

**Royal Forest and Bird Protection Society
of New Zealand Inc.**

Technical Report

Save Our Sealions:

**Conservation management issues and options for the
New Zealand sea lion, *Phocarctos hookeri*.**

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Executive Summary

The Minister of Fisheries has set the New Zealand sea lion bycatch limit (Fishing related mortality limit) for the 2007 squid fishery (SQU 6T) at 93. This compares with the 13 year average (1991-92 – 2002-03) of 66 sea lions, which represents a 40% increase.

The New Zealand sea lion, *Phocarctos hookeri*, is endemic to New Zealand and is globally recognised as requiring urgent conservation management action. Research over the last few years is showing a steady decline in their number, both in terms of pup production and adult survival.

While current management of sea lions would benefit from more data, inadequate use of the data available and poor focus on conservation and recovery of sea lion populations has resulted in continued declines.

This report explores the natural and human-induced threats faced by sea lions and highlights the highly contentious implications of mitigation measures presently used in the southern squid trawl fishery. A review of current management measures and alternative options for sea lion conservation available are also presented.

Forest and Bird's advocacy for management of the New Zealand sea lion supports:

- Extension of the no-trawl Marine Mammal Sanctuary around the Auckland Islands to the continental shelf edge (500m contour);
- Reduction of fisheries related sea lion mortality close to zero – this should include all fisheries known to interact with sea lion populations;
- Squid jigging within the no-trawl Marine Mammal Sanctuary around the Auckland Islands;
- Establishment of a Marine Mammal Sanctuary around the Campbell Islands;
- A robust Population Management Plan that supports the growth and expansion of all NZ sea lion populations;

During the 2006-07 fishing season, the Minister of Fisheries should regulate the squid (SQU6T) fishery to:

- Restrict tow length and duration;
- Increase strike rate to 5.81 per 100 tows;
- Reduce the SLED Discount Factor

Given their national significance and global importance, it is critical that wider management options are explored and adequate action is taken immediately.

1. Introduction

The New Zealand sea lion, *Phocarctos hookeri*, is unique to New Zealand and the only endemic species of sea lion we have. It is listed as a '**threatened species**' under section 2(3) of the Marine Mammals Protection Act 1978, largely on the basis of there being a limited number of breeding colonies or rookeries. The NZ sea lion is globally recognised as one of the world's rarest and most highly localised pinnipeds (sea lions, seals and walrus)¹ and is subsequently listed as '**vulnerable**' by the International Union for the Conservation of Nature and Natural Resources (IUCN), in recognition of them facing a "high risk of extinction in the wild".

Despite efforts to protect the New Zealand sea lion, research over the last few years is showing failure of the population to recover from both disease epidemics and the impacts of fishing. There has been a steady decline in their number, both in terms of pup production and adult survival.

This report outlines the threats faced by the NZ sea lion, the current protection measures in place and the possible options for management under current legislation.

2. Populations Under Threat

Before the arrival of humans, sea lions enjoyed a widespread distribution along the whole length of the New Zealand coast, from the north of the North Island through to Stewart Island and the subantarctic islands².

They now only occupy a restricted range at the southern extreme of their pre-human range, with breeding colonies limited principally to the subantarctic Auckland Islands, between latitudes 48°S and 53°S³. An estimated 90% of all breeding is restricted to just two rookeries on Dundas and Enderby islands⁴, with the remaining small breeding populations being on Figure of Eight Island (within the Auckland Islands) and Campbell Island. Although some animals do disperse as far as the main land (Figure 1) and occasional births have been recorded, populations have failed to establish successful breeding populations in these areas⁵.

The population of NZ sea lions appears to be undergoing a decline in recent years from the population estimate of approximately 12,000 -14,000 individuals in the mid 1990s⁵. The population is now estimated to be just 11,709 individuals, the lowest estimate recorded since

¹ Chilvers, L. B., Wilkinson, I. S., Duignan, P. J. and Gemmill, N. J. (2005) Summer foraging areas for lactating New Zealand sea lions *Phocarctos hookeri*. *Marine Ecology Progress Series*, 304: 235-247.

² Childerhouse, S. and Gales, N. (1998) Historical and modern distribution and abundance of the New Zealand sea lion *Phocarctos hookeri*. *New Zealand Journal of Zoology*, 25:1-16.

³ Gales, N. J. and Mattlin, R. H. (1997) Summer diving behaviour of lactating New Zealand sea lions, *Phocarctos hookeri*. *Canadian Journal of Zoology*, 75:1695-1706.

⁴ Wilkinson, I. S., Duignan, P. J., Castinel, A., Grinberg, A., Chilvers, B. L. and Robertson, B. C. (2006) *Klebsiella pneumoniae* epidemics: possible impact on New Zealand sea lion recruitment. In: *Sea lions of the World*, Alaska Sea Grant College Program, AK-SG-06-01: 385-403.

⁵ Campbell, R. A., Chilver, B. L., Childerhouse, S. and Gales, N. J. (2006) Conservation management issues and status of the New Zealand (*Phocarctos hookei*) and Australian (*Neophoca cinerea*) sea lion. In: *Sea lions of the World*, Alaska Sea Grant College Program, AK-SG-06-01: 455-469.

systematic assessments began⁶, with the breeding adult population an estimated 5000 individuals only (per. comms. Department of Conservation).

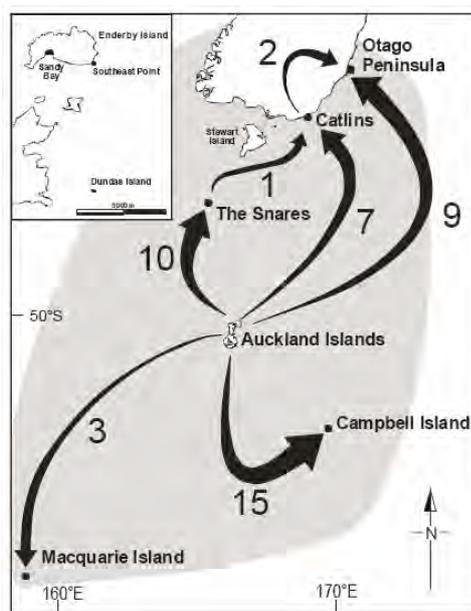


Figure 1. Post-breeding season dispersal of adult male New Zealand sea lions during the 2002/03 season (from Robertson *et al* 2006)⁷.

Pup production at Enderby Island appears to be stable for the last three decades, but is now showing the same slow decline as the overall population⁵. Indeed, since 1998, estimated total pup production has declined by approximately 30%⁸ at an average rate of 4.5% per annum (per. comms. Department of Conservation) (Figure 2).

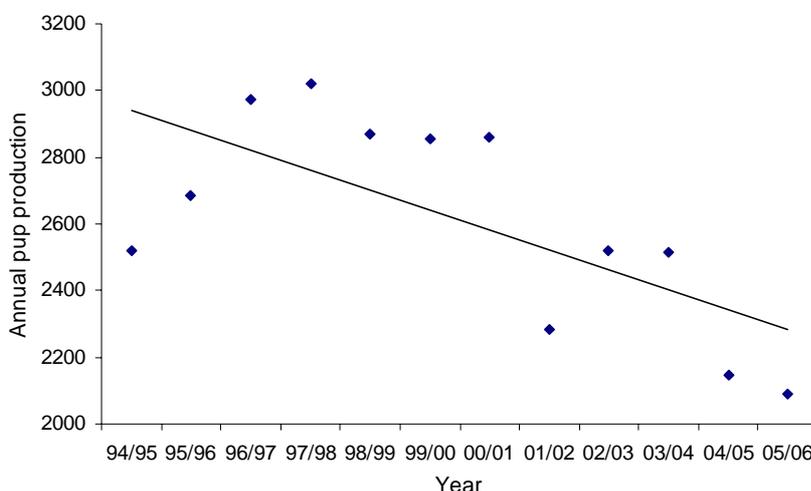


Figure 2. Pup production estimates for the Auckland Islands 1994 – 2006 (from available Department of Conservation data⁷.) (Line fitted by linear regression.)

⁶ Chilvers, L. (2006) NZ sea lion research trip, Auckland Islands, November 28th 2005 to February 20th 2006. Department of Conservation, Marine Conservation Unit, May 2006.

⁷ Robertson, B. C., Chilvers, B. L., Duignan, P. J., Wilkinson, I. S. and Gemmill, N. J. (2006) Dispersal of breeding, adult male *Phocarctos hookeri*: implications for disease transmission, population management and species recovery. *Biological Conservation*, 127: 227-236.

⁸ Chilvers, L. (2005) Technical Report: New Zealand sea lions, *Phocarctos hookeri*, Auckland Island pup production 2004/05. Department of Conservation, Marine Conservation Unit.

Reasons for the decline are not fully understood, however, given the natural and human-induced threats they are faced with, it is evident that urgent action is required to protect these vulnerable animals from extinction.

2.1 Natural Threats

2.1.1 Disease

Epidemics affecting marine mammal populations may be occasional events, but they are not unusual, with many examples in recent years from around the world⁴. What is so fundamental in the case of the New Zealand sea lion, is that even modest declines in health or increases in mortality during the breeding season are likely to have significant implications for population survival⁴.

Bacterial infection

In the 1997/98 breeding season, over 53% (n = 1,600) of pups and at least 70 adults died from an unidentified cause, speculated to have been a bacterial infection⁵.

