

Shorefishes of the Tropical Eastern Pacific Online Information System

D. Ross Robertson

ABSTRACT. Shorefishes of the Tropical Eastern Pacific Online Information System (SFTEP) version 1, 2008, provides an online electronic identification guide and information system for the known fauna of shorefishes found in the Tropical Eastern Pacific. SFTEP allows users (i) to identify all shorefishes known from the Tropical Eastern Pacific (TEP) (1,287 species in version 1) and (ii) to analyze and conduct biogeographic research on the composition of that fish fauna at varying spatial scales. Tools for identification emphasize the use of color photographs, along with descriptive text that highlights key morphological features; allow comparison of similar species; facilitate identification of unfamiliar species using information on location and fish morphology (shape, color pattern, and color); and incorporate interactive keys to members of two species-rich families (Gobiidae, Sciaenidae) that have many similar-looking species. To accommodate nonspecialist users, scientific jargon is minimized; the interface is intuitive and user-friendly, and searches for species can be made using common names. The Research Engine, which provides information about the composition of local faunas and the regional fauna, allows users to compare geographic ranges of multiple taxa, to construct faunal lists of taxonomic and functional groups of species for single and paired sites, and, at varying spatial scales, to determine local endemism and to display region-wide patterns of species richness of different taxa and functional groups of fishes. The system is accessible online at www.stri.org/sftep.

INTRODUCTION

Shorefishes of the Tropical Eastern Pacific Online Information System (SFTEP), version 1, 2008, provides an online electronic identification guide and information system for the known fauna of shorefishes found in the Tropical Eastern Pacific (TEP). This version represents the latest iteration of a series that began with the 1994 English-language printed identification guide of the same name (Allen and Robertson, 1994). That book was followed by a Spanish-language printed edition in 1998 (Allen and Robertson, 1998). Both these works were succeeded by a dual-language CD-based information system in 2002 (Robertson and Allen, 2002), which was revised and expanded in 2006 (Robertson and Allen, 2006).

SYSTEM FEATURES

DUAL LANGUAGE INTERFACES

The system incorporates separate, full-capability English- and Spanish-language interfaces.

AIDS TO VISUAL IMPAIRMENT

The system incorporates two types of aids:

1. Variable map-color formats are available. Users can select various color schemes designed to accommodate different patterns of color blindness, including monochrome or color with the ability to select colors.
2. Page layout structure accommodates variation in font size. Two page layouts are possible—landscape and portrait. Page structure is stable over a threefold range in font size.

SYSTEM MODULES

HOME

The home page provides an overview of the capabilities of the system and access to all major modules through buttons and/or tabs that act as shortcuts (Figure 1). In addition there are links to several modules not accessible from other parts of the system: to the **Copyright notice**, a switch to change between **English** and **Spanish** interfaces, and to the websites of the **Smithsonian Tropical Research Institute** and **Coeus**, the company that programmed the system.

Each of the authors and major contributors of information directly related to the construction of SFTEP has an individual contributor page, accessible from the **Contributors** button and from a link at the top of any screen. In addition, the major contributors of information presented on each family are noted on each family page.

GENERAL INFORMATION

General information about Shorefishes of the Tropical Eastern Pacific Online Information System (SFTEP) is shown in Figure 2; this module includes three sections.

Introduction

The “Introduction” to the TEP and its shorefish fauna provides background information on the oceanography of the region and its marine habitats (geographic and temporal variation in climate, rainfall and salinity, primary

production and coastal upwelling systems, ocean current systems, influences of the El Niño cycle, shoreline habitats and rocky and coral reefs in the region); a history of taxonomic fish guides, major modern guides, global online resources, systematic ordering of the fishes, and the scientific and common names of fishes); the ecology of TEP shorefishes (species that occur in the upper 100 m of the water column over the continental shelf or within ~50 km of the shore), their use of different environments and habitats, their depth-distribution patterns, their dietary groupings, and their modes of reproduction; and the zoogeography of the fauna—studies of the region’s zoogeography, resident versus vagrant species, relationships of the fauna to the faunas of other areas, distribution of the fauna in different climate zones, the geography of variation in species richness and local endemism throughout the region, and biogeographic subdivisions of the TEP.

Features & User Guide

The “Features & User Guide” section describes system features, providing information available on taxon pages, databases on biological and zoogeographic characteristics, information used to identify fishes, an interactive glossary of ichthyological terms, the functioning of the zoogeographic research engine (comparison of taxon ranges, assembly of faunal lists, determination of local endemism, assembly of maps of species richness and sampling intensity, assembly of lists of species from predefined parts of the TEP), the functioning of the interactive library, the database of images, and credits to contributors.

Acknowledgments

The “Acknowledgments” section recognizes support from STRI, funding, government permissions, logistical support, assistance collecting fishes, identification of specimens and reviews of section, databases, Spanish translations, images and illustrations, database management, and digital image preparation.

