

New Zealand sea lion/pakake/ whakahao field research report



Auckland Islands 2024/25

CSP POP 2023-05

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Te Papa Atawhai

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Cover: Treating a female sea lion pup with Ivermectin. Sandy Bay, Enderby Island. *Photo: Dr. Lydia Uddstrom.*

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1 Executive summary

This report summarises fieldwork undertaken by the Department of Conservation (DOC) Marine Bycatch and Threats team as part of Conservation Services Programme (CSP) project POP2023-05 'Auckland Islands New Zealand sea lions' (DOC 2024).

The DOC field team spent a total of eight weeks at the Auckland Islands (2 December 2024 – 25 January 2025): six weeks at Enderby Island, three nights on Dundas Island, and one day on Figure of Eight Island. Direct counts of pups were undertaken each day at Sandy Bay, Enderby Island. At Dundas Island, the team conducted a mark-recapture survey and direct counts of pups. At Sandy Bay, Enderby Island, 283 pups were microchipped and 280 of those pups were also double-flipper tagged. At Dundas Island, 200 pups were double-flipper tagged. All female pups born at Sandy Bay, Enderby Island were treated with a subcutaneous injection of ivermectin (a deworming medication) at approximately one week of age.

Resightings of marked (flipper tagged/microchipped) animals of all age and sex classes were collected during daily dedicated surveys at Sandy Bay, Enderby Island, and opportunistically at Dundas and Figure of Eight Islands. Total counts of pups, females, sub-adult males, and adult males were undertaken daily at Sandy Bay, and weekly around the accessible areas of Enderby Island.

New Zealand sea lion pup production at the Auckland Islands in 2024/25 was estimated as **1376 ± 28 pups** (mean ± 1 SE) which is lower than last year's estimate of 1457 ± 19 pups and only slightly higher than the historic low of 1278 ± 23 pups reported in 2022/23 (Manno & Young 2023, Manno et al. 2024). This year's pup production estimate again falls below the minimum level set to trigger review of the [New Zealand sea lion Threat Management Plan](#) (NZSL TMP) (DOC & MPI 2017).

The drop in pup production over the past three years could indicate a temporary reduction in breeding rate or a decline in survival or fecundity of this population of breeding females. The Department has been actively reviewing management actions to recover the New Zealand sea lion population, and the decision to treat pups with ivermectin at Enderby Island is a direct result of that review. Further management actions will be considered as the Department reviews the New Zealand sea lion Threat Management Plan with Te Rūnanga o Ngāi Tahu and Fisheries New Zealand.

2 Introduction

The New Zealand sea lion/pakake/whakahao (*Phocarctos hookeri*), one of the world's rarest sea lions, is taonga to Ngāi Tahu, and currently classed as Nationally Endangered, with a total population estimate of 10,000 individuals breeding on the Auckland Islands/Motu Maha, Campbell Island/Motu Ihupuku, Stewart Island/Rakiura, and the South Island/Te Waipounamu (Baker et al. 2019; Roberts & Edwards 2023; Lundquist et al. 2025). Approximately 70% of New Zealand sea lions breed at the Auckland Islands, at Dundas Island, Enderby Island, and Figure of Eight Island. The foraging distribution of New Zealand sea lions at the Auckland Islands overlaps with commercial trawl fishing activity, particularly in SQU6T (the southern squid trawl fishery) and SCI6A (the Auckland Islands scampi fishery), and Fisheries New Zealand (FNZ) report occasional incidental captures of sea lions in these fisheries (Chilvers et al. 2005; Johnston 2024). The known primary threats to the recovery of Auckland Islands sea lions are *Klebsiella pneumoniae* infection, limitations on food availability causing nutritional stress, and commercial trawl-related mortality (Augé 2010; Large et al. 2019; Meyer et al. 2015; Michael et al. 2019; Roberts & Doonan 2016; Roberts et al. 2018; Roe et al. 2015).

The breeding population of Auckland Islands New Zealand sea lions was estimated to have declined by 40% between the late 1990s and 2008/09, leading to the development of the [New Zealand sea lion Threat Management Plan](#) (NZSL TMP) (DOC & MPI 2017). The NZSL TMP is an initiative led by the Department of Conservation (DOC) in partnership with Te Rūnanga o Ngāi Tahu and FNZ to halt the decline of the New Zealand sea lion. Both the NZSL TMP and the [Operational Plan to manage the incidental capture of New Zealand sea lions in the southern squid trawl fishery](#) (Squid 6T Operational Plan) (FNZ 2019) set a minimum target of 1575 pups born annually at the Auckland Islands, with values lower than 1575 triggering reviews of these documents to refine protection measures. In 2022, the use of Sea Lion Exclusion Devices (SLEDs) in the southern squid fishery was made mandatory and in 2024, [FNZ decided to no longer produce the Squid 6T Operational Plan](#) (FNZ 2024). The NZSL TMP has been reviewed over the past two years, and a new updated plan, developed by DOC in partnership with Te Rūnanga o Ngāi Tahu, FNZ, and stakeholders, will be released in 2025.

Annual monitoring of New Zealand sea lions at the Auckland Islands includes estimates of pup production (the number of pups born), as a proxy for the number of breeding females, and tagging and resighting of marked individuals using flipper tags and microchips for determining survival of specific age and sex classes. The collection of demographic data from the Auckland Islands is critical for assessments of the species overall population size and vulnerability to human activities (Bowen 2012, Roberts & Edwards 2023).

Pup production at Dundas and Enderby Islands has historically been estimated using a range of methods including aerial surveys, ground-based mark-recapture, marking of all known individuals, and direct visual counts (Baker et al. 2012; Childerhouse 2012; Chilvers 2012). This year's project objectives were to determine pup production at the Enderby Island, Dundas Island, and Figure of Eight Island colonies, to double-flipper tag, microchip, and measure a subset of pups, and to collect tag resightings to provide survivorship data for demographic modelling (DOC 2024). The field team were tasked with treating all female pups born at Enderby Island with a weight-appropriate dose of ivermectin (a deworming medication) at approximately one week of age, following from research showing the potential of ivermectin to increase pup survivorship (Michael et al. 2021).

Although the team was mainly occupied with NZSL demographic monitoring, they also collected scats for a new study of NZSL diet. Some hoiho (*Megadyptes antipodes*) and southern royal albatross/toroa (*Diomedea epomophora*) research tasks were also undertaken as time allowed.

A second DOC field team conducted a drone survey of Dundas Island as part of DOC's ongoing efforts to future-proof population monitoring of New Zealand sea lions. The Dundas Island bivvy remains in critical need of replacement to enable field teams to safely and effectively undertake population counts and tagging; drone surveys may provide supplementary information in years when a field team cannot safely land or stay overnight on Dundas. Drone survey results will be reported on separately.

A third DOC field team were deployed on Enderby Island from late January through mid-March 2025. This team was tasked with assessing pup mortality at the Sandy Bay colony, continuing the terrain trap mitigation project, collecting scat samples, and trialing the use of 3D-imaging technology for assessing body condition of the animals.