During the 2001/02 and 2002/03 breeding seasons, the New Zealand sea lions contracted an epidemic strain of the bacterial pathogen *Klebsiella pneumoniae*. This led to a dramatic increase in pup mortality after just three weeks from the start of the pupping season; three times the mean in 2001/02 and twice the mean in 2002/03⁴. Limited to pup mortality, research suggests that most adults may be resistant to, or even carriers of this particular pathogen, particularly adult males^{4,6}.

These events highlight that disease events can have significant impacts on population dynamics, in particular, recruitment into future populations. For example, by 2007/08, when females from the 2001/02 and 2002/03 cohorts will be mature, it has been estimated that there will be between 93 and 144 fewer females than the present population (2.3% and 4.6% respectively), representing a considerable drop in the reproductive ability of the sea lion population⁴.

Infections from the *Klebsiella* bacterium are ongoing. For example, a further epidemic in sea lions this year (2006), has resulted in a 15% pup mortality (per. comms. Department of Conservation). Given the considerable movement of male sea lions (Figure 1), the likelihood of disease transmission to other areas is very high.

Tuberculosis

There are also anecdotal reports of sea lions having tuberculosis in the 1980's, though the first confirmed case was a female from Sandy Bay in February 2001⁹.

In the case of threatened species such as the New Zealand sea lion, which are impacted by fisheries activities, it is vital to incorporate the effects of disease into management models to ensure that the effects of fishing related mortality on the population can be accurately determined, and appropriate bycatch limits set⁴.

⁹ Dupont, C., Duignan, P. J., Cousins, D., Gibbs, N., McLachlan, S., Collins, D. and Murray, A. (1998) Tuberculosis in New Zealand pinnipeds. Poster Presentation, Massey University.

2.1.2 Behavioural Aggression

Many male pinnipeds show aggression during the breeding season that can lead to both female and pup injury and death. A study of the New Zealand sea lions on Enderby Island showed that 84 % of adult females have permanent scars from male bites and that male harassment accounted for the mortality of 10 adult females at the Sandy Bay colony in the last 4 years (mortality rate of 0.5% per year)¹⁰. The study also showed that indirect impacts, such as the time and energy invested in avoidance and pup separation can also have significant long-term effects on both individuals and the population as a whole.

The threat from males is likely to be higher when there is a lower ratio of females to males. As the number of females is decreasing around the Auckland Islands, this threat is likely to continue and possibly increase.

2.1.3 Predators

As with most animals in the wild, the NZ sea lion is subject to natural mortality through predation. The primary predators are white pointer sharks and leopard seals, with killer whales (orca) presenting a threat in some areas (they do not occur around the Auckland or Campbell Islands).

2.1.4 Climate Change

Studies have shown that although climate change may have possibly led to the change in sea lion distribution, it is unlikely to have led to the decline in range². This is supported by research on New Zealand fur seals on the west coast of the South Island. Despite fluctuations in fur seal population figures in this region following El Niña and La Niña events, the population has failed to recover from the most recent event. Evidence from 16 years of data show that this failed recovery is highly likely to be due to bycatch from fisheries in this area¹¹.

In addition to these natural threats, research on the ecology of NZ sea lions has shown that around the Auckland islands they are operating not only at their geographical limits but also at their physiological limits¹. Sea lions are generalist feeders that eat fish, octopus, squid and crabs, all of which constitute low energy prey (less than 4 kJ/g) and are the deepest and longest diving seal, found to exceed aerobic limits on 68% of dives relative to other sea lions and seals (4-10% of dives) (per. comms. Department of Conservation).

2.2 Human-induced Threats

2.2.1 Subsistence and Commercial Killing

Reports from at least 47 sites around New Zealand show the remains of sea lions, most of which were Maori or Mariori middens, indicating that sea lions were used for food².

¹⁰ Chilvers, L. B., Robertson, B. C., Wilkinson, I. S., Duignan, P. J. and Gemmill, N. J. (2005) Male harassment for female New Zealand sea lions, *Phocarctos hookeri*: mortality, injury, and harassment avoidance. *Canadian Journal of Zoology*, 83: 642-648.

¹¹ Best, H. (2006) Fur seal population study, west coast South Island. Presentation by the Department of Conservation, Marine Conservation Unit, Haast, 31 August 2006.

In the early nineteenth-century Europeans hunted New Zealand sea lions for skins and oil. Sealing reached its height about 1822 and by 1830 populations of sea lions were almost extinct¹². In 1830 Benjamin Morrell, skipper of the schooner Antarctic, recorded in his journal that:

*"Although the Auckland Isles once abounded with numerous herds of fur and hair-seal [the old name for sea lions], the American and English seamen engaged in this business have made such clean work of it as to scarcely leave a breed"*¹².

Sea lions were later eaten by sailors who were frequently shipwrecked on the Auckland Islands. When the schooner Grafton was wrecked there in 1864 the crew subsisted on sea lion meat and the captain Thomas Musgrave wrote his journals using sea lion blood for ink¹³.

Sea lions are now protected under the Marine Mammals Act 1978 and it is illegal for anyone to deliberately kill a sea lion. Nevertheless, the odd incidence does still occur, particularly on the mainland and is thought to be largely due to negative attitudes and a perceived overlap in prey species and local fisheries¹⁴.

2.2.2 Pollution

Accidental spills of oil or other pollutants pose a potentially significant threat to the New Zealand sea lion. Seals are particularly vulnerable to oil pollution as they spend a large portion of their time on or near the surface of the water or in areas where oil tends to gather - around inlets and bays where they haul out.

Seals could also be damaged through the ingestion of polluted food, attempts to clean pups or the inhalation of toxic droplets and vapours. Oil, especially light oils and hydrocarbon vapours, will attack exposed sensitive tissues and can cause corneal abrasions, conjunctivitis and ulcers¹⁵. Consumption of polluted prey could lead to the accumulation of toxins in tissues and organs.

Following the Jessica oil spill in January 2001, for example, a total of 79 oiled Galapagos sea lions (*Zalophus wollebaeki*) were recorded and a high incidence of conjunctivitis and burns were detected¹⁶.

2.2.3 Disturbance

Habitat loss and the threat of disturbance from tourism in Otago and the sub-Antarctic may potentially pose a threat to sea lion populations. In addition, although uncommon, sea lions on the mainland around the Otago coastline are subject to threat from dogs. Dogs pose a threat to sea lions in terms of disturbance of adults, but they also

¹² Heritage Expeditions (2006) Auckland Islands. <http://www.heritage-expeditions.com/travel/auckland-islands/>

¹³ Dreamlike (2006) Hooker's Sea Lion (*Phocarctos hookeri*) at Waipapa Point.

<http://www.dreamlike.info/nzl/sou/so/li/sealion.htm>

¹⁴ McConnell, H. (2001) New Zealand sea lions on the South Island and Stewart Island: abundance, recolonisation status and management considerations. Masters thesis, University of Otago.

¹⁵ Global Marine Oil Pollution Information Gateway (2006) Effect of oil pollution on marine wildlife. <http://oils.gpa.unep.org/facts/wildlife.htm>

¹⁶ Salazar, S. (2003) Impacts of the Jessica oil spill on sea lion (*Zalophus wollebaeki*) populations. *Marine Pollution Bulletin*, 47(7-8): 313-318.

potentially pose a direct threat to pups. If unsupervised, dogs may attack vulnerable sea lion pups.

2.2.4 Fisheries Interactions

Every year, sea lions are caught as bycatch in commercial fisheries targeting squid, scampi, southern blue whiting, hoki, jack mackerel and orange roughy¹⁷. The exact number of sea lions caught is unknown, largely as a result of low observer coverage, particularly in the scampi, orange roughy and southern blue whiting fisheries around the Auckland Islands.

The Arrow Squid fishery

The squid fishery, which began in 1979, has been responsible for the highest NZ sea lion bycatch. They are largely caught in nets 60 m high and over 150 meters wide towed by large foreign chartered trawlers. The squid fishery is managed by the Deepwater Group Ltd (DWG), comprising 12 major companies that represent about 99% of the squid catch in quota management area SQU6T and the adjoining area SQU1T.

The squid fishery is highly variable due to the variable nature of squid stocks (Table 1). Squid only live for a year before spawning and thus the number of squid present every year is mainly dependent on environmental conditions. In the last 10 years the reported catch in the fishery around the Auckland Islands has varied between 950 tonnes and 34,634 tonnes. The current catch limit is 32,369 tonnes, however, the sustainable catch limit for squid in any of the New Zealand squid fisheries is not known. Moreover, despite a TACC being set, squid has been over caught on a number of occasions.

Squid makes up a consistent, but variable proportion of the sea lion's diet around the Auckland Islands¹⁸. Diving and foraging patterns of sea lions brings them into direct conflict with the SQU6T squid trawl fishery, both spatially and temporally between January and June each year.

Number of sea lions killed in commercial fisheries

Since recording began, the Auckland Islands squid fishery is estimated to have killed 1456 sea lions, at an average of 77 per annum (Table 1). Across all commercial fisheries, this figure is likely above 2000 sea lions as observer coverage is poor (Table 2).

Research on the overlap of female sea lion foraging ranges with bycatch captures shows that the areas directly west of Enderby and Auckland Islands, and northwest of these islands around the 250m bathymetric line, are particularly significant, accounting for 72% of captures in the last 4 years¹. However, the area southeast of the Auckland Island group also poses a significant risk area, accounting for 28% of sea lions caught in squid fisheries in the last 4 years. Further research is needed on foraging ranges of other populations, particularly from the largest breeding colony on Dundas Island, before key overlap areas can be confidently identified.

¹⁷ Ministry of Fisheries (2006) Proposed operational plan to manage the incidental capture of New Zealand sea lions in the squid (SQU) 6T trawl fishery for the 2006-07 fishing year: initial position paper, 15 September 2006.

