

DETERMINING SEX RATIOS FROM COLLECTED SPECIMENS

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Ornithologists have recently shown considerable interest in determining the sex ratios of birds, particularly on the breeding grounds. Field counts are possible only for sexually dimorphic species. Investigators working on monomorphic species have therefore turned to the data accompanying museum specimens. The method of collecting these specimens is usually unknown, and may bias the sex ratio, as I will show.

In 1971 I collected a number of Franklin's Gulls (*Larus pipixcan*) in the vicinity of Agassiz National Wildlife Refuge, Marshall County, Minnesota. The gulls were collected during May and June at or within 8 km of a breeding colony of 10,000–15,000 pairs of gulls (see Burger, Anim. Behav. 22:521–567, 1974). Birds were collected by three methods; nest-trapping (Burger, Bird-Banding 42:123–124, 1971), shooting, and netting birds that were feeding behind a plow. I used all three methods only to increase my sample of specimens. I nest-trapped between 09:00 and 11:00 throughout the incubation period. Shooting and netting were done on the same days and in the same two fields where 200–500 gulls were feeding. A local farmer

TABLE 1. Sex ratios of Franklin's Gulls collected by different methods. Shown are the number of each sex collected by each method.

	Males	Females	Total
Shot	29	6	35
Nest-trapped	22	20	42
Netted behind plow	6	22	28
Total	57	48	105

DIVING DEPTHS OF THE GENTOO PENGUIN (*PYGOSCELIS PAPUA*)

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At Marion Island in the southwestern Indian Ocean (46°52'S, 37°51'E), the Gentoo Penguin (*Pygoscelis papua*) breeds sympatrically with Macaroni (*Eudyptes chrysolophus*), Rockhopper (*E. chrysocome*) and King (*Aptenodytes patagonicus*) penguins. Duration of foraging trips and chick feeding rates suggest that, in contrast to the other species, the Gentoo Penguin is primarily an inshore feeder (Croxaall and Prince 1980a, Williams 1980, 1981). Consequently, Gentoo Penguins may need to dive for food less

caught birds following his plow with the use of a long-handled fish net, reaching out from the tractor seat and catching gulls as they flew close by. The birds that were shot were also feeding on invertebrates in the same fields, although only six were shot directly behind the plow.

The three methods yielded different sex ratios ($\chi^2 = 23.2$, $df = 2$, $P < 0.001$). Gulls collected by shooting were mostly males (83%), those netted were mostly females (79%), and those nest-trapped had an equal sex ratio (Table 1). Characteristically, once a bird was shot, other gulls approached, circled over it, and were themselves shot. If this behavior is related to the greater aggressiveness of males, it might explain their greater vulnerability. Or, males may simply have remained in the area longer. Females may have been less wary, hence more likely to come closer to the plow and so be netted. Since birds were collected by both methods in the same field, it is apparent that one or both samples gave biased estimates of sex ratios (Table 1).

I assume that the sex ratio of Franklin's Gulls was nearly equal in the area because no birds were loafing near the colony (Franklin's Gulls loaf near their nests), and no males on territories lacked females. There were no areas where birds loafed within 40 km of the refuge. I had enlisted the aid of local farmers in reporting any gull flocks. Although I received many reports of foraging gulls, there were no reports of any sizeable loafing flocks. Furthermore, this was the only breeding colony of Franklin's Gulls in Minnesota; consequently, there was no influx of gulls into the area around the Agassiz colony during the breeding season.

My results indicate that the method of collecting can influence the sex ratio of the specimens obtained. Thus, the sex ratio of this sample may be a misleading indicator of the population's sex ratio. The danger in using museum specimens to gauge sex ratios is greater if the exact method of collecting is unknown, if the direction of the biases have not been examined for that species, and if sample sizes are small.

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deeply than the more pelagic species. We report here on our measurements of the diving depths of Gentoo Penguins at Marion Island.

We conducted our study during November and December 1981. Twenty-five Gentoo Penguins were fitted with depth gauges attached to leather harnesses and released. Harnesses were recaptured upon their return to the island to spend the night ashore or to feed chicks.

The harnesses consisted of a contoured collar (placed above the flippers) joined to a thoracic band below the flippers by four narrow leather straps. The depth gauge was fitted to the thoracic band and lay flush with the penguin's back. The harness is described more fully in Wilson and Bain (in press). The depth gauges were a capillary type, coated on the inside with a water-soluble powder. Water entering the open end of the capillary tube compressed the volume of air trapped in the tube, and compression varied with depth as described by Boyle's Law. Because the relationship is non-linear, however, shallower depths were recorded more precisely than deeper