

Deepwater Group Ltd

OPTIMISE THE SUSTAINABLE ECONOMIC VALUE OF OUR DEEPWATER FISHERIES



**SEAFOOD INDUSTRY
COUNCIL**

The New Zealand Seafood Industry Council Ltd

**PROPOSED OPERATIONAL PLAN TO MANAGE THE
INCIDENTAL CAPTURE OF NEW ZEALAND SEA LIONS IN
THE SQU6T FISHERY FOR THE 2007-08 FISHING YEAR**

**SUBMISSION BY
DEEPWATER GROUP LTD
AND
SEAFOOD INDUSTRY COUNCIL**

1 OCTOBER 2007

BACKGROUND

- 1 The Deepwater Group Limited (DWG) and the Seafood Industry Council (SeaFIC) appreciate the opportunity to make this submission on the Initial Position Paper (IPP) for the 2007-08 SQU6T Operational Plan.
- 2 SeaFIC is the primary umbrella organisation representing the generic interests of all sectors of the New Zealand seafood industry. SeaFIC shareholders cover participants in the fishing and aquaculture sectors and collectively represent around 95% of the seafood industry by value.
- 3 DWG was formed in November 2005 by the amalgamation of the Hoki Fishery Management Company Ltd, the Squid Fishery Management Company Ltd and the Orange Roughy Management Company Ltd. It represents participants in New Zealand's major deepwater fisheries, including squid, hoki, hake, orange roughy, oreos and southern blue whiting.
- 4 Shareholders in DWG hold about 97% of the quota in New Zealand's squid trawl fishery areas (SQU1T and SQU6T respectively). DWG makes this submission as a representative of quota holders in quota management area SQU6T.
- 5 This submission begins with a summary of our position in relation to the IPP. This is followed by more detailed comments on the content of the IPP.

SUMMARY

Fishing Related Mortality Limit

- 6 The Minister of Fisheries' role is to take measures necessary to avoid, remedy or mitigate the effects of fishing-related mortality on the New Zealand Sea Lion (NZSL) and such measures may include setting a fishing related mortality limit (FRML). The Minister must determine the extent to which (or the point at which) utilisation of the squid resource threatens the sustainability of the sea lion population, and *if necessary*, may impose a FRML to avoid, remedy or mitigate the interaction.
- 7 In making his decision, the Minister is required to balance the utilisation of the squid resource with the conservation of the NZSL. DWG and SeaFIC consider that the best available information demonstrates that fishing related mortality is not having a detrimental effect on the NZSL population, so that a FRML is not necessary.
- 8 However, should the Minister consider that a FRML is necessary for the 2007-08 fishing year, even on a conservative and precautionary basis, a FRML of less than **250** (which is about 50% of the FRML generated by the "Cusp rule") cannot be justified. This notwithstanding, DWG recognises that a lower FRML will usually allow for adequate utilisation of the fishery, and would therefore agree to a voluntary cap on the FRML of **150**.

Strike rate

- 9 There is no credible basis on which to increase the predetermined strike rate and we recommend that the status quo strike rate of **5.3%** be retained.

Discount factor for SLEDs

- 10 We recommend that, based on an analysis of recent data relating to survivability, the discount rate for the use of SLEDs is set at no less than **53%**.

RATIONALE FOR MANAGEMENT OPTIONS

Background information

- 11 The IPP states in paragraphs 3 and 12 that the foraging range of lactating sea lions overlaps the fishing grounds of the SQU 6T fishery. More correctly, the overlap relates to both male (incapable of lactating) and female NZSL (not all of whom are actually lactating).
- 12 These paragraphs also state that it is the overlap between the foraging grounds of sea lions and the SQU 6T fishery that *leads* to the incidental capture of sea lions. While a spatial overlap between sea lions and the fishery may be the ultimate cause of captures, the proximate cause of mortality is the inability of some sea lions to escape from trawl nets. This point is not entirely pedantic: in general, management actions directed at the immediate cause of an interaction should provide the greatest benefit at the lowest cost.
- 13 Paragraph 13 gives the total estimated population size for NZSL as “*approximately 12,000 animals*”. The source is not stated, but this number is not the current best available estimate. Breen (2006, Appendix 2 in 2006-07 SQU 6T Sea Lion Operational Plan Initial Position Paper) gives the median species total in 2005-06 as 14,546 animals (including the Campbell Islands population). With the increase in Auckland Islands pup count numbers this year the population will be above this.
- 14 The IPP asserts at paragraph 13 that NZSL is the “*world’s rarest sea lion*”. There is no information provided as a basis for this statement. In our view, rare is defined as “occurring very infrequently”, and therefore the Australian sea lion (*Neophoca cinerea*) is the “world’s rarest”¹.

¹The *Threatened Species Day fact sheet*, [Australian] Department of the Environment and Heritage, 2006 states that the estimated size of their population is fewer than 10 000 animals. McKenzie J, Goldsworthy SD, Shaughnessy PD, McIntosh R (2005). *Understanding the impediments to the growth of Australian sea lion populations*. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, 107pp. The SARDI Publication Number RD04/0171 estimates this population to be between 10 000 -12 000.

