

Predicting the Sex of Kelp Gulls by External Measurements

CHANTAL TORLASCHI¹, PATRICIA GANDINI^{2,3}, ESTEBAN FRERE²
AND ROLANDO MARTINEZ PECK²

¹Departamento de Ciencias Biológicas, Facultad de Ciencias Exactas y Naturales
Universidad de Buenos Aires. Estrada 1275. (9050) Puerto Deseado. Santa Cruz, Argentina
Internet: chantal@pdeseado.com.ar

²Centro de Investigaciones de Puerto Deseado, Universidad Nacional de la Patagonia
Austral, Avda. Lotufo s/n, cc 238 (9050), Puerto Deseado, Santa Cruz, Argentina

³CONICET, Consejo Nacional de Investigaciones Científicas y Técnicas, Argentina

Abstract.—Male and females of Kelp Gulls (*Larus dominicanus*) are not clearly sexually dimorphic and are thus difficult to identify in the field. This paper evaluates sexual size dimorphism in this species and provides a reliable method for predicting the sex of measured individuals. Discriminant analysis of six morphometric characters of adult birds indicated that head length, bill length and bill depth were the most accurate variables for use in a discriminant function model, predicting sex with 97% accuracy. Received 12 May 2000, accepted 1 June 2000.

Key words.—Argentina, discriminant analysis, Kelp Gull, *Larus dominicanus*, sexual dimorphism.

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Sexing live birds presents little problem in species where there exists plumage and structural differences, but in the majority of seabirds, such as Kelp Gulls (*Larus dominicanus*), it is not possible to distinguish sexes externally (Coulson *et al.* 1983; Hanners & Patton 1985; Bosch 1996). Head length and other morphometric measurements have been used to predict the sex of Herring Gulls (*L. argentatus*, Fox *et al.* 1981; Evans *et al.* 1995); Laughing Gulls (*L. atricilla*, Hanners and Patton 1985; Evans *et al.* 1993), Yellow-Legged Gulls (*L. cachinnans*, Bosch 1996) and Great Black-backed Gulls (*L. marinus*, Mawhinney and Diamond 1999).

The aim of this study was to find an easy and quick way of identifying the sex of adult Kelp Gulls in the field.

METHODS

From March to and August 1997 (non-breeding season) and during October 1998 (breeding season), 134 adult Kelp Gulls were shot at a fishing dump (47°43'S, 65°50' W) located at Puerto Deseado, Santa Cruz, Argentina, as part of a major project to assess the magnitude of the utilization of fishing dumps by Kelp Gulls (Frere *et al.* 2000; Gil *et al.* 1997).

Six body measurements were taken: 1) head length (HL) (distance from the tip of the bill to the posterior ridge formed by the parietal-supraoccipital junction), 2) bill depth (BD) (minimum depth of the bill posterior to the gonys), 3) bill length (BL) (length of the culmen from the tip of the upper mandible to where the rinoth-

eca meets with the skin), 4) nalospi (N) (distance from the tip of the bill to the nostril), 5) foot (F) (distance from the distal end of tarso-metatarsus to the base of the nail on the middle toe of the flattened foot) and 6) body-weight (W). All measurements were taken using a digital caliper (± 0.01 mm) except for foot length that was measured with a ruler (± 1 mm) and weight that was recorded with a hand-held 3,000 gr pesola (± 25 gr). All measurements were taken in a six-hour period, soon after the bird was collected. Later, gulls were dissected and their sexes determined on the basis of internal morphology.

Multivariate analyses of variance (MANOVA) were used to determine whether the overall external morphology varied with sex. A discriminant function was developed and tested for accuracy, using the V_1 validation procedure described by Frank *et al.* (1965) and discussed by Fox *et al.* (1981). Following this procedure, only a proportion (analysis sample; $N = 100$) of the total sample was used to derive the discriminant function which was then tested on the remainder (validation sample; $N = 34$) to establish the bias level of the sample.

We used the statistical package "STATISTICA" to apply the discriminant analysis to the biometric data of the individuals of known sex. The combination of measurements that best discriminated between the sexes was selected, deriving two discriminating functions.

In order to assess the variation in measurements taken at different times of the year, we used analysis of variance (Two-factor ANOVA), where the dependent variable was the measurement of interest, and the independent variables were the period of the year (reproductive and non reproductive) and sex.

RESULTS

Males were significantly larger than females in all body measurements ($P < 0.001$, Table 1). Head length emerged as the single