same storm hit nest No. 1, and feeding rates were about normal for this nest.

Overall, for both nests, there was no clear systematic trend in feeding rates over the experimental period. Between the two nests there was a very distinct difference in feeding rates. Numbers of feedings per day and especially weight of food per day were much lower for nest No. 1 than for nest No. 2. This difference could be a function of a number of factors including differences in habitat (food supply) or differences in hunting abilities between the adults of the two nests. We believe differences in quality of habitat were very likely the major factor, as prey species were much more conspicuous to us in the territory of nest No. 2 than in the territory of nest No. 1 during the experimental period.

DISCUSSION

The results suggest that under the circumstances of the experiment adult hawks did little, if anything, to compensate for changes in numbers of young by altering hunting rates. Since the experiment was run at a stage of the breeding cycle when both male and female adults were hunting and bringing food to nests, there was ample opportunity for both sexes to assess both numbers of chicks and state of hunger in the chicks. One might argue that there might be a lag in adjustment of hunting rates which our experimental design of frequent nest shifts might not detect, and perhaps longer periods of observation after each switch might have yielded results more consistently in the expected direction. If we examine the feeding rates at the two nests and look for progressive changes in rates from the day following a switch to the day 2 days after a switch, we find that in terms of numbers of feedings per day the rates do consistently increase for nests with five young. This consistent increase in numbers of feedings is not, however, paralleled by a consistent increase in grams of food per day. Moreover, for nests with two young there is also a tendency toward increase in numbers of feedings per day over the 2-day observation periods. These latter facts argue against adaptive progressive changes in feeding rates following nest switches.

In general, the results are consistent with the assertion that both pairs were operating at maximal capacity in supplying food to young regardless of brood size. Furthermore, the overall results suggest that young can survive, at least for short periods, under rather widely varying rates of feeding per chick. However, rates of feeding at nest No. 1 were so extremely low that we fed the young supplementary food on several occasions between switches just to keep them alive. Young in this nest were in a perpetual state of near starvation, and incipient cannibalism was noted on several occasions, with young attacking each other. As actual cannibalism was noted in other Cooper's Hawk nests in the region which were not under observation from blinds, there is no reason to suspect that the presence of observers was depressing feeding rates at this nest. Certainly the behavior of the adults appeared completely normal. It must be emphasized that 1971 was a year of low food availability because of extended drought conditions.

Though it is difficult to document, we strongly suspect that clutch size is a function of habitat quality. The few clutches of five eggs we have seen have been in areas of apparent abundance of prey, while clutches of three have been typical in apparently marginal habitat. The two nests under study in this experiment provide additional evidence for this assertion. Whether adults are normally adapted to adjust hunting rates to needs of young late in the breeding cycle is unclear. The species may simply be programmed so that adults hunt to their maximum capacities at this stage. Brood size may well be sufficiently high in general that even maximal hunting by adults is insufficient to satiate young.

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RECENT NESTING OF THE RHINOCEROS AUKLET IN CALIFORNIA

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The 1957 edition of the AOU Check-list lists the breeding range of the Rhinoceros Auklet (*Cerorhinca monocerata*) as south to Destruction Island, Washington, and states that it formerly bred on Smith and Whidbey Islands, Washington, and at the Farallon Islands, California. The Farallon Island breeding records are based on accounts by Hepburn in 1859 (Swarth, Condor 28:249, 1926) and by Gruber in 1865 (Grinnell, Condor 28:37, 1926).

One bird was found excavating a burrow at Goat Island, Oregon, in March 1966 (Browning and English, Condor 70:88, 1968) and one bird was resident on the Farallon Islands throughout the 1972 breeding season (J. Smail, pers. comm.).

I visited Castle Island, Del Norte Co., California, on 17 July 1969, 16 May 1970, and 20 May 1972 and found Rhinoceros Auklets breeding there on all three dates. In 1969, Don Gastineau, California Department of Fish and Game, and I accidently stepped through a burrow and discovered a nearly fledged Rhinoceros Auklet chick. The chick was covered with flight and contour feathers except on the back, belly, and part of the crown. The bill had a small bump at the location of the "horn." One addled egg was also found in an adjacent burrow and was collected.

In 1970, my wife and I again accidently stepped into a burrow and found an adult with an egg which had apparently broken as I fell through the burrow. The egg contained a fully feathererd embryo. The burrow that had contained the young in 1969 held only an egg. Four additional burrows large enough to hold this species were examined and four adults incubating eggs were banded. On the following day, these four burrows were again examined and four unbanded adults were present.

In 1972, G. Friedrichsen, my wife, and I banded 10 adults all incubating eggs in 10 burrows. One of the birds banded in 1970 was recaptured within 3 m of its 1970 location.

