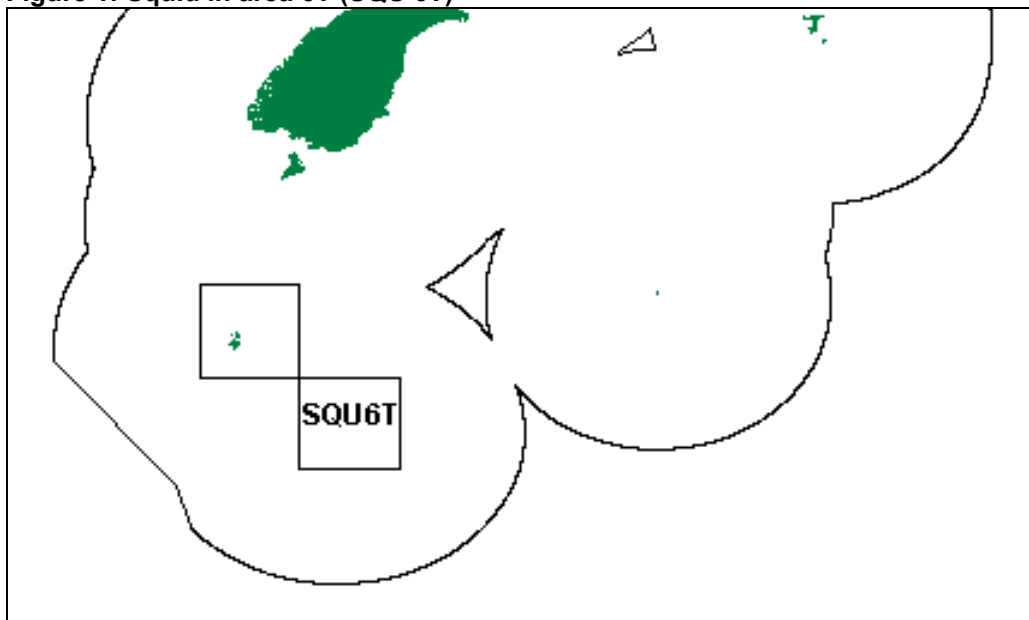


# 2007-08 SQU6T OPERATIONAL PLAN: INITIAL POSITION PAPER

## Purpose

- 1 This paper sets out the Ministry of Fisheries (MFish) initial position on proposed management measures for the squid fishery operating around the Auckland Islands (SQU6T) for the 2007-08 fishing season.
- 2 MFish reminds stakeholders that the initial position paper (IPP) is not presented to the Minister. Its purpose is to provide information to stakeholders, including the initial views of MFish where appropriate, so that stakeholders can provide relevant feedback. The contents of the IPP, the views of stakeholders and any additional information and analysis are then formulated as final advice to the Minister.

**Figure 1: Squid in area 6T (SQU 6T)**



## Executive summary

- 3 The foraging range of lactating New Zealand sea lions (sea lions) that inhabit the Auckland Islands overlaps the fishing grounds of the SQU6T fishery and leads to the incidental capture of sea lions by trawl vessels.
- 4 Under s 15 (2) of the Fisheries Act 1996 (the Act) the Minister of Fisheries may take such measures as he considers 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 (FRML). The proposed management regime is similar to that used in previous years and focuses on the use of a FRML to constrain sea lion mortalities to a sustainable level.
- 5 The harvest control rules which meet the management criteria (see paragraph 22) are assessed by the Breen-Kim model and result in a range of available FRMLs. For the 2007-08 fishing year, the FRMLs range from 0 to 513. In choosing where to set the FRML for

the coming fishing season the Minister must balance the sustainability and utilisation requirements in the fishery. MFish's initial view is that the FRML is set by applying a harvest control rule that results in a FRML within the range of 81 – 222 sea lions.

- 6 A predetermined strike rate is used to assess fishing performance against the FRML. In past seasons this has been set at 5.3%, which is the mean strike rate observed between 1997 and 2003. MFish has reviewed the strike rate for the coming season to reflect the increase in tow duration observed in recent seasons; tow duration is one of the factors that influence the rate of sea lion captures.
- 7 Two possible strike rate options are presented. Option 1 is the status quo (5.3%); Option 2 (5.65%) is based on the mean of the actual observed captures between 1997-2003. There is uncertainty associated with each option but MFish considers they are both valid for the Minister's consideration. MFish invites stakeholders to provide views on both options.
- 8 Vessels that deploy an approved sea lion exclusion device (SLED) (see Appendix 1) have received a discount of 20% on the strike rate in the past to reflect the increased likelihood that sea lions can escape from nets fitted with these devices. There is continued uncertainty over the survivability of sea lions entering SLEDs, but MFish has included new information in this IPP relevant to SLED efficacy and has provided a range of possible higher SLED discounts from 20% to 40%. MFish invites stakeholders to provide views in the information provided and the resulting discount rate options.
- 9 Each year the Minister is required to consider all relevant information and make a decision on the sea lion operational plan. Therefore all information needed to make this decision is discussed in this IPP and stakeholders are invited to provide their view. This IPP highlights all new information received since the 2006-07 operational plan advice including:
  - a) An increase in tow duration
  - b) Changes to SLED design
  - c) Performance of operators in deploying and using SLEDs during the 2006-07 season.
  - d) Autopsy data on returned sea lions
  - e) 2006-07 pup count numbers.
- 10 MFish intends to implement, in conjunction with the Deepwater Group Ltd (DWG), a similar monitoring and reporting scheme as the 2006-07 season.

## **Summary of options**

- 11 MFish is proposing the following measures for SQU6T in the 2007-08 fishing season.
  - a) Implement an operational plan for the 2007-08 fishing season.
  - b) Set an FRML for the coming season based on one of the following harvest control rules set out in Table 2 below. MFish preference is that an FRML is selected from one of the rules in bold. However, the Minister may set the FRML for the 2007-08 season at any level he considers appropriate.

- c) Use a predetermined strike rate of 5.3% or 5.65%, or any other strike rate that the Minister considers appropriate.
- d) Use a discount factor of 20%, 30% or 40% for vessels deploying an approved SLED and where the requirements of the operating plan are fully met.
- e) Enable the Minister to close the SQU6T fishery under s 15 (5) of the Fisheries Act 1996 in the event the FRML is reached.

## Background information

- 12 The foraging range of lactating sea lions that inhabit the Auckland Islands overlaps the fishing grounds of the SQU6T fishery and leads to the incidental capture of sea lions by trawl vessels.
- 13 The New Zealand sea lion is the world's rarest sea lion and is currently listed as a threatened species under s 2(3) of the Marine Mammals Protection Act 1978. However, threatened species classification is made on the basis of the small number of breeding colonies, rather than the estimated population size of approximately 12,000 animals. Under this classification, the New Zealand sea lion is considered not immediately threatened with extinction, but could be vulnerable to population decline.
- 14 Section 15 of the Act sets the Minister of Fisheries' (the Minister) responsibilities for managing the fishing-related mortality of marine mammals. In the absence of a Population Management Plan (PMP) which is the case for sea lions, the Minister is required to consult with the Minister of Conservation before taking such measures as he considers necessary to avoid, remedy, or mitigate the effect of fishing-related mortality on the long-term viability of sea lions. Available measures include setting a limit on sea lion mortality so as to ensure the sea lion population is not threatened by fishing activity.
- 15 In making this decision the Minister is required to balance utilisation opportunities and the sustainability risk to the sea lion population. In particular he is required to consider:
  - a) The purpose of the Act and the need to provide for utilisation while ensuring sustainability.
  - b) That any decision made should be based on best available information recognising that not all the information available is of the same standard.
  - c) Section 15 (2) of the Act requires the Minister to take measures he considers **are necessary** to avoid, remedy or mitigate the effects of fishing-related mortality on any protected species.
  - d) That some of the best available information is uncertain. When dealing with uncertain information the Minister is required to adopt a cautious approach that is appropriate to the circumstances.
  - e) Environmental principles set out in section 9 of the Act
    - i) Associated or dependent species should be maintained above a level that ensures their long-term viability
    - ii) Biological diversity of the aquatic environment should be maintained
    - iii) Habitats of particular significance for fisheries management should be

protected.

