

Euphausiids in the diet of some sub-Antarctic *Eudyptes* penguins

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Euphausiid crustaceans were found in samples of stomach contents taken from rockhopper penguins Eudyptes chrysocome and macaroni penguins E. chrysolophus at Marion Island and from rockhopper penguins at Gough Island. Thysanoessa spp. were the principal prey recorded at both localities. Euphausia sp. were only found in macaroni penguin stomach samples. The results confirm the importance of euphausiid crustaceans in the diet of Eudyptes penguins at sub-Antarctic localities.

Euphausiid skaaldiere is in die monsters van maaginhoudes van geelkuif-pikkewyne Eudyptes chrysocome en macaroni-pikkewyne E. chrysolophus by Marion-eiland en van geelkuif-pikkewyne by Gough-eiland. Thysanoessa sp. was die vernameeste prooisort by al twee plekke. Die uitslae bevestig die belangrikheid van euphausiid skaaldiere in die dieet van Eudyptes pikkewyne by sub-Antarktiese omtrekke.

Introduction

Rockhopper penguins *Eudyptes chrysocome* and macaroni penguins *E. chrysolophus* are widely distributed in the Southern Ocean (Watson 1975). According to many authorities (Murphy 1936, Ealey 1954, Tollu 1978, Croxall & Prince 1980, Croxall & Furse 1980) these penguins feed primarily on krill (shoaling planktonic crustaceans) but data supporting this contention are sparse. More particularly, little is known of the birds' diet in the sub-Antarctic. This report documents evidence of the occurrence of euphausiid crustaceans in the diet of *Eudyptes* penguins at Gough Island (40°20'S, 10°00'W) and at Marion Island (46°54'S, 37°45'E).

Materials and Methods

Five recently-fed rockhopper penguin chicks between 1 and 7 days old were killed at Gough Island in October 1979, and their entire stomach contents kept frozen until analysed. Adult rockhopper and macaroni penguins returning with food for their young at Marion Island were caught and samples of their stomach contents were taken by means of a stomach pump of the type developed by Emison (1968). Twenty samples were obtained from macaroni and two from rockhopper penguins. These samples were obtained during January-March in both 1973 and 1974. The 1973 samples were kept in alcohol, and the 1974 samples were frozen.

The volumes of the whole sample, identifiable items, and of unidentifiable material in it were determined by displacement of water in a measuring cylinder. Fragments which could not be visually identified as from a crustacean, cephalopod or fish were classed as unidentifiable.

Results

All five stomachs of the rockhopper penguins from Gough Island contained euphausiids identified as *Thysanoessa vicina*.

This species formed 75, 60, 40, 20 and two per cent (by volume) of the entire stomach contents.

All the stomach samples obtained at Marion Island contained euphausiids and in all but three cases the genus concerned was *Thysanoessa*. The only *Thysanoessa* identified in the samples was *T. macrura*. Members of the genus *Euphausia* were identified in three samples but to species only once - an *E. valentini*. Both penguin species fed on *T. macrura* but *Euphausia* occurred only in samples from macaroni penguins.

Discussion

Eudyptes penguins feed their chicks at intervals in excess of 24 h (Williams 1980), and in between may forage as far as 200 km from their breeding colonies (Williams & Siegfried 1980). Consequently, when parents return to their chicks much of the food in their stomachs is in an advanced state of digestion. The bulk of all samples obtained in this study consisted of unidentifiable mush or if recognisable as crustaceans the diagnostic parts critical for identification were often missing. Stomach pumping yielded only a fraction of a bird's stomach contents. Thus, although rockhopper and macaroni penguins may feed their chicks as much as 500 and 1 000 g respectively at a time (Williams 1980), often less than 20 g was obtained.

