increased.

TABLE 1
CURRENT STOCK SIZE AND STATUS

STOCK	YEAR OF ASSESSMENT	HARD LIMIT (%B_0)	SOFT LIMIT (%B_0)	TARGET (%B_0)	VIRGIN BIOMASS (B_0) (t)	CURRENT BIOMASS (%B_0)
Sub-Antarctic (HAK 1)	2011	10	20	40	94,150	52
Chatham Rise (HAK 4)	2012	10	20	40	37,000	47
West Coast South Is. (HAK 7)	2013	10	20	40	88,980	58

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, also known as virgin biomass.

TABLE 2
HAKE FISHERIES HARVEST STRATEGY

REFERENCE POINT	MANAGEMENT RESPONSE
Management Target of 40% B_0	Stocks should fluctuate around this target. TACC changes are used to move stocks toward or above this target.
Soft Limit of 20% B_0	If the size of any stock is below this limit, a formal time-constrained rebuilding plan will be implemented to increase the stock size back toward the management target.
Hard Limit of 10% B_0	If the size of any 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.

In New Zealand, this management framework is underpinned by the Fisheries Act 1996 which 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}[4]). MSY is the largest average long-term annual catch that can be taken from a stock under prevailing ecological and environmental conditions.

In 2008, this management framework was further defined through the introduction of the Harvest Strategy Standard for New Zealand Fisheries (HSS).[iii] The HSS is a government policy that establishes best practice in relation to the setting of targets and limits for QMS fish stocks.

The HSS provides a technical elaboration of the MSY-related requirements of the Act. It also adds the 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.

Management Reference Points

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

Stock Assessments

Stock assessments for hake fisheries are undertaken regularly for each stock to estimate how they are performing against the management reference points.

Stock assessment models use 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) to estimate current stock size. Not only do the models look at current stock size, but they also look at what might happen to stock size in the future under different catch regimes.

Assessment results are presented to the Ministry for Primary Industries' (MPI) open scientific forum, the Deepwater Fisheries Assessment Working Group (DWFAWG), for peer review. The DWFAWG is attended by MPI scientists, research providers, independent scientists, fisheries managers, and representatives from industry and environmental NGOs. High standards are held and any 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.[v]

Once accepted by the DWFAWG, stock assessments are further peer reviewed through a scientific plenary process and are reported in the annual Fisheries Assessment Plenary Report[ii] (publically available on MPI's website[vi]). Stock assessments have been accepted for all three stocks in recent years, as

4. B_{MSY} is the estimated biomass that will support the Maximum Sustainable Yield (MSY).

summarised in Table 1. Specific details on the methodology and results from each of these assessments can be found in the Plenary report.[ii]

Assessment results are used by management to inform decisions – such as increasing or decreasing the TACC.

A History of the Fisheries' Management

New Zealand's hake fisheries have been managed under the QMS since its introduction in 1986 and TACCs for each QMA have been in place since that time. Traditionally hake has been caught as bycatch in the much larger hoki fisheries but in recent years hake has increasingly become a highly valued target fishery.

TACC increases were introduced in 1991-92, with HAK1 increasing from 2,610 t to 3,632 t, and HAK4 from 1,000 t to 3,500 t. Reported catches from each stock rose over a number of years to these new TACC levels. In HAK1, annual catches remained relatively steady up to 2004-05, but have since been generally less than 3,000 t. Catches from HAK4 declined erratically from over 3,000 t in 1998-99 to a low of 161 t in 2011-12. From 2004-05, the TACC for HAK4 was reduced to 1,800 t. Annual catches have been markedly lower than the new TACC since then. In 2005-06, the TACC for HAK7 was increased to 7,700 t. This new catch limit was set equal to the average catch level over the last 12 years. However, HAK7 catches have been relatively low since 2007-08.

HAK1

Estimates suggest a decline in the Sub-Antarctic (HAK1) stock size since the late 1980s but owing to an apparent increase in stock size during the mid-1980s (driven by catch-at-age data) current stock size is healthy relative to the estimated virgin biomass (B_0). Annual catches (averaging 2,400 t since 1990-91) appear to have had a slight effect on the biomass level, given the lower than average recruitment during that time. Consequently, future annual catches of 2,300 t (the mean annual catch for the last five years from 2005 to 2010), combined with recent stronger than average year classes, are projected to allow stock size to increase by about 50% by 2016.

An unusually large aggregation of possibly mature or maturing hake was fished on the western Chatham Rise, west of the Mernoo Bank (HAK1) in October 2004. Over a four week period, approximately 2,000 t of hake were caught from that area. In previous years, catches from this area have typically been between 100-800 t. These unusually high catches resulted in the TACC for HAK1 being over-caught during 2004-05 and a substantial increase in landings associated with the Chatham Rise. Fishing on aggregated schools in the same area also occurred during October-November 2008 and 2010.

HAK4

Year class strength estimates for the Chatham Rise (HAK4) stock suggest that the stock was characterised by a group of relatively strong year class strengths in the late 1970s to early 1980s, and again in the early 1990s, followed by a period of relatively poor recruitment (except for 2002). Consequently, biomass increased slightly during the late 1980s, then declined to about 2005. The growth of the strong 2002 year class has resulted in a recent upturn in biomass. Annual exploitation rates (i.e. catch over vulnerable biomass) have been low up to 1993 and since 2007. Model projections assuming a future annual catch of 1,800 t suggest that biomass will decline to about 38% B_0 by 2017. Note that 1,800 t is higher than recent annual catches from this stock, which have averaged about 1,070 t in the last five years.

