

FINAL

Preliminary Report for CSP
Project New Zealand sea lion
monitoring at the Auckland
Islands 2017/18

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1. Executive Summary

Blue Planet Marine (BPM) was contracted by the Conservation Services Programme (CSP) of the Department of Conservation (DOC) to provide services for the CSP Project POP2017-05 New Zealand sea lion (NZSL) monitoring at the Auckland Islands 2017/18. The field component of the work was completed on 22 January 2017. Pup production for Figure of Eight is being undertaken under a separate contract and was not available at the time of writing. This preliminary report summarises the pup production estimates available at the time to writing which are now complete and the report will be updated when additional information becomes available in February (e.g. locations of marking on Dundas Island, resighting data, Figure of Eight pup production estimates).

In summary:

- Pup production was estimated for NZSL colonies at Sandy Bay (n=332), Dundas Island (n=1,397), Figure of Eight Island (not yet available) and South East Point (n=0); with total pup production for Enderby and Dundas Island in 2017/18 estimated as **1,729**. The estimate for these two Islands in 2017/18 is 9% lower than for 2016/17 and is 31% higher than the lowest ever estimate for pup production in 2008/09. Since the lowest ever record of total pup production at the Auckland Islands in 2008/09, pup production has seen annual increases in six of the last eight years and overall production appears to have stabilised at around 1500-2000 pups per annum since 2008/09. While the stabilisation of total pup production is a positive step, it is important to note that pup production in 2017/18 still represents a ~40% decline since the peak in 1997/98. The good news is that the estimate for 2017/18 is ~15% higher than the lowest ever estimate for pup production of 1501 pups seen in 2008/09.
- Estimates of pup mortality to the date of the pup production estimate in mid-January are broadly comparable to previous 'non-epidemic' years. However, many of these figures do not represent full season surveys and are not directly comparable to data collected prior to 2012/13, and so should be viewed as a minimum. Pup mortality estimates to the date of pup count are: Sandy Bay 7% (to 16 January), Dundas Island 4% (on 19 January) and overall for both sites 5%.
- Three of the four mean pup weights in 2017/18 were lower than in 2016/17. At Sandy Bay were 1% and 10% lower than for females and males respectively. Mean pup weights at Dundas Island were 4% lower and 5% higher for females and males respectively;
- Seven hundred and nine pups were marked at the Auckland Islands including: Sandy Bay – 309 flipper tagged and microchipped; Dundas Island – 400 flipper tagged only;
- Provisional cause of death was not part of this contract and will be reported separately by DOC;
- There was only a small amount of resighting effort conducted as part of this project as there was no time allocated to it. Additional limited resighting effort is being undertaken by DOC personnel remaining on Enderby Island;
- To the date of this report, there were few reports of pup mortalities in holes due to the fact that pups at Sandy Bay have yet to reach the areas with holes and also that some additional ramps were added to key spots on Dundas Island last year which has likely contributed to the lower observed rate of mortality in holes out there; and
- Overall, the project was a success and all objectives were completed.

2. Methodology

Blue Planet Marine (BPM) was contracted by the Conservation Services Programme (CSP) of the Department of Conservation (DOC) to provide services for the CSP funded project POP2017-05 New Zealand sea lion Auckland Island monitoring 2017/18.

A full description of methods used in this field study are available in Childerhouse (2017), which is available from DOC and the authors upon request. The research outlined here follows almost exactly the same methods as undertaken previously by DOC and as described in Chilvers (2012). The only major differences to survey work undertaken prior to 2012/13 include:

- dead pups were removed at Sandy Bay from the start of the breeding season whenever possible to allow for autopsy and the determination of cause of death;
- the survey of Figure of Eight Island was undertaken under a separate contract and are therefore not covered here;
- no dedicated resighting effort was required but rather it was to be undertaken when time allowed after completion of core monitoring work; and
- only 8 days of field work were contracted for 2017/18 season compared with approximately 6-7 weeks for previous seasons (e.g. 48 days in 2015/16 – 2 weeks pup census and tagging & 5 weeks resighting) although additional monitoring was undertaken under a separate contract and will be reported separately.

A team of four sea lion researchers (Burns, McNutt, Godoy, McCormack) and one wildlife vet (Michael) undertook the counts and marking work. Several researchers will remain on Enderby Island under a separate contract until March 2018 to investigate disease and mortality in pups and this work will be reported separately.

3. Results

3.1 Logistics

A summary of key dates:

- 13 January – Three researchers (McNutt, Godoy, McCormack) departed Bluff aboard *RV Evohe* for the Auckland Islands;
- 14 January – Arrived Enderby Island, Auckland Islands and joined the two other team members (Burns, Michael) already on the Island;
- 15-17 January – Survey and pup marking at Sandy Bay;
- 18-20 January – Survey and pup marking at Dundas Island; and
- ~31 January – Three researchers (McNutt, Godoy, McCormack) will depart Enderby Island aboard *RV Evohe* and two researchers remain undertaking other work.

The field work included 3 days on Enderby Island, 3 days on Dundas Island and no survey effort on any other Island. There were researchers on Enderby Island from mid-November involved in Yellow Eyed Penguin research and from mid-December involved in NZSL pup disease and mortality work. Both these projects were operating under separate DOC contracts and will be reported on separately.

