

## Seabird Research at Cape Shirreff, Livingston Island, Antarctica, 2008-09

Kevin W. Pietrzak, James H. Breeden, Aileen K. Miller and Wayne Z. Trivelpiece

**Abstract** Land-based seabird data were collected during the Antarctic breeding season, October 24, 2008 through March 6, 2009. Results from the research period include:

- The gentoo chick count was 1,010 chicks, 86% higher than the 2007-08 count but only 6% higher than the previous 12-year mean.
- The chinstrap chick count was 4,332 chicks, 282% higher than the 2007-08 count but still 33% lower than the previous 12-year mean.
- Diet samples were collected from 20 gentoo and 40 chinstrap penguins between 6 January and 10 February 2009. 100% of the gentoo penguin diet samples contained evidence of fish, and 42% of chinstrap penguin diet samples contained evidence of fish. Antarctic krill (*Euphausia superba*) comprised the majority of diet in 100% of chinstrap penguin samples and 68% of gentoo penguin samples.

### Introduction

The U.S. Antarctic Marine Living Resources (AMLR) program conducted its 12<sup>th</sup> field season of land-based seabird research at the Cape Shirreff field camp on Livingston Island, Antarctica (62° 28'S, 60° 46'W), during the austral summer of 2008-09. Cape Shirreff is a Site of Special Scientific Interest; long-term monitoring of predator populations are conducted in support of US participation in the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR).

The objectives of the seabird research program for the 2008-09 season were the following, according to the CCAMLR 2004 long-term monitoring protocol:

1. To estimate chinstrap (*Pygoscelis antarctica*) and gentoo penguin (*P. papua*) breeding population size (Std. Method A3);
2. To band 500 chinstrap and 200 gentoo penguin chicks for demography studies (Std. Method A4);
3. To determine chinstrap penguin foraging trip durations during the chick rearing stage of the reproductive cycle (Std. Method A5);
4. To determine chinstrap and gentoo penguin breeding success (Std. Methods 6a,b&c);
5. To determine chinstrap and gentoo penguin chick weights at fledging (Std. Method 7c);
6. To determine chinstrap and gentoo penguin diet composition, meal size, and krill length-frequency distributions (Std. Methods 8a,b&c); and
7. To determine chinstrap and gentoo penguin breeding chronologies (Std. Method 9).

### Methods

We arrived at Cape Shirreff on 24 October 2008 via the National Science Foundation vessel R/V *Laurence M. Gould*. We conducted research until we closed camp on 7 March 2009. The AMLR chartered vessel R/V *Yuzhmorgeologiya* provided logistical support and transit back to Punta Arenas, Chile at the field season's conclusion.

#### Breeding biology

We conducted nest censuses for gentoos on November 12, 2008 and for chinstraps on 29 November 2008, approximately one week after mean clutch initiation for each species. Chick censuses were conducted for gentoo penguins on 20 January 2009 and for chinstrap penguins on 6 February 2009, approximately one week after mean crèche.

Reproductive success was also measured by following a sample of 50 pairs of breeding gentoo penguins and 100 pairs of breeding chinstrap penguins from clutch initiation through to crèche formation (Std. Methods 6b). Because chick mortality is typically low following crèche, these numbers are also an estimate of fledging success.

Fledging weights were collected from chinstrap penguin chicks as a measure of chick condition. Chinstrap penguin fledglings were caught on the beaches just before fledging, between 18 and 26 February 2009.

In addition to penguins, the breeding success of all skuas at Cape Shirreff and nearby Punta Oeste was followed during the breeding season. The reproductive performance of kelp gulls (*Larus dominicanus*) nesting on Cape Shirreff was also followed throughout the season.

#### Foraging Ecology

Diet samples were collected from 20 gentoo and 40

chinstrap penguins between 6 January and 10 February 2009. Adults were captured at their nest sites upon returning from foraging trips, to assure they were feeding chicks, and the total stomach contents were collected using the wet-offloading technique (Wilson 1984). A sub-sample of 50 individual Antarctic krill from each diet sample were measured and sexed to determine length and sex frequency distributions of the krill selected by foraging penguins.