3 Trip logistics

The schedule of fieldwork was as follows:

- 25 – 28 November 2024: Field Team 1 arrive in Invercargill; quarantine and biosecurity.
- 29 November – 2 December 2024: Transit from Bluff to Enderby Island.
- 3 December 2024 – 10 January 2025: Daily direct counts of all sexes and age classes, flipper tag/microchip resightings, capture of week-old pups (sexing, microchipping, capping, morphometrics, and ivermectin treatment for females) terrain trap mitigation at Sandy Bay, and weekly round-the-island surveys; sea lion scat collection and processing, Enderby Island.
- 10 January 2025 – 15 January 2025: Pup double-flipper tagging; weighing and measuring of 50 male and 50 female pups, Enderby Island
- 16 January 2025 – Field Team 2 arrive Enderby Island.
- 16 – 18 January 2025 – Field Team 2 induction; resights, necropsies, Enderby Island.
- 19 – 21 January 2025: Field Team 1 transit to Dundas Island. Direct counts of live and dead pups, double-flipper tagging 100 male and 100 female pups; weighing and measuring 50 male and 50 female pups; mark-recapture; opportunistic resights.
- 21 January 2025: Field Team 1 transit to Enderby for final handover to team 2.
- 22 January 2025: Field Team 1 transit to Figure of Eight Island. Direct counts of live and dead pups; opportunistic resights.
- 23 January 2025: Stopover at Dundas Island enroute to Bluff to conduct drone survey with Team 3. Depart Auckland Islands for Bluff.
- 25 January 2025: Arrive Bluff.
- 25 – 28 January 2025: Unpacking, sorting, cleaning gear in Invercargill.

Field Team 1 consisted of Jordana Whyte (Team Leader, Contractor), Dr. Lydia Uddstrom (DOC), Tom Hitchon (DOC), and Anna Harris (Contractor).

Field Team 2 consisted of three team members who joined the for the January trip only (Georgia-Rae Flack (Kati Huirapa Rūnaka ki Puketeraki), and Robyn Ashton (Ōtākou Rūnaka)), Joris Tinnemans (DOC, drone operator), and a three person necropsy team who remained on the island through March ((Sarah Forder (Team Leader, Contractor), Dr. Kat Johnston (Contractor), Dr. Bryony Griffiths (Massey University researcher)).

Field Team 3 (the Dundas drone team) were Joris Tinnemans (DOC), Tristan Rawlence (DOC) and Anja McDonald (DOC).

Field Team 1 conducted operations on Enderby Island from 3 December 2024 until Team 2 arrived on 16 January 2025. A site induction for Team 2 was carried out on Enderby from 17 to 18 January 2025.

Field Team 1 landed on Dundas Island on 19 January 2025. The team completed the mark-recapture, direct counts, and flipper tagging of 200 pups (100 male, 100 female), including weighing and measuring 50 pups of each sex. Due to deteriorating sea conditions, the team disembarked the island one day earlier than planned, on 21 January, though all planned work was completed. Field Team 1 transited to Carnley Harbour from Dundas Island and went ashore in the early afternoon of 22 January 2025 at Figure of Eight Island to conduct direct counts of live and dead pups there.

While the Dundas Island team were away, the remaining team members on Enderby Island conducted daily counts, collected tag resightings, and confirmed tagged pup-female pairs at Sandy Bay. Drs. Kat Johnson and Bryony Griffiths conducted necropsies on all pups found dead in this period.

Drone images of the Dundas Island colony were collected on 23 January 2025, after the drone team were retrieved from Adams Island. Joris Tinnemans (DOC) operated the drone from the deck of the Evohe at anchor in calm sea conditions.

Field Team 1, two members of Field Team 2, and the DOC drone team returned to Bluff at the end of January 2025. The remaining three members of Field Team 2 remained on Enderby Island until 18 March 2025.

4 Methods

4.1 Pup production estimates

4.1.1 Enderby Island

Pup production on Enderby Island was assessed using two methods: (1) daily direct counts, and (2) marking of all known pups using double-flipper tags and microchips. No mark-recapture work was conducted on Enderby Island, as it was considered unnecessary this season after the intensive monitoring of pup births for the ivermectin programme.

Daily direct counts were completed at Sandy Bay from 3 December 2024 to 10 January 2025, and on 12, 19, and 20 January 2025 across the entire beach and sward area (Figure 1). Direct counts were undertaken by team members walking through the colony using hand counters to tally the total number of individuals in each of four defined age-sex classes (pups, females, sub-adult males (SAMs), adult males). Counts were conducted between 09:00 – 12:00 NZDT to avoid disturbing the mass outgoing transit of hoiho across the sward and beach. As the breeding season progressed and the colony increased in size, each team member conducted two or more daily counts of females and pups. If animals were disturbed during the count, team members repeated the counts until each team members' counts agreed within 10%. Where each team member

undertook multiple direct counts of the same defined age-sex class, means were taken across all counts undertaken by all team members each day.

On days when cruise ships visited Sandy Bay, daily direct colony counts were sometimes delayed, depending on the number and movement of the visitors. This was necessary for maintaining the health and safety of the field team and limiting additional stress on the animals.

The round-the-island survey was undertaken by two to four observers once per week to check for pups born at other areas of Enderby Island. Total counts of NZSL by age-sex class and incidental tag resightings were recorded for each segment of the track.

Dead animals were counted, and where possible, dead pups were moved out of the colony to the far end of the beach to avoid double-counting. Pups that died or disappeared before tagging age were added to the count of tagged pups to arrive at the pup production estimate.



Figure 1. Satellite imagery of Sandy Bay, Enderby Island. Direct counts of defined age-sex classes of New Zealand sea lions (*Phocarctos hookeri*) were undertaken in the yellow shaded area, including the beach and open coastal swardlands.

4.1.2 Dundas Island

Pup production on Dundas Island was determined using two methods: (1) mark-recapture and (2) direct counts. Drone orthomosaics of Dundas Island were obtained, but have not yet been processed.

Dundas Island pup production was estimated using the mark-recapture method as outlined in Chilvers (2012). A total of 300 white 5cm-diameter cotton canvas caps ([plain cotton canvas, 375GSM](#) purchased at Spotlight, New Zealand, caps cut by field team) were glued to the heads of pups using [Loctite® 454™ glue](#) (Henkel AG & Co. KGaA, Düsseldorf, Germany), as per the New Zealand sea lion and fur seal pup tagging SOP ([DOC-5993453](#)). Caps were applied on the evening of 19 January 2025. The caps were distributed on the heads of pups around the entire island. Two observers walked

through the colony on the morning of 20 January 2025 to search for lost caps or dead capped pups prior to the mark-recapture counts.

