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Three new records of coastal fishes in the Hawaiian Islands

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Abstract

We document three new records of coastal fish species for the Hawaiian Islands: the Orange-lined Triggerfish *Balistapus undulatus* (Balistidae), the Masked Bannerfish *Heniochus monoceros* (Chaetodontidae), and the Spotted Sand Bass *Paralabrax maculatofasciatus* (Serranidae). The record of *B. undulatus* could be a biogeographic waif from the northern Line Islands or an aquarium fish release. *Heniochus monoceros* is a common ornamental species and, as it has not been observed at Johnston Atoll or the northern Line Islands, was probably an aquarium fish release. We suggest that *P. maculatofasciatus* may have been introduced via maritime shipping from southern California through either ballast water or a sea chest. There is no evidence that these species have established populations in the Hawaiian Islands; thus, they should not be considered part of the resident coastal fish fauna at this time.

Key words: biogeography, *Balistapus undulatus*, *Heniochus monoceros*, *Paralabrax maculatofasciatus*, Pacific Ocean, coastal fishes, coral reefs.

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Introduction

The Hawaiian Archipelago is an isolated string of 18 major islands and atolls stretching in a northwest-southeast direction for 2,500 km in the central north Pacific Ocean. While the Hawaiian Islands have one of the best studied and documented coastal fish faunas in the world (Mundy 2005, Randall 2007), the occasional sighting of previously unrecorded species does occur (e.g. Franklin 2017, Randall et al. 2019). Three primary mechanisms have been proposed for new records of marine fish species in Hawaiian waters: the arrival of biogeographic waifs or vagrants via ocean currents, typically as pelagic larvae (Mundy 2005, Randall 2007, Franklin 2017, Randall et al. 2019); the release of aquarium fishes into coastal waters (Randall 2007); and the unintended introduction of species via maritime shipping in ballast water or sea chests (Carlton 1987, Coles et al. 1999, Eldredge & Carlton 2002, Godwin 2003). There have also been a number of intentional introductions of marine species to the Hawaiian Islands (Randall 1987). Fishery-related releases that were prominent sources of introductions in the past are no longer condoned in the state of Hawaii.

For our update of the records of observations of species new to the the Hawaiian Islands, we relied on both our observations as well as reports from the community of divers and fishers in the area with taxonomic identification skills sufficient to recognize these unusual species. Using these observations and reports, this study documents the occurrence of three new species records for the coastal fish fauna of the Hawaiian Islands (Fig. 1).

Materials and Methods

We define coastal or inshore fishes as species found from the shore to 200 m, excluding oceanic species that sometimes occur in nearshore waters. Two of the fish species (*Balistapus undulatus* and *Heniochus monoceros*) were observed during SCUBA dives by co-author AEG and recorded with underwater photographs offshore of O‘ahu (Fig. 1). The record of *Paralabrax maculatofasciatus* was reported from a landed specimen and photographed by a fisher on O‘ahu that was relayed to us as a unique species observation from the network of divers and fishers maintained by the authors. Species identifications were made using standard diagnostic approaches (Eschmeyer et al. 1983, Randall 2007, Love 2011).

