Demographic parameters and at-sea distribution of New Zealand sea lions breeding on the Auckland Islands (POP2007/01)

Auckland Islands research trip, December 2nd 2008 to February 16th 2009 (Final report, November 2009)

Dr. Louise Chilvers
Marine Conservation Section
Aquatic and Threats Unit
Department of Conservation

This report outlines the work completed in the 2008/09 New Zealand sea lion research field trip to the Auckland Islands for the Conservation Services Programme (CSP). The period covered in this report is from December 2nd 2008 when the first team arrived on Enderby Island through to the departure of the second team from the Island on February 16th 2009. This work continues annual surveys of the Auckland Island breeding sites of the New Zealand sea lions (*Phocarctos hookeri*).

Objectives

The objectives[1] of the work reported here were:

1. To collect field data that will allow quantification and estimation of:
   - pup production,
   - survival of previously marked New Zealand sea lions,
   - reproduction by known-age female New Zealand sea lions;
2. To maintain and update the New Zealand sea lion database;
4. To make available field data for relevant modelling work; and
5. To characterise at-sea distribution of poorly known age and sex classes of New Zealand sea lions.

Logistics

The scientific trip was split into two parts: December 2nd - January 10th, and January 10th - February 16th. The breaks in the field season permitted changes in personnel during the summer. The first science team comprised of three people: Nathan McNally (DOC Otago), Amelie Auge (Otago University) and Kelly Buckel (Massey University). The second team comprised of six people: Louise Chilvers (DOC, MCT), Katja Geschke (Wellington Zoo), Laureline Meyneir (Massey University), Jacinda Amey (DOC contractor), Jim Fyfe (DOC Otago) and Rob Hood (DOC Tongariro Taupo). Transport during the season was aboard the Evohe under charter to DOC. All personnel were accommodated in the two huts at Sandy Bay and the Apple Hut at Dundas Island.

Sea lion counts

Daily counts were undertaken for pups (live and dead) from 2nd December 2008 to 15th February 2009 and for adults at Sandy Bay from the 2nd December 2008 to January 20th 2009. Adult and pup counts were undertaken daily at South East Point between 2nd December 2008 and 20th January 2009 and then weekly until the 15th February 2009. Counts were made at approximately one week intervals at East Bay and other areas around Enderby Island. One five day trip was

[1] For further details see the Conservation Services Annual Plan 2007/08 available at: http://www.doc.govt.nz/publications/conservation/marine-and-coastal/marine-conservation-services/csp-plans/archive/2007-2008/approved-csp-annual-plan-2007-08/

made to Dundas Island. during the season to count, tag and resight animals. Figure of Eight Island was counted on January 10th with 26 females, 17 males, and 48 live and 6 dead pups being recorded. Resightings were also conducted by the NZ sea lion team on the main Auckland Island from Kekeno to Ross Harbour and throughout the harbour area including Rose & Ewing Islands (see Figure 1).

Figure 1: The Auckland Islands showing areas where sea lions were sighted: Figure of Eight, Dundas, Enderby, Ewing, Rose and Auckland Islands.

Pup production estimate

Estimates of pup production were calculated for the breeding sites in the Auckland Islands between 10 Jan to 21 Jan 2009 (Tables 1 and 2). Mark recapture methods (see Chilvers et al 2007 for detailed methodology) have been used to estimate of pup production from Sandy Bay and Dundas Island, while Figure of Eight Island and South East Point areas were estimated using direct counts. The total pup production estimate was 1501 ± 16 (Fig. 2).

On the 16th of January, the mark-recapture estimate at Sandy Bay was 289 ± 2. There were 12 dead pups from the area at the 16th January giving a total pup production for Sandy Bay for the 2008/2009 season of 301 ± 2. The mark recapture estimate at Dundas Island was completed on 21st January 2009 with an estimation of 1065 live pups ± 16. 67 dead pups were counted on the island on the same day giving a total pup production for Dundas Island of 1132 ± 16. Direct counts from Figure of Eight Island on the 10th Jan yielded a count of 48 pups + 6 dead giving a total of 54. The direct count at South East Point yielded 8 live pups + 6 dead giving a total of 14 pups.

The estimate of pup production from the Auckland Islands was 31% lower than that seen in 2007/08. Pup mortality during the first 4 weeks of the 2008/ 09 season from all studied locations was 6% (Table 2). Pup mortality at Sandy Bay was 4% at 16th January and was 12% by 15th Feb 2009.

