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## Adding fish images taken in other countries to the biodiversity database of a Japanese public museum, with report of range extension of *Labrisomus jenkinsi* from the Pacific coast of Costa Rica

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**Abstract** Many biodiversity databases have been launched in recent years. Various species of certain developed taxa, such as fish, quadrupeds, and butterflies, are currently able to be photographically identified, in particular for ecological and biogeographic studies. However, there are problems that result from registration of images from countries with different primary languages. In this study, we provide an example of the challenges associated with registering fish images, specifically one case that has functioned as a voucher for the range extension of *Labrisomus jenkinsi* (Heller and Snodgrass, 1903) (Perciformes: Labrisomidae) from the Galapagos Islands to the Pacific coast of Costa Rica. The fish image database in question belongs to a Japanese public museum [the Kanagawa Prefectural Museum of Natural History; the online version (FishPix) is provided by the museum and the National Museum of Nature and Science]. We propose that there are problems associated with image registration caused by using different lan-

guages. Furthermore, these challenges should be a common subject for discussion among museums as they attempt to accumulate biodiversity data from citizens in the future.

**Keywords** Citizen science · Distribution · Documented record · Open science · Photograph

### Introduction

Since 1992, many biodiversity online databases, such as the Global Biodiversity Information Facility (GBIF) and the Encyclopedia of Life (EOL), have been launched on a global scale, and their importance is increasing because of the growing realization of the urgency of biodiversity conservation worldwide (e.g., Novacek 2008; Devictor et al. 2010). Simultaneously, a new approach, citizen science, has been growing rapidly alongside the development of information and commu-

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nication technology (ICT), and creates new opportunities to monitor the natural environment and biodiversity over broad geographic regions (Kobori et al. 2016). Citizen science involves public participation and collaboration in scientific research to increase scientific knowledge (Kobori et al. 2016). Consequently, this approach constitutes a feasible method to collecting much broader scientific data that would otherwise be impossible to collect because of time and resource limitations, and has promoted notable advances in areas such as ecology, education, and conservation (Dickinson and Bonney 2012; Dickinson et al. 2012; Crain et al. 2014; Wals et al. 2014; Kobori et al. 2016).

Some ichthyology studies could also apply citizen science. In our focal example, fish museum collections, both specimens and photographs that include common and uncommon—even undescribed species—have been utilized in taxonomic and/or morphologic research, and in applied studies in areas such as macroecology, biogeography, and biodiversity conservation (see Miyazaki et al. 2014a, b, 2015a, b, 2016). Similarly, public participation in scientific programs that focus on fishes using ICT has been ongoing in some countries, mainly in the European Union and the United States (e.g., Silvertown et al. 2015; Wei et al. 2015), and it is currently expected to spread worldwide (Silvertown 2009; Dickinson et al. 2010; Kano et al. 2013).

The Kanagawa Prefectural Museum of Natural History (KPM) in Japan has accumulated fish images from scientists and the general public as a museum collection since 1994, some of which are available online at the FishPix (Japanese: <http://fishpix.kahaku.go.jp/fishimage/>, English: <http://fishpix.kahaku.go.jp/fishimage-e/>). By February 2016, more than 170,000 fish images had been deposited into the collection, and a large portion of them are available online. These images have been used as a source of distributional data in taxonomical and biogeographical studies as vouchers for descriptions of body coloration and external morphological characters (see Matsuura and Senou 2002; Miyazaki et al. 2014b, 2015b), and enhancement of public awareness through lectures, exhibitions, guide books, and mass media (Miyazaki et al. 2014a, 2015a, 2016; Miyazaki 2015, 2016).

Most of the data in the fish image database are, of course, from Japan; roughly 86.7% of all images by February 2016, with the exception of those of aquarium origins, were from Japan. The remaining 13.3% were from 24 other countries and the open sea, i.e., Indonesia (approximately 5100 photos), Philippines (3900), Malaysia (2400), United States (1550), Fiji (1350), Costa Rica (1275), Palau (1250), and other countries (< 1000). Fish images from Costa Rica accounted for 0.8% of all images, which is the sixth-largest number of images for a country other than Japan. These images were mainly provided by AM (the second author) and RS (the third author), who were Japan Overseas Cooperation Volunteers members between January 2012 and March 2014 (AM), and from October 2014 (RS), working at Parque Nacional Carara (AM) and Parque Nacional Manuel

Antonio (RS). The images mostly correspond to specimens taken from the Pacific coast of the country.