Mark-recapture observations were undertaken on the morning of 20 January 2025, with each observer collecting four replicate counts of capped and uncapped pups using hand tally counters (n = 16 counts total). Only pups with heads fully visible were counted. Mark-recapture estimates and standard error (± 1 SE) for the Dundas Island colony were calculated using the Lincoln-Petersen estimator (Chapman 1952), as outlined by Chilvers (2012).

Direct counts of live pups at Dundas Island were conducted on the afternoon of 20 January 2025 by four observers, with four repetitions per observer. Counts were undertaken independently by each observer walking through the colony with hand tally counters. The total direct count estimate was derived by calculating the mean ± 1 SE of all individual estimates.

Dead pups were counted and marked by two observers using Donaghy's Sprayline® (Donaghy's Ltd., Christchurch) on the afternoon of 20 January 2025 to arrive at one cumulative dead pup count. For both the mark-recapture estimate and the direct count estimate, the total number of dead pups was added to the live pup estimates to arrive at total pup production for Dundas Island.

No other age-sex classes were surveyed at Dundas Island.

4.1.3 Figure of Eight Island

Three observers conducted direct counts of pups at Figure of Eight Island on 22 January 2025. Each observer conducted independent counts, but the team moved together throughout the colony to ensure their safety amongst aggressive males in the dense rātā forest. Observers recorded total numbers of live and dead pups, and dead pups were marked using Donaghy's Sprayline® (Donaghy's Ltd., Christchurch) to avoid double-counting. The total direct count estimate was derived by calculating the mean ± 1 SE of all individual estimates of live + dead pups.

No other age-sex classes were surveyed at Figure of Eight Island.

4.1.4 Auckland Islands pup production estimate

Estimates of pup production for each of the colonies were added together to arrive at the total estimate of New Zealand sea lion pup production for the Auckland Islands for 2024/25. Methods for pup production estimation differed between each location (mark-recapture, total number of pups tagged, direct counts).

Standard error in the difference of means ($SEDM = \sqrt{((SE_1)^2 + (SE_2)^2)}$) was used to calculate overall standard error for pup counts summed across all islands, as outlined by Chilvers (2012).

4.2 Ivermectin programme

From 18 December 2024 to 15 January 2025, the team treated female pups with the deworming medication ivermectin, following the 2021 plan developed by Dr. Sarah Michael ([DOC-6638869](#)).

Pups were captured at approximately one week of age, when their mothers were away at sea. Each pup was sexed on capture. Female pups were weighed to determine the ivermectin dosage, given a subcutaneous injection, microchipped, and then marked with a white cotton canvas cap with a unique number. Male pups that were captured were microchipped and marked with a blue cotton canvas cap with a unique number. The first 50 pups of each sex were also weighed to the nearest 0.2kg and measured for total length and axillary girth to the nearest centimetre. Data were recorded in the tagging logbook and entered into a spreadsheet daily. This work was done in accordance with the subcutaneous injection protocol in the New Zealand sea lion and fur seal pup tagging and sampling SOP ([DOC-5993453](#)).

To limit handling, any pups that had not reached one week of age by 8 January 2025 were left to be treated at the time of flipper-tagging.

4.3 Pup tagging

4.3.1 Sandy Bay, Enderby Island

The team followed the methods described in the New Zealand sea lion and fur seal pup tagging and sampling SOP ([DOC-5993453](#)) to double-flipper tag and microchip all pups at Sandy Bay using laser-printed yellow Allflex® [Male-Female 29mm Button](#) tags (Allflex, Palmerston North) and Trovan® ID-162C FDX-B 11.5mm microchips (Trovan Ltd., United Kingdom). All microchips were scanned before and after implantation, using either a Gallagher HR5 V2 EID wand reader (Gallagher Animal Management, Hamilton), or an [Allflex® RS420 Stick Reader](#) (Allflex®, Palmerston North). Readers were fully charged each day to ensure optimal operation in the field, and a spare battery for the Allflex® reader served as back-up.

Flipper tagging was completed at Sandy Bay, Enderby Island, from 10 to 15 January 2025. Pups that had not yet been handled and microchipped during the ivermectin treatments were microchipped at the time of flipper tagging. The 50 pups of each sex that were weighed and measured during the ivermectin work were re-measured to make these data comparable with previous seasons. Tagging was completed on 15 January 2025.

A total of 283 pups were microchipped and 280 of those pups were also double-flipper tagged. The remaining three pups either died or disappeared between microchipping and flipper tagging.

4.3.2 Dundas Island

The field team double-flipper tagged a total of 200 pups at the Dundas Island colony from 20 to 21 January 2025 using laser-printed yellow Allflex® [Male-Female 29mm Button](#) tags (Allflex, Palmerston North) following the methods described in the New Zealand sea lion and fur seal pup tagging and sampling SOP ([DOC-5993453](#)).

Pups were selected opportunistically for tagging, although the team spread this selection effort through the colony as much as possible. The first 50 pups of each sex were weighed to the nearest 0.2kg and measured to the nearest centimetre for total length and axillary girth. Dundas Island pups were not implanted with microchips.

4.3.3 Figure of Eight Island

No pups were tagged, microchipped, or measured at Figure of Eight Island.

4.4 Flipper tag and microchip resightings

When conditions allowed, each day from 3 December 2024 to 9 January 2025, field team members walked the length of Sandy Bay beach to collect tag resightings of marked NZSL using binoculars, a DSLR camera, a close-range monocular, and microchip resightings using Trovan GR-250 and GR-252 microchip scanners.

The team walked systematically through the colony each day, scanning sleeping animals for microchips, and photographing and recording flipper tag numbers and colours, tag shape, left/right flipper tag presence, sex, and age class for each tagged animal. Multiple sessions of resightings were conducted each day when possible, depending on other fieldwork priorities, cruise ship presence, and weather conditions, as well as the activity in the colony. Resighting sessions spanned throughout the day, from as early as 10:00 to as late as 22:00 NZDT.

The priority for resightings this field season was to identify marked females. The team generally did one resight survey in the morning, covering all age and sex classes, and then further sessions throughout the day focused primarily on tagged females. For health and safety reasons, the field team did not move through the colony to undertake resightings when cruise ship visitors were present on the island. Cameras and binoculars were used from the sward or edges of the colony at these times. Once visitors departed the island for the day, the field team were often able to carry out late afternoon or evening resighting sessions in the colony. Weather conditions also impacted resighting efforts. Rain coupled with strong winds tended to result in highly alert and active sea lions, making it difficult to scan sleeping animals, and wet sand obscured the numbers on flipper tags immediately after rain events. If weather or visitor conditions restricted the window for resightings on a given day, then female resightings were prioritised over the whole-colony survey.

A large southeasterly storm from 20 to 22 December 2024 deposited large amounts of kelp at Sandy Bay and created a hole on the seaward side of the colony at the middle of the beach. Due to the kelp and sinking sand in this area, the team were unable to safely access the bottom edge of the colony for approximately two weeks, which impacted on their ability to collect resights of breeding females.

