no evidence of body molt. The weight of the bird (416 g) indicated that it was probably a female. (Weights of adult Pied-billed Grebes from Palmer [1962], and Norris and Johnston [Wilson Bull. 70:114–129, 1958] show females ≤435 g, males ≥435 g.) We released the grebe after banding it (U.S.F.W.S. aluminum band 645-30146). Twenty-seven other nesting Pied-billed Grebes that we examined on Rush Lake during 1979 and 1980 showed no signs of molting. These birds included 15 suspected females and 12 suspected males captured between 14 May and 18 July. Our trapping attempts were confined to the days after the completion of the clutch but prior to the start of hatching.

Because the flight feathers constitute a relatively small portion of the plumage, replacement of these feathers should require much less energy than would a complete molt. If molting of the flight feathers is energetically compatible with the nesting activities of Pied-billed Grebes, we suggest that the nesting season is an opportune time for these birds to replace their flight feathers; nesting Pied-billed Grebes rarely fly (pers. obs.), and they have rather small home ranges. Glover (Wilson Bull. 65:32–39, 1953) estimates the average home range of nesting Pied-billed Grebes to be less than 2 ha. Grebes could easily traverse such a small area by swimming. Therefore, flightlessness owing to wing molt should be of negligible consequence to nesting Pied-billed Grebes. More information will be needed to determine if molting of flight feathers by nesting Pied-billed Grebes reduces either the production of fledglings or the survival of molting adults. Five of the six eggs hatched in the nest on which we captured the molting grebe. We do not know the fates of the hatchlings or the molting adult.

Our observations indicate that wing molt does occur, albeit uncommonly, among nesting Pied-billed Grebes. Munro (Studies of Waterfowl in British Columbia: the Grebes, Occas. Paper Br. Col. Prov. Mus. No. 3, 1941) presents an additional report of molting by nesting grebes. He found both members of a nesting pair of Horned Grebes (*Podiceps auritus*) partly molted to the winter plumage on 10 August. This was the latest date for a Horned Grebe nest with eggs for Munro's study. We suggest that molting by nesting grebes is likely limited to late nesting individuals.

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Partition of water loss from the eggs of the Sooty Tern between the pre-pipping and pipped periods.—In a previous publication (Rahn et al., Physiol. Zool. 49:245–259, 1976), it was reported that the total water loss from the eggs of the Sooty Tern (*Sterna fuscata*) over the entire incubation period amounted to 15% of the mass of the freshly laid eggs. More recent work on the White Tern (*Gygis alba*) and the Gray-backed Tern (*Sterna lunata*) implies that the figure of 15% is an underestimate of the true water loss because the augmented water loss from pipped eggs was not measured in the earlier study (Pettit et al., Condor 84: 355–361, 1981; Whittow et al., Condor, in press, 1985). The purpose of the study reported here was to measure the water loss from pipped eggs of the Sooty Tern.

The site of the study was Green Island, Kure Atoll (28°25'N, 178°10'W) in the Northwestern Hawaiian Islands. The water loss from the eggs was determined by measuring the

TABLE 1

WATER LOSS FROM PIPPED AND UNPIPPED EGGS, TOGETHER WITH THE DURATION OF THE PIPPED AND UNPIPPED PHASES OF INCUBATION, IN THE SOOTY TERN. SD = STANDARD DEVIATION; N = NUMBER OF MEASUREMENTS

Phase of incubation	Mean duration (hr)	Mean daily water loss (mg/day ± SD)	N	Water loss during phase in mg (% of total)
Unpipped	577[a]	162.21 ± 28.68	36	3900 (59.0)
Star-fracture	78[a]	437.91 ± 139.25	14	1423 (21.5)
Star-fracture–pip-hole[b]	—	604.31 ± 100.81	7	— —
Pip-hole	31[a]	995.66 ± 281.21	4	1286 (19.5)
Total	686[a]			6609 (100)

[a] Brown, Condor 79:133–136, 1977.
[b] The eggs were star-fractured when they were first weighed and there was a distinct pip-hole at the time of the second weighing.

mass loss (Rahn and Ar, Condor 76:147–152, 1974) using an Ohaus field balance (Model 1010-10).

The mean dimensions of 33 eggs were: length = 51.1 mm ± 1.9 (SD); width = 35.7 mm ± 1.2 The mean daily water loss from the eggs was least in unpipped eggs and greatest in eggs with pip-holes (Table 1). The mean incubation period of the Sooty Tern on Manana Island, in the main Hawaiian Islands, is 686 h (Brown, Condor 79:133–136, 1977). The initial star-fracture of the shell occurs 109 h prior to hatching, and a pip-hole is formed 31 h before hatching. Using these data in conjunction with the measurements of water loss made in the present investigation, it is apparent (Table 1) that the mean total water loss from the eggs over the entire incubation period is 6609 mg. This represents 18.5% of the mass of the freshly laid egg (Rahn et al. 1976), which is higher than the 15% value reported by Rahn et al. (1976). The mean daily water loss from unpipped eggs was 14.6% lower than that reported by Rahn et al. (1976), raising the possibility that the conditions during incubation were somewhat different. This notwithstanding, the water loss from pipped eggs (initial star-fracture to hatching) is 2709 mg (1423 + 1286, Table 1), which represents 41.0% of the water loss from the egg over the entire incubation period, although the time interval between star-fracture and hatching amounts to only 15.9% of the incubation period.

The results of the present study, together with those of three earlier investigations (Pettit et al. 1981, Whittow et al. 1984, Pettit and Whittow 1984), reveal that the total water loss from the eggs of tropical terns and noddies is a greater percentage of the mass of the freshly laid egg than had hitherto been reported (Rahn et al. 1976), and that the water loss from pipped eggs represents a disproportionate fraction of the total water loss from the egg.

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