- f) The sea lion is a protected species under the Marine Mammals Protection Act 1978.
  - g) The selection of the FRML, the predetermined strike rate and the SLED discount factor are individual and separate management decisions.
- 16 The Minister should also be particularly mindful of:
- a) The uncertainties associated with the Breen-Kim model
  - b) The impact the abundance of squid in any particular fishing season has on the likelihood of the FRML being reached
  - c) The uncertainties that surround setting the predetermined strike rate
  - d) The uncertainties that surround the levels of sea lion survival after they come into contact with a SLED.

### **Population management plan**

- 17 As noted above, the Minister of Fisheries is permitted to set a FRML in the absence of a PMP for sea lions. However DOC has recently completed a version of the PMP which was released for consultation on 25 August 2007. The PMP will not be available to inform the Minister's decision for the 2007-08 SQU6T fishery. The Minister of Fisheries will continue to set the FMRL for the coming season. The PMP may be in place to inform the management of the 2008-09 SQU6T fishing season.
- 18 The Minister of Fisheries is required to concur with the PMP before it is implemented. In deciding on whether to concur the Minister of Fisheries is required by the Marine Mammal Protection Act 1978 to consider the impact of the PMP on the commercial fishing industry and any other matters he considers relevant. MFish expects to consult stakeholders on behalf of the Minister to assess the likely impact of the PMP. This will occur after the DOC consultation process, once the PMP is sent to the Minister of Fisheries for concurrence.
- 19 Should the PMP be approved without substantial modification, the implications on both the annual FRML decision and on the management of sea lion interactions with fishing vessels are described below:
- a) Once implemented, the PMP will set a limit on maximum fishing-related mortality (MALFiRM). This will replace the annual FRML set by the Minister of Fisheries.
  - b) The Minister of Fisheries will manage performance of the fishery against the MALFiRM and therefore a full operational plan will still be required every year. MFish will continue to consult stakeholders annually on this operational plan which will likely include a strike rate, discount rate and monitoring and reporting requirements.
  - c) The MALFiRM will apply to New Zealand waters as a whole and will not be restricted to SQU6T. MFish will therefore need to consider whether additional management procedures are required outside of SQU6T to ensure that the MALFiRM is not exceeded.

## Rationale for management options

### *Fishing related mortality limit*

- 20 The FRML sets a limit on the maximum number of sea lions that can be caught annually as bycatch in the SQU6T fishery.
- 21 Since the 2003-04 fishing season the Breen-Kim model has been used to derive an appropriate FRML. The model, in itself, does not determine FRMLs; these are calculated annually from the various harvest control rules that met the three management criteria described below. The Breen-Kim model allows the impact of different levels of sea lion mortality, or ‘harvest control rules’, to be examined, both in terms of their biological effects on the sea lion population and the potential fishing opportunities foregone as a result of constraining fishers from catching the squid Total Allowable Commercial Catch (TACC).
- 22 Each harvest control rule is assessed against the following three management criteria:
- a) Provide for an increase in the sea lion population to more than 90% of carrying capacity, or to within 10% of the proportion of carrying capacity that would have been attained in the absence of fishing.<sup>1</sup>
  - b) Attain the levels in (a), with 90% certainty, over 20-year and 100-year projections.
  - c) Attain a mean number of mature mammals that exceeded 90% of carrying capacity in the second 50 years of 100-year projection runs (to allow for build up of numbers in hypothetical depleted populations over time).
- 23 Table 1 below details the performance of twelve harvest control rules against the management criteria (performance of rules 360 and 370 do not appear explicitly in the 2003 Breen and Kim results). The model also details the impact of each rule against levels of sea lion bycatch and potentially lost utilisation.
- 24 To help interpret Table 1 the following provides an explanation for the numbers relating to Rule 320:
- a) The chances that the model population will be at a level greater than 90% of carrying capacity or within 10% of the proportion of carrying capacity that would have been attained over a 20 year period is likely 99,989 times out of 100,000 (99.98% of cases).
  - b) The chances that the model population will be at or above 90% of carrying capacity or within 10% of the proportion of carrying capacity 90% of the time that would have been attained over a 100 year period is likely in 487,109 times out of 500,000 (97.42% of cases).
  - c) The requirement that the model population will be at or exceed the 90% carrying capacity criteria in the second 50 years of a 100-year projection run is likely in 93.4% of cases.
  - d) On average (based on 5,000 model runs) if the FRML is set using Rule 320 the

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<sup>1</sup> Carrying capacity of an ecosystem is the maximum size of a group (population, subpopulation, stock, whatever) that can be supported by the ecosystem in which it lives.

fishery will forego 328 tows.

- e) On average (based on 5,000 model runs) if the FRML is set using Rule 320 the fishery could potentially close early in 23% of seasons.
- f) The maximum sea lion bycatch in any one year in 100 years may be 151 sea lions.
- g) The average annual bycatch over the same 100 year period will be 76 sea lions.

25 The FRML calculated from each of the individual harvest control rules is expected to vary from year to year because the key model input, average of the previous two year's pup production numbers, will vary annually. As this average goes up, the calculated FRMLs for each of the harvest control rules will go up, and vice versa. Using Rule 330 as an example, even though the FRML could change annually, over 100 years the mean annual bycatch is expected to be 87 and the maximum bycatch in any one year will not on average exceed 222, as calculated by the model.

**Table 1: Harvest Control rule performance against key indicators from the base case projections from Breen and Kim 2003**

Harvest control rule	Crit20 <sup>a</sup>	Crit100 <sup>b</sup>	Nmat/K <sup>c</sup>	Lost fishing effort <sup>d</sup> (tows)	Seasons closed <sup>e</sup>	Max bycatch <sup>f</sup> (100yr runs)	Mean annual <sup>g</sup> bycatch
0	na	na	98.2%	2 910	100%	0	0
305	100 000	500 000	96.4%	1 614	77%	39	31
310 (Wade)	100 000	499 052	95.0%	904	52%	77	53
Rule 4	99 997	489 846	93.5%	350	24%	169	75
320	99 989	487 109	93.4%	328	23%	151	76
330	99 810	473 902	92.6%	138	11.1%	222	87
340	99 409	464 642	92.2%	64	5.7%	290	92
350	99 006	458 702	92.0%	31	3.2%	355	95
380	98 264	451 181	91.8%	0	0.7%	516	98
390	98 131	450 181	91.8%	0	0.5%	540	98
Cusp (392)	98 115	450 003	91.8%	0	0.4%	542	98
1	97 781	447 570	91.7%	0	0.0%	545	99

<sup>a</sup> **Crit20**: Whether the number of mature animals in the population in a specific year are **either** above 90% of *K* **or** above 90% of the numbers that would have occurred with no fishing, evaluated over the first 20 years of each run only with a pass level for this index of 90 000 out of 100 000 projection-run years.

<sup>b</sup> **Crit100**: Whether the number of mature animals in the population in a specific year are **either** above 90% of *K* **or** above 90% of the numbers that would have occurred with no fishing, evaluated for each of the half million years in a set of runs, and that it should be true for least 90% of years, ie 450 000 out of 500 000 projection-run years.

<sup>c</sup> **Nmat/K**: the median of the numbers in the final year of each run expressed as a percentage of *K* - pass level for this index is 90% of *K*.

<sup>d</sup> **Lost fishing effort**: the median (of the 5 000 runs) of the mean tows lost through the operation of the harvest control rule during the run (as a measure of cost to the fishing industry), this is based on average annual fishing effort (2 871 tows) conducted during the years 1988-2003. It is not possible to determine percentage of tows lost at this stage, unless the model is run again with further indicators included.