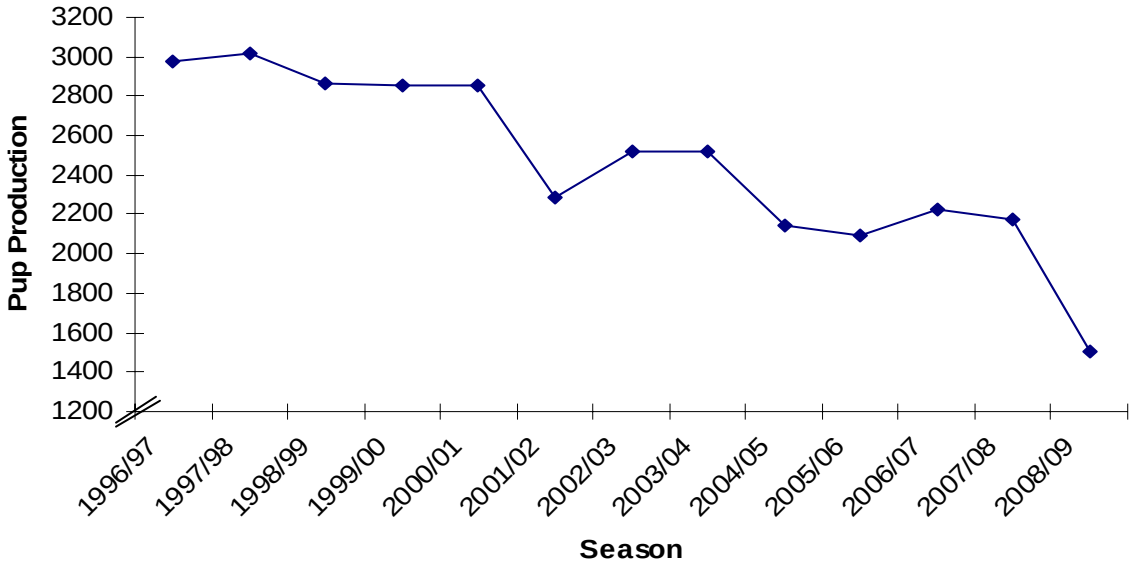

Figure 2. Annual pup production for the Auckland Islands 1996/97 to 2008/09.

Table 1: Pup production estimates for Auckland Islands

Season	Sandy Bay			Dundas Island			Figure of Eight Island			South East Point		
	total	alive	dead	total	Alive	Dead	Total	alive	dead	total	alive	Dead
97/98	477	468	9	2373	1748	625	120	97	23	51	37	14
98/99	513	473	40	2186	1957	229	109	100	9	59	42	17
99/00	506	482	24	2163	2039	124	137	131	6	50	37	13
00/01	562	527	35	2148	1802	346	94	92	2	55	47	8
01/02	403	320	83	1756	1395	361	96	90	6	27	21	6
02/03	489	408	80	1891	1555	336	95	89	5	43	26	17
03/04	507	473	34	1869	1749	120	87	86	1	52	39	13
04/05	441	411	30	1587	1513	74	83	79	4	37	31	6
05/06	422	383	39	1581	1349	232	62	55	7	24	20	4
06/07	437	414	23	1693	1587	106	70	67	3	24	19	5
07/08	448	425	23	1635	1512	123	74	72	2	18	13	5
08/09	**301**	**289**	**12**	**1132**	**1065**	**67**	**54**	**48**	**6**	**14**	**8**	**6**

Table 2: Total pup production from the Auckland Islands (NB. These estimates do not include an estimate of pup production from Campbell Island).

Season	Annual pup production			% Annual change in no. pups born	% Mortality at mark recapture estimate date		% Mortality at end of season (SB only)
	Total	**Alive**	**Dead**		**Total**	**SB only**	
97/98	3021	2350	671	1.5%	22.2%	2%	42%
98/99	2867	2572	295	-5.1%	10.3%	8%	9%
99/00	2856	2689	167	-0.4%	5.8%	5%	11%
00/01	2859	2468	391	0.1%	13.7%	6%	10%
01/02	2282	1826	456	-20.2%	20.0%	21%	33%
02/03	2518	2078	438	10.3%	17.4%	16%	21%
03/04	2515	2347	168	-0.001%	6.7%	8%	15%
04/05	2148	2034	114	- 14.6%	5.3%	7%	12%
05/06	2089	1807	282	- 2.8%	13.5%	9%	16%
06/07	2224	2087	137	6.4%	6.2%	5.3%	16%
07/08	2175	2022	153	-2%	7%	5.1%	14%
08/09	**1501**	**1410**	**91**	**- 31%**	**6%**	**4%**	**12%**

Pup tagging

Pups have been tagged to provide a pool of known age individuals for the estimation of parameters such as survival, recruitment and reproductive rate as part of the long-term study. Tags applied were pink 'coffin' shaped Dalton 'Jumbo' tags with a letter and three-digit number combination. All pups were tagged in both flippers. All live pups at both Sandy Bay (301) and South East Point (8), and 400 pups (100 males and 300 females) at Dundas Island were tagged. 25 pups were tagged on Figure of Eight Island with Green Dalton tags. 183 pups were captured approximately 4 weeks after tagging at Sandy Bay and checked for tag loss, 2 pups had lost tags (one lost one tag, the other lost both tags) giving a probability of losing a single tag of 0.8% within 4 weeks. Tag loss over the first 4 weeks during the years of use of Dalton tags has been 0.3%, 0.2%, 0.5%, 0.2%, 0.4%, 1.4%, 0.6%, 1.3%, 3.5% and 0.8%. This year's lower tag loss relative to 2007/08 was the result of changing the position in tag placement on the pups flipper due to the larger tag pin size as noticed last year, and this change appears to have had successful results for tag retention. The change in tag position was minor, predominantly moving the tag placement approximately 1 cm further away from the pups flipper edge to compensate for the larger tag pin. The result of the small change in tag placement meant that the distance between the flipper edge and tag pin is now similar to what it was before the tag pin size was increased.