HAK7

Year class strength estimates for the West Coast South Island (HAK7) stock exhibit a relatively low level of between-year variation, although there was a period of less than average recruitment from 1993 to 2003, followed by four years of relatively strong year classes. Estimated biomass declined throughout the late 1970s owing to relatively high catch levels, then increased through the mid-1980s concurrent with a marked decline in catch. Biomass then steadily declined from 1988 to 2007 owing to higher levels of exploitation and the recruitment of year classes that were generally of below-average strength. The increase since 2006 is a consequence of the recruitment of the above-average year classes since 2004. Annual exploitation rates have been low to moderate up to about 1999, increased during the 2000s, and have subsequently declined. Estimates of the West Coast South Island stock suggest that there has been a steady increase in stock size since 2007, when it was about 30% B_0.

Historical catches and TACCs for hake are shown in Figures 2-4. TACC changes have been made in response to changes in stock biomass as seen in Figures 5-7.

FIGURE 2
CATCHES AND TACCs FOR SUB-ANTARCTIC STOCK (HAK1)[II]

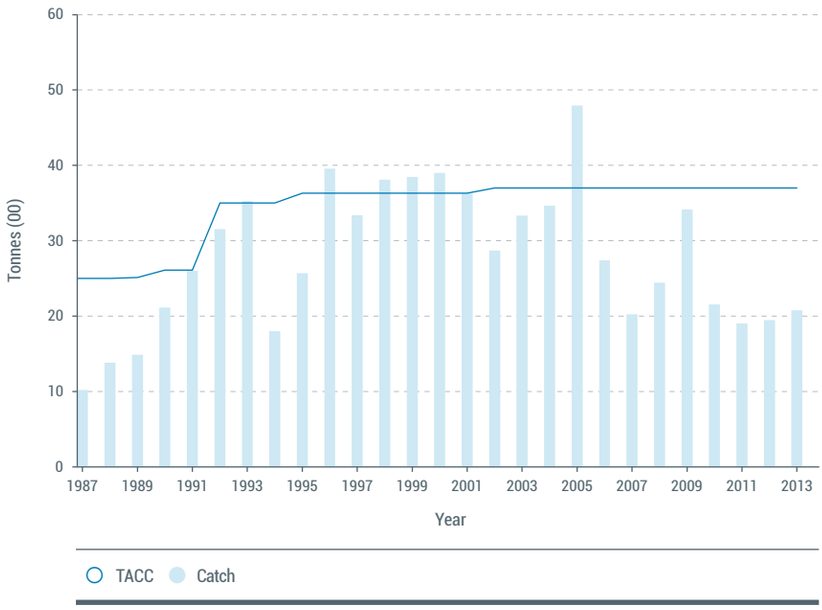


FIGURE 3
CATCHES AND TACCs FOR CHATHAM RISE STOCK (HAK4)[II]

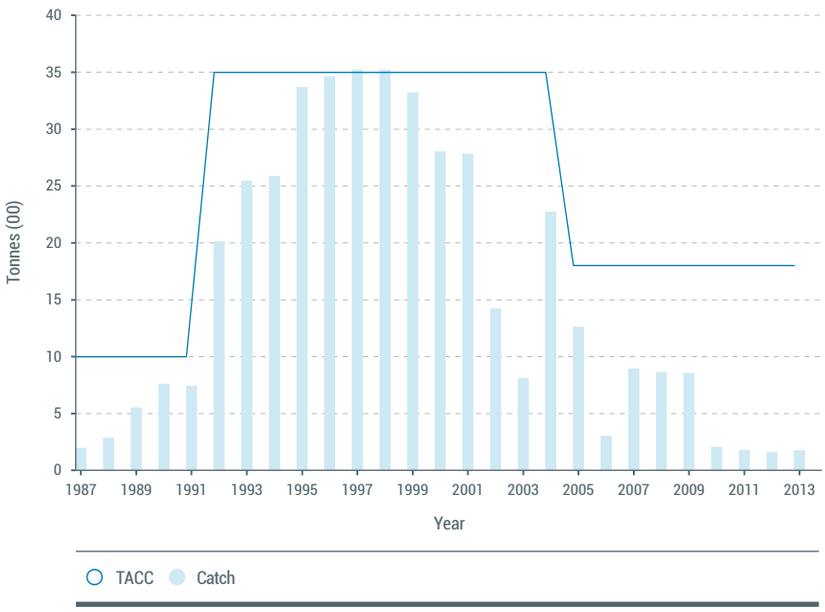


FIGURE 4
CATCHES AND TACCs FOR WEST COAST SOUTH IS. STOCK (HAK7)[II]

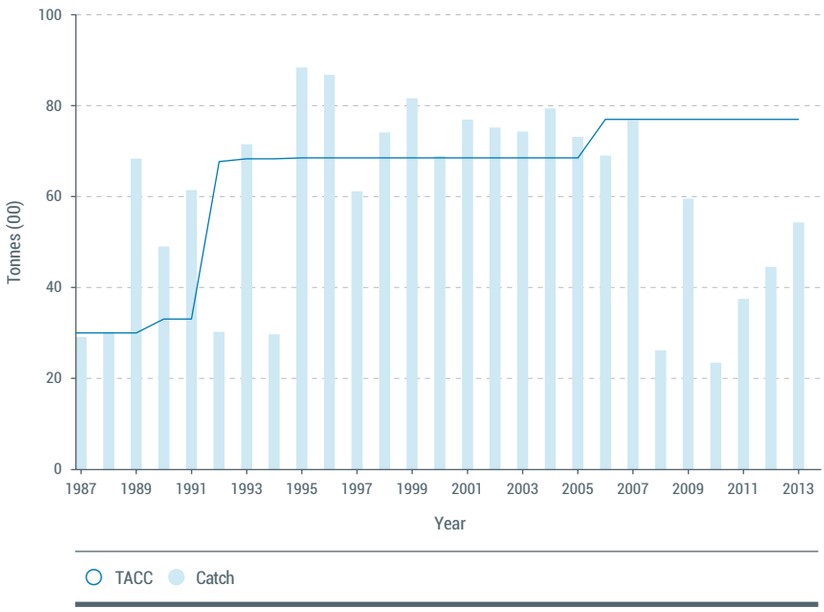


FIGURE 5
ESTIMATED BIOMASS FOR SUB-ANTARCTIC STOCK (HAK1)[II]

