

Unusual mortality of the
New Zealand sea lion,
Phocarctos hookeri,
Auckland Islands,
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REPORT OF A WORKSHOP HELD 8–9 JUNE 1998, WELLINGTON,
AND A CONTINGENCY PLAN FOR FUTURE EVENTS



Department of Conservation
Te Papa Atawhai

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Compiled by Alan Baker

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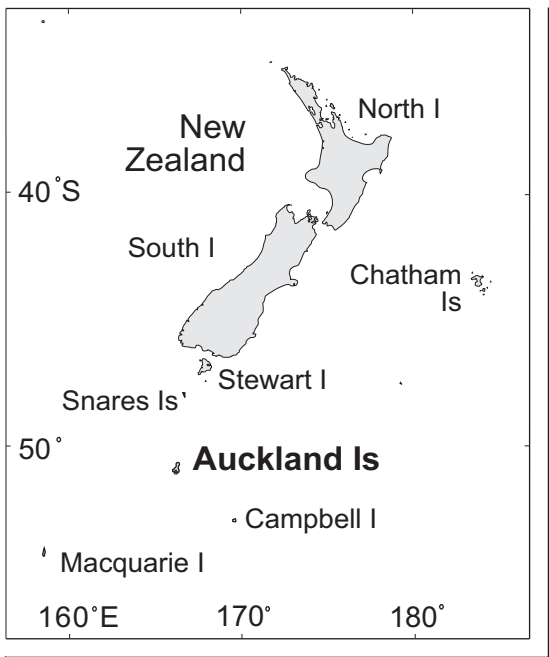
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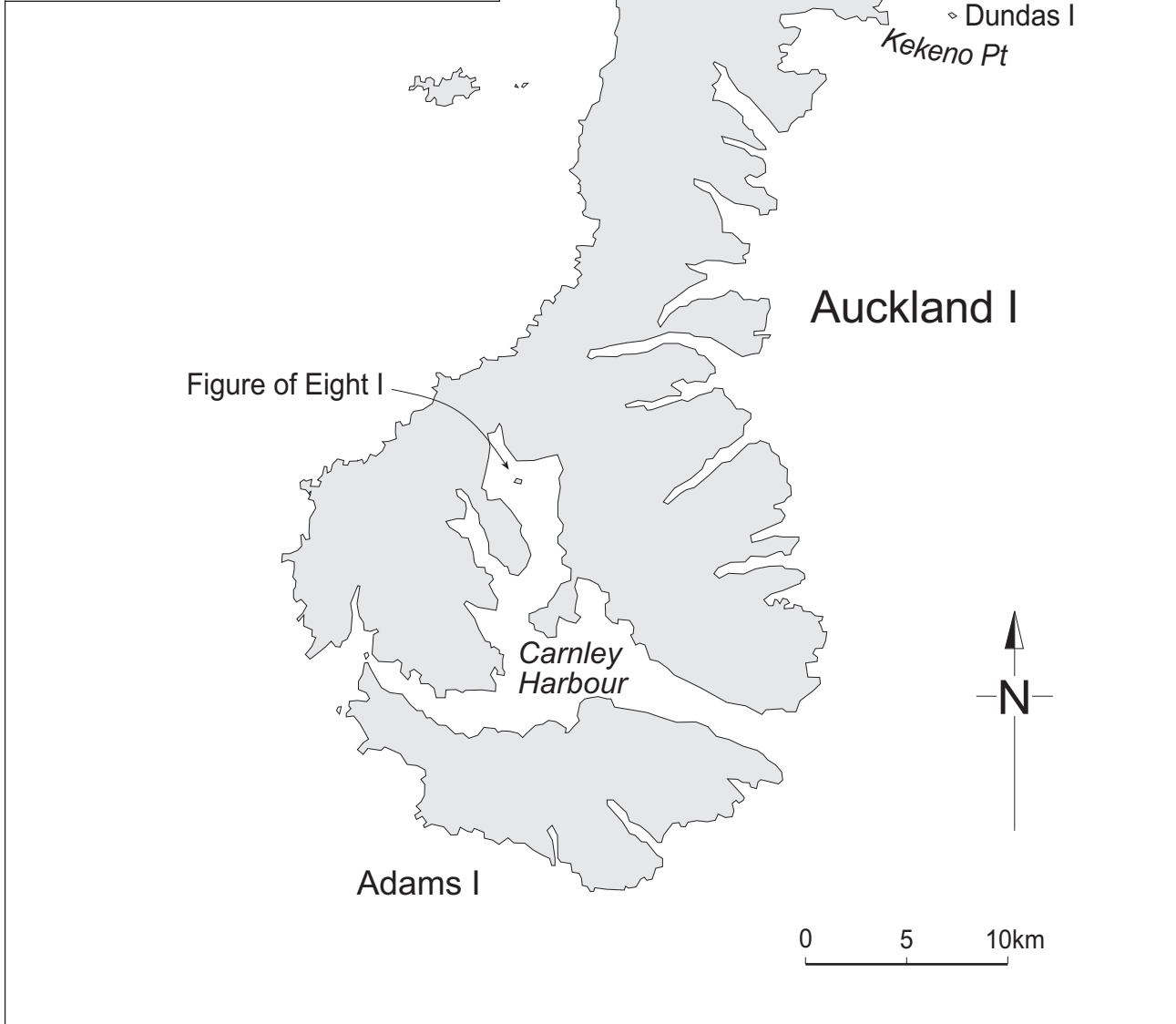
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Part 1. Proceedings of a workshop on unusual mortality of the New Zealand sea lion, *Phocarctos hookeri*, Auckland Islands, January-February 1998; held 8-9 June 1998 in Wellington



Auckland Islands



Workshop overview

Alan Baker

Science & Research Unit, Department of Conservation, Wellington

1. INTRODUCTION

The New Zealand sea lion, *Phocarctos hookeri*, is one of the world's rarest pinnipeds: its total population size is between 11 600 and 15 200 animals. It breeds within a highly localised range on the islands south of New Zealand (Childerhouse and Gales 1998). About 95% of the sea lion pups are born on the Auckland Islands (50°S 166°E), mostly at Sandy Bay, Enderby Island, and on nearby Dundas Island (Fig. 1). Adult males establish territories from late November and pregnant females begin to arrive on rookeries during the first week of December. Most pups are born from early December through mid-January. Mating occurs 7-10 days after the pups are born, and most adult males return to sea by late February. The females forage at sea and return to suckle their young every 24-48 hours. Lactation continues for 8-12 months.

During January and February of 1998, approximately 60% of the sea lion pups and an unknown number of adults died over a 30-day period on Enderby and Dundas Islands. A Department of Conservation (DOC) expedition had arrived at Enderby Island on 13 January 1998 to conduct an annual mark-recapture estimate of sea lion pup production. Conditions there were apparently normal at that stage, with an unusually low level of natural mortality amongst pups (2.3%). Over the next few days mortality levels of 19% to 27% were recorded at various small colonies on Enderby Island and at Figure of Eight Island, but these were within the normal range. On 22 January, however, 36% mortality of pups was found on Dundas island: as this was 2.5 times the normal level, and the dead pups were in poor condition, it was regarded as unusual, although the cause of these deaths was not obvious. Among the possible causes for a mass mortality event in pinnipeds are: viral or bacterial infection, biotoxin poisoning, oil or chemical pollution, some natural imbalance in environmental conditions, or adverse human interaction.

Over the following week, further pup and some adult mortalities were observed on Enderby Island, and large swellings were found on the throats of some live adults. On 27 January, the Southland Conservancy was notified that an unusual mortality event was underway on the Auckland Islands, and a helicopter was despatched from Invercargill to obtain sea lion samples for analysis. Because the Auckland Islands are remote and have no permanent facilities, all scientific equipment must be carried to and from the islands.

