



# New Zealand Sea Lion (Rāpoka) Monitoring on the Auckland Islands for the 2019/20 Season: Field Research Report



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Photo: Christina Cheng

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## 1 Executive Summary

This report outlines components of New Zealand sea lion (NZSL) population monitoring work on the Auckland Islands as a part of the wider NZSL Threat Management Plan (TMP).

This work consists of two major components:

- Population monitoring (i.e. pup production) funded by the Conservation Services Programme (CSP), and
- Population demographics and pup mortality work funded by the NZSL Threat Management Plan (TMP).

Plans for the season were significantly impacted; first by financial constraints when the usual charter vessel was unavailable to transport the team to the subantarctic islands, and then by the breakdown of the alternative vessel commissioned for the work. This meant that the original plans for a six-week field season were reduced to 2-3 weeks, and then reduced further to only ten days.

During the 2019/20 field season, total pup production was estimated at 1,740 for the Auckland Islands. This estimate is 3.6% higher than the 2018/19 estimate of 1,679, continuing the relatively stable trend over the past 12 years since the lowest pup production recorded in 2008/09. Total pup production was estimated at 289 on Enderby Island (Sandy Bay n=289; South East Point n=0); 1,398 at Dundas Island; and 53 at Figure of Eight Island.

Flipper tags were used to permanently mark 510 pups (284 at Enderby, 200 at Dundas, and 26 at Figure of Eight). All tagged pups on Enderby were microchipped but no chipping was done on Dundas or Figure of Eight. One hundred pups at Dundas Island, 98 pups at Sandy Bay, and 26 pups at Figure of Eight Island were weighed and measured. Sea lion pup mortality investigations were only planned for carcasses found on Enderby and only one gross post-mortem was completed during the 2019/20 season. The cause of death for this pup was inconclusive due to moderate decomposition and extensive scavenging of the carcass.



Figure 1.1. The view from Enderby Island during the 'around the island walk' (Photo: Megan Melidonis).



## 2 Introduction

The New Zealand sea lion (*Phocarctos hookeri*, Rāpoka) is listed as ‘Threatened – Nationally Vulnerable’ (Baker *et al.* 2019). Due to a 50% drop in the number of pups born annually between 1998 and 2009 at the Auckland Islands and the third lowest pup count in the history of monitoring recorded in 2014, the New Zealand sea lion Threat Management Plan (TMP) was finalised in 2017. The TMP’s vision is to “promote recovery and ensure the long-term viability of New Zealand sea lions”. This includes, but is not limited to, the long-term monitoring of demographic parameters supported by the annual collection of resight data, morphometric data, and opportunistic mortality investigations.

As a project delivered under the Conservation Service Programme (CSP), measuring pup production was continued through the counting, tagging, and microchipping of pups. This paper reports on the field work undertaken by researchers from 16 January to 27 January 2020 on the Auckland Islands. This information is valuable for monitoring whether the TMP is meeting the objectives of the protection and recovery of this species, or whether future actions need to be reviewed.

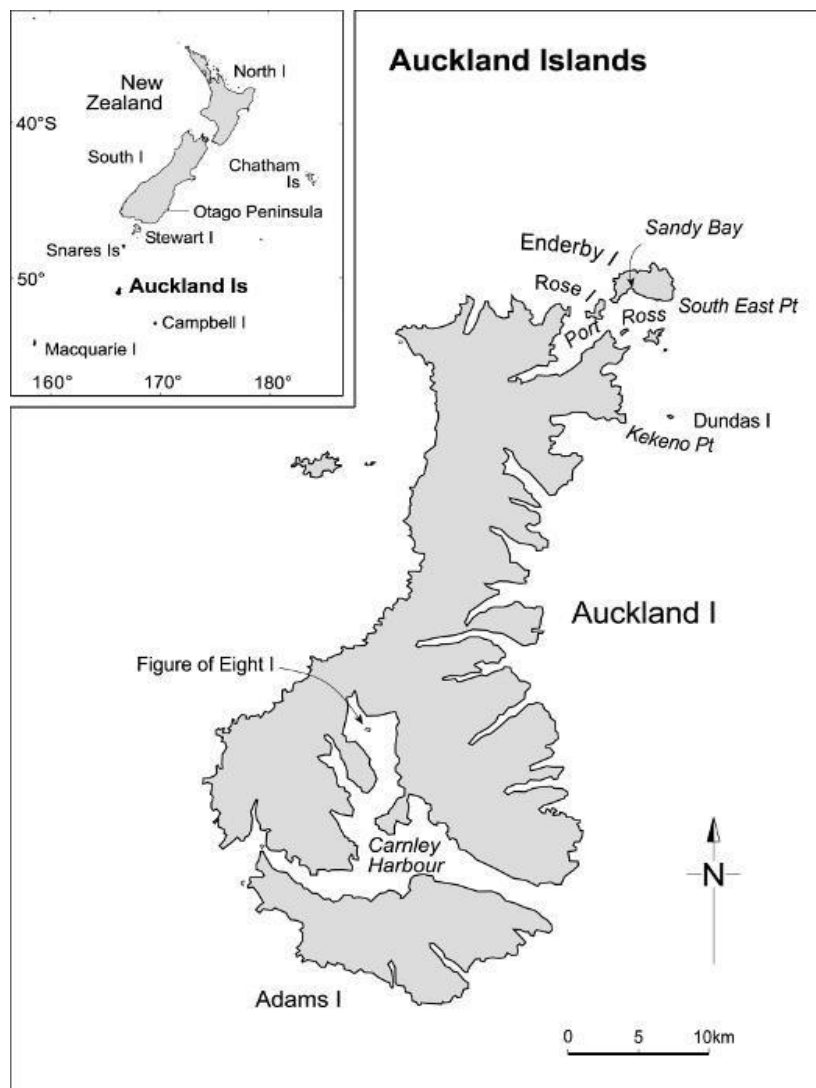


Figure 2.1. Map of the Auckland Islands showing Figure of Eight, Dundas, Enderby and Auckland Islands.