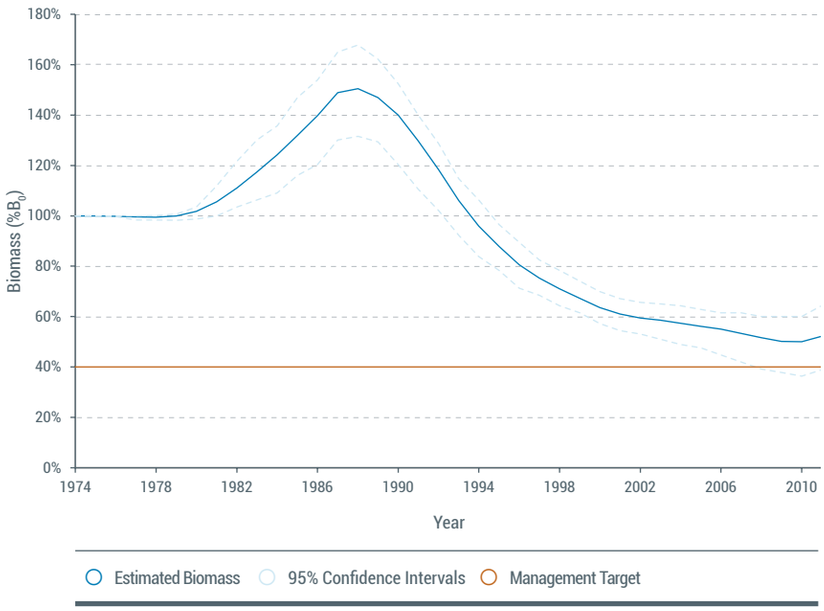


FIGURE 6
ESTIMATED BIOMASS FOR CHATHAM RISE STOCK (HAK4)[II]

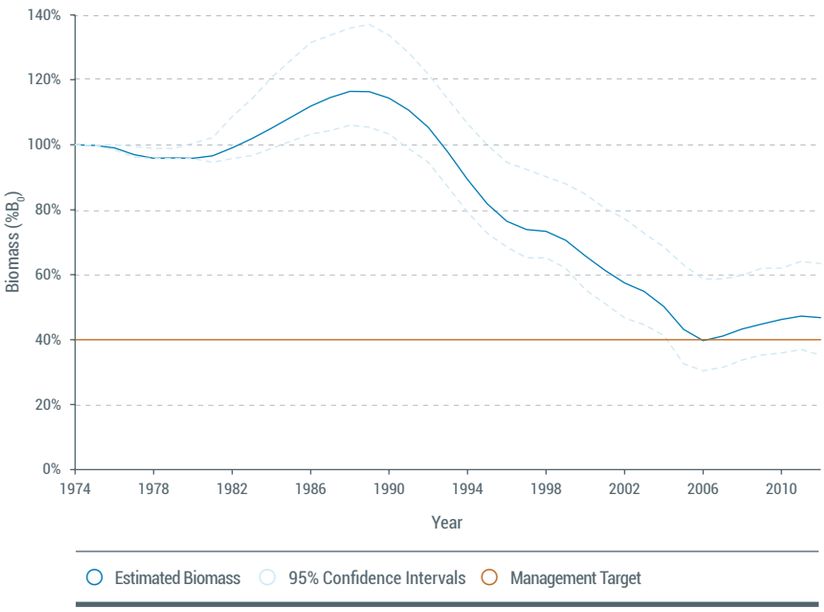
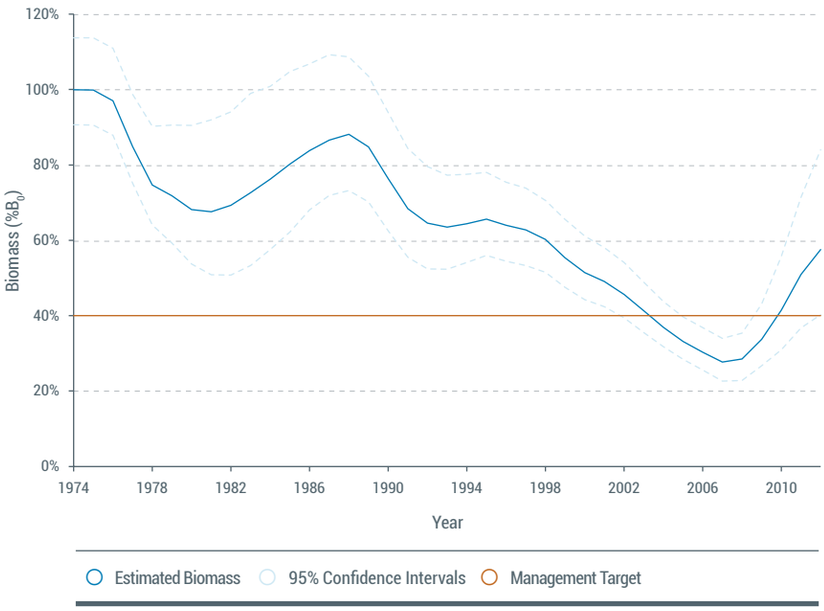


FIGURE 7
ESTIMATED BIOMASS FOR WEST COAST SOUTH IS. STOCK (HAK7)[II]



Managing Environmental Effects

All seabirds, all marine mammals, all corals, and many species of sharks are fully protected by law in New Zealand.

Bycatch Species

New Zealand's hake fisheries generally take little non-commercial finfish bycatch. More than 90% of the catch by weight consists of hake and other retained commercial species sustainably managed under the QMS, such as hoki, ling, and silver warehou. The key bycatch species in the hake fisheries are comparable to those in the related hoki and ling fisheries.