Photographs and field notes were reviewed after resighting sessions, and to limit erroneous data, each flipper tag/microchip resight was checked and verified against the Dragonfly Data Science New Zealand sea lion [database](#) record before entry into the spreadsheet. Where flipper tags/microchips were consistently observed in the colony and verified, but did not match existing records in the database, the entries were flagged for correction in the database.

An effort was made to catalogue flipper tag degradation images in an attempt to understand the impact of weathering on flipper tag readability. Tags of a range of

colours and ages were photographed and filed. Where possible, tag numbers were matched in the database and photographs were labelled with the age and original colour of the tag. Notes were made if the tag was readable in the field with typical equipment (e.g. binoculars, DSLR), or if a positive ID could only be made by reviewing photographs back at base.

Opportunistic tag resightings were collected at Dundas Island and Figure of Eight Island, although opportunities were limited in the short time spent at these sites.

4.5 Terrain trap mitigation

Terrain traps at Sandy Bay were surveyed and assessed on 15 January 2024. Self-rescue ramps were added where needed, and the status of each terrain trap was documented, along with notes for Field Teams 2 and 3 regarding suggested mitigation for areas of concern. No pups were found in terrain traps; however, Trip 1 did not overlap the known period of vulnerability during which pups venture onto the sward.

Self-rescue ramps were not checked at Dundas Island due to time restrictions. Several pups were found dead in bogs and other wet areas on Dundas Island; however cause of death was unclear.

5 Results and Discussion

5.1 Pup production estimates

5.1.1 Enderby Island

Daily counts at Sandy Bay followed historic trends through December 2024 and January 2025, indicating no apparent change in breeding phenology this season. The total number of live pups plus the cumulative total number of dead pups found at the colony was recorded as 289 on 12 January 2025 and the number of females attending at the colony plateaued from 29 December 2024 to 1 January 2025, during the peak pupping period when the highest female colony attendance is expected (Figure 2).

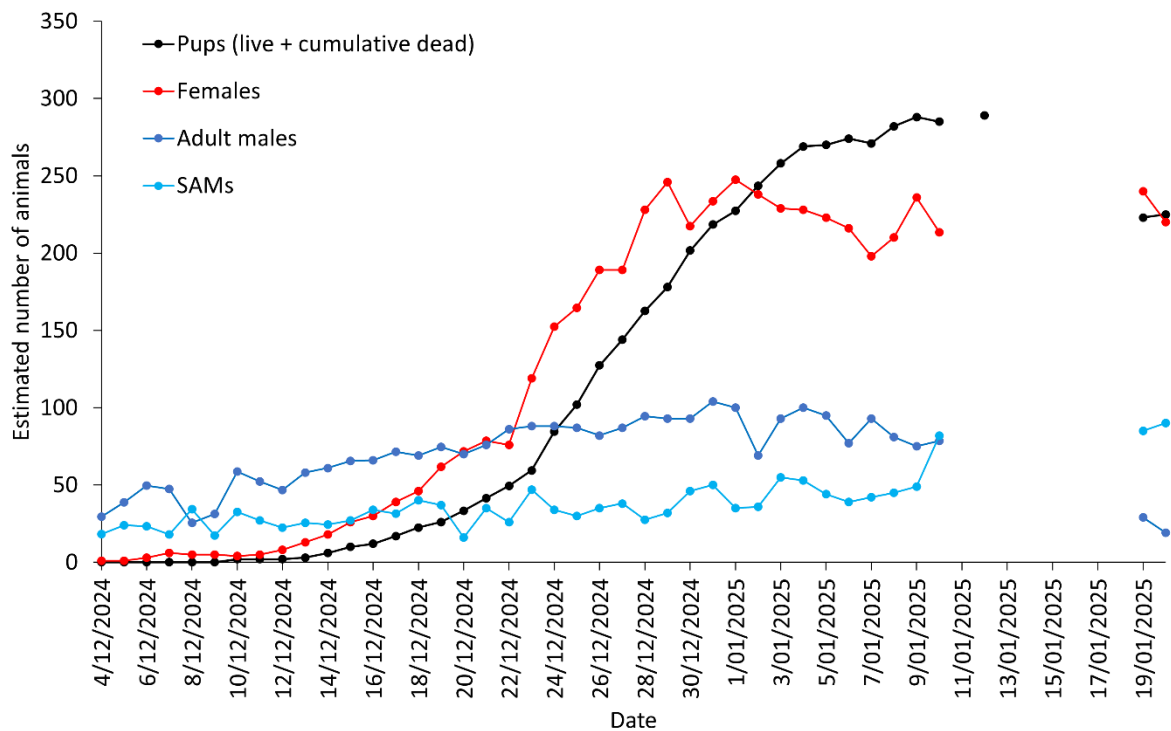


Figure 2. Mean daily counts of New Zealand sea lions at Sandy Bay, Enderby Island, by age and sex class (SAM = subadult male), in 2024/25 (beach and sward combined).

A total of 280 pups were flipper tagged at Sandy Bay, and the intensive observation effort applied by Team 1 gave high confidence in the estimate of pups born at the colony. A cumulative total of 12 pups died or disappeared from the colony before they reached tagging age. The total estimated pup production for Sandy Bay, Enderby Island was 292 pups (280 live plus 12 dead pups).

No pups were found on the weekly round-the-island surveys. An occasional lone female was seen at Derry Castle reef, but females were not seen anywhere else on the island.

When compared with previous years, the daily counts of females ashore in 2024/25 at Sandy Bay, Enderby Island, was low (Table 1). During the peak pupping period, at which time the maximum number of females are found ashore (27 December – 2 January, Chilvers et al. 2007), the mean number of females counted at Sandy Bay this year was the fifth lowest ever recorded in the history of this data set (Table 1).

The raw Enderby Island daily count data are available in Appendix 1 (Table A1.1).

Table 1. Mean, minimum, and maximum numbers of females counted daily at Sandy Bay, Enderby Island, between the mean pupping period from 27 December – 2 January, 1997/98 to 2024/25 (1997 – 2012 data from Louise Chilvers, Department of Conservation; 2015 – 2017 data from Simon Childerhouse, Blue Planet Marine; 2018 data from Sarah Michael, University of Sydney).

<i>Season</i>	<i>Mean # females at Sandy Bay</i>	<i>Minimum</i>	<i>Maximum</i>
1997/98	368	355	388
1998/99	342	300	393
1999/00	390	374	413
2000/01	320	303	352
2001/02	316	303	352
2002/03	363	326	388
2003/04	372	335	389
2004/05	294	226	337
2005/06	325	253	355
2006/07	307	289	337
2007/08	308	283	340
2008/09	209	190	225
2009/10	290	264	317
2010/11	318	285	358
2011/12	290	259	325
2015/16	196	186	211
2016/17	258	193	282
2017/18	259	244	278
2022/23	206	162	231
2023/24	221	212	235
2024/25	229	189	248

5.1.2 Dundas Island

After addition of the 21 pups found dead, mean direct counts at the Dundas Island colony produced a total estimate of 1122 ± 11 pups (mean ± 1 SE). The mark-recapture yielded an estimate of 1024 ± 28 pups including the dead pup tally. No dropped caps were found, and no capped dead pups were found. The raw data from Dundas Island counts are available in Appendix 2 (Tables A2.1 and A2.2).