- 15 The IPP states that the NZSL is listed as a threatened species under s 2(3) of the Marine Mammals Protection Act and that this classification is based on the small number of breeding colonies. We have made extensive comments on this issue previously and question the appropriateness of this classification.²

Management objective

- 16 The purpose of this IPP is to consult on proposed management measures relating to the interaction between the squid fishery operating around the Auckland Islands and the NZSL, i.e. the management of fishing-related mortalities of NZSL. The IPP claims at paragraph 4 that the management regime is focused on the use of a FRML to “constrain the NZSL mortalities to a sustainable level”.
- 17 This is incorrect. The FRML is used to constrain NZSL fishing-related mortalities having regard to the Minister’s determination of the point at which utilisation of the SQU6T fishery threatens the sustainability of the sea lion population. The FRML is determined by the Minister having regard to the evaluation of bycatch control rules in the Breen-Kim model.
- 18 The management criteria used in the Breen-Kim model (as stated in paragraph 22 of the IPP) to evaluate the bycatch control rules require that the NZSL population remains above 90% of its carrying capacity (K), or above 90% of the level it would be in the absence of fishing-related mortality, with 90% certainty. The criteria were agreed by the Ministry of Fisheries Aquatic Environment Working Group (AEWG) to give effect to DoC’s objective of ensuring the population is at a high percentage of its carrying capacity to encourage the expansion of breeding colonies. This is a far more conservative approach than a sustainable harvest target such as MSY (as used for harvested fishstocks) or even the maximum net productivity level objective (as used in US marine mammals legislation).

Statutory considerations

- 19 In the absence of a species population management plan (PMP)³ for sea lions the Minister has discretionary powers under section 15(2) of the Fisheries Act 1996 to take such measures that he or she considers are necessary to avoid, remedy or mitigate the effects of fishing-related mortality on NZSL, and such measures may include setting a FRML.
- 20 The Court of Appeal has made it clear that the Minister may *only* take measures which he “*considers necessary*” in terms of avoiding, remedying or mitigating adverse effects of fishing on NZSL. The Minister is therefore “*required to form a view of the extent to which (or point at which) utilisation of the squid resource threatens the sustainability of the sea lion population*”.⁴ It is surprising that the IPP omits to mention the Court of Appeal’s direction to the Minister when setting a FRML

² E.g. DWG submission of 20 October 2006 on the 2006-07 SQU 6T Operational Plan, DWG submission on Department of Conservation Draft Population Management Plan for New Zealand Sea Lion.

³ Approved under section 3E of the Marine Mammals Protection Act 1978.

⁴ *SFMC v Minister of Fisheries* (CA39/04) at [79].

in the summary of the Minister's statutory considerations in paragraph 15 and paragraphs 106 to 121.

- 21 This omission is exacerbated by the erroneous assertion in the IPP at paragraph 108 that in deciding "*where*" to set the FRML, if the Minister chooses a higher FRML, he is "*giving greater emphasis to utilisation over sustainability*". While we recognise that a precautionary approach is open to the Minister where information is uncertain, all bycatch control rules tested by Breen-Kim, up to and including the Cusp rule meet the very conservative management criteria and are by definition "sustainable".
- 22 We disagree with the Ministry's statement at paragraph 56 that when determining the FRML, the Minister may take into account "*societal values*" as a relevant consideration. The concept of societal values is incorporated into the purpose of the Act, but only through the definition of "utilisation". That term incorporates the concepts of conserving and using fisheries resources in such a way as provides for social well-being. However, in the IPP, the Ministry appears to be implying that societal values may be relevant in further constraining utilisation "*in favour of greater sea lion protection*".
- 23 In our opinion it would be wrong to suggest that "societal values" or "strong public opinion" form a separate head for consideration, beyond the considerations of ensuring sustainability (s8), maintaining associated or dependent species above a level that ensures their long-term viability (s9), or avoiding, remedying or mitigating the effect of fishing-related mortality on the sea lion population (s15). The Act sets the environmental standards required. While the Minister clearly has considerable discretion to decide what measures are required to avoid, remedy or mitigate the effect of fishing related mortality on the sea lion population, having done so, he cannot further restrict utilisation for some wider societal reason – such as to acknowledge "*strong public opinion in favour of greater sea lion protection*".
- 24 The Court of Appeal⁵ has also made it clear that the "political acceptability" of an increased FRML (i.e. due to public perception) is irrelevant to the Minister's decision:

[83] Running through the material we have read is a sub-theme that there may well be substantial support for a policy which protects sea lions as individuals. Associated with this are concerns sometimes mentioned in the papers as to the political acceptability of an increased MALFiRM.

[84] We see these considerations as irrelevant to the current exercise.

- 25 It is also incorrect for the IPP to suggest that the "*strong public opinion in favour of greater sea lion protection*" 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 relationship is the other way around – the "public awareness campaign" has led to MFish perceptions of so-called strong public opinion. Unfortunately, much of the public opinion is based on misinformation and inaccurate

⁵ Ibid.

analysis distributed by organisations with a poor understanding of sea lion conservation and fisheries issues (but with strong self interest in lobbying public and government alike).

