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Morphological variation and sexual dimorphism in the California skate, *Raja inornata* Jordan and Gilbert, 1881 from the Gulf of California, Mexico

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Abstract

Knowledge of taxonomy, systematics and life histories of the skates that inhabit the Gulf of California is scarce. Five species have been documented in the Sea of Cortez: *R. cortezensis*, *R. equatorialis*, *Raja inornata*, *R. rhina* and *R. velezi*. The California skate (*R. inornata*) is the most abundant species caught as by-catch during the hake trawl fishery in the Gulf. Intraspecific variation in the external morphology of *R. inornata* from the northern Gulf of California, México is described on the basis of 24 proportional morphometric variables from 45 males (227–525 mm total length TL) and 52 females (226-690 mm TL). Males and females had 9 and 14 proportional dimensions respectively that were isometric with total length (TL). Regression slope and elevation analysis revealed that 9 relationships between TL and morphometric variables were sexually dimorphic. A stepwise discriminant function separated three groups of skates (females and males of *R. inornata* and males of *Raja cortezensis*) and was able to correctly classify 97%, 100% and 100% of the original grouped cases, respectively. The variables that best discriminated between species and sexes were preorbital length, preoral length, distance between fifth gill openings, maximum distance between pelvic fins, and distance from cloaca to anterior caudal fin. The study also revealed that several of the meristic characters examined showed considerable variation and, therefore, should be used with caution in taxonomic studies.

Key words: morphometrics; allometry; sexual dimorphism; *Raja*; Rajiformes; Gulf of California

Introduction

Skates have a wide distribution and occur shallower than 50 m deep (McEachran & Miyake, 1990). In temperate and subpolar seas they are commonly found in shallow waters. At tropical latitudes they are generally restricted to the outer shelf to abyssal depths (< 3,000 m) (Ishiyama, 1967; McEachran & Miyake, 1990). There are at least 15 genera of rajids and at least 136 species, comprising the largest chondrichthyan family (Compagno, 2005).

Although the skate fauna in eastern Tropical Pacific waters is apparently poor in species richness in comparison with other regions, this may, in part, be due to misidentification (McEachran & Miyake, 1984). Knowledge of taxonomy, systematics and life histories of the skates inhabiting the Gulf of California (Sea of Cortez) is scarce. One of the main problems that biologists face in Mexico is the difficulty of correctly identifying the diverse species of elasmobranchs caught by artisanal fleets and fishery vessels (Castillo, 1992). Skates are no exception. Ishiyama (1958, 1967) mentioned the complexity of distinguishing among the differ-

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