



## Descriptions of skate egg cases (Chondrichthyes: Rajiformes: Rajoidei) from the eastern North Pacific

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### Abstract

Egg cases for 10 of 11 valid skate species known to occur in the eastern North Pacific (ENP) were identified and are here described. In addition, egg cases of two unidentified skate species were collected from very deep water off central and southern California, USA. Examples of egg cases for all species, except for two, were removed *in utero* in order to confirm their species specific identification. The egg cases of seven skate species, including egg cases from the two unidentified species, have not previously been described or illustrated from this region. Previous attempts to identify skate egg cases with their associated species have been inadequate. The ENP skate egg cases can broadly be classified into two main groups: those with broad lateral keels (> 10% maximum egg case width) and those with narrow lateral keels (< 10% maximum egg case width). Egg cases in the former group (with broad lateral keels) generally have a finely striated surface texture that is smooth to the touch. Those in the latter group (with narrow lateral keels), with one exception, tend to have a coarse surface texture, often with prickles, and are rough to the touch. A revised key to the skate egg cases from the ENP is provided.

**Key words:** *Amblyraja*, *Bathyraja*, *Raja*, skate egg cases, eastern North Pacific

### Introduction

Skates are the most diverse elasmobranch group, comprising over 20% of the known species for this group of fishes (Compagno, 2005). These flatsharks, as they are sometimes called, occur from nearshore to the outer continental shelf in cool temperate to polar waters and in the deepsea. The number of species within this elasmobranch group is likely to increase as taxonomic issues are resolved and new species are identified. One method by which skate species may be distinguished from each other is by their egg case morphology. The egg case morphology of each skate species, like the claspers on males, is unique to that species and can be used in its identification (Ishiyama, 1958a).

The use of skate egg cases as a taxonomic tool for species identification and to study their phylogenetic relationships is well known (Ishiyama, 1958a, b; Hubbs & Ishiyama, 1968; Ishiyama & Hubbs, 1968). However, identification of species specific egg cases is often wanting as researchers often assume, incorrectly, that an egg case came from a certain species since the species in question is known to occur in a particular area. Often this assumption does not account for the possibility of non-resident species migrating into an area, depositing their egg cases, and then leaving. Therefore, proper identification of egg cases associated with the correct species can be erroneous if they are not removed from the adult female *in utero*.

Since 2002, researchers from the Pacific Shark Research Center (PSRC), Moss Landing Marine Laboratories (MLML), have been studying the life history and systematics of eastern North Pacific (ENP) skates, including those found in the Bering Sea (Ebert, 2005) and Gulf of Alaska. As part of this research program we