Samples from three adult females and four pups were returned to the mainland on 29 January and sent to Massey University's Institute of Veterinary, Animal and Biomedical Sciences. Massey University staff began testing the samples for the presence of bacteria and viruses, and sub-samples for additional study were sent to Auckland University; the New Zealand

Ministry of Agriculture's Central Animal Health Laboratory; the Institute of Virology, Erasmus University Hospital, Rotterdam; and the Foreign Animal Diseases Diagnostic Laboratory, US Department of Agriculture, New York. Tissue samples were also provided to the Toxicology and Food Safety Laboratory at the New Zealand Pastoral Agriculture Research Institute (AgResearch), Ruakura, for marine biotoxin analysis; and to the New Zealand Institute of Environmental Science and Research (ESR), Lower Hutt, to determine the presence of any organochlorine contaminants. A sample of "slime", collected from scampi trawl nets near the Auckland Islands about the time of the mortality event, was examined at the Cawthron Institute, Nelson.

A second suite of sea lion samples, including serum, milk and faeces were sent from the Auckland Islands on 22 February, by which time the sea lion mortality event was over and the DOC expedition was returning to the New Zealand mainland.

The event had lasted primarily between about 20 January and 8 February. During this 20-day period, 1606 pups and 74 adults died. Because some adult females would have been at sea foraging, and many of the adult males would have left the islands by January, the total mortality of adults is not known. A female with a partly healed throat lesion was captured in the squid trawl fishery 25 km north of the Auckland Islands on 24 February.

A command structure was set up within DOC to deal with issues surrounding the mortality event. The Southern Regional Office in Christchurch assumed overall control of expenditure, the Southland Conservancy in Invercargill handled operational logistics, the Science & Research Unit in Wellington coordinated scientific aspects, and the External Relations Division in Wellington handled media and stakeholder enquiries and the dissemination of information as it became available.

On 8-9 June 1998, a workshop was held at the DOC Science & Research Unit in Wellington to review all known aspects of the sea lion mortality event, including operational issues and the research undertaken into causative agents. Specialists from the New Zealand agencies involved in the study of samples presented their findings, and reviewed the results of foreign studies. Those papers are included in this workshop report, together with the field history of the event, data on the collection of samples, and a sea lion mortality event contingency plan, which was also discussed at the workshop and developed subsequently.

Based on the comprehensive research results, the workshop participants were unable to attribute the mortality event to any single causative agent, and Dr Pádraig Duignan of Massey University summarised the workshop's general conclusion in his paper as follows:

"The cause of death of many of the sea lions examined was overwhelmingly bacterial infection... Laboratory diagnostic tests... allow the following hypotheses to be proposed:

- (a) The event may have been caused by a previously unknown—or difficult to identify—gram-negative pleomorphic bacterium. This organism may be a highly pathogenic organism in its own right that has been recently introduced into a naive population, or it may be a normal commensal that

became pathogenic because of some change in the normal host/pathogen relationship, swinging the balance in favour of the pathogen.

- (b) Some event predisposed the sea lions to a suite of bacterial infections. This could have been infection by a previously unknown virus, a marine biotoxin, or a drastic environmental change associated with the El Niño/Southern Oscillation phenomenon. There are cogent arguments against the role of viruses or toxins... The role of environmental change is difficult to quantify. However, whether or not it played a primary role in the event, it is likely that it at least played some facilitating role.”

Although this result was less specific than hoped for, the present report should assist in increasing our understanding of the phenomenon; the resulting contingency plan will also improve our ability to react should a similar event arise.

Acknowledgements

The Department of Conservation wishes to thank the many individuals and agencies who offered and rendered assistance during the sea lion mortality event. The international response to news of the event was remarkable, and there were many offers of scientific advice, unpublished information, specialist research facilities, and expert personnel.

Members of the DOC 1998 Auckland Islands sea lion research expedition, who in January found themselves in an unplanned, difficult and stressful situation when the event broke out, did a very commendable job in gathering valuable scientific information and samples, which has resulted in the comprehensive research results reported in these proceedings.

Reference

Childerhouse, S. and Gales, N. 1998. Historical and modern distribution and abundance of the New Zealand sea lion *Phocartos bookeri*. *New Zealand Journal of Zoology* 25: 1-16.

2. PROGRAMME, 8 - 9 JUNE 1998

Purpose: To review all aspects of the 1998 sea lion mortality event, including recognition and duration of the event, epidemiology, sampling and data protocols, logistics, research into causative agents, synthesis of results, and operational matters, so that the Department may learn as much as possible from the event and prepare a contingency plan for any future similar events.

2.1 Day 1: Epidemiology, research, and results

1. Massey University: Review of pinniped mortality events and causes
2. DOC: History of NZ sea lion event: field observations and data, sampling procedures
3. Massey University: Review of results of research on sea lion samples and conclusions drawn: pathology, bacteriology, virology
4. AgResearch: Biotxin analysis
5. ESR: Organochlorine contaminant analysis
6. NIWA: Climatic and ocean conditions around Auckland Islands, 1997/98
7. Discussion

2.2 Day 2: Operational matters and contingency plan

Responsibilities

- *DOC administration* (management, logistics, communication, emergency funding, media, stakeholder and Ministerial liaison), and
- *Coordination* (sampling requirements, selection of testing labs, distribution of samples, provision of scientific health information, collation of results).

Field activities

- Recognition and characterisation of event(s)
- Necropsy examinations
- Sampling and data collection protocols
- Environmental sampling
- Weather and ocean data
- Equipment
- Communication
- Personnel

Future actions and contingency plan

- Winter sea lion sampling expedition
- Contingency plan for similar events in the subantarctic region

Publication of workshop papers

3. PARTICIPANTS

Dr Alan Baker	Science & Research Unit, DOC, Wellington (Coordinator, Sea Lion Mortality Event Science and Workshop Coordinator)
Mr Hugh Best	Science & Research Unit, DOC, Wellington (fur seal biologist)
Mr Andrew Bignell	Manager, External Relations, DOC, Wellington
Mr Reg Blezard	Science & Research Unit (CSL), DOC, Wellington
Mr Andrew Branson	Squid Fishing Company, Wellington
Mr Keith Briden	Southern Regional Office, DOC, Christchurch
Mr Jeremy Carrol	Southland Conservancy, DOC, Invercargill
Mr Martin Cawthorn	Fishery Consultant, Wellington
Mr Simon Childerhouse	Science & Research Unit, DOC, Wellington (sea lion biologist, expedition member)
Dr Steve Dawson	Otago University, Dunedin (cetacean biologist)
Dr Pádraig Duignan	Massey University, Palmerston North (pathologist)
Mr Bruce Dix	Wellington Conservancy, DOC, Wellington (fur seal biologist)
Mr Michael Donoghue	External Relations, DOC, Wellington
Dr Alan Edmonds	General Manager, Science Technology & Information Services, DOC, Wellington (Chair of Workshop Day 1).
Dr Nick Gales	CALM, Perth (sea lion biologist, expedition member)
Dr Ian Garthwaite	AgResearch, Ruakura (toxicologist)
Ms Nadine Gibbs	Massey University, Palmerston North (veterinary student, expedition member)
Ms Gail Higgs	Wellington, Workshop Secretary
Dr Jane Hunter	Massey University, Palmerston North (bacteriologist)
Dr Paul Jones	ESR, Lower Hutt (organochlorine analysis)
Prof. Per Madié	Massey University, Palmerston North (Director, Cetacean Investigation Centre)
Dr Rob Murdoch	NIWA, Wellington (algal blooms)
Mr Ian West	Manager, Conservation Services Levy, Science & Research Unit, DOC, Wellington (Chair of Workshop Day 2).

Field observations and sampling regime

Nick Gales

Conservation and Land Management, Perth

Simon Childerhouse

Science & Research Unit, Department of Conservation, Wellington

1. INTRODUCTION

The sudden die-off of New Zealand sea lions, *Phocarctos bookeri*, at the Auckland Islands in the summer of 1997/98 is a stark reminder of the vulnerability of this species. The primary terrestrial sites where mortalities were recorded were its two major rookeries: sites which account for over 95% of the species' pup production. This event, and the information we derive from it, must serve as a timely reminder of the vulnerable status of the New Zealand sea lion and the need for special protection and a precautionary approach prescribed in a forthcoming Population Management Plan.

