

DRAFT Final Report for CSP Project 4426 New Zealand sea lion ground component 2012/13

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Prepared by: Dr Simon Childerhouse, Jacinda Amey, Derek Hamer & Ann McCrone
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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 CSP project 4426 - New Zealand sea lion ground component. The field component of the work was undertaken in the Auckland Islands between the 8th and 31st of January 2013. All the the research was sucessfully completed with the following outcomes:

- Pup production was estimated for New Zealand sea lion colonies at Sandy Bay (n=365), Dundas Island (n=1,491), Figure of Eight Island (n=75) and South East Point (n=0) with total pup production for the Auckland Islands in 2013 estimated as 1,931 – a 14.7% increase on the estimate from 2012;
- Seven hundred and eighty two pups were double flipper tagged at Sandy Bay (n=347), Dundas Island (n=400), Figure of Eight Island (n=33), South East Point (n=0) and elsewhere on Enderby Island (n=2¹);
- Over 2,262 tag, brand and micro-chip resightings of individual sea lions were made. All of these resightings are still being verified and validated and, once that is completed, the exact number of resightings and the data itself will be available; and
- The New Zealand sea lion database was used for the first time, and all of the tagging and resighting data has been entered into it.

It was a very successful trip despite being considerably shorter than previous trips and having fewer personnel.

2. Introduction

Blue Planet Marine (BPM) was contracted by the Conservation Services Programme (CSP) of the Department of Conservation (DOC) to undertake CSP project 4426 - New Zealand sea lion ground component 2012/13. This report meets the provisions of Milestone 4 of the contract, specifically being:

1. A Final Report(s) suitable for DOC Publication;
2. The manuscript(s) will cover the methods used, data collected, results found and recommendations made under each specific objective Final Report(s) suitable for DOC Publication; and,
3. The report(s) must include due consideration of feedback from the CSP Technical Working Group.

¹ These pups have not been included in overall estimates of pup production as, given the timing of their tagging, it was not possible to determine if they had been born on Enderby or had been born at the Dundas Island colony and had subsequently swam over to Enderby.

3. Methods

A full description of methods used in this field study are available in Childerhouse (2012) which is available from the CSP website and the author upon request. The detailed methodologies have not been reported again here but relevant issues are included in the discussion section of this report.

As general statement, the research outlined here will follow almost exactly the same methods as undertaken previously by DOC and as described in Chilvers (2012) and with reference to the aerial survey methods in Baker et al. (2012). The text of this report highlights where differences in methodology exist.

4. Results

4.1 General comment

Overall, it is important to note that when comparing the outcomes from the 2012/13 project and report with previous field reports from the Auckland Islands, that the 2012/13 project had a significantly smaller budget, significantly smaller team size (i.e. only 4 rather than 6 researchers) and was significantly shorter (i.e. only 1 month rather than almost three months).

4.2 Logistics

The team assembled in Bluff on 4th January and, following discussions with the Master of *RV Tiama*, decided to leave one day earlier than originally planned due to a more favourable weather window at that time. As a result we departed for the Auckland Islands from Bluff on Sunday 6th January rather than Monday 7th January as previously planned. We also shared the charter with two researchers undertaking research on Albatross at Adams Island in the Auckland Islands group. A summary of key dates:

- 6th January – departed Bluff aboard *RV Tiama* for the Auckland Islands;
- 8th January – Arrived Adams Island and unloaded researchers;
- 9th January – Visited Figure of Eight Island and arrived at Enderby Island and dropped the team off;
- 31st January – departed Auckland Islands for Bluff; and
- 2nd February – arrived Bluff.

The field work included 20 days on Enderby Island, 3 days on Dundas Island and 1 day on Figure of Eight Island. This is considerably shorter than previous research trips of almost three months in duration.

The field team comprised four experienced NZ sea lion researchers: Dr Simon Childerhouse, Jacinda Amey, Derek Hamer and Ann McCrone who were all present for the whole trip. The team worked very well and achieved all the required tasks. This is a considerably smaller team than used during previous research trips.

4.3 General approach and timing of field work

As stated previously, these results follow the methodology previously described in Childerhouse (2012) unless otherwise stated. To ensure consistency with previous work, there were some key dates that we were aiming to achieve:

- Figure of Eight Island – the aim was to undertake a pup census on 10th January but due to unfavourable weather conditions for our planned departure date, we departed one day

earlier and therefore arrived one day earlier at Figure of Eight Island. The census was undertaken one day earlier than planned on the 9th January. It is unlikely that there will be a problem with comparability with previous surveys as the dates for counts at Figure of Eight have varied considerably over the years.