The collection of Costa Rican fish images represent 162 species (including 11 unidentified species) from 58 families (Table 1). Some scientifically important

**Table 1** Details of fish photographs taken in Costa Rica that were deposited into the Image Database of Kanagawa Prefectural Museum of Natural History, Japan

Family	No. of species
Haemulidae	17
Carangidae	12
Pomacentridae	9
Gerreidae	7
Tetraodontidae	7
Gobiidae	6
Labridae	6
Serranidae	6
Centropomidae	5
Eleotridae	5
Lutjanidae	5
Sciaenidae	5
Ariidae	4
Poeciliidae	4
Acanthuridae	3
Balistidae	3
Batrachoididae	3
Paralichthyidae	3
Achiridae	2
Belonidae	2
Chaetodontidae	2
Characidae	2
Clupeidae	2
Diodontidae	2
Engraulidae	2
Kyphosidae	2
Mugilidae	2
Muraenidae	2
Polynemidae	2
Pomacanthidae	2
Scorpaenidae	2
Albulidae	1
Ateleopodidae	1
Blenniidae	1
Carcharhinidae	1
Chaenopsidae	1
Chlopsidae	1
Cichlidae	1
Cirrhitidae	1
Dasyatidae	1
Ephippidae	1
Gobiesocidae	1
Hemiramphidae	1
Holocentridae	1
Labrisomidae	1
Lepisosteidae	1
Lobotidae	1
Moridae	1
Muraenesocidae	1
Ogocephalidae	1
Peristediidae	1
Priacanthidae	1
Scaridae	1
Sparidae	1
Syngnathidae	1
Synodontidae	1
Urolophidae	1

specimens and species are represented in this collection, which highlights the value of this kind of collection.

In this paper, we illustrate and discuss the case of the species *Labrisomus jenkinsi* (Heller and Snodgrass 1903) (Perciformes: Labrisomidae), which we herein report their occurrence in the Pacific coast of Costa Rica for the first time based on photographic evidence.

## Methods

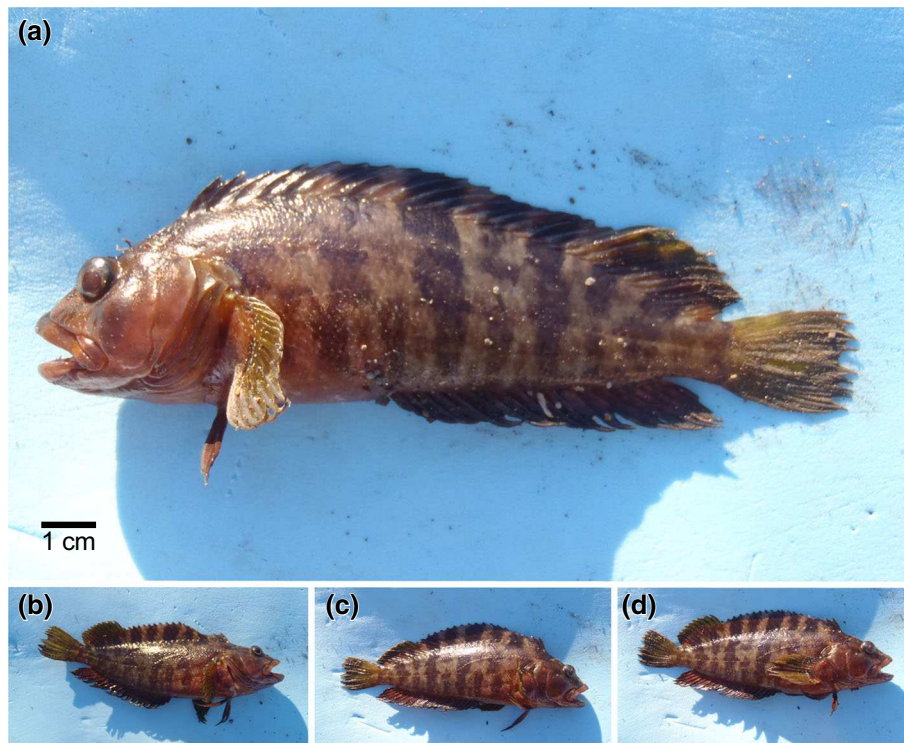
On 2 February 2013, a recreational fisherman (citizen), caught a fish specimen that belonged to family Labrisomidae at the mouth of the Mata de Limon River in Caldera, Esparza, Puntarenas, on the Pacific coast of Costa Rica. Although the fish was not preserved as a scientific specimen, because he ate it, several digital full-color photographs were taken (Fig. 1). The photographs supporting this record along with the attribute information were deposited into the fish image database of the KPM (original number: KPM-NR 141811), and were available online at the FishPix website after March 2016. The description of the specimen found in the next section was based on these photographs (Fig. 1: KPM-NR 141811A–D).