- 26 Earlier this year, in partial response to an invitation from the Primary Production Committee, SeaFIC scientists, with input from NIWA and other scientists, prepared a critique⁶ of the recent Forest & Bird “Technical Report” entitled *Save Our Sealions: Conservation management issues and options for the New Zealand sea lion, Phocarctos hookeri*. The critique highlighted numerous errors of fact, interpretation, and omission in the report. The poor standard of the Forest & Bird report is mirrored by the populist article entitled “Making a Killing!” that was published in Forest & Bird’s magazine in August 2006. People who sign Forest & Bird petitions or respond in other ways to public awareness campaigns do so in good faith, but have little time, resources or inclination to research the facts behind the immediate appeal of the issue.
- 27 We consider that if the Minister is to be advised that public opinion is a relevant consideration in his decision, he should also be advised that, in this case, the public opinion is the result of a campaign of misinformation and should be weighted accordingly in the decision making process.
- 28 Furthermore, we suggest that it is not correct to equate the alleged “strong public opinion” of a subset of New Zealanders with “societal values” in general (or with general notions of “public interest”). The values of individuals within New Zealand society will (not surprisingly) vary greatly on any specific issue. What is certain, however, is that the general values of New Zealand’s society, as reflected through Parliament and now in the Fisheries Act, are that the viability of associated and dependent species such as sea lions will be maintained, and that, subject to ensuring sustainability, our fisheries resources will be available to be utilised for social, economic and cultural well-being. Having taken measures to ensure sustainability (through the FRML and other management measures), it is not open to the Minister to further restrict utilisation, based on some consideration of wider societal values. To do so would be contrary to the obligation to provide for utilisation except to the extent necessary to ensure sustainability.

Population Management Plan

- 29 Paragraph 19 of the IPP discusses the change in management processes that would eventuate should a Population Management Plan be approved under the Marine Mammals Protection Act 1978. As a draft PMP has only recently been released for consultation, we do not consider it either appropriate or useful to discuss the implications for management if the current draft is “approved without substantial modification”. The draft PMP is ambiguous and unclear, and its implications for the management of the SQU6T/NZSL interaction are uncertain. For example, the draft PMP proposes the establishment of a NZ fisheries waters MALFiRM and a SQU6T MALFiRM, utilising different management criteria.

⁶ SeaFIC (2007). A critique of the Royal Forest and Bird Protection Society's technical report “Save our sealions”, 31 January 2007. Provided to Primary Production Committee with SeaFIC submission on Petition 2005/81.

MANAGEMENT OPTIONS

Setting a FRML

General process

- 30 The primary purpose of the Breen-Kim modeling (and the current work to update that modeling) is to establish rules for the automatic generation of sea lion catch limits based on pup counts. Rules are tested to ensure that, if applied consistently, management targets will be met (with specified probability). The current annual operational plan process is time-consuming, has high transaction costs, provides stakeholders with little certainty, and is largely unnecessary. DWG and SeaFIC support a process to adopt an agreed rule that will be applied (in the absence of exceptional circumstances, and without fettering the Minister's discretion) consistently for a period of, say, five years.
- 31 For the avoidance of doubt, our favoured process would involve the following steps:
- 31.1 Specifications of management objectives for the NZSL population (i.e. the so called "90/90/90" rule or appropriate variants).
 - 31.2 Testing of proposed FRML setting rules against the management objectives using a population model for the New Zealand sea lion (i.e. the Breen-Kim model, or its update) and a model of the fishery.
 - 31.3 To the extent that the modeling demonstrates that a FRML is necessary due to the adverse effects of fishing related mortality, the choice of a specific FRML setting rule that (i) is assessed as meeting the pre-determined management objectives, and (ii) subject to (i) provides for fishery utilisation.
 - 31.4 Specification of a management framework that specifies (i) the FRML setting rule; and (ii) the process for implementing the FRML rule, including required research within a "fishery plan" for a pre-determined period (say 5 years).
 - 31.5 Subject to "exceptional circumstances" implementation of the plan for the period specified.
- 32 We note that that in paragraphs 43 - 44 of the IPP MFish appears to support an approach where a rule is selected and applied on a consistent basis for a number of years.

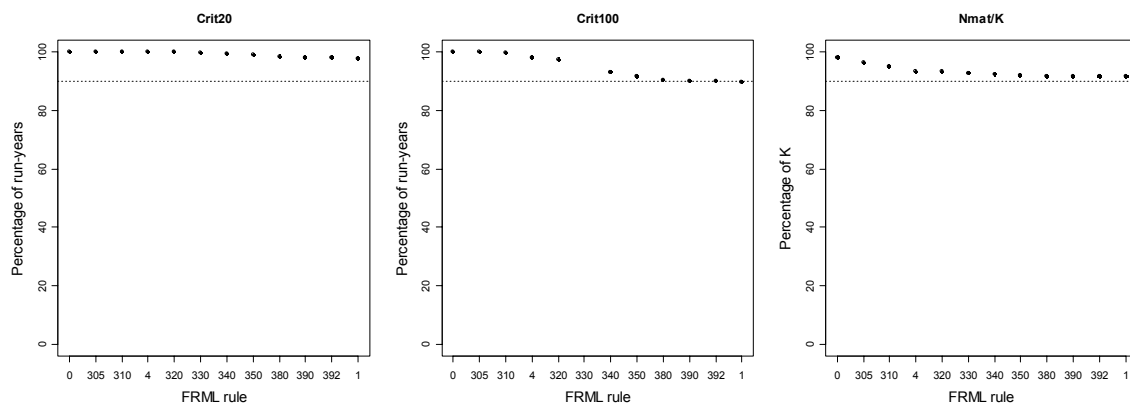
Breen-Kim general conclusions

- 33 The Minister can only take measures, such as setting a FRML that he considers necessary to mitigate the adverse effects of fishing related mortality on the sea lion population. It concerns DWG and SeaFIC that, as with previous MFish advice papers, the conclusions of the Breen-Kim modeling work are not acknowledged. The Breen-Kim model is widely accepted as providing the best available information for assessing bycatch control rules and its conclusions are highly relevant to the Minister's decision in relation to whether a FRML is necessary, and if so, the level of the FRML.