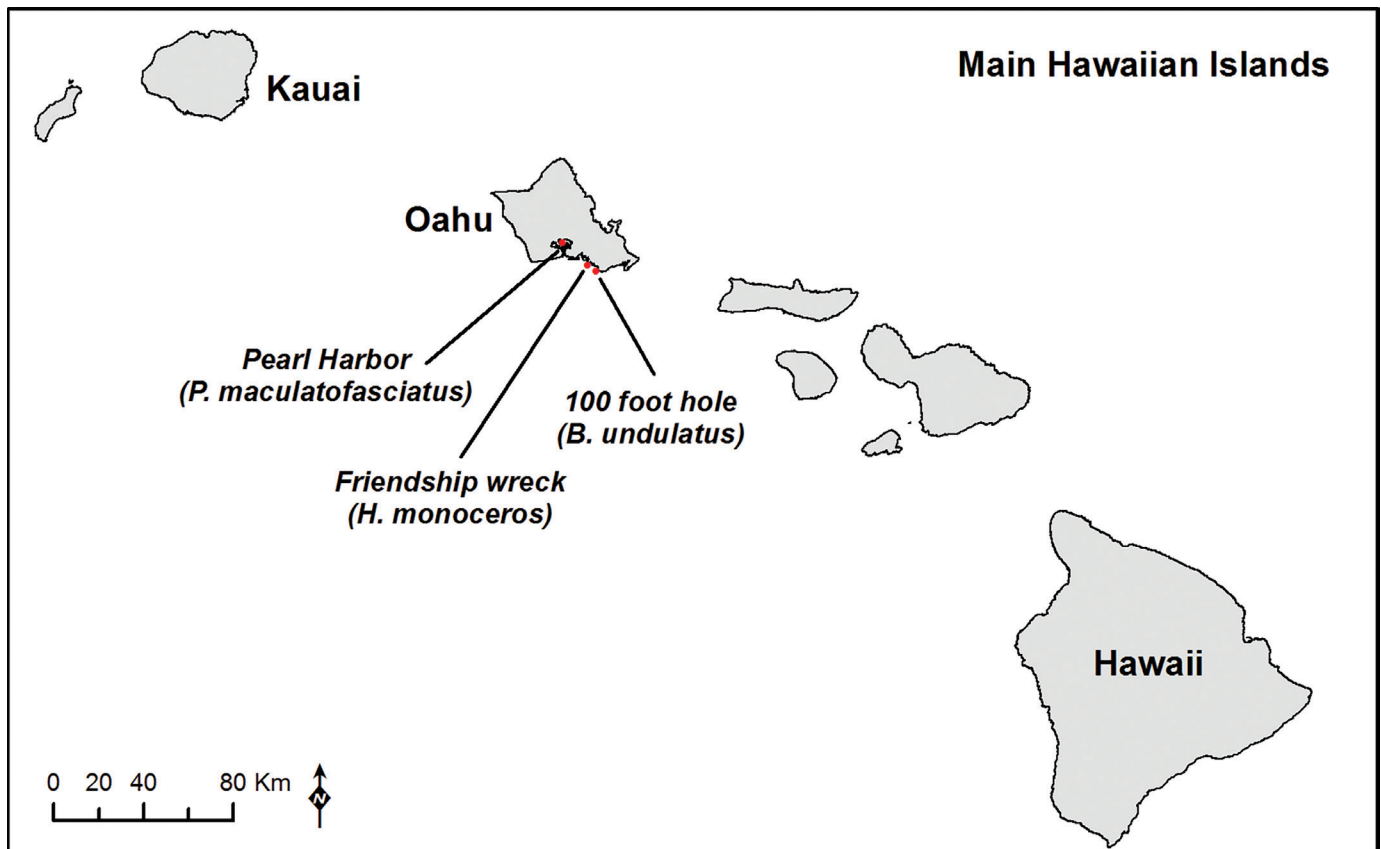


Figure 1. Map of the locations of the three new coastal fish species records from the Hawaiian Islands; red circles indicate the approximate location of each species record.

Results

Three new records of coastal fish species for the Hawaiian Islands were identified from three teleost families: Balistidae, Chaetodontidae, and Serranidae. The new records all occurred around the island of O‘ahu. New species to the Hawaiian Islands were considered those not documented in two comprehensive monographs for coastal and reef fishes of the region (Mundy 2005, Randall 2007) or in more recent reviews of introductions (Carlton & Eldredge 2009, 2015, Randall et al. 2019).

Balistapus undulatus (Park, 1797); Family: Balistidae

An adult Orange-lined Triggerfish, *Balistapus undulatus*, has been observed at a recreational-dive site off Honolulu called “100 foot Hole” (location: 21.2555°, -157.8340°) for several years. An underwater photograph of