Radio transmitters were deployed on 18 breeding adult chinstrap penguins during the chick rearing phase in order to determine their foraging trip durations. Colony attendance was logged between 7 January 2009 and 1 March 2009 using a remote receiver and data collection computer.

Gentoo and chinstrap penguins were also instrumented with satellite transmitters (PTTs), to provide geographic data on adult foraging locations during the chick rearing period. Twenty-six PTTs were deployed during the brooding phase for each species: 10 on gentoo penguins in late December and 16 on chinstrap penguins in early and mid January. Nineteen PTTs were deployed during the crèche phase for each species: 10 on gentoo penguins and nine on chinstrap penguins in late January and early February, respectively.

Time-depth recorders (TDRs) were also attached to chinstrap and gentoo penguins to collect penguin diving behavior data during the chick-rearing period. Twenty-four TDRs were deployed while these adults were brooding chicks: 10 on gentoo penguins in early January and 14 on chinstrap penguins in late December to mid January. Twenty TDRs were deployed during the crèche phase, when nests are unattended and both parents forage simultaneously: 10 on gentoo penguins in mid January and 10 on chinstrap penguins in early February.

All data were collected according to the Standard Methods delineated in the CCAMLR Ecosystem Monitoring Program: Standard Methods (2004).

## Results

### *Breeding biology*

The penguin rookery at Cape Shirreff consisted of 19 sub-colonies of gentoo and chinstrap penguins during the 2008-09 breeding season. A total of 879 gentoo penguin nests were counted (Figure 6.1), a 44% increase from last year's census. This count represents an 8% increase over the previous 11-year average and is the highest since the 2001-02 season. A total of 4,026 chinstrap penguin nests were counted. While this is a 33% increase from last year's census, it is still 32% lower than the previous 11-year average of 5,958. This count could be interpreted as a rebound

from last year's very low nest census but still represents a general trend of decline in the chinstrap penguin breeding population at Cape Shirreff.

The gentoo chick count was 1,010 chicks, 86% higher than the 2007-08 count but only 6% higher than the previous 12-year mean (Figure 6.1). The chinstrap chick count was 4,332 chicks, 282% higher than the 2007-08 count but still 33% lower than the previous 12-year mean (Figure 6.2).

Based on census data, overall gentoo penguin fledging success was 1.15 chicks/nest. This is 3% lower than the previous 11-year mean. Overall chinstrap penguin fledging success was 1.08 chicks/nest. This is 7% higher than the previous 11-year mean. Based on data from our reproductive study, gentoo penguins fledged 1.34 chicks/nest and chinstrap penguins fledged 1.16 chicks/nest.

Nests of known-age penguins that initiated clutches were also followed to crèche. Thirty-three known-age gentoo penguin nests (at least one member of the pair was of known age) fledged 0.67 chicks/nest. Thirty-three known-age chinstrap penguin nests fledged 0.79 chicks/nest.

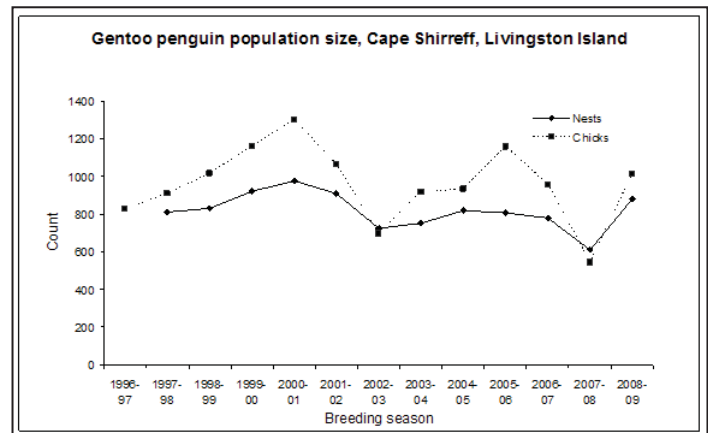


Figure 6.1. Gentoo penguin population size during breeding season at Cape Shirreff, Livingston Island, Antarctica, 1996-97 to 2008-09.