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".*

'Utilisation' is defined as

> *"conserving, using, enhancing and developing 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

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
		Gorgonian corals	All species in the order Gorgonacea
		Stony corals	All species in the order Scleractinia
	Hydrozoa (hydra-like animals)	Hydrocorals	All species in the order Stylasteridae
Chordata	Chondrichthyes *(cartilaginous fishes)*	Carcharhiniformes	Oceanic whitetip shark *(Carcharhinus longimanus)*
		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)*

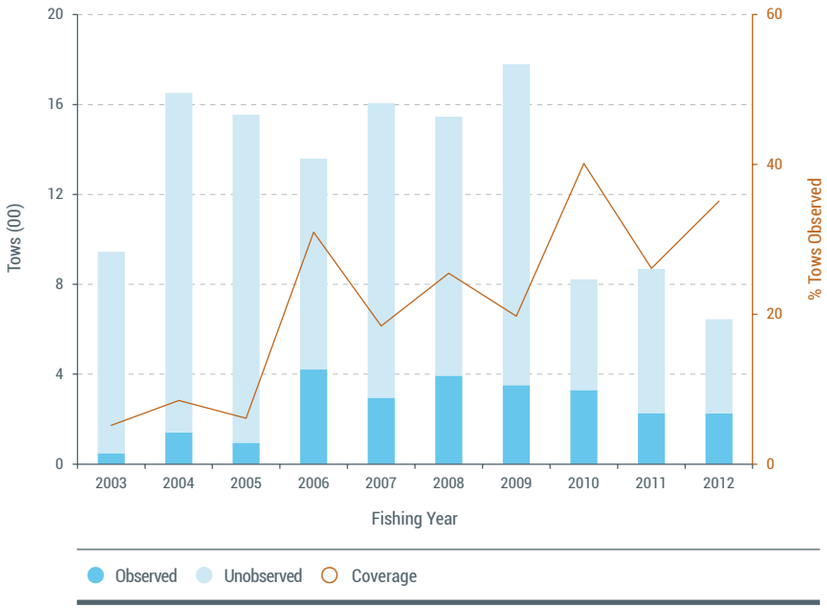
opportunistic source of food. In seeking access to this easy source of food, they have demonstrated that they can modify their behaviour to overcome obstacles and may unwittingly put themselves at risk of harm. Patterns of 'at risk' behaviour are observed to vary seasonally and between species, and to be dependent on their eagerness to feed in close proximity to vessels and nets. 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 seabird and coral species, and many shark species, are protected under the Wildlife Act 1953 (Table 3). 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.

Observer coverage of New Zealand's hake fisheries is delivered through MPI's Observer Programme, which provides independent monitoring of any interactions that occur between protected species and the hake fisheries (Figure 8). Around 27% of all tows targeting hake have been documented by scientific observers in recent years.[vii]

The long-term goal is to minimise interactions where possible, with zero interactions being the ultimate goal.

FIGURE 8
EFFORT AND OBSERVED EFFORT IN HAKE TRAWL FISHERIES[VII]



White-capped mollymawk

Seabirds

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

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[viii], 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.

Hake 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 hake, have reduced over time.[ix]

Vessels targeting hake 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 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 hake fisheries enables independent monitoring

FIGURE 9
ESTIMATED SEABIRD CAPTURES IN HAKE TRAWL FISHERIES[VII]

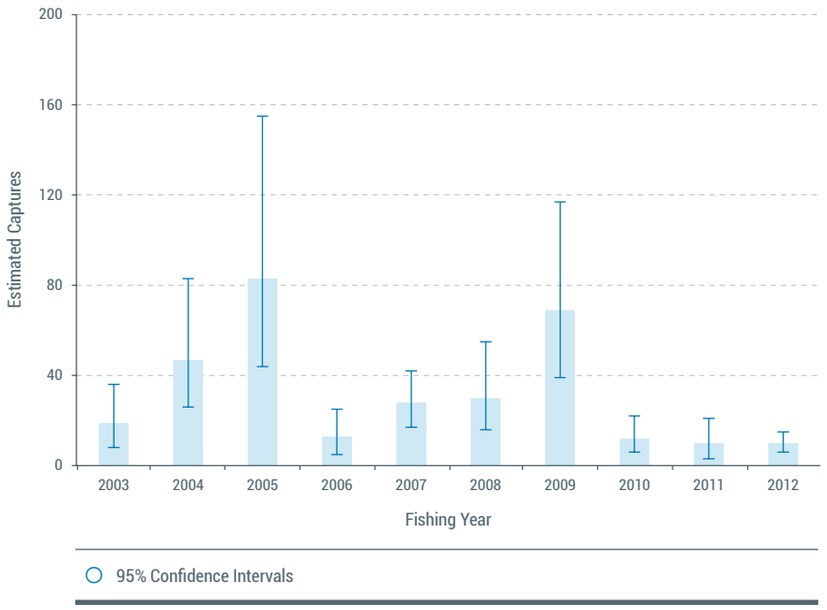
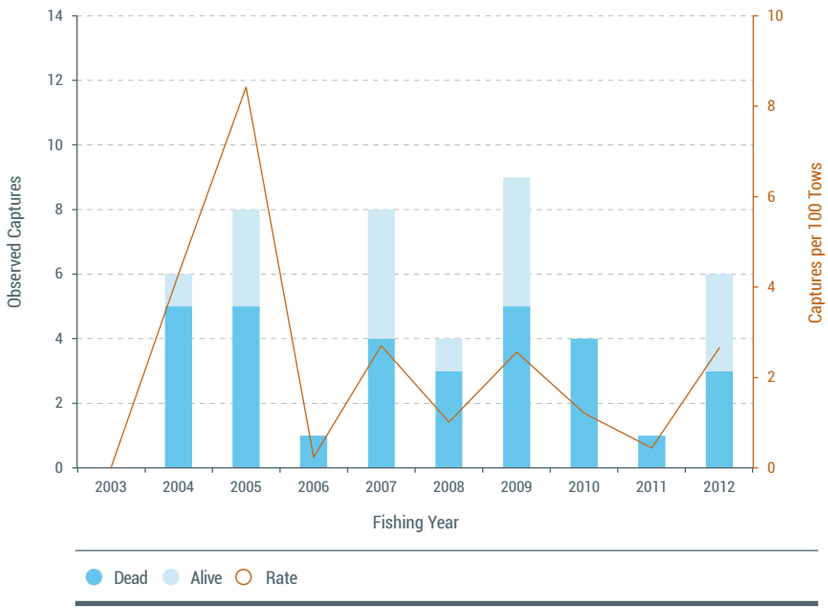