The team of researchers undertaking the primary research included: Thomas Burns, Sarah Michael, Lou McNutt, Dan Godoy, and Chris McCormack. The data in this report are a credit to the hard work, dedication and expertise of these people.

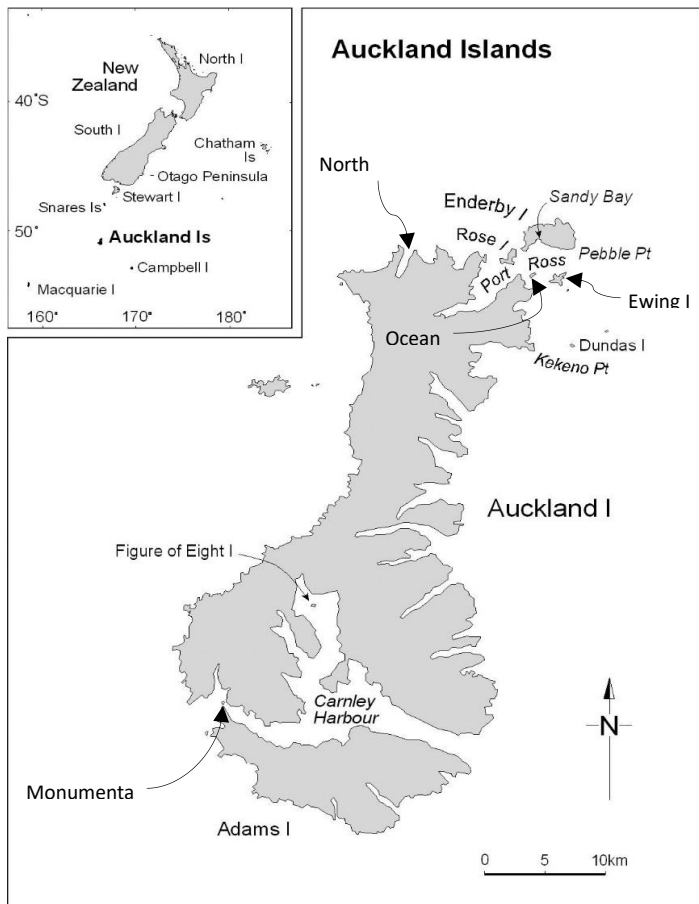


Figure 1: Map of the Auckland Islands showing sites mentioned in the text.

3.2 Estimates of pup production

Annual estimates of pup production for each colony and for total Auckland Islands pup production from 1994/95 until 2017/18 are shown in Appendix 1. Figures showing annual estimates for pup production by colony are shown in Appendix 2. Note that at the time of the preparation of this report, no count information was available for Figure of Eight Island. This report may be updated with that information when it becomes available in February.

3.2.1 Sandy Bay, Enderby Island

Table 1: Summary of pup production estimates for Sandy Bay for 2017/18

Method	Date	No. counts	Start/end time	Estimate (SE)
Mean direct live count	16 Jan 2017	9	08:05/10:22	302 (2.6)
Cumulative dead count to the day of the mark-recapture ¹	16 Jan 2017	N/A	08:05/10:22	23
Mean mark-recapture estimate	16 Jan 2017	9	08:05/10:22	308 (3.0)
Total number pups individually marked	16-17 Jan 2017	N/A	N/A	309

Total pup production for Sandy Bay is estimated at **332** (309 live plus 23 dead pups) for 2017/18. This estimate uses the number of live pups tagged on the 15 and 16 January rather than the mark-recapture estimate of abundance as it is more accurate. This total is 5% lower than the estimate for previous season. Figures showing annual estimates for Sandy Bay colony are shown in Appendix 1

¹ This represents the cumulative total from daily observations of dead pups from observations starting on 6 December 2016 and therefore provides a good estimation of total pup mortality.

and Appendix 2. Raw data for counts at each of the colonies are provided in Appendix 3: Raw data for pup production estimates for Sandy Bay, Dundas Island and Figure of Eight Island 2017/18. The estimate of mortality to the 16 January 2017 was 7% which is consistent with the long-term average (1994/95-2016/17) of 7% but noting that this year's estimate represents a complete season count whereas previously, many years only represent a count from early January onwards.

Estimates of pup production at Sandy Bay were completed successfully. Nine mark-recapture counts by three people were undertaken and 9 direct counts by three people were undertaken of live pups (Appendix 3). In addition, a daily direct count of was undertaken daily between 6 December and 18 January 2017 and this information will be added to the report when it becomes available. A description of the breeding area searched during pup counts at Sandy Bay is provided in Appendix 4.

One hundred and twenty caps were used as marks for the mark-recapture and were put out on 15 January (between 08:30 and 16:30). Three caps were recovered from the ground prior to starting the mark-recapture counts on the 16 January. The number of marked pups was, therefore, considered to be 117 for the purposes of the mark-recapture estimation (Appendix 3: Raw data for pup production estimates for Sandy Bay, Dundas Island and Figure of Eight Island 2017/18).