Number of cows breeding and daily pup:cow ratios

As in previous seasons, daily counts of all animals and resights of tags and brands on NZ sea lions were undertaken on Enderby Island to understand the composition of animals at this breeding site and to enable the calculation of survivability, recruitment and fecundity of animals. Checks were undertaken on Enderby Island with 5500 resights made on 963 animals previously tagged or branded (including 287 individuals identified from a chip). We had a significantly higher chip sighting rate this year. Effort for chipping resighting was normal, the increase appeared to be due to a new more effective chip reader bought last year allowing better chip reading ability. Figure 3 and 4 represent a comparison of the daily number of females ashore at Sandy Bay in 2008/9 (Fig. 3) and pup:cows ashore ratios (Fig. 4) with the previous seasons. As can be seen in Figure 3 the daily counts of females ashore was significantly down compared with the 2007/08 season.

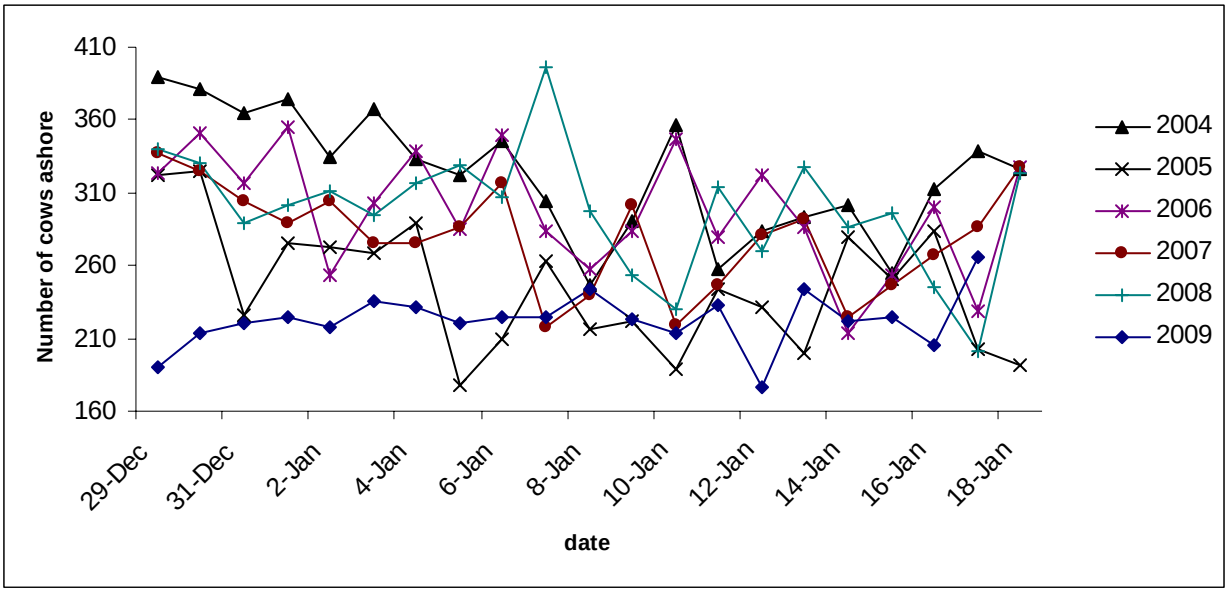

Figure 3. Numbers of females recorded ashore each day between 29th December and 18th January for the years 2003/04 to 2008/09.