FIGURE 10
OBSERVED SEABIRD CAPTURES IN HAKE TRAWL FISHERIES[VII]



and reporting of seabird interactions with both government and industry risk mitigation requirements.

Seabird captures in the hake fisheries have varied over time and by area but, as noted earlier, are considered to pose little risk to seabird populations (Figures 9 and 10).

When looking at New Zealand EEZ fisheries as a whole, captures of all bird types combined have decreased between 2002-03 and 2011-12.[ix] Although 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[x] 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 have proved effective at mitigating these interactions through the management of offal discharges. 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.[xi] Other best practice includes mitigation methods such as tory or streamer lines, bird bafflers, and warp deflectors which have been mandatory since April 2006 (Figure 11).

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.[ix]

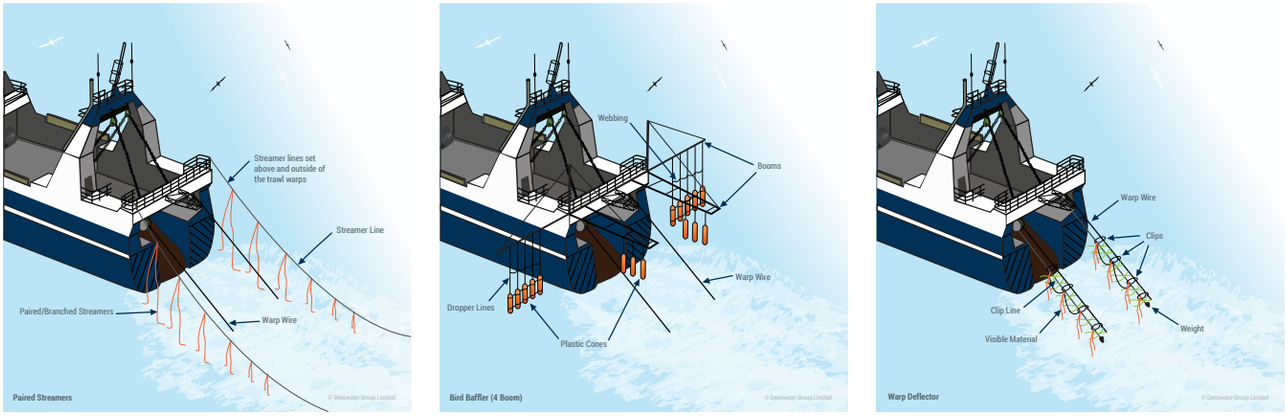
Although warp captures have reduced significantly, reducing net captures of small diving birds is proving to be more challenging. MPI and industry are continually seeking better ways to deter birds from attending the net.

New Zealand Fur Seal

The hake fishery is not having any unsustainable impacts on fur seal populations.

The New Zealand fur seal was classified in 2008 as *'Least Concern'* by the

FIGURE 11
SEABIRD MITIGATION EXAMPLES (TORI LINES, BIRD BAFFLER, WARP DEFLECTOR)



International Union for the Conservation of Nature (IUCN) and in 2010 as *'Not Threatened'* under the New Zealand Threat Classification System.[xii] Fur seal populations are monitored, with the total population around New Zealand estimated to exceed 50,000 adults and thought to be increasing.[ix]

Observed fur seal captures in hake fisheries peaked in 2009, with 28 captures, but generally there are less than five observed captures in total each year. In 2012 there was one observed capture (which was released alive) and it was estimated by statistical model that there was a total of eight captures (Figures 12 and 13).[xv] These levels of interaction are not considered to pose a risk to fur seal populations.

DWG and MPI have worked closely with scientists and eNGOs to develop and implement effective Marine Mammal Operational Procedures (MMOPs) to provide guidance and best practice to reduce fur seal interactions to the lowest possible levels. All deepwater trawl vessel operators have agreed to follow the MMOPs and to submit their vessel's performance to an annual audit by MPI.[xiii]

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.[xiv] This area was identified to be of most potential concern because of the number of incidental interactions between vessels here 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. Interaction rates in HAK7 (west coast South Island) are within precautionary estimated PBR levels for this region.

FIGURE 12
ESTIMATED NEW ZEALAND FUR SEAL CAPTURES IN HAKE TRAWL FISHERIES[VII]

