Fisheries New Zealand
Tini a Tangaroa

Consultation on the

Squid 6T Operational Plan

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New Zealand Government

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Submission Information

Fisheries New Zealand welcomes written submissions on any or all of the proposals contained in the Consultation Document. All written submissions must be received by Fisheries New Zealand no later than 6 September 2019.

Submission can be emailed to: **FMsubmissions@mpi.govt.nz**

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Executive Summary

New Zealand sea lions are a taonga species for tāngata whenua, and are protected under New Zealand's legislation. The sea lion population, which was estimated to be around 11,800 individuals in 2015, is currently classified as being 'Nationally Vulnerable' in the New Zealand Threat Classification Scheme. The population has stabilised at the Auckland Islands and either stable or increasing at the two other breeding colonies in New Zealand.

The main sea lion breeding colony is at the Auckland Islands, where their foraging range overlaps with the trawl fishery for squid in the area (Quota Management Area SQU6T, referred to as Squid 6T).

Since the 2007/08 fishing year, all fishers operating in Squid 6T have deployed Sea Lion Exclusion Devices (SLEDs) in their trawl nets. SLEDs are intended to enable the survival of sea lions. The introduction of SLEDs in the Squid 6T fishery has resulted in a significant reduction in sea lion mortalities (peak of approx 160 in 1995/96 to an estimated 3 in 2017/18 and around 9 in 2018/19).

Interactions between New Zealand sea lions and the squid fishery around the Auckland Islands are managed through the Squid 6T Operational Plan, which sets out a range of measures to avoid, remedy, or mitigate the effect of fishing-related mortality on the New Zealand sea lion population.

The primary regulatory measure in the Squid 6T Operational Plan is a fishing-related mortality limit which is the maximum number of sea lion mortalities that may occur in the fishery annually. Should the limit be reached, the fishery is closed immediately.

In recent years, the Squid 6T Operational Plan has included the fishing-related mortality limit and also management settings used to monitor the fishery against the mortality limit to account for sea lion mortalities that may not be able to be observed.

Fisheries New Zealand is proposing a new, more direct, approach to monitor against the mortality limit based on observed captures. This is made possible by new research which better quantifies and reflects the uncertainty in the effectiveness of SLEDs and estimated sea lion mortalities in the fishery. The research estimates probabilities for each outcome that can happen to a sea lion that swims into a trawl net. The outputs indicate that for every three sea lion captures that are observed, another sea lion has died.

Based on the updated analyses, the squid fishery is estimated to be having less than a 1.5 percent impact on the sea lion population. Given the low impact of the current fishery, the options for a fishing-related mortality limit in this paper are unlikely to constrain the amount of fishing activity. However, the proposed fishing-related mortality limits would serve as a backstop to ensure that fishing does not have an adverse effect on the sea lion population in future.

Proposed options for the fishing-related mortality limit would result in fishing having a maximum potential impact on the population of 2.5 percent, 5 percent, or 10 percent if the mortality limit were reached every year (Table 1).

Fisheries New Zealand also requests views on whether the use of SLEDs in the Squid 6T fishery should be made compulsory through regulation. SLEDs are currently used on all tows in the Squid 6T fishery on a voluntary basis.

The current (2017-2019) Squid 6T Operational Plan includes a commitment to at least 70 percent observer coverage across all tows in the Squid 6T fishery. Actual observer coverage has been over 85 percent in both the 2017/18 and 2018/19 fishing years. Fisheries New Zealand is proposing to increase the minimum observer coverage level to 90 percent in recognition of the importance of verifying reporting of sea lion captures, and requests views on the appropriate level of observer coverage.

Table 1: Options for fishing-related mortality limit and associated potential maximum impact on Auckland Island sea lion population

	Maximum impact on population	Fishing-Related Mortality Limit
Option 1	2.5%	26
Option 2	5%	52
Option 3 (Not preferred)	10%	104

Background

NEW ZEALAND SEA LION

Status

The New Zealand sea lion (rāpoka) is an endemic, protected species that is a taonga for tāngata whenua. New Zealand sea lions have been protected since 1894 when their hunting was prohibited. As a result of intense hunting prior to 1894, the breeding population is now concentrated in the sub-Antarctic islands with around 98 percent of annual pup production coming from the Auckland and Campbell Islands. The Auckland Islands population declined significantly between 2000 and 2009 but appears to have stabilised in recent years.

At Campbell Island, the sea lion population increased rapidly between 2000 and 2010 and appears to have stabilised thereafter. The population on Stewart Island was recognised as a breeding colony in 2018 and appears to be increasing. The relatively new breeding population on the New Zealand mainland is increasing but is not yet large enough to be recognised as a breeding colony.

The New Zealand Threat Classification Status of New Zealand sea lion was updated in 2019 from "'Threatened – Nationally Critical" to "Threatened – Nationally Vulnerable"[1]. The overall rate of population decline at the Auckland Islands has slowed, and sea lion numbers are stable or increasing at most other breeding locations.

New Zealand sea lion/rāpoka Threat Management Plan

The New Zealand sea lion/rāpoka Threat Management Plan 2017-2022 (NZSL TMP) provides a five-year strategic programme of work with four work streams: Engagement, Direct Mitigation, Targeted Research, and Evaluation. The NZSL TMP includes population-level initiatives and site-specific actions for mitigating the main threats at the four breeding sites.

The vision of the NZSL TMP is to "*promote the recovery and ensure the long-term viability of New Zealand sea lions, with the ultimate goal of achieving 'Not Threatened' status*[2]*".*

The objectives are to:

1. Halt the decline of the New Zealand sea lion population within 5 years; and
2. Ensure the New Zealand sea lion population is stable or increasing within 20 years, with the ultimate goal of achieving "Not Threatened" status.

The objectives of the NZSL TMP need to be considered in the context of the need to balance sustainability with utilisation in Fisheries Act 1996. The information supporting the development of the NZSL TMP indicates that the direct impacts of fishing were not the major cause of the observed population decline at the Auckland Islands colony between 2000 and 2009.

Fisheries New Zealand considers that the proposals in this paper are consistent with the vision and objectives of the NZSL TMP.

Population modelling

Abundance trends for each New Zealand sea lion breeding population are monitored using pup counts to estimate pup production, which then provides an index of total population size. This Operational Plan is based on estimates of abundance and impacts for the Auckland Islands female breeding population only.