THE FISHES

A Page for Each Species, Genus, and Family

Information on the members of the fauna is provided through interlinked species, genus and family pages. Genera and species are ordered alphabetically within each family, with families being arranged in “phylogenetic” order. “The Fishes” module provides access to **Species**, **Genera**, and **Families** pages by browsing within each taxo-

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Home General Information What Fish is That? The Fishes Library Random Images Glossary Research Engine

Go to: Species Genera Families

Welcome to the Shorefishes of the Tropical Eastern Pacific Online Information System

General Information Contributors

The Fishes Settings

What Fish is That? Copyright Notice

Library Language
English

Research Engine

Sponsors

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Smithsonian Latino Initiatives Fund
Smithsonian Marine Sciences Network
Smithsonian Tropical Research Institute

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COEUS

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FIGURE 1. Opening screen and “Home” module.

onomic level, browsing from within a **Systematic Tree** (with optional alphabetic or systematic ordering, and optional use of common or scientific names), browsing from within a **Book Mode** (species within genera within families), or user-selection of level and taxon from pull-down lists.

Family and genus pages include a brief introduction to systematics, biology, global geographic distribution, and an estimate of the number of genera and species worldwide and present within the TEP; a text description

of distinguishing morphological features—*black text* indicates the least distinctive features for identification purposes, *red text* indicates important features, and *red text with yellow high-lighting* shows the most important features (see Figure 3); a database map of the taxon's range limits distribution in the TEP (assembled from the distributional maps of component species) and a list of component genera and species with links to their pages; an image of a representative species that has a key feature

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INTRODUCTION TO THE TROPICAL EASTERN PACIFIC AND ITS SHOREFISH FAUNA

1. THE TROPICAL EASTERN PACIFIC (TEP)
2. OCEANOGRAPHY AND MARINE HABITATS OF THE TEP
 - 2.1 Climatic variation in the region
 - 2.2 Rainfall and ocean salinity
 - 2.3 Primary production and coastal upwelling systems
 - 2.4 Ocean current systems of the TEP
 - 2.5 Influences of the El Niño cycle
 - 2.6 Shoreline habitats of the TEP
 - 2.7 Rocky and coral reefs in the TEP
3. THE SHOREFISH FAUNA
 - 3.1 A short history of taxonomic studies
 - 3.2 Major modern identification guides
 - 3.3 Global Online resources
 - 3.4 Systematic order in which fishes are arranged in this system
 - 3.5 Names of Fishes
 - 3.5.1 Scientific
 - 3.5.2 Common names
4. BIOLOGY AND ECOLOGY OF TEP SHOREFISHES
 - 4.1 Use of environments and habitats
 - 4.2 Reef-associated fishes
 - 4.3 Soft-bottom fishes
 - 4.4 Water-column fishes
 - 4.5 Use of environments of differing salinities
 - 4.6 Depth distribution patterns
 - 4.7 Fishes dietary groupings
 - 4.8 Modes of reproduction
 - 4.9 Longevity and size
5. ZOOGEOGRAPHY OF THE SHOREFISH FAUNA
 - 5.1 Scientific studies of TEP zoogeography
 - 5.2 Resident and vagrant species
 - 5.3 The size of the fauna
 - 5.4 Relationships of the fauna to the faunas of other areas
 - 5.5 Distribution of the fauna in different climate zones
 - 5.6 Variation in species richness and local endemism throughout the TEP
 - 5.7 Zoogeographic subdivisions of the TEP
 - 5.7.1 One, two or three continental provinces?
 - 5.7.2 Continental and island components of the regional fauna
 - 5.7.3 An ocean-island province?


1. THE TROPICAL EASTERN PACIFIC (TEP)

We cover the marine biogeographic region known as the Tropical Eastern Pacific (TEP), which encompasses the continental shoreline that extends south of Magdalena Bay (~ 25°N) along the outer coast of southern Baja California, throughout the Gulf of California, and down the continental coastline to about Cabo Blanco (4°S) in northern Peru. This region also includes five offshore islands and groups of islands - the Revillagigedos, Clipperton, Cocos, Malpelo and the Galapagos. Politically the region spans all or part of the Pacific coasts of 10 Central and South American countries: (most of) Mexico, Guatemala, El Salvador, a small part of Honduras in the upper reaches of the Gulf of Fonseca, Nicaragua, Costa Rica, Panama, Colombia, Ecuador, and northern Peru, as well as a tiny piece of French Polynesia in the form of Clipperton Island. The northern and southern continental limits of this region are defined by cold currents that flow from the poles along the continental coasts towards the equator and then move away from the coast towards the central Pacific at about these points. The northern quarter of the Gulf of California also included as part of this tropical region even though it has a more subtropical to temperate environment and a fish fauna with significant affinities to the fauna of the temperate Californian Province.