The purpose of this summary report is to outline the timing of the die-off, the symptoms observed and the sampling regime used.

The base camp for annual sea lion work by the Department of Conservation (DOC) at the Auckland Island is at Sandy Bay, Enderby Island. Consequently, this site is reported in detail as we were able to work here every day during the event. Dundas Island lies about 9 km to the south of Sandy Bay and is accessible only on calm days with low sea swell. The more spasmodic data collection at Dundas Island reflects this logistical hurdle. Figure of Eight Island and South East Point (aka Pebble Point) on Enderby Island are small colonies and were visited when possible (see map, page 2).

2. QUANTIFICATION OF MORTALITY AND MORBIDITY OF THE EVENT

Mortality is defined as the number of dead animals; morbidity is the state of diseased animals.

Mortality was observed among all age and sex classes of sea lions, albeit at apparently different magnitudes. Clearly, the major determinant of our ability to quantify mortality by age and sex class is our access to a known proportion of any group of animals. Pups are the only age class to which we had full access and for which we can present reasonable estimates of mortality. This access was restricted to the period 13 January 1998 (the date of our arrival) to about 27 January 1998. Thereafter the pups at Sandy Bay started to move into the rata forest behind the beach and may easily have been overlooked during

surveys. Similarly, the pups at Dundas Island started leaving the island with their mothers; a pup tagged at Dundas Island was seen at Sandy Bay on 27 January. Estimates of pup mortality after this date are likely to be biased downwards as our surveys on Dundas Island were restricted to those remaining on the island, and the surveys at Sandy Bay were primarily restricted to pups on the beach or those found nearby in the rata forest. We present our data on pup mortality, morbidity and symptoms in section 2.1.

Reproductive females are the next age class to which we had reasonable access. Females, with a dependent pup, return to the natal site about every two days after foraging at sea and spend a similar period ashore. As there is no discernible diurnal pattern to their arrival and departure, it is reasonable to expect that at least half the number of females will be ashore at any one time (Gales and Mattlin 1997). Naturally, this pattern is masked by factors such as weather, lunar phase and food availability, but it is usual to see between 200 and 400 cows on the beach each day. Note that Gales and Fletcher (in press) report over 200 cows on the beach at Sandy Bay every day between 25 December 1994 and 31 January 1995. After January the cows at Sandy Bay move initially onto the grassy sward behind the beach as well as into the rata forest behind the sward. At about the same time the cows on Dundas Island move to other sites in the rata on the main Auckland Island or various sites around Enderby Island. As a result, evidence of disease among adult females with live pups would usually be clear during December and January of any normal breeding season. We present our data on mortality and symptoms among adult females in section 2.2.

Adult and sub-adult male sea lions are present in moderate numbers during December and start to leave during January. By the time we arrived in mid-January, many males had left. During the mortality event few males were present at the sea lion breeding sites; several dozen had hauled out at various sites away from the breeding locations. The proportion of the total male sex class these animals represent is not known.

Juvenile sea lions are encountered infrequently around the breeding and haul-out locations of the Auckland Islands. Sightings of sick or dead juveniles are thus not able to be quantified in terms of the proportion of the total cohorts. We present our data on mortality and symptoms among juveniles and non-juvenile males in section 2.2 also.

2.1 Mortality, morbidity and symptoms of pups

A summary of the number of dead pups recorded at all Auckland Island rookeries is presented in Table 1. At Sandy Bay and Dundas Island all pup carcasses were collected into piles to avoid recounting. Since 1995 about 10% of pups are usually dead at the time of the mark-recapture experiment. Although there has been no previous effort to measure pup mortality past this date (16 January on Sandy Bay, 21 January on Dundas Island) we have observed few dead pups in previous years after the mark-recapture work. This is in obvious contrast to the 52.6% overall mortality we recorded for the Auckland Island pup production in 1998, much of which occurred in late January and early February (see section 3). We believe that between about 13 and 27 January we had good access to the dead pups and would have counted most that died during that time. 478 pups were tagged at Sandy Bay by 17

January. A further 399 pups were tagged on Dundas Island, where any pups that died close to or below the high water mark would have been washed away. This proportion may have been significant but cannot be quantified. Table 1 clearly demonstrates that Dundas Island was the site of maximum pup mortality. Sandy Bay was also significantly affected. The high level of pup mortality at South East Point is not unusual compared to other years when mortality rates of this order have been recorded. Adult sea lions showing disease symptoms were seen at South East Point. It is not clear if the disease was present or not at Figure of Eight Island. Mortality rates of 22% and <10% have been recorded at this site for the previous two breeding seasons, indicating variable annual rates. There were no animals with symptoms of disease seen at Figure of Eight Island in 1998, but only two visits were made to this site, and both were necessarily short.

There were few clinical signs of disease observed in pups at Sandy Bay. The live pups either appeared healthy, or extremely close to death with few animals showing any external signs. The exception was that about 10 pups at Sandy Bay were apparently paralysed in the hind limbs. Post-mortem examinations showed this paralysis to be associated with an abscess around the hip region (in two pups autopsied). The dead pups were often in good condition (had plenty of fat), although as the mortality event progressed more lean and apparently starving pups were found. Pups that were in extremis (close to death) would typically lie with their mouth slightly open, straining to breathe in a stiff posture with the head bent slightly back. At the height of the event, the death of pups was rapid: the beach was checked for carcasses at least twice each day with both dead and extremely sick animals removed each time. Despite this, more dead pups were found a few hours later.

At Dundas Island more clinical signs were noted among the pups, although many of these may have been secondary. The most typical lesions were small pussy abscesses on the crown of the head and body, pussy eyes and ulceration of the vagina and/or anus. Many of the pup carcasses appeared to be in good condition, although once again, cachectic (extremely malnourished) pups were more evident as the mortality event progressed.

TABLE 1. SUMMARY OF ALL RECORDED SEA LION DEATHS AT THE AUCKLAND ISLANDS, SUMMER 1997/98 AS AT 20 FEBRUARY 1998.

LOCATION	PUPS			DEAD ADULTS	
	ALIVE	DEAD	% DEAD	FEMALES	MALES
Sandy Bay	296	194	>39.6	23	3
Dundas Island	1028	1345	>56.7	13	3
Figure of Eight Island	86	34	28.3	0	0
South East Point	28	23	45.1	17	3
Port Ross	0	0		21	2
TOTAL	1438	1596	52.6	74	11

2.2 Mortality, morbidity and symptoms of non-pup age and sex classes

A summary of the number of females and males (excluding pups) found dead around the Auckland Islands is given in Table 1. The 74 females were found at Sandy Bay, other locations around Enderby Island, the Port Ross area and Dundas Island. There was no systematic search for adult carcasses as their distribution was so wide and many sites are inaccessible for much of the time due to weather. Some carcasses had clearly been washed ashore, whereas other seals had died ashore. The significance of the adult mortalities cannot be determined as adults are widely distributed at this time and forage well offshore. Deaths were almost certainly occurring at sea; it is not possible to estimate their number from those washed ashore and available for counting. An estimate of adult female mortality will be possible, after two or three years of pup production has been monitored to detect any changes in numbers of breeding females. It will never be possible to directly estimate the number of males that may have died in this event. The best-case scenario for mortality among non-pup females is that we found all carcasses and only 74 animals died. This seems unlikely. The worst-case scenario is that each pup that died was as a result of the loss of its mother, and thus at least 1596 reproductive females died. This scenario also seems unlikely as many pups in good condition died (i.e. not from starvation), and some adult females we monitored (as part of a study of foraging ecology) lost their pups, but apparently survived. Actual adult female mortality must lie between these two scenarios.