At the Auckland Islands, a large proportion of the sea lion population has been tagged to allow for annual re-sighting information to be collected. A statistical demographic population model has been developed which incorporates all available data including pup counts, age distribution data from lactating females, and tag re-sight data to inform estimates of critical demographic rates.

The model structure allows the underlying demographic rates responsible for the observed population changes (including the decline at the Auckland Islands colony between 2000 and 2009) to be identified. In this case, the model indicates that the observed Auckland Islands population decline was a consequence of both low pup survival and reduced adult survival. The importance of low pup survival, which has also been confirmed by direct observations, indicates that there is more than one cause of the population decline. This is because the fishery does not directly impact pups, and the apparent levels of pup mortality are far higher than could be explained as a consequence of impacts on lactating mothers.

1 Baker, C.S.; Boren, L.; Childerhouse, S.; Constantine, R.; van Helden, A.; Lundquist, D.; Rayment, W.; Rolfe, J.R. 2019: Conservation status of New Zealand marine mammals, 2019. New Zealand Threat Classification Series 29. Department of Conservation, Wellington. 18 p.

2 Threat classification considers the following criteria: number of mature individuals, predicted population trend, number of populations, number of mature individuals in the largest population, and area of occupancy of total population. To achieve Not Threatened status, the overall population trend would need to be stable to 10 percent, the number of mature individuals over 20,000, and more than the two current populations/breeding colonies. With the recognition of Stewart Island as a new breeding colony in 2018, the latter criterion has been achieved.

COMMERCIAL FISHERIES

Commercial fishing is excluded from the Auckland Islands out to a distance of 12 nautical miles, first by the designation of the area as a Marine Mammal Sanctuary in 1993 and second by the designation of the area as a Marine Reserve in 2003. However, because sea lions forage beyond 12 nautical miles from shore, there is overlap between foraging sea lions and commercial fisheries that operate near the Auckland Islands. This can lead to incidental mortalities of sea lions in fishing gear.

Auckland Islands squid trawl fishery

The southern squid trawl fishery (Quota Management Area SQU6T) started in the late 1970s, and targets arrow squid on the Auckland Islands shelf primarily between December and June each year. Arrow squid (*Nototodarus gouldi* and *Nototodarus sloanii*) were introduced into the Quota Management System in 1987.

The current Total Allowable Commercial Catch in SQU6T is 32,369 tonnes, but landings have not reached this level since 2004. In the last 10 years (2008/09 to 2017/18) the average annual catch has been 14,948 tonnes, ranging from 6,127 tonnes in 2014/15 to 28,872 tonnes in 2008/09. The number of vessels participating in the Squid 6T fishery has declined over time, from 63 vessels operating in 1990 to 20 in 2018. In 2017/18, 1,130 tows targeted squid in the Squid 6T fishery. The estimated export value[3] of SQU6T in the 2018 calendar year was $56.6M FOB[4].

In the five years from 2013/14 to 2017/18, observed captures in the Squid 6T fishery ranged from 0 to 3, with 84 percent of tows observed. There have been seven captures observed in 2018/19. Total estimated sea lion deaths in the fishery have been less than six per year for the five year period 2013/14 to 2017/18, with an estimated nine in 2018/19.

Other fisheries

Sea lions from the Auckland Islands may be captured in other commercial fisheries including the trawl fishery for scampi (SCI6A), which operates nearly year round approximately 20-60 nautical miles from the Islands. Other middle depth trawl fisheries, targeting species such as hoki, hake, ling or warehou species, may also capture Auckland Islands sea lions, although this is rare given they operate further from the breeding colony locations (e.g. over 60 nautical miles).

All sea lion mortalities from these fisheries are incorporated into the estimates of demographic rates in the population model, and are therefore taken into account when the Population Sustainability Threshold (PST) for the Auckland Islands squid trawl fishery is calculated.

SQUID 6T OPERATIONAL PLAN

The *Operational Plan to Manage the Incidental Capture of New Zealand sea lions in the southern squid trawl fishery* (Squid 6T Operational Plan) sets out the management measures that will be employed to manage interactions between the SQU6T fishery and New Zealand sea lions.

Squid 6T Operational Plan Technical Advisory Group

To better engage on the review of the Operational Plan, a multi-stakeholder Technical Advisory Group was set up in 2017 to provide advice and recommendations to Fisheries New Zealand on:

- Management settings of the Operational Plan; and
- Updated population objective criteria for future Operational Plans.

The membership of the Squid 6T Operational Plan Technical Advisory Group (TAG) includes representatives from Fisheries New Zealand, the Department of Conservation, iwi, environmental Non-Government Organisations, the commercial fishing industry and four independent experts contracted by Fisheries New Zealand. TAG membership is listed in Appendix 1. The recommendations of the TAG for options to be included in this consultation document are attached (Appendix 1) and are reflected in the following sections.

Fishing-related mortality limit

The primary regulatory management measure in the Squid 6T Operational Plan is the fishing-related mortality limit, which is set under section 15(2) of the Act by the Minister of Fisheries after consultation with the Minister of Conservation. The fishing-related mortality limit sets the maximum number of sea lion mortalities (generally expressed as an annual limit per fishing year) that may occur in the fishery.

Annual limits on fishing-related mortality of sea lions in the Squid 6T fishery have been in place since 1991. The fishing-related mortality limit was set at 68 sea lions per year from 2010/11 to 2016/17, and has historically ranged from a high of 115 sea lions in 2004/05 (which was reached and the fishery closed) to a low of 38 in 2017/18 and 2018/19.

The most recent Squid 6T Operational Plan (2017-2019) set an annual fishing-related mortality limit of 38 sea lions. This

3 Figures taken from provisional export statistics provided by Seafood New Zealand: https://www.seafood.org.nz/fileadmin/documents/Export_data/18.12.10a.pdf

4 FOB – Free on board. The value of export goods, including raw material, processing, packaging, storage and transportation up to the point where the goods are about to leave the country as exports. FOB does not include storage, export transport or insurance cost to get the goods to the export market.

represents the lowest fishing-related mortality limit since 1991. The 2017-2019 fishing-related mortality limit was based on outputs from the New Zealand sea lion demographic population model and a desired population objective of the Auckland Islands population being no more than 5 percent lower than it would be in the absence of human-caused mortality with 90 percent confidence, over five years.

The 2017-2019 fishing-related mortality limit included an allowance for sea lion mortalities in fisheries other than Squid 6T that may have impacted on the Auckland Islands sea lion population. This was implemented by setting the fishing-related mortality limit at eight fewer than the estimate of the population sustainability threshold. Upon further consideration, this was found to be double-counting, as the population model already includes and accounts for mortalities in other fisheries.