The methodology for estimating the number of dead pups has varied over the years. Prior to 2012/13, all dead pups were counted daily (generally starting early December) and removed from the beach for autopsy throughout the season. This therefore represents a cumulative and complete seasonal count of dead pups. In 2012/13, all dead pups were left on the beach to allow for helicopter aerial surveys to be undertaken to count both live and dead pups, and the first dead counts were made on January 11 when the team arrived with no counts prior to this. For 2013/14 and 2014/15, all dead pups found on the beach during the first survey on 8 January were counted and removed. Therefore between 2012/13 and 2014/15, these counts represent incomplete season counts. Since 2015/16, there was a cumulative and complete count from mid-November until around 19 January. Overall, it is important to be aware of the different timing and methods used to estimate the number of dead pups at Sandy Bay as incomplete season counts will be underestimates.

3.2.2 Dundas Island

Table 2: Summary of pup production estimates for Dundas Island for 2017/18

Method	Date	No. of counts	Start/end time	Estimate (SE)
Mean direct live count	18 Jan 2017	4	08:35/11:45	1258 (37.3)
Mean direct dead count	18 Jan 2017	3	08:35/11:45	57 (0)
Mean mark-recapture estimate	18 Jan 2017	9	08:35/11:45	1340 (16.8)
Total number pups tagged	18-20 Jan 2017	N/A	N/A	400 (100 male, 300 female)

Total pup production for Dundas Island is estimated at **1397** (1340 live plus 57 dead pups). The estimate for 2017/18 was 10% lower than the estimate for 2016/17. Figures showing annual estimates for Dundas Island colony are shown in Appendix 2. Pup mortality to 18 January was estimated as 4%, which is considerably lower than the long-term average (1994/95-2015/16) of 10%. The full data series for pup production at Dundas Island is shown in Appendix 1 and Appendix 2. Raw data for counts at Dundas Island are provided in Appendix 3: Raw data for pup production estimates for Sandy Bay, Dundas Island and Figure of Eight Island 2017/18

Estimates of pup production at Dundas Island were completed successfully. Nine mark-recapture counts were undertaken by three different people and three direct counts by three different people

were undertaken for live pups. Three direct counts of dead pups were undertaken by the whole four-person team working together and all dead pups found were marked with spray paint to avoid recounting.

Four hundred mark-recapture caps were put out on pups on 18 January on Dundas Island. The aim was to mark approximately 20-25% of the live pups on the day of marking, therefore, caps were put out amongst pups in that approximate ratio (i.e. 1 cap for every 4-5 pups) across the whole area where pups were present. Four hundred caps were put out on 18 January and six caps were recovered from the ground prior to starting the mark-recapture counts on 19 January. The number of marked pups was, therefore, considered to be 394 for the purposes of the mark-recapture estimation (Appendix 3).

Pup mortality estimates at Dundas Island are undertaken differently from at Sandy Bay. At Dundas the estimate of pup mortality represents that number of dead pups found during an Island wide search on the day of the recapture and therefore represents a minimum estimate of mortality. This method has been used consistently at Dundas Island since monitoring began in 1994/95.

3.2.3 Figure of Eight Island

This work will be undertaken under a separate contract and is therefore not reported here. When that work is completed, the results may be added here.

3.2.4 South East Point, Enderby Island

Table 3: Summary of pup production estimates for South East Point for 2017/18.

Method	Date	Estimate (SE)
Direct live count	22 Jan 2016	0
Direct dead count	22 Jan 2016	0
Total number pups tagged	22 Jan 2016	0

Total pup production for South East Point is estimated at **0** (0 live plus 0 dead pups). There has been no pup production recorded at South East Point since 2011/12. Figures showing annual estimates for South East Point colony are shown in Appendix 2.

3.2.5 Total pup production for the Auckland Islands

It is not possible to provide a total pup production estimate for the Auckland Islands as Figure of Eight Island had not yet been assessed when this report was developed. Overall, total pup production for the Enderby and Dundas Islands combined in 2017/18 was estimated to be 1729 pups (1649 live pups and 80 dead pups). This total represents an overall decrease of 9% from the 2016/17 estimate.

The long-term pattern in total Auckland Island pup production shows some clear inflection points in the series with a maximum recorded in 1997/98 and a minimum recorded in 2008/09 (Figure 2). There was a significant increase in the series from when consistent records started in 1994/95 until a peak in 1997/98, followed by a period of significant decline from 1997/98 until a low point in 2008/09. Between 2008/09 and 2016, total pup production has varied between 1550 and 1965 with no apparently significant trend either upward or downward over this period. When the estimate of pup production for Figure of Eight Island is available a total estimate for the Auckland Islands will be compiled and this report will be updated.

A steep decline in total pup production was seen from 1997/98 until 2008/2009 but numbers have not fallen below the 2008/09 value since that time. Since the lowest ever record of total pup

production at the Auckland Islands in 2008/09, pup production has seen annual increases in six of the last nine years and overall production appears to have stabilised at around 1500-2000 pups per annum since 2008/09. While the stabilisation of total pup production is a positive step, it is important to note that pup production in 2017/18 still represents a ~40% decline since the peak in 1997/98. The good news is that the estimate for 2017/18 is ~15% higher than the lowest ever estimate for pup production of 1501 pups seen in 2008/09.