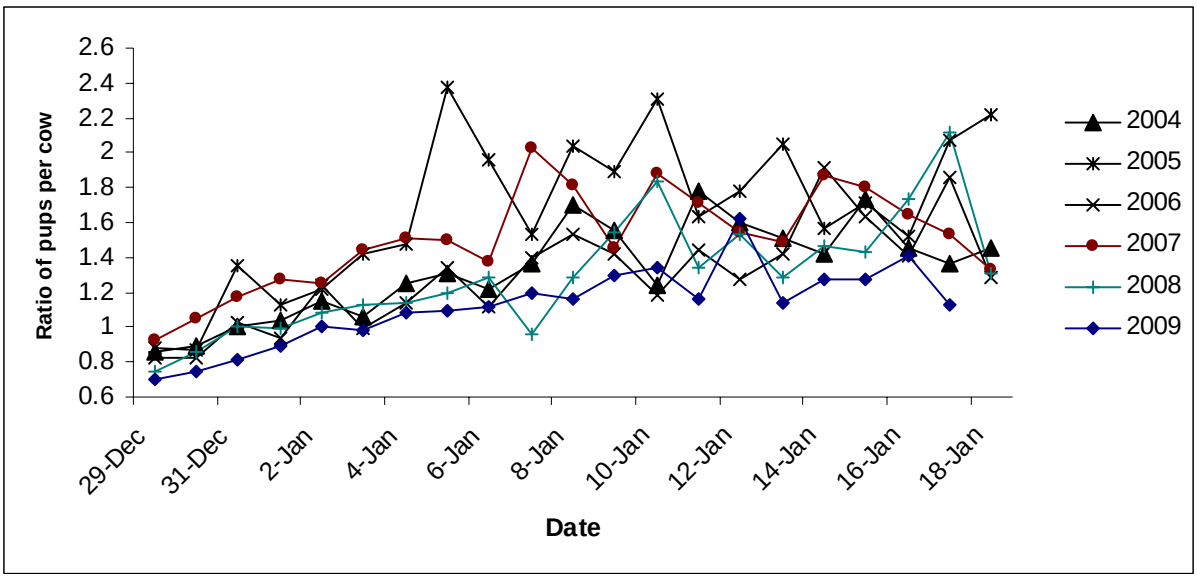

Figure 4. Pup:cow ratio at Sandy Bay between 29 December and 18 January for the years 2003/04 to 2008/09.

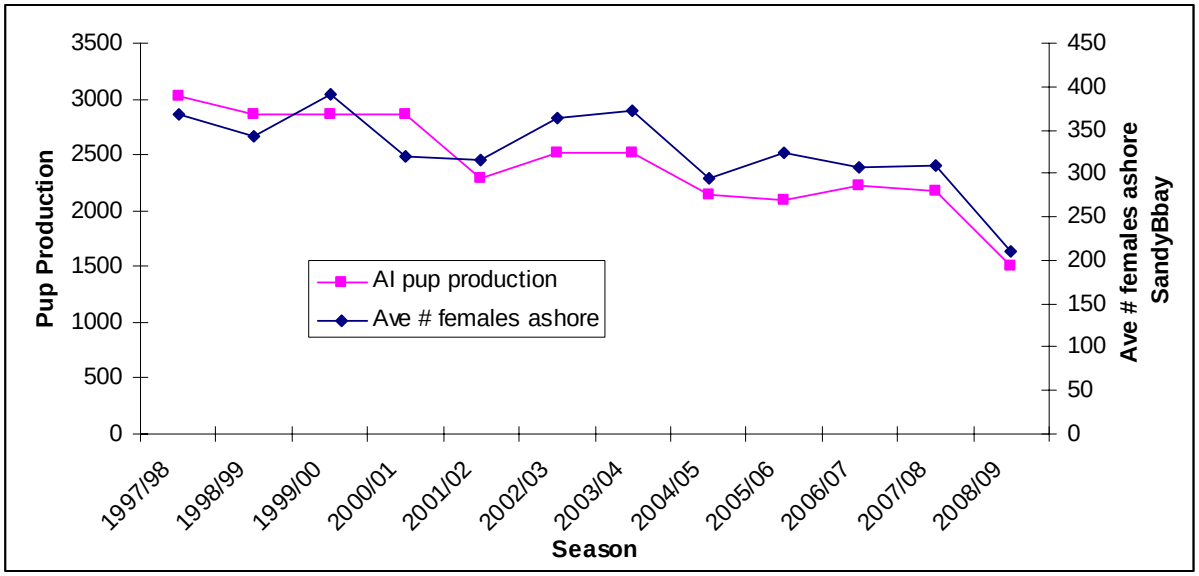

Figure 5. Auckland Island pup production compared with the average number of females seen ashore each day between 27th Dec (mean pupping date) and 2nd Jan at Sandy Bay, Enderby Island.