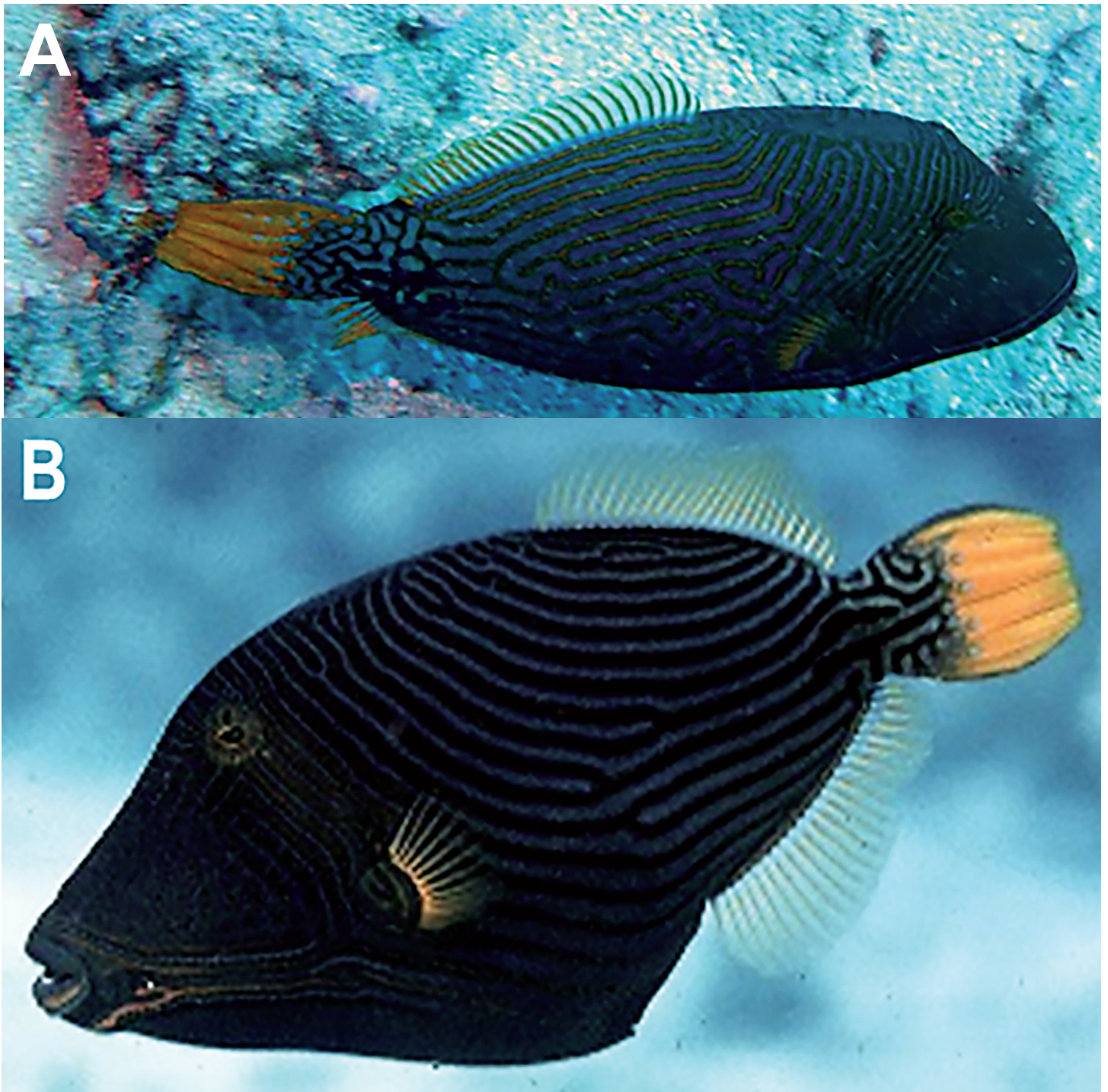


Figure 2. *Balistapus undulatus*, A: at the “100 foot hole” site off Honolulu, O‘ahu on 4 September 2015 (A.E. Gray); B: adult individual from the Red Sea (J.E. Randall).