Symptoms in adult females and males were of three classic types. Dead adults exhibited some, all, or none of the symptoms. The first and most common symptom observed was a swelling in the throat region, typically on the left or right side of the ventral throat. Post-mortem it appeared to involve the salivary gland and be caused by an extensive abscess, diffuse in the tissue surrounding the gland. As the event continued, these throat swellings burst and drained; surviving females appeared to heal well. The second lesion typical of this event was a variable number of discrete, raised swellings about 1 cm in diameter, distributed primarily on the ventral region of the animal. In severely affected animals these lesions spread to the lateral and dorsal aspect. On post-mortem the lesions were firm and filled with purple-coloured cells. No pus was evident although some lesions appeared to have burst on some animals. The third symptom, seen in about six adult animals, was apparent paralysis in the hind limbs, as seen in the pups. We only conducted a post-mortem on one of these animals and found an extensive, diffuse, pus-filled abscess around the head of the femur. The post-mortems revealed no common internal lesions beyond those described above. Further details on the post-mortems conducted are appended to this report (Section 5.2).

3. TIMING AND DURATION OF THE EVENT

The timing and duration of the event is most clearly defined at Sandy Bay, Enderby Island, where we appear to have arrived before the major die-off of sea lion pups. The annual estimate of pup production from mark-recapture

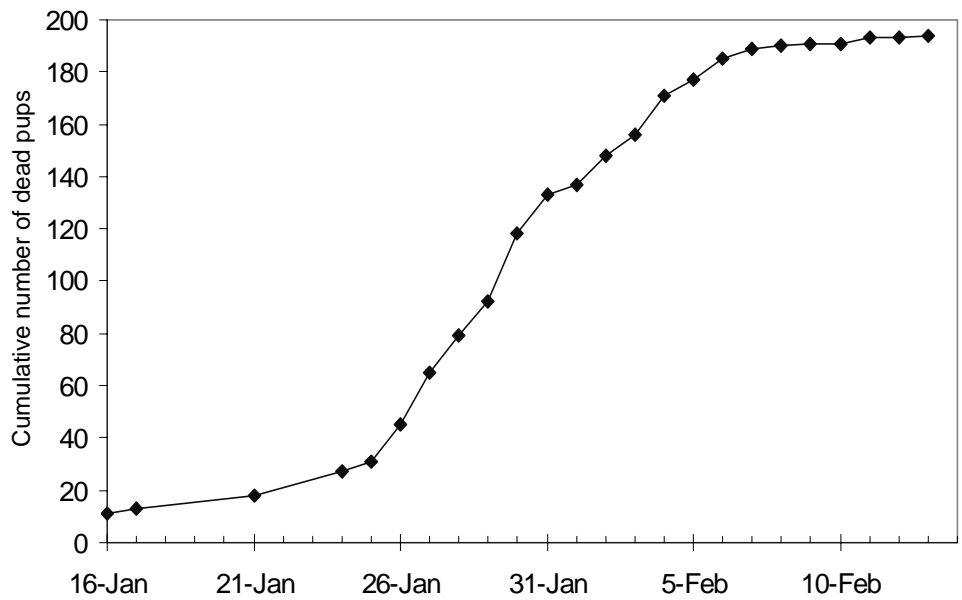


FIGURE 1. CUMULATIVE NUMBER OF DEAD PUPS AT SANDY BAY IN 1998.

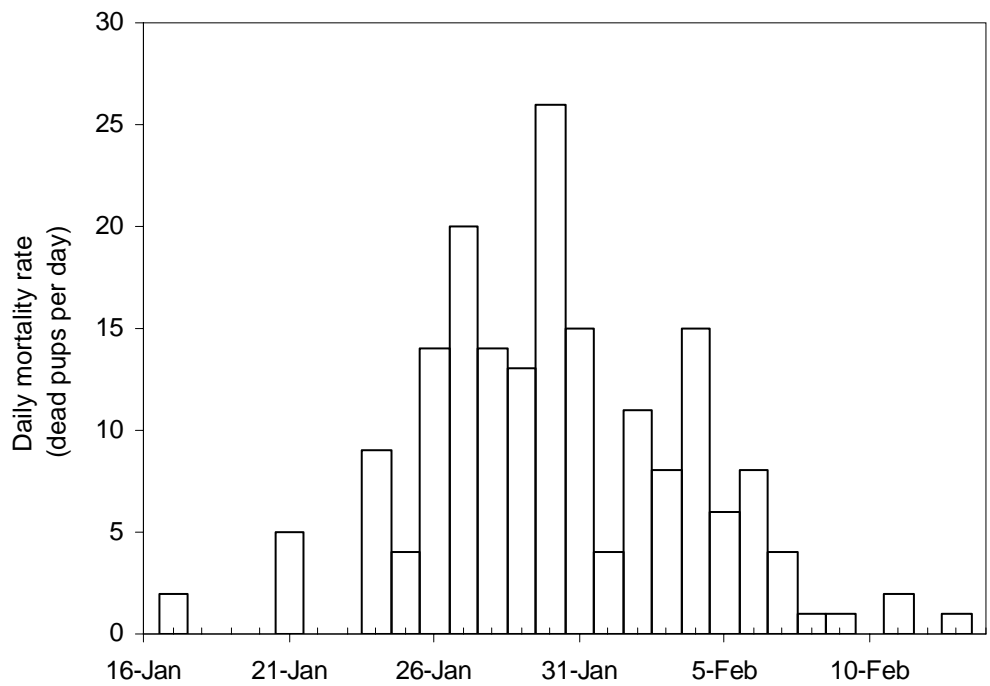


FIGURE 2. DAILY MORTALITY RATE AT SANDY BAY.

was conducted on 16 January. At that time only 11 dead pups were counted and the colony appeared normal. Over the next week, daily pup mortality increased from 2 per day on 16 and 17 January, to 5, 9, 4, 14 and 20 per day over the next five days. At this time we became convinced that a significant mortality event was underway at Enderby Island. Figure 1 shows the cumulative number of dead pups on Sandy Bay.

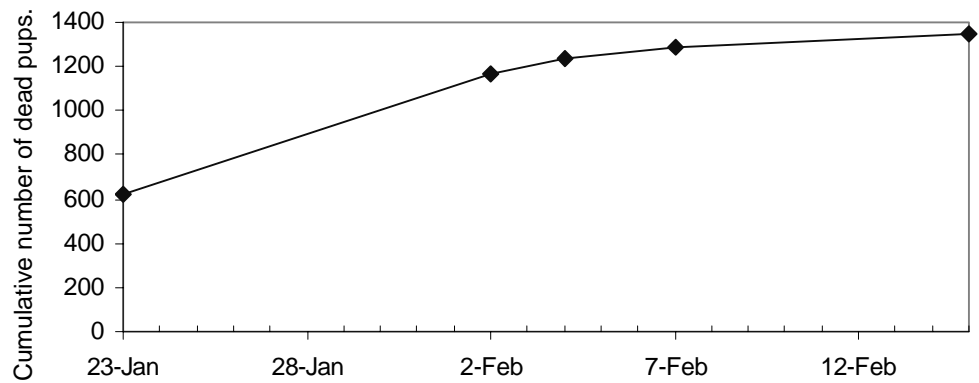


FIGURE 3. CUMULATIVE NUMBER OF DEAD PUPS, DUNDAS ISLAND IN 1998.

Figure 2 shows the number of pups that died each day. Figures 1 and 2 suggest that the event lasted primarily between about 20 January and 8 February, at least in terms of pup deaths at this site. Mortality data are also available for Dundas Island, although the counts were less regular (Figure 3 and Table 2).

Dundas Island was first visited on 21 January to conduct the annual pup production estimate. This is slightly later than in previous years as bad weather prevented us landing earlier. We were immediately struck by the large number of dead pups on the island. These were counted on 23 January: the total of 625 was about three times the normal mortality for this location at this time of year. We did not know if the mortalities were continuing at this time and considered that the deaths may have been due to a limitation in food as a result of El Niño/Southern Oscillation. Based on the level of decay, we estimated that much of the pup mortality had occurred during the week preceding our visit. Our next visit to the island was on 25 and 26 January when we captured cows for age estimation (using teeth sections). Eight of the 34 cows we captured had swellings in the throat region. Our observation of the sudden increase in pup deaths at Sandy Bay and the continuation of pup deaths at Dundas Island indicated that an unusual mortality event was occurring, and we raised the alarm with DOC's Southland Conservancy.

