## Patterns of Species Diversity in the Distributions of Estuarine, Mangrove, and Mud Flat Fishes of the Western Pacific

## Patrones de Diversidad de Especies en las Distribuciones de peces en Estuarios, Manglares y Lodazales en el Pacífico Occidental

# Modèle de Diversite de Espéce en le Distribution des Poissons de Estuaire, de Mangroves et de Plage de le Pacifique-Ouest

### TERRY DONALDSON<sup>1</sup>\* and ROBERT F. MYERS<sup>2</sup>

<sup>1</sup>University of Guam Marine Laboratory, UOG Station Mangilao, Guam 96923 USA. \*<u>donaldsn@uguam.uog.edu</u>. <sup>2</sup>Seaclicks/Coral Graphics, 9273 Silent Oak Circle, Wellington Florida 33411-6634 USA.

#### EXTENDED ABSTRACT

We examined patterns of biogeographic diversity in mangrove and mud flat, and estuarine fish assemblages found in the tropical, subtropical, and warm and cool temperate western Pacific, including the Indo-Malayan Triangle where Pacific and Indian Ocean species occur in an area affected greatly by changes of sea level historically. In particular, we focused upon patterns of species richness, diversity, and similarity in assemblage structure at 24 geographic localities. Our examination of a data set of more than 2,500 species of inshore fishes from the region resulted in 721 species that we considered to be mud flat and estuarine species, including those found in mangroves. Species richness and diversity are greatest in the Indo-Malayan Triangle (Figure 1). This area consists of 14 localities of which seven are continental and seven are continental shelf archipelagos or those associated within the Andesite Line.

This level of diversity is attributed to geographic position within this center of diversity, to the tropical and subtropical environments found there, and to the continental or large continental shelf-islands that being larger in size possess greater



## Mudflat and Estuarine Fishers of the Western Pacific

**Figure 1.** Non-metric multidimensional scaling (MDS) plot of fish assemblage structure relationships between localities (n = 100 iterations). The stress value of 0.8 indicates very good representation of these relationships. Locality code definitions are as follows: BOR = Borneo, CAM = Cambodia, CHI = China (including Hainan Island), CHU = Chuuk, CJP = central Japan, IND = Indonesia, KOR = Korean peninsula, KOS = Kosrae, MAL = Malaysian Peninsula, MAR = Mariana Islands, NAS = northern Australia (tropical), NJP = northern Japan, PAL = Palau, PHI = Philippine Islands, PNG = Papua New Guinea, PON = Pohnpei, RYK = Ryukyu Islands, SJP = southern Japan; SNG = Singapore, SOL = Solomon Islands, TAI = Taiwan, THA = Thailand, VNM = Vietnam, YAP= Yap (after Donaldson and Myers, 2014).

watershed development compared to oceanic island localities that support low or moderate levels of species richness and diversity. The latter include most of the Micronesian archipelagos examined (n = 5). Another Micronesian archipelago, the Palau Islands (Palauan Region), owing to its proximity to the Indo-Malayan region, has affinities with both regions. Similarly, the Southern Japan Region shares affinities with the Indo-Malayan Region thanks to the Kyushu Current that brings tropical fish larvae to higher latitudes but allows also for coastal water temperatures to remain warmer than would be expected, thus promoting residency in a number of species. The remaining region, East Asian, consists of one continental and two continental insular localities whose fauna are largely temperate or cold temperate, although some species or species groups have tropical and warm temperate affinities thanks to the influence of the Kyushu Current. Our results offer a basis for future comparisons with assemblages of mangrove, mud flat and estuarine fishes from other regions, including the wider-Caribbean, Gulf of Mexico and western Atlantic (in preparation).

KEY WORDS: Diversity, geographical distribution, habitat, inshore fishes, species richness

#### LITERATURE CITED

Donaldson, T.J. and R.F. Myers. 2014. Biogeography of tidal mud flat and estuarine fishes of the Western Pacific including the Indo-Malayan Triangle. Pages 145-156 in: Hiroyoshi Yamashita and Sunae Ii (eds.) Nature and Culture of Tidal Flats in the Western Pacific. Tokai University Press, Tokyo, Japan.