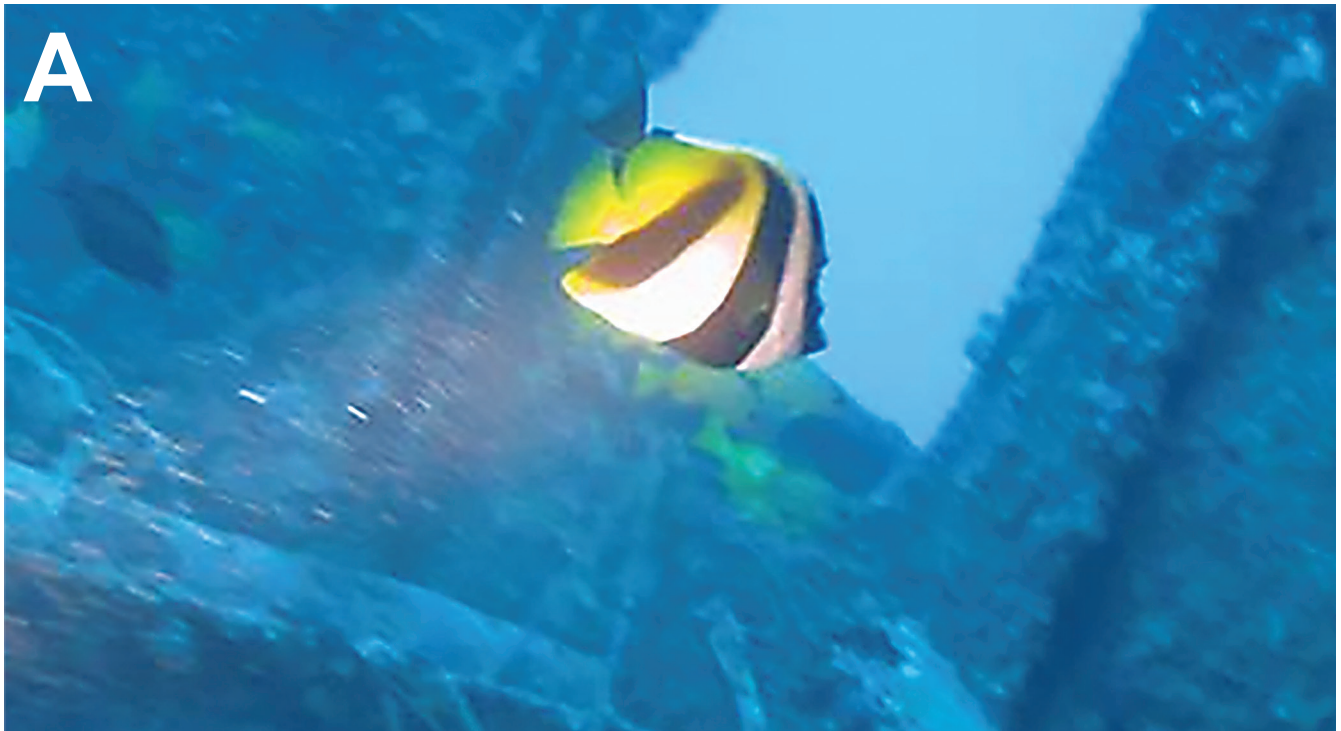


Figure 3. *Heniochus monoceros*, A: at the *Friendship* wreck off Honolulu, O‘ahu (A.E. Gray); B: adult individual from Japan (J.E. Randall).

the individual was taken by AEG on 4 September 2015 (Fig. 2A). The fish was not collected, but an identification could be made from the photograph. The characteristic triggerfish body-plan and green-to-brown coloration of the head and body with diagonal orange lines and an orange caudal fin (Fig. 2B) confirm that the fish was not any of the resident balistid species native to the Hawaiian Islands (Mundy 2005, Randall 2007).

***Heniochus monoceros* Cuvier, 1831; Family: Chaetodontidae**

The Masked Bannerfish, *Heniochus monoceros*, was observed during SCUBA dives on the *Friendship* wreck off Kewalo Basin, Honolulu. Two adult individuals were concurrently observed at the site on several dives from 31 October 2015 until as recently as 26 May 2018. An underwater photograph of one was taken by AEG (Fig. 3A). The fish were not collected, but an identification could be made from the photograph. The distinct black bar through the face and the yellow posterior body and tail (Fig. 3B) confirm that these fish were not Pennantfish, *Heniochus diphreutes* Jordan, 1903, the only congener resident in the Hawaiian Islands (Mundy 2005, Randall 2007).

***Paralabrax maculatofasciatus* (Steindachner, 1868); Family: Serranidae**

A more unusual new record is that of a Spotted Sand Bass, *Paralabrax maculatofasciatus*, a demersal species endemic to the eastern Pacific, that was caught on hook-and-line in Pearl Harbor, O‘ahu in September 2014. The species commonly occurs over sandy bottom near hard substrates along the southern California coast (Love 2011). The fisher, who requested anonymity, caught and landed the fish and took a photograph (Fig. 4A) prior to using the fish for bait. The Hawaiian Islands have relatively few resident serranid fishes and those species have only a remote resemblance to *P. maculatofasciatus*. The similarity of the Pearl Harbor fish in body shape, fin structure, and the distinctive spots and bars to specimens from southern California (e.g. Fig. 4B) confirms that the species was *P. maculatofasciatus*, matching all characters described for the Spotted Sand Bass by Eschmeyer et al. (1983).

