



## A review of the systematics of western North Pacific angel sharks, genus *Squatina*, with redescriptions of *Squatina formosa*, *S. japonica*, and *S. nebulosa* (Chondrichthyes: Squatiniformes, Squatinidae)

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### Abstract

Squatinids are quite distinct from other shark-like fishes, but individual species are difficult to differentiate. Four of the 16 known, valid squatinid species occur in the western North Pacific (WNP). Differences among the WNP species complex have traditionally relied upon the nasal barbel shape, interorbital and interspiracle distances, ocellus patterns, number of dermal folds about the mouth, and the presence of midback thorns. Unfortunately, many of these characters are difficult to distinguish, hindering identification of individuals. Using WNP squatinid specimens and photographs, both from field expeditions and museums, we confirm the validity of four species in the area. Additionally, we correct mistakes made in the literature on *S. formosa* type material, clarify differences in the particularly challenging distinction between *S. formosa* and *S. nebulosa*, and provide the basis for a revised dichotomous key for the region that includes all four known valid WNP squatinid species.

**Key words:** Squatinidae, angel sharks, redescription, Japan, Taiwan

### Introduction

*Squatina* Dumeril, 1806 is a monotypic genus within the family Squatinidae (Bonaparte, 1838). Although morphologically similar to batoids, squatinids are distinct from true batoids in that the squatinids have lateral gill openings, pectoral fin lobes that are free lateral to the gills, and possess a lower caudal fin lobe that is longer than the upper caudal lobe. Within the genus these sharks can be difficult to distinguish due to the lack of well defined characteristics. Adding to the confusion in the literature are the inadequate original descriptions of many species.

Sixteen valid species are recognized worldwide, with four reported to occur in the western North Pacific (WNP; Compagno et al., 2005). These four species include *Squatina formosa* Shen and Ting, 1972, *S. japonica* Bleeker, 1858, *S. nebulosa* Regan, 1906, and *S. tergocellatoides* Chen, 1963. Distinctions among these four WNP species hinge upon the nasal barbel shape, interorbital and interspiracle distances, ocellus patterns, number of dermal folds about the mouth, and the presence of midback thorns (Lindberg & Legeza, 1967; Shen & Ting, 1972; Nakabo, 2002). However, specific identification is hard to assign to individuals because many of these characters are difficult to distinguish, and many characters currently used are susceptible to damage during collection or from preservation. Additionally, inadequate original descriptions for some species and confusion within the subsequent literature have further obscured definitive characters among the WNP species. Because members of this genus are frequently targeted in fisheries in an area that has sparsely recorded catch information, and congeners are particularly sensitive to fishing pressure (Gaida, 1997; Stevens et al, 2000), it is imperative that adequate descriptions are available to identify individual species.