<sup>e</sup> **Seasons closed**: the median % of seasons closed early through the operation of the harvest control rule during the run.

<sup>f</sup> **Max bycatch (100 yr runs)**: the median of maximum annual bycatch in each run.

<sup>g</sup> **Mean annual bycatch**: the median of mean annual bycatch in each run.

26 With the exception of Rule 1 (which models unconstrained fishing activity) all harvest control rules met the three management criteria detailed above when the model was developed in 2003. These harvest control rules remain unchanged from season to season; each rule is used to calculate a possible FRML each season. A key input into the model runs for each season are details of the sea lion pup production numbers from the Auckland Islands which are collected annually by DOC.

27 Consequently the FRML changes from season to season to reflect changes in the key input data.<sup>2</sup> For the 2007-08 fishing season the rules use the average of the 2005-06 and 2006-07 pup production estimates from the Auckland Islands. The pup count estimates have increased slightly in the most recent year and for this reason the FRML based on each rule is slightly higher than it was last year.

### ***Breen-Kim model***

28 The Aquatic Environment Working Group (AEWG) has accepted the Breen-Kim model as the best available method to provide options on setting the FRML. However, a degree of uncertainty surrounds the results produced by this model; particularly around the likelihood of some of the higher rules continuing to meet the management criteria. More information on the types of uncertainty associated with the model is described later in this paper.

29 NIWA has recently been contracted to update the Breen-Kim model and this work is currently underway. The updated model will be available by mid 2008 and will be used to inform management decisions in future seasons irrespective of whether those decisions are made through a PMP or under section 15 of the Fisheries Act.

### ***Strike rate***

30 Once the FRML has been determined, fishing activity is then monitored against this limit. However, the actual number of sea lions that are incidentally caught in squid fishing gear cannot be directly recorded due to the use of SLEDs, which are designed to prevent sea lions from getting trapped in the trawl cod end.

31 Therefore a proxy for mortal interaction between squid vessels and sea lions is used. This is known as the predetermined strike rate (strike rate) and in recent seasons it has been set at 5.3%. Applying this strike rate means that for every 100 tows undertaken in the squid fishery 5.3 sea lions are presumed killed and counted against the FRML.

### ***Sea lion exclusion devices***

32 SLEDs are installed inside trawl nets to reduce sea lion mortality levels by allowing live animals to escape from the net. Three factors influence how effective SLEDs are at reducing sea lion mortalities:

- a) Survival of animals that come into contact with the SLED grid<sup>3</sup>
- b) The escapement rate of individuals from the net through the escape hatch following interaction with the grid
- c) The survival rate of animals that do escape.

33 Industry considers the deployment of SLEDs on SQU6T vessels results in far fewer sea lion mortalities and therefore vessels deploying SLEDs should be able to undertake more tows before reaching the FRML. However, information on SLED efficacy is incomplete; in particular the rate of survivability of sea lions that escape from SLEDs is still unclear.

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<sup>2</sup> For example, Rule 320 produced a FRML of 109 for 2006-07 and a FRML of 111 for 2007-08.

<sup>3</sup> The purpose of the grid is to prevent sea lions finding their way into the cod end. It is unlikely that any animal that passed through the grid into the cod end would be able to find their way back to the escape hatch.

- 34 In previous seasons vessels deploying approved SLEDs received a 20% discount on the strike rate. This discount rate was derived following an analysis of autopsy data from 7 sea lions caught in the cover net after ‘escaping’ from the SLED during the 2001-02 season. This discount reduces the strike rate from 5.3% to 4.24%, meaning that for every 100 tows from a vessel deploying a SLED, 4.24 sea lions are counted against the FRML.
- 35 In order for vessels to secure this discount, vessel operators must deploy an approved SLED and fulfil all monitoring and reporting obligations set out in the operational plan. These obligations are discussed in more detail in the later section on monitoring.

## Assessment of management options

### FRML

- 36 Fourteen harvest control rules have been assessed, using the Breen-Kim model, for the 2007–08 season. FRMLs have been produced for each of these rules (See Table 2 below). Rule 1 was the only rule that did not meet the three management criteria described. In theory this permits the Minister to set the FRML between 0 and 513 sea lions.

**Table 2: FRMLs for the 2007-08 SQU6T fishing season for each of the 14 harvest control rules using latest pup production estimates.**

Rule	Estimated FRML (numbers rounded)
Rule 0	no fishing (0 sea lions)
Rule 305	28 sea lions
Rule 310	56 sea lions
<b>Rule 4</b>	<b>81 sea lions</b>
<b>Rule 320</b>	<b>111 sea lions</b>
<b>Rule 330</b>	<b>167 sea lions</b>
<b>Rule 340</b>	<b>222 sea lions</b>
Rule 350	278 sea lions
Rule 360	333 sea lions
Rule 370	389 sea lions
Rule 380	445 sea lions
Rule 390	500 sea lions
Cusp Rule	513 sea lions
Rule 1	none

- 37 Rules at the lower end of the spectrum provide for less utilisation, whereas rules at the higher end of the spectrum provide opportunity for greater levels of utilisation. Conversely, rules at the higher end of the spectrum represent a greater risk to the sustainability of the sea lion population, whereas rules at the lower end of the spectrum represent little or no risk. When selecting an appropriate rule the Minister should consider the extent of an increase or decrease in potential utilisation in the SQU6T fishery against the extent of an increase or decrease in possible sea lion mortalities and the impact this may have on the sea lion population.
- 38 In previous seasons MFish has advised the Minister that when choosing a harvest control rule (and the corresponding FRML) he should also be mindful of:
- a) Recent period of decline in sea lion pup numbers

b) Acknowledged limitations with the Breen-Kim model

39 These factors are also relevant for the Minister's consideration for the 2007-08 season and are discussed below.

### *Sea lion pup production numbers*

40 Pup production from the Auckland Islands is used to estimate sea lion population size for that region. Table 3 below details the pup production estimates from 1998 – 2007. Although the 2007 pup count is higher than that of 2006, since 1998 pup production from the Auckland Islands overall has declined by 26.4%. Accordingly the Minister should continue to be cautious when deciding where to set the FRML for the coming season. There is no information to suggest that fluctuations in sea lion numbers are the direct result of fishing activity.

**Table 3: Pup production estimates from the Auckland Islands rookeries combined, 1998-2007 (Source: Department of Conservation).**

Year	Pup numbers
1998	3021
1999	2867
2000	2856
2001	2858
2002	2282
2003	2518
2004	2515
2005	2148
2006	2089
2007	2224

41 The Breen-Kim model does take into account pup production over the most recent two years when modeling harvest control rules. Therefore the recent pup count increase is reflected in the FRMLs modeled for the 2007-08 season. This means that the FRMLs calculated for each of the harvest control rules are slightly higher than those same harvest control rules in the 2006-07 season.

### *Model limitations*

42 Although the Breen-Kim model is being updated, AEWG considers the existing version to be the best approach to generate the possible FRMLs for the coming season. There are a number of limitations with this version of the Breen-Kim model that are acknowledged by MFish, AEWG and stakeholders.

- a) The model is a representation of the actual squid fishery and sea lion population interaction. What is sustainable in theory may in reality be unsustainable if the model is not an accurate representation of real life. This means there is an inherent level of uncertainty associated with using this, or indeed any model.
- b) Paul Breen, co-developer of the model, raised a number of possible issues at the AEWG meeting on 1 September 2006. He asserts that when these issues are tested they are likely to indicate that the existing model may have been optimistic in some areas but pessimistic in others. These issues are discussed in more detail in Appendix 2.