## 2.1 Objectives

The objectives of the 2019/20 Auckland Island sea lion monitoring project were to:

1. Conduct direct counts and mark-recapture estimates of pup production at Enderby Island (Sandy Bay and South-East Point), and Dundas Island, and one direct count at Figure of Eight Island;
2. Double flipper tag and microchip all pups at Sandy Bay, double flipper tag all pups at Figure of Eight, and double flipper tag 400 pups at Dundas Island (300 females and 100 males);
3. Weigh and measure (i.e. dorsal straight length and auxiliary girth) a sample of 100 pups (50 males and 50 females) at Sandy Bay and Dundas Island, and all pups at Figure of Eight;
4. Undertake daily counts of dead and live animals at Sandy Bay and one count around Enderby Island;
5. Improve understanding of population dynamics through the resighting of tagged and microchipped animals.
6. Undertake post-mortem autopsies of freshly dead pups on Enderby Island to determine cause of death;
7. Continue monitoring the “Planks for Pups” project and establish new ramps as needed; and
8. Opportunistic acquisition of shark scar photographs for future research (e.g predation rate studies).

This Report is a summary of the field work completed at the Auckland Islands during the summer field season 2019/20. Note that Objectives 1-4 are the core part of the CSP pup monitoring programme and points 5-7 are part of the wider TMP and this report summarises data collected under both these programmes.



Figure 2.2. Adult sea lions in the sward above Sandy Bay, Enderby Island (Photo: Megan Melidonis).

### 3 Methods

Methods strictly follow the Department of Conservation New Zealand Sea Lion and Fur Seal Pup Tagging Standard Operating Procedures (Boren 2018). Methods adopted for the 2019/20 season follow previously used techniques as closely as possible, although some changes were necessary due to delays in deploying the research team in the field. These changes are detailed in the Results and Discussion section.

#### 3.1 Logistics

The field season was largely split into two components as the priorities transitioned from the CSP portion of the project to the TMP portion. Plans for the season were significantly impacted; first by financial constraints, when the usual charter vessel was unavailable to transport the team to the subantarctic islands, and then by the breakdown of the alternative vessel commissioned for the work. This meant that the original plans for a six week field season were reduced to 2-3 weeks, and then reduced further to only ten days. The wider logistics team and vessel crew did an excellent job in getting a field team onto the islands to undertake the work as it was looking unlikely that any counts would be possible for this season.

#### 3.2 Team members

The team comprised the following people:

- Suzanne Berry (Team Leader)
- Christina Cheng
- Hanna Ravn
- Elizabeth Friend
- Megan Melidonis
- Mike Morrissey



Figure 3.1. The field team and vessel crew on return from the Auckland Islands trip for the 2019/20 season.

### 3.3 Summary of Key dates

Details of the 2019/20 field season include:

- 16 January Arrival at Auckland Islands (afternoon). Caps deployed at Sandy Bay (evening).
- 17 January Recapture at Sandy Bay (morning). Caps put out at Dundas (afternoon).
- 18 January Recapture at Dundas (morning). Tagging at Sandy Bay (afternoon).
- 19 January Tagging at Sandy Bay. Direct counts and resights at Sandy Bay.
- 20 January Tagging and direct counts at Dundas Island.
- 21 – 22 January Tagging at Sandy Bay. Direct counts and resights at Sandy Bay.
- 23 – 25 January Direct counts and resights at Sandy Bay.
- 26 January Direct count and tagging at Figure of Eight Island (morning).  
Direct counts at Sandy Bay (evening).
- 27 January Direct counts and resights at Sandy Bay.
- 28 January Direct counts and resights at Sandy Bay (morning). Departure from Auckland Islands.

### 3.4 Mark-Recapture calculation

Mark-Recapture (M-R) estimates of pup production were calculated using the Petersons estimate described in Chapman (1952) as indicated in Chilvers (2012).

$$P_i = [(M+1)(C_i+1)/(R_i+1)] - 1$$

Where  $P_i$  = pup production estimate calculated from the mean of individual observations,  $M$  = previously marked sea lion pups,  $C_i$  = total number of pups observed in the recapture sample,  $R_i$  = number of marked pups counted in the recapture sample.

For a full description of M-R methods, please see previous reports from the Auckland Islands research programme (e.g. Chilvers 2012, Dodge *et al.* 2019).



## 4 Results and Discussion

### 4.1 Pup counts

Annual pup production estimates are listed in Appendix 1, while pup count data are listed in Appendix 2.

#### 4.1.1 Sandy Bay Pup Counts

Methods follow previously used techniques as closely as possible although some changes were necessary this season due to delays with the deployment of the research team into the field. Consistent with the previous season, 200 caps were deployed for the Mark-Recapture estimate (M-R) and were left overnight before counting.