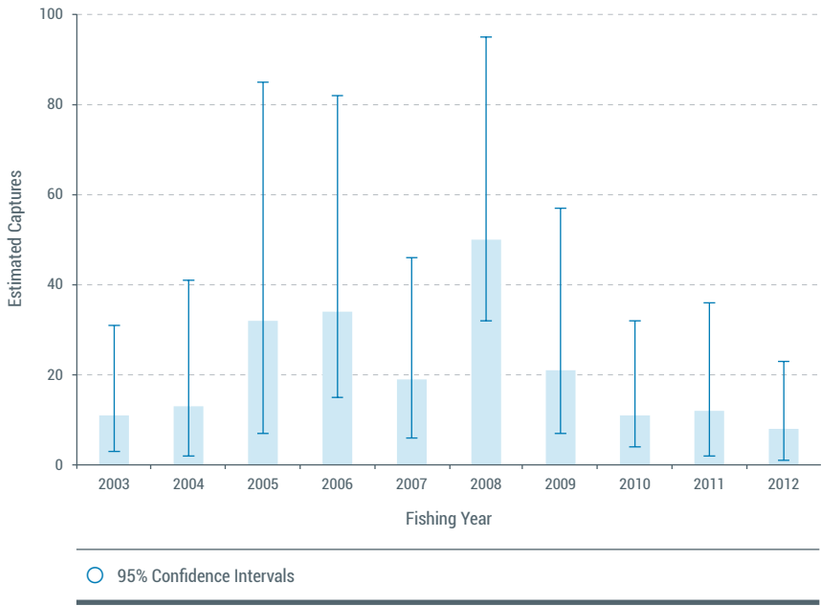
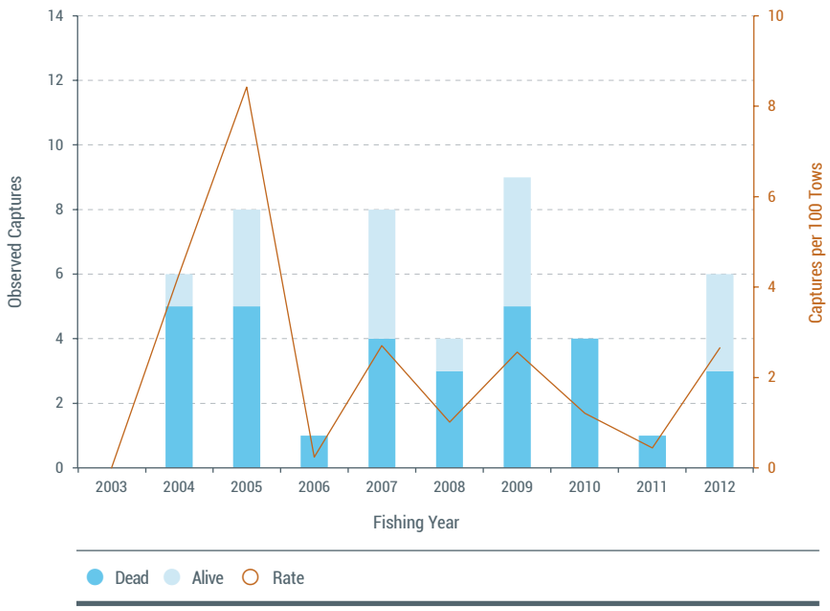


FIGURE 13
OBSERVED NEW ZEALAND FUR SEAL CAPTURES IN HAKE TRAWL FISHERIES[VII]



No interactions have been reported with sea lions, dolphins or whales.[xv]

Protected Coral & Fish

MPI observers also record the levels of interactions with protected fish and coral species. Among all of the bycatch species for hake 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 the Southland-Auckland Islands area (southerly part of HAK1), although these occurrences are rare and highly unlikely to lead to any adverse effect on the population. Further research is in progress to improve our understanding of interactions between basking sharks and deepwater fisheries with the view of further reducing these interactions.[xvi]

Few protected coral species are recorded as bycatch in the hake fisheries.[xvii] Only 2.6% of observed hake tows recorded coral bycatch between 2007-08 and 2009-10.[xviii] The current best scientific information indicates that the hake fisheries (along with the New Zealand hoki and the New Zealand ling fisheries) have minimal overlap with where protected corals are distributed and, therefore, pose little risk to protected corals.

Habitats & Ecosystems

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

Hake are widely distributed throughout the middle depths of New Zealand waters, mostly south of 40 °S. Adults are mainly found at depths of 250 m to 800 m, while juveniles are found in inshore regions shallower than 250 m.

Hake are taken by both mid-water and bottom trawls. Bottom trawling is known to impact fragile benthic (or seabed) invertebrate communities, the degree of such impacts is dependent upon sediment type.

As part of MPI's 10-Year Research Programme, the footprint of all trawl fisheries, including hake, is 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. Research projects such as the Oceans Survey 20/20, which used both acoustic mapping and underwater cameras to map New Zealand's marine biodiversity and habitat types, continually increase our knowledge and understanding of the effects of fishing on the benthic environment and are critical to informing management decisions. Key fishing grounds such as the Chatham Rise are now well studied and understood in terms of habitat and biodiversity.

MPI and DWG have also developed and implemented a programme of spatial management (Table 4 and Figure 14), which includes:

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

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. To give an indication of their size,

TABLE 4
MARINE SPATIAL MANAGEMENT IN NEW ZEALAND'S EEZ

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)[5]			1,200,741
Total Area as a Percentage of New Zealand's EEZ			30%

5. In some areas, BPAs and 'Seamount' Closures overlap. Therefore, this is based on the footprint area.

New Zealand's BPA network is over four times the area of New Zealand's landmass.