¹⁸ Childerhouse, S., Dix, B. and Gales, N. J. (2001) Diet of New Zealand sea lions (*Phocarctos hookeri*) at the Auckland Islands. *Wildlife Research*, 28:291-298.

Table 1. SQU 6T fishery statistics, showing over caught squid catches (bold) and sea lion mortality (red). (FRML = fishing related mortality limit – see section 3.2 of this report.)

Year	TACC (tonnes)	Reported Catch	% TACC caught	FRML	Total SQU 6T estimated mortalities	Cumulative estimated mortality
86/87	32333	16025	50			
87/88	32333	7021	22		33	33
88/89	35933	33462	93		141	174
89/90	42118	19859	47		117	291
90/91	30190	10658	35		21	312
91/92	30190	10861	36	32	82	394
92/93	30369	1551	5	63	17	411
93/94	30369	34534	114	63	32	443
94/95	30369	30683	101	69	109	552
95/96	30369	14041	46	73	101	653
96/97	30369	19843	65	79	123	776
97/98	30369	7044	23	63	62	838
98/99	30369	950	3	64	14	852
99/00	32369	6241	19	65	71	923
00/01	32369	3254	10	75	67	990
01/02	32369	11502	36	79	84	1074
02/03	32369	6887	21	70	39	1113
03/04	32369	34634	107	62	118	1231
04/05	32369	27314	84	115	115	1346
05/06	32369	16862	52	150	110	1456

Table 2. Observed sea lion captures in trawl fisheries south of 46° from 1997/98 to 2004/05 fishing seasons¹⁹

Fishing Year	SCI	ORH	JMA	HOK	SBW	SQU
	Recorded bycatch (fishery observer coverage %)					
1997/98	0 (4)	1 (22)	0 (15)	0 (3)	0 (10)	15 (2)
1998/99	0 (2)	1 (14)	0 (9)	0 (7)	0 (7)	5 (3)
1999/00	0 (4)	0 (19)	2 (17)	1 (4)	0 (9)	25 (5)
2000/01	4 (4)	0 (1)	0 (45)	0 (2)	0 (18)	42 (6)
2001/02	0 (4)	0 (10)	0 (18)	0 (3)	1 (10)	23 (3)
2002/03	1 (9)	0 (13)	0 (18)	1 (3)	0 (15)	11 (2)
2003/04	3 (9)	0 (25)	0 (8)	0 (5)	1 (10)	17 (2)
2004/05*	0 (3)	0 (20)	0 (19)	0 (17)	2 (36)	13 (17)

* Data from DOC Conservation Services Programme²⁰

¹⁹ Department of Conservation (2006) Draft: Population management plan for New Zealand sea lion. *Pre-notification Consultation Document*, January 2006.

²⁰ Department of Conservation (2006) Conservation Services Program – summary of 2004/05 observer coverage.

Implications for sea lion populations

A study on the foraging behaviour of lactating females has shown that NZ sea lions feed primarily on the shelf, up to 188km from their breeding site and at varying depths, with some diving to more than 500m¹. These values are high relative to other sea lions and seals, indeed, they are believed to be the deepest and longest-diving sea lions in the world³. This factor, combined with other studies on foraging behaviour, suggests that NZ sea lions may be operating at their physiological limits^{1, 21, 22, 23}.

Autopsy of sea lions caught by fisheries allows data collection on life history parameters, diet, genetics and health status. A study of by-caught sea lions between 1997 and 2002 showed that the sex ratio of sea lions caught by fisheries is variable year to year²⁴. It also showed that most males were mature (though only 25% more sexually active) and that 97% females were mature, with 68% lactating, indicating they had given birth that season and were actively suckling a pup at the time of capture. It was also noted that all sea lions were known to have been entangled in nets and all had lesions consistent with death from asphyxiation or drowning.

For the last five years, captures have been dominated by female sea lions (Table 3). The timing of the squid fishery overlaps with a very critical period for female sea lions, their pups and the population as a whole. The fishing season is concentrated over a relatively short time period, February to May, which coincides with the first 4 months of a 9 month lactation period, when pups are growing most rapidly and are totally dependent on maternal provisioning^{1, 25}.

When mothers are at sea foraging, their pups are in effect fasting. Mothers that get caught as bycatch cannot therefore return to feed their pups, which are left to starve and die.

As NZ sea lions mate almost immediately after giving birth to their pups, many of the females interacting with the squid fishery are pregnant. If an adult female is killed, the unborn foetus as well as the newborn pup and are killed, causing a triple reduction to the future population's survival.

In addition to direct kill from interaction with trawl nets and indirect impacts on new recruits to the population, the sea lions could be further impacted through an ecological competition for squid. Over the last 5 years, mean weights of 1 month old pups born at Sandy Island have shown a decline¹. The fat content of sea lion milk during early lactation - the period of overlap with the squid fishery - is the lowest recorded for a sea lion or seal, is similarly showing an overall decline¹.

²¹ Costa, D. P. and Gales, N. J. (2000) Foraging energetic and diving behaviour of lactating New Zealand sea lions, *Phocartos hookeri*. *The Journal of Experimental Biology*, 203: 3655-3665.

²² Costa, D. P., Gales, N. J. and Crocker, D. E. (1998) Blood volume and diving ability of the New Zealand sea lions, *Phocartos hookeri*. *Physiological and Biochemical Zoology*, 71: 208-217.

²³ Crocker, D. E., Gales, N. J. and Costa, D. P (2001) Swimming speed and foraging strategies of New Zealand sea lions (*Phocartos hookeri*). *Journal of Zoology*, 254: 267-277.

²⁴ Gibbs, N. J., Duignan, P. J. and Jones, G. W. (2003) Life history characteristics of New Zealand sea lions incidentally caught in fisheries around New Zealand, 1997-2002. Poster presentation on behalf of Massey University and the Department of Conservation.

²⁵ Gales, N. J (1995) New Zealand (Hooker's) sea lion recovery plan. Threatened Species Recovery Plan Series, Department of Conservation.

Table 3. Observed New Zealand sea lion captures in SQU6T in the seasons 1992 to 2004²⁶ (The predominant sex killed in each fishing year is shown in bold.)

Fishing Year	NZ sea lion captures		
	Males	Females	TOTAL
1992/93	5	3	8
1993/94	2	3	5
1994/95	2	2	4
1995/96	4	4	8
1996/97	3	10	13
1997/98	20	9	29
1998/99	11	4	15
1999/00	1	4	5
2000/01	13	11	25*
2001/02	16	22	38
2002/03	6	16	22
2003/04	4	6	10
2004/05	2	14	16
2005/06**	1	10	11

* One sea lion was unsexed in the 2000 season

** Data from captured and autopsied animals only²⁷.

As a population under threat, at the extreme of their physical capabilities, the interaction with commercial fisheries, particularly the squid trawl fishery, is posing a considerable risk to the recovery of New Zealand sea lions.

Industry Code of Practice

The industry has developed a voluntary Code of Practice (CoP) for marine mammal interactions. The code originally included a provision that any vessel that catches three or more sea lions will be removed from the fishery so that a review can be undertaken.

In 1997 two vessels caught three or more sea lions, with one vessel catching more than seven. None of these vessels were removed and no review was undertaken. Since the development of sea lion exclusion devices (SLEDs), the CoP has been used to encourage the use of Ministry of Fisheries approved SLEDs. Last season some of the SLEDs used grid bars that were too narrow or too broadly spaced and the escape hatch was either too small, significantly greater than the minimum requirements or of a different shape all together²⁸. The DWG has acknowledged that compliance with the

²⁶ Smith, M. H. and Baird, S. J. (2006) Estimation of incidental captures of New Zealand sea lions (*Phocarctos hookeri*) in New Zealand fisheries in 2003-04, with particular reference to the SQU 6T squid (*Nototodarus spp.*) trawl fishery. *Draft New Zealand Fisheries Assessment Report presented at the Aquatic Environment Working Group*, 1 September 2006.

²⁷ Roe, W. (2006) Identification of marine mammals captured in New Zealand fisheries, 2005-2006. *Interim report to Aquatic Environment working Group*, September 2006.

²⁸ Middleton, D. A. J., Lydon, G and Cawthron, M. (2006) SLED measurements and sea lion captures observed in the 2006 squid fishery. *Seafood Industry Council*. Report prepared for the Deepwater Group Ltd, 16 September 2006.

SLED specifications and the CoP has been inconsistent and that they want to ensure that all vessels use approved SLEDs in future (pers. comms DWG).

A changing fishery

At the Aquatic Environment Working Group (AEWG) on the 1st September this year, it was noted that there have been a number of substantial changes to fishing practises in the squid fishery over the last few years. SLEDs are now used on almost all vessels and there has been an increase in tow duration. Independent studies have shown that both of these factors have been significant contributors to the bycatch of sea lions, particularly for females^{29, 30}.

One explanation for increased tow duration is that some vessels, particularly Korean chartered vessels, travel at slow speeds and so require a longer time to safely haul in the nets. However, a more pessimistic view would be that the fishery has adopted the practise to get around a key loophole in current management practises. The number of sea lion by-kills is calculated by multiplying a predetermined 'strike rate' by the number of tows conducted. The possible closure of the fishery is therefore dependent on the number of tows that can occur before the fisheries related mortality limit is reached. By increasing the duration of the tows the fishery can catch more squid. However, the longer tows appear to be capturing more sea lions but this is not reflected in the by-kill estimates.