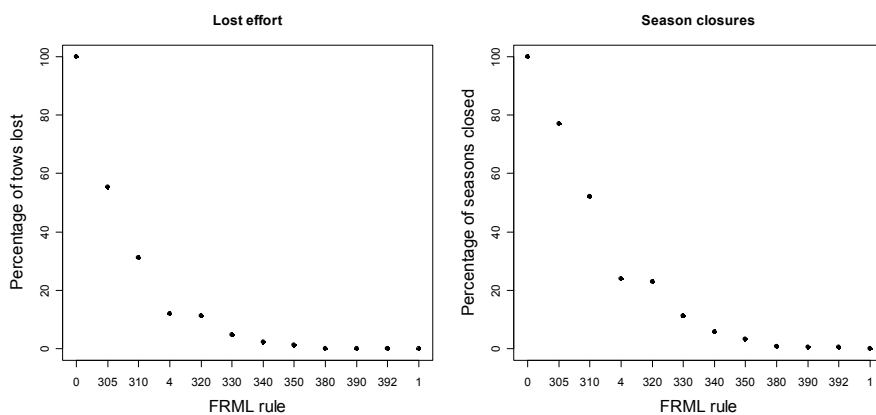
- 34 The Breen-Kim model (and all its subsequent iterations) concluded that:
- the population of sea lions is probably near its carrying capacity (K);
 - the SQU6T fishery has a small effect on the population under current levels of fishing effort;
 - measures to mitigate the effects of bycatch do not have much effect to mitigate.
- 35 These general conclusions suggest that (in the previous words of the Department of Conservation) the squid fishery is not having a detrimental effect on the sea lion population, so that a FRML is not necessary for the purposes of section 15(2).

Relative performance of rules

- 36 The general conclusions of the Breen-Kim model are supported by the model's analysis of the relative performance of the bycatch control rules against the management criteria. Paragraph 37 of the IPP, in common with a number of other recent IPPs from MFish, characterises the risk of the various FRML options in purely relative terms. It is true that the various FRMLs represent a spectrum from "lower" to "greater" sustainability risk, but only trivially so. What is important is not the relative risk, but the absolute risk. In the case of the sea lion, the Breen-Kim analyses provide a quantitative risk assessment, so the failure to discuss risk in more concrete terms is inexcusable. It is critical to note that all the FRML rules in Table 2 of the IPP, up to and including the Cusp rule, have been assessed as meeting the very conservative predefined management objectives.
- 37 The management objective assessed using the Breen-Kim model was not simply the "sustainability" or viability of the New Zealand sea lion, it is the maintenance of the Auckland Islands population at a high level, in the hope of encouraging dispersal and the establishment of new breeding colonies, so addressing the "range restricted" threat classification. In the summary of preferred FRML rules (paragraph 55), MFish consistently refers to risks "to sea lion sustainability". We consider that none of the FRML rules proposed result in a significant risk to sustainability of the sea lions.
- 38 The figure below illustrates the performance of the various FRML rules in terms of the three management criteria: the pre-determined performance threshold is shown as the dotted line. These "risk profiles" are relatively flat, and only rule 1 ("unconstrained" fishing) fails to pass the pre-determined threshold for crit100.

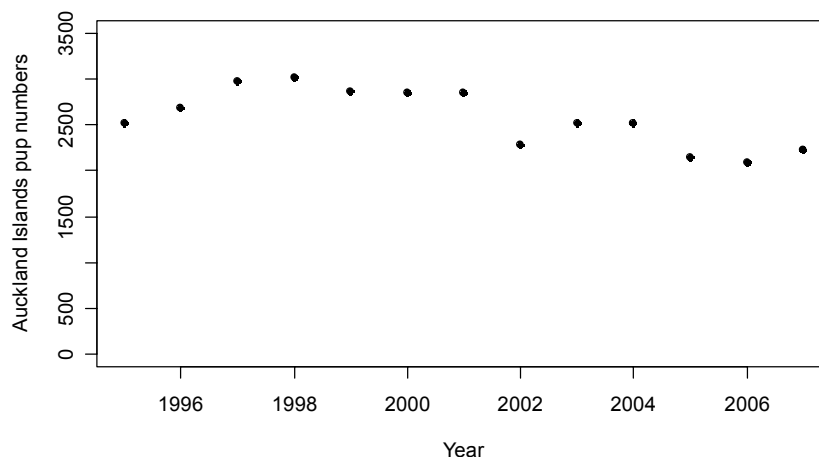


- 39 Thus, the relative “risk to sustainability” is largely irrelevant to the choice between rules: all of the FRML rules considered meet the management objectives, and lower numbered rules provide only small gains in terms of increased probability of being above the threshold values. In contrast, the cost to the fishery in terms of lost fishing effort varies greatly between rules. The choice of FRML rule is largely a choice of the extent to which utilisation is constrained.