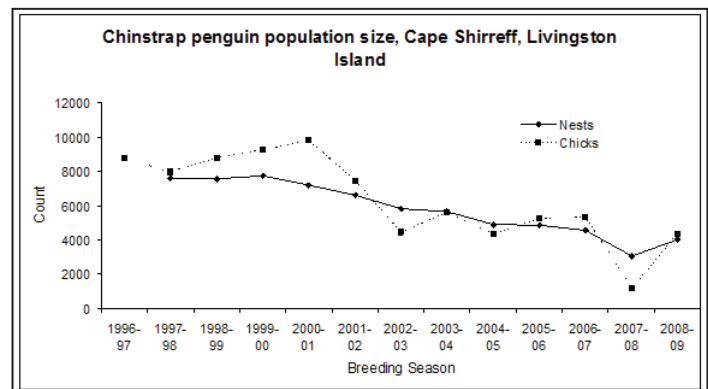


Figure 6.2. Chinstrap penguin population size during breeding season at Cape Shirreff, Livingston Island, Antarctica, 1996-97 to 2008-09.

A sample of 200 gentoo and 500 chinstrap penguin chicks was banded for future demographic studies. The banded chicks that survive and return to the colony as adults will be observed for age-specific survival and reproductive success.

Fledging chicks had an average mass of 3,245 g ( $n = 304$ ; S.D. = 354). This is slightly higher (4%) than the previous 12-year mean. Gentoo penguin chicks are usually weighed 85 days after their mean clutch initiation date; approximately the age at which other *Pygoscelis sp.* chicks fledge. However, conditions at the colony did not allow us to collect gentoo penguin chick weights at this time, so fledge weights are not available for the 2008-09 field season.

There were 25 skua pairs holding breeding territories, all of which were brown skuas (*Catharacta lonnbergi*) with the exception of one pair, which are likely hybrid brown-South Polar skuas (*C. maccormicki*). Clutches were initiated by 16 pairs of skuas, and overall fledging success was 0.52 fledglings/pair. This is 30% lower than the previous 11-year average. Kelp gulls initiated 40 nests; overall fledging success was 0.95 fledglings/pair.

#### Foraging ecology

Antarctic krill (*Euphausia superba*) was present in samples and comprised the majority of diet in 100% of chinstrap penguin samples and 68% of gentoo penguin samples. Fish was the next largest component, while squid and other marine invertebrates represented <1% of penguin diets.

During the 2008-09 season, 100% of the gentoo penguin diet samples contained evidence of fish. This is the third consecutive year of our study in which all gentoo penguin diet samples contained evidence of fish. Previous to that only 75% of gentoo diet samples contained evidence of fish. Similarly, 42% of chinstrap penguin diet samples contained evidence of fish, which is higher than the previous 11-year average of 30%. Still, fish represented 25% of the gentoo penguin diet by mass and <1% of the chinstrap penguin diet by mass.

Krill in gentoo penguin samples were larger on average ( $48 \pm 6$  mm) than krill in chinstrap penguin samples ( $43 \pm 5$  mm) (Figure 6.3). Penguin diets were composed of 4% juvenile krill (those less than 36 mm in length), 58% males and 38% females (Figure 6.4).

The average chick meal mass for chinstrap penguins was 660 g; this is 8% higher than the previous 11-year mean of 611 g. The ratio of fresh to digested portions in the chinstrap penguin's diet samples was comparable to the previous nine seasons. We only collected the fresh portion of diet samples from gentoo penguins, so chick meal mass

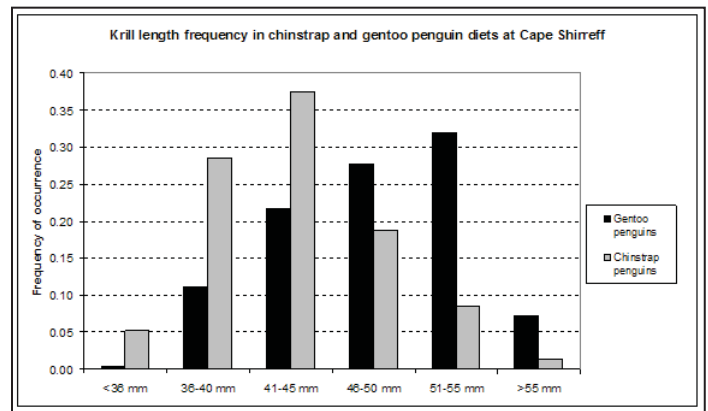


Figure 6.3. Krill length-frequency distribution in gentoo and chinstrap penguin diet samples at Cape Shirreff, Livingston Island, Antarctica, 2008-09.