TABLE 2. DAILY MORTALITY RATE OF PUPS AT DUNDAS ISLAND.

DATE	NUMBER OF NEW DEAD PUPS COUNTED	CUMULATIVE NUMBER OF DEAD PUPS	CUMULATIVE % OF DEAD PUPS	DAYS BETWEEN VISITS	AVERAGE NUMBER OF DEAD PUPS PER DAY	% DAILY MORTALITY OF REMAINING LIVE PUPS
23-Jan	625	625	26.3	50*	12.5	0.5
2-Feb	538	1163	49.0	10	53.8	3.1
4-Feb	73	1236	52.1	2	36.5	3.0
7-Feb	53	1289	54.3	3	17.7	1.6
15-Feb	56	1345	56.7	8	7.0	0.6

* estimate of the time since the first pup was born in early December

The sea lion deaths at Dundas Island appear to have started earlier than those at Sandy Bay. If our estimate of pup mortalities starting at Dundas Island one week prior to our first visit is correct, then the “disease” was most active from about mid-January to about 7 February. This difference in timing between the two colonies suggests that the “disease” may have spread from Dundas Island to Enderby Island some time between mid-January and 20 January. One cow with paralysed hind limbs was seen at Sandy Bay on 18 January, a dead cow was also found on Sandy Bay on 24 January and a post-mortem was conducted revealing a pus-filled abscess in the right salivary gland. These animals may have been among the first diseased animals to spread the “disease” to the Sandy Bay population. Alternatively, we may have been responsible for transmission of the “disease” from Dundas Island to Sandy Bay ourselves when we returned from the mark-recapture work on 23 January. This hypothesis seems reasonably unsupported as an increase in pup deaths at Sandy Bay was already recorded by 21 January.

The spread of the mortalities between Dundas Island, Sandy Bay and South East Point, plus our observation of movement of tagged pups between these sites, reinforces the idea that these three breeding sites should be considered as only one population.

The duration and extent of the mortality event can also be gauged from observations of adult animals with observable clinical lesions. Two surveys were conducted around Enderby Island of all adult animals hauled out and each animal was inspected for lesions. The first survey on 30 January revealed that 18% of adult females showed at least one symptom of disease. A second survey duplicating the protocol of 30 January was conducted on 8 February and revealed that the percentage of infected cows had decreased by 50%. Among these animals, many had healing lesions. These were not seen during the earlier survey. These limited data suggests a similar temporal span of the event as the pup deaths.

At the time of our departure on 22 February we believe the event was virtually over. Only with the benefit of hindsight and the results from the samples that we collected can further conclusions be drawn.

4. REFERENCES

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5. APPENDICES

5.1 Field report summarising events at the Auckland Islands, 13–29 January 1998

14 January Set up camp, Enderby Island. Seven dead pups found at Sandy Bay. This is unusually low for mortality at this stage of the breeding season. Walked to South East Point (Pebble Point), Enderby Island; found 37 live pups and 14 dead pups. This level of mortality is normal for this site where 20-40% mortality has been recorded in previous years.

15 January Tagged, marked and injected microchips into 207 pups at Sandy Bay. 100 pups were weighed and did not differ significantly from previous years. At this stage we had noticed nothing abnormal about the sea lion colony.

16 January Conducted a mark/recapture experiment at Sandy Bay which resulted in an estimate of 477 live pups plus 11 dead pups. This pup production is similar to previous years. Tagged and chipped 36 pups at South East Point, Enderby Island.

17 January Caught and marked the remaining 271 untagged pups on Sandy Bay. All pups born at Sandy Bay were now tagged. Females were still on the beach with their pups and the colony appeared normal.

18 January Deployed 7 sets of satellite tags and time depth recorders on adult females at Sandy Bay. Removed teeth for aging from five of these animals.

19 January M.V. *Shokalski* arrived, landed guides and meteorological technician, but too rough to land passengers. Departed at lunchtime for Carnley Harbour. Checked marked pups on Sandy Bay, caught 8 adult females and removed teeth for aging study. Technician stayed overnight after servicing automatic weather station.

20 January M.V. *Shokalski* landed at Sandy Bay. Attempted landing at Dundas Island, but swell too high and attempt aborted. Checked Kekeno Bay, several sub-adult male sea lions seen.

21 January Surveyed Figure of Eight Island: 97 live and 23 dead pups counted; this was within normal range. Landed on Dundas Island late in the afternoon. Our first impression was that there were many more dead pups on the beach and grass areas. Many of the pups appeared to have died at about the same time, which we estimated was several days before our arrival. Several dead adults were seen on the beach, but this was within normal range.

22 January Tagged, marked and chipped 400 pups in a very long day. Many of the pups appeared to be in poorer condition than usual and displayed signs such as pussy eyes, abscessed head lesions, ulcerated genitals, and other general infections. Many of the other pups appeared healthy and well. We had not counted the dead pups at this stage, but were certainly concerned by the large areas on the beach with dead pups.

23 January Conducted a mark-recapture experiment on Dundas Island resulting in an estimate of 1748 ± 90 live pups. We then walked around the island and counted 625 dead pups, this was substantially more than we had expected and is more than three times the level we have recorded in previous years. The mud pools on this island account for about 50 mortalities each year, and this also applied this year. Mortality at this stage was a minimum of 26%, given that the dead pup count is bound to be an underestimate of actual mortality. Most dead pups were on the beach and grass area and were not on the top of the island where many cows and pups had moved to. At this point we were concerned that an unusual mortality event had occurred, and considered causes such as El Niño/Southern Oscillation (ENSO), disease and toxins. However, as mortality was low at Sandy Bay, and within normal ranges for South East Point and Figure of Eight Island, we felt the causative agent was restricted to Dundas Island. Apart from the pup mortality we did not notice anything else unusual about the number of females or the behaviour of any of the animals.

24 January Dead female found on Sandy Bay beach and autopsied. Small area of pus noted in right salivary gland area. Blood from vagina was noted and extensive haemorrhage in the uterus was also recorded, this may be post-partum in cause. Localised congestion in the lungs was also noted and may have been from post-mortem changes. Samples were collected in formalin to be returned on the helicopter on 25 January. (One or two dead female sea lion were seen each year at Sandy Bay.)

25 January Went to Dundas Island and captured 12 adult females for aging study. Five had enlarged swellings in the throat region, they were on the left or right lateral/ventral side. The cause of these swellings was unknown, but had not been noted in previous years. In all other ways the cows appeared healthy. We noted that pup mortality had continued, but a further count was not made. Several of the dead pups were tagged on our previous trip. There were not as many females around as usual on the island and far fewer on the top of the island. A dead female was seen at Keken Bay, washed up against the rocks.

26 January 26 adult females captured on Dundas Island for tooth removal for aging, three were noted to have enlarged growths in their throats. 14 dead pups and three dead cows were found on Sandy Bay, the cows appeared in good condition. Two cows were autopsied and samples taken. One cow with satellite tag and time depth recorder was seen on the beach with her dead pup. We returned from Dundas Island late in the evening, captured the cow and removed the equipment. The number of 14 dead pups was noted as being unusual for this stage of the breeding season when most cows have established a pattern of time at sea and time ashore to feed the pup. Symptoms such as pussy eyes and other wounds were not seen on Sandy Bay pups at this time. Total pup mortality at Sandy Bay was 45, which was within normal ranges, albeit at a later stage.