The fishing-related mortality limit has not been reached in any year during the most recent Operational Plan.

OTHER SETTINGS

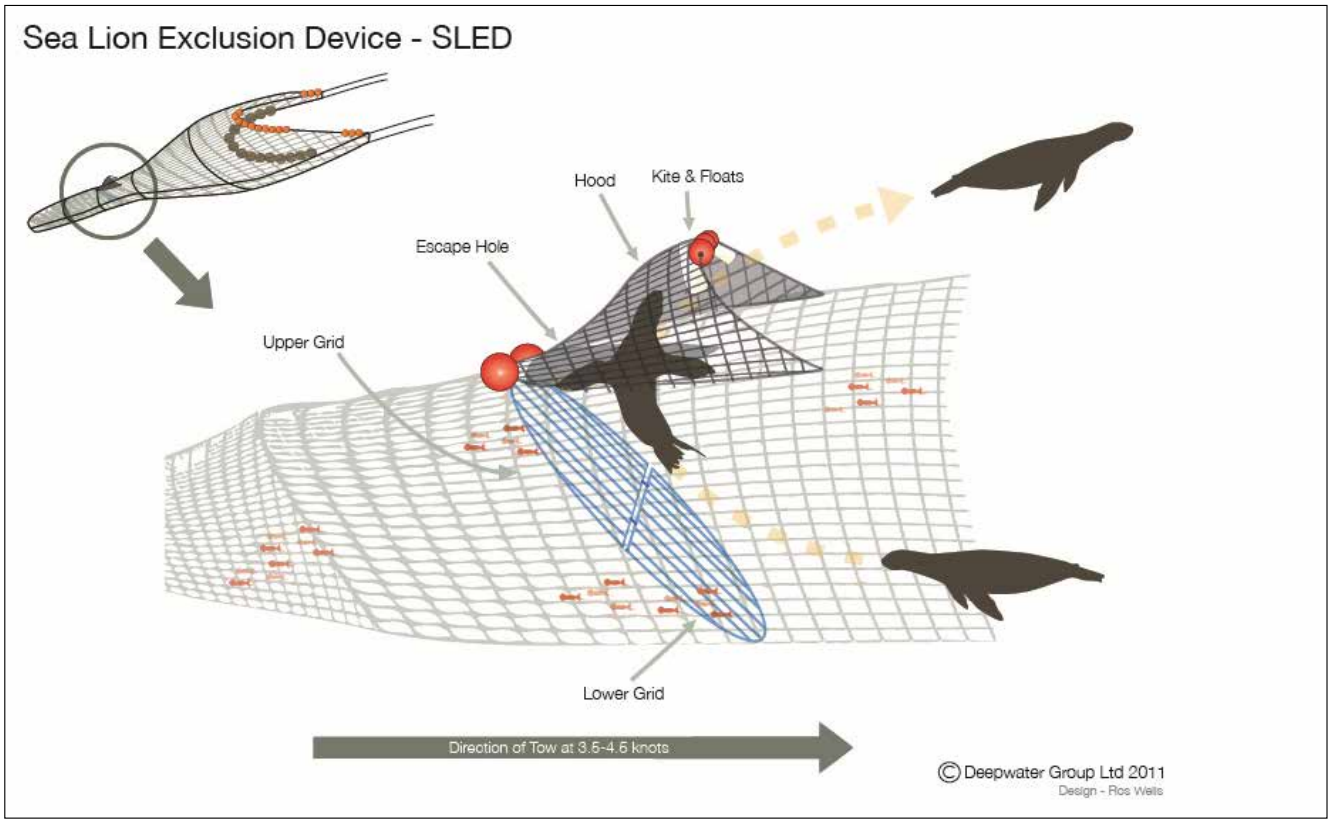
Sea Lion Exclusion Devices

The most important initiative to mitigate impacts of fishing on sea lions is the Sea Lion Exclusion Device (SLED), which was developed by the fishing industry in the early 2000s. The SLED is designed to allow actively swimming sea lions to escape through a hole in the top of the net. From their introduction between 2000 and 2007, the design of SLEDs was regularly adjusted to improve performance. From the 2007/08 fishing year, the "Mark 3/13" design became the agreed SLED standard.

The use of SLEDs is not currently regulated, however all vessel operators that intend to fish for squid in the Squid 6T fishery have agreed to deploy SLEDs on all tows. SLEDs have been deployed on every tow in the fishery since at least the 2014/15 fishing year.

SLEDs are considered to be effective at allowing sea lions to escape from the trawl net and survive. However, their use means that it is not possible to directly count all sea lion mortalities in the fishery, to the extent that a sea lion exiting the net may nonetheless die as a consequence of the interaction with the fishing gear. The death of sea lions that exit the trawl net via the SLED but do not survive is termed "cryptic mortality."

Figure 1: Diagram of a SLED[5]



5 Image provided by Deepwater Group Limited

Observer Coverage

The current Operational Plan includes a commitment to a minimum observer coverage of 70 percent. The previous Operational Plan, which was in place from 2010/11 to 2016/7 included a commitment to a minimum of 30 percent observer coverage.

Actual observer coverage has been over 84 percent in the last five years, primarily as the result of having at least one observer on every foreign owned vessel at all times. In the 2017/18 fishery, over 88 percent of tows were observed, and 95 percent of tows were observed in the 2018/19 Squid 6T fishery.

LEGAL CONTEXT

Marine Mammals Protection Act 1978

The New Zealand sea lion is a marine mammal under section 2(1) of the Marine Mammals Protection Act 1978. It is therefore a protected species under section 2 of the Fisheries Act 1996 and is also an associated or dependent species under section 2. It is further categorised as a threatened species under section 2(3) of the Marine Mammals Protection Act 1978.

Section 3E of the Marine Mammals Protection Act 1978 provides a mechanism for the Minister of Conservation to approve a population management plan for New Zealand sea lions but to date no population management plan is in place for New Zealand sea lions.

Fisheries Act 1996

Section 9

Section 9 of the Act sets out environmental principles that any person exercising or performing function, duties, or powers under the Act, in relation to the utilisation of fisheries resources or ensuring sustainability, shall take into account. The principles are:

a) Associated or dependent species should be maintained above a level that ensures their long-term viability;
b) Biological diversity of the aquatic environment should be maintained; and
c) Habitats of particular significance for fisheries management should be protected.