- 43 The model has also not been used in the way it was originally intended. It has been used to provide options for setting the FRML on an annual basis irrespective of the harvest control rule associated with this FRML. The assessment of the ability of control rules to meet the sustainability criteria was based on an application of a particular rule for 100 years. The model's original purpose was to select a harvest control rule and to apply the FRML based on that rule for at least a five year period. The expectation is that a rule is selected and the annual FRML is set using this rule. However, this is not how the model has been used; rather a FRML is selected on an annual basis irrespective of the rule that is used to generate it. It is not possible to assess how using the model in this way, changing the rules from year to year, will affect the model outputs.
- 44 MFish considers the model outputs, and the subsequent management measures selected, would benefit from consistency of rule application.

### **FRML for the 2007-08 season**

- 45 The Act permits the Minister to set the FRML at the point at which he considers that utilisation of the squid resource poses an unacceptable risk to the sea lion population. The Minister is not required to set the FRML at a level beyond what he considers is necessary to achieve this. In deciding where to set the FRML the Minister must balance the utilisation opportunities in the squid fishery and the sustainability risk to the sea lion population. MFish's initial view is that the Minister selects a FRML within the range of 81 to 222 sea lions (rule 4 to rule 340).

### *Utilisation*

- 46 The potential lost utilisation associated with the harvest control rules is difficult to determine accurately for the following reasons:
- a) The availability of squid varies from fishing season to fishing season, which influences the number of tows undertaken and the amount of squid caught per tow.
  - b) Market price is influenced by the size and quality of squid, and the global availability and demand for squid. Market prices are currently depressed as New Zealand squid competes on the global market with squid from the South Atlantic.
  - c) Accurate information on the value of squid caught from the SQU6T fishery is not available. In its place MFish uses average port price per kg, which for 2007-08 is \$790 per tonne. This is an indication of gross product (greenweight) value.
  - d) The ACE trading price is also a useful indicator of value since it provides an indication of the value of the fish less fishing costs. The current ACE trading price is within the range of \$50 - \$717 per tonne, with a weighted average price of \$187 per tonne.
- 47 In the past when preparing IPPs and FAPs MFish has estimated potential lost utilisation opportunities in terms of tows forgone and landed value of squid using the port price. However, MFish does not consider it useful to compare the potential lost utilisation opportunities associated with each FRML in terms of percentage of the TACC forgone. The FRML imposes a theoretical cap on utilisation which may result in lost revenue but there are also other relevant factors:
- a) Fluctuations in squid abundance mean that in many years it would not have been

possible to catch the full TACC, even without the constraints of a FRML. Equally in years of good abundance the TACC may act as the limit in the fishery, not the FRML.

- b) The use of port price to determine squid value is problematic and is likely to provide conservative estimates of lost revenue.
- c) Calculating potential loss of earnings based on port price does not take into account the fixed and variable costs associated with fishing activity.

48 However, squid is one of the more important export earners for the seafood industry. In 2006 the total export value for squid was \$118 million. This figure relates to exports from the entire squid fishery and it is not possible to determine how much of this export value has come from squid harvested in SQU6T. Typically squid harvested from SQU6T is larger and commands a higher price. If the Minister chooses a FRML from the lower end of the range available this is likely to constrain fishing activity and may reduce export earnings, particularly if there is good squid abundance.

### ***Analysis of harvest control rules***

49 The three management criteria outlined above set the threshold beyond which management intervention could be considered to be necessary. However, even if the management criteria have been met, the Minister is still permitted to adopt a cautious approach, given the uncertainties associated with the Breen-Kim model, the fluctuations in the Auckland Islands sea lion population and the uncertainties associated with the strike rate used to monitor performance against the FRML. However, in choosing a cautious approach the appropriate degree of caution is that which is necessary in the circumstances.

50 As noted, Rule 1 does not meet the three management criteria and therefore is not included for further consideration. The remaining rules met the management criteria in 2003 when the original modelling was done but the uncertainties associated with the Breen-Kim model now means the higher rules may no longer meet the agreed criteria. This is being considered as part of the Breen-Kim model update currently underway.

51 This means the Cusp Rule is the starting point for assessing which is the most appropriate rule to select. The further away from the Cusp Rule, the greater the likelihood that any uncertainties and risk will be mitigated.

52 Given the 26.4% decline in pup count numbers since 1998 and the uncertainties associated with the model, MFish does not consider setting the FRML based on the higher rules (Rule 350, Rule 360, Rule 370, Rule 380, Rule 390, Cusp Rule) is appropriate. On average rules greater than 340 result in relatively small increases in utilisation opportunities but allow for greater levels of sea lion mortality as expressed in the higher FRMLs produced from these rules. Although these rules met the management criteria when the model was developed in 2003, if the FRML is based on these rules, the assumption is that the pup numbers and model uncertainties are insignificant or of marginal effect. MFish does not believe this to be the case.

53 Setting the FRML based on a harvest control rule lower than Rule 4 (Rule 0, Rule 305, Rule 310) provides for low levels of sea lion bycatch but could potentially impact considerably on fishing effort and therefore potential utilisation opportunities. At this time MFish does not consider the risk to the sea lion population warrants such a measure and setting an

FRML based on these rules would likely over estimate the risk that utilisation in the squid fishery has on the sustainability of the sea lion population. MFish welcomes submissions on this view.

54 Therefore MFish's initial view is to dismiss the higher and lower rules and set the FRML for the 2007-08 fishing season based on one of four harvest control rules as follows:

- a) Rule 4: FRML of 81 sea lions
- b) Rule 320: FRML of 111 sea lions
- c) Rule 330: FRML of 167 sea lions
- d) Rule 340: FRML of 222 sea lions.

55 A summary of each of the preferred rules follows:

- a) Rule 4 is an adaptive rule and is based on sea lion bycatch relative to pup production estimates. Rule 4 is more responsive to the risk posed to the sea lion population when pup production is at low levels but it also provides for more fishing opportunities when pup production is at higher levels. In relatively low pup production years, such as is currently the case, choosing Rule 4 places greater emphasis on the sustainability risk associated with fishing activity and the societal benefits associated with maintaining and protecting the sea lion population.
- b) Choosing Rule 320 continues to place greater emphasis on sustainability at some risk to utilisation opportunities.
- c) Choosing Rule 330 to set an FRML of 167 sea lions is unlikely to constrain the number of tows fishers can make since the number of tows permitted under this FRML (3,939 tows)<sup>4</sup> is in excess of the mean annual tows of 2,871. This is also well in excess of the average level of effort recorded in recent years (approx. 1724 tows).
- d) Choosing Rule 340 places a greater emphasis on utilisation and will provide for greater levels of fishing effort. This rule will not provide for much additional utilisation opportunity beyond that provided for by Rule 330, but it will give industry greater headroom to fish to the limit of the TACC should there be a high level of squid abundance in the 2007-08 season. Of the four recommended harvest rules, this option poses the greatest risk to sea lion sustainability because the maximum mortality limit will be set at 222.

56 MFish acknowledges there is strong public opinion on this issue in favour of greater sea lion protection. This is reflected in the many public awareness campaigns requesting the Minister to reduce the levels of sea lion mortality from fishing to close to zero. The Minister may take into account other factors that he considers relevant, such as societal values, when choosing the FRML for the 2007-08 season. For instance, the Minister may consider this public interest when deciding how much risk is acceptable and how far back from the cusp the FRML should be set so as to ensure uncertainty is appropriately managed.

57 Although MFish has suggested the range of rules from Rule 4 to Rule 340, MFish invites stakeholders to provide views on all potential options for the FRML for the 2007-08 season.