- Sandy Bay, Enderby Island – the mark-recapture was undertaken on 15th (marking) and 16th January (recapture) as planned.
- Dundas Island – the mark-recapture was undertaken on 20th (marking) and 21th January (recapture) as planned

4.4 Estimates of pup production

The following estimates of pup production were completed. Annual estimates of pup production for each colony and for total Auckland Islands pup production from 1994/95 until 2012/13 are shown in Appendix 1. Figures showing annual estimates for pup production by colony are shown in Appendix 2. Raw data from pup production mark recapture estimates are provided in Appendix 3.

4.4.1 Sandy Bay, Enderby Island

Table 1: Summary of pup production estimates for Sandy Bay for 2012/13

Method	Date	Estimate (\pm SE)
Direct live count	16 th January	331 ²
Direct dead count	16 th January	8
Mark-recapture count	16 th January	357 \pm 4
Total number pups tagged	15-17 th January	347

Estimates of pup production at Sandy Bay were completed successfully. Nine mark-recapture counts were undertaken (three counts each by three different people). The methodology for the direct live count was to include three people walking around the entire breeding area up to three times each to achieve multiple direct counts of live pup production. However, due to a smaller team and other operational pressures, only one count by a single person was undertaken yielding a single live count of 331 for Sandy Bay on 16th January. Additional direct counts were made and are reported in Appendix 4. While 150 caps were put out on the 15th January, two caps were recovered from the ground prior to starting the mark-recapture counts on the 16th January and therefore the number of marked pups was considered to be 148 for the purposes of the mark-recapture estimation (see Appendix 3).

The methodology for estimating the number of dead pups differed from previous years. During previous years, all dead pups were removed from the beach, counted and autopsied whereas this year all dead pups were left on the beach to allow for helicopter aerial surveys to be undertaken to count both live and dead pups. The direct dead count was undertaken as a single count of eight dead pups. This estimate is not directly comparable with most previous dead pups counts which represents a cumulative count of dead pups removed from the colony through the season. It should therefore be considered a minimum estimate of dead pups. Furthermore, previous daily counts of dead pups from 2012/13 yielded higher counts (e.g. 10 on 13/01/13 and 17 on 14/01/13) than were obtained on 16/01/13 and at least two dead pups were observed to wash off the beach before 16/01/13 providing further evidence that the 8 dead pups recorded on 16/01/13 is an underestimate.

Overall the 2012/13 estimate of total pup production for Sandy Bay was **365 pups** (357 live plus 8 dead pups) which is 1.1% higher than 2011/12. Pup mortality to 16/01/13 was estimated as 2.1%

² This figure was originally incorrectly reported as 361 in the previous preliminary report but has been correctly reported here as 331.

which is lower than the 4.7% recorded in 2011/12, although as discussed above, it is noted that the estimate for 2012/13 is an underestimate. The full data series for pup production at Sandy Bay is shown in Appendix 1 and Appendix 2. Raw data for counts at Sandy Bay is provided in Appendix 3.

4.4.2 Dundas Island

Table 2: Summary of pup production estimates for Dundas Island for 2012/13

Method	Date	Estimate (\pm SE)
Direct live count	21 th January	1271 \pm 25
Direct dead count	21 th January	127
Mark-recapture count	21 th January	1364 \pm 46
Total number pups tagged	19-21 st January	400 ³

Estimates of pup production at Dundas Island were completed successfully. Nine mark-recapture counts were undertaken (three counts each by three different people). Three direct live counts were undertaken by three different people and a single direct dead count was undertaken by the whole four person team. It was proposed that four people walk around the entire breeding area up to two times with the whole group counting all visible dead pups. However, only a single count was undertaken by the whole team due to logistic constraints and running out of time before the scheduled helicopter pick up and therefore only a single direct dead count was achieved.

The approximate location of where mark-recapture caps were put out on pups on Dundas Island is shown in Appendix 5. Please note that this aerial image of Dundas Island was kindly provided by Barry Baker, Latitude 42, but is from the previous year (2011/12) and therefore the location of pups shown on this image does not reflect the location of pups in 2012/13 but has been used here for illustrative purposes. The aim was to mark approximately 20-25% of the live pups on the day of marking. Therefore, caps are put out amongst pups in that approximate ratio (i.e. 1 cap for every 4-5 pups) across the whole distribution of pups. While 400 caps were put out on the 20th January, two caps were recovered from the ground prior to starting the mark-recapture counts on the 21st January and therefore the number of marked pups was considered to be 398 for the purposes of the mark-recapture estimation (see Appendix 3).

One separate count each by three observers were also made of pups up on the top of the Island in, amongst, and under the vegetation and tussock cover. The counts were 84, 87, and 94 pups providing an indication of the number of pups that may be difficult to see from aerial photography. It should be noted that these numbers are highly variable over the day and through the seasons. For example, during particularly hot and cold periods pups appear to congregate under the vegetation for shade or shelter but at other times, there can be almost no pups present there.