The proposed options for the operational plan specifically address the requirements of Section 9(a)

Section 10

Section 10 of the Act sets out information principles that any person exercising or performing functions, duties or powers under the Act, in relation to the utilisation of fisheries resources or ensuring sustainability, shall take into account. The principles are:

a) Decisions should be based on the best available information;
b) Decision makers should consider any uncertainty in the information available in any case;
c) Decision makers should be cautious when information is uncertain, unreliable, or inadequate; and
d) The absence of, or any uncertainty in, any information should not be used as a reason for postponing or failing to take any measure to achieve the purpose of this Act.

Fisheries New Zealand considers all proposals in this consultation document are consistent with the environmental and information principles of the Act. All information used to support the options in this consultation document was reviewed through Fisheries New Zealand's Aquatic Environment Working Group.

Section 11

Section 11(1) of the Act states that the Minister of Fisheries may, from time to time, set or vary any sustainability measures after taking into account:

a) Any effects of fishing on the stock and the aquatic environment;
b) Any existing controls that apply to the stock or area concerned; and
c) The natural variability of the stock concerned.

There are a range of other considerations the Minister must have regard to or consider when setting or varying measures under section 11 of the Act.

The most relevant consideration under section 11 for the proposal to regulate the use of Sea Lion Exclusion Devices, is the National Deepwater Fisheries Plan, which has been approved by the Minister under section 11A of the Act. The National Deepwater Fisheries Plan sets out management objectives that the Minister must take into account when making sustainability decisions under the Act. The most relevant objectives in the National Deepwater Plan are:

- *Objective 8* – Manage deepwater and middle-depth fisheries to avoid, remedy or mitigate the adverse effects of these fisheries on the long-term viability of endangered, threatened and protected species populations
- *Objective 10* – Ensure there is consistency and certainty of management measures and processes in the deepwater and middle-depth fisheries

Fisheries New Zealand considers that the proposal to regulate the use of Sea Lion Exclusion Devices under section 11 of the Act is consistent with the objectives of the National Deepwater Fisheries Plan and other considerations of section 11.

Section 15

Section 15 of the Act sets out options for the Minister of Fisheries to manage the fishing-related mortality of marine mammals or other protected species.

Section 15(2) states that, in the absence of a population management plan, the Minister may, after consultation with the Minister of Conservation, take such measures as he or she considers are necessary to avoid, remedy, or mitigate the effect of fishing-related mortality on any protected species, and such measures may include setting a limit on fishing-related mortality.

This is interpreted as measures necessary to avoid, remedy, or mitigate effects at the species level. The options proposed here may be considered conservative as they are based on models for the Auckland Islands New Zealand sea lion sub-population only.

If the limit on fishing-related mortality is reached, the fishery may be closed via Gazette notice in accordance with section 15(5) of the Act.

New Information

POPULATION SUSTAINABILITY THRESHOLD

For sea lions incidentally captured or killed in the Auckland Islands squid fishery, Fisheries New Zealand defines a "Population Sustainability Threshold" or PST, which represents the maximum number of fishery-related deaths that the population can sustain while still achieving a certain population outcome. The population outcome is defined in terms of how much impact (reduction in population size) that the fishery can have, relative to the un-impacted population. For a full explanation of PST please refer to chapter 3 of the **Aquatic Environment and Biodiversity Annual Review** 2018.

In the first instance, Fisheries New Zealand estimates a PST[6] that would result in a particular population outcome "in the long term", as a function of the biological characteristics of the population. This calculation is done using a generic population model. Fisheries New Zealand scientific working groups noted it is likely that this model is somewhat pessimistic (i.e. biased toward lower PST values) for New Zealand sea lions. The generic population model used to calculate PST values assumes "equilibrium" (long-term) population outcomes under stable environmental conditions. However, there is evidence that the Auckland Islands sea lion population has experienced substantial population fluctuations, most likely driven by changing environmental conditions: the population grew rapidly in the 1990s, declined rapidly from 2000 – 2009, and has stabilised thereafter.

6 Note that impacts from other fisheries will already be reflected in the measured demographic rates used in the forward population trajectories. For this reason the model projections apply only to impacts in the Squid 6T fishery. This generalisation depends on the structural assumption that historical impacts from these other fisheries have been roughly constant over time. This assumption appears valid, most notably in the scampi fishery, which is estimated to have captured between 5-10 sea lions per year in the past 20 years.

Predictions based on 'equilibrium' population outcomes can be problematic over shorter timeframes in the context of unpredictable environmental conditions (especially where populations may decline even in the absence of human impact). For this reason, Fisheries New Zealand also tested the shorter term effects on the population of different environmental conditions when annual fishing-related deaths are equal to the fishing-related mortality limit options proposed in *Monitoring* below under different environmental conditions. To do this, the Auckland Islands sea lion demographic population model was used to estimate potential sea lion population trajectories assuming annual Squid 6T fisheries impacts equal to the PST[7], and either:

- favourable environmental conditions (demographic rates observed during sea lion population increase); or
- unfavourable environmental conditions (demographic rates observed during sea lion population decline).

Outputs of the projections are detailed in the proposals section below.

Models used to estimate the PST for the Auckland Islands sea lion population are for female sea lions only. The use of the female-only PST to inform a fishing-related mortality limit was discussed by the TAG, and it was agreed that the female-only PST should be doubled to account for both sexes.

MONITORING

Cryptic Mortality Multiplier

The death of sea lions that exit the trawl net via the SLED but do not survive is termed "cryptic mortality." Fisheries New Zealand contracted a research programme in 2018 to estimate cryptic sea lion deaths as a multiplier on observed sea lion deaths in the squid 6T fishery.

This research initially characterised the different potential outcomes when a sea lion enters a trawl net that has a SLED, as follows:

a) The sea lion successfully exits the net via the SLED, and survives (survivor);
b) The sea lion drowns in the net despite the presence of a SLED, and the body is retained (observable capture);
c) The sea lion drowns in the net but the body is subsequently lost without being able to be observed (body non-retention); or
d) The sea lion exits the net via the SLED but nonetheless dies as a consequence of the interaction (post-exit mortality).

Together, outcomes c and d constitute cryptic mortality as, by their definition, they cannot be observed.

Research was commissioned to summarise and integrate all available data to estimate the frequency of the outcomes c and d, including the uncertainty around each outcome, and construct a statistical model to estimate levels of cryptic mortality with explicit consideration of uncertainty.

Approximate probabilities for each potential outcome when a sea lion swims into a trawl net are summarised below.