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<sup>4</sup> This calculation includes the 20% SLED discount rate on the current strike rate of 5.3%

## **Predetermined strike rate**

- 58 The 5.3% rate used in past years was based on a simple average (the mean) of the actual strike rate amongst vessels operating in the SQU6T fishery during seven fishing seasons from 1996-97 to 2002-03. This average is based on observed seasonal strike rates which ranged from 2.8% to 11.8% in any one year. Therefore there is some uncertainty associated with the actual annual strike rate and it is likely to vary from year to year. In some years (when the actual strike rate is at the higher end of the range) the number of sea lion mortalities could be underestimated by 55%. In other years the actual strike rate in a season could reflect the lower end of the range and the number of sea lion mortalities could be overestimated by 90%. This level of variation between years is not necessarily a problem, as long as over time the actual strike rate is close to 5.3%. In effect a higher actual rate in one year is offset by a lower actual strike rate in other years.
- 59 Since 2003 the actual strike rate has not been monitored because the use of SLEDs means it is not possible to assess the actual number of squid trawl gear and sea lion interactions because sea lions now have a method of escape.
- 60 Fishing practices appear to have changed in recent years including an increase in observed tow duration.<sup>5</sup> The median tow length observed in 2006-07 was 6.8 hours, compared to median tow duration of 5.8 hours in 2005-06 and 4.0 hours in the 2002-03 fishing season. Research indicates there is a correlation between tow duration and rate of sea lion capture although tow duration is not the most significant factor to influence capture rates (for example, distance from the sea lion colony and time of year of capture are more important). This means the current strike rate of 5.3% could underestimate the extent of the interactions between squid fishing vessels and sea lions.
- 61 The recent observed increase in tow duration is likely influenced by two factors:
- a) Since performance against the FRML is measured in tows, the incentive is for vessel operators to maximise the potential squid harvest from each tow – one way to achieve this is to tow for longer.
  - b) Different vessels engage in different fishing practices to reflect gear configuration and market demands. As a result some vessels tow for longer periods as part of their normal fishing practice. MFish considers a greater number of these vessels are now operating in SQU6T.
- 62 To inform the decision on strike rate, MFish requested NIWA to model the mean strike rate for SQU6T vessels for each of the following three fishing seasons; 2003-04, 2004-05 and 2005-06. This also coincides with a period of continuous increased tow duration. This analysis produced a strike rate of 5.65%. However, there is a high degree of uncertainty associated with this value because it is based on tows where there is a strong likelihood that some form of SLED was used. Therefore this modelled value is based on limited data and consequently there is a high degree of uncertainty associated with it.
- 63 In contrast the existing strike rate of 5.3% is based on actual observed interactions from vessels that were not deploying a SLED; however this strike rate does not take into consideration recent tow duration increases.

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<sup>5</sup> Tow duration represents the length of time nets are engaged in trawling – it does not include shooting and hauling time.

- 64 MFish is proposing two options for the strike rate for the 2007-08 season:
- a) Option 1 (status quo): 5.3%
  - b) Option 2: Increase the strike rate from 5.3% to 5.65% as per the average strike rate estimated from the past three fishing seasons, to reflect the recent increase in tow duration.<sup>6</sup>
- 65 There is uncertainty associated with the two strike rate options but MFish considers they are both valid for the Minister's consideration. MFish invites stakeholders to provide views on both these options.
- 66 In previous seasons MFish has considered options to improve information to assess the strike rate. One option could be to request some vessels in the SQU6T fleet to fish without SLEDs or to use SLEDs with cover nets tied down, thus preventing sea lions escaping from the SLED and enabling them to be recovered for counting.
- 67 MFish does not consider this research is necessary at this time. Rather MFish will continue to advise the Minister that in making his decision on where to set the FRML he must also be mindful of the uncertainty associated with strike rate information.

### ***SLED Discount Rate***

#### *Calculation of discount rate*

- 68 In recent seasons a 20% discount on the strike rate has been applied to tows where vessels have approved SLEDs and where vessel operators have complied with the monitoring and reporting requirements set out in the operational plan. This means that for eligible tows the strike rate was reduced from 5.3% to 4.24%.
- 69 This 20% discount rate was derived following an analysis of autopsy data from 7 sea lions caught during the 2001-02 season. These animals were selected because they were caught in vessels where SLEDs were deployed and where cover nets were tied down, preventing the animals from escaping. These recovered animals had in theory escaped from the net through the escape hatch in the SLED.
- 70 The autopsies indicated that 5 of the 7 sea lions were unlikely to survive the trauma associated with their capture, had they not drowned. This assessment was made because many of the animals displayed severe head trauma that may have been caused by interacting with SLED grid bars. This study therefore assumed that 29% of sea lions would be likely to survive following interactions with a SLED had they been able to escape. Given the small sample size and the uncertainty associated with the study, a discount factor of 20% was considered more appropriate than 29%.
- 71 There are a number of factors that may suggest that an increase to the 20% discount is appropriate:
- a) Considerable work has gone into improving the design and deployment of SLEDs

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<sup>6</sup> Tow duration has increased further in the 2006-07 recent fishing season, which was not included in the NIWA analysis.

since the study was conducted in 2001-02 recent years. This work is ongoing and is described in more detail below.

- b) The autopsy data from animals recovered in 2005-06 and 2007-08 suggests that many of the sea lions interacting with SLEDs did not sustain severe or fatal injuries. If the animals manage to escape from the SLED, their survival prognosis is good. This is discussed in greater detail below.
- c) Autopsy data also suggests that severe head trauma has also been found in sea lions that were caught when no SLED was deployed which would indicate that observed head trauma is not necessarily caused by animals interacting with SLED grid bars.<sup>7</sup>

72 MFish is aware that environmental NGOs have not supported the use of a discount factor in the past because:

- a) They considered the sample size from the 2001-02 study was too small to produce any meaningful results.
- b) There is limited information to support the efficacy of SLEDs.

### *Recent and ongoing improvements in the developments and deployment of SLEDs*

73 MFish agrees that a 20% discount rate was appropriate in the early years of SLED development: improvements were required to the SLED design, and there was some uncertainty with the quality of SLEDs used by some operators.

74 However, in recent years industry has engaged in a continuous programme to update and improve SLED design through the SLED working group. Much of these recent improvements have focused on the design and manufacture of the SLED grid; particularly the grid bar spacing and the material used in its construction. In previous seasons the grid failed in some cases and sea lions were recovered from the codend. However, none of the 8 sea lions caught in the most recent season were found in the codend. This suggests that the improvements to the SLED grid are ensuring that sea lions remain in the area of the net close to the escape hatch.

75 However, 8 actual sea lion mortalities were still recorded for the 2006-07 season. Two vessels were responsible for five of these deaths and the SLEDs from these two vessels underwent a post-season audit to assess what, if anything, may have contributed to the high number of fatal interactions. Evidence from the net manufacturer who undertook this audit, who is experienced in net structure and water dynamics, suggests that the sea lions were unable to exit the escape hatch following interaction with the SLED. Following this audit, further technical improvements to SLEDs have been devised for the coming season. These improvements will be made in time for the start of the 2007-08 season and relate to the SLED hood and kite, which are responsible for maintaining the structure of the escape hatch when the SLED is in use.

76 This focus on the escape mechanism is supported by recent camera footage from one of the vessels operating in SQU6T in the 2006-07 season.<sup>8</sup> The footage taken during a commercial squid fishing tow, using an infra red camera at a depth of 182 meters, shows that when the

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<sup>7</sup> Personal communication with Wendi Roe, Veterinary Pathologist, Massey University.

<sup>8</sup> This camera footage is from an ongoing industry funded project to gather evidence on sea lion interactions with SLEDs.

kites and hoods are not constructed with sufficiently robust material, water pressure can force the escape hatch to close over which means the sea lion has no way to get out of the net. MFish is confident that this issue will be addressed in the coming season, as all SLEDs used in the 2007-08 squid fishing season will be modified to ensure that the hoods, kites and escape hatches are working effectively.<sup>9</sup>

- 77 MFish acknowledges the steps that industry has taken step to improve the SLED design in an effort to provide maximum opportunity for sea lions to escape from squid trawl nets. However, the success of these modifications cannot be known with certainty since there is no known method of measuring the survivability of sea lions that interact with SLEDs. However MFish believes these ongoing improvements to SLED design may lead to greater levels of sea lion survival than have occurred in the past. For this reason MFish considers a higher discount rate may be appropriate at this time. MFish welcomes stakeholder submissions on this information and analysis.