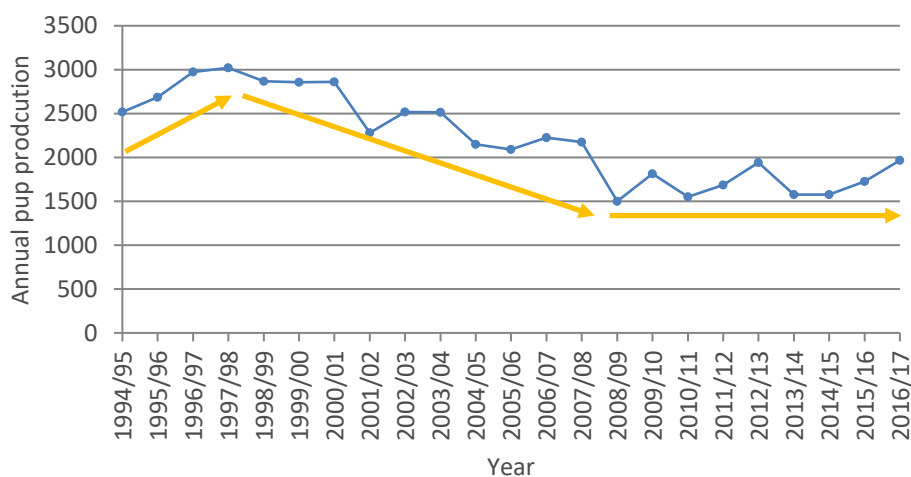


Figure 2: Total estimated pup production for New Zealand sea lions at the Auckland Islands 1994/95 – 2016/17. (Data prior to 2012/13 from Chilvers (2012)).

3.3 Pup weights

Table 4: Summary of mean pup weights for the Auckland Islands for 2017/18

Location	Mean female weight			Mean male weight		
	n	Kg (SD)	Change from 2016/17	n	kg (SD)	Change from 2016/17
Sandy Bay	50	11.8 (1.9)	-1%	50	12.3 (2.0)	-10%
Dundas Island	50	10.8 (1.9)	-4%	50	12.4 (1.9)	+5%
Figure of Eight Island	*	*	*	*	*	*

A random sample of 100 pups (50 of each sex) were weighed at both Sandy Bay and Dundas Island on the same day of the mark-recapture count (16 and 19 January respectively). Mean pup weights from previous surveys at Sandy Bay and Dundas Island show in Figure 3, Figure 4, and Figure 5. For the second year, length and axillary girth measurements were also taken from all individuals that were weighed.

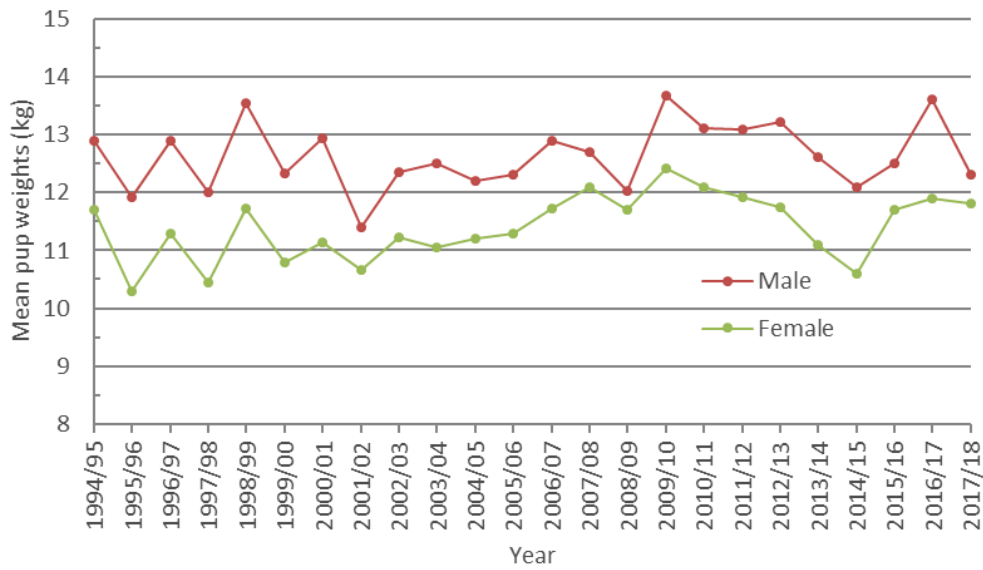


Figure 3: Mean pup weights for Sandy Bay Island colony by sex 1994/95 – 2017/18. (Data prior to 2012/13 from Chilvers (2012)).