Though sea lion deaths were recorded in the first experimental squid trawls undertaken near the Auckland Islands in 1978, sea lions are still referred to as an "accidental bycatch" of the squid fishery. As clearly discussed, although fisheries may not intend to catch sea lions, the bycatch and death of sea lions is an inevitable consequence of trawling near the Auckland Islands. The fact that there is an allowed sea lion catch limit alone disputes the argument that sea lions are "accidentally" caught by fisheries.

²⁹ Smith, M. H. and Baird, S. J. (2005) Factors that may influence the level of incidental mortality of New Zealand sea lions (*Phocartos hookeri*) in the squid (*Notodarus spp.*) trawl fishery in SQU 6T. *Draft New Zealand Fisheries Assessment Report 2005/20*, March 2005.

³⁰ Abraham, E. (2006) Evaluating methods for estimating the incidental capture of New Zealand sea lions. *Draft Ministry of Fisheries Report for Project ENV200502/2 presented at the Aquatic Environment Working Group*, 1 September 2006.

3. Current Management of the Sea Lion Populations

3.1 Legislation

The mortality of New Zealand sea lions in fisheries should be managed by the Minister of Conservation. However, because there is still no formalized Population Management Plan (PMP) under the Marine Mammals Protection Act 1978, sea lion bycatch is currently managed by the Minister of Fisheries.

The Minister of Fisheries is required to manage the bycatch of sea lions under the following legislative obligations:

3.1.1 International Obligations

The following international agreements are applicable to the management of sea lion bycatch in New Zealand fisheries:

Agreements to adopt the ecosystem approach to fisheries management by adequately protecting associated ecosystem structure, function and associated species:

FAO Code of Conduct for Responsible Fisheries – sections 6.6, 6.7, 7.2.2(d) and 7.2.2(f);

UN Fish Stocks Agreement – Articles 5(e), 5(f), 5(g) and 6.1;

UN Convention on the Law of the Sea – Articles 61 and 192.

Agreements to allow the recovery of at risk species:

Convention on Biological Diversity – including sections 8(f), 8(k) and 9(c).

Agreements to apply the precautionary principle:

FAO Code of Conduct for Responsible Fisheries – section 7.5.

UN Fish Stocks Agreement – Article 6.

In addition to direct international obligations to protect the New Zealand sea lion, the Minister must have regard for the fact that the Auckland Islands and surrounding 12 nautical miles is a designated World Heritage Area. One of the primary reasons for this designation is the status of the NZ sea lions.

3.1.2 National Obligations

The bycatch of NZ sea lions is managed by the Marine Mammals Protection Act 1978 and the Fisheries Act 1996. Since 1 October 1996 new provisions were added to the Marine Mammals Protection Act that allow the Minister of Conservation to develop a Population Management Plan (PMP) for protected species at risk from fisheries. Although no plan currently exists for any species, the sea lion PMP has been drafted and includes setting a Maximum Allowable Level of Fishing Related Mortality (MALFiRM). As the PMP is not yet formalized, the mortality of NZ sea lions for the 2006-07 fishing season is determined under the Fisheries Act 1996 and managed under an Operational Plan written by the Ministry of Fisheries.

The Fisheries Act 1996 has within it provisions to control the by-catch of protected species such as the New Zealand sea lion:

Purpose

Section 8 of the Act describes the purpose as being to provide for the **utilisation of fisheries resources while ensuring sustainability**. The first part of the definition for ensuring sustainability refers to the fisheries resource:

Maintaining the potential of fisheries resources to meet the reasonably foreseeable needs of future generations - Section 8(2a).

The second definition of ensuring sustainability in section 8 of the Act is:

Avoiding, remedying, or mitigating any adverse effects of fishing on the aquatic environment - Section 8(2b).

Environmental Obligations

The fisheries Act specifies under section 9 that the following shall be taken into account:

- (a) Associated or dependent species should be maintained above a level that ensures their long-term viability*
- (b) Biological diversity of the aquatic environment should be maintained*
- (c) Habitat of particular significance for fisheries management should be protected – section 9(c)*

Information Obligations

In relation to the utilisation of fisheries resources or ensuring sustainability, section 10 of the Act requires that:

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

Sustainability Obligations

When setting sustainability measures in terms of interaction of the squid fishery with NZ sea lions, the Fisheries Act requires the following to be taken into account:

“Any effects of fishing on any stock and the aquatic environment” – section 11(1a).

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

Also, the Minister may:

“prohibit all or any fishing or fishing methods in an area.....

for the purpose of ensuring that any limit on fishing-related mortality is not exceeded” – section 15(5b).

Forest and Bird regards that current management of the NZ sea lion does not adequately reflect many of the above legislative obligations.

3.2 Sea Lion Catch Limit

In 1992, in an effort to limit the impact of the squid (SQU) 6T trawl fishery on sea lions, a catch limit or fishing related mortality limit (FRML) of sea lions was set by the government on the basis of draft guidelines from the United States National Marine Fisheries Service⁵. This catch limit is applied only to the SQU 6T fishery, despite sea lions being caught in other fisheries (see Table 2, p.8).

The number of sea lion caught as bycatch and landed on board vessels is monitored by Ministry of Fisheries (M-Fish) observers. M-Fish (previously MAF) has had observer coverage on commercial vessels since 1988. During 1997 – 2000, the Ministry had observer coverage on 25% of the SQU 6T fleet. In 2001, observer coverage was raised to 100% following concern over bycatch issues. It was subsequently decreased the following year to 26% and has remained at around this low level ever since. This is a direct result of funding availability.

The number of sea lions caught as bycatch and landed on trawling vessels is monitored by on board observers. This value has been used to estimate the number caught in the fishery as a whole. Once the FRML is reached, the fishery is closed. The squid fishery has exceeded the FRML seven times over the last 13 years and has been closed early a total of six times as a result.

Monitoring of the FRML is now based on calculations using a pre-determined strike rate and the number of tows reported by the fishery:

$$(\text{number of tows} / 100) \times \text{strike rate}$$

3.2.1 Strike Rate Calculation

Many different variables may influence the rate at which sea lions are caught in fishing operations²⁹. Before the 2003-04 season, fishing related mortality was monitored by in-season estimation of sea lion captures based on industry collected data that included data from observed tows and captures²⁶.

The current model used to estimate sea lion strike rate is based on the average of the actual strike rate estimated during seven fishing seasons (1996/97 to 2002/03)¹⁷. This gives a strike rate of **5.3** sea lions per 100 tows (5.3%). As this method averages the trends over a relatively long time period, it effectively hides the impacts of recent changes in fisheries management, SLED use and increased tow length or tow duration. As pointed out by the Ministry of Fisheries, using this historical average may be underestimating the actual strike rate and associated estimate of sea lion mortality¹⁷.

A new model is currently being developed by NIWA scientists that addresses multiple factors rather than relying purely on observed tows²⁶. It allows for correction of

differences in capture rate between observed and unobserved tows plus random vessel effects.

At the AEWG on the 1st September this year MFish, DOC, NIWA scientists and ENGOs all agreed that this model, using data from the last 5 years up to 2004, provided the best available information for estimating strike rate as it was more representative of recent fisheries management practises. The strike rate from this model is **5.81** sea lions per 100 tows (5.81%), which still lies within the historical observed range (1.3 to 11%). Failure to adopt this strike rate would therefore contravene section 10 of the Fisheries Act.

Fishing industry representatives at the AEWG did not support the new strike rate model and believed that the original model is most suited as it relies on more observations of captures, when SLEDs were not in place. This argument is weak given that SLEDs are now used by every vessel and that this practise considerably changes the ability of observers to record sea lion mortality (discussed in section 3.2.2).

The previous strike rate value of 5.3% should therefore be replaced this season with the new estimate of 5.81% as it is more applicable to current fishing practises. In addition, as supported by the AEWG, this new model, using 2005/06 data, should be further developed and utilised for future monitoring of the FRML.

3.2.2 Calculation of Fishing Related Mortality Limit

Over last few years, the fishing related mortality limit (FRML) has been increased dramatically from an average of 66 sea lions for seasons 1991/92 to 2002/03, to last years' limit of 150 sea lions (Figure 3).

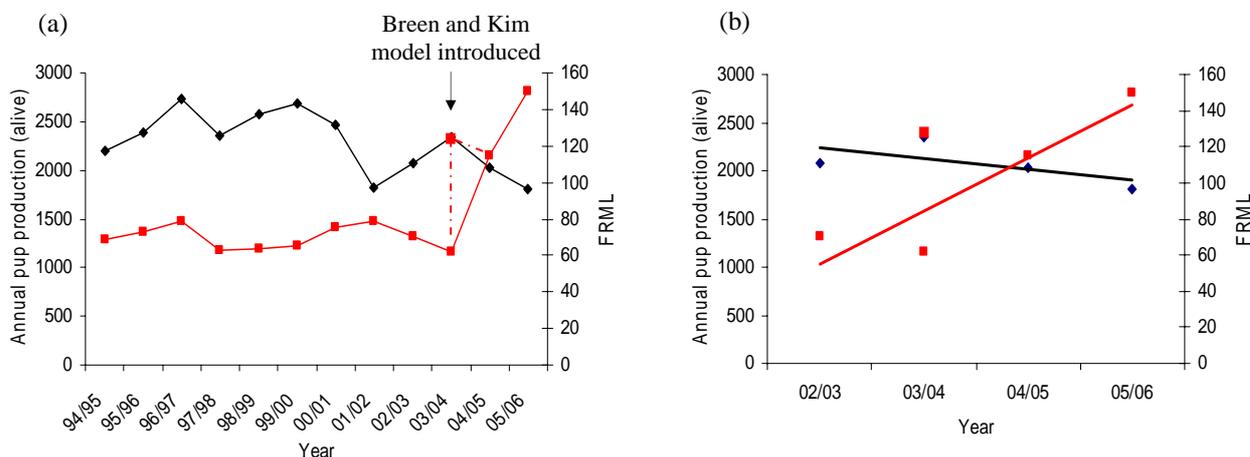


Figure 3. Conflicting management practices: decline in annual pup production (animals observed alive – black data points) versus massive increases in sea lion catch limit (FRML – red data points) since the 1994-95 fishing season (a) and over the last four seasons (b). (In the 2003/04 fishing year, a legal action by the fishery resulted in an effective increase of the FRML from 62 to 124 sea lions.)