Overall the 2012/13 estimate of total pup production for Dundas Island was **1,491** pups (1,364 live plus 127 dead pups) which is 19.5% higher than 2011/12. Pup mortality to 16/01/13 was estimated as 8.5% which is higher than the 4.7% recorded in 2011/12, and was estimated using comparable methods between years. 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 is provided in Appendix 3.

³ Only 400 pups were required to be tagged (i.e. 100 males and 300 females)

4.4.3 Figure of Eight Island

Table 3: Summary of pup production estimates for Figure of Eight Island for 2012/13

Method	Date	Estimate (\pm SE)
Direct live count	9 th January	70 \pm 1
Direct dead count	9 th January	5
Total number pups tagged	9 th January	33 ⁴

Estimates of pup production at Figure of Eight Island were completed successfully. As noted in Section 4.3, the counts at Figure of Eight were undertaken a day earlier than planned (i.e. 9th rather than the 10th January). It is unlikely that there will be a problem with comparability with previous surveys as the dates for counts at Figure of Eight have varied considerably over the years. Three direct live counts were undertaken by three different people and a single direct dead count was undertaken by the whole four person team.

Overall the 2012/13 estimate of total pup production for Figure of Eight was **75** pups (70 live plus 5 dead pups) which is 1.4% higher than 2011/12. Pup mortality to 16/01/13 was estimated as 6.7% which is higher than the 2.7% recorded in 2011/12, and was estimated using comparable methods between years. The full data series for pup production at Figure of Eight Island is shown in Appendix 1 and Appendix 2. Raw data for counts at Figure of Eight Island is provided in Appendix 3.

4.4.4 South East Point, Enderby Island

Table 4: Summary of pup production estimates for South East Point for 2012/13

Method	Date	Estimate (\pm SE)
Direct live count	13 th January	0
Direct dead count	13 th January	0
Total number pups tagged	13 th January	0

In 2011/12, only a single pup was recorded at South East Point. The first count at South East Point in 2012/13 was undertaken on 13th January which is contrast to previous years where there have been regular counts from early December onwards. Therefore it is possible that pups that could have been born before 13th January but have moved away or died and been washed away prior to this date. However, there are anecdotal reports from tourist vessels visiting South East Point prior to 13th January and these all reported seeing no pups there. With estimated pup production reaching zero for the first time, this breeding site has now become functionally extinct.

Overall the 2012/13 estimate of total pup production for South East Point was **0** pups (0 live plus 0 dead pups) which is 100% lower than 2011/12. Pup mortality in 2011/12 was 100% (i.e. 1 dead pup of 1 produced). The full data series for pup production at South East Point is shown in Appendix 1 and Appendix 2.

4.4.5 Total pup production for the Auckland Islands

Overall, total pup production for the Auckland Islands in 2013 was estimated to be **1931** pups (1791 live pups and 140 dead pups). This was 14.7% increase over estimated pup production in 2012 of 1684. Overall pup production for the Auckland Islands since 1994/95 is shown in Figure 1.

⁴ This was as many as could be tagged in the time available

Table 5: Summary of pup production estimates for the Auckland Islands for 2012/13

Location	Live pup estimate	Dead pup estimate	Total estimate
Sandy Bay, Enderby Island	357	8	365
Dundas Island	1364	127	1491
Figure of Eight Island	70	5	75
South East Point, Enderby Island	0	0	0
Total Auckland Islands	1791	140	1931

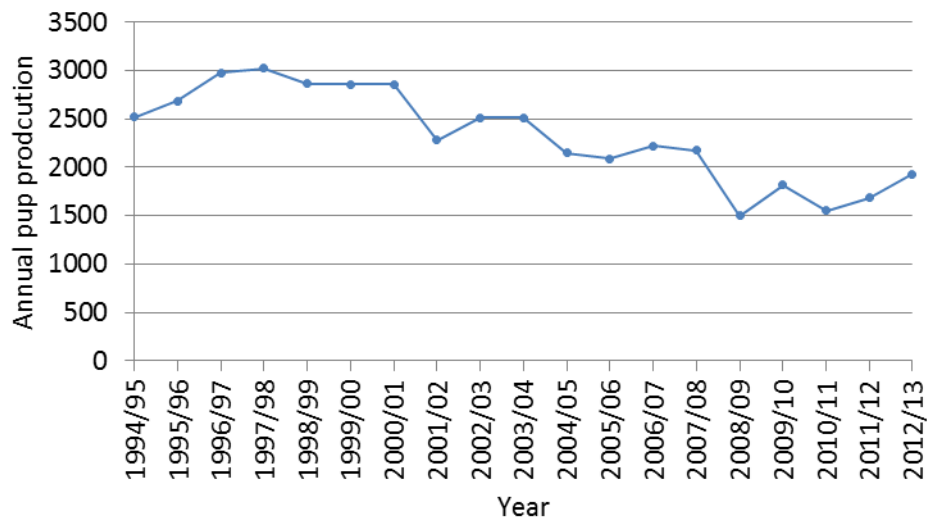


Figure 1 Total estimated pup production for New Zealand sea lions at the Auckland Islands 1994/95 – 2012/13. (Data prior to 2012/13 kindly provided by Dr. Louise Chilvers, as reported in Chilvers (2012))