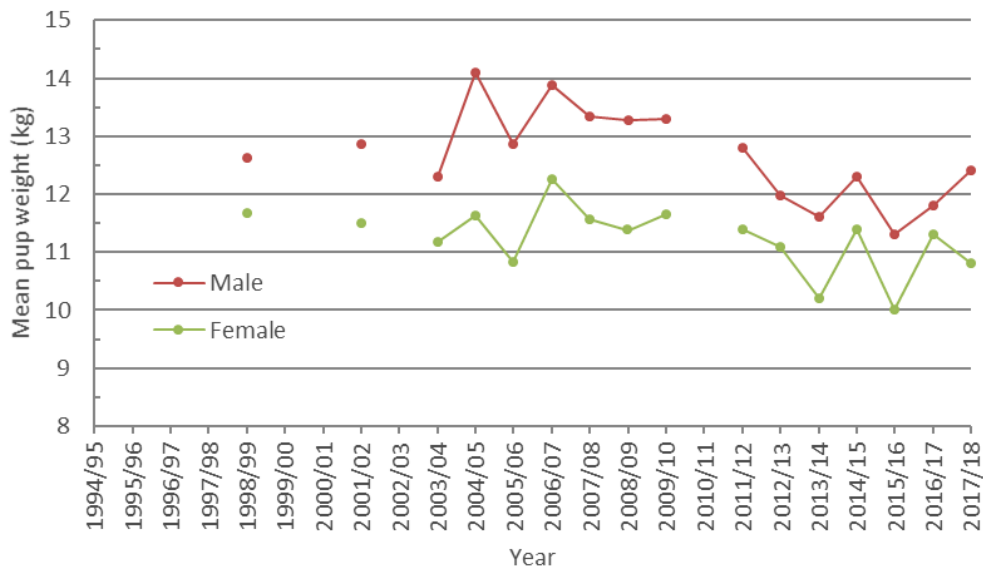


Figure 4: Mean pup weights for Dundas Island colony by sex 1994/95 – 2017/18. (Data prior to 2012/13 from Chilvers (2012)).

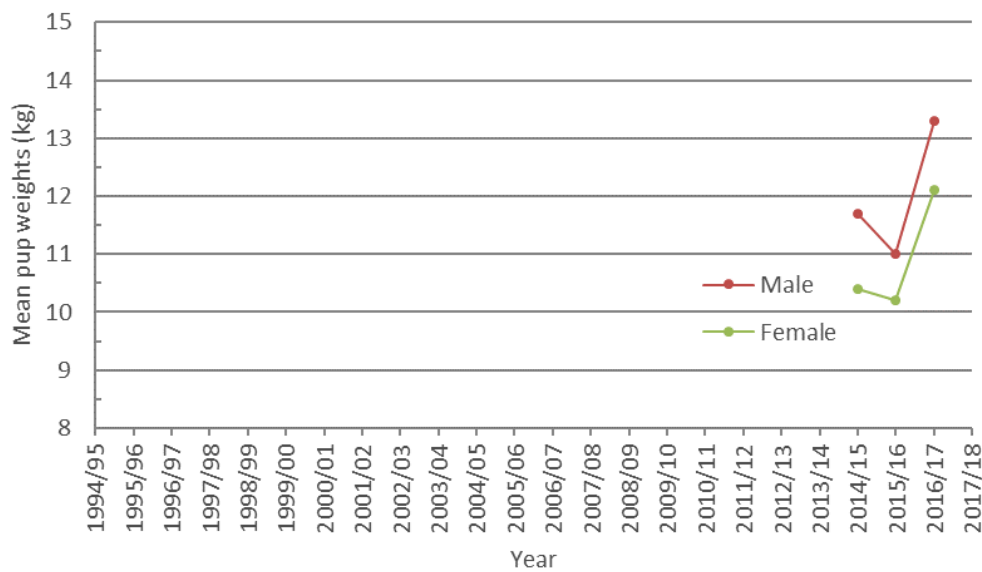


Figure 5: Mean pup weights for Figure of Eight colony by sex 1994/95 – 2016/17. (Data prior to 2012/13 from Chilvers (2012)).

3.4 Direct counts at Sandy Bay

Direct counts of live and dead pups, adult females, adult and sub-adult males were made at Sandy Bay from 11 November to 22 January 2018. These data are not yet available and will be added when they become available in February.

3.5 Tagging and micro-chipping

Flipper tagging and subcutaneous micro-chipping were also undertaken as part of the project. A summary of pup marking:

- Dundas Island – 400 pups were double flipper tagged (100 males and 300 females); and
- Sandy Bay - Most pups were microchipped as close to their birth as possible, but this work will be reported separately by Sarah Michael. All live pups on 16 January were double flipper tagged and microchipped (if they didn't already have one). Overall, a total of 309 live pups were tagged and microchipped.

All data (including weight, sex, length, girth) from tagged and microchipped pups will be added into the NZSL database as part of this contract.

3.6 Resighting effort and data management

A total of 8 days field work were contracted for as part of the 2016/17 CSP contract compared with approximately 6-7 weeks for previous seasons (e.g. 48 days in 2015/16 – 2 weeks census & 5 weeks resighting). No dedicated resighting effort was specified in the contract but rather it was to be undertaken when time allowed after completion of core monitoring work this contract. Additional limited resighting effort was undertaken by other DOC personnel working on the Island as time allowed and this will be reported separately by DOC.

3.7 Preliminary assessments of cause of death in pups

This work does not form part of this contract and will be reported separately by DOC.

3.8 Summary of other work undertaken

No additional work was undertaken this season due to the short field season, but some work will be undertaken by the other DOC research teams on the Island and will be reported separately.

4. Acknowledgements

This project is funded by the Department of Conservation's Conservation Services Programme through levies on the commercial fishing industry. This research would not have been possible without the support of many people, and for which we are very grateful:

- Steve Evohe, master of the *RV Evohe*, and his crew were extremely professional and accommodating and the *RV Evohe* was an excellent vessel for the work;
- DOC staff including Katie Clemens-Seely, Laura Boren, Sharon Trainor, Jo Hiscock, Joseph Roberts, Enrique Pardo;
- Shannon Taylor for her help with field work; and
- Members of the CSP Technical Working Group who provided useful feedback on this project.