The changes to previous years included:

- The M-R live pup estimate was undertaken one day later on 17 January rather than 16 January. Only four recapture counts were undertaken when normally nine counts would be undertaken.
- The direct live pup count was undertaken two days later than the M-R estimate which is normally undertaken on the same day. The direct count was three days later than normal on the 19 January rather than the 16 January. Only one direct count was undertaken when normally nine counts would be undertaken.
- The cumulative dead pup count only represents counts from 16 January as no counts were able to be conducted prior to this as the team did not arrive on the Island until that date.
- Tagging of pups was undertaken between the 18 and 22 January when normally undertaken on the 15 and 16 January.

Table 4.1. Calculation of pup production estimates for Sandy Bay 2019/20.

Method	Date	Counts	Estimate (SE)
<b>Mean M-R estimate</b>	17/01/20	4	<b>262 (3.6)</b>
<b>Direct live count</b>	19/01/20	1	<b>233</b>
<b>Cumulative dead count for season (A)</b>	19/01/20	1	<b>4</b>
<b>Total number of pups tagged (B)</b>	18-22/1/20		<b>284+1*</b>
<b>Total pup production (A+B)</b>			<b>289</b>

\*Note: All pups on Enderby Island were accounted for: 284 pups were tagged (125 male and 158 female); and one additional pup of unknown sex was not tagged as it was inaccessible (but was added to the total number of pups tagged in the table above). SE = standard error.

The total pup production for Sandy Bay in 2019/20 is estimated at **289**. This number reflects the total number of live pups tagged ( $n=284$ ), plus the number of dead pups cumulative to the day of pup production counts ( $n=4$ ) and one live untagged pup ( $n=1$ ) that was being aggressively protected by its mother (Table 4.1). For this report, the actual numbers of tagged pups were used for pup production rather than the M-R calculation. This is because all pups on the Island, save one, were tagged.

In most circumstances, a M-R calculation results in the most accurate population

representation and remains consistent with the methods used to determine pup production at Sandy Bay in past years. In 2019/20 the M-R was undertaken for comparability with the long-term data set and was used as a familiarisation exercise prior to conducting M-R at Dundas Island. Due to the small population at Enderby, it is suggested that the M-R may not be necessary for accuracy and the usefulness of M-R at this site should be reviewed for future surveys with consideration of the impact on such a vulnerable species.

Figure 4.1 shows annual pup production estimates at Sandy Bay from season to season. The 2019/20 pup production estimate at Enderby (n=289) was 9.4% lower than the 2018/19 season (n=319) and is the second lowest Enderby Island count since consistent records began in 1994/95 (n=286). During the 2019/20 survey 1% pup mortality was observed; however, it is important to note that this year’s pup mortality (and therefore this year’s pup production estimate) may be an underestimate as the team arrived late in the field (on 16 January) and any pups that died prior to this may not have been available for counting. Some previous seasons saw field teams arrive by late November/early December. This year, early season pup deaths may not have been captured due to events such as scavenging where carcasses would no longer be present in early January. During the previous season the number of dead pups up to 16 January totalled seven (Dodge *et al.* 2019) compared to this year’s total of four dead pups (Figure 4.2).

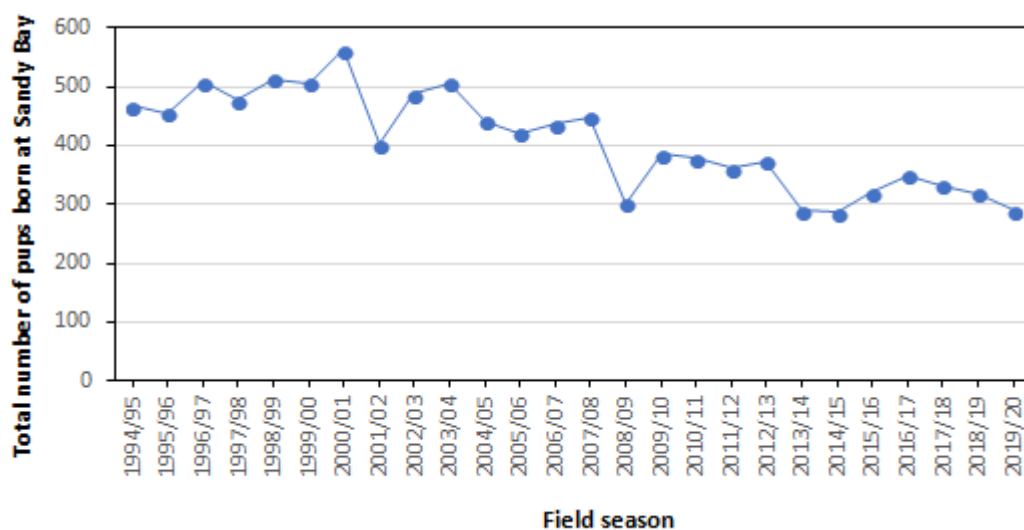


Figure 4.1. Total estimated pup production for New Zealand sea lions at Sandy Bay 1994/95-2019/20. Data prior to 2012/13 from Chilvers (2012) and data prior to 2018/19 from Childerhouse *et al.* (2018).

