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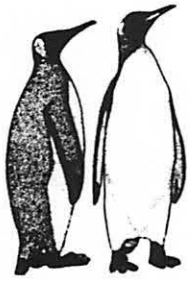

UNITED STATES
AMLR ANTARCTIC MARINE LIVING RESOURCES PROGRAM

AMLR 1991/92
FIELD SEASON REPORT
Objectives, Accomplishments and Tentative Conclusions

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May 1992

ADMINISTRATIVE REPORT LJ-92-17

Southwest Fisheries Science Center
Antarctic Ecosystem Research Group

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TABLE OF CONTENTS

BACKGROUND

The long-term objective of the U.S. Antarctic Marine Living Resources (AMLR) field research program is to describe the functional relationships between krill, their environment, and their predators. The field program is based on two working hypotheses: (1) krill predators respond to changes in the availability of their food; and (2) the distribution of krill is affected by both physical and biological aspects of their habitat. In order to refine these hypotheses, a study area was established in the vicinity of Elephant Island (Figure 1). A seasonal field camp was established at Seal Island, off the northwest coast of Elephant Island, where reproductive success and feeding ecology of seal and penguin breeding colonies are monitored. A complementary series of shipboard observations were initiated to describe both within and between season variations in the distributions of nekton, zooplankton, phytoplankton, and water types. In addition, research on aspects of the ecology of Adelie penguins is conducted at Palmer Station each year during the austral summer.

SUMMARY OF 1992 RESULTS

Four surveys were conducted between mid-January and mid-March, 1992. The hydrographic front north of Elephant Island moved offshore as the season progressed. Current flow was generally from the southwest to northeast, with meanders evident north of Elephant Island and intensified flow between Clarence and Elephant Islands. In contrast to the previous season, both phytoplankton biomass and krill abundance decreased from the beginning to the end of the sampling period. Early in the season, phytoplankton biomass was highest south of the hydrographic front and was composed of discoid diatoms, 30-40μm in diameter. Krill were very abundant during the first survey; they were distributed in a band extending across the north side of Elephant Island and wrapping around the western end. By mid-March only a few small areas of high krill density remained northwest of Elephant Island. The size distribution of sampled krill was bimodal: a juvenile mode at 25-30mm and an adult mode at 45mm. The large numbers of juvenile krill and the low numbers of 35-40mm krill suggest successful krill spawning in 1990/91 relative to 1989/90 and 1988/89. The number of chinstrap penguins breeding on Seal Island was the highest ever observed; survival and growth of chicks, however, was only slightly higher than average. Cape petrel reproductive success was particularly good; both breeding and chick survival were above average. The growth rate of fur seal pups was above average as well. At Palmer Station, measures of breeding success suggested that Adelie penguin productivity was higher than last year.