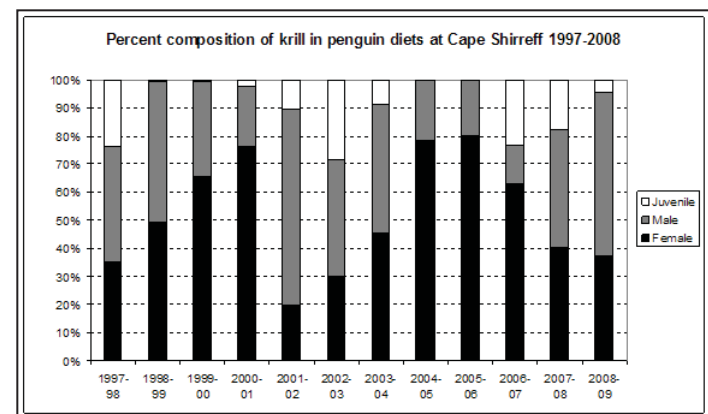


Figure 6.4. Demographic composition of Antarctic krill (*Euphausia superba*) in gentoo and chinstrap penguin diet samples at Cape Shirreff, Livingston Island, Antarctica, 1997-98 to 2008-09.

was not evaluated.

Chinstrap penguin foraging trips averaged  $14.2 \pm 3.4$  hr. PTT and dive data for both chinstrap and gentoo penguins are awaiting analysis.

#### Discussion

Our 12<sup>th</sup> season of seabird research at Cape Shirreff allows us to assess trends in penguin population size, as well as inter-annual variation in reproductive success, diet and foraging behavior.

Breeding population counts and reproductive success of both gentoo and chinstrap penguins were significantly higher than last year's counts. Gentoo penguin nest and chick censuses were the highest seen in seven years. While there was an increase from last year, overall the chinstrap breeding population at Cape Shirreff has continued to decline. Fledging weights for chinstraps were comparable to the previous 11-year average.

Diet composition of both species was comparable to previous seasons; all gentoo penguin samples contained fish and overall the samples contained a relatively high proportion of male krill. Gentoo penguins on average took larger krill than chinstrap penguins. The interpretation of these diet patterns may be aided by analysis of foraging location and diving behavior data.

### **Protocol Deviations**

There were no deviations from the protocol, as described in the CCAMLR Ecosystem Monitoring Program: Standard Methods (2004).

### **Disposition of Data**

Land-based seabird data are available from Dr. Wayne Trivelpiece, NOAA Fisheries, Antarctic Ecosystem Research Division, 3333 N. Torrey Pines Ct, La Jolla, CA 92037. Ph: 858-546-5607, FAX: 858-546-5608

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### **References**

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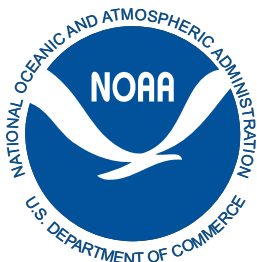
## AMLR 2008/2009 FIELD SEASON REPORT

### Objectives, Accomplishments and Tentative Conclusions

Edited by  
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U.S Department of Commerce  
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8604 La Jolla Shores Drive  
La Jolla, California, U.S.A. 92037

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**Inquiries should be addressed to:**

**Antarctic Ecosystem Research Group  
Southwest Fisheries Science Center  
8604 La Jolla Shores Drive  
La Jolla, California, USA 92037**

**Telephone Number: (858) 546-5600  
E-mail: [Amy.VanCise@noaa.gov](mailto:Amy.VanCise@noaa.gov)**