Discussion

Balistapus undulatus is a wide-ranging species in the Indo-Pacific region, occurring from the Western Indian Ocean to the Line Islands. We suggest that the individual of this species observed in the Hawaiian Islands was either a biogeographic waif transported to the islands as a pelagic larva or, alternatively, an aquarium fish release, since the species is present in the trade. If the specimen was a biogeographic waif, the most likely sources would be the nearest other islands or shallow banks with resident populations of that species within the major geostrophic currents that flow to the Hawaiian Archipelago (Randall et al. 2019). Three areas are usually mentioned as possible sources of waif marine species in the Hawaiian Islands: Johnston Atoll, 1200 km southwest of the Hawaiian Islands (Gosline 1955, Kobayashi 2006); the Line Islands, 1700 km south of the Hawaiian Islands (Randall et al. 1985, Ho & Shao 2010); and the western Pacific region, including Japan (Randall et al. 1985, Hourigan & Reese 1987). Johnston Atoll is the closest shallow reef habitat to the Hawaiian Islands and Kingman Reef and Palmyra Atoll in the northern Line Islands are the next closest. Sources from the western Pacific are much more distant, but have been suggested since several fish species are only found in the northern part of the western Pacific and the Hawaiian Islands (Hourigan & Reese 1987, Mundy 2005, Randall et al. 1985). For example, the Indo-Pacific Sergeant, *Abudefduf vaigensis* (Quoy & Gaimard, 1825) likely colonized the islands as waifs associated with marine debris from the western Pacific (Carlton & Eldredge 2009, 2015).

Balistapus undulatus has not been reported from Johnston Atoll (Gosline 1955, Kosaki et al. 1991, Randall et al. 1985), making it an unlikely source for the potential waif found in the Hawaiian Islands, but there are confirmed records from Palmyra Atoll and Kingman Reef (Mundy et al. 2010). Connectivity between Kingman Reef and the Hawaiian Islands is supported by observations of fish distributions (Randall 2007, Randall et al. 2019) and the genetic population structure of the coral *Acropora cytherea* (Dana, 1846) (Concepcion et al. 2016) and a sea cucumber *Holothuria atra* Jaeger, 1833 (Skillings et al. 2011). The great distance from sources to the