5.1.3 Figure of Eight Island

Three separate counts were averaged to arrive at a total of 59 ± 1 pups (mean ± 1 SE) at the Figure of Eight Island colony. This number included seven dead pups. The raw data from Figure of Eight Island are available in Appendix 3 (Table A3.1).

5.1.4 Auckland Islands pup production estimate

The total New Zealand sea lion pup production estimate for the Auckland Islands in 2024/25 was **1376 ± 28 pups** (mean ± 1SE, Table 2), which falls in-between the pup production estimates for 2022/23 and 2023/24 (Manno & Young 2023, Manno et al. 2024).

Table 2. Auckland Islands pup production estimates for 2024/25 including standard error (± 1SE).

Location	Method	Date	Number of counts (observers)	Cumulative dead pups prior to counts	Live pup estimate ± 1 SE
Sandy Bay, Enderby Island	Count of pups tagged	10 - 15 Jan	1 (8)	12	280
Enderby Island (other)	Mean direct count	4 Dec - 17 Jan	6 (2 - 7)	0	0
Dundas Island	Mark-Recapture	20 Jan	16 (4)	21	1003 ± 28
Figure of Eight Island	Mean direct count	22 Jan	3 (3)	7	52 ± 1
Dead and live estimates				40	1335 ± 28
Total pups ¹				1376 ± 28 pups	

For the third year in a row, the Auckland Island pup production estimate has fallen below the trigger value for review of the [New Zealand sea lion Threat Management Plan](#) (1575 pups, DOC & MPI 2017) (Figure 3).

Table A4.1 in Appendix 4 summarises the historic pup production estimates from the Auckland Islands since 1994/95. Raw count data from 2024/25 are stored in [DOC-7822219](#).

¹ The total estimate is 1375.53 pups, rounded to 1376.

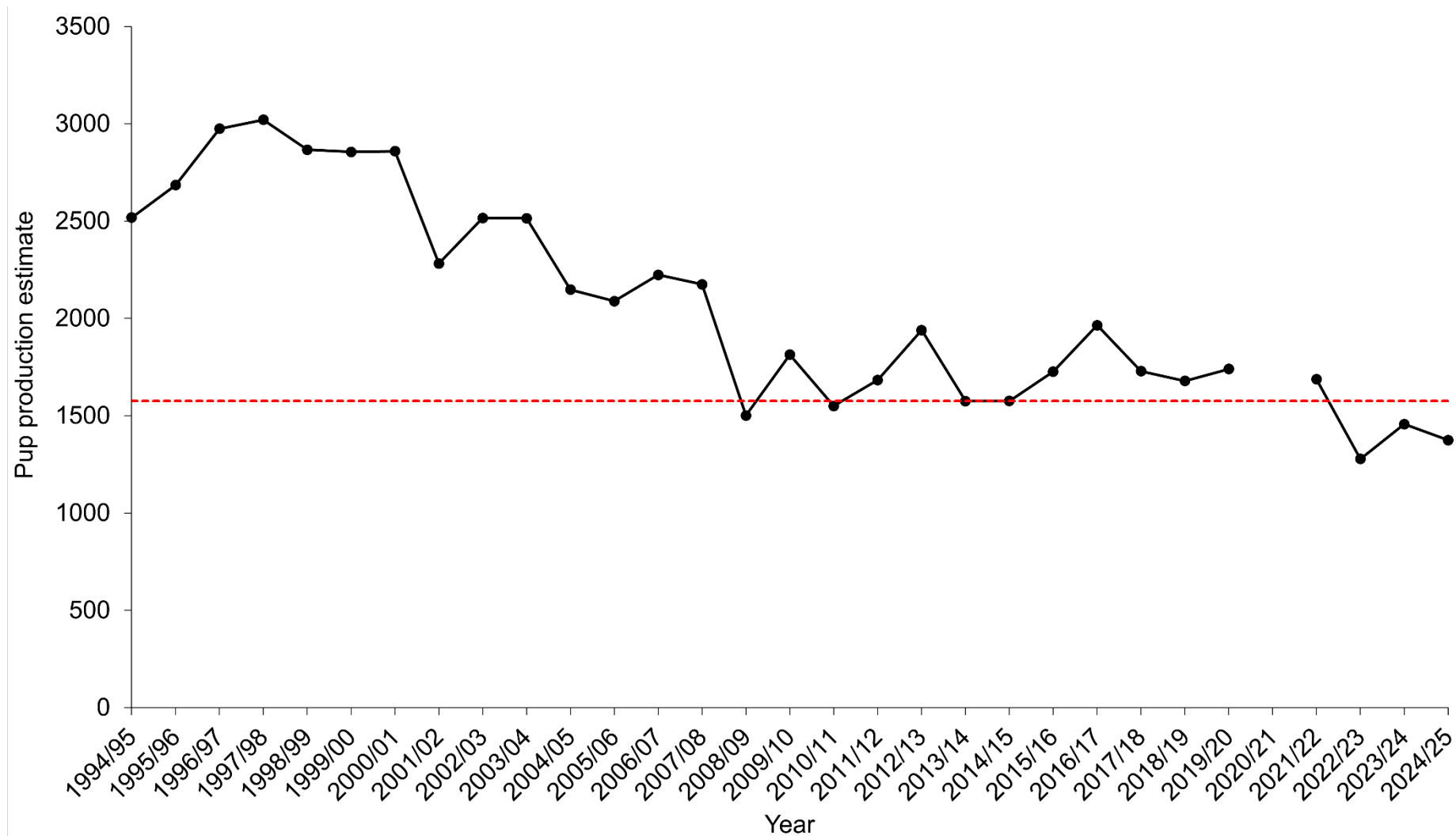


Figure 3. Auckland Islands total New Zealand sea lion pup production estimates 1994/95 – 2024/25. The red dashed line represents the minimum count of 1575 pups set to trigger review of the New Zealand sea lion Threat Management Plan (DOC & MPI 2017).

5.2 Pup tagging

All 2024/25 pup tagging data are stored in [DOC-7822220](#).

5.2.1 Sandy Bay, Enderby Island

A total of 283 pups were microchipped at one week of age at Sandy Bay, Enderby Island, and 280 of those pups were also double-flipper tagged between 10-15 January 2025. The sex ratio of pups marked at the colony was 153 female : 130 male. All pups born at the colony who survived to one week of age were marked. The first 50 pups of each sex who survived and were captured at one week of age were weighed, measured, and sexed as part of the ivermectin programme. The same pups (49 female : 53 male)² were weighed and measured again at the time of flipper tagging between 14 and 15 January 2025 (Table 3).