27 January A further 20 pups were found dead on the beach and nearly all the females had departed. Many other pups appeared weak and lethargic. A further adult female, and two adult males were found dead on the beach. The female had lesions on her ventral side and an enlarged swelling in the neck. A

post-mortem was conducted. As this stage we were convinced that a significant, and unusual mortality event was occurring at Dundas Island and Sandy Bay (95% of the breeding population of this species). Given the disastrous die-offs of marine mammals from viral diseases in the Northern Hemisphere in recent years, we determined that a major investigation was warranted and Southland Conservancy of DOC was contacted. We received an immediate response and plans were instigated to send a helicopter with relevant sampling equipment and protocols. The science program was stopped to minimise stress on the animals and any potential further transmission of disease. Discussions were undertaken with Southland regarding the potential problems of visits from tourist ships and the return of bycatch sea lions on fishing vessels. Stewart Island also established a radio-telephone discussion with Ministry of Agriculture & Forestry in Invermay near Dunedin. In the afternoon, an adult female hauled out on the beach at Sandy Bay; she convulsed and appeared to be in a state of spastic paralysis. A sub-adult male and two adult females appeared to be stiff and sore and allowed us to stand directly next to them without moving. Only 43 females were on Sandy Bay in the afternoon (by contrast, 100-250 would normally be on the beach). Two adult females were found dead in the water at South East Point as well as four pups. Post-mortems were not conducted. A further small cow, close to death, had extensive skin lesions. All dead pups on Sandy Bay were collected and placed in a small fenced-off area on the sward.

28 January A further 14 pups were found dead on Sandy Bay along with 4 cows and 1 bull. This brought the total to 79 dead pups, 10 cows, and 3 adult males. Of the remaining pups, many were still clearly sick, but the rate of deaths appeared to be decreasing. A few more females returned to the beach, but the numbers were still far lower than usual. Among the females, more animals with enlarged throats were seen. At Sandy Bay all dead adult animals were marked to prevent duplicate counting. Eight pups that were very close to death all exhibited spastic paralysis. Two females with paralysed hindquarters were seen on the beach during the day. One adult fur seal hauled out on Sandy Bay with an enormous shark bite on its hind quarters. The mixing of fur seal with sea lion raises the potential for transmission of the disease between the species. Two dead cows and three cows with lesions in their necks were seen at South East Point; 18 live pups and 1 dead pup were also seen there. At East Bay a weak female with skin lesions was seen in the water and about 50 apparently healthy cows were on the beach. Of the 7 females on which we deployed satellite and dive instruments, we have only retrieved one set of units: the other cows have not yet returned and are overdue. The positions of 3 females (radioed to us from Wellington, via Stewart Island) indicate these animals are still alive and may return to the island. If this sub-sample of females is representative of the entire female population, then as many as 40% may have died. At 7:00 a.m. the helicopter from Invercargill arrived with the equipment for post-mortem samples. The gear was sorted and at 8:00 p.m. we conducted a detailed post-mortem on a female that was euthanased at Sandy Bay. The female was clinically diseased and in our opinion would have died in the near future. The post-mortem finished at 10:30 p.m.

29 January Departed Enderby Island for Dundas Island by helicopter at 6:15 a.m. and landed at 6:30 a.m. No adults had recently died, but there were at least several dozen pups that had died since we were last on the island. The remaining pups looked much better than previously and generally appeared in good condition. Five recently died pups were collected as well as two pups that were still alive, but close to death: these died in transit. We landed back at Enderby Island at 7:50 a.m. During the trip to Dundas Island, Nadine Gibbs and Bernie Haberley conducted a post-mortem on a recently died pup at Sandy Bay. Upon our return we captured a healthy-looking adult female who had a swelling on her neck that had ruptured. Blood, milk and tissue swabs and samples were taken before she was released. We then captured and euthanased an adult female sea lion with extensive lesions and in a very poor condition. She was already close to death. A thorough post-mortem was conducted. Further post-mortems were conducted on an adult female that had died at Sandy Bay 24 hours earlier, a juvenile female that had died overnight, the two pups from Dundas Island that died during the helicopter flight and a pup from Sandy Bay that had died the day before. Three other pups from Dundas were packaged for return to Massey University. Information from Stewart Island indicated that sea lions have been seen dead at sea around the Auckland Islands. This mortality at sea is in keeping with the low numbers we are seeing on the Island. Causes such as biotoxins related to ENSO effects must be considered a high possibility. The samples were flown by helicopter to Invercargill in the early afternoon for analysis at Massey University the next day.

Further work Over the next few days we burnt all carcasses at Sandy Bay, conducted a survey of dead pups at Dundas Island and conducted a survey at Figure of Eight Island and South East Point; further work depending on feedback from Massey University and advice from Southland Conservancy in Invercargill and Science & Research Unit in Wellington.

5.2 Autopsy details of sea lions and samples taken during the 1998 event

Specimen E1

Details: Adult female from Sandy Bay. Untagged but tag scar on right pectoral flipper.

Date: 28 January 1998.

Comments: Female found alive on the sward and was anaesthetised and later euthanased. She had enlarged swelling on the right side of her neck and appeared to have been unable to comfortably close her mouth: it was held open most of the time. She showed very slow and stiff movements. There was no sign of a pup. She was anaesthetised using isoflurane and given 3 mL of hypnoval and 1 mL of oxytocin. Under anaesthetic she had extreme difficulty breathing. Oxygen was administered but her breathing continued to be shallow and irregular. Decision made to euthanase her and 10 mL pentobarb 500 was administered. A lump in her neck was aspirated and a small amount of pus and blood was exuded. This exude appeared to come from the salivary gland. She had connective tissue thickening in the neck around the swelling. She had a few dozen discrete, raised lesions on her ventral chest region. Despite the obvious lesions and swelling she appeared in good condition.

SPECIMEN E1	HISTO	BACTO	VIRO	TOX
Blood	X	-	-	-
Lung	X	X	X	-
Liver	X	X	X	X
Kidney	X	X	X	X
Spleen	X	X	X	-
Brain	X	-	X	-
Lymph nodes	X	X	X	-
Tonsils	X	-	-	-
Trachea	X	-	-	-
Heart	X	-	-	-
Muscle	X	-	-	-
Aorta	X	-	-	-
Lesion - neck	X	X	X	0
Lesions - body	X	X	X	0
Stomach fluid	X	-	-	-
Tooth	X	0	0	0
Adrenals	X	0	0	0
Milk	X	0	0	0
Thyroids (both sides)	X	0	0	0
Skin dermis	X	0	0	0
Pancreas	X	0	0	0

Explanation: Histo = Histopathology sample; Bacto = Bacteriology sample; Viro = Virology sample; Tox = Toxicology sample; "X" means sample was taken for particular purpose identified in column; "0" means condition or sample not present; "-" indicates no samples were taken.

Specimen E2

Details: Male pup from Sandy Bay. Tag No. A0881.

Date: 29 January 1998.

Comments: Firm lesions above right tuber coxae and when incised it discharged a lot of viscous red-tinged pus. Lesion located in the connective tissue. Pup died overnight and was found at 7:30 a.m. on 29 January. It was in good condition and healthy in appearance. Post mortem started 8:00 a.m., completed 9:10 a.m.

Specimen E4

Details: Female yearling from Sandy Bay. Untagged.

Date: 29 January 1998.

Comments: Yearling was in excellent condition. Died overnight and had no external lesions. There were 3 discrete bands of lesions in the blubber along the ventral mid line: one each in the neck, thoracic and abdominal regions. Haemorrhage associated with necrotic tissue. Some photos taken of these haemorrhages. Liver was covered in small, white, circular discrete lesions. These lesions did not exude any fluid. There were also deeper lesions that were extensive throughout the parenchyma. These did exude pussy fluid when incised. Lungs appeared normal. There was also extensive bruising on the dorsal surface of the skull.

SPECIMEN E2	HISTO	BACTO	VIRO	TOX
Blood	X	-	-	-
Lung	X	X	X	-
Liver	X	X	X	X
Kidney	X	X	X	X
Spleen	X	X	X	-
Brain	X	-	X	-
Lymph nodes	X	X	X	-
Tonsils	X	-	-	-
Trachea	X	-	-	-
Heart	X	-	-	-
Muscle	X	-	-	-
Aorta	X	-	-	-
Lesions	X	X	X	X
Stomach	X	-	-	-
Pancreas	X	0	0	0

SPECIMEN E4	HISTO	BACTO	VIRO	TOX
Blood	X	-	-	-
Lung	X	X	X	-
Liver	X	X	X	X
Kidney	X	X	X	X
Spleen	X	X	X	-
Brain	X	-	X	-
Lymph nodes	X	X	X	-
Tonsils	X	-	-	-
Trachea	X	-	-	-
Heart	X	-	-	-
Muscle	X	-	-	-
Aorta	X	-	-	-
Lesions	X	X	X	X
Stomach wall	X	-	-	-
Mandibular salivary gland	X	X	0	0
Pancreas	X	0	0	0

Specimen E5

Details: Adult female from Sandy Bay.