One of the difficulties in estimating the FRML is that the number of the pristine abundance and distribution of sea lions is unknown. For this reason, models have been developed that incorporate known information and predict population change depending on fishing related mortality.

One of the primary problems with establishing models for calculating a FRML is the limited observer coverage and the need to extrapolate observed data to provide a fleet-wide estimate of sea lion mortality. Since the introduction of SLEDs, the estimation problem has been made more difficult - sea lions escaping the nets mean that there are less direct observations on which to base estimates³⁰. Moreover, as the survivability of sea lions escaping the nets is unknown, mortality estimates are even more uncertain.

It is essential that management models facilitate management decisions despite large uncertainties and that such models must be based on parameters that can be estimated readily, should clearly account for uncertainty, and should be simple to understand and implement³¹.

3.2.2.1 The Breen and Kim model

The Breen and Kim model is based on a model created and contracted by the fishing industry in the late 1990s. Further work was done on the model by Mark Maunder, Paul Breen and Susan Kim.

The model has developed into the Breen and Kim model and has been applied in the Operational Plan since 2004. It is fitted to updated pup production estimates and to six other sets of population data from unpublished studies conducted by the Department of Conservation (DOC)³². It also incorporates 34 different parameters on sea lions. However, since the decision to accept this model as the best approach there has been substantial concern raised with the model and its application to the management and recovery of a threatened marine mammal population.

Some of the critical concerns raised include those noted by an independent review of sea lion modelling approaches:

“If the data is too sparse or lacking in information in some parameters, it is possible that this approach can become a ‘black box’ where it is unclear why we obtain certain values for the estimates, especially where they appear to contradict our current knowledge.

There are obvious problems with the estimation of some parameters of the model. Standard diagnostics for this type of Bayesian estimation (MCMC) suggest that the model could be trying to do too much with the data. Breen and Kim (2004) refer to this problem and state that a stock assessment would proceed differently. It is unclear what they are referring to here, but it could be taken to imply that what matters is the robustness of the comparison between fishing rules rather than obtaining a model that fits the data better (although the latter is clearly desirable).”³³

³¹ Taylor, B. L., Wade, P. R., De Master, D. P and Barlow, J. (2000) Incorporating uncertainty into management models for marine mammals. *Conservation Biology*, 14(5): 1243-1252.

³² Breen, P. A. and Kim, S. W. (2006) Exploring alternative management procedures for controlling bycatch of Hooker's sea lions in the SQU 6T arrow squid fishery. *Final Research Report for Ministry of Fisheries Research Project MOF2002/03L, Objective 3 Revision 5*. National Institute of Water and Atmospheric Research, 3 February 2006.

³³ Fletcher, D. (2004) Review of modelling approaches for the New Zealand sea lion PMP. *Proteus Wildlife Research Consultants*, 8 November 2004.

At the AEWG in September this year, some of the concerns raised by critics have indeed been acknowledged by the modellers. In his presentation to the group, Paul Breen highlighted 11 different uncertainties in the model. These uncertainties and limitations of the Breen and Kim model noted by its critics include:

- 1) The model has not been updated since 2003 to incorporate more recent data and older data not made available in 2003 – recent significant changes in the fishery such as SLED use and increased tow duration are therefore not accounted for, nor is data showing a decline in pup production;
- 2) There is a mismatch between model structure and available data - does not use data on late season pup mortality and hence there is a mismatch between current population size and the model's predictions;
- 3) The model does not include pup deaths when pregnant females are killed in the fishery;
- 4) There is considerable uncertainty in the model about current population size and how close the population is to carrying capacity;
- 5) Poor ability to estimate key parameters such as population growth rate, hence failure to detect the low 2006 pup count;
- 6) Assumes dynamics among the four rookeries are homogenous or that loss of sea lions around the Auckland Islands is having no effect on other populations - this is unlikely to be realistic;
- 7) The model assumes that the number of sea lions killed is perfectly known, when it is actually highly uncertain;
- 8) Only accounts for observation error, when a broad spectrum of errors are involved – therefore underestimates risk;
- 9) Data gaps between years;
- 10) Only the SQU 6T fishery is modelled, despite several other fisheries also reporting sea lion bycatch, some within the Auckland Islands area;
- 11) The model is based on the assumption that each rule will be applied consistently for 100 years;
- 12) The rules leading to the higher bycatch quotas are not reliable.

It is clear that the model has a number of unusual and unsuitable features. For example the way it deals with survival rates result in underestimating environmental variability in survival and underestimating the impact of bycatch in fisheries on the population as a whole. There are a dozen or so ways to model survival rates, and this is the odd one out. This feature has been in the model since its early development. It appears not to have been corrected.

In order to effectively test if management measures are sufficiently precautionary to allow a viable and stable population of sea lions, if not recovery, data on the whole population of sea lions must be taken into account. The Breen-Kim model only includes the Auckland Islands population and excludes the mainland numbers. The efficiency of the model as a management tool is therefore weakened.

The model is effectively 'testing' the effect of different levels of bycatch and waiting for a population response. This is extremely dangerous as if you discover the decision was wrong, it could have already done serious damage to the sea lion population. For example, if a population is declining by 5% per year and it takes 10 years to detect a statistically significant decline, the population may have declined to around 50% of its original level before corrective management action is taken.

Since the introduction of the model, the FRML has dramatically increased and at the same time a pattern of decline in the population of sea lions has been observed (Figure 3, p.15).

At the AEWG in September, it was outlined that the Cusp Rule (in effect the maximum number of sea lions that the model assumes can be killed before the population crashes) and possibly other higher rules were no longer valid as they could not meet the sustainability criteria. In the last year the Minister of Fisheries has repeatedly quoted the 550 sea lion FRML as the upper limit of biologically acceptable bycatch and evidence that he has dramatically compromised squid utilisation for sustainability of sea lion populations^{34, 35, 36}. He did so despite the Court of Appeal noting in 2004 that adoption of such a value was not appropriate³⁷.

Although consensus was reached at the AEWG that the Breen and Kim model needed to be updated, there was neither detailed discussion nor consensus on which model was the best available approach and should be adopted for the forthcoming fishing season.

Forest and Bird and other members of the AEWG regard that given the acknowledged limitations to the Breen and Kim model and the current status of the NZ sea lion population, the Breen and Kim approach is not the best approach at this time.

3.2.2.2 The Potential Biological Removal model

The Potential Biological Removal (PBR) model was utilised and drafted according to guidelines from the United States National Marine Fisheries Service and was used to set an FRML in the New Zealand squid fishery up until 2004.

Wade (1998)³⁸ developed this model after testing it, under a range of scenarios that were deliberately chosen to ensure that it was robust to some of the uncertainties inherently affecting marine mammals²⁶. Although the Breen and Kim model does use a wide variety of available data, this data is minimal at present, hence the multitude of limitations currently faced by the Breen and Kim model. The PBR model in contrast is designed to be robust even in data poor situations.

The Breen and Kim model is clearly inadequate in its current form for use as the basis for management decisions concerning the well-being of a threatened marine mammal that is one of the world's rarest sea lion species.

International fisheries management agreements (*FAO Code of Conduct for Responsible Fisheries* – section 7.5 and *UN Fish Stocks Agreement* – Article 6) and national legislation (section 10 of the Fisheries Act) plus policy statements throughout government agencies, stipulate that caution must be exerted when information is uncertain, unreliable, or inadequate - the Precautionary Principle.

³⁴ Minister of Fisheries (2006) Letter to Dr Peter Maddison, Forest and Bird National President, 18 July 2006.

³⁵ Minister of Fisheries (2006) Letter to stakeholders: The 2005-06 southern squid trawl (SQU 6T) fishery operational plan, 10 January 2006.

³⁶ Minister of Fisheries (2006) Letter to Mr Elwell-Sutton, 9 August 2006.

³⁷ Court of Appeal (2004) *Squid fishery Management Company Limited v The Minister of Fisheries*, Wellington, CIV-2003-485-2706, 13 July 2004

³⁸ Wade, P. R. (1998) Calculating limits to the allowable human-caused mortality of cetaceans and pinnipeds. *Marine Mammal Science*, 14: 1-37.

Adoption of the PBR model follows the precautionary principle and utilises transparent parameters that are statistically robust. Forest and Bird regards that given the limitations to the Breen and Kim model and the current status of the NZ sea lion population, **the PBR approach is the best approach at this time.**

3.2.3 Application of the FRML

The delay in reporting sea lion bycatch and closure of the fishery has resulted in the FRMLs being exceeded seven times in the last 15 years (Table 1, p8). In addition, legal action by the fishing industry has forced increases in the FRML and the re-opening of the fishery after closure. On 22nd March 2004, for example, the SQU6T fishery was closed having reached the FRML of 62 sea lions, yet in April 2004 a Court of Appeal ruling allowed for continued fishing and an FRML of 124 sea lions¹⁷.

Uncertainty in the applied models, weak enforcement of management measures and continued decline of the sea lion population illustrate that current application of an FRML is not adequately protecting the New Zealand sea lion.