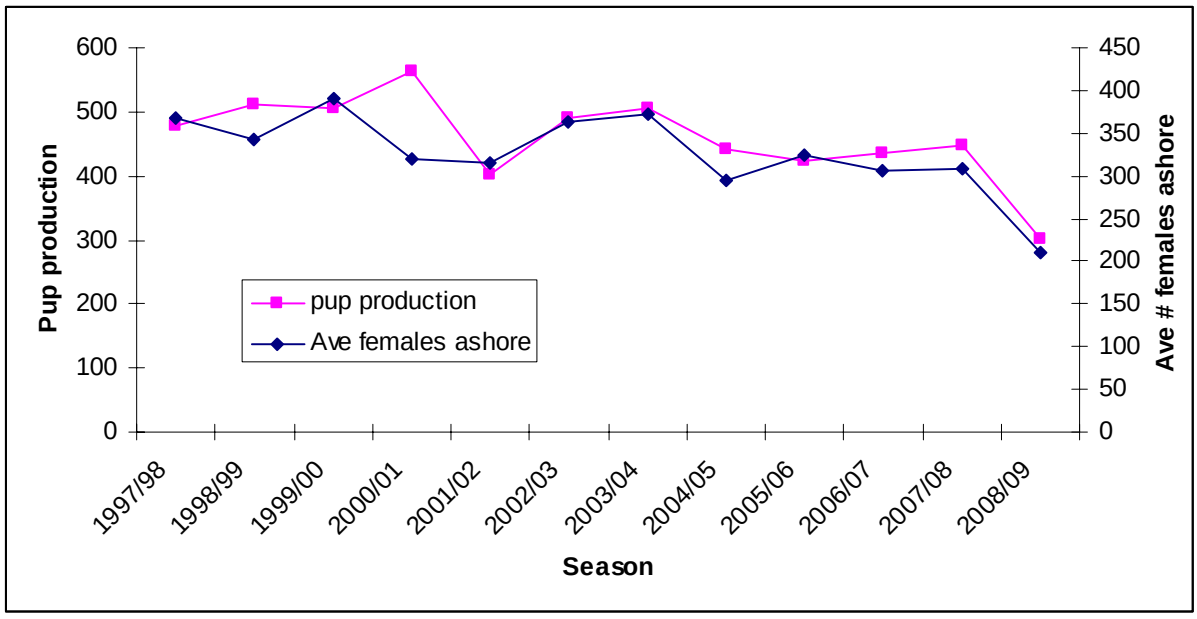

Figure 6. Sandy Bay pup production compared with the average number of females seen ashore each day between 27th Dec (mean pupping date) and 2nd Jan at Sandy Bay, Enderby Island.

Figures 5 & 6 compare pup production for the Auckland Islands and Sandy Bay, Enderby Island, with the average number of females seen ashore at Sandy Bay each day between 27th December (mean pupping date) and 2nd January. This period is chosen because it is the period when maximum numbers of females will be present ashore (69% of all births occur a week either side of the 27th December (Chilvers et al. 2006) and these dates are before the period when female start foraging trips therefore numbers start to fluctuate (Fig. 3)). These graphs clearly show the relationship between the numbers of females present at the harems and the numbers of pups born. The number of females sighted at Sandy Bay this year was considerably lower than any other year since 1997/98 (Table 4). There has been a downward trend in females present at Sandy Bay (and presumably all other colonies) particularly in the last 5 years.

Table 4. Number of females seen ashore each day between 27th Dec (mean pupping date) and 2nd Jan at Sandy Bay, Enderby Island.

Season	Ave. # female ashore Sandy Bay	Minimum	Maximum
97/98	368	355	388
98/99	342	300	393
99/00	390	374	413
00/01	320	303	352
01/02	316	303	352
02/03	363	326	388
03/04	372	335	389
04/05	294	226	337
05/06	325	253	355
06/07	307	289	337
07/08	308	283	340
08/09	209	190	225

Figures 7 & 8 show daily number of adult males (determined by size and mane development) and all males (adult and sub-adult) ashore at Sandy Bay in 2008/09. Overall the number of adult males sighted each day appeared relatively normal compared to other years, however it appeared

that the number of sub-adult males was lower than normal giving an overall slightly lower number of males sighted daily on Sandy Bay than in the last five years.