4.5 Colony counts

4.5.1 Sandy Bay, Enderby Island

Direct counts of live and dead pups, adult females, adult and sub-adult males were made at Sandy Bay from 11-16th January 2013 (Figure 2). All counts were made by a single person each day. Raw data is provided in Appendix 4.

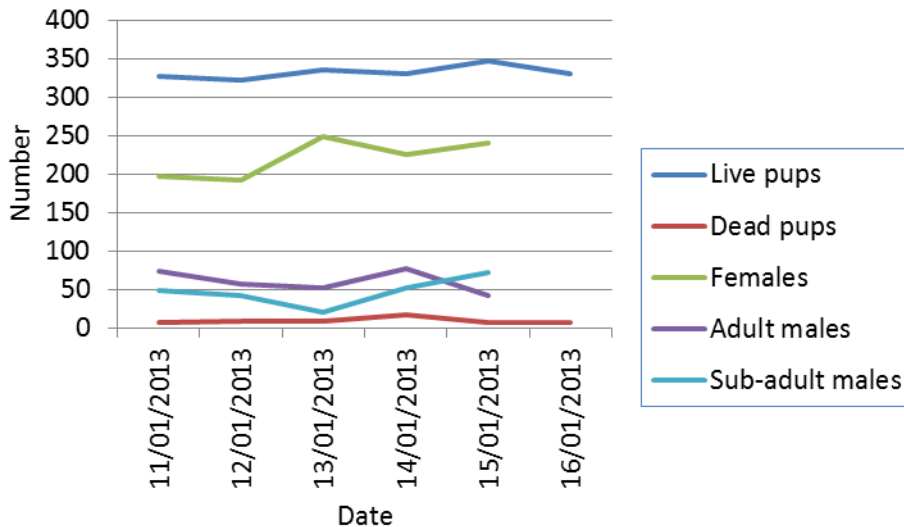


Figure 2 New Zealand sea lion counts at Sandy Bay, Enderby Island 2013

4.5.2 South East Point, Enderby Island

Counts were made on nine different days (i.e., January 11, 12, 13, 14, 22, 24, 27, 28, 30) at South East Point and no live or dead pups were ever recorded. There were also no other sea lions (e.g. adults or sub-adults) recorded there either at any time.

4.6 Tagging and micro-chipping

Flipper tagging and subcutaneous micro-chipping were also undertaken. Pups at Dundas Island and Figure of Eight Island were double flipper tagged and pups at Sandy Bay were double flipper tagged and also micro-chipped. Summary of pup tagging was:

- Dundas Island – 400 pups tagged (comprising 100 males and 300 females);
- Figure of Eight Island – 33 pups (as many as could be tagged in the time available);
- Sandy Bay – 347 pups; and,
- Enderby Island – 2 pups. These pups were tagged away from Sandy Bay on 23rd January 2013. One pup was tagged half way between Sandy Bay and South East Point and the other was tagged near the top of the Island, northwest of Sandy Bay. These pups have not been included in overall estimates of pup production as, given the timing of their tagging, it was not possible to determine if:
 - they were pups that had swum over from Dundas Island colony⁵;
 - they were born at Sandy Bay on Enderby Island and moved away prior to tagging there; or,
 - they had been born elsewhere on Enderby Island.

All pup tagging details were entered into the New Zealand sea lion data base (<http://data.dragonfly.co.nz/nzsl-demographics/>).

⁵ The first pup tagged on Dundas Island and seen on Enderby Island was 25th January.

4.7 Pup weights

Table 6: Summary of mean pup weights for the Auckland Islands for 2012/13

Location	Mean female weight (kg ± SE)	Mean male weight (kg ± SE)
Sandy Bay	11.7 ± 0.26	13.2 ± 0.34
Dundas Island	11.1 ± 0.25	12.0 ± 0.31

100 pups (50 of each sex) were weighed at both Sandy Bay and Dundas Island on the same day of the mark-recapture count (16th and 21st January respectively). Mean pup weights at Sandy Bay were 1.1% higher and 1.4% lower than 2011/12 for males and females respectively. Mean pup weights at Dundas Island were 9.8% lower and 2.5% lower than 2008/09 (the most recent for which data were available at the time of writing this report) for males and females respectively. Data from previous surveys at Sandy Bay and Dundas Island are show in Figure 3 and Figure 4.