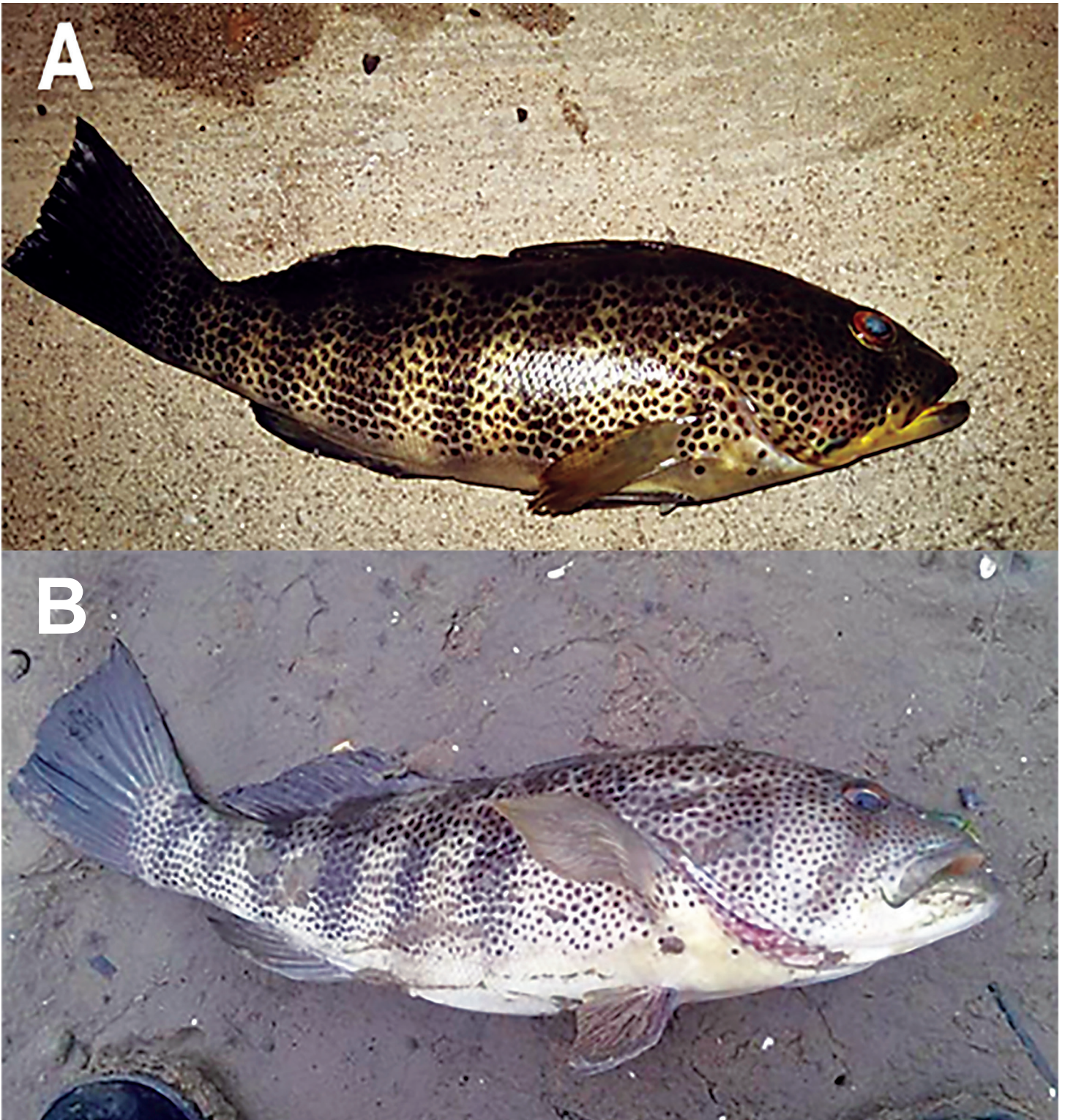


Figure 4. *Paralabrax maculatofasciatus*, A: from Pearl Harbor, O'ahu in September 2014 (anonymous); B: from Newport Beach Harbor, California in June 2012 (M. Bullock).

west of the Hawaiian Islands and the northerly position of the Kuroshio Extension (Taguchi et al. 2010) make it improbable that a waif originates from the west. These conclusions are based on the assumption that probabilities of successful dispersal events are a product of distance, current speeds, and pelagic larval durations, although Mora et al. (2012) did not find a relationship between pelagic larval duration and range sizes in their review of tropical reef fish species.

The records of *Heniochus monoceros* are likely the product of aquarium fish releases, given that the species has not been observed at Johnston Atoll or the northern Line Islands (Gosline 1955, Randall et al. 1985, Kosaki et al.

1991), and is present in the aquarium fish trade. Globally, aquarium fish releases are responsible for a significant number of introductions of non-native species (Ruiz et al. 1997). Examples of prior records that were probable aquarium fish releases in the Hawaiian Islands include the Palette Tang *Paracanthurus hepatus* (Linnaeus, 1766) and the Longfish Batfish *Platax teira* (Forsskål, 1775) (Randall 2007).

The most surprising new record is of *P. maculatofasciatus*, a demersal species native to coastal areas of southern California (USA). It is not known to be sold in the marine aquarium fish trade, and thus most likely represents an introduction via maritime shipping from southern California, through either ballast water or a sea chest (Frey et al. 2014). The majority of marine species introductions to the Hawaiian Islands have occurred via shipping (Coles et al. 1999, Eldredge & Carlton 2002, Godwin 2003, Carlton & Eldredge 2009, 2015). There is considerable commercial and military ship traffic between southern California and the Hawaiian Islands (Franklin 2008). The occurrence in Pearl Harbor, where a large US naval base is located, suggests that the introduction may have come from a military vessel originating at the extensive naval facilities in southern California. Randall et al. (2019) documented the occurrence of another eastern Pacific fish species, *Sarda chiliensis lineolata* (Girard) in Hawai'i, although that species is pelagic, and thus more able to cross from the Americas than the demersal *P. maculatofasciatus*.

Overall, the total number of marine and brackish-water species introductions to the Hawaiian Islands, from a variety of mechanisms including aquarium releases, is 333 (with 130 additional cryptogenic species of uncertain origins that potentially may have been introduced): 22 of which are fish species (Carlton & Eldredge 2009, 2015). Although valid as new records, until these three species are known to represent a reproducing population in the Hawaiian Archipelago, they should not be included in the resident Hawaiian coastal fish fauna.

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