### *Autopsy data*

- 78 The original discount rate of 20% was based on autopsy information from sea lions caught in the 2001-02 fishery. Every year sea lions caught in the SQU6T fishery are autopsied to assess, amongst other things, the likely cause of death, the extent of injuries and the link between these injuries and the death of the sea lion.
- 79 As SLED use has increased (although full SLED adherence was only achieved in the current fishing year) the nature of the sea lion injuries and the impact they have on survivability have changed. In recent years, injuries have been classed as mild, moderate and severe. Animals displaying mild to moderate injuries are considered likely to survive if they had escaped the SLED. Animals displaying severe injuries are deemed unlikely to survive.
- 80 More recent sea lion autopsy data indicates that in the majority of cases animals that interact with SLEDs are unlikely to incur fatal or serious injuries which would limit their survivability should they escape from the net. For example, autopsy data from the 10 sea lions caught during the 2005-06 fishing season indicates that three of the animals had injuries classed as severe by the pathologist, which would suggest they would not have survived if they had successfully escaped from the SLED.<sup>10</sup>
- 81 The autopsy results from the 8 sea lions caught during the 2006-07 have yet to be approved by AEWG but they confirm that interaction with SLEDs do not always result in life threatening injuries. Of the 8 sea lions, the pathologist classed the injuries of 2 of the sea lions as 'severe'. Additional work on fur seal autopsies also suggests that some of the injuries observed in sea lions in previous seasons may have been due to the impact of freezing on the sea lion carcass.<sup>11</sup>

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<sup>9</sup> These improvements are being funded by DOC and DWG with support from MFish.

<sup>10</sup> 11 sea lions were caught in the 2005-06 season but one of the sea lions caught was in a decomposed state which suggests it was dead before it was hauled up.

<sup>11</sup> Blood-tinged fluid was present in the abdominal cavity of all autopsied sea lions. Two fur seals were autopsied both before and after freezing, as part of an evaluation of whether freezing is a plausible source of this fluid. Neither fur seal had fluid in the abdominal cavity prior to freezing, and both had such fluid after having been frozen from 4 to 5 weeks (150 ml and 250 ml). Therefore, "the results of this initial trial indicate that the fluid seen in the abdominal cavities of bycaught sea lions is consistent with that expected to occur as a direct result of freezing. This observation, in conjunction with the lack of observed trauma to body organs and major vessels strongly suggests that the presence of blood-tinged abdominal fluid is not a result of blunt trauma, and should not be included in any assessment of trauma

- 82 This information is in contrast to the autopsy data from 2001-02, which was used to set the current discount rate, when five of the seven animals were believed to have experienced severe trauma which would have limited their survivability if they had escaped. The greater frequency of severe injuries in early years may be related to poorer quality SLED design and deployment than that employed currently.
- 83 In recent seasons, the autopsied animals have been recovered from vessels where SLEDs were deployed and where cover nets were open. Therefore deaths of these animals reflect a failure in the operation of the SLED. The continued improvements in SLED design and their deployment are designed to address these failures.
- 84 MFish considers autopsy data provides useful information which suggests that some sea lions do not experience fatal injuries when interacting with SLEDs and therefore have a greater likelihood of long-term survival if they manage to escape from the SLED. This further reinforces the need to improve the escape hatch design, which is the focus of the current programme of pre-season SLED audits. MFish does acknowledge that the sea lions caught in nets with SLEDs which are returned for autopsy may not be representative of sea lions that escape. MFish welcomes stakeholder submissions on this information and analysis.

### *Discount rate options*

- 85 MFish acknowledges the information available gives no clear guidance on the efficacy of SLEDs in mitigating fishing vessel and sea lion interactions. However, in recent years there have been ongoing improvements in the development and use of SLEDs. This is supported by the autopsy data which indicates (albeit not conclusively) that fewer sea lions appear to be receiving severe injuries from interactions with SLEDs, and that SLEDs may have the potential to be more effective than the current discount rate of 20% suggests.
- 86 Based on this assessment, MFish considers that a discount rate greater than 20% may be appropriate for the coming season and proposes the following options:
- a) Option 1 (Status Quo): A discount of 20% on the predetermined strike rate.
  - b) Option 2: A discount of 30% on the predetermined strike rate
  - c) Option 3: A discount of 40% on the predetermined strike rate.
- 87 MFish considers that a discount rate of greater than 40% is not warranted given the unproven effectiveness of the current improvements to escape hatch design. If in future seasons the improvements to the escape hatch result in fewer animals drowning in SLEDs then the discount rate will be reviewed.
- 88 MFish acknowledges that Options 2 and 3 are not based on an analysis that 30% or 40% (respectively) of sea lions are surviving. Instead these are increases over the current rate of 20% that the Minister may consider reasonable. The Minister must be satisfied that recent autopsy results and improvements in SLED design are likely to result in increased survivability of sea lions warranting a discount rate greater than 20%. The Minister is not limited to the options listed above and may set the discount rate at whatever level he

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severity or survival prognosis. Source: Necropsy of marine mammals captured in New Zealand fisheries in the 2006-07 fishing year. Report prepared by W.D. Roe, Institute of Veterinary, Animal and Biomedical Sciences, Massey University.

considers best meets his obligations under the Act.

89 The following table details the likely impact of these discount options on the strike rate options for the coming season.

**Table 4: Proposed strike rate options for the 2007-08 SQU6T and relationship with discount factor**

Strike Rate	Discount Factor		
	Option 1 20%	Option 2 30%	Option 3 40%
5.3%	4.24%	3.18%	2.65%
5.65%	4.52%	3.96%	3.39%

90 MFish welcomes views from stakeholders on these proposed options.

## **Monitoring and reporting requirements**

### ***Overview of 2006-07 season***

91 Evidence from the 2006-07 fishery indicates widespread compliance from industry with both the use of SLEDs and the requirements of the operational plan. All SLEDs were independently audited prior to the start of the SQU6T season. Only approved SLEDs (recognised by a unique identification number) qualified for the discount factor during the season. This was supplemented by MFish observers checking the measurement of each SLED during the fishing trip and by Fishery Officers inspecting SLEDs when the vessel returned to port. This level of monitoring ensured that SLEDs continued to meet the required standard throughout the fishing season.

92 In general both the level of effort by MFish Operations, Fisheries Officer and Observers and the degree of integration between these groups well exceeded that of any previous year.

93 A total of 1318 tows were undertaken during the SQU6T season. All but three of these tows were eligible for the discounted strike rate. One vessel failed to meet the 72-hour notification requirement and therefore did not receive the discount factor for the three tows they completed in SQU6T during that trip. On no occasion were vessels penalised for non-compliance with SLED requirements. This is a considerable improvement in performance from 2005-06, when 530 tows did not receive the discount factor.

94 Therefore MFish proposes to implement the same monitoring and reporting procedures that were in place for the 2006-07 season. This will require:

- a) The fishing vessel operator to notify the MFish Observer Programme at least 72 hours before leaving port to ensure there is sufficient time to place an observer on board the vessel before it sails. This notification may also be used as an opportunity for fishery officers to undertake a port inspection of the SLED.
- b) The Master of the fishing vessel is required to report to MFish, at the end of the fishing trip, any encounter with a marine mammal that resulted in death or injury. MFish observers will notify the Observer Programme immediately following the capture of sea lions.