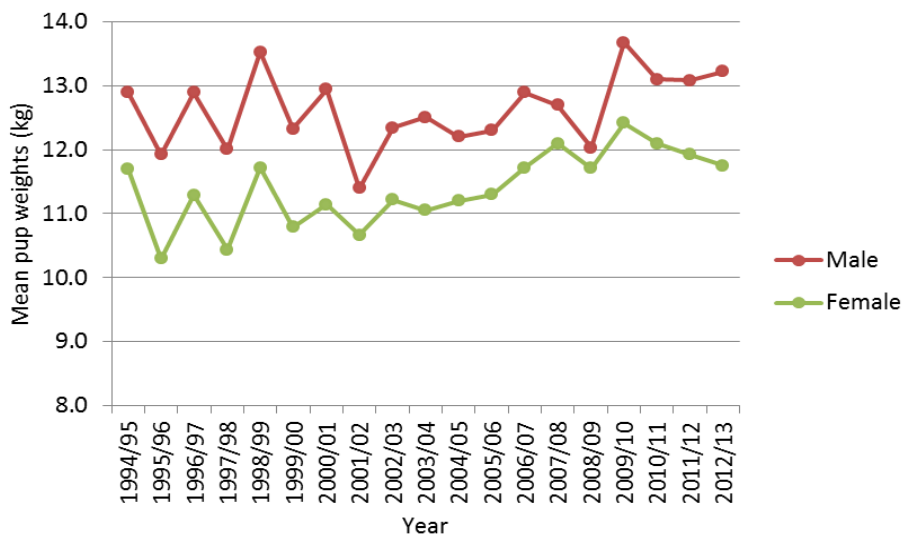


Figure 3 Mean pups weights for Sandy Bay colony by sex. (Data prior to 2012/13 kindly provided by Dr. Louise Chilvers)



Figure 4 Mean pups weights for Dundas Island colony by sex. (Data prior to 2012/13 kindly provided by Dr. Louise Chilvers)

4.8 Resighting and tagging data management

A total of 2,262 individual tag, brand and micro-chip resightings were made and entered into the New Zealand sea lion database. These records do not represent different individuals but rather the total number of all resights collected and includes multiple resights of some individuals. Over 770 different individuals were recorded. Most (1,797 or 79%) resights were tag resights but there were 252 records of 157 individuals identified from a microchip and 213 records of 68 individuals identified from a brand. Most resightings (99%) were collected on Enderby Island (n=2,234) and most of these at Sandy Bay (n=1,872). A few resights were also collected from Dundas Island (n=27) and Figure of Eight Island (n=1). As requested by the Technical Working Group, Figure 5 provides a breakdown of the total number of resights by day for all sites combined. By comparison, 6,914 individual records were collected in 2011/12.

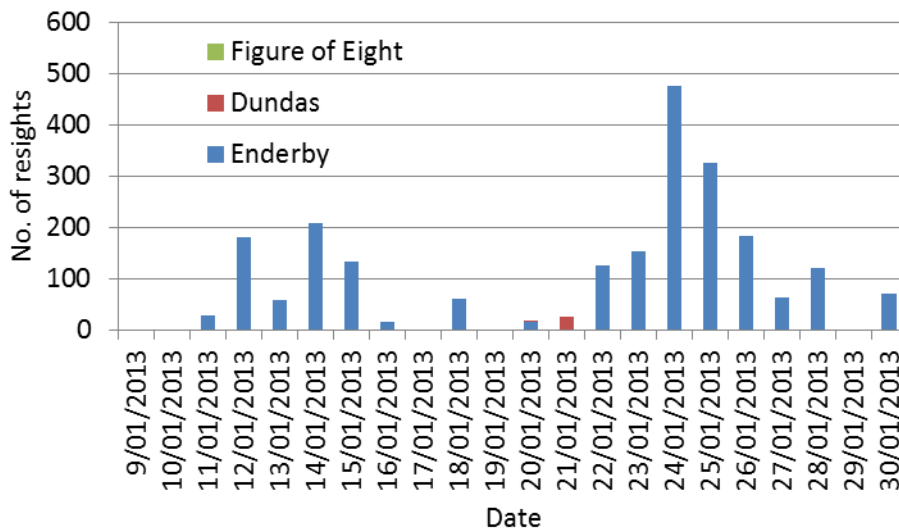


Figure 5 Total number of resightings records collected by day and by Island at the Auckland Islands.