Murphy (1936), reviewing earlier studies, reported that rockhopper penguins feed on crustaceans (including amphipods, copepods, and parasitic isopods) supplemented by squids and fish, and that macaroni penguins feed on euphausiid crustaceans and some squids. According to Ealey (1954), rockhopper penguins at Heard Island take large quantities (200-300 g) of the amphipod *Euphausia antarctica* and large numbers of another amphipod *Hyperia alba*. Apparently, the primary food of macaroni penguins at Macquarie Island is euphausiids (Carrick 1972). At Amsterdam and St. Paul Islands, Tollu (1978) found that the stomachs of rockhopper penguins contained cephalopod material (75%) and crustaceans (35%) of which 25 per cent was euphausiids and 10 per cent *Jasus paulensis*. Macaroni penguins feed primarily on *Euphausia superba*, with some *Parathemisto gandichaudi* (an amphipod), at South Georgia during January-February (Croxall & Prince 1980). At Elephant Island, South Shetland Islands, macaroni penguins take *E. superba* and large numbers of *Thysanoessa* sp. (Croxall & Furse 1980). The results presented here indicate that shoaling crustaceans are also important items in the diet of *Eudyptes* penguins at Marion and Gough islands, at least during the chick-rearing period.

Marion Island is situated some 400 km north of the mean position of the Antarctic Convergence and Gough Island is situated some 350 km south of the Subtropical Convergence. Four species of *Thysanoessa* occur south of the Subtropical Convergence, the strictly deepwater *T. parva*, and *T. gregaria*, *T. vicina* and *T. macrura* all of which occur within surface

waters (Nemoto 1966, Dzik & Jazdzewski 1978). *Thysanoessa macrura* occurs primarily south of the Antarctic Convergence and is generally thought to occur north of that convergence only in reduced numbers (Nemoto 1966, Dzik & Jazdzewski 1978). *T. vicina* has been recorded further north than *T. macrura* (Nemoto 1966). Its published range (58°S-43°S) means that its presence as prey of the rockhopper penguin at Gough Island (40°S) represents a northerly range extension of approximately 300 km.

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Local movement of southern elephant seal pups *Mirounga leonina* (Linn.) at Marion Island

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Southern elephant seal pups Mirounga leonina were counted and tagged at Marion Island (46°54'S, 37°45'E) between October 1980 and April 1981. The pups showed two distinct phases of movement, a post-weaning phase with eventual departure from the island in January, and a resting phase with pups returning to the island in March. Percentages of pups that moved during these phases were 16,9 and 18,9 respectively. There was no correlation between the stage of the season at which weaning occurred and the numbers that moved.

Tussen Oktober 1980 en April 1981 is welpies van die suidelike olifantrob Mirounga leonina op Marioneiland (46°54'S, 37°45'O) getel en gemerk. Olifantrobwelpies toon twee duidelik onderskeibare bewegings: die eerste fase is nadat hulle gespeen is, met uiteindelijke vertrek van die eiland in Januarie; die tweede is 'n rusfase wanneer hulle in Maart na die eiland terugkeer. Die persentasie welpies wat tydens die twee fases beweeg het, was onderskeidelik 16,9 en 18,9. Daar is geen korrelasie gevind tussen die stadium van die seisoen wanneer die welpies gespeen is en die getal wat beweeg het nie.

Introduction

The southern elephant seals (*Mirounga leonina*) on Marion Island were first studied by Rand (1955, 1962) and La Grange (1962) with limited data being supplied on population sizes and annual cycles. Since 1973 the South African Scientific Committee on Antarctic Research (SASCAR) initiated work on the southern elephant seal at Marion Island. This work (Condy 1977, 1978, 1979, 1980) provides detailed data on the elephant seals on the island.

The Prince Edward Islands, consisting of Marion Island (46°54'S, 37°45'E) and Prince Edward Island (46°38'S, 37°57'E), lie 2 300 km south-east of Cape Town in the South Indian Ocean. Apart from Prince Edward Island, the Crozets are the nearest land to Marion Island.

The synchronized haul-out sequences of the different age and sex classes are described by Condy (1979). The birth season at Marion Island is from early September to late November. Pregnant cows start to haul out in late August, and all have weaned their pups and departed by late