Castle Island is located 4.0 km (2.5 miles) NW of Crescent City and 0.8 km (0.5 miles) offshore. The island measures 2.76 ha (6.82 acres) and is occupied by 12 species of sea birds during the breeding season. The major vegetation of the island is *Elymus mollis*, *Lasthenia minor*, and *Poa annua*. All the Rhinoceros Auklet burrows were found in the area with *Lasthenia-Poa* cover, no more than 2–3 cm high. Most of the burrows were 2–3 m long and 10–30 cm below the surface. Because of the shallow nature of the burrows, walking on the island is difficult.

Based on the numbers of suitable burrows present, I would estimate the breeding population of Rhinoceros Auklets on Castle Island to be 50–75 pairs.

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REMOTE SENSING OF BODY TEMPERATURE IN A CAPTIVE 25-G BIRD

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INTRODUCTION

Much attention has recently been focused on the application of remote sensing to studies of the physiology and behavior of unrestrained animals under field and laboratory conditions (Boyd and Sladen 1971; Goodman 1971; Davis 1970; Gates 1968; Zigmond et al. 1970; Essler and Folk 1961). The inherent errors in "grab and jab" and implanted thermocouple techniques of body temperature measurements are avoided by transmitting the temperature by telemetry. In a study on the cold-temperature physiology of White-crowned Sparrows (*Zonotrichia leucophrys gambelii*) held in captivity, a simple method of telemetry of body temperature was developed (Southwick 1971). This telemetry system herein described is uncomplicated and can be constructed in most laboratories without special knowledge or tools.

MATERIALS AND METHODS

Instrumental characteristics. A small temperature transmitter was developed for surgical implantation in the intraperitoneal cavity of the White-crowned Sparrow. It consisted of a small oscillating circuit, utilizing a temperature-sensitive resistor as the sensing element. A change in temperature altered the resistance so that the frequency of oscillation increased with increasing temperature. The electrical design was similar to that described by Mackay (1970) and used by Coulombe (1970) and Osgood (1970). The completed unit weighed about 0.86 g or less than 3.5% of the body weight of the bird. It was nearly spherical with a diameter of 6–8 mm. The 25-g bird showed no visible effect from the implanted transmitter and could not be distinguished from birds without the unit. A schematic diagram of the transmitter is shown in figure 1.

A receiver was constructed to integrate the output signal over time via a "one-shot" (mono-stable multivibrator), resulting in a variable potential proportional to the transmitted frequency, which was read directly on a meter or a strip-chart recorder.

The readability of the meter or graphic display, combined with the nonamplifying receiver circuit employed, resulted in body temperature readings reliable to 0.1° C. Each transmitter was calibrated in a saline bath over the range of temperature expected to be encountered in the test animal (usually 35–45° C). Only those units that held calibration over a 3-day trial period were used in experimental animals. The transmitter's range was limited to about 1 m.

The continuous graphic output indicated not only telemetered body temperature but also provided a rough index of locomotor activity. As the bird moved about, the coil position of the implanted transmitter changed relative to the stationary receiving antenna, resulting in brief periods of weaker signals.

Techniques of surgical implantation. Animals to be used for body-temperature measurements were lightly anesthetized with ether. Following procedures similar to a laporotomy, a 1-cm incision was cut with scissors through the skin and muscle layer parallel and just posterior to the rib cage (at left lateral apterum). The transmitter was cleaned with alcohol and rinsed with saline before implantation. The transmitter was placed in the abdominal cavity between the liver and stomach, thus lying a little to the left of midline. The position of the transmitter was later

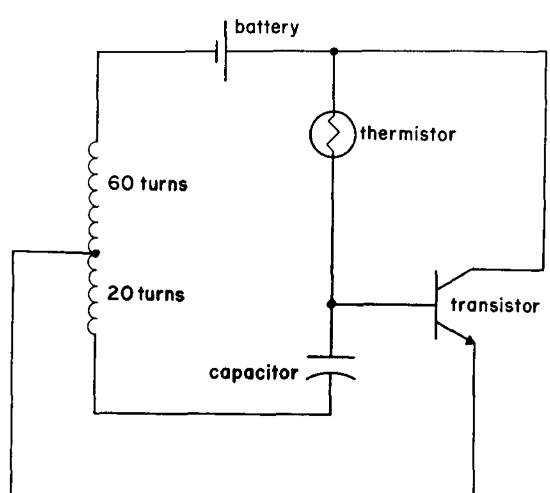

FIGURE 1. Schematic diagram of the implantable temperature transmitter. Various components were tried in the circuit. Those parts listed were found to be most reliable and easily obtained: wire—40-gauge copper magnet wire (frequency depends on number of turns in coil); battery—1.4 volt (Mallory 212); thermistor—1000 kohm (Fenwal GABIJI); transistor—NPN (GE D26Er); capacitor—0.68 to 0.1 μF tantalum (Allied 162D); encapsulated in Silastic®.

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