For midwater trawl:

- 88 percent of sea lions that swim into the net swim out again:
  - 5-7 percent of those that swim out don't have enough air to reach the surface and drown (outcome 4).
- Of the 12 percent that stay in the net and drown, over 90 percent are retained and are observed as being captured.

For bottom trawl:

- 57 percent of sea lions that swim into the net swim out again.
  - 5-7 percent of those that swim out don't have enough air to reach the surface and drown.
- Of the 43 percent that stay in the net and drown, over 90 percent are retained and are observed as being captured

This approach, in particular the treatment of uncertainty and incorporation of expert judgement, significantly increases confidence in the estimates of how effective SLEDs are at allowing sea lions to survive encounters with trawl gear.

The outcomes are expressed as a "cryptic mortality multiplier" i.e. the ratio of sea lion captures that can be observed to total sea lion deaths.

Estimates of cryptic mortality multipliers of 1.15 for bottom trawls and 1.60 for midwater trawls (mean estimates) were derived. Using these multipliers, total sea lion deaths can be estimated as a simple multiplier on the number of observed captures (assuming all tows are observed).

All inputs and outputs from this work were reviewed by the Fisheries New Zealand Aquatic Environment Working Group.

Fatal Interaction Rate

The Spatially Explicit Fisheries Risk Assessment (SEFRA) method was used to estimate overlap and interactions of sea lions with the squid fishery with increased certainty. This approach represents a significant improvement in the

7 Note that impacts from other fisheries will already be reflected in the measured demographic rates used in the forward population trajectories. For this reason the model projections apply only to impacts in the Squid 6T fishery. This generalisation depends on the structural assumption that historical impacts from these other fisheries have been roughly constant over time. This assumption appears valid, most notably in the scampi fishery, which is estimated to have captured between 5-10 sea lions per year in the past 20 years.

estimation of both overall interactions and fatal interactions of sea lions with fishing gear. It makes use of all available capture data and also integrates information on the sea lion population size, known foraging distribution, spatial distribution of the fishing effort, and catchability in different fishing gear types.

One of the outputs of the modelling was an estimate of the number of sea lion deaths that occur per tow (i.e. the "fatal interaction rate") in trawls targeting squid around the Auckland Islands. The estimated "fatal interaction rate" was 2.4 sea lion fatalities per 1000 tows for bottom trawls and 2.0 fatalities per 1000 tows for midwater trawls.

This rate can be used to estimate the number of sea lion deaths occurring on tows that are not monitored directly by Fisheries New Zealand observers.

For comparison, the management settings in the current Squid 6T Operational Plan, which are based on highly uncertain capture estimates, primarily from the period before SLEDs were introduced, estimate that there are 15.85 sea lion mortalities per 1000 tows.

Proposals

Table 2: Proposals for the 2019 Squid 6T Operational Plan compared to current settings

				Achieved by:		Sea Lion Exclusion Device		
	Maximum impact on population	PST (Annual)	FRML (Annual)	Tow "limit"	Observed captures "limit"	Use/ Expected Use	Regulatory status	(Proposed) Minimum observer coverage
Current	5%	46	38	2,397	N/A	100%	No	70%
Option 1	2.5%	26	26	N/A	20	100%	Possible	90%
Option 2	5%	52	52	N/A	40	100%	Possible	90%
Option 3 (not preferred)	10%	104	104	N/A	80	100%	Possible	90%

FISHING-RELATED MORTALITY LIMIT

The options for the fishing-related mortality limit for the Squid 6T fishery are based on estimation of the maximum number of annual sea lion mortalities that will allow the Auckland Islands sea lion population to achieve a defined population outcome. The options for an allowable mortality limit for each outcome are expressed in terms of allowable fisheries impact relative to what it would have been in the absence of fishing. Specifically:

"with 95 percent certainty, impacts are at or below a level that will allow the Auckland Islands New Zealand sea lion population to recover to, and/or stabilise at, an equilibrium size that is at or above a proportion of the un-impacted population size".

This is the same approach taken to the proposed desired population outcomes for Hector's and Māui dolphins for the Threat Management Plan. In the draft Threat Management Plan, it is proposed that human impacts are managed to allow the Māui dolphin population to recover to a level at or above 95 percent of unimpacted population size and Hector's to stabilise at a level at or above 90 percent of the unimpacted population size.

The proportions used to define the options for sea lions in the Squid 6T fishery, which are the outcomes of discussion with the TAG, are 97.5 percent, 95 percent and 90 percent, which are equivalent to a maximum potential impact of 2.5 percent, 5 percent, and 10 percent relative to the un-impacted population.

The resulting fishing related mortality limit options proposed are:

Option 1

The fishing-related mortality limit is set to ensure that the maximum impact of the squid fishery on the recovery or stabilisation outcome of the population is no more than 2.5 percent in the long term.

This would result in an annual fishing-related mortality limit of 26 sea lions (both sexes combined).

Projections using the demographic population model estimate that if environmental conditions are favourable (comparable to the 1990s), the sea lion population will be 2 percent lower than what it would be without the Squid 6T fishery in 5 years. If environmental conditions are unfavourable (comparable to the 2000s), it is estimated the population would be 2.5 percent lower than it would be without trawl fishing in Squid 6T in 5 years. Projections assume that the fishing-related mortality limit is fully taken every year and therefore represents a "worst case".

This option has the highest likelihood of impacting on fishing operations in the Auckland Islands squid trawl fishery but would have the least potential impact on the sea lion population.

Option 2

The fishing-related mortality limit is set to ensure that the maximum impact of the squid fishery on the recovery or stabilisation outcome of the population is no more than 5 percent in the long term. This option is based on the same defined population outcome as the current (2017-2019) fishing-related mortality limit.

This would result in an annual fishing-related mortality limit of 52 sea lions (both sexes combined).

Projections using the demographic population model estimate that if environmental conditions are favourable, the Auckland Islands sea lion population will be 3.9 percent lower than it would be without the Squid 6T fishery in 5 years. If environmental conditions are unfavourable, it is estimated the population would be 5 percent lower than it would be without Squid 6T fishing in 5 years. Projections assume that the fishing-related mortality limit is reached every year and therefore represent a "worst case".

A fishing-related mortality limit of 52 is higher than the current limit and has a relatively low risk of significantly impacting on the fishing industry while still providing a high degree of certainty that the sea lion population will be maintained at a level that ensures their long-term viability.

