METABOLISM AND THERMOREGULATION IN HATCHLING WESTERN GULLS

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Parental attentiveness provides hatchlings of many precocial and semiprecocial birds with a large measure of protection from the vagaries of the thermal environment. Nonetheless some of these species differ in thermoregulatory capacity of newly hatched chicks, in correlation with climatic conditions during the breeding season. For example, hatching ducks of species breeding exclusively in the arctic and subarctic tend to have better control of body temperature in cool environments than do those of species with wider and more southerly distributions (Koskimies and Lahti 1964). A similar pattern seems to exist for hatching gulls. Black-headed Gulls (Larus ridibundus) and Ring-billed Gulls (L. delawarensis) can approximately double their rates of heat production over basal levels when subjected to cold stress on the day of hatching (Kespuk and Davydov 1966, Dawson et al. 1976). In contrast, Laughing Gulls (L. atricilla), which appear to breed under somewhat warmer conditions, can increase their by only 50% (Dawson et al. 1972). The range of metabolic capacity among hatching gulls may be even greater than these values indicate, for the genus Larus includes more than 30 species whose respective breeding ranges embrace a latitudinal span from the arctic to the subantarctic. At opportunities arise, we are attempting to assess the extent of differences in thermoregulatory capacities among hatchlings of these species. We report here observations on chicks representing the subspecies of Western Gull (Larus occidentalis livens) breeding in the Gulf of California, Mexico.

Our experimental subjects were obtained from Isla Partida, Baja California Norte, Mexico (23°54'N, 113°3'W) on 29 April-1 May 1976. During this period, nights were cool, days were warm, and solar radiation was intense. Conditions were similar to those on nearby Isla Rasa (10 km SE), where we had made micrometeorological measurements from 18-28 April 1976, in connection with studies of Heermann's Gull (L. heermanni). Daily minimal and maximal temperatures at nest height on Isla Rasa averaged 12.9°C (range, 8.4-16.7°C) and 32.2°C (range, 28.7-34.7°C), respectively. Intensity of solar radiation reached 1036 W/m² at midday on 19 April 1976, and was near this level on several subsequent days.

Following collection, newly hatched Western Gulls were transferred for study to the nearby RV Delphin, and then exposed to constant ambient temperatures (Tₐ) between 26° and 35.3°C for two-hour periods. These concluded with measurements of oxygen con-
suspension (Vc) and body temperature (Tb), using pro-
cedures and instrumentation described by Dawson et al. (1972, 1976). None of the 15 hatchlings studied was used in more than two tests and these were separated by at least two hours, during which the birds were kept at an Tb of 23°C and fed canned cat food. All of the gulls were returned to their respective nests at the conclu-
sion of measurements.

Daytime Vc's of hatchling Western Gulls at 29°-
35.7°C were taken as basal metabolic rates (BMR). These averaged 1.35 ± 0.041 (S.E.) ml (g.h)-1 for the 11 birds tested (mean body mass 65.4 g). This mean BMR represents 94, 82, and 103% of the respective values predicted for a 65.4-g adult non-passerine by Lasiewski et al.'s (1967) equation. Insulation is the re-
verse relation exists between Vc for euthermic chicks below 22.5°C and some of the chicks had cooled sev-
erate degrees by the end of the two-hour tests. An in-
crease below thermal neutrality (Fig. 1), the ability to conserve heat. Among these chicks, the down
mature birds (cf. Fig. 1 and values for hatchling
22.5° and 35°C. The equation relating these variables in this interval is:

\[ Vc = 4.92 - 0.12 Tc \]

where \( Vc \) and \( Tc \) are in ml (g h)-1 and degrees C, re-
spectively (S.E. of estimate, 0.209; \( r^2 = 0.77; \) F ratio, 45.18). Metabolic data were converted to a thermal ba-
stic equation for the active portion of the daily cycle, and the A-P equation for the inactive (p) portion of the daily cycle (Aschoff and Pohl 1970). These per-
centages resemble those obtained in similar compari-
sons involving daytime measurements of BMR in hatchling Herring Gulls (L. argentatus; Descott 1967), and Ring-billed gulls (see Table 2 in Dawson et al. 1976). The BMR of gull chicks approaches the metabolic rate characterizing adult non-passerine birds of similar size, even though the Tb of these chicks is below that of young birds (cf. Fig. 1 and values for adult gulls given by Neumann et al. 1960).

The Western Gulls we studied possessed some abil-
ity to thermoregulate below thermal neutrality (Fig. 1), as do newly hatched gulls of other species. Thus only a minor dependence of Tb on \( Tc \) is apparent between 22.5° and 35°C. The equation relating these variables in this interval is:

\[ Tc = 29.2 + 0.27 Tb \]

with \( Tc \) and \( Tb \) in degrees C (S.E. of estimate, 0.056; \( r^2 = 0.67; \) F ratio, 10.81). Performance was more variable below 22.5°C and some of the chicks had cooled sev-
erate degrees by the end of the two-hour tests. An in-
verse relation exists between \( Vc \) for euthermic chicks (\( Tc > 23°C \)) and \( Tc \) between 19° and 25°C. This can be described by the following equation:

\[ Vc = 1.92 - 0.12 Tc \]

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LITERATURE CITED


DAWSON, W. R., A. F. BENNETT, AND J. W. HUDSON. 1972. Metabolism and thermoregulation in hatch-
ing Ring-billed Gulls. Condor 74:49-60.

ing Laughing Gulls (Larus atricilla). Condor 74:177-
181.