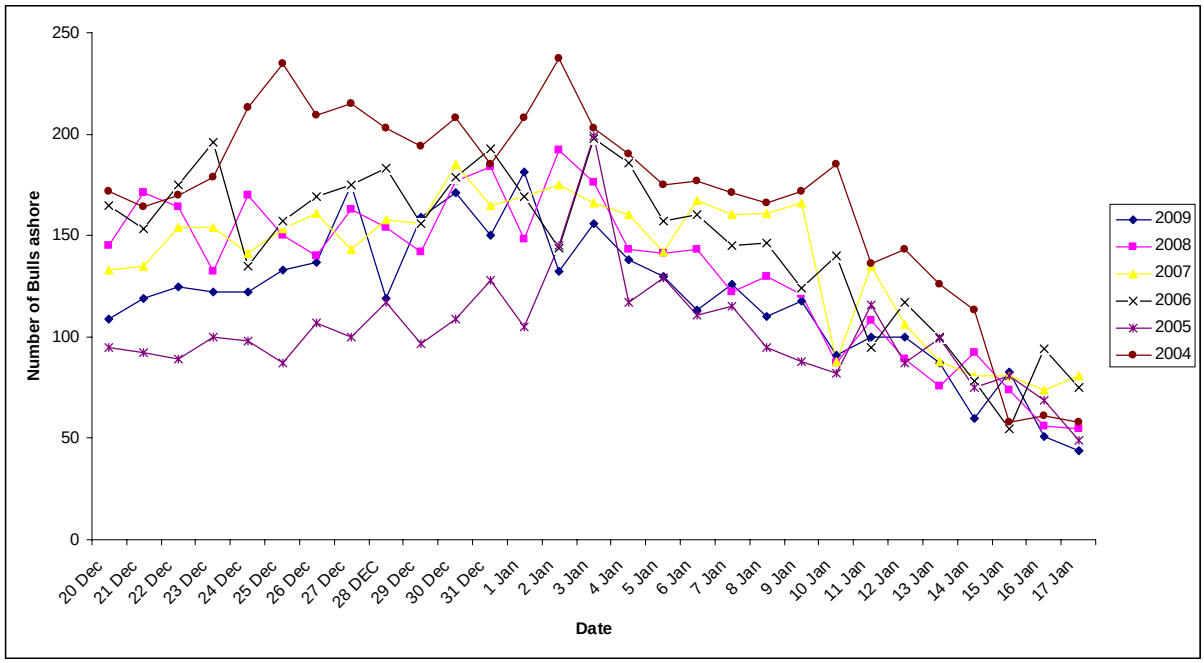

Figure 7. Numbers of adult males recorded ashore each day between 20th December and 17th January for the years 2003/04 to 2008/09.

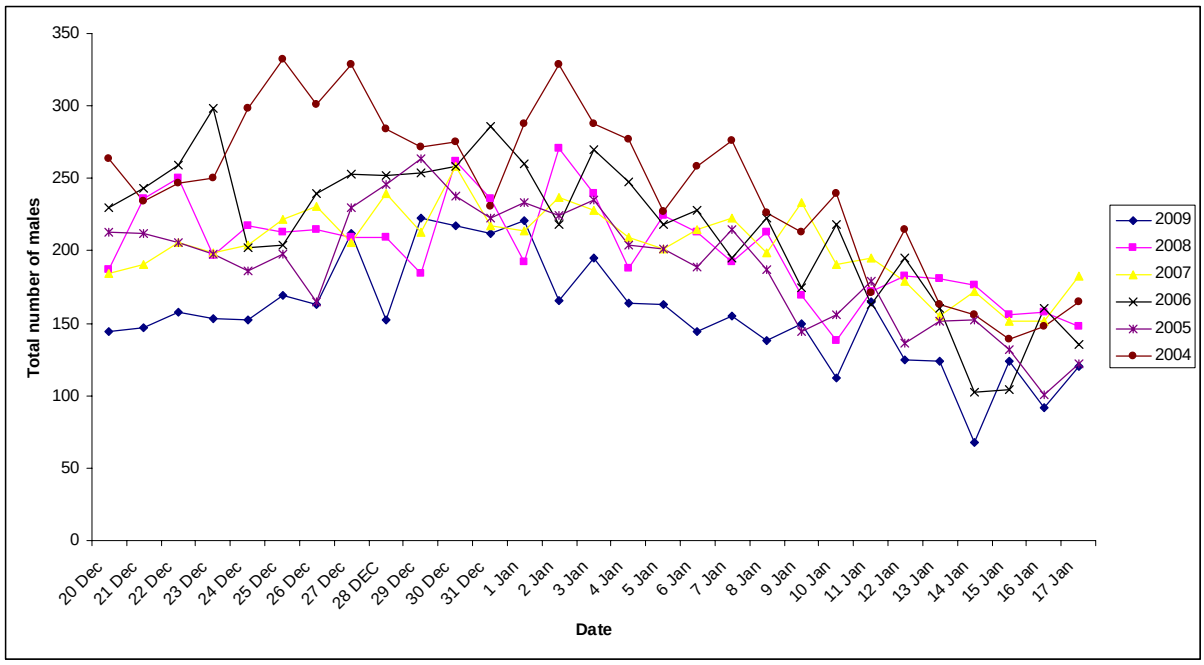

Figure 8. Numbers of all males recorded ashore each day between 20th December and 17th January for the years 2003/04 to 2008/09.

Maintenance and updating the NZ sea lion database and making available the 2008/09 field data for relevant modelling work

Resight data has been entered into the NZ sea lion database and verified. Data has been extracted and provided to CSP contractors for the estimation of demographic parameters (CSP Project POP2007/01 Objective 3).

Juvenile satellite tagging 2009

In January and February 2009 ten juvenile sea lions (4 male and 6 female) between the age of 2 and 5 years were captured at Sandy Bay, Enderby Island. Tags were deployed for between 9 and 38 days (Table 5). Figure 9a, b & c show satellite locations of these animals.

Table 5. Dates, tag number, satellite tag identification, sex, age, weight, length, girth, number of days deployed and number of satellite locations received from 10 juvenile sea lions captured January 2008.