Option 3 (not preferred)

The fishing-related mortality limit is set to ensure that the maximum impact of the squid fishery on the recovery or stabilisation outcome of the population is no more than 10 percent in the long term. This option is based on the population outcome that was used to set the fishing-related mortality limit from at least 2010/11 and is included for consistency with previous years. It is important to recognise that a different modelling approach was historically taken to estimating the appropriate fishing-related mortality limit.

Projections using the demographic population model estimate that if environmental conditions are favourable, the Auckland Island sea lion population will be 8 percent lower than it would be without the Squid 6T fishery in 5 years. If environmental conditions are unfavourable, it is estimated the population would be 10 percent lower than it would be without Squid 6T fishing in 5 years. Projections assume that the fishing-related mortality limit is reached every year and therefore represent a "worst case".

This option is likely to have the least impact on fishing operations in the Auckland Islands squid trawl fishery but represents the highest potential impact on the sea lion population of up to 10 percent difference from the unimpacted population if the fishing-related mortality limit was reached every year.

MANDATORY USE OF SEA LION EXCLUSION DEVICES

Fisheries New Zealand is considering whether to make the use of SLEDs mandatory under section 11 of the Act.

All proposed management settings in this consultation paper are based on parameters for trawl gear where there is a SLED deployed that meets the Mark 3/13 specifications. All vessel operators in the Squid 6T fishery currently deploy SLEDs on all tows as the result of a non-regulatory commitment given through the Operational Plan.

Under the current Operational Plan, all vessels carry at least two SLEDs to ensure they have a SLED that meets specifications in the case that one is damaged. All SLEDs are audited before each season by a fishing gear net maker, and measured by Fisheries New Zealand observers at the beginning of each Squid 6T trip.

Regulating the use of SLEDs in the Squid 6T fishery would provide more assurance that SLEDs will be used on all tows, and provide a tool for Fisheries New Zealand to respond if any tows were to be completed without a SLED. While a mandatory requirement would provide greater certainty regarding the use of SLEDs, it could also act as a disincentive for innovation/improvement in SLED design.

The penalty for a breach of a measure set under section 11 (3) of the Fisheries Act is a maximum fine of $100,000.

Discussion questions:

Which option for a fishing-related mortality limit do you think is most appropriate, taking into account the purpose of the Fisheries Act 1996 to allow utilisation while ensuring sustainability?

Do you think the use of Sea Lion Exclusion Devices should be required by regulation?

Do you think the penalty for breach of regulated use of Sea Lion Exclusion Devices is appropriate?

OTHER SETTINGS

Monitoring approach

Fisheries New Zealand is seeking stakeholder views on the proposed approach to monitoring the fishery against the fishing-related mortality limit.

Proposed approach to monitoring

The best available information indicates a cryptic mortality rate of 1.3 sea lion deaths per observable capture. This figure arises from cryptic mortality multipliers estimated separately for trawls employing midwater and bottom trawl gear configurations. The TAG agreed that a single cryptic mortality rate should be used, based on the weighted average of effort composition (ratio of midwater to bottom trawls) for the three most recent fishing years (2015/16 to 2017/18).

Taking this approach, each observed mortality would be adjusted by the cryptic mortality multiplier and the fishery closed when the adjusted total reaches the fishing-related mortality limit. Table 3 shows the observed captures that would be equivalent to the fishing-related mortality limit options proposed above.

Table 3: Observed captures equivalent to the proposed fishing-related mortality limit options using a multiplier of 1.3

Option	Fishing-related mortality limit	Equivalent observed captures
Option 1	26	20
Option 2	52	40
Option 3	104	80

More than 90 percent of sea lions captured in the Squid 6T fishery are dead when they arrive on deck. For clarity and transparency, and to avoid questions about post-release mortality of sea lions, Fisheries New Zealand proposes that both live and dead observed captures should count against the fishing-related mortality limit. This approach is precautionary, as it is generally thought that live animals survive after release.

Observer coverage

A key consideration in this approach is the level of monitoring required to provide confidence that all captures are accounted for. In recognition of the current levels of observer coverage (over 85%), and the importance of verifying reporting of observed captures under the proposed monitoring approach, Fisheries New Zealand proposes a minimum of 90 percent of tows be observed by Fisheries New Zealand observers.

This coverage will allow for direct testing of the models that underpin management settings, and the unobserved effort can be accounted for using estimates of sea lion fatalities per tow.

Information from the SEFRA model provides an estimate of the number of sea lion fatalities per trawl tow ("fatal interaction rate"), including variability between years. The model estimates fatal interaction rates separately for bottom trawl and midwater trawl gear types. The TAG agreed that a single "fatal interaction rate" should be used, based on the weighted average of effort composition (i.e. ratio of midwater to bottom trawls) for the most recent three fishing years (2015/16 to 2017/18). This results in an estimated 2.3 sea lion fatalities per 1000 tows.

For tows that have not been observed, Fisheries New Zealand will calculate estimated sea lion mortalities resulting from that effort based on the "fatal interaction rate" of 2.3 fatalities per 1000 tows. This ensures that all squid fishing activity that may result in a sea lion fatality is accounted for in monitoring against the fishing-related mortality limit.

The TAG expressed support for 100 percent monitoring in the fishery to provide additional confidence that all captures in the fishery are accounted for.

However, 100 percent observer coverage would have high resourcing requirements, both for the fishing industry and also for the Fisheries New Zealand observer programme. It is estimated that over 2,500 observer days may be required to provide 100 percent observer coverage, which would comprise nearly 25 percent of the total observer programme capacity (based on 2018/19 financial year delivery). This would represent a cost of over NZ$1 million that would be recovered from the owners of Squid 6T quota.

Fisheries New Zealand notes that in future, monitoring approaches other than human observers may be considered for the fishery which could reduce the resourcing requirements. However, this is not available in the short term.

The cryptic mortality multiplier and "fatal interaction rate" would need to be revisited if there was a significant change in fishing practices (e.g. tow duration, ratio of bottom trawl vs midwater tows) as this might change the inputs to the modelling that supports calculation of the cryptic mortality multiplier.

Effort limit

Fisheries New Zealand and the TAG discussed an option to set a tow limit for the fishery based on the "fatal interaction rate" and the fishing-related mortality limit.

However, Fisheries New Zealand does not consider this to be a practical option for monitoring the fishery as a stand-alone measure, and therefore is only proposing that the "fatal interaction rate" be considered in conjunction with monitoring of observed captures as previously described.

Duration of Operational Plan

Fisheries New Zealand proposes that the new Operational Plan apply for either four or six fishing years and seeks your views on the proposed duration.