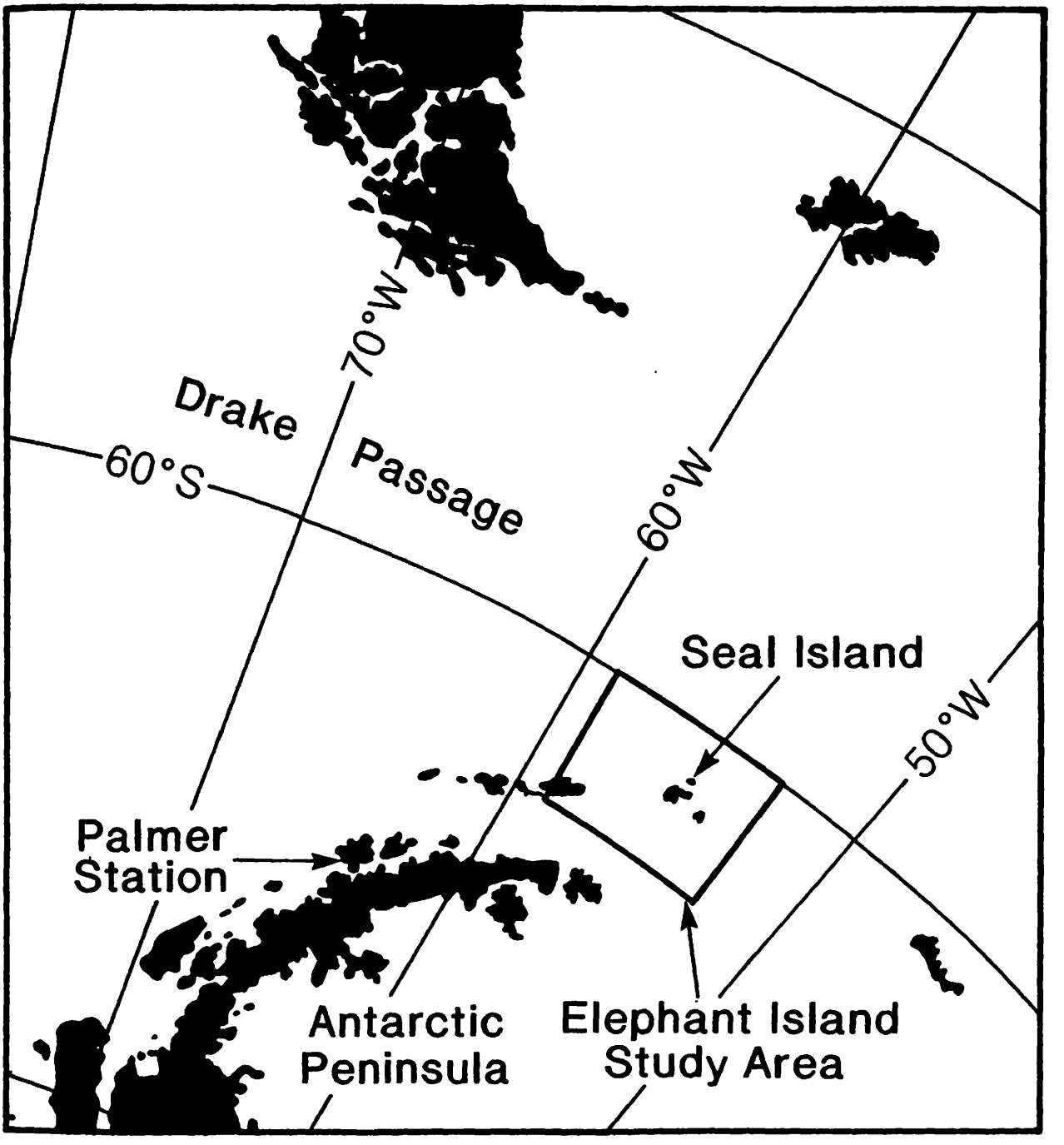

Figure 1. Locations of the U.S. AMLR field research program: Elephant Island Study Area, Seal Island, and Palmer Station.

5. Conduct directed research on chick growth and condition, and seasonal patterns in the diving behavior of chinstrap penguins to assess changes in foraging behavior and effort as the breeding season progresses.

6. Assess the reproductive success, survival, and recruitment of cape petrels.

7. Measure the food load delivery to dependent chicks contemporaneously with foraging effort.

8. Measure intra-annual differences in foraging effort in breeding chinstrap penguins.

9. Initiate a feasibility study of the winter foraging behavior and distribution of chinstrap penguins.

Palmer Station:

1. Determine Adelie penguin breeding success.

2. Examine how present and past indices of Adelie penguin breeding success relate to a true measure of breeding success.

3. Gather information on Adelie penguin diet composition and meal size.

4. Determine Adelie penguin chick weights at fledging.

5. Determine the amount of time breeding adult Adelie penguins need to procure food for their chicks.

6. Band a representative sample (1000 chicks) of the Adelie penguin chick population.

7. Determine adult Adelie penguin breeding chronology.

8. Explore the feasibility of adding more of the Standard Methods to the suite of data now being collected at Palmer Station.

FRASER

AMLR

14. Seabird research undertaken as part of the NMFS/AMLR ecosystem monitoring program at Palmer Station, 1991-1992; submitted by William Fraser, Old Dominion University.