Date: 29 January 1998.

Comments: Female was seen on the beach having convulsions and looking very weak. She had extensive lesions on her belly and neck. She was anaesthetised using isoflurane; blood and milk were collected. She was then euthanased using pentobarb 500 and a full post-mortem conducted. She has extensive lesions on entire ventral side—these are discrete, raised lesions about 1 cm in diameter, particularly on the neck and chest. A cross-section of them showed a purple tissue that was not pus-filled. Lesions on neck were predominantly as described but lesions further back appeared more “flat” and red. She had a thick blubber layer. She had severe mastitis on left mammary tissue: swab samples taken. Many cestodes seen. Salivary gland appeared OK. No external neck swelling seen. Lungs showed patchy pink/purple colouration. There were areas in the lungs that were solid and raised and several samples were taken. The stomach had a haemorrhage and erosions or ulcers in the gastric lining. Uterus appeared normal.

SPECIMEN E5	HISTO	BACTO	VIRO	TOX
Blood	X	-	-	-
Lung	X	X	X	-
Liver	X	X	X	X
Kidney	X	X	X	X
Spleen	X	X	X	-
Brain	X	-	X	-
Lymph nodes	X	X	X	-
Tonsils	X	-	-	-
Trachea	X	-	-	-
Heart	X	-	-	-
Muscle	X	-	-	-
Aorta	X	-	-	-
Lesions - neck	X	X	X	X
Stomach wall and contents	X	-	-	-
Adrenal	X	0	0	0
Mammary tissue	X	X	X	0
Salivary gland	X	0	0	0
Lymph nodes maxillary and pre scapular	X	X	X	X
Mandibular salivary gland	X	X	0	0
Pancreas	X	0	0	0

Specimen E6

Details: Adult female from Sandy Bay. Untagged.

Date: 29 January 1998.

Comments: Milk was present in the mammary gland. There was a lesion around the tip of the femur. It was 10-15 cm long and 2 cm deep. It was located under the muscle lining the abdomen, and between the muscle and bone. It was a white, lobulated lesion that exuded a pussy discharge when opened.

Specimen E7

Details: Male pup from Sandy Bay. Tag No. A1108.

Date: 29 January 1998.

Comments: none.

SPECIMEN E6	HISTO	BACTO	VIRO	TOX
Blood	X	-	-	-
Lung	X	X	X	-
Liver	X	X	X	X
Kidney	X	X	X	X
Spleen	X	X	X	-
Brain	0	-	0	-
Lymph nodes	X	X	X	-
Tonsils	X	-	-	-
Trachea	X	-	-	-
Heart	X	-	-	-
Muscle	X	-	-	-
Aorta	X	-	-	-
Lesions	X	X	X	X
Stomach wall	X	-	-	-
Mandibular salivary gland	X	X	X	0
Pancreas	X	0	0	0

SPECIMEN E7	HISTO	BACTO	VIRO	TOX
Blood	0	-	-	-
Lung	X	X	X	-
Liver	X	X	X	X
Kidney	X	X	X	X
Spleen	X	X	X	-
Brain	X	-	X	-
Lymph nodes	X	X	X	-
Tonsils	X	-	-	-
Trachea	X	-	-	-
Heart	0	-	-	-
Muscle	X	-	-	-
Aorta	X	-	-	-
Lesions	0	0	0	0
Stomach wall	0	-	-	-
Mandibular salivary gland	X	X	X	0
Adrenal gland	X	0	0	0

Specimen D7

Details: Male pup from Dundas Island. Untagged.

Date: 29 January 1998.

Comments: Pup in reasonable/fair condition. Died at about 07:50 a.m. and post-mortem started at 9:15 a.m., completed 9:45 a.m. No sign of any lesions or abnormal tissue.

Specimen D8

Details: Female pup from Dundas Island. Tag No. A1591.

Date: 29 January 1998.

Comments: Pup in reasonable condition. Died at 8:50 a.m. Post-mortem started at 9:50 a.m., completed at 10:45 a.m. Right mandibular salivary gland had a pussy discharge. This was swabbed and whole gland was taken for bacto and tox. Nothing else abnormal seen.

SPECIMEN D7	HISTO	BACTO	VIRO	TOX	SPECIMEN D8	HISTO	BACTO	VIRO	TOX
Blood	X	-	-	-	Blood	X	-	-	-
Lung	X	X	X	-	Lung	X	X	X	-
Liver	X	X	X	X	Liver	X	X	X	X
Kidney	X	X	X	X	Kidney	X	X	X	X
Spleen	X	X	X	-	Spleen	X	X	X	-
Brain	X	-	X	-	Brain	X	-	X	-
Lymph nodes	X	X	X	-	Lymph nodes	X	X	X	-
Tonsils	X	-	-	-	Tonsils	X	-	-	-
Trachea	X	-	-	-	Trachea	X	-	-	-
Heart	X	-	-	-	Heart	X	-	-	-
Muscle	X	-	-	-	Muscle	X	-	-	-
Aorta	X	-	-	-	Aorta	X	-	-	-
Lesions	0	0	0	0	Lesions	X	X	X	X
Stomach wall	X	-	-	-	Stomach contents	X	-	-	-
Mandibular salivary gland	X	X	X	0	Mandibular salivary gland	X	X	X	X
Pancreas	X	0	0	0	Pancreas	X	0	0	0

Specimen E10

Details: Dead male pup. Untagged. Found dead on Sandy Bay sward.

Date: 16 February 1998.

Comments: Pup appeared freshly dead and was in good condition. No signs of sickness present. Full post-mortem undertaken.

Specimen E11

Details: Adult female. Untagged. Live capture on Sandy Bay beach and euthanased.

Date: 16 February 1998.

Comments: Female was covered in large, raised lesions all across her body except the dorsal midline. She appeared very sick but still had normal movement. There was no sign of swollen neck lesions.

SPECIMEN E10	HISTO	VIRO
Blood (ventricular)	X	-
Lung	X	X
Liver	X	X
Kidney	X	X
Spleen	X	X
Brain (complete)	X	X
Lymph nodes	X	X
Tonsils	X	-
Trachea	X	-
Heart	X	-
Muscle	X	-
Aorta	X	-
Lesion - neck	0	0
Lesions - body	0	0
Stomach fluid	0	-
Salivary gland	X	0
Adrenals	0	0
Spinal cord	0	0
Thyroids	X	0
Pancreas	X	0

SPECIMEN E11	HISTO	VIRO
Blood	X	-
Lung	X	X
Liver	X	X
Kidney	X	X
Spleen	X	X
Brain (complete)	X	X
Lymph nodes	X	X
Tonsils	X	-
Trachea	X	-
Heart	X	-
Muscle	X	-
Aorta	X	-
Lesion - skin	X	X
Lesions - blubber	X	X
Stomach - contents	X	-
Stomach - wall	X	0
Spinal cord	X	0
Adrenals	X	0
Blubber & skin	X	0
Ovaries	X	0
Milk	0	0
Thyroids	X	0
Pancreas	X	0
Salivary gland	X	0
Faeces	X	0
Peripheral nerve	X	0

She was captured and given 20 mL pentobarb. She died immediately. Full post-mortem undertaken. All internal organs appeared normal. Linguinal, mediastinal, and intestinal lymph nodes taken. A single lesion found in the blubber which was not pus-filled. A small amount of milk expressed but not enough for collection.