A four-year timeframe for the next Operational Plan would result in a new plan being put in place for the 2023/24 fishing year. This would line up well with the planned review of the New Zealand sea lion Threat Management Plan, which will begin in 2022 and likely be completed in 2023.

A six-year (or longer) timeframe, with appropriate triggers for early review, would provide stability for the fishing industry and reduce resourcing required to support future reviews.

Fisheries New Zealand has not proposed a five year timeframe for the Operational Plan in an effort to reduce overlapping processes and ensure that the next review does not take place in the same year as other significant work items (e.g. the review of the National Plan of Action for Seabirds and the Threat Management Plan for Hector's and Maui dolphin).

Trigger for Review of the Operational Plan

It is proposed that the Operational Plan will be reviewed if:

Significant new information becomes available that indicates fisheries activities are having a different impact on sea lion survival than estimated in 2019, if there are changes in fishing operations or level of effort, or if there are significant new concerns regarding the sea lion population.

Some examples of what might trigger an early review of the Operational Plan include:

- Auckland Islands pup count that is less than 1,575;
- unusual mortality/disease event affecting large numbers of sea lion pups and/or adults;
- if observed mortalities are significantly different to predicted mortalities based on SEFRA outputs. This would be estimated post-season once data is available. It would be calculated from observed mortalities and measured effort most likely based on 100 percent observer coverage; or
- evidence of substantial change in the captures of Auckland Islands sea lions in other fisheries (i.e. observed captures/capture rates).

Discussion questions:

Do you agree with the proposed approach to monitoring the fishery against the fishing-related mortality limit?

Do you support a minimum target of 70 percent monitoring of the Squid 6T fishery, if so, why, and if not, what level of monitoring do you think is appropriate?

Fishery Closure Process

If the fishing-related mortality limit is reached (or observed capture/tow limit as appropriate), the Squid 6T fishery will be closed without consultation via notice in the Gazette. Fisheries New Zealand will work with vessel operators to ensure that fishers are aware of estimated mortalities compared to the fisheries-related mortality limit throughout the season and are informed in advance of any impending closure.

Next Steps

Fisheries New Zealand welcomes written submissions on the Squid 6T Operational Plan, in particular on the proposed options for a fishing-related mortality limit, possible regulatory requirements for the deployment of SLEDs, and views on required levels of observer coverage.

The deadline for all submissions is:

5 pm on 6 September 2019

Please make sure you include the following information in your submission:

- The title of this consultation document;
- Your name and title;
- Your organisation's name (if you are submitting on behalf of an organisation); and
- Your contact details (e.g. phone number, address and email).

Appendix 1

Squid 6T Operational Plan Technical Advisory Group

10:00 – 5:00 17 June; 9:00 – 3:00 18 June
Charles Fergusson Building (34-38 Bowen St) – Room 1.03
Wellington, NZ

MINUTES – DAY 1

Attendees: Arthur Hore (Chair), Tiffany Bock, Greg Lydon, Ben Sharp (Fisheries New Zealand), Richard Wells (DWG/FINZ), Jim Roberts (NIWA), Enrique Pardo (DOC), Amanda Leathers (WWF), Tamar Wells (Te Ohu Kaimoana), Simon Childerhouse (Cawthorn)

Skype: Katrina Goddard (Forest & Bird), Stefan Meyer (Abacusbio)

Apologies: David Middleton (FINZ), Tom Clark (FINZ), Barry Weeber (ECO), Alice Mackay (Independent), Bruce Robertson (Otago Uni), Mike Gerner (AFMA)

I. Presentation and discussion of population modelling and informing fishing-related mortality (FRML) options

- Summary of framework/approach (Fisheries NZ)
- Generic population modelling (Fisheries NZ)
- Demographic population model (Jim Roberts, NIWA)
  - Update
  - Projections

Fisheries New Zealand presented the approach taken to calculate Population Sustainability Thresholds for the Auckland Islands sea lion population including the use of a general population simulation framework and exploration of the outputs through the Auckland Islands demographic population model.

The update of the demographic population model was also presented and forward projections were run under a range of demographic rate assumptions for two PST scenarios and assumptions of zero future fishing mortalities and of the average estimated mortalities from the last 5 years.

II. Desktop estimation of cryptic mortality (Stefan Meyer, Abacusbio)

- Data-based priors (pMTBI, pExit, pRet)
- Outputs and Sensitivities

Stefan Meyer (AbacusBio) presented the data inputs and final outputs from the desktop estimation of cryptic mortality. The base case model estimates a cryptic mortality multiplier (cryptic mortalities per observable capture) for bottom trawl of 1.14 and for midwater trawl of 1.49.

The TAG requested a number of sensitivities to be run to understand how sensitive the cryptic multipliers are to changes in various parameters. The sensitivities requested are listed below:

- All animals with mild traumatic brain injury 'MTBI' do not exit;
- All animals with MTBI that do exit, do not survive;
- Retention probability is shifted to a binomial distribution centred around 1/5 not being retained (currently is a uniform prior between 0.9 and 0.99, meaning 1/10 – 1/100 is not retained); and
- Doubling the mean of '1-pSurv' and maintain width of distribution (e.g. estimating that instead of .94 surviving post-exit, 0.88 survive).

III. 2019 Squid 6T Operational Plan – Monitoring

- Direct observation (capture limit)
- Tow limit

Fisheries New Zealand provided information on two proposed monitoring approaches for the upcoming year to get input from TAG Members. This discussion was continued on Tuesday, with further notes recorded there.