The Tropical Eastern Pacific

FIGURE 2. Opening screen from the "General Information" module.















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Heterodontiformes - Heterodontidae - Heterodontus - Heterodontus francisci

Heterodontus francisci

All Families (148)
All Genera (504)
All Species (1287)

eye crest ends abruptly	no clear bar between eyes	D1 origin over pectoral base
deeply concave between eyes	body spots < 1/3 eye	



High Resolution Map

Images

This-species (6)
This-genus (3)
Similar-species (2)

Previous
Next

Similar Species (2)
This Genus species (3)

Map Color Settings

Heterodontus francisci (Grard, 1855)

Horn shark Pacific horn-shark

Head high, conical; snout piglike; **mouth small, anterior**; a low bony ridge above each eye that ends abruptly at rear; space between eyes deeply concave; nasal grooves before mouth; front teeth on both jaws with 1 large central point and a small point at each side on base of tooth; 5 gill slits, first enlarged, 2-3 over pectoral fin; 2 dorsal fins, each with spine at front; **first dorsal fin origin over pectoral base**; skin denticles on flank small (~ 200/km² in adults) and smooth.

Dark to light grey, back and sides with small dark spots < 1/3 eye diameter; **no light bar between eyes**; small dark spots on a dusky patch below eye; young brightly colored, with dark saddles.

Size: 122 cm.

Habitat: rocky and sandy habitats, and macroalgal beds.






Depth: 1-150 m, usually 2-11 m.

California to the western and NE Gulf of California; possibly Ecuador and Peru.

Species data

Create Report

Size	Habitat	Depth	Feeding
Reproduction	Zoogeography	Range	Conservation status
IUCN Red List <ul style="list-style-type: none"> • Listed (5) • Data deficient (5) 			
CITES <ul style="list-style-type: none"> • Not listed (5) 			

Questions or comments

Email STRI_data_manager

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FIGURE 3. Example of a species page.

overlay indicating diagnostic features of the taxon that distinguish it from similar taxa; and comparisons with similar taxa. To assist in distinguishing look-alike fishes, each taxon page includes a button-link that allows the user to compare images (with key feature overlays) of such taxa. Each page also includes a list of designated similar fishes (at the same taxonomic level), with links to their taxon pages.

Species data pages are similar to genus and family pages but also include multiple images (e.g., juvenile, female, male, color morphs, specific morphological characteristics) and access to a downloadable list of species zoogeographic and ecological attribute data. For example, the **Zoogeography** tab includes **Global endemism**, a species global-scale distribution and its occurrence outside the TEP; **Regional endemism**, distributions of species within the TEP, including TEP endemics (species that occur only in the region or have the great bulk of their distributions within it), temperate eastern Pacific endemics (whose distributions are primarily to the north and south of the TEP, in the Californian and Peruvian provinces), eastern Pacific non-endemics (species that have populations outside the eastern Pacific, for instance circumtropical species). Categories relating to the distributions of species within the TEP include the occurrence of endemic and non-endemic species at offshore islands and/or the continental shore, whether TEP endemics are endemic to the offshore islands (and which islands) or to the mainland, and to which of the three mainland provinces (or combinations thereof) each continental TEP endemic is restricted. Attributes for **Climate zone** and **Residency** (whether the species appears to be a resident or a vagrant in the region) are also included.

Other species ecological attributes that are presented include the following:

- the known maximum total length of each species;
- a species' maximum and minimum depth of occurrence;
- the salinity of environment(s) in which a species occurs;
- the specific habitat(s) a species uses (as well as habitat categories as defined by FishBase, see www.FishBase.org);
- whether a species is restricted to inshore waters or occurs in offshore, oceanic conditions;
- the position in the water column at which a species lives (e.g., bottom, surface);
- a species' feeding group (e.g., carnivore);
- items in a species' diet (e.g., fishes, pelagic crustaceans, microalgae);
- a species' reproductive mode (e.g., different types of eggs, live birth); and
- a species' CITES and IUCN REDLIST status.

When information is available (e.g., for diet) for a species itself, an "S" is given after the value in the database. In

cases for which such species-level information is lacking, the page displays information for the genus (indicated by "G"), or for the family ("F") if there is no information for the genus.

Taxon pages includes direct links to external websites concerning the same taxon in the following external online sources: William Eschmeyer's Catalog of Fishes (www.calacademy.org/research/ichthyology/catalog), which provides comprehensive up-to-date data on the systematics of fishes; FishBase (www.fishbase.org), which covers a variety of aspects of the biology of fishes; ITIS, the International Taxonomic Information System (<http://www.itis.gov>) and WoRMS, the World Register of Marine Species (<http://www.marinespecies.org>), both of which focus on scientific names of fishes; and OBIS, the International Biogeographic Information System (<http://www.iobis.org>), which aggregates geo-referenced databases of collection records of fishes.