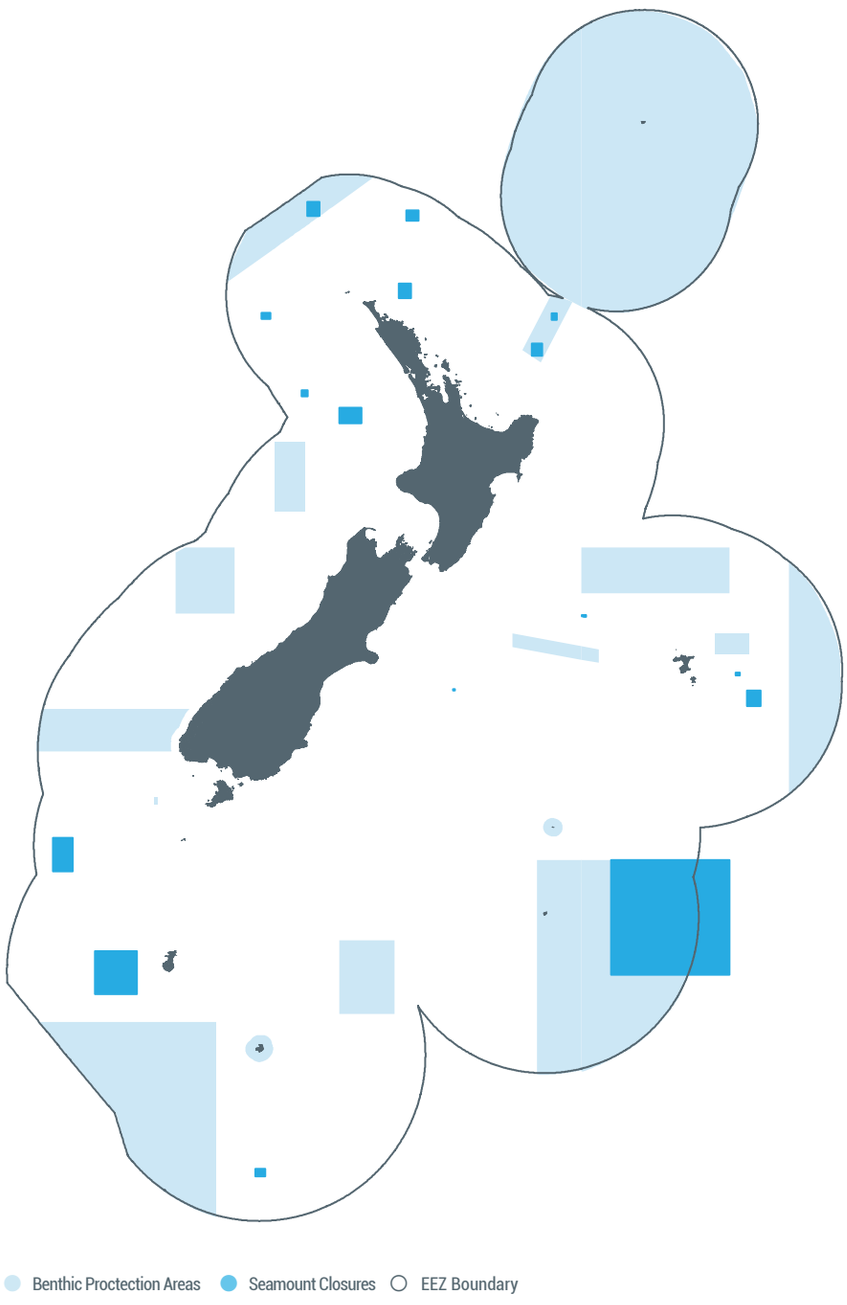
The requirement for the BPA design was to encompass not less than 10% of each oceanic class of the MEC and each oceanic class was to be represented in two or more BPAs. They were also spread by latitude and longitude throughout the New Zealand EEZ, which runs from sub-tropical waters to sub-Antarctic waters, and to protect benthic habitats over a range of depths. The designated BPAs are indicated to protect:

- 28% of Underwater Topographic Features (including seamounts)
- 52% of seamounts (underwater mountains over 1,000 m in height)
- 88% of active hydrothermal vents.

Over 98% of the area where hake are distributed within the EEZ has either been closed to bottom trawling and/or has never been contacted by trawls targeting hake over the period 1990 to 2012. Over the last five years, HAK1 and HAK4 had an area closed and/or not trawled of over 99.5%, for HAK7 it was 99.0%. By these measures, the extent of the hake bottom trawl grounds is very small and localised.[xxi xxiii]

The hake fishing grounds have been progressively developed over the past two decades and there is now relatively little exploratory fishing over new grounds. Most hake 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.

FIGURE 14
BENTHIC PROTECTION AREAS AND 'SEAMOUNT' CLOSURES



MAKORORI BEACH. EAST CAPE, NEW ZEALAND.[XXX]

Effective Fisheries Management

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

New Zealand by Satellite[xxxi]

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 fishing year, ITQ generates Annual Catch Entitlements (ACE), the annual harvesting right expressed in kilogrammes. 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".*[xxiv]

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 for Primary Industries 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, hake is managed in accordance with the National Fisheries Plan for Deepwater and Middle-depth Fisheries, there is a species-specific chapter for hake within this Plan.[iv]

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.[xxv] In a second study, New Zealand was ranked first for managing marine resources among the 53 major fishing nations that were assessed.[xxvi]

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,[xxvii] including the hake fisheries. This partnership has been updated in 2008 and 2010 and has directly facilitated improved management of the hake 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 MPI's 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 hake, through fisheries plans.

Environmental organisations and other interested parties also actively participate and contribute to management processes.

Nugget Point[xxxii]

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. 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.

Within the VADE framework, enforcement is but one of the tools utilised, however it is the intervention that sets the conditions and incentive for voluntary compliance.

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 vessels' 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 24% of all tows targeting hake are observed each year and MPI has plans in place to increase this coverage further (Figure 8). Quayside inspections are also undertaken to verify reported landings.

Commercial fishermen face prosecution and risk severe penalties, including automatic 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 the incentive for 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 stocks, such as hake, 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 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.[xxviii]

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.

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 a specific chapter that focuses on hake fisheries.[iv] This Fisheries Plan (the Plan) is a statutory document, approved by the Minister of Fisheries in 2010. 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 hake fisheries will be assessed against agreed reference points for the management of hake harvests. 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 is 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 hake fisheries; these regulations are complemented by additional industry-agreed non-regulatory measures, known as the New Zealand Deepwater Fisheries Operational Procedures (OPs). The Minister relies on the effectiveness of both regulatory and non-regulatory measures to ensure the sustainable management of these fisheries.

The OPs apply to all deepwater fisheries, including those for hake, and set out agreed industry best practice for minimising interactions with protected species such as seabirds, marine mammals and sharks.