Direct observation of captures/capture limit

This approach would set an observed capture limit by translating the FRML based on the cryptic mortality multiplier to find out how many observable mortalities would equate to the FRML. Key discussion points were as follows:

- There would need to be clarity on treatment of live vs. dead observed captures (ie. does a live capture count against the fishing-related mortality limit)
- This approach would likely require 100 percent monitoring (100 percent observer coverage), at least in the short term
  - High cost, not just to the fishing industry, but also high resourcing requirements for the Fisheries New Zealand Observer Programme
  - A point was made that electronic monitoring could/should be considered as a way to complement observers and provide for more monitoring without the human observer cost, provided it is consistent with legislation
- This approach provides an incentive to continue to improve fishing practices and continue to reduce sea lion captures

Tow limit

This approach would set a tow limit for the fishery based on the "fatal interaction rate" calculated by the Spatially Explicit Fisheries Risk Assessment (SEFRA) work and the FRML. It was clarified that it would be based on a single "fatal interaction rate" and not differentiated by fishing method (bottom vs midwater trawl). Key discussion points were as follows:

- This option remains hard to explain as it is not monitoring actual sea lion captures – may need to explain "fatal interaction rate" calculations
- Would need to be reviewed/re-visited if there was a significant change in fishing practices (e.g. tow duration, ratio of bottom trawl vs. midwater tows)
- Observer coverage would continue on a proportion of the fleet allowing cross referencing with model outputs on an annual basis
- Contrary to the direct observation method, a tow limit does not incentivise improvements in operations to reduce captures

Other options

There was a brief discussion about employing a hybrid model with lower observer coverage and using the cryptic multiplier plus a multiplier for the observed portion of effort to implement a capture (or tow) limit without the need for 100 percent observer coverage. Key discussion points were as follows:

- This option is more complicated and much more difficult to explain
- It would be difficult to calculate on an ongoing basis as observer coverage is variable over time

Duration & Triggers

The proposed duration and potential triggers for early review of the Operational Plan were briefly discussed. The proposed triggers were generally supported, and there was support for also including the trigger for early review that is in the current Squid 6T Operational Plan *(If new research or information becomes available that indicates fisheries activities are having a greater impact on sea lion survival than previously thought, if there are changes in fishing operations or level of effort, or if there are new concerns regarding the sea lion population.)*

MINUTES – DAY 2

Attendees: Arthur Hore (Chair), Tiffany Bock, Greg Lydon, Ben Sharp (Fisheries New Zealand), Richard Wells (DWG/FINZ), Enrique Pardo (DOC), Amanda Leathers (WWF), Tamar Wells, Kirsty Woods (Te Ohu Kaimoana), Simon Childerhouse (Cawthorn)

Skype: Katrina Goddard (Forest & Bird), Stefan Meyer (Abacusbio), Barry Weeber (ECO), Mike Gerner (AFMA)

Apologies: David Middleton (FINZ), Tom Clark (FINZ), Alice Mackay (Independent), Bruce Robertson (Otago Uni)

II. Desktop estimation of cryptic mortality (Stefan Meyer, Abacusbio)

- Data-based priors (pMTBI, pExit, pRet)
- Outputs and Sensitivities

Stefan Meyer presented the outputs from the sensitivities requested by the TAG on Day 1.

There were some misunderstandings about what sensitivities had been requested, and two of the sensitivities run were not what was requested. One of these was updated after the meeting and provided to Fisheries New Zealand and the outputs distributed to the TAG. Details of sensitivities will be available in the AEBR for this project which will be available for the public consultation.

It was pointed out that the sensitivities do not necessarily represent realistic inputs, but rather they are run to 'test' how much the outputs change if you change the input assumptions.

Outputs from the sensitivities suggested that the model is working as expected, and the cryptic mortality multipliers shift in the direction and approximate quantum as one would expect.

III. 2019 Squid 6T Operational Plan – Monitoring

- **Direct observation (capture limit)**
- **Tow limit**

There was agreement that both options should be provided for public consultation. Key points in the discussion for reflection in the consultation document were as follows:

- It is important that the Operational Plan allows for alternative monitoring approaches in the future other than human observers (e.g. video monitoring);
- 100 percent observer coverage was recognised as being resource-intensive and potentially has some pitfalls (e.g. what happens if Fisheries New Zealand is unable to provide an observer, potential reduction of observer coverage in other fisheries because of squid coverage)
  - There was some discussion about the justification/rationale for the need for 100 percent observer coverage, including that bycatch estimates can be made with less than 100 percent observer coverage, but full coverage was identified as being important to members of the TAG at this stage.

There are a range of methods to calculate the cryptic mortality multiplier if the direct observation approach were to be used. There were two suggested ways to combine the two independent cryptic mortality multipliers (i.e. bottom trawl 1.14 and midwater trawl 1.49):

1) Use a weighted average based on the ratio of bottom trawl vs. midwater trawl effort over the 3-year period from 2015/16 to 2017/18

2) Use the higher cryptic mortality value of 1.49 to be precautionary (this suggestion was not supported by all members of the TAG)

IV. Options for the Fishing-Related Mortality Limit

The TAG noted a desire to provide additional context in the Squid 6T Operational Plan, including links to the New Zealand sea lion Threat Management Plan.

It was clarified and confirmed that the population modelling incorporates mortalities from other fisheries, and therefore the options for the FRML do not need to be adjusted to take account of mortalities in other fisheries.

Environmental groups (WWF, Forest & Bird, and ECO) requested the inclusion of an option for the FRML based on a PST estimate for a phi of 0.05. They also expressed a shared view in support of adoption of a zero bycatch goal for sea lions.

Other members of the group, in particular Deepwater Group, Fisheries Inshore New Zealand, and Te Ohu Kaimoana did not

agree with the inclusion of a FRML option based on the PST estimate for a phi of 0.05, and opposed a zero bycatch goal.

V. Duration & Triggers

It was noted that a 4-year timeline for the next Operational Plan likely lines up with the review of the TMP which is likely to be complete in mid-2023. The group agreed that ideally a new Operational Plan should be developed immediately after the finalisation of the next TMP and draw upon the data from that process. The possibility of having a longer duration for the Operational Plan next time to sync up with TMP reviews should also be considered.

The group considered triggers for early review of the Operational Plan and recommended the following:

- Review the Operational Plan if significant new information becomes available. Examples of such information include:
- Auckland Islands pup count under 1,575 (from TMP);
- Unusual mortality/disease event affecting large numbers of pups and/or adults;
- If observed captures are significantly different to predicted captures based on SEFRA outputs. This would be estimated post-season once data is available. It would be calculated from captures and measured effort most likely based on fishery with 100 percent observer coverage; or
- Evidence of substantial change in the captures of Auckland Islands sea lions in other fisheries (i.e. observed captures/ capture rates)

VI. Process and Timeframe

Fisheries New Zealand is intending to publically consult on options for a new Operational Plan from early August, with a view of finalising an Operational Plan as soon as possible.

VI. Next steps

Fisheries New Zealand will consider next steps to address the impacts on sea lions from other fisheries, likely focused on scampi in the first instance. This will also include consideration of overlaps and interactions between fisheries or cumulative impacts on the sea lion population.

Work is underway to complete development of a generic population simulation model for sea lions to inform future conversations about timeframes for recovery of the sea lion population under different scenarios.

Fisheries New Zealand

Tini a Tangaroa

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