## Description

Dorsal-fin rays XVIII, 12 with the front spines not elongated, notched between spines and rays; anal-fin rays II, 17; pectoral-fin rays 14; head scaleless except for a few scales along top edge of gill cover. Fresh color of head brownish orange without pale spots, and fresh color of body greenish brown without pale spots, but with five diffuse blackish bars on the side and a subtle white streak at the mid-base of the caudal fin.

## Discussion

The characteristics of the specimen photographed corresponded well to the color features of male *Labrisomus jenkinsi*, as described by Allen and Robertson (1994) and Robertson and Allen (2015). Although the external morphology of the specimen did not completely coincide with original descriptions—such as “six transverse bars,” which was based on only three type specimens (Heller and Snodgrass 1903)—detailed ranges of the *L. jenkinsi* external morphology based on additional specimens were provided later, including “eight black bars extending onto dorsal fin” (Grove and Lavenberg 1997) or “5–6 diffuse blackish bars on side” (Allen and Robertson 1994; Robertson and Allen 2015). In addi-



**Fig. 1** Photographs of an individual of *Labrisomus jenkinsi* (Heller and Snodgrass 1903) captured from Caldera, Puntarenas on the Pacific coast of Costa Rica on 2 February 2013 (14.9 cm in total

length; photo by AM). **a** The left side of the body (KPM-NR 141811B); **b–d** the right side of the body (KPM-NR 141811A, C, and D)

tion, the number of dorsal-fin soft rays did not entirely coincide with the descriptions by Allen and Robertson (1994) and Robertson and Allen (2015), but it did correspond with the original description. This could be caused by geographic variation in the species. Thus, we identified the specimen photographed as *L. jenkinsi*.

Until now, no specimens of this species had been recorded in Costa Rican or Central American waters (Bussing and López 2009; Murase et al. 2014; Robertson and Allen 2015). This species has been known only from the Galapagos Islands (McCosker and Rosenblatt 2010; Robertson and Allen 2015). Only a related species, *L. multiporosus*, was recorded from central Baja California and the Gulf of California to Peru, and it is able to be distinguished from *L. jenkinsi* by its external color patterns, such as absence of five diffuse blackish bars on its side body, and presence of a pair of oblique brown bands across the cheek and an ocellus at the front of the dorsal fin (Robertson and Allen 2015). Therefore, this is the first known occurrence of *L. jenkinsi* in the Pacific coast of Costa Rica and Central America, with its subsequent range extension (approximately 700 km northeast), which is supported by photographic evidence along with associated attribute information. As demonstrated here, various species of developed taxa, such as fish, quadrupeds, and butterflies, are currently able to be photographically identified, particularly for ecological and biogeographic studies (e.g., Silvertown 2009, Silvertown et al. 2015; Kobori et al. 2016; Miyazaki 2016).

Unfortunately, the *L. jenkinsi* fish specimen was eaten. However, it is essential for supporting verifiable identification that citizen scientists keep the specimens and donate some local public museums. In Japan, the museums that belong to public boards of education (i.e. “registered museums”) have a principle to permanently store their collections based on the National Museum Act (see Senou 2015 and the original sentences of the act and local ordinances related). Therefore, we recommend public museums for specimen donation.

Based on the present case, we propose an improvement in how data entry is performed when constructing these databases, and suggest that they should also account for multiple languages, contain more accurate attribute information (locality names, in particular), and that they should be more conveniently accessible to local citizens. Accounting for multiple languages would have greatly benefited researchers in this case, as the official language in most Latin American countries, including Costa Rica, is Spanish; because the KPM database is written and presented in Japanese and English, this will cause some conflicts from language differences. However, the curators are not familiar with languages other than English and Japanese. Additionally, specific accented characters (e.g., á, ñ, and ü in Spanish) are not available in the KPM database system. Therefore, accuracy of attribute information for scientific usage may not be guaranteed, especially for locality information, such as the correct name of the collection locality. We suspect that this is a topic common to all museums

that attempt or will attempt to accumulate data from citizens.

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