4.9 Tagging data management

A key element of this research was to ensure that the data are collected in an accurate and robust fashion and furthermore that these data are provided in an electronic format suitable for upload into the New Zealand sea lion database. Dragonfly Ltd (current DOC contractor developing the database) provided a copy of the New Zealand sea lion database for use on the trip and all of the tagging and resighting data has now been entered into the database. Feedback was provided to Dragonfly Ltd on further improvements to the software.

4.10 Coordination with the Helicopter

The use of the helicopter for transport to and from Dundas was very successful. We were dropped on Dundas early on 19th in two short trips (e.g. one for personnel and one for gear) and picked up on the 21st with a further two trips. This was a change we made to the original logistics plan which was to fly out and back to Dundas each day (e.g. return flights on the 19th, 20th and 21st). Instead we stayed on Dundas for 2 nights, which allowed us more time to complete the work program and ultimately to collect more tag resight data.

One issue with this approach was that most, if not all, of the other helicopter survey work had already been completed prior to the 19th and so the helicopter could have returned back to the mainland if they hadn't needed to stay around to transport the sea lion ground team or complete other work. If helicopters are to be used for transport in the future, it would be beneficial to overlap the work programmes to minimise the amount of time a helicopter is required and avoid additional costs.

5. Acknowledgements

This project was 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 kind support of many people for which we are very grateful:

- Henk Haazen, master of the *RV Tiama*, and his crew were extremely professional and accommodating and the *RV Tiama* was an excellent vessel for the work;
- DOC staff including Igor Debski, Kris Ramm, Sharon Trainor, Pete McClelland, Doug Veint, and in particular, Dr Louise Chilvers who was very helpful with the loan of equipment, advice and in sharing her wealth of experience about NZ sea lions and making previous data available for this report;
- Igor Debski of DOC for helpful comments on an earlier draft of this report;
- Dragonfly staff including Finlay Thompson, Richard Mansfield and Ed Abraham;
- Southern Lakes Helicopters and Mark Deaker for helicopter support;
- The Auckland Islands helicopter team of Barry Baker, Mark Holdsworth, Pete McClelland, Louise Chilvers and Mark Deaker for excellent company and support; and,
- Members of the CSP Technical Working Group who provided useful feedback on this project.

6. References

- Baker B, Jenz K, Chilvers BL (2012) Aerial survey of New Zealand sea lions – Auckland Islands. DOCDM-872849. Report prepared for Ministry of Agriculture & Forestry, Deepwater Group Limited & Department of Conservation. 11 p
- Childerhouse SJ (2012) Methodology for CSP Project 4426 New Zealand sea lion ground component 2012/13. Unpublished paper presented to the Conservation Services Programme, Department of Conservation, New Zealand. 8th November 2012. BPM document number: BPM-TAS-12-Methodology for CSP project 4426 NZ sea lion ground component 2012-13 v1.0. 8 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

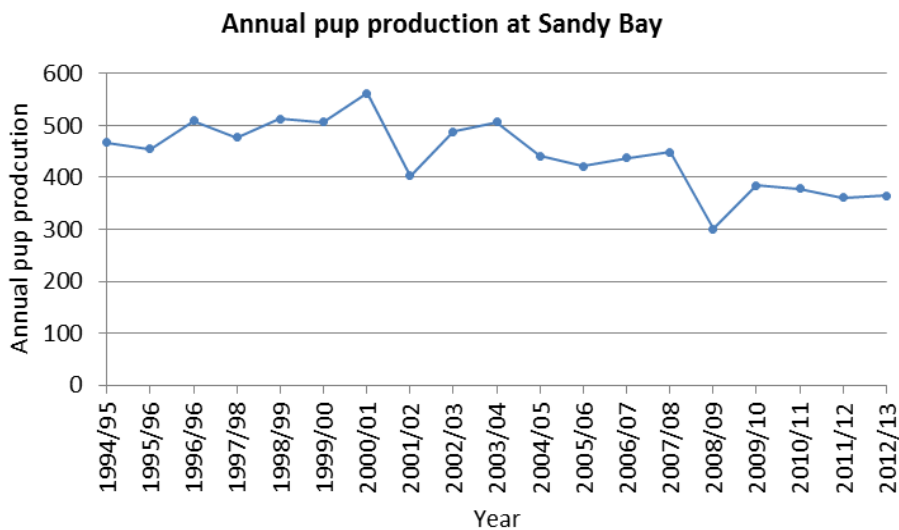
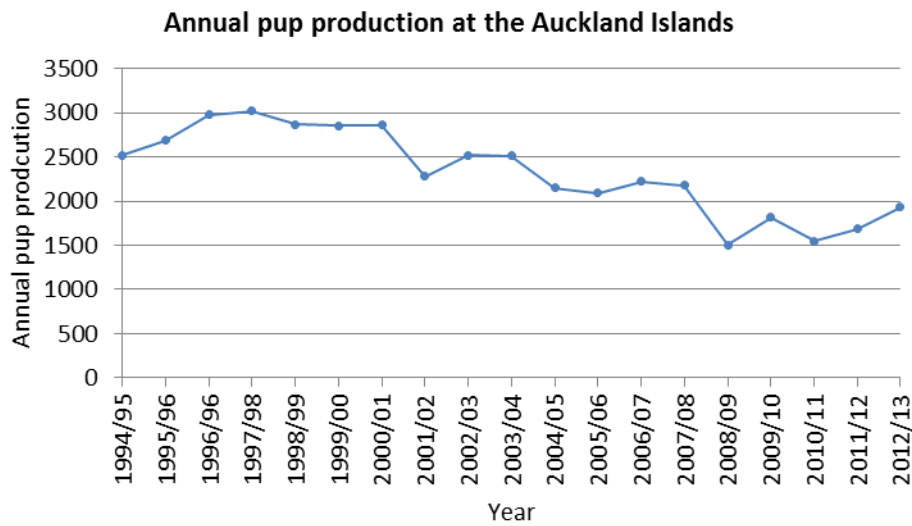
Annual estimates of live, dead and total pup production for each colony and for total Auckland Islands pup production 1994/95 – 2012/13 (NB. Previous year’s survey data from Chilvers (2012))