Pup production numbers

- 40 Paragraph 40 of the IPP discusses recent pup production estimates from the Auckland Islands. The IPP notes that, although the 2007 count is greater than the 2006 count (it is also greater than the 2005 count), there has been a 26.4% decrease in pup production since 1998. The reason for choosing 1998 as a benchmark is unclear – it is simply the highest level of pup production observed in recent years. The 1997/98 pup count was the highest recorded in recent years, and had not been stable at this high level in the preceding years. Natural fluctuations in recruitment are expected in all populations and, as noted in the IPP, there is no information to suggest that the fluctuations in sea lion numbers are the direct result of fishing activity.



- 41 We consider that it is inappropriate to advise that the change in pup production from 1998 to 2007 is a reason for additional caution in setting the FRML for the coming season, for two reasons:
- 41.1 Subject to the caveats below, the Breen-Kim population model already estimates year to year variation in pup production and includes this variability in projections. Thus, varying pup production is already accounted for in the model used to assess the performance of the various FRML setting rules.
- 41.2 All FRML setting rules are already based on pup production numbers. Thus if pup numbers decline, the rule outputs a lower FRML. A change in pup numbers does not require a “more cautious” rule as the rules all output a lower FRML if pup numbers decrease.
- 42 As noted above, we support a process to choose a FRML setting rule based on (i) assessed ability to meet the management criteria and (ii) other relevant factors such as utilisation trade-offs, with the resulting rule being applied consistently for an agreed period. Although, as noted in paragraph 43 of the IPP, a single rule has not been applied consistently over time, all chosen rules have met the pre-determined management criteria, and it is therefore likely that the aggregate outcome would still meet these criteria.
- 43 We consider that the main additional uncertainty relevant to the selection of an FRML rule is the observation that variability in pup production appears to have been greater than that estimated in the base case model of Breen and Kim (2006). Sensitivity runs (*sens2*) with increased variation in pup production were explored by Breen and Kim. Their conclusions, in particular with respect to the low impact of the fishery on the sea lion population, were broadly robust to this increased variability. Nevertheless we agree that increased variation in pup production is likely to result in a somewhat lower multiplier in the “cusp”.

Fishery value

- 44 The IPP discusses at paragraphs 46 to 47 the difficulties associated with assessing the value of lost utilisation as a result of the use of a FRML to constrain bycatch. DWG and SeaFIC consider that the most important consideration is the overall value of the squid fishery over time. In our opinion, “point in time” fish prices have

no relevance in the MFish decision making process given that infrastructural and market commitments and contracts may be made over much more broad time frames. Furthermore, the level of integration of seafood companies makes the global commodity price on a given day a poor indicator of the value of the fishery to New Zealand.

- 45 The squid fishery is very significant for the fishing industry and New Zealand. The SQU6T fishery represents a very important component of the wider squid fishery, and it should not be unnecessarily constrained unless it is “necessary” to do so due to any adverse effects on the NZSL population.
- 46 The range of ACE trading prices quoted in paragraph 46(d) of the IPP is very wide. This wide range deserves further explanation before its utility for valuing the fishery can be clearly established. In general, the upper end of the range of ACE trading prices are the only useful indicators of open-market prices.
- 47 We consider that the export value of the fishery is the best indicator of the fishery value. For 2006/07 this was approximately \$1700/tonne. It is important to note that on a per unit basis the SQU6T fishery is more valuable than the SQU1 fishery due to the larger average size of squid taken in SQU6T; the key value driver is the size of the animal.

FRML for 2007

- 48 We consider that the Breen-Kim model demonstrates that a formal FRML is unnecessary for the purposes of section 15(2), even applying a precautionary approach due to uncertainty in information. The model concludes that there is little effect to mitigate through management measures. The difference in the performance between bycatch control rules primarily relates to differences in utilisation constraints. Given the use of SLEDs to mitigate the little effect that there is, there is no principled justification for the imposition of a FRML.
- 49 To the extent that the Minister disagrees and considers a FRML is necessary for the 2007-08 fishing year, the Cusp rule must be the starting point to the Minister’s consideration of a FRML. At the cusp (the point at which the *crit100* criteria are just met), a FRML of **513** sea lions is produced for 2008, which is predicted to result in minimal lost utilisation opportunity (0.4%), and a mean annual bycatch of 98. Of course, once the new modelling work has been completed, the need for a FRML and the consistent application of an appropriate rule should be reassessed.
- 50 The IPP asserts at paragraph 52 that setting a FRML based on higher rules (Rule 350 to the Cusp rule) is inappropriate because it assumes pup number and model uncertainties are insignificant or marginal. However, even if the Minister wished to set a FRML based on the most conservative and precautionary approach due to perceived uncertainty in information, a discount of more than 50% to the Cusp rule cannot be justified on any rational basis (i.e. Rule 346 generating a FRML of about **250**).
- 51 A FRML of 250 would allow for greater utilisation of the squid fishery (particularly if the season is a good one) at very little risk to the NZSL population. As discussed

above, based on the modeling, the marginal difference in relative risk between such a FRML and those which severely restrict utilisation is insignificant.