SPECIMEN E12	HISTO	VIRO
Blood	X	-
Lung	X	X
Liver	X	X
Kidney	X	X
Spleen	X	X
Brain (complete)	X	X
Lymph nodes	X	X
Tonsils	X	-
Trachea	X	-
Heart	X	-
Muscle	X	-
Aorta	X	-
Lesion - skin	0	0
Lesions - blubber	X	X
Stomach - content	X	-
Stomach - wall	X	0
Spinal cord	X	0
Adrenals	X	0
Blubber and skin	X	0
Ovaries	X	0
Milk	0	0
Salivary gland	X	X
Faeces	X	0
Thyroids	X	0
Peripheral nerve	X	0
Pancreas	X	0

Specimen E12

Details: Adult female. Untagged. Live capture on Sandy Bay beach and euthanased.

Date: 16 February 1998.

Comments: Female appeared in very poor condition and was very stiff. She had limited movement and would not get up when approached or prodded. She had been seen on the beach for the last 3 days lying at the highwater mark and occasionally moving into the water. When she was in the water she floated very high and was only seen to move back and forth along the beach. All internal organs appeared to be normal. Left adrenal appeared to have a small lesion. Linguinal, mediastinal, and intestinal lymph nodes taken. There were two lesions in the blubber in the ventral abdominal region. They were pus-filled and samples of the pus and lesion were taken for histo and bacto.

Specimen E13

Details: Adult female. Untagged. Live capture on Sandy Bay sward.

Date: 16 February 1998.

Comments: Female appeared healthy and was in good condition. She was anaesthetised with isoflurane and given 1 mL oxytocin. No pup was seen suckling but she had prominent, erect nipples. Milk was easily obtained. No signs of external lesions or abscesses.

Samples: Blood collected in serum tubes: some chilled and some serum placed in liquid nitrogen. Milk samples taken: all frozen.

Specimen E14

Details: Adult female. Tag No. 4337. Live capture on Sandy Bay sward.

Date: 16 February 1998.

Comments: Female appeared healthy and was in good condition. She was anaesthetised with isoflurane and given 1 mL oxytocin. Healthy pup was seen suckling and captured. Milk was easily obtained. No signs of external lesions or abscesses.

Samples: Blood collected in serum tubes: some chilled and some serum placed in liquid nitrogen. Milk samples taken: all frozen.

Specimen E15

Details: Adult female. Untagged. Live capture on Sandy Bay sward.

Date: 16 February 1998.

Comments: Female appeared healthy and was in good condition. She was anaesthetised with isoflurane and given 1 mL oxytocin. Healthy pup was seen suckling. Milk was easily obtained. No signs of external lesions or abscesses.

Samples: Blood collected in serum tubes: some chilled and some serum placed in liquid nitrogen. Milk samples taken: all frozen.

Specimen E16

Details: Adult female. Untagged. Live capture on Sandy Bay sward.

Date: 6 February 1998.

Comments: Female appeared healthy and was in good condition. She was anaesthetised with isoflurane and given 1 mL oxytocin. No pup was seen suckling. Milk was easily obtained. She had two lesions on both sides of her neck. The right-hand side lesion was small and only slightly swollen and had not burst. The left-hand side was burst with a large hole with blood and tissue visible. No sample of lesion was taken as it was very clean, probably from flushing when at sea.

Samples: Blood collected in serum tubes: some chilled and some serum placed in liquid nitrogen. Air-dried blood smear collected. Milk samples taken: all frozen.

Specimen E17

Details: Adult female. Untagged. Live capture on Sandy Bay sward.

Date: 16 February 1998.

Comments: Female appeared healthy and was in good condition. She was anaesthetised with isoflurane and given 1 mL oxytocin. No pup was seen suckling. Milk was easily obtained. She had a lesion on the left-hand side of her neck which appeared to have healed and it looked healthy.

Samples: Blood collected in serum tubes: some chilled and some serum placed in liquid nitrogen. Air-dried blood smear collected. Milk samples taken: all frozen.

Specimen E18

Details: Adult female. Untagged. Live capture on Sandy Bay sward.

Date: 16 February 1998.

Comments: Female appeared healthy and was in good condition. She was anaesthetised with isoflurane and given 1 mL oxytocin. No pup was seen suckling. Milk was easily obtained. She had a large, burst neck lesion on her left-hand side. It was a large, open wound showing light red flesh beneath but with no pus evident. The hair around the lesion was wet indicating that the lesion may have still been exuding liquid. The lesion looked healthy otherwise.

Samples: Blood collected in serum tubes: some chilled and some serum placed in liquid nitrogen. Air-dried blood smear collected. Milk samples taken: all frozen.

SPECIMEN E19	HISTO	VIRO
Blood	X	-
Lung	X	X
Liver	X	X
Kidney	X	X
Spleen	X	X
Brain (sample)	X	X
Lymph nodes	X	X
Tonsils	X	-
Trachea	X	-
Heart	X	-
Muscle	X	-
Aorta	X	-
Lesion - neck	0	0
Lesions - body	0	0
Stomach fluid	0	-
Salivary gland	X	0
Spinal cord	0	0
Adrenals	0	0
Thyroids	0	0
Pancreas	X	0

Specimen E19

Details: Dead male pup. Tag No. A1177 - tagged this year. Found dead on Sandy Bay.

Date: 13 February 1998.

Comments: Pup appeared freshly dead and was in good condition. Pup had been seen the day before looking very sick and dragging its hind flippers. Full post-mortem undertaken.

Specimen E20

Details: Live adult cow. Tag No. A1198. Caught on Sandy Bay sward.

Date: 18 February 1998.

Comments: She appeared in good condition and there were no signs of illness. She had what appeared to be a necklace. She was caught, anaesthetised using isoflurane and blood was taken. She was previously untagged, so we tagged (A1198) and microinjected (00-01BF-08BB) her.

Samples: 2 cyrovials of serum were aliquoted from the blood samples. We were unable to aliquot any white blood cells because it had coagulated into a mass. Frozen in liquid nitrogen.

SPECIMEN D9	HISTO	VIRO
Blood	X	-
Lung	X	X
Liver	X	X
Kidney	X	X
Spleen	X	X
Brain (sample)	0	0
Lymph nodes	X	X
Tonsils	X	-
Trachea	X	-
Heart	X	-
Muscle	X	-
Aorta	X	-
Lesion - neck	0	0
Lesions - body	0	0
Stomach - wall	X	-
Stomach - contents	X	0
Salivary glands	X	0
Spinal cord	0	0
Brain	0	0
Blubber	X	0
Adrenals	X	0
Thyroids	X	0
Pancreas	X	0

Specimen D9

Details: Dead male pup. Untagged. Found dead on Dundas Island.

Date: 16 February 1998.

Comments: Pup appeared freshly dead and was in good condition. No signs of sickness. Full post-mortem undertaken.

Specimen E21

Details: Live adult cow. Untagged. Caught on Sandy Bay sward.

Date: 19 February 1998.

Comments: She appeared in good condition and there were no signs of illness. No pup seen with her. No tags or tag scars seen.

Samples: 2 cyrovials of serum and 1 of white blood cells were aliquoted from the blood samples. Frozen in liquid nitrogen.

Specimen E22

Details: Live adult cow. Untagged. Caught on Sandy Bay sward.

Date: 19 February 1998.

Comments: She appeared in good condition and there were no signs of illness. Pup seen with her. Tag scars seen on right pectoral flipper.

Samples: 2 cyrovials of serum and 1 of white blood cells were aliquoted from the blood samples. Frozen in liquid nitrogen.

Specimens E23–E39

Details: 16 Live adult cows. Caught on Sandy Bay sward.

Date: 19 February 1998.

Comments: All appeared in good condition and there were signs of illness in only two specimens—E38, which had a healing lesion on the right side of the neck, and E39, which had a fresh lesion on the right side of the neck. Pups were seen with E27, E37, and E39. E27 and E39 were tagged (No. 4391 and No. 3699) and right pectoral tag scars were seen in E32, E33, and E34.

Samples: 2 cyrovials of serum and 1 of white blood cells were aliquoted from the blood of each specimen and frozen in liquid nitrogen.

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