14.1 Objectives: Research at Palmer Station focuses on aspects of the ecology of Adelie penguins that are complementary to the scope of research and objectives outlined by the CCAMLR Ecosystem Monitoring Program (CEMP). CEMP has recommended that directed research and monitoring activities be conducted at several integrated study areas in the Southern Oceans with access to large populations of krill-eating predators. Palmer Station is one of two sites on the Antarctic Peninsula where long term monitoring of seabird populations is being undertaken in support of U.S. participation in CEMP. Our objectives during 1991-1992, the fifth season of field work at Palmer Station, were to: (1) determine Adelie breeding success, (2) examine how present and past indices of Adelie breeding success relate to a true measure of breeding success, (3) gather information on Adelie diet composition and meal size, (4) determine Adelie chick weights at fledging, (5) determine the amount of time breeding adult Adelie penguins need to procure food for their chicks, (6) band a representative sample (1000 chicks) of the Adelie chick population, (7) determine adult Adelie breeding chronology and 8) explore the feasibility of adding more of the Standard Methods to the suite of data now being collected at Palmer Station.

14.2 Accomplishments and Field Schedules: Field work at Palmer Station was initiated on 17 October 1991 and terminated on 7 March 1992. The early start date was aided by joint funding from the National Science Foundation's (NSF) Division of Polar Programs. NSF recently chose Palmer as a Long Term Ecological Research (LTER) site and has committed long-term funding and logistics support to an ecosystem study in which Adelie penguins represent one of two key upper trophic level predators selected for research. As a result of this cooperative effort between the National Marine Fisheries Service (NMFS) and NSF, the length of field seasons at Palmer will effectively be extended by nearly three months. Palmer will thus be the first U.S. AMLR study area to provide data on Adelies during the entire course of their 5-month breeding season. Field work schedules and activities related to the above cited objectives were as follows:

1. Adelie breeding success.

Until this season, breeding success in Adelie penguins had been estimated by using indices based on chick production per colony, the number of active nest sites in early January, and the ratio of 1-and 2-chick broods (see below). A true measure of breeding success, that is, the number of chicks reaching creche age per breeding pair, had not been previously obtained due to the late start of the field season and the subsequent inability to determine the number of breeding pairs and the fate of their eggs and chicks early in the season. This year, in contrast to past seasons, a 100-nest sample was followed on Humble Island from clutch initiation to creche. Adelies creched 1.39 chicks per pair, suggesting relatively high productivity in 91-92. The major cause of mortality was nest flooding and the subsequent loss of eggs.

2. Breeding success and the use of indices.

As in past seasons, two indices of breeding success were determined. On 9 January, the proportion of 1 and 2 chick broods was assessed at 51 colonies in 5 different rookeries; on 26 January these and other colonies were censused to assess chick production. Of the 3020 active territories examined, 70.5% were 2-chick broods. Production at selected colonies totaled 6388 chicks (4025 active territories), which suggests a per-pair productivity of 1.59 chicks, or 0.20 chicks more than the more accurate measure obtained above. This difference does not appear to be large enough to negate the potential usefulness of these indices.

3. Diet composition.

Diet studies were initiated on 15 January and terminated on 19 February. During each of the 8 sampling periods, 5 adult Adelies were captured and lavaged (stomach pumping using a water off-loading method) as they approached their colonies to feed chicks on Torgersen Island. All birds (N=40) were subsequently released unharmed. The resulting diet samples were processed at Palmer Station. A nearly complete absence of all prey other than krill (*Euphausia superba*) characterized the 91-92 samples. These krill were larger than in previous seasons, averaging 40-45mm in length.

4. Chick fledging weights.

Data on Adelie chick fledging weights were obtained between 7-25 February at beaches near the Humble Island rookery. During this interval, 391 chicks were weighed and released. Peak fledging occurred on 19 February; average fledgling weight was 3.2kg.

5. Length of foraging bouts.

Radio receivers and automatic data loggers were deployed at the Humble Island rookery between 15 January and 23 February to monitor presence-absence data on 36 breeding Adelies carrying small radio transmitters. These transmitters were glued to adult penguins feeding 10-14 day old chicks. An additional 3 transmitters available to us were not functioning properly and were not deployed. Analysis of the data has not yet been accomplished due to the size of the databases obtained. These results will be presented as part of the final report being delivered at a later date.