3.3 Sea Lion Exclusion Devices

Despite initially opposing research by the Department of Conservation to develop a seal exclusion device in 1992, the squid fishing industry has subsequently installed sea lion exclusion devices (SLEDs) on all vessels in the fishery. Development of SLEDs is ongoing and highly problematic.

The SLEDs are designed to prevent sea lions traveling to the bottom of the net (cod-end) and to allow them to escape via a hatch in the roof of the net (Figure 4).

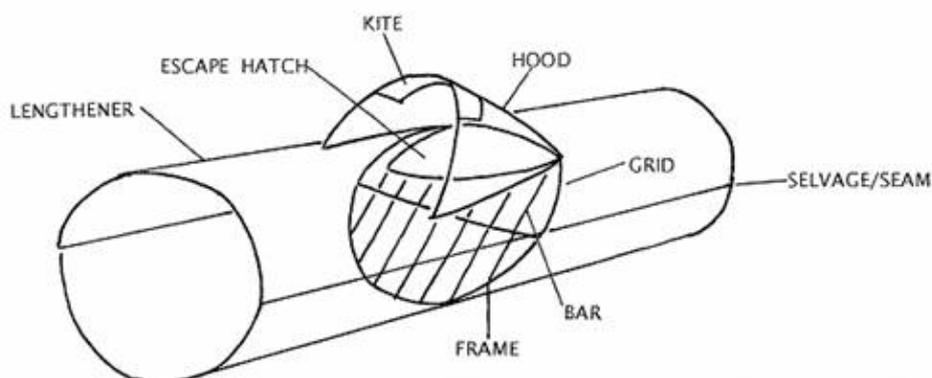


Figure 4. Sea lion excluder device (SLED) design aimed to prevent sea lions reaching the cod-end of the net and to allow them to exit via an escape hatch³⁹.

It is unclear, however, whether the device works efficiently. Results to date appear to show a decline in the number of sea lions observed landed as bycatch following being caught and drowned in the trawl nets. This would suggest that a number of sea lions entering the nets

³⁹ Enfocus (2006) SLED efficacy and the survivability of sea lions escaping via SLEDs in the New Zealand squid 6T fishery. *Working Group Report to May 2006*, 31 May 2006.

may be ejected via the SLED escape hatch. However, the primary concern is how many of these sea lions survive being ejected.

Research on SLED efficacy

SLED design has been developed at the Napier Marine Aquarium. Initial trials of the SLED on operational squid trawl nets in 2001 and 2002 resulted in sea lions suffering life-threatening injuries. The 2001 autopsy results showed:

- 90% of animals had heart damage consistent with severe acute stress/asphyxiation.
- 76% of 38 animals had blunt trauma.
- 58% had trauma injuries which would have compromised survival.
- Properties of the SLED increased chances of life threatening trauma.
- At least 1 of the 3 animals deemed to have survived based on video footage had severe trauma injuries which would have compromised survival.

The results also indicated that the SLED did not always work as proposed and resulted in a significant number of failed ejections of sea lions from the net.

Results from the 2002 autopsies revealed that 100% of those autopsied (20 animals) had evidence of blunt trauma. It also showed that 80% of animals in nets with a SLED suffered trauma injuries that would compromise survival.

If the SLEDs eject mortally injured sea lions, but these animals are then not counted in any limits on sea lion deaths, the SLEDs may be having the opposite impact on sea lion populations than intended. While design changes may improve the SLED it is unclear whether this will be successful. The squid (SQU) 6T fishery is still killing a significant number of sea lions.

In the latest season (2005/06) 16 sea lions were recorded as having been recovered on board vessels. Using a model based on number of sea lion deaths per 100 tows, the end-of-season fishing related mortality was estimated at 110 individuals. Of the observed dead sea lions recorded, five captures were inadequately documented, and of the 11 documented sea lion deaths, one was found in the cod-end and so had passed through the bars of the SLED, two were recovered from the hood of the SLED and the remaining eight were recovered from in front of the grid¹⁷.

Research on SLED compliance shows a number of vessels were not using the improved specifications established by the SLED working group in October 2005. A total of five vessels in the fleet of 35 were identified as using SLEDs with dimensions different from those specified in the Operational Plan¹⁷. Some of the SLEDs being used had grid bars that were too narrow or too broadly spaced, the escape hatch was either too small or significantly greater than minimum requirements or of a different shape all together²⁸.

The SLED efficacy programme is still lacking robust research on the bycatch of sea lions in the SQU6T fishery and in particular the survivability of sea lions with and without SLEDs in the trawl nets. Without having a direct comparison of trawls without SLEDs, the efficacy of the mitigation measure cannot be determined.

Video trials in the 2006/07 season are hoped to allow a better understanding of sea lion interaction with the SLEDs so that strike and ejection rate can be better estimated. However, there is still some question about the value of the research for sea lion conservation. The fishing industry is primarily concerned about the amount of stock lost via the escape hatch, while the survivability of sea lions exiting the nets will not be assessed.

SLED Discount Factor

Despite clear controversy over the efficiency of the SLEDs, the Ministry of Fisheries currently offers an incentive to use them by applying a discount on the pre-determined strike rate. The SLED discount factor is currently set at 20% on the assumption that 20% of sea lions passing through the escape hatch survive. It is based on 2003 necropsy findings of seven sea lions recovered from the only SLED trails with the escape hatch tied-down. Use of the SLED discount factor has the effect of increasing the FRML by 20% in relation to fishing effort⁵ or, based on a 5.3% predetermined strike rate, lowers the effective strike rate to 4.24%.

Vessels that do not use SLEDs or do not comply with approved SLED specifications, are not meant to receive the discount factor. However, at the SLED working group on 10th October 2006, the Ministry of Fisheries outlined that withdrawal of the discount factor was not applied across all non-compliant vessels in the 2005/06 fishing year.

Given that calculations for the discount factor are statistically unreliable, that compliance and enforcement is not robust and that tows using SLED's are continuing to catch a significant number of sea lions, use of a discount factor cannot be justified at this time.

3.4 Exclusion Zone

In 1986 the government imposed a 12 nautical mile (22km) fishing exclusion zone around the Auckland Islands as a direct response to concern over the bycatch of sea lions and to protect the main breeding populations. In 1994, this effectively became what is now coined the 'Marine Mammal Sanctuary'. More recently, in January 2004, the Motu Maha Marine Reserve was established, further supporting the prohibition of all fishing activities.

Research on the foraging habits of lactating female New Zealand sea lions has shown that their range can extend as far as 188km from their breeding site¹. Of tracked females, the current 12nm exclusion zone did not provide protection for the entire foraging area of any individual.

This research, combined with the continuing bycatch of sea lions in commercial fisheries, illustrates that the current exclusion zone is not sufficiently protecting the Auckland Island New Zealand sea lion populations.

4. Alternative measures that can be implemented

Despite management efforts to mitigate the impacts of fishing on the New Zealand sea lion, legislative obligations are not being fully met, sea lions are still being caught and killed in significant numbers and a declining trend is evident for both pup production and the population as a whole. A robust Population Management Plan is required that supports the growth and expansion of all NZ sea lion populations.

A number of additional measures are currently available to more effectively mitigate the effects of fishing on the New Zealand sea lion.

4.1 Precautionary Fisheries Practises

As noted in section 2.2.4, there have been a number of substantial changes to fishing practises in the squid fishery over the last few years. Most notably, is the introduction of SLEDs on almost all vessels but also the increase in tow duration. Independent research has shown these parameters to be important factors influencing the level of sea lion bycatch^{29, 30}, particularly for females.

A management requirement that could be easily imposed would be to restrict tow length or tow duration.

Additional findings from research have shown that time of day is important to males and with additional data and analysis, other factors such as turning may prove to be important. In the hoki fishery, to mitigate the capture of New Zealand fur seals, the companies Code of Practice requires that:

“during the course of fishing the vessel must not execute wide turns or changes in direction with the mouth of the net open and near the surface”.

Similar measures could be put in place in the squid fishery, especially considering the DWG Ltd. manages both of these fisheries. Additional measures such as hauling in nets before turns may also help to mitigate bycatch of sea lions.

Further research and co-ordination with vessels is required to explore fisheries mitigation practises. In the interim, however, regulations governing tow duration and length are likely to reduce the bycatch of sea lions.

4.2 Extension of the Marine Mammal Sanctuary

The existing Marine Mammal Sanctuary (MMS) excludes fishing from within 12 nautical miles (22km) of the Auckland Islands. Given that sea lions are continuing to be caught in significant numbers by the squid fishery and by other commercial fisheries in the area, the current MMS is not sufficient to protect the NZ sea lion. Given that over 90% of the breeding population of sea lions are resident around the Auckland Islands, it is critical that management efforts are adequate to reduce the impacts of fishing and to allow these concentrated and vulnerable populations the chance to recover.

A study tracking foraging females from Enderby Island suggests that if the current MMS was extended to 50km, it would entirely protect 31% of female's foraging locations¹. However, to fully protect all of the foraging ranges of Enderby Island females, the MMS would need to be

extended to 100km. As there is high variability in female foraging ranges and distance from nearest rookery has been found to be an important factor contributing to the bycatch of sea lions females^{29, 30}, only large protected areas would be sufficient to cover all or at least the majority of these foraging areas¹.

The current 20km marine mammal sanctuary around the Auckland Islands therefore needs to be extended to offer full protection to sea lions and allow populations the chance to recover. Although extension to 100km would cover all sea lions, additional information on foraging ranges and MMS protection released under the Official Information Act shows that extension to the continental shelf edge along the 500m contour would sufficiently protect most foraging female sea lions (Figure 5).