5. References

Childerhouse SJ (2017) Methodology for New Zealand sea lion population monitoring Auckland Islands 2017/18. Unpublished paper presented to the Conservation Services Programme, Department of Conservation, New Zealand. BPM document number: BPM-17-Methodology for CSP Project NZ sea lion ground component 2017-18 v1.0. 9 p.

Chilvers BL (2012) Research to assess the demographic parameters of New Zealand sea lions, Auckland Islands 2011/12 Contract Number: POP 2011/01 Final Research Report, November 2012. Report prepared for the Conservation Services Programme, Department of Conservation. 11 p.

Appendix 1: Annual estimates of live, dead and total pup production for each colony and for total Auckland Islands pup production 1994/95 – 2017/18

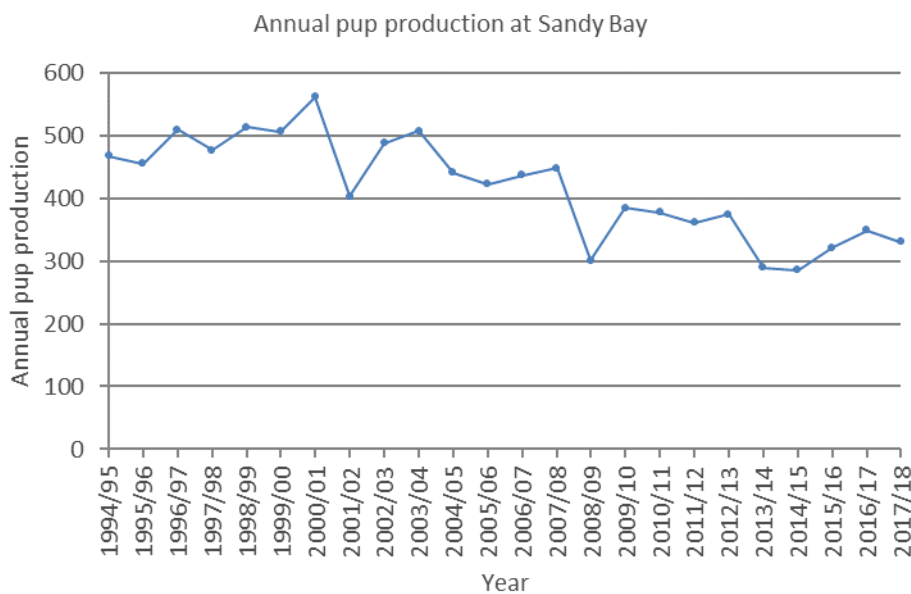
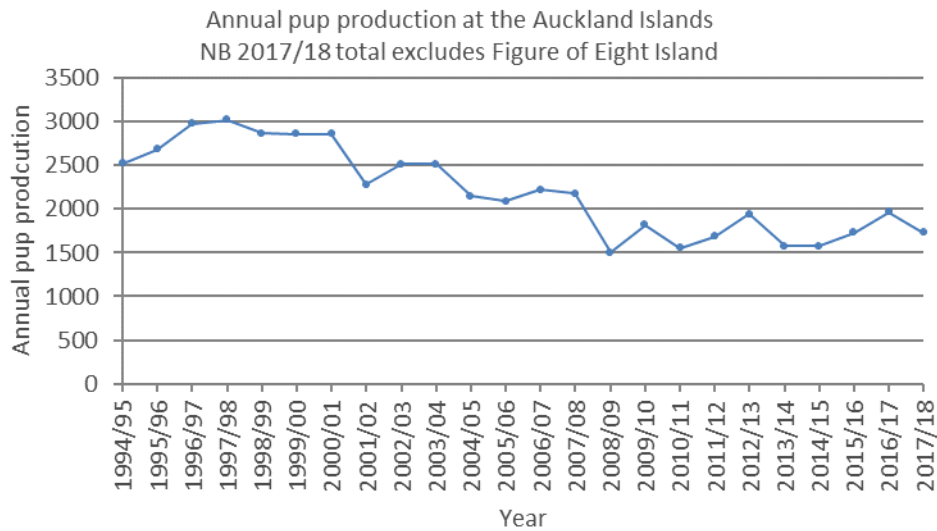
(NB. Data prior to 2012/13 from Chilvers (2012))

Year	Sandy Bay			Dundas Island			Figure of Eight Island			South East Point			Total Auckland Islands		
	Total	Live	Dead	Total	Live	Dead	Total	Live	Dead	Total	Live	Dead	Total	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	*	*	*	0	0	0	1729*	1649*	80*