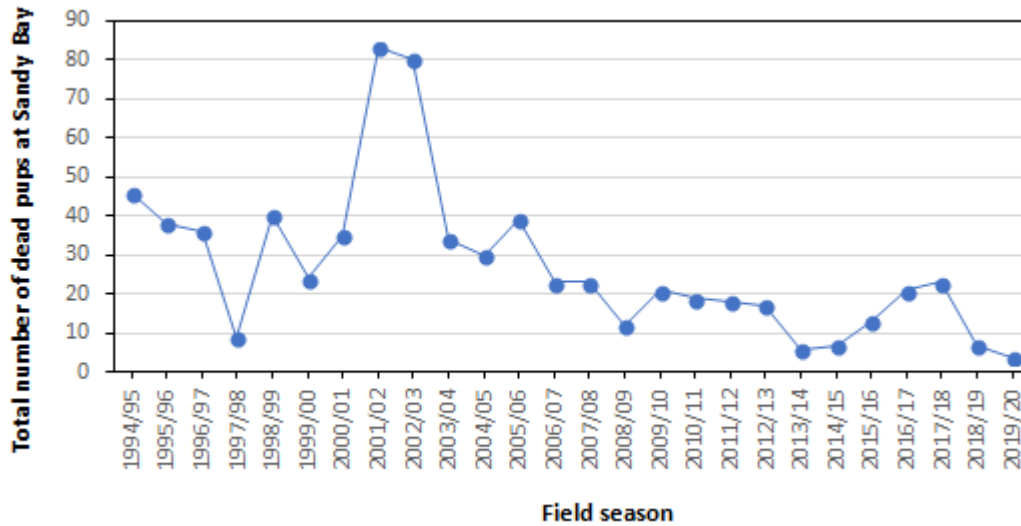


Figure 4.2. Total number of dead pups found at Sandy Bay, Enderby Island from 1994/95-2019/20.

#### 4.1.2 South East Point pup counts

Although field teams searched the area thoroughly, there were no pups recorded at South East Point, indicating that there has been no re-establishment of breeding at this site (Figure 4.3).

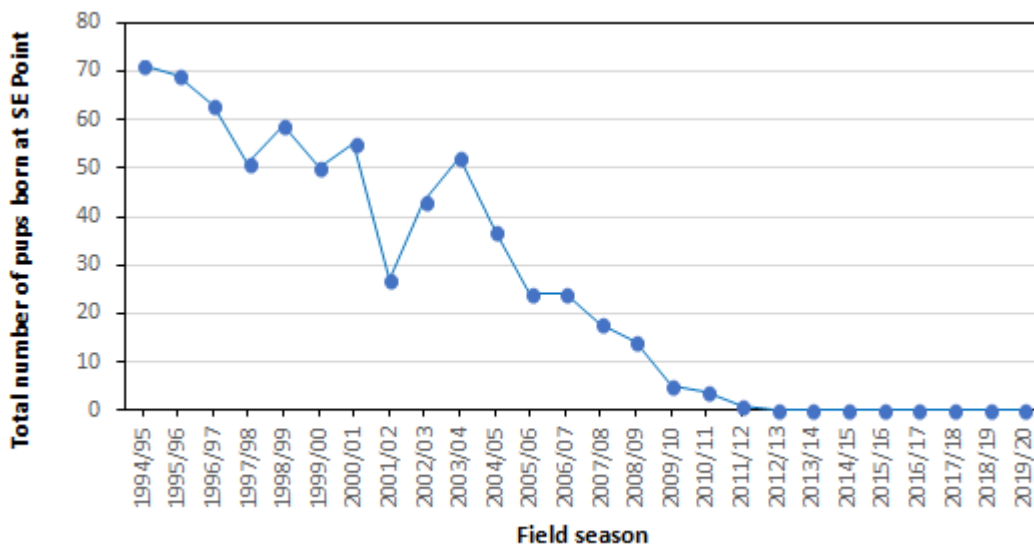


Figure 4.3. Total estimated pup production for New Zealand sea lions at South East Point 1994/95-2019/20. Data prior to 2012/13 from Chilvers (2012) and data prior to 2018/19 from Childerhouse *et al.* (2018).

### 4.1.3 Dundas Island pup counts

Methods follow previously used techniques as closely as possible, although some changes were necessary this season due to delayed deployment of the research team in the field and reduced time on the island due to adverse sea conditions making landing and recovery unsafe. Consistent with previous years, 400 caps were put out for the M-R and were left overnight before counting.

Changes to previous years included:

- Live and dead direct counts at Dundas Island were undertaken two days after the M-R was completed (M-R 18 January and direct counts 20 January).
- Only two M-R counts were undertaken when normally there would be nine.
- Only one direct live and dead count was undertaken when normally there would be three.
- All work on Dundas Island was completed in fewer than two full days rather than the usual four full days.

Table 4.2. Calculation of pup production estimates for Dundas Island for the 2019/20 season.

Method	Date	Counts	Estimate (SE)
<b>Mean M-R estimate (A)</b>	18/01/20	2	<b>1,353 (63)</b>
<b>Dead count on day of M-R (B)</b>	18/01/20	1	<b>45</b>
<b>Mean direct live count</b>	20/01/20	1	<b>749</b>
<b>Cumulative dead count*</b>	20/01/20		<b>68</b>
<b>Total number of pups tagged</b>	20/01/20		<b>200**</b>
<b>Total pup production (A+B)</b>			<b>1,398</b>

\* Total of dead pups counted on 17/01=25, 18/01=20 and 20/01=23

\*\* 109 male and 91 female pups were tagged. SE = standard error.