The mean mass of pups and the difference between male and female pup mass were similar to historic measurements taken at this colony, with male pups being approximately two kilograms heavier than females at tagging (Table 3; Figure 4). Caution should be applied when interpreting this year's pup weights in the time-series, as the methods applied this year have skewed the sample towards older pups, as these were the first pups born at the colony.

Table 3. Mean mass (mean \pm 1 standard deviation) of a selection of pups tagged at Enderby and Dundas Islands in January 2025.

<i>Island</i>	<i>Female pup mass in kg (mean \pm 1SD)</i>	<i>Number of female pups measured</i>	<i>Male pup mass in kg (mean \pm 1SD)</i>	<i>Number of male pups measured</i>
Sandy Bay, Enderby Island	12.2 \pm 1.9	49	13.5 \pm 2.0	53
Dundas Island	11.4 \pm 1.7	50	12.1 \pm 2.1	50
Auckland Islands	10.9 \pm 1.8	99	13.0 \pm 2.1	103

5.2.2 Dundas Island

A total of 200 pups (100 females : 100 males) were double-flipper tagged at Dundas Island from 20 to 21 January 2025, and the first 50 pups of each sex were weighed and measured at the time of tagging (Table 3). The mean mass of pups and the difference between male and female pup mass were similar to historic measurements taken at this colony (Figure 5).

5.2.3 Figure of Eight Island

No pups were tagged, microchipped, or measured on Figure of Eight Island in 2024/25.

² Three pups mistakenly sexed as female at 1-week of age were confirmed as male during flipper tagging which altered this ratio from the intended 50:50 split.

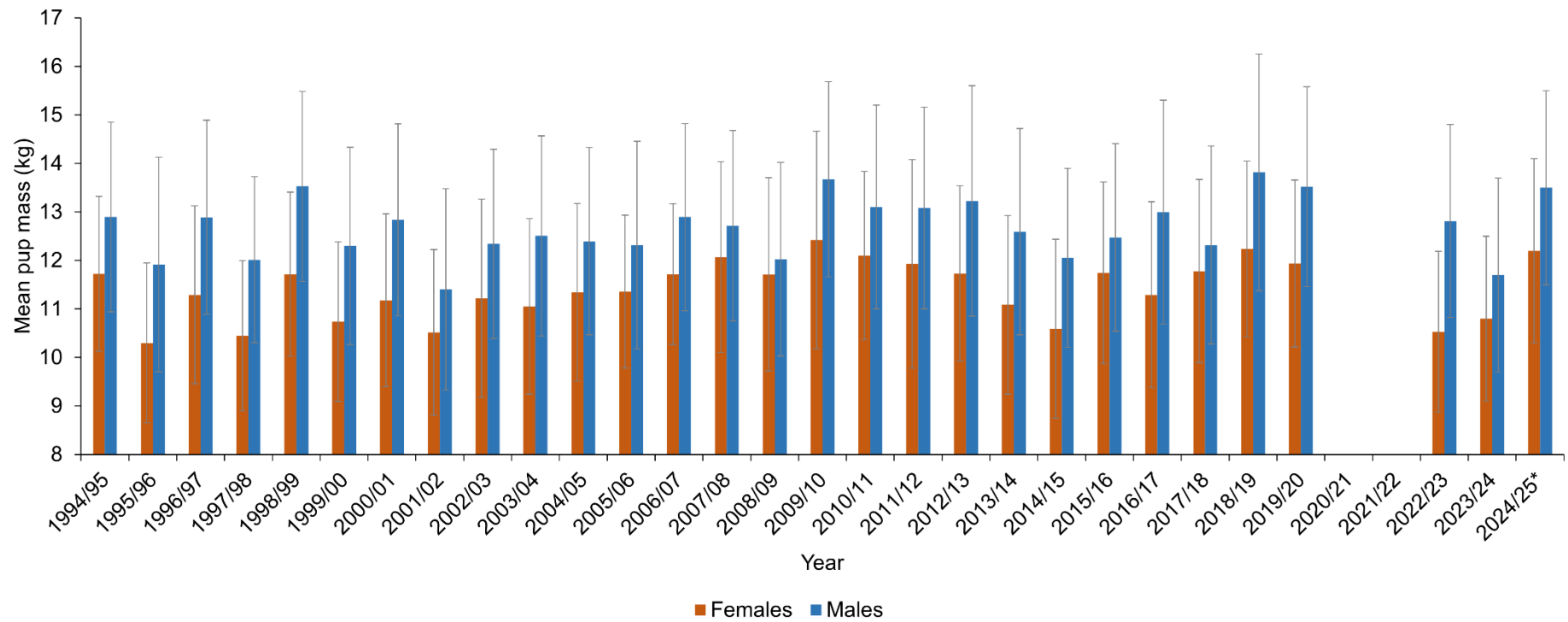


Figure 4. Mean pup mass at tagging (kg) for Sandy Bay, Enderby Island female and male pups (1994/95 – 2024/25). Error bars represent the standard deviation of the mean \pm 1SD. *Note that the apparent increase in weight in pups this year is likely an effect of altered methods which skewed the sample towards older pups.

