
ICHTHYOLOGY

Early Developmental Stages of the Cockatoo Righteye Flounder *Samaris cristatus* Gray, 1831 (Pleuronectiformes: Samaridae) from the South China Sea, Identified Using DNA Barcoding

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Abstract—This study examines the late embryonic and early larval development (until first feeding) of the Cockatoo righteye flounder *Samaris cristatus*. The chronology of development and a detailed morphological description of the eggs, embryos, prelarvae, and early larvae are presented. The eggs of *S. cristatus* were obtained from ichthyoplankton catches, which were performed in the coastal waters of central Vietnam, and incubated under laboratory conditions at a temperature of approximately 24°C. The taxonomic identification was carried out by the method of DNA barcoding based on analysis of the nucleotide sequence of the mitochondrial cytochrome oxidase c subunit 1 (CO1) gene.

Keywords: *Samaris cristatus*, Samaridae, eggs, early larvae, DNA barcoding, taxonomic identification

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INTRODUCTION

The taxonomic identification of fishes at early developmental stages is the most significant component of most of integrated studies of marine ecosystems. It is necessary in studies of the life history, migrations, and zoogeographic distribution of fishes, in assessing the status of coral communities, ecological monitoring, and in predicting the abundance of commercially important species, etc. However, the identification of fish larvae involves great difficulties, which are primarily connected with the paucity of data on the early ontogeny of fishes. Development has been described only in a small number of fishes. At least one larval stage has been described in less than 50% of the Indo-Pacific fishes, while a more complete description of ontogeny exists only for very few species. The scarcity of information on the very early development stages is even more marked. The species identification of the eggs is a much more complicated task [7]. The egg structure is unknown for most fishes; even data on the type of spawning are lacking for many species. The most direct and informative method of replenishing the database for the taxonomic identification of fishes at early ontogenetic stages is the study and description of the development of the fertilized eggs from spawners of particular species. However, it is often not possible to organize and accomplish such research. It is sometimes more practicable to obtain embryonic material from ichthyoplankton catches and incubate it

under laboratory conditions in order to describe fragments of early ontogeny in different species. The most appropriate method for the taxonomic identification of the objects of study is the molecular genetic method of DNA barcoding, which has been successfully applied for resolving such tasks [8, 10–12, 15, 17]. A final goal of such investigations is to create a database suitable for the identification of objects of the fish fauna of a region at early developmental stages.

The above discussion holds true for the right-sided cockatoo flounder *Samaris cristatus*, which is found in the western Indo-Pacific, the Red Sea, from eastern Africa to New Caledonia, and from Australia to Japan [5]. This is the only one of the five species of the genus *Samaris* that occurs in the South China Sea [1]. The aim of the present work is to describe the early development of *S. cristatus*, which was identified using DNA barcoding.

MATERIALS AND METHODS

Sampling and Examination of Embryological Material

Investigations were carried out from 1993 to 2015 at the base of the Maritime Branch of the Joint Russian–Vietnamese Tropical Research and Technology Center (Nhatrang, Vietnam). The materials were obtained from ichthyoplankton catches performed in the central part of straits between islands Tre and Mieu, Tre and Tam, Tre and Mot, as well as between Mot and

ness of the character relating to the structure of the egg membrane in *S. cristatus*, this suggests that they are representatives of the same species. Their larvae are similar to older larvae (size, 3.6 and 6.8 mm; preserved material) of representative of the genus *Samaris* [2] both in the segment formula of the body (35–42 : 8–14 + 22–36) and in the presence and location of the main characteristic accumulations of pigment.

Thus, a detailed morphological description of the late embryonic and early larval development of *S. cristatus*, whose taxonomic identification was performed by the method of DNA barcoding, is consistent with the morphological and zoogeographical data available in the literature.

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