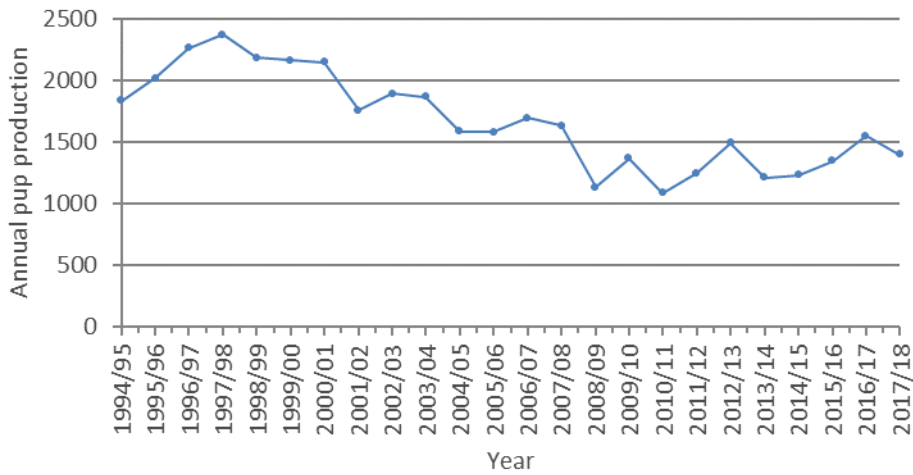
* The count for Figure of Eight Island had not been completed prior to the writing of this report and therefore the totals for the Auckland Islands are provisional and do not include any pup production for Figure of Eight Island

Appendix 2: Annual estimates of total pup production for each colony and for total Auckland Islands pup production (excluding Figure of Eight Island) to 2017/18

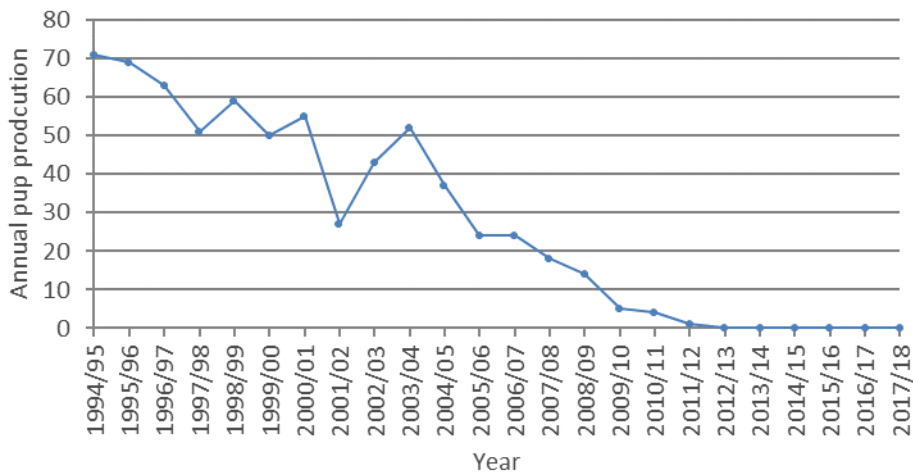
(NB. Data prior to 2012/13 from Chilvers (2012))



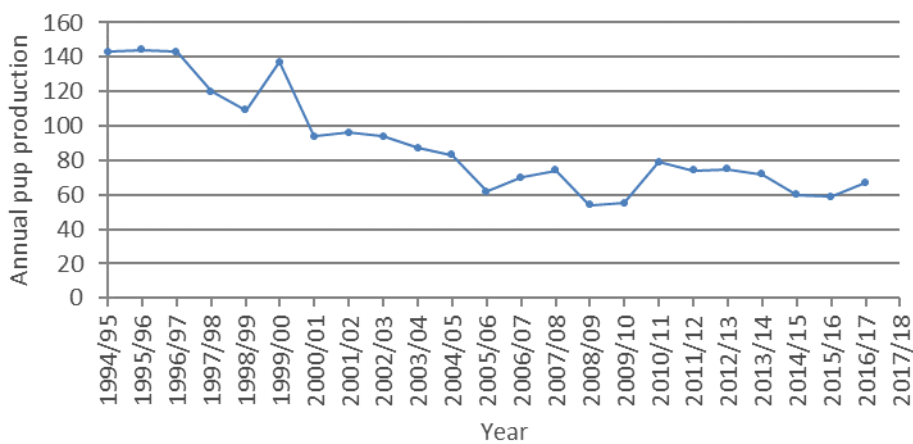
Annual pup production at Dundas Island



Annual pup production at South East Point



Annual pup production at Figure of Eight Island
NB. Count for 2017/18 not available at the time of writing