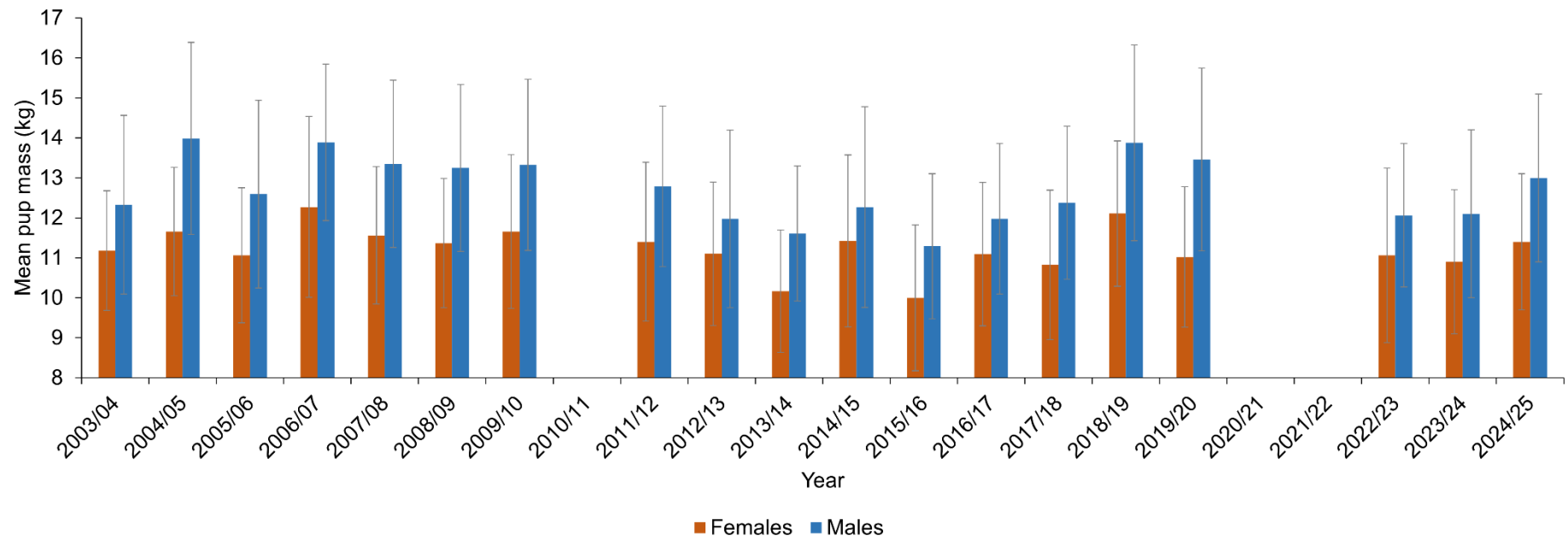


Figure 5. Mean pup mass at tagging (kg) for Dundas Island female and male pups (2003/04 - 2024/25). Error bars represent the standard deviation of the mean $\pm 1SD$.

5.3 Resightings of tagged individuals

Resightings were undertaken between 3 December 2024 and 24 January 2025 at Sandy Bay, Enderby Island. A total of 1,412 resighting events of approximately 400 unique marked New Zealand sea lions aged 1+ years (240 females : 160 males) were recorded on Enderby Island to 24 January 2024. Fifteen tagged animals were resighted on Dundas Island, and four were resighted on Figure of Eight Island. Resighting data are uploaded to the [New Zealand sea lion database](#) hosted by Dragonfly Data Science and are stored in [DOC-7822221](#). Teams 2 and 3 continued to collect resight records on the island after Team 1 departed the island, which are not recorded in this report, but have been uploaded to the New Zealand sea lion database.

DSLR cameras with large lenses were a valuable tool for recording flipper tag resightings. New this season was use of a close-range monocular that allowed the user to be within 30cm of the tag with clear magnification, which proved useful as often binoculars do not allow close range magnification even when it is safe and tolerated by the sea lion. Monoculars are recommended for future field use.

Increasingly, flipper tags are wearing and warping, and binoculars are no longer adequate for reading flipper tags in the field. The preliminary analysis of tag photographs indicates that many tags were intact (i.e. both sides and swivel in place) but were unreadable, and in some cases, the colours were faded to an indeterminate light brown colour. More research into cohort effects of tag loss and readability on demographic modelling are required, which could be determined from the dual-marked Enderby Island population once females have moved up onto the sward with pups and can be identified primarily using their implanted microchip.

5.4 Terrain trap mitigation

Terrain trap assessment and mitigation actions are described in a separate report.

6 Recommendations

- Review and implement a new iteration the New Zealand sea lion Threat Management Plan with Te Rūnanga o Ngāi Tahu and Fisheries New Zealand as partners (DOC & MPI 2017).
- Analyse tag resight data to investigate any changes in breeding rate or demographics of female New Zealand sea lions observed at Sandy Bay.
- Repeat this population survey in 2025/26, with continued emphasis on tag resightings to provide quality data for demographic modelling.
- Repeat ivermectin treatment program in 2025/26 to maximise survivorship of female NZSL pups, and consider extending treatment to male pups if indicated by demographic assessment of survival.
- Investigate links between the continued low levels of pup production, diet and dietary quality change, oceanographic conditions, and fisheries patterns. Determine evidence for nutritional stress from faecal samples.
- Conduct winter tracking of female New Zealand sea lions at Auckland Islands, to provide insights into the observed decline in pup production.
- Incorporate new information on population size and trajectory into assessment of threats and threat mitigation measures for New Zealand sea lions.

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9 Appendices

9.1 Appendix 1: Enderby Island daily direct counts

Table A1.1. Daily direct count data for all age-sex classes of New Zealand sea lions at Sandy Bay, Enderby Island in 2024/25. Mean best estimates were calculated from one to five observers undertaking multiple counts at the site.

<i>Date</i>	<i>Males</i>	<i>Subadult males</i>	<i>Females</i>	<i>Live pups</i>	<i>Cumulative dead pups</i>	<i>Daily counts # observers (# counts)</i>
4/12/2024	30	18	1	0	0	4(1)
5/12/2024	39	24	1	0	0	4(1)
6/12/2024	50	23	3	0	0	3(1)
7/12/2024	48	18	6	0	0	2(1)
8/12/2024	26	34	5	0	0	3(1)
9/12/2024	31	17	5	0	0	3(1)
10/12/2024	59	33	4	2	0	3(1)
11/12/2024	52	27	5	2	0	3(1)
12/12/2024	47	22	8	2	0	3(1)
13/12/2024	58	26	13	2	1	2(1)
14/12/2024	61	25	18	5	1	2(1)
15/12/2024	66	27	26	9	1	2(1)
16/12/2024	66	34	30	11	1	3(1)
17/12/2024	72	32	39	16	1	4(1)
18/12/2024	69	40	46	22	1	4(1)
19/12/2024	75	37	62	25	1	4(1)
20/12/2024	70	16	72	32	1	4(1)
21/12/2024	76	35	79	41	1	3(1)
22/12/2024	86	26	76	49	1	4(1)
23/12/2024	88	47	119	58	1	3(1)
24/12/2024	88	34	153	84	1	4(3)
25/12/2024	87	30	165	100	2	2(1)
26/12/2024	82	35	189	125	2	3(1)
27/12/2024	87	38	189	142	2	2(3)
28/12/2024	95	28	228	159	4	2(2)
29/12/2024	93	32	246	174	4	3(3)
30/12/2024	93	46	218	198	4	3(3)
31/12/2024	104	50	234	214	5	2(1)
1/01/2025	100	35	248	222	5	3(1)
2/01/2025	69	36	238	238	6	2(1)
3/01/2025	93	55	229	250	8	2(2)
4/01/2025	100	53	228	260	9	1(2)
5/01/2025	95	44	223	261	9	1(3)

<i>Date</i>	<i>Males</i>	<i>Subadult males</i>	<i>Females</i>	<i>Live pups</i>	<i>Cumulative dead pups</i>	<i>Daily counts # observers (# counts)</i>
6/01/2025	77	39	216	265	9	1(3)
7/01/2025	93	42	198	262	9	1(3)
8/01/2025	81	45	210	273	9	2(3)
9/01/2025	75	49	236	279	9	2(2)
10/01/2025	79	82	214	275	10	4(2)
12/01/2025	-	-	-	278	11	1(2)
16/01/2025	-	-	-	-	12	1(1)
19/01/2025	29	85	240	211	12	5(1)
20/01/2025	19	90	220	213	12	5(1)

9.2 Appendix 2: Dundas Island direct counts and mark-recapture

Table A2.1 Dundas Island direct counts of New Zealand sea lion pups on 21 January 2025 (four observers, four replicate counts).