- 52 MFish proposes a FRML range of 81 to 222, derived from Rule 4 and Rules 320 to 340. This range unnecessarily restricts utilisation for very little benefit for the NZSL population. For example, a FRML under Rule 4 of 81 is about 16% of the FRML derived from the Cusp rule, and results in a very significant constraint on utilisation. DWG and SeaFIC cannot understand how MFish can suggest that uncertainties associated with the model mean that the FRML derived from the rule which satisfies all of the conservative management criteria should be discounted by 84%.
- 53 Even adopting the most precautionary approach by discounting the Cusp rule by 50% is beyond MFish's recommended range. It is simply not credible for MFish to assert that only FRMLs which are well below 50% of the FRML derived from the Cusp rule are appropriate.
- 54 While SeaFIC and DWG do not accept that a FRML less than 250 can be justified, even on the most precautionary basis, without prejudice to this view, industry is prepared to offer on a good faith basis a voluntary cap on the FRML of **150**. This cap recognises that such a limit will allow adequate utilisation of the fishery (unless the season is an exceptionally good one) and also recognises that there are perception issues associated with the FRML (even though such issues are not legally irrelevant to the Minister's decisions).

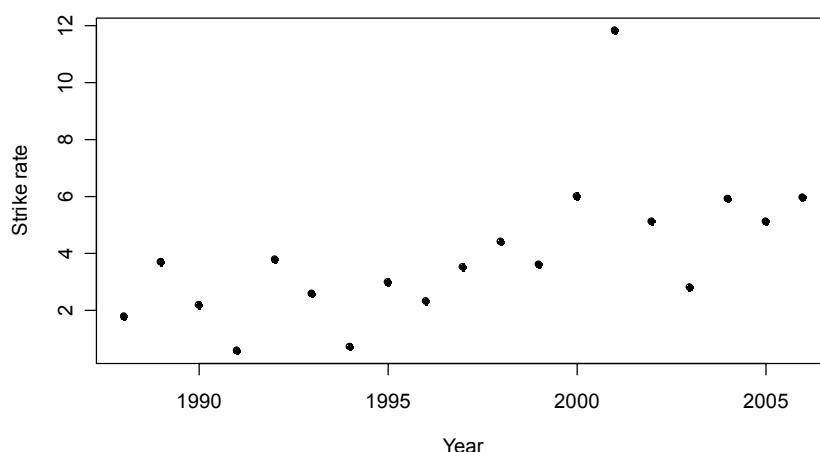
Implementing the FRML

General process

- 55 The statement at paragraph 30 that "once the FRML has been determined, fishing activity is then monitored against this limit" is not a very clear statement of the current process for implementing the FRML. We suggest that the advice to the Minister clearly states that MFish does not currently attempt to implement the FRML by direct in-season counts (or estimates) of sea lion mortalities. Instead the FRML is translated into a limit on allowed tows. This is a pragmatic management decision that results from difficulties in estimating actual sea lion mortality counts.
- 56 Providing real-time estimates of the actual number of mortalities is not straightforward because:
- 56.1 Interactions are rare. Without complete observer coverage sampling error is introduced.
 - 56.2 Interaction rates appear to vary considerably from year to year.
 - 56.3 SLEDs are used throughout the fleet. Escapement rates are estimated to be high, so most interactions are unobserved.
- 57 While we agree that continuation of the current approach to implementing the FRML (a predetermined strike rate and discount factor leading to limits on the number of tows), we note that this approach is not without difficulties. We recommend that, as a fishery plan is finalised for squid, DWG and MFish review the options available for FRML implementation.

Strike rate

- 58 Assessing the number of sea lions captured, and thus implementing the FRML, is necessarily a probabilistic exercise. Use of a *predetermined* strike rate is necessitated by the pragmatic decision to translate the FRML into a tow based limit, rather than attempt in-season estimation of the number of sea lion mortalities.
- 59 Because the actual rate of sea lion interactions with trawl vessels is known to fluctuate quite substantially from year to year, the pre-determined strike rate will almost certainly lead to a poor estimate of sea lion captures in any particular year. Thus a clear statement of the management objective in setting the strike rate would be helpful. Breen et al. (2005)⁷ noted that the *status quo* use of a pre-determined strike rate carried the implicit assumption that MFish is accepting a 50% risk that the true bycatch is lower (or higher) than that estimated from the pre-determined rate. This implies that a median estimate of strike rate is appropriate as the pre-determined value.
- 60 Although not explicit, paragraph 58 of the IPP indicates an intention that the long term total mortalities estimated via the pre-determined strike rate should equal the actual long term total, having taken into account the annual variations in strike rate. This implies that the appropriate strike rate would be the expected value of the overall strike rate (mortalities/tows) *over time*, assuming that the annual strike rates arise from a statistically stationary process.
- 61 Examination of strike rate over time (plotted below) does not suggest a stationary process. Strike rates since 1997 or 1998 are generally higher than those in the preceding decade. Although modeling indicates that tow durations influence the probability of capturing a sea lion in a tow, and recent increases in typical tow durations in the fishery are therefore expected to influence the overall annual strike rate, annual variability dominates strike rates and the shift to a regime with higher strike rates appears to predate the recent changes in the tow time distribution.