(a) Current Marine Mammal Sanctuary – 12/22km

(b) Entire Shelf along 500m contour

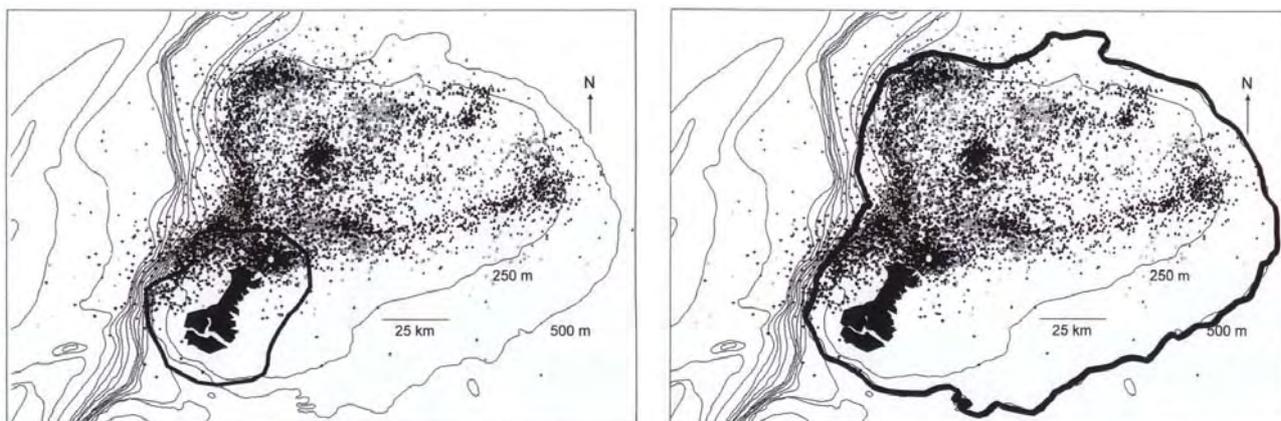


Figure 5. Distribution of foraging female sea lions in 2002, 2003 and 2004 (dots) and the degree of protection offered by the Marine Mammal Sanctuary (black line) currently in place (a) and if it were extended to the 500m contour continental shelf edge (b). (Images obtained under the Official Information Act)

Extension of the MMS to the shelf edge would have considerable impacts on the squid trawl fishery in the SQU 6T fishing area, though not in other areas. For this reason, the terms of the marine mammal sanctuary could be negotiated. For example, other forms of squid fishing such as jigging could still be allowed in the sanctuary, as jigging poses virtually no threat to marine mammals. Jigging would, however still be prohibited within 20km of the island as required by the Motu Maha Marine Reserve.

Establishment of sanctuaries around the Campbell Islands should also be considered in order to protect sea lions that breed there.

4.3 Jigging

Forest and Bird has been advocating for the adoption of jigging vessels in place of trawlers by the squid fishery for many years. In response, we have repeatedly been told that jigging is not possible around the Auckland Islands as weather conditions make it too hazardous. However, as presented here, jiggers can and have been successfully used in SQU6T and we advocate that jigging viability is researched thoroughly and that jig vessels in SQU6T be trialled with the support of the Minister, the industry and other governmental agencies.

Jigging is a standard fishing method used to catch squid, which generally relies on fishing at night with the use of bright overhead lights. By illuminating the water either side of the vessel, concentrations of squid are attracted into the shaded area under the vessel where they can be caught (Figure 6). The squid are caught using barbless lures that are continuously lowered and retrieved by jigging machines⁴⁰. Using barbless lures means that as the lures are recovered over the end rollers, the squid fall off into the boat where they are easily collected and rapidly frozen to retain high quality.

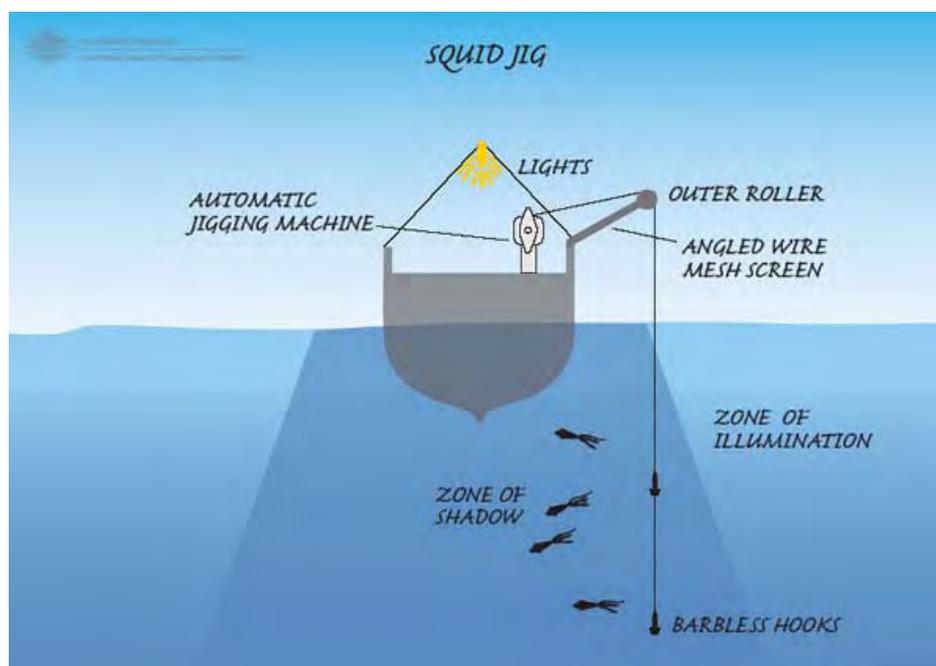


Figure 6. Squid jigging (from Australian Fisheries Management Authority⁴⁰)

Squid jigging has a high specificity for target species and is considered a safer method of fishing that decreases the risk of interaction with marine mammals and seabirds⁴¹. For example, research in the Falkland Islands has shown that competition for resources between jig fisheries and seabirds is low⁴². In the Australian Southern Squid Jig Fishery during April and May 2002, observers reported only 4 birds, only one of which, a little penguin, was hooked by jig gear and was released unharmed⁴³.

Jigging also does none of the damage to the seafloor that trawling is blamed for⁴⁴ and so causes less disruption to ecosystem structure and function – critical for sustaining healthy squid stocks.

Economically, roughly equal quantities of squid are caught by trawling and jigging⁴⁵, so there should be no loss of revenue from switching to jigging. In fact, as the quality of jig-caught squid is higher, it is sold for a premium price over trawl caught squid^{41,44}.

⁴⁰ Australian Fisheries Management Authority (2006) Squid Jig. <http://www.afma.gov.au/information/students/methods/jig.htm>

⁴¹ Australian Fisheries Management Authority (2004) Draft assessment report – southern squid jig fishery. April 2004, p.95.

⁴² Barton, J. (2002) Fisheries and fisheries management in Falkland Islands Conservation Zone. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 12(1): 127-135.

⁴³ Australian Fisheries Management Authority (2006) Southern squid jig fishery: Bycatch Action Plan 2004.

⁴⁴ Barclay, P. (2003) Dancing the squid jig. *Big Fish – an occasional series*, 2: 51-53.

Squid jigging is successfully used in Australia, Japan and the Falkland Islands. Falklands fisheries policy has conservation of resources as the primary objective whilst encouraging growth of a domestic fisheries sector. The squid fisheries management, utilising jig vessels, has been successful in conserving squid stocks in the Falklands for over 13.5 years of the fisheries regime.

In Australia, the Southern Squid Jig Fishery operates off the south-east coast, mostly between January and June each year, with the highest catches concentrated in March to April, although it can operate year round⁴⁶ (Figure 7). Bycatch and impacts to threatened species is considered to be low and the high quality squid is marketed overseas in Japan, Korea, Taiwan, Spain and Italy⁴⁶.



Figure 7. Southern Squid Jig Fishery operations (Pink area) in south east Australia⁴⁷.

In the 1970s and 80s, over 200 squid jigging vessels came to fish in the New Zealand EEZ⁴⁸ and accounted for about 4% of the world squid landings in 1989⁴⁵. During this time, jigging **did** occur around the Auckland Islands in the fishing seasons **1979-80**, **1981-82**, **1984-85** and **1989-90**⁴⁵ (Figure 8). The catch rates achieved around the Auckland Islands (3.4 tonnes per day)⁴⁹ were similar to or well above the jig fishery for *Nototodarus sloanni* elsewhere. For example, in 1984-85, the catch per unit effort was 2.5 tonnes per day³. This clearly contradicts the argument that jigging is not possible in SQU6T due to poor sea conditions.

⁴⁵ Gibson, D. J. M. (1995) The New Zealand squid fishery, 1979-93. *New Zealand Fisheries Technical Report No. 42*.

⁴⁶ Australian Government - Department of the Environment and Heritage (2004) Assessment of the ecological sustainability of management arrangements for the Southern Squid Jig Fishery, *November 2004*.

⁴⁷ Australian Fisheries Management Authority (2006) Southern Squid Jig Fishery: At a glance.

http://www.afma.gov.au/fisheries/scallop_squid/squid_jig/at_a_glance.htm

⁴⁸ Ministry of Fisheries (2006) Arrow squid (SQU) (*Nototodarus gouldi*, *N. sloanii*). In: Report from the Fisheries Assessment Plenary, May 2006: stock assessments and yield estimates – Part 1: Albacore to Orange roughy: 67-71.