<i>Date</i>	<i>Live pups</i>	<i>Cumulative dead pups</i>	<i>Observer # (count #)</i>
21/01/2025	1158	21	1 (1)
21/01/2025	1116	21	1 (2)
21/01/2025	1135	21	1 (3)
21/01/2025	1183	21	1 (4)
21/01/2025	1034	21	2 (1)
21/01/2025	1059	21	2 (2)
21/01/2025	1079	21	2 (3)
21/01/2025	1112	21	2 (4)
21/01/2025	1110	21	3 (1)
21/01/2025	1033	21	3 (2)
21/01/2025	1053	21	3 (3)
21/01/2025	1093	21	3 (4)
21/01/2025	1074	21	4 (1)
21/01/2025	1156	21	4 (2)
21/01/2025	1106	21	4 (3)
21/01/2025	1122	21	4 (4)

Table A2.2 Mark-recapture count data for New Zealand sea lion pups from the four observers at Dundas Island on 20 January 2025. A total of 300 pups were capped on 19 January 2025.

<i>Date</i>	<i>Capped</i>	<i>Uncapped</i>	<i>Observer # (count #)</i>
21/01/2025	138	316	1 (1)
21/01/2025	98	250	1 (2)
21/01/2025	68	191	1 (3)
21/01/2025	91	208	1 (4)
21/01/2025	129	268	2 (1)
21/01/2025	76	174	2 (2)
21/01/2025	77	188	2 (3)
21/01/2025	85	210	2 (4)
21/01/2025	123	312	3 (1)
21/01/2025	109	309	3 (2)
21/01/2025	105	269	3 (3)
21/01/2025	113	344	3 (4)
21/01/2025	179	350	4 (1)
21/01/2025	143	238	4 (2)
21/01/2025	124	256	4 (3)
21/01/2025	128	239	4 (4)

9.3 Appendix 3: Figure of Eight Island direct counts

Table A3.1 Figure of Eight Island direct counts of New Zealand sea lion pups from three observers on 22 January 2025.

<i>Date</i>	<i>Live pups</i>	<i>Cumulative dead pups</i>	<i>Total pups</i>	<i>Observer # (count #)</i>
22/01/2025	51	7	58	1 (1)
22/01/2025	54	7	61	2 (1)
22/01/2025	52	7	59	3 (1)

9.4 Appendix 4: Auckland Islands pup production estimates, 1994/95 to 2024/25

Table A4.1 Pup production estimates for Auckland Islands New Zealand sea lion colonies 1994/95 – 2024/25. Table copied from Melidonis & Childerhouse (2020). Data prior to 2012/13 from Chilvers (2012), data prior to 2018 from Childerhouse et al. (2018); 2018 – 2023 data from the Conservation Services Programme.

	<i>Sandy Bay Enderby Island</i>			<i>Dundas Island</i>			<i>Figure of Eight Island</i>			<i>Enderby Island (other)</i>			<i>Auckland Islands</i>		
<i>Year</i>	<i>Total pups</i>	<i>Live</i>	<i>Dead</i>	<i>Total pups</i>	<i>Live</i>	<i>Dead</i>	<i>Total pups</i>	<i>Live</i>	<i>Dead</i>	<i>Total pups</i>	<i>Live</i>	<i>Dead</i>	<i>Total pups</i>	<i>Live</i>	<i>Dead</i>
1994/95	467	421	46	1837	1603	234	143	123	20	71	59	12	2518	2206	312
1995/96	455	417	38	2017	1810	207	144	113	31	69	49	20	2685	2389	296
1996/97	509	473	36	2260	2083	177	143	134	9	63	39	24	2975	2729	246
1997/98	477	468	9	2373	1748	625	120	97	23	51	37	14	3021	2350	671
1998/99	513	473	40	2186	1957	229	109	100	9	59	42	17	2867	2572	295
1999/00	506	482	24	2163	2039	124	137	131	6	50	37	13	2856	2689	167
2000/01	562	527	35	2148	1802	346	94	92	2	55	47	8	2859	2468	391
2001/02	403	320	83	1756	1395	361	96	90	6	27	21	6	2282	1826	456
2002/03	489	408	80	1891	1555	336	94	89	5	43	26	17	2516	2078	438
2003/04	507	473	34	1869	1749	120	87	86	1	52	39	13	2515	2347	168
2004/05	411	411	30	1587	1513	74	83	79	4	37	31	6	2148	2034	114
2005/06	422	383	39	1581	1349	232	62	55	7	24	20	4	2089	1807	282
2006/07	437	414	23	1693	1587	106	70	67	3	24	19	5	2224	2087	137
2007/08	448	425	23	1635	1512	123	74	72	2	18	13	5	2175	2022	153
2008/09	301	289	12	1132	1065	67	54	48	6	14	8	6	1501	1410	91
2009/10	385	364	21	1369	1218	151	55	48	7	5	1	4	1814	1631	183
2010/11	378	359	19	1089	952	137	79	71	8	4	2	2	1550	1384	166
2011/12	361	343	18	1248	1189	59	74	72	2	1	0	1	1684	1604	80
2012/13	374	357	17	1491	1364	127	75	70	5	0	0	0	1940	1791	149
2013/14	290	284	6	1213	1141	72	72	62	10	0	0	0	1575	1487	88
2014/15	286	279	7	1230	1163	67	60	47	13	0	0	0	1576	1489	87
2015/16	321	308	13	1347	1221	126	59	53	6	0	0	0	1727	1582	145
2016/17	349	328	21	1549	1415	134	67	52	15	0	0	0	1965	1795	170
2017/18	332	309	23	1397	1340	57		NA	NA	0	0	0	1729	1649	80

	<i>Sandy Bay Enderby Island</i>			<i>Dundas Island</i>			<i>Figure of Eight Island</i>			<i>Enderby Island (other)</i>			<i>Auckland Islands</i>		
<i>Year</i>	<i>Total pups</i>	<i>Live</i>	<i>Dead</i>	<i>Total pups</i>	<i>Live</i>	<i>Dead</i>	<i>Total pups</i>	<i>Live</i>	<i>Dead</i>	<i>Total pups</i>	<i>Live</i>	<i>Dead</i>	<i>Total pups</i>	<i>Live</i>	<i>Dead</i>
2018/19	319	312	7	1295	1240	55	65	60	5	0	0	0	1679	1612	67
2019/20	289	285	4	1398	1353	45	53	27	26	0	0	0	1740	1665	75
2020/21	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2021/22	341	336	5	1284	1253	31	61	52	7	1	1	0	1686	1643	43
2022/23	268	258	10	960	911	49	51	50	1	0	0	0	1278	1218	60
2023/24	318	297	21	1107	996	111	32	26	6	0	0	0	1457	1319	138
2024/25	292	280	12	1024	1003	21	59	52	7	0	0	0	1376	1335	40