Total pup production for Dundas Island in 2019/20 was estimated at **1,398** (Figure 4.4). This number reflects the mean of the M-R estimate (n=1,353) plus the cumulative dead count up until the day of recapture (n=45) (Table 4.2). This estimate was 7.9% higher than the estimate calculated for Dundas Island in 2018/19 (n=1,295).

A mortality rate of 3% was calculated from the M-R estimate, which is likely to be an underestimate given that pups deceased prior to the team arriving on the Island were likely unavailable for counting.



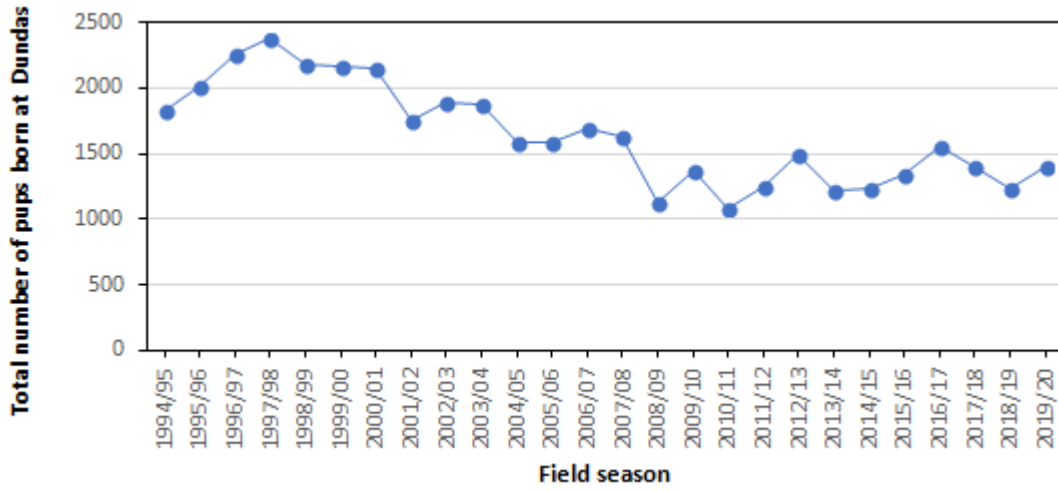


Figure 4.4. Total estimated pup production for New Zealand Sea Lions at Dundas Island 1994/95-2019/20. Data prior to 2012/13 from Chilvers (2012) and data prior to 2018/19 from Childerhouse *et al.* (2018).

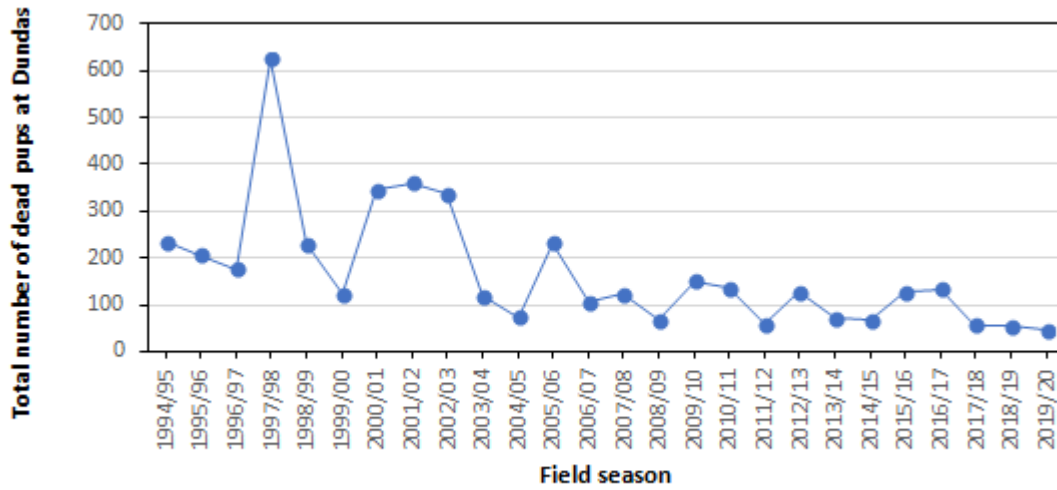


Figure 4.5. Total number of dead pups found at Dundas Island from 1994/95-2019/20.

#### 4.1.4 Figure of Eight Island pup counts

Surveys at Figure of Eight Island are generally undertaken as resources are available. Methods follow previously used techniques as closely as possible, although the survey was undertaken later this year (26 January) rather than by 10 January due to limited transport options.

Table 4.3. Calculation of pup production estimates for Figure of Eight Island for the 2019/20 season.

Method	Date	Counts	Estimate (SE)
<b>Direct live count (A)</b>	26/01/2020	1	<b>27</b>
<b>Dead count on the day of direct count (B)</b>	26/01/2020	1	<b>26</b>
<b>Total number of pups individually tagged</b>	26/01/2020		<b>26*</b>
<b>Pup production estimate (A+B)</b>			<b>53</b>

\*Note: 13 male and 13 female pups were tagged.