6. Chick banding.

One-thousand Adelie chicks were banded as part of long-term demographic studies at AMLR colonies on Humble Island. This effort was accomplished during the first week in February to accommodate differences in chick size at the various colonies. These differences in size were due to variations in breeding chronology between colonies due to significant differences in the amount of snow cover early in the breeding season. The

presence of birds banded in previous seasons was also monitored during the entire field season on Humble Island as part of these demographic studies.

7. Adult breeding chronology.

As last season, a 100-nest sample was established on Humble Island to assess the chronology of breeding events, with relevant data being obtained every 1-3 days as weather permitted from 17 October to 7 March. Relative to last season, peak activity in a variety of breeding events occurred 3-5 days later in 91-92, although it is now clear that there are large variations between colonies due primarily to the amount of snow cover.

8. Feasibility studies.

Because of the longer field seasons that can now be undertaken at Palmer Station, great potential exists for adding more of the CEMP Standard Methods to the suite of data being collected. In 91-92, we successfully added Procedure B (chicks raised per breeding pair) to Standard Method A6.2 (breeding success). Procedure B, perhaps the most labor intensive of all the Standard Methods, will be implemented each season to complement data being obtained with Procedure A (chick counts) and the proportion of 1- to 2-chick broods. Procedure C (chicks raised per colony) was not successfully implemented this year due primarily to early season problems with access to the rookeries because of pack ice. For the same reason, Standard Method A2.2 (duration of the first incubation shift) was also not implemented. However, Standard Method A3.2 (breeding population size) was implemented and will become part of the suite of data collected at Palmer each season. Obviously, for these and the other methods discussed above, data collection was expanded to incorporate the months of October, November and December. This includes weather and other environmental data as well.

14.3 Preliminary Results: This season's measures of breeding success suggest that Adelie productivity was higher than last in terms of the number of 2-chick broods present, the number of chicks creched per colony, and the number of chicks creched per pair. The factors responsible for this change are currently not known and must await further analysis of our data. As last year, the predominant component in the diets of Adelie penguins was the krill *Euphausia superba*. Noteworthy, was the fact that this season other prey were virtually non-existent in Adelie diets and krill size classes continued to emphasize the larger specimens (41-50mm). We currently cannot provide any information on the relative availability of krill between seasons based on telemetry data used to estimate the length of foraging intervals; analysis of these data is currently beyond the scope of this report due to the large size of the pertinent databases.

Mean Adelie chick fledging weights did not differ significantly from those evident last season (3.20 vs. 3.10kg). As last year, the fledging period again encompassed a 3-week interval (7-25 February), with peak fledging occurring on 19 February (vs. 16 February during 90-91). This 3-5 day delay in peak activity of this breeding event was

typical of the chronology of other breeding events this season, suggesting some delay in the overall timing of breeding. The season was in general characterized by heavier than normal snowfall both before and after breeding got underway. From comparisons between colonies, it is clear that snow cover is potentially one of the greatest terrestrial determinants affecting the timing of breeding in this species.

14.4 Disposition of the data: No diet samples were returned to the U.S. for analysis as all work was successfully completed at Palmer Station. All other data relevant to this season's research are currently on diskettes in our possession and will be made available to the Antarctic Ecosystems Research Group coincident with the final report on this season's activities due in July.

14.5 Problems, Suggestions and Recommendations: This season, in contrast to others, was relatively problem-free at Palmer Station. Minor problems with the telemetry equipment were repaired on site, thus allowing this aspect of the research to achieve its full potential. All other procedures were successfully completed, and it is clear that several new Standard Methods can be added to the data being collected without taxing the available field and personnel resources. The only persistent problem at Palmer continues to be obtaining consistent access to AMLR colonies due to weather and pack ice, which tend to limit small boat (Zodiac) operations. As a result, Standard Methods that depend on predictable and consistent access to study sites are not likely to be successfully implemented at Palmer. We are continuing to investigate ways of obtaining data relevant to CEMP within the constraints imposed on us by Palmer's unique working environment, and will report potentially new alternatives to NMFS as they are found.