As part of this, DWG has an Environmental Liaison Officer whose role is to liaise with vessel operators, skippers, and the Ministry to assist with the effective implementation of these best practice guidelines.

Sea Urchins

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 Led* – to 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 efficiencies in science service provision.

Fisheries research falls into several key areas, each of which has its own specific goals. These are:

- *Fisheries Resources* – to provide information on sustainable yields and stock status required for sustainable utilisation of New Zealand's fisheries resources
- *Harvest Levels* – to determine the nature and extent of commercial and recreational catch, Maori customary take, illegal catch, and fishery-induced mortality
- *Cultural, Economic, and Social Research* – to provide information on cultural, economic, and social factors that may need to be considered in the management decision-making process to enable people to provide for their social, economic and cultural well-being
- *Traditional and Customary Research* – to provide information on the traditional and customary factors that may need to be considered in the management decision-making process to enable the Minister to discharge his/her obligations to tangata whenua under the Deed of Settlement and the Treaty of Waitangi (Fisheries Claims) Settlement Act to enable Maori to provide for their traditional and customary well-being.

Research plans and reports are made publically available.

HAKE ESCABECHE WITH AVOCADO OIL.

Certified Sustainable

The 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 Deepwater Group has embarked on an ambitious programme to have all its main fisheries assessed and certified as sustainable under the Marine Stewardship Council's (MSC) programme, the international 'gold standard' for sustainable fisheries performance.

The 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?

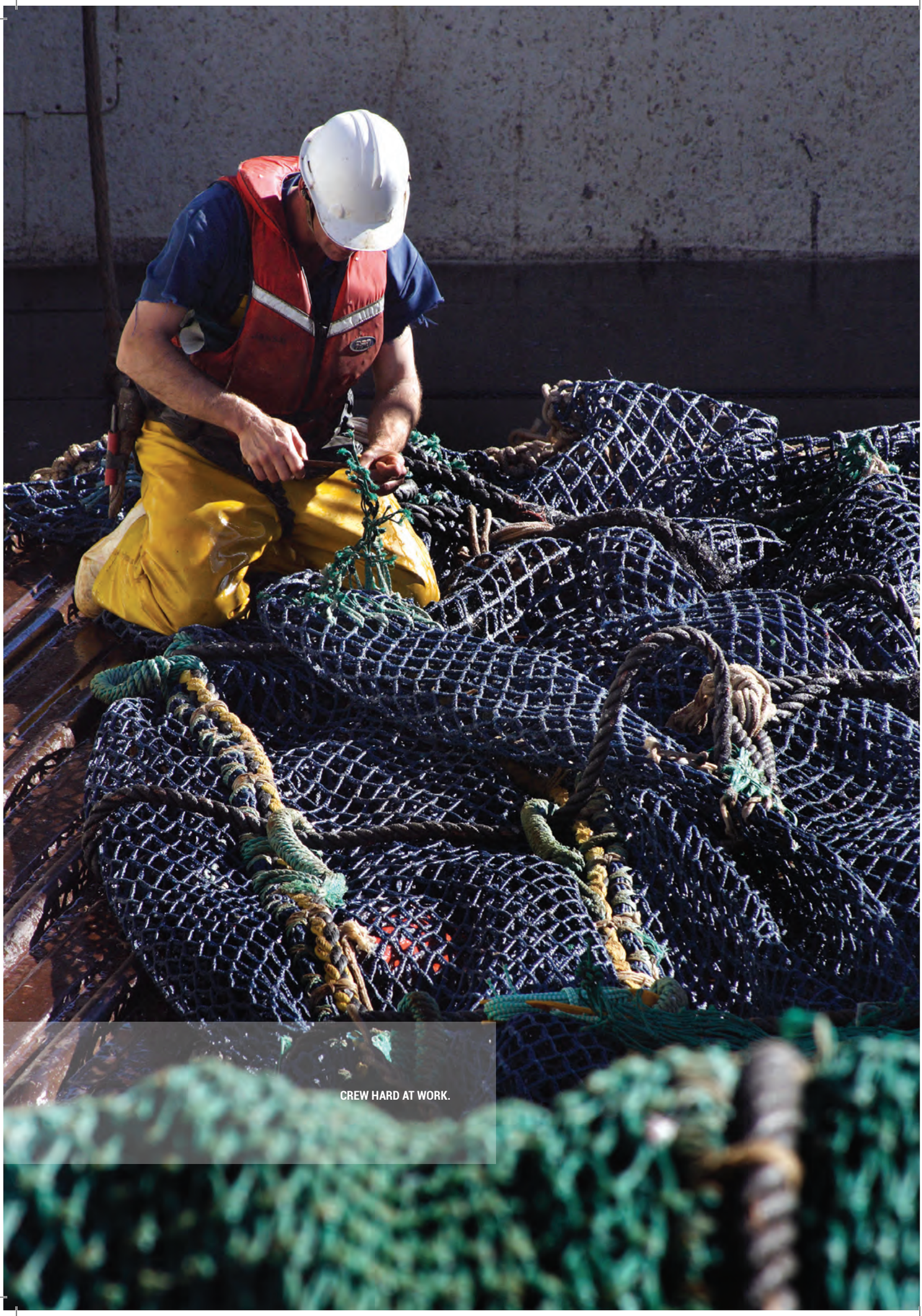
Fisheries are assessed by third-party accredited auditors and their findings are peer-reviewed.

Currently New Zealand's hake fisheries are certified as meeting the MSC standards. Furthermore, being certified sustainable without conditions makes the New Zealand hake fisheries one of a select few global fisheries (which include New Zealand hoki and New Zealand southern blue whiting) that are MSC certified without conditions.

MSC certification provides independent validation of the seafood industry's commitment to continuous improvement and the collaborative partnership with MPI; a commitment that 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.

This partnership also aligns strategic and operational objectives, resulting in a long-term science and information plan and more investment in monitoring and research.

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



CREW HARD AT WORK.

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