- c) All vessels in the SQU6T fishery will participate in a weekly reporting regime managed by the Deepwater Group Ltd (DWG). When 70% of the FRML is reached, reporting will be daily. The information reported will include:
    - i) Each tow undertaken in the SQU6T fishery
    - ii) Whether the tow was observed by an MFish Observer
    - iii) If an approved SLED was deployed during the tow
    - iv) If any sea lions were caught during the tow and whether they were released alive, retained or returned dead to the sea.
- 95 Before a vessel can receive the recommended SLED discount rate certain conditions must be met.
- a) Vessels must deploy a SLED that meets the approved design specification (Mark 3/13 design) which will include the improved kite and hood design.
  - b) The SLED must be deployed with the escape hatch open at all times during fishing operations.
  - c) Each SLED must be stamped with a unique number and photographed before the start of the fishing season by the DWG.
- 96 MFish will continue to work closely with the DWG to ensure these conditions are met and there is accurate monitoring against the FRML throughout the squid fishing season. This will include participating in the pre-season briefing with all operators. MFish is confident that the good performance experienced in the 2006-07 will continue and further improvements will be made.
- 97 Information received by MFish that a vessel intends to deploy an approved SLED during the 2007-08 season this information will be made available to the both the MFish Observer Programme and MFish Compliance to enable observers and fishery officers to inspect SLEDs to ensure:
- a) The vessel is carrying the SLED for which it was given approval and,
  - b) The SLED has not been adjusted or modified and is in working order.
- 98 As in previous seasons, MFish intends to retrospectively remove the discount rate accreditation for all tows where a non-approved SLED was deployed or where the reporting requirements have not been met.
- 99 MFish also intends to request vessel operators to return all dead sea lions caught during the SQU6T season irrespective of whether the vessel is carrying an MFish observer. These sea lions will be returned to Massey University for autopsy.
- 100 MFish also intends to continue with a target of 30% observer coverage across the SQU6T fishery during the 2007-08 fishing season. In 2006-07, 41% of tows were observed in the fishery.

### **Closure Procedure**

- 101 Under s 15 (5) of the Act the Minister may close the SQU6T fishery when the FRML is reached.

- 102 MFish will work with the DWG to monitor performance against the FRML. Should the estimated mortality get close to the FRML, MFish will advise the Minister so that he may close the SQU6T fishery by Gazette Notice.
- 103 This closure will be undertaken without consultation but MFish will ensure all participants in the fishery are kept updated on levels of fishing activity against the FRML throughout the fishing season. For the past two seasons, MFish has sent weekly reports to all stakeholders providing information on progress towards the FRML, so ample warning of the closure will be available.

### **Future management**

- 104 MFish and the DWG are in the process of developing a squid fisheries plan that will include the SQU6T fishery. This plan will build on recent initiatives to manage seabird and marine mammal interaction and will also include key bycatch species. The draft squid fisheries plan will be consulted on widely with stakeholders before being provided to the Minister for approval for the start of the 2008-09 fishing season.

### **Consultation**

- 105 MFish is seeking views from stakeholders on the management options presented in this IPP. Stakeholder submissions will be considered before final advice is prepared for the Minister. **MFish reminds stakeholders that submissions received will be posted on the MFish website.** If for any reason a submission contains confidential information and it should not be made public then MFish should be advised at the time the submission is made.

### **Statutory considerations**

- 106 The following statutory considerations have been taken into account in developing the initial position paper on the interactions between the SQU6T fishery and sea lions.
- 107 **Section 8:** MFish considers the management options presented in this paper provide for utilisation in the SQU6T fishery while ensuring the sustainability of both the squid stock and non-fish interactions.
- 108 In deciding where to set the FRML the Minister must balance the need to provide for utilisation while ensuring the sustainability of sea lions and other non-fish bycatch. If the Minister chooses a higher FRML he is giving greater emphasis to utilisation over sustainability. If the Minister decides to choose a lower FRML it is because he considers it necessary to ensure greater sustainability over utilisation.
- 109 **Section 5(a) International and Settlement Obligations:** Decision-makers are required to act in a manner consistent with New Zealand's international obligations relating to fishing, including the Law of the Sea and the Fish stocks agreement as well as regional fishery management agreements. Decision-makers must also act in a manner consistent with the provisions of the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992. MFish considers that the proposed options are consistent with both New Zealand's international obligations relating to fishing and the provisions of the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992.
- 110 **Section 9 (a):** Management proposals have been recommended to the Minister so as to ensure the sea lion population around the Auckland Islands will be maintained above a level

that ensures their long term viability.

- 111 **Section 9 (b) and (c):** The specific impact on squid trawling in the SQU6T fishery on biological diversity and habitats of particular significance is not known. Squid vessels engage predominantly in mid-water trawling but bottom trawls are known to occur in SQU6T.
- 112 **Section 10:** MFish considers the information used to support the proposals set out in this paper is the best available information. Given the uncertainties associated with some aspects of this information the management options proposed balance the risks to both potential utilisation and the sustainability of the sea lion population.
- 113 **Section 11 – Sustainability measures:** the management options described in this IPP have been produced as per the requirements under this section of the Act.
- 114 **Section 11 (1)(a):** The purpose of this IPP is to address the effects of squid trawling on one particular aspect of the aquatic environment, namely sea lions.
- 115 **Section 11 (1)(b):** In his decision the Minister must take into account any existing controls that apply to the stock. Apart from the existing TAC, TACC, allowances, and the annual FRML there are no other existing fisheries management controls for SQU6T.
- 116 **Section 11 (2) – Section 11(2)** also requires that the Minister must also, when setting sustainability measures, have regard to any provisions of:
- a) Hauraki Gulf Marine Park Act 2000 – the SQU6T quota management area does not overlap with the waters of the Hauraki Gulf Marine Park. Therefore there are no relevant considerations under the Hauraki Marine Park Act 2000.
  - b) Conservation Act 1987 – MFish is not aware of any relevant management strategies or plans under the Conservation Act 1987 for SQU6T.
  - c) Resource Management Act 1991 – MFish is not aware of any relevant policy statements or (proposed) regional plans, under the Resource Management Act 1991 relevant to SQU6T.
- 117 **Section 11(2A)(a) & (c):** Before setting or varying any sustainability measure the Minister must take into account any conservation or fisheries service, or any decision not to require such services. MFish does not consider that existing or proposed services materially affect the proposed operational plan for the SQU6T fishery. No decision has been made not to require a service that would be relevant to the SQU6T fishery.
- 118 **Section 11(2A)(b) – Fisheries plans:** There is currently no fisheries plan in place in the SQU6T fishery. However, work is progressing on developing a fisheries plan for squid which will include SQU6T and this is discussed in the IPP in the section on future management.
- 119 **Section 14:** The squid TAC is set under section 14 because the inter-annual variability associated with squid means there is insufficient information from which to determine a maximum sustainable yield. The management issues detailed in this paper do not impact on the management of the squid resource under s. 14.
- 120 **Section 15 (2):** MFish considers that providing recommendations on a FRML satisfies the

option for the Minister to take such measures as he considers necessary to avoid, remedy or mitigate the effect of fishing-related mortality.

- 121 **Section 15 (5):** This section provides the Minister with the discretionary power to prohibit all or any fishing if the fishing-related mortality limit has been met. This has been addressed in this final advice paper.

***Ngai Tahu Claims Settlement Act 1998***

- 122 Section 288 of the Ngai Tahu Claims Settlement Act 1998 requires the Crown to acknowledge the cultural, spiritual, historic, and traditional association of Ngai Tahu with their taonga species. Section 287 prescribes the New Zealand sea lion (or Rapoka/Whakahao) as a taonga species under this Act.