The total pup production for Figure of Eight Island in 2019/20 was estimated at **53** (Table 4.3). This reflects the mean of the direct count estimate (n=27) plus the dead count (n=26). This estimate is 18.5% lower than that recorded in 2018/19 (n=65) and is the lowest count ever recorded for Figure of Eight Island (Figure 4.6). Although this may be a true representation of pup production on the Island, the survey was conducted later than in previous years potentially leading to lower numbers of females and pups left on the Island.

Concerning is the number of dead pups found on Figure of Eight Island this season, the second highest (n=26) ever recorded at this site (Figure 4.7). The 2019/20 mortality rate of 49% indicates that the colony may have been struck by devastating adversity (e.g. bad weather, disease). Most of the individuals observed were freshly dead with some still twitching from rigor mortis. Again, it is important to note that some live pups may have relocated to other sites before the Island was surveyed.

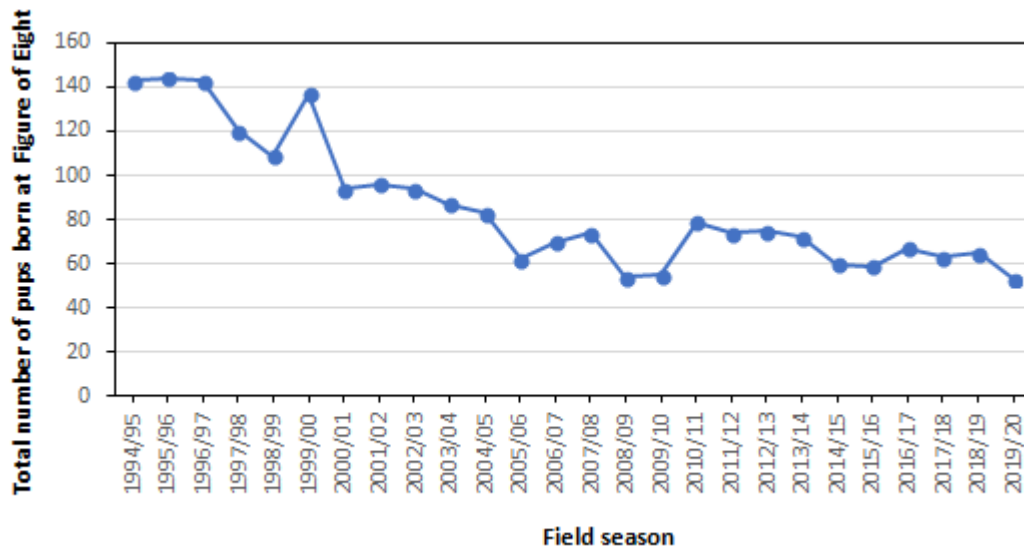


Figure 4.6. Total estimated pup production for New Zealand sea lions at Figure of Eight Island 1994/95-2019/20. Data prior to 2012/13 from Chilvers (2012) and data prior to 2018/19 from Childerhouse *et al.* (2018).

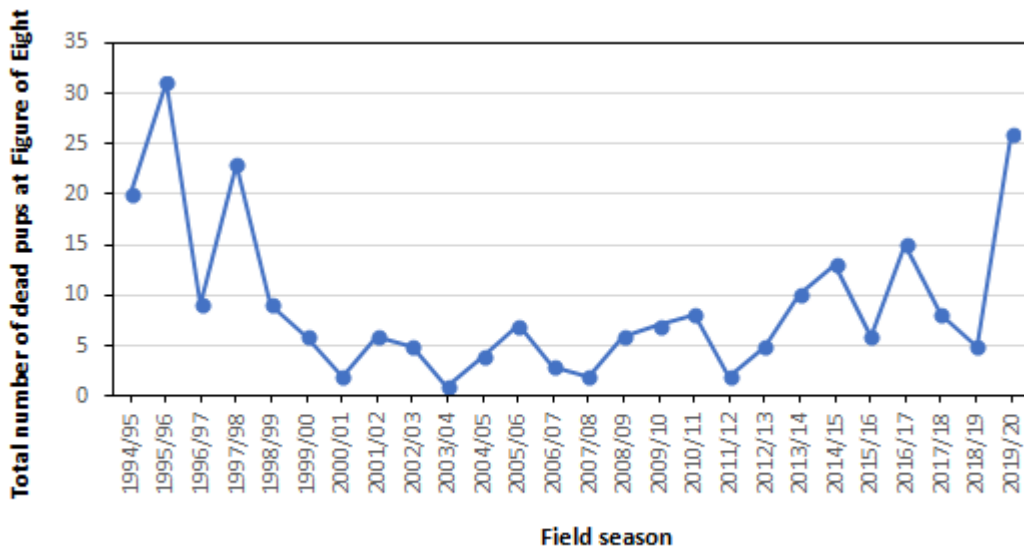


Figure 4.7. Dead pups recorded at Figure of Eight Island 1994/95 to 2019/20.

#### 4.1.5 Auckland Islands pup production

The following section provides a summary of the total pup production for the Auckland Island group during the 2019/20 season. Direct counts were used to calculate pup production on both Enderby and Figure of Eight Islands due to small population numbers (Table 4.4). While M-R counts were the primary method for estimating pup production at Dundas, direct counts of pups were undertaken prior as a comparative reference (see Section 4.1.3).

Table 4.4. Summary of pup production estimates for the Auckland Islands for the 2019/20 season.