⁴⁹ Allen, r. L. (1992) Letter to Forest and Bird from MAF, 6 May 1992.

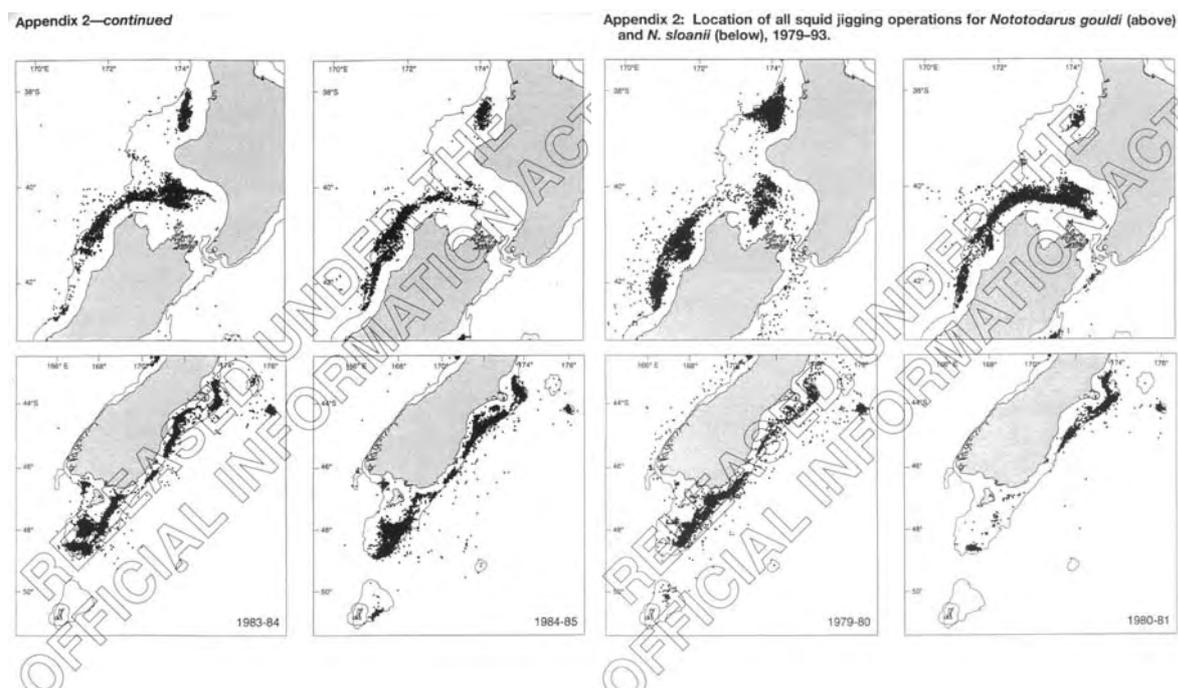


Figure 8. Squid jigging (black dots) in New Zealand in the years 1983-84, 1984-85, 1979-1980 and 1980-81⁴⁵. (Images obtained under the Official Information Act.)

Large wave heights around the Auckland Islands can indeed reach considerable heights. The Ministry of Fisheries provided advice to the Minister in response to an OIA request from Forest and Bird (Ref. JA324 OIA) using satellite data. They argued that in the summer, this data shows wave heights of around 3.0 – 4.0 meters. However, this data and alternative data with similar results shows that such estimates are based on **significant wave height** rather than average wave height. Significant wave height is defined by NIWA as:

“The average wave height of the highest 33% or one-third of ranked wave heights measured or modeled over a given sampling period”⁵⁰.

Data based purely on significant wave height therefore offer a biased assessment of jigging viability around the Auckland Islands. Moreover, other international monitoring of significant sea swell height shows that the Auckland Islands may be similar to areas around the south east of Australia where the Southern Squid Jig Fishery operates (Figure 9).

The argument against jigging around the Auckland Islands was further undermined when a few years ago, a vessel approached the Ministry to jig in SQU6T (per comms Ministry of Fisheries). The Squid Fishery Management Co Ltd, now the DWG Ltd, more recently also expressed an interest in jig fishing in SQU6T once the trawl fishery is closed⁵¹. Both of these expressions of interest, combined with the interest of MFish to conduct jigging trials and the fact that jigging is possible around the Auckland Islands, supports our advocacy work for this practice to be adopted to allow the fishery to continue, but to protect the sea lions.

⁵⁰ NIWA (2006) Physical Hazards Affecting Coastal Margins and the Continental Shelf: Definitions. <http://www.niwascience.co.nz/rc/prog/chaz/intro/def>

⁵¹ E-mail correspondence (2005) Ministry of Fisheries to Richard Cade. Jigging in SQU6T, 18 February 2005. Obtained under OIA (JA 260 OIA)

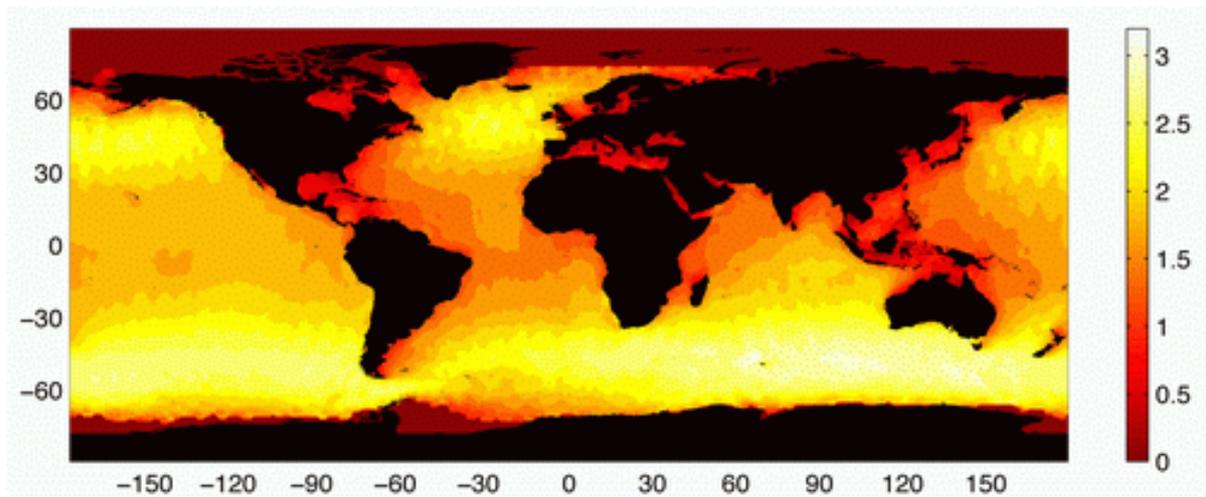


Figure 9. Annual mean significant height of global sea swell in meters⁵² ©ARGOSS

In 2005 the New Zealand Seafood Industry Council reported that research on squid jigging was hoped to revive the fishery⁵³. Forest and Bird is hopeful following discussions with the Ministry of Fisheries that progress can be made on this research and can be extended to include SQU6T.

If the New Zealand government were to support the extension of the Marine Mammal Sanctuary around the Auckland Islands to protect the NZ sea lion and prohibit fishing methods that compromise their survivability, then jigging vessels would become the only acceptable squid-fishery method in this area.

Jigging is a method that would enable the Ministry to demonstrate commitment to “*avoid, remedy and mitigate the effects of fishing*” and allow utilisation of squid resources without the problematic bycatch associated with squid trawl fisheries.

⁵² European Space Agency (2006) Annual Mean Significant Height of Global Sea Swell in meters
http://www.eomd.esa.int/booklets/ibooklet163_3.asp

⁵³ Seafood New Zealand (2005) Research may revive squid jig fishery. Obtained under OIA (JA 260 OIA).

5. Proposal to ‘Save Our Sealions’

The Royal Forest and Bird Protection Society (Inc) was established in 1923 and has campaigned for over 80 years for the protection of New Zealand's native species and the habitats on which they depend.

The constitutional purpose of Forest and Bird is:

“To take all reasonable steps within the power of the Society for the preservation and protection of the indigenous flora and fauna and natural features of New Zealand, for the benefit of the public including future generations.”

The Society has a long history of advocacy for the protection of New Zealand’s marine mammals and has been at the forefront of efforts to protect the New Zealand sea lion.

Forest and Bird does not consider any number of sea lion deaths to be an acceptable consequence of squid fishing. The fisheries-related deaths of these vulnerable marine mammals can and must be eliminated. For this reason, the only precautionary management option that would ensure recovery of the declining New Zealand sea lion population, is to set the FRML close to zero.

In June 2006 Forest and Bird launched a campaign to ‘Save Our Sealions’. Over 18,000 signatures were collected on a petition urging the government to reduce the number of threatened New Zealand sea lions that fishing vessels are allowed to kill in the southern squid fishery each year to close to zero.

Given the alternatives clearly available, Forest and Bird’s advocacy for management of the New Zealand sea lion include:

- Extension of the no-trawl Marine Mammal Sanctuary around the Auckland Islands to the continental shelf edge (500m contour);
- Reduction of fisheries related sea lion mortality close to zero – this should include all fisheries known to interact with sea lion populations;
- Squid jigging within the no-trawl Marine Mammal Sanctuary around the Auckland Islands;
- Establishment of a MMS around the Campbell Islands;
- A robust Population Management Plan that supports the growth and expansion of all NZ sea lion populations.

During the 2006-07 fishing season, the Minister of Fisheries should regulate the squid (SQU6T) fishery to:

- Restrict tow length and duration;
- Increase strike rate to 5.81 per 100 tows;
- Reduce the SLED Discount Factor.