Date	Tag	Satellite tag id	Sex	Age	Weight	Length	Girth	Days	Number of satellite locations
11/01/2009	4907	1757	M	5	117	184	107	14	138
15/01/2009	7458	49093	F	2	57	140	90	13	105
15/01/2009	6363	76964	F	3	79	165	98	10	135
19/01/2009	6485	67260	M	3	85	159	98	12	208
19/01/2009	7610	76965	F	2	54	140	84	25	316
20/01/2009	6214	54760	M	3	81	160	104	13	139
20/01/2009	6218	54761	M	3	76	155	92	38	570
20/01/2009	6536	76963	F	3	70	157	93	19	235
25/01/2009	7445	89574	F	2	53	138	83	9	149
25/01/2009	8023	49094	F	2	54	135	84	17	206

Table 6. Age and sexes of juvenile animals satellite tagged 2007/2008 and 2008/2009.

Age	2	3	4	5
Male	0	3	2	3
Female	5	7	NA	NA

The analysis of this NZ sea lion distribution data in a fisheries context will be reported at a later date.

Acknowledgements

We are grateful for the significant logistical support provided throughout the whole trip from DOC Southland, particularly Sharon Trainor, Kathryn Pemberton, Pete McClelland, Gilly Adams and Andy Roberts. We also appreciate the helpful and friendly radio schedules coordinated by Stewart Island staff. Funding was provided by the Department of Conservation's Conservation Services Programme (www.csp.org.nz) project POP2007/01 by the Department of Conservation and through a levy principally on the quota holders of SQU 6T.

References

Chilvers BL, Robertson BC, Wilkinson IS, Duignan PJ (2006) Growth and survival of New Zealand sea lions, *Phocarctos hookeri*: birth to 3 months. Polar Biology 30:459-469

Chilvers BL, Wilkinson IS, Childerhouse, S (2007) New Zealand sea lion, *Phocarctos hookeri*, pup production – 1995 to 2006. New Zealand Journal of Marine and Freshwater Research 41: 205-213.

Figure 9a Satellite locations of juvenile male NZ sea lions 4907 ●, 6485 ★, 6214 ▲ & 6218 ■