## SLED Specification October 2006

MK. 3/13 SLED Specification

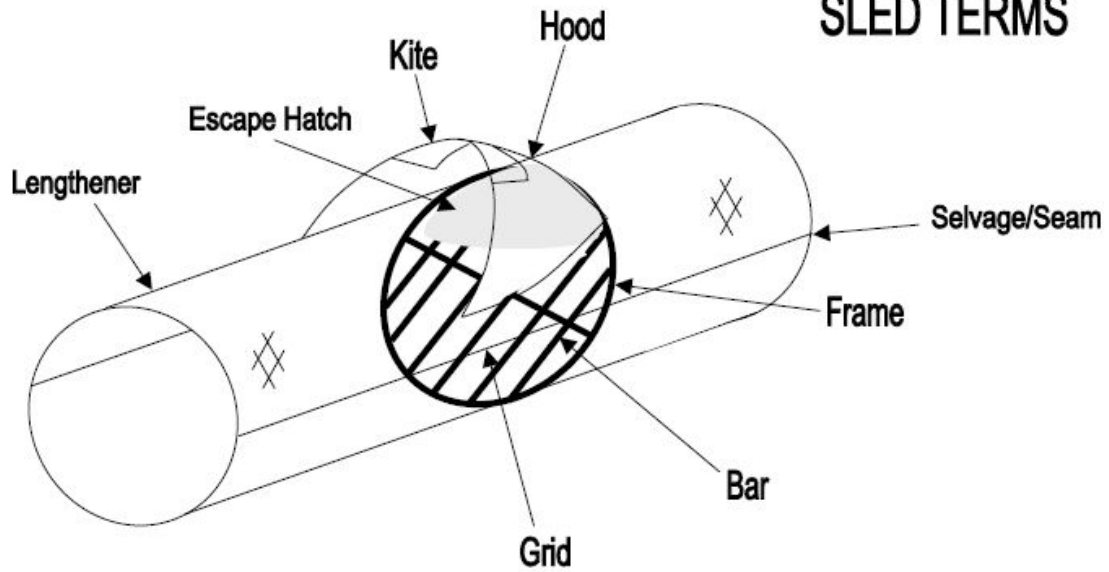
For the use in the 2006/07 SQU 6T Fishing Season

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The SLED required for use by all vessels in the 6T squid fishery is an approved type that meets the following criteria:

1. The SLED must consist of a lengthener section of net, with either 2 or 4 seams, containing a 2 (or 3) piece grid, hinged along the middle. The grid should be set in the net at about  $45^{\circ} \pm 5^{\circ}$  downstream from the vertical and continuously sewn to the net meshes around its circumference.
2. The grids must be constructed of **minimum 20mm stainless steel bar** and should be shaped to conform to the working parameters of the net.
3. Vertical **grid bars** must be **evenly spaced** at a **maximum distance of 23cm between bars** (see diagram). There will be no minimum number of bars, provided they are **evenly spaced** and do not exceed the recommended maximum spacing.
4. The Escape Hatch must be triangular and let into the upper surface of the lengthener section. The hatch must be a **minimum of 1metre wide at the base**, along the top bar of the grid. The apex of the triangle must be a **minimum of 1metre forward** (upstream) of the base (refer diagram).
5. Above the Escape Hatch, a hood-shaped mesh scoop must be attached with its open (leading) end facing into the water-flow and its closed (trailing) end attached one to three meshes behind the top bar of the grid. The leading edge of the Hood must be a **minimum of 80cm high** when fully extended.
6. The Hood must have a strip of semi-rigid material (Kite) under the meshes of the Hood. The leading edge of the Kite must be attached to the leading edge of the Hood. The leading corners of the Hood must extend forward of the Escape Hatch.
7. The SLED must be inserted into the trawl with the Escape Hatch on the upper surface when the net is fishing.
8. There are elements of the SLED configuration that may vary including, the presence or absence of floats attached to the grid or kite, the shape, width and height of the grid, the number of vertical bars in the grid, the number of meshes in the hood, the number and size of meshes in the lengthener section depending on the net in which the SLED is inserted.
9. Each SLED grid frame must have a unique registration number, identifying it as an approved unit, clearly stamped into the frame bar at each end of each hinge section. Each SLED registration number will be recorded by Deepwater Group Ltd. DWG's register of SLED numbers must be provided to MFish as required.
10. **Clarification:** For clarity please note that while the specification calls for bar spacings in the grid to be even, it may be necessary to have the last spacings between the final bar and the grid frame differing from the rest of the spacings. Provided they are **always LESS THAN 23cm** apart between bars and frame.

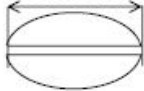
# SLED TERMS



2 Section



Max Width



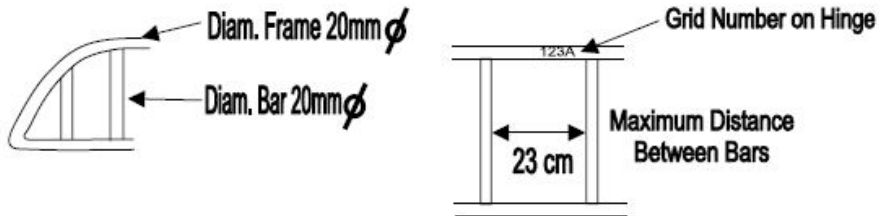
3 Section



Max Height of Each Section

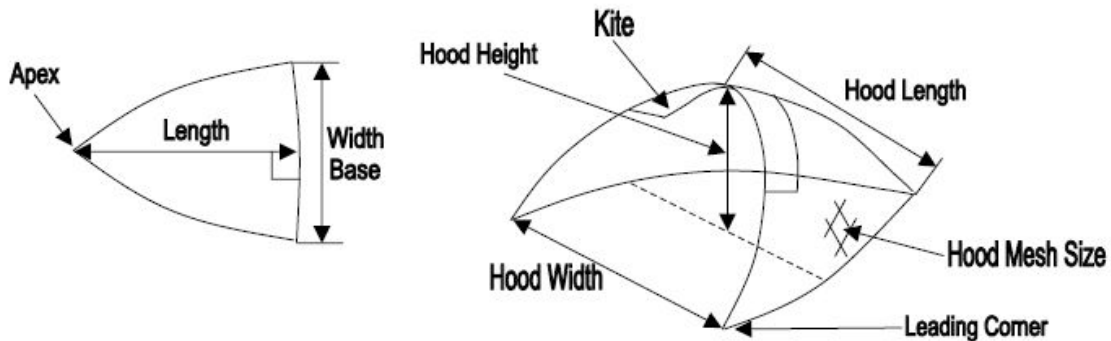


# GRID



Escape Hatch

# ESCAPE HATCH



**Current issues with the Breen-Kim model, raised by Paul Breen at the AEWG meeting held 1 September 2006.**

1. Recent pup counts were lower than the minimum estimates generated by the model, suggesting that insufficient process error was allowed in the model. The model cannot reproduce the declines seen recently, and survival rate or pupping rate may have changed. The effect of introducing more variability would be that high-numbered harvest control rules would no longer meet the 90:90:90 sustainability criterion, and the cusp rule would be some lower-numbered rule than 392. Lower pup counts would also cause uncertainty in the minimisation of the model because it assumes observation error and no process error.
2. Late-season pup mortality estimates were not included in the original model. Late season mortality appears to be more variable than early season mortality. This suggests that the model should include process error on pup mortality.
3. Some other data sets not available in 2003 have since become available.
4. The 2003 model had no implementation error, even though actual mortality of sea lions is poorly known.
5. The 2003 model was restricted to SQU6T even though some sea lions are caught elsewhere and some other fisheries have sea lion interactions in the SQU6T box.
6. It was acknowledged that, in hindsight, different parameterisations of survival might have been better to avoid parameter correlations.
7. The model assumed homogeneous dynamics in the four rookeries and this may not be realistic.
8. The “strike rate” may have a time trend but this was not modelled in the 2003 projections.
9. The very low growth rate favoured by the model is thought to be unrealistic and suggests problems in the specification of density dependence. It is possible that there is density dependence in survival as well as, or instead of, in pupping rate.
10. Catch and effort data are assumed known.