- 62 Calculating the expected long term strike rate, such that the long term total from the predetermined rate matches the actual long term total, requires an assessment of

⁷ Breen, P.A., Kim, S. & Starr, P.J. (2005). Estimating sea lion bycatch in the SQU 6T and SQU 1T fisheries. NIWA Client Report WLG2005-37 for Squid Fishery Management Company.

the appropriate period over which to estimate the temporal distribution of strike rates (i.e. the period over which strike rate is assumed to arise from a stationary distribution). This has not been formally addressed, but inspection of the plot above indicates that the three year period 2004/04 to 2005/06 (paragraph 62 of the IPP) is almost certainly too short. Overall strike rates in this period do not capture the between-year variability evident in the last decade. From 1997 to 2006, the average of the preceding three years strike rates has varied from 2.93% to 7.63%. Furthermore, as noted at paragraph 62, recent strike rates estimates have wide confidence intervals.

- 63 The probability distributions for estimated strike rate in recent years tend to be skewed to the left. Thus the most likely values – the mode of the distribution – are less than the median, which in turn is less than the mean. Rather than relying on estimating a long term average, such that the pre-determined strike rate leads to the correct total captures over time, we suggest a more explicitly probabilistic approach to the value used for the pre-determined strike rate, such that the objective in setting the rate is clearly specified in terms of the probability that the FRML is exceeded (or, alternatively, the probability that the season is closed before the FRML is exceeded). For consistency with the previous (implicit) assumption of a 50% risk that the true bycatch in a given year is lower (or higher) than that estimated from the pre-determined rate, we suggest that the median is the appropriate value to use for the pre-determined strike rate.
- 64 In summary, a good process for determining the appropriate default strike rate to be used in the current management regime would involve explicit confirmation of the intended management objective of FRML implementation, consideration of the appropriate period over which to calculate a strike rate in order to best achieve the stated objective, and calculating the appropriate rate based on the outcome of this study.
- 65 In the absence of this detailed work, we consider that the median strike rate of 5.35 for the period 2004 to 2006 indicates that the predetermined strike rate of 5.3% remains appropriate.
- 66 We again note that the pragmatic management approach of a pre-determined strike rate and a limitation – in practice – on tows rather than actual annual mortalities implies an acceptance that sea lion captures in a given year need not be well estimated. Rather than hoping to estimate the long term expected strike rate sufficiently well that use of the predetermined rate results in the correct total mortalities over time, we consider that it is more practical that any deviations between mortalities estimated from the pre-determined rate, and those estimated from modeling that takes into account the actual annual rate and fishery, are taken into account in periodic updates of the operating model used to assess the FRML rules.
- 67 We fully agree that the proposal to use cover nets over SLEDs (or to fish without a SLED) to provide better estimates of strike rate is not necessary. Clearly the main aim of managing the interaction between the squid fishery and sea lions is to minimise any sea lion mortalities. Any proposal to adopt lethal research methods to better estimate a parameter must clearly establish the management value of the more precise strike rate estimates that will be obtained.

68 In contrast to paragraph 59 (which may have been specifically talking about in-season monitoring) annual estimation of strike rates and actual sea lion captures is possible, and is carried out (as noted in paragraph 62 of the IPP). High SLED escapement rates, and high (100% in the 2006/07 fishing year) SLED usage rates, mean that these estimates are imprecise. However, it is not clear that this imprecision is greatly problematic. Periodic updates of the Breen-Kim modeling can take into account the best estimates of captures, and the imprecision of these estimates. The life span of sea lions is sufficiently long, and the assessed impact of the fishery on the sea lion population sufficiently low, that more precise annual mortality estimates are probably unnecessary. The main uncertainty in annual mortalities arises not through the strike rate estimate, but as a result of the difficulty in assessing the survivability of sea lions which escape via SLEDs. However, should it be determined that more precise strike rate estimates would have real management value, then non-lethal means of assessing strike rate should clearly be considered before adopting the use of cover nets.

SLED effectiveness and the “discount factor”

- 69 Contrary to the “three factors” noted at paragraph 32, SLED effectiveness is entirely determined by *two* probabilities:
- 69.1 the probability of escapement via the SLED; and
 - 69.2 the probability of survival of animals that do escape.
- 70 Although interactions with the SLED grid may influence both escapement and survival probabilities this is not usefully considered as a separate factor.
- 71 The discount rate should represent the overall effectiveness of using a SLED, thus it is the product of escapement rate and post-escapement survival rate. We agree that the current discount rate was decided on the basis of very limited information, and consider it is far too low.
- 72 Early estimates of escapement rate (e.g. MacKenzie, 2003⁸) suggested rates of well over 90%. More recent estimates (Breen et al., 2005; Smith & Baird, 2006⁹), however, are closer to 70%. The recent industry focus on improved SLED performance, in particular addressing the hood and kite problems noted in paragraphs 75 and 76 of the IPP, should result in improved escapement rates.
- 73 Currently autopsy data provide the only means of assessing the potential survival of sea lions that escape from SLEDs. These data are clearly not ideal as they represent animals which either did not escape, or which were required to be retained and drowned in cover nets. Historically these autopsy data have not always been assessed in the light of the circumstances of the capture – for example, whether a SLED was used.
- 74 Autopsy data from the 8 animals recovered from trawls using SLEDs in 2007 show two categorised as having severe trauma, and three each with moderate or mild

⁸ MacKenzie, D.I. (2003) Research on Sea Lion Exclusion Device efficacy. Final report for Ministry of Fisheries project MOF2002-01D.