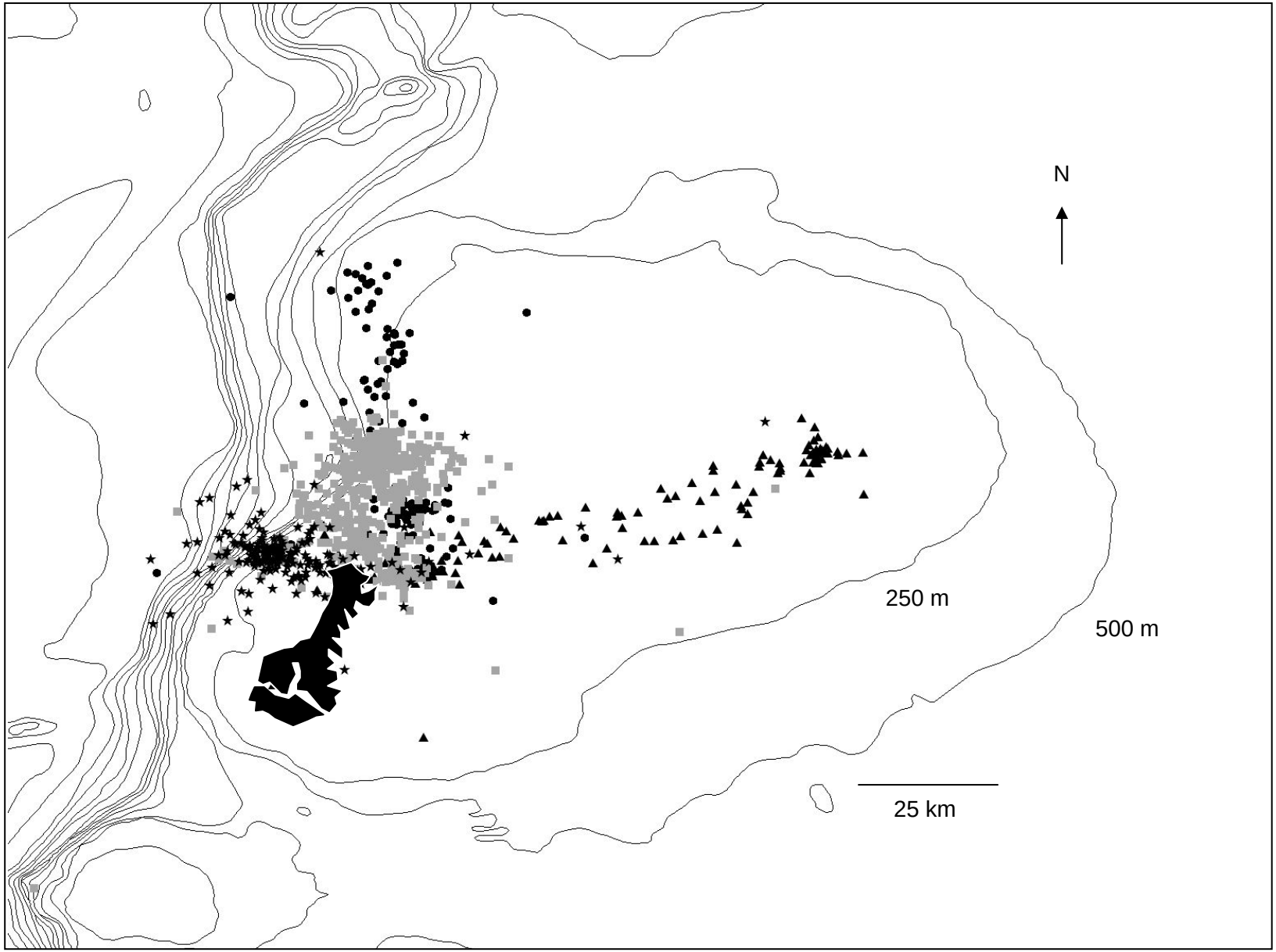

Figure 9b Satellite locations of juvenile female NZ sea lions 7445■ , 8023 ● & 6363 ▲.

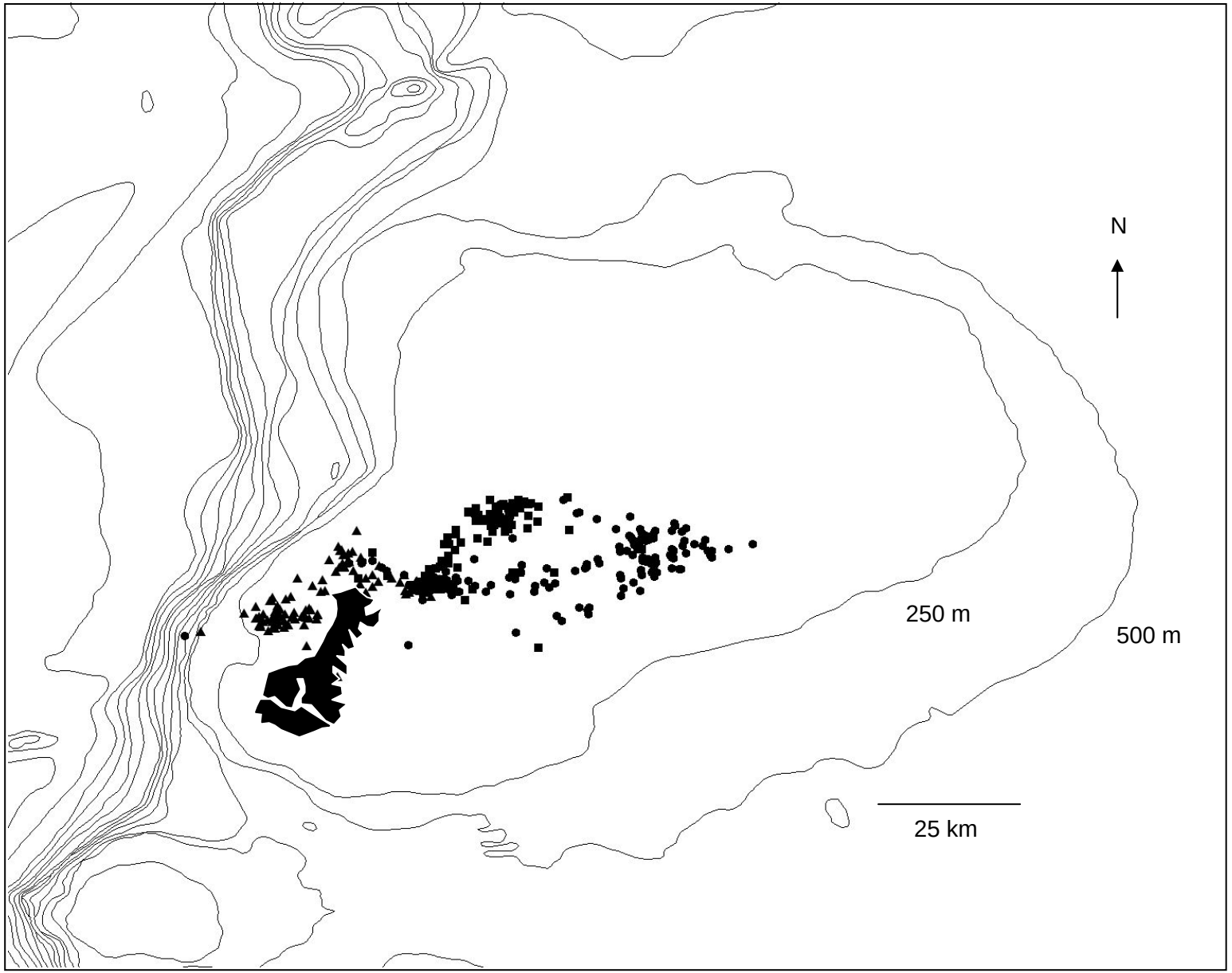

Figure 9c Satellite locations of juvenile female NZ sea lions 6536 ▲, 7458 ● & 7610 ■.