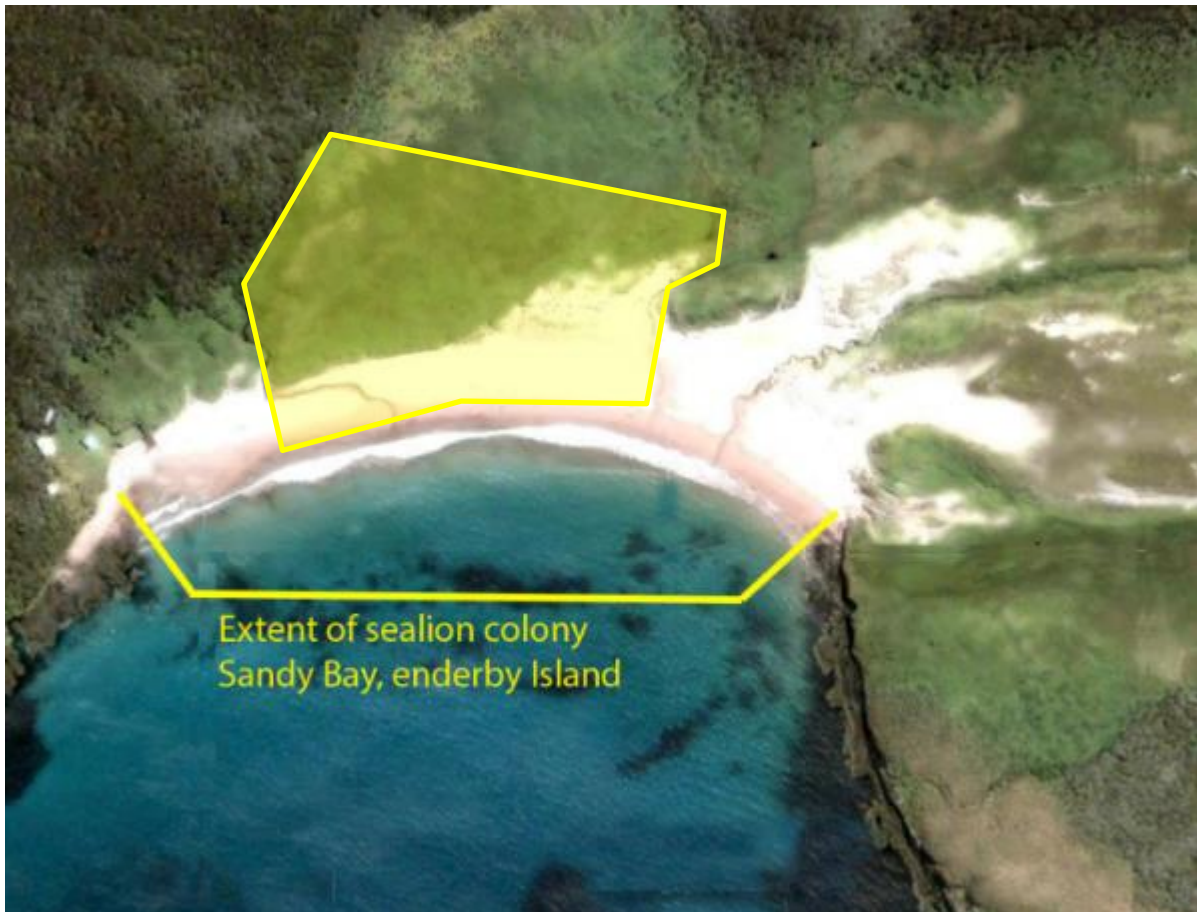
Appendix 3: Raw data for pup production estimates for Sandy Bay, Dundas Island and Figure of Eight Island 2017/18

Mark recapture individual counts for Sandy Bay, 16 January 2018		
No. of animals marked = 117 (i.e. 3 caps found (i.e. fell off) before MR)		
	Number marked counted	Number unmarked counted
Counter 1-1	100	165
Counter 1-2	102	177
Counter 1-3	99	171
Counter 2-1	80	132
Counter 2-2	83	129
Counter 2-3	84	134
Counter 3-1	98	159
Counter 3-2	92	138
Counter 3-3	103	173
Direct live pups counts for Sandy Bay, 16 January 2018		
	Number counted	
Counter 1-1	304	
Counter 1-2	297	
Counter 1-3	298	
Counter 2-1	293	
Counter 2-2	305	
Counter 2-3	312	
Counter 3-1	291	
Counter 3-2	311	
Counter 3-3	308	
Cumulative dead pup counts for Sandy Bay to 16 January 2018		
	Cumulative number counted	
Cumulative count	23	
Mark recapture estimates for Dundas Island, 19 January 2018		
No. of animals marked = 394 (i.e. 6 caps found (i.e. fell off) before MR)		
	Number marked counted	Number unmarked counted
Counter 1-1	335	780
Counter 1-2	268	652
Counter 1-3	302	677

Counter 2-1	355	861
Counter 2-2	301	757
Counter 2-3	300	779
Counter 3-1	345	822
Counter 3-2	366	806
Counter 3-3	294	733
Direct counts for number of live pups for Dundas Island, 19 January 2018		
Number counted		
Counter 1-1	1320	
Counter 2-1	1278	
Counter 3-1	1175	
Direct counts for number of dead pups for Dundas Island, 19 January 2018		
Number counted		
Count 1	57	
Count 2	57	
Count 3	57	
Direct counts for number of live pups for Figure of Eight Island		
Number counted		
Counter 1-1	*	
Counter 3-1	*	
Counter 4-1	*	
Direct counts for number of dead pups for Figure of Eight Island		
Number counted		
Counter 1-1	*	
Counter 3-1	*	
Counter 4-1	*	

Appendix 4: Description of breeding area searched during pup counts at Sandy Bay, Enderby Island, 2017/18

The following figure provides a graphical presentation of the “entire breeding area” searched during pup counts at Sandy Bay, Enderby Island. All of the beach and surrounding sward (e.g. green, grassy area adjacent to the beach) constitutes the “entire breeding area” but the forested area is excluded. On 16 January, the areas over which pups were spread and the was mark-recapture undertaken is indicated by the yellow shape.



This image is taken with permission from Baker B, Jenz J and Chilvers L (November 2012). Aerial survey of New Zealand sea lions – Auckland Islands 2011/12. Report prepared for Ministry of Agriculture and Forestry, Deepwater Group Limited and Department of Conservation. 11 p.