⁹ Smith, M.H & Baird, S. (2006). AEWG 2006/05.

trauma.¹⁰ Of 11 sea lions autopsied in 2006¹¹ from trawls with SLEDs, three were classified as having severe trauma, and four each with moderate or mild trauma. We understand that those classed as having severe trauma are considered to have injuries that would lead to a poor prognosis of survival.

- 75 Recent data on escapement rate (72.4%¹²) and potential survival rate (14 of 19 animals) therefore lead to an estimate of SLED effectiveness of 53%, indicating a discount rate of 53% would be appropriate.
- 76 SeaFIC is continuing to work with MFish and DoC to collate all existing autopsy data with data relevant to the circumstances of the capture. This should provide data from more autopsied animals than the 19 from 2006 and 2007. However, recent autopsy reports indicate that historical autopsy information will most likely have to be re-interpreted in light of improved trauma classifications and developing understanding of freezing artefacts on autopsy results.

Monitoring and reporting

- 77 We agree with the monitoring and reporting provisions of the Operational Plan as recommended in paragraphs 94 to 98. DWG will continue to support and work closely with MFish on these provisions.

Closure procedure

- 78 We agree with the closure procedure as stated in paragraphs 101 – 103 of the IPP.

Clarifications of the IPP text

- 79 We suggest that the “Summary of options” (paragraph 11) is clarified to read:
- c. Use a predetermined strike rate *to translate the FRML into an allowable number of tows.*
 - d. *Apply a discount factor to the strike rate of ... for vessels deploying an approved SLED.*
- 80 We suggest that paragraph 16 is clarified to read:
- c. *The implications of implementing the FRML via a predetermined strike rate*
 - d. *The uncertainty around the survival rate of sea lions that escape trawls via a SLED*

¹⁰ Roe, W.D. (2007). Necropsy of marine mammals captured in New Zealand fisheries in the 2006–07 fishing year. Draft report to Aquatic Environment Working Group (15 August 2007, AEWG 2007/42).

¹¹ Roe, W.D. (2007). Necropsy of marine mammals captured in New Zealand fisheries in the 2005–06 fishing year. New Zealand Aquatic Environment and Biodiversity Report 11, Ministry of Fisheries, Wellington.

¹² Smith, M.H. & Baird, S. (2007). Estimation of New Zealand sea lion incidental captures in 2006 for the squid trawl fishery in the Auckland Islands part of SQU 6T. AEWG 2007/37.

81 The management criteria employed in the Breen Kim modeling are not stated precisely at paragraph 22 of the IPP. For simplicity we recommend adopting the wording used by Breen & Kim (2006, revised report for MOF2002/03L): “The first and second criteria, for the 100- and 20-year runs respectively, were to have bycatch managed to produce a 90% likelihood, for each year of either the population being at or above 90% *K* or the population being at or above 90% of where it would have been in the absence of fishing. The third criterion was that the mean of mature numbers as a percentage of *K* should be at least 90% over the second 50 years of the 100-year runs.”

82 The explanations at paragraph 24 should be reworded, e.g.

To help interpret Table 1 the following provides an explanation for the numbers relating to Rule 320:

- a. In 99,989 out of 100,000 of the first 20 years of 5000 runs (99.98% of cases) the model population was at a level greater than 90% of carrying capacity or greater than 90% of the proportion of carrying capacity that would have been attained in the absence of fishing.
- b. In 487,109 years of the 500,000 years (97.42% of cases) of 5000 100-year runs the model population was at a level greater than 90% of carrying capacity or greater than 90% of the proportion of carrying capacity that would have been attained in the absence of fishing.
- c. The requirement that the mean number of mature animals in the model population was at or above 90% of carrying capacity in the second 50 years of a 100-year projection run was met in 93.4% of cases.
- d. On average (based on 5,000 model runs) if the FRML is set using Rule 320 the fishery will forego 328 tows.
- e. On average (based on 5,000 model runs) if the FRML is set using Rule 320 the fishery will close early in 23% of seasons.
- f. The maximum sea lion bycatch in any one year in 100 years may be 151 sea lions (median over 5000 runs).
- g. The average annual bycatch over the same 100 year period will be 76 sea lions (median over 5000 runs).

83 Paragraph 25: the pup counts are the *only* (not key) inputs to the FRML *rule* (not to the “model”). The pup counts are a key set of data in the Breen-Kim model, although this is not the point being made at paragraph 25.

84 At paragraph 28 the term “Breen-Kim model” is used too generically. It does not clearly separate the population model and the simulation process that uses the model. It would be more accurate to state that the AEWG has accepted the Breen-Kim model as the best available model of the New Zealand sea lion for testing whether rules for setting FRMLs achieve the specified management outcomes.

85 At paragraph 36 the qualifier “for the 2007-08 season” appears in the wrong sentence. The rules have been assessed against long term projections from the Breen-Kim model. FRMLs have been produced, using these rules, *for the 2007-08 season*.

Contact details

- 86 To discuss to any of the matters raised in this submission please contact in the first instance David Middleton (SeaFIC) for scientific and technical matters and Kamila Skapa (DWG) for statutory considerations.