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

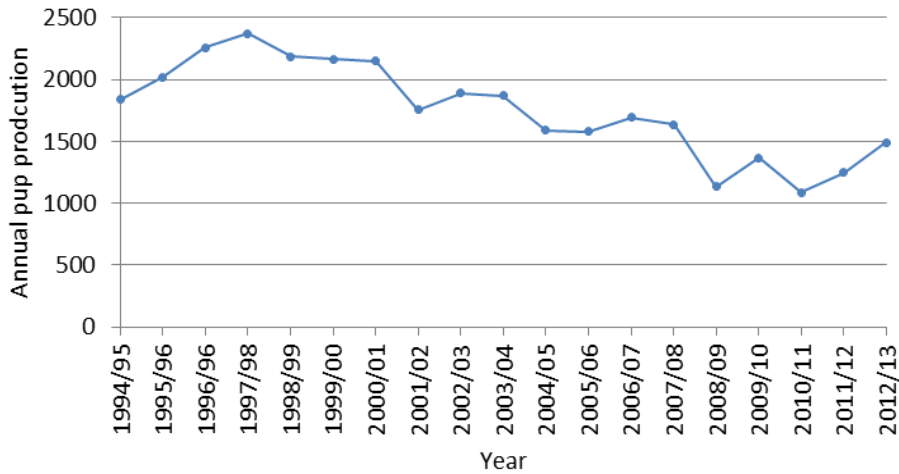
Year	Sandy Bay			Dundas Island			Figure of Eight Island			South East Point			Total Auckland Islands		
	Total	Live	Dead	Total	Live	Dead	Total	Live	Dead	Total	Live	Dead	Total	Live	Dead
2009/10	385	364	21	1369	1218	151	55	48	7	5	1	4	1814	1631	183
2010/11	378	359	19	1089	952	137	79	71	8	4	2	2	1550	1384	166
2011/12	361	343	18	1248	1189	59	74	72	2	1	0	1	1684	1604	80
2012/13	365	357	8	1491	1364	127	75	70	5	0	0	0	1931	1791	140

Appendix 2

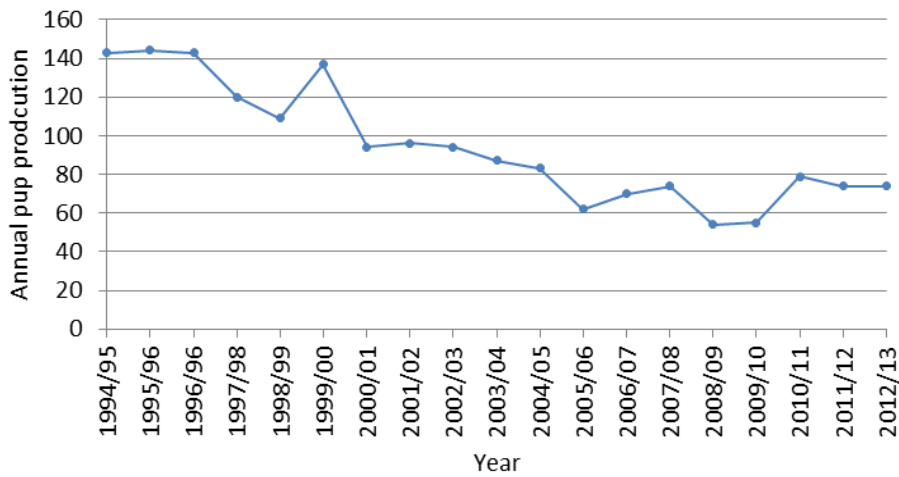
Annual estimates of total pup production for each colony and for total Auckland Islands pup production (NB. Previous year's survey data from Chilvers (2012))



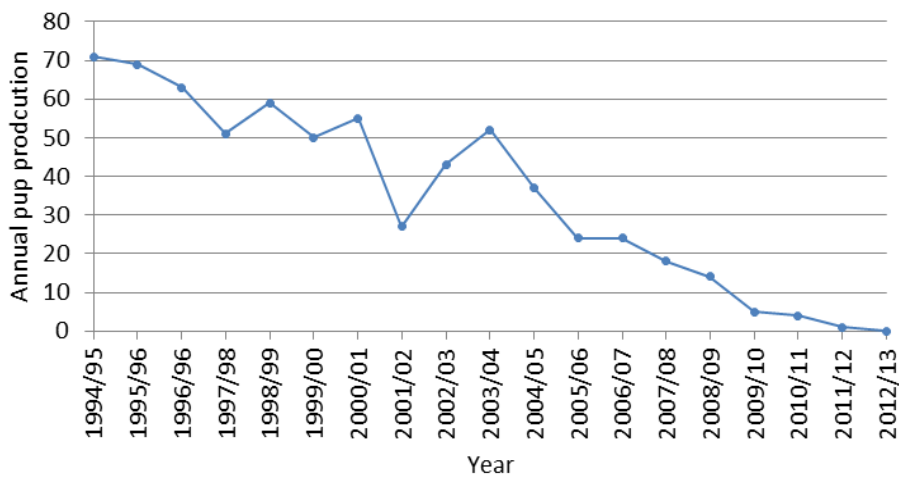
Annual pup production at Dundas Island



Annual pup production at Figure of Eight Island



Annual pup production at South East Point



Appendix 3

Raw data for pup production estimates for Sandy Bay, Dundas Island and Figure of Eight Islands

Mark recapture individual counts for Sandy Bay, January 16th 2013		
No. of animals marked = 148 (i.e. 2 caps found and lost before MR)		
	Number marked counted	Number unmarked counted
Counter 1-1	131	185
Counter 1-2	121	179
Counter 1-3	125	183
Counter 2-1	118	179
Counter 2-2	121	173
Counter 2-3	115	162
Counter 3-1	117	149
Counter 3-2	112	146
Counter 3-3	91	134
Mark recapture estimates for Dundas Island, January 21st 2013		
No. of animals marked = 398 (i.e. 1 cap found and lost before MR)		
	Number marked counted	Number unmarked counted
Counter 1-1	231	649
Counter 1-2	236	597
Counter 1-3	248	611
Counter 2-1	232	645
Counter 2-2	240	634
Counter 2-3	227	606
Counter 3-1	172	336
Counter 3-2	176	336
Counter 3-3	158	339
Direct counts for number of live pups for Dundas Island, January 21st 2013		
	Number counted	
Counter 1	1238	
Counter 2	1319	
Counter 3	1257	
Direct counts for number of live pups for Figure of Eight Island, January 9th 2013		
	Number counted	
Counter 1	71	
Counter 2	71	
Counter 3	68	

Appendix 4

Direct counts made at Sandy Bay, Enderby

Date	Live pups			Dead pups			Adult females			Adult males			Sub-adult males		
	Beach	Sward	Total	Beach	Sward	Total	Beach	Sward	Total	Beach	Sward	Total	Beach	Sward	Total
11/01/2013	326	2	328	7		7	185	12	197	49	25	74	44	6	50
12/01/2013	323	NC	323	9	0	9	172	21	193	46	12	58	31	12	43
13/01/2013	336		336	10	0	10	249	NC	249	52	NC	52	21	NC	21
14/01/2013	322	8	330	17	0	17	211	14	225	46	31	77	11	42	53
15/01/2013	331	16	347	8	0	8	241	NC	241	31	12	43	28	45	73
16/01/2013	331	NC	331	8	0	8									

NC – this denotes that a single total count was made and the numbers on the beach and sward were not counted separately

Appendix 5

Approximate location of where mark-recapture caps were put out on pups on Dundas Island

The following figure identifies the approximate number and location of where mark-recapture caps were put out on Dundas Island for the mark of the mark-recapture. Please note that this aerial image of Dundas Island was kindly provided by Barry Baker but is from the previous year (2011/12) and therefore the location of pups shown on this image does not reflect the location of pups in 2012/13 but has been used here for illustrative purposes.