Location	Method	Total	Live	Dead
<b>Sandy Bay</b>	Direct count	289	285	<b>4</b>
<b>South East Point</b>	Direct count	0	0	<b>0</b>
<b>Dundas</b>	M-R	1398	1,353	<b>45*</b>
<b>Figure of Eight</b>	Direct count	53	27	<b>26</b>
<b>Total Auckland Islands</b>		<b>1,740</b>	<b>1,665</b>	<b>75</b>

\*Note: Number dead on the date of the M-R count. A further 23 dead pups were found during tagging on Dundas Island.

Overall pup production for the Auckland Islands during the 2019/20 season was estimated at 1,740 (1,665 live pups and 75 dead pups) showing a 3.6% increase from the 2018/19 estimate of 1,679. Figure 4.8 shows pup production at the Auckland Islands increasing from the 1994/95 season to a peak in the 1997/98 season. A sharp downward trend was observed up until the 2008/09 season after which the estimated number of pups born fluctuated between 1,501 and 1,965 with 1,740 pups recorded during the 2019/20 season.

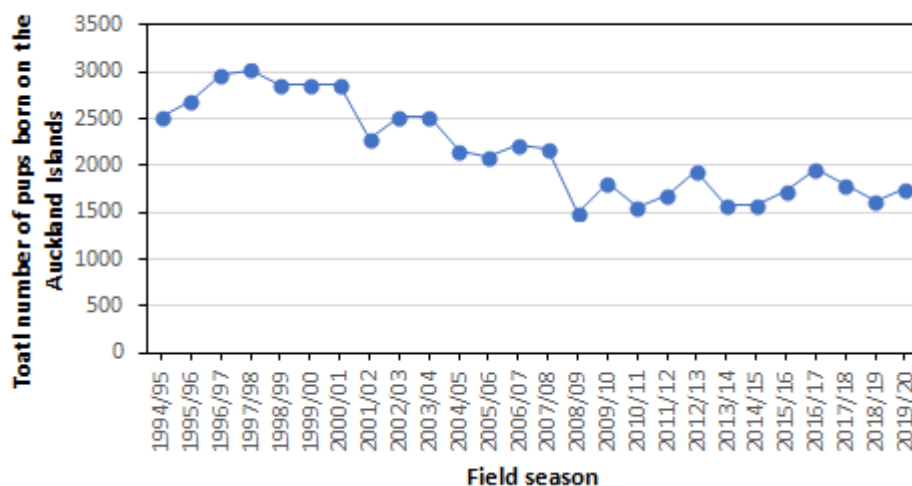


Figure 4.8. Total estimated pup production for New Zealand sea lions at the Auckland Islands (all colonies combined) 1994/95-2019/20. Data prior to 2012/13 from Chilvers (2012) and data prior to 2018/19 from Childerhouse *et al.* (2018).



## 4.2 Tagging and morphometrics

Methods follow previously used techniques as closely as possible, although some changes were necessary this season due to delays in deploying the research team into the field. All pups at Sandy Bay were tagged and microchipped with the exception of a single pup.

The changes to previous years included:

- Pup tagging at Sandy Bay undertaken several days later than in previous years; and
- 200 pups tagged (but not microchipped) on Dundas Island due to limited time available on the Island. Normally 400 pups (100 male, 300 female) are tagged.



Figure 4.9. Tagging pups on Dundas Island (Photo: Christina Cheng).

Sex ratio for pups tagged was:

- Sandy Bay – 158 female to 125 male (i.e. 1.30 : 1.00)
- Dundas Island – 91 female to 109 male (i.e. 0.83 : 1.00)
- Figure of Eight Island – 13 female to 13 male ( i.e. 1.00 : 1.00)

A sample of pups were weighed and measured at each colony following consistent methods (Boren 2018, Dodge *et al.* 2019).

Table 4.5. Mean pup weights for Sandy Bay (18-19 January), Dundas Island (20 January) and Figure of Eight Island (26 January) for the 2019/20 season.

Location	Mean female weight			Mean male weight		
	n	kg (SD)	Change from 2018/19	n	kg (SD)	Change from 2018/19
Sandy Bay	48	12.3 (0.2)	+0.4%	50	13.9 (0.3)	+0.4%
Dundas	50	11.4 (0.3)	-0.4%	50	13.8 (0.3)	-5.9%
Figure of Eight	13	13.6 (0.8)	N/A*	13	14.2 (0.7)	N/A*
<b>Auckland Is Ave</b>	<b>111</b>	<b>12.4</b>		<b>113</b>	<b>14.0</b>	

\*Pups not weighed on Figure of Eight in previous years. SD = standard deviation.

### 4.3 Daily counts

The field team of six members completed an around the island walk on 21 January and daily counts were completed on Enderby Island as per the data presented in Table 4.6.

Table 4.6. Summary of the daily counts and the around the Island walk completed on 21 January 2020. SAM = Sub adult male.

Date	Start	End	Location	Bulls	SAMs	Females	Pups
19/01/20	16:26	18:43	Sward	10	36	1	23
19/01/20	16:26	18:10	Beach	32	59	193	210
20/01/20	18:05	20:07	Sward	4	3	5	0
20/01/20	18:05	19:17	Beach	49	51	220	209
21/01/20	18:37	19:00	SE Point	21	77	6	0
22/01/20	18:30	19:52	Sward	22	52	30	65
22/01/20	18:30	19:41	Beach	41	39	169	153
23/01/20	10:50	12:07	Sward	10	43	67	122
23/01/20	10:50	12:32	Beach	16	63	162	142
24/01/20	09:30	10:28	Sward	19	48	56	81
24/01/20	09:30	11:59	Beach	19	72	193	177
25/01/20	07:40	08:58	Sward	7	51	146	152
25/01/20	12:00	15:39	Beach	10	53	167	129
26/01/20	19:00	20:16	Beach	24	87	272	168
26/01/20	19:00	20:26	Sward	8	23	30	96
26/01/20	19:00	19:24	Forest	0	0	5	0
27/01/20	07:22	10:06	Beach	13	49	128	127
27/01/20	07:22	09:18	Sward	3	29	42	86
27/01/20	07:22	07:58	Forest	0	0	4	37
28/01/20	07:30	08:25	Sward	0	10	5	8



Figure 4.10. Pups socialising on Sandy Bay beach, Enderby Island (Photo: Christina Cheng).

#### 4.4 Tag and microchip resighting

No resight effort was possible on Dundas and Figure of Eight Islands due to the limited time spent at each site. Tag resighting was undertaken between 19 and 28 January at Enderby Island using a magnifying glass attached to a pole and telephoto lens photography for tag resights, and a microchip reader attached to a pole for microchips. Total resighting effort on Enderby was measured per resighting team and totalled 6 hours 51 minutes spread across ten days. After removing duplicates of the same animal recorded on the same day, a total of 259 individual resights were collected.

Resighting data was added to the NZSL Dragonfly database and can be accessed at <https://sealions.dragonfly.co.nz/demographics/>.

#### 4.5 Post-mortems

Sea lion pup mortality investigations were only planned for carcasses found on Enderby due to logistical and time constraints. One gross post-mortem was completed during the 2019/20 season as only one pup was in a condition suitable for autopsy. The remaining three pup carcasses were already reduced to skeletons when discovered by the field team. The cause of death for the pup examined on Enderby on 22 January was inconclusive due to moderate decomposition and extensive scavenging of the carcass, although enlarged splenic lymph nodes and suspected microabscesses on liver and spleen were noted. No parasites were detected.



#### 4.6 Planks for pups

During the 2019/20 field season pups were located only on Sandy Bay Beach and in the sward directly above the beach. During inspection of the bog and riverine area, no obvious terrain traps were identified. As a result, it was not necessary to install any additional ramps. Existing ramps are as per Dodge *et al.* 2019 and should be reassessed in the upcoming field season if necessary.

#### 5 Acknowledgements

Thank you to the field team for their hard work in extremely challenging conditions. None of this work could be completed without the effort and coordination put in by Katie Clemens-Seely, Kristopher Ramm, Laura Boren, Ian Angus, Enrique Pardo, and the DOC supporting staff. DOC quarantine staff, especially John Peterson and Janice Kavern, remain an asset to this project in their contribution to logistics and ensuring that gear arrives on the islands only after passing the most strict quarantine standards. A big thank you to those at the Murihiku office, especially John McCarol, Joseph Roberts and Sharon Trainor, and the duty officers whose watch ensured our safety and with whom we spoke to daily. Gratitude goes to members of the TMP and CSP Technical Working Group that provided feedback which allows DOC to continue to make improvements to the protection of New Zealand sea lions in the future.



Figure 4.11. Pups on Enderby Island (Photo: Christina Cheng).



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6.1.1 Appendix 1. Annual estimates of the total Auckland Island pup production and total pup production estimates for each colony (including live and dead) 1994/95-2019/20.

Data prior to 2012/13 from Chilvers (2012), and data prior to 2018/19 from Childerhouse *et al.* (2018).

Year	Sandy Bay			Dundas Island			Figure of Eight			Southeast Point			Auckland Islands		
	Annual pup production	Live	Dead	Annual pup production	Live	Dead	Annual pup production	Live	Dead	Annual pup production	Live	Dead	Annual pup production	Live	Dead
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	488	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	441	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	63	55	8	0	0	0	1792	1704	88
2018/19	319	312	7	1295	1240	55	65	60	5	0	0	0	1679	1612	67
<b>2019/20</b>	<b>289</b>	<b>285</b>	<b>4</b>	<b>1398</b>	<b>1353</b>	<b>45</b>	<b>53</b>	<b>27</b>	<b>23</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1740</b>	<b>1665</b>	<b>75</b>

6.1.2 Appendix 2. Raw data for direct and mark-recapture counts at Sandy Bay and Dundas Island for 2019/20.

Mark- Recapture counts for Sandy Bay on 17 January 2020		
<b>200 pups capped (i.e. marked)</b>		
<b>Sandy Bay</b>	<b>Total number of pups recaptured</b>	<b>Number of recaptured pups that were marked</b>
Counter 1-1	111	88
Counter 1-2	122	91
Counter 2-1	119	89
Counter 2-2	118	90

Mark- Recapture counts for Dundas on 18 January 2020		
<b>400 pups capped/marked</b>		
<b>Dundas Island</b>	<b>Marked Counted</b>	<b>Unmarked Counted</b>
Counter 1-1	286	637
Counter 2-1	268	681
<b>Direct Live Pup Counts for Dundas Island</b>		
	Direct Count	
Counter 1	749	20 January 2020
<b>Cumulative dead pup count for Dundas Island</b>		
	Dead Count	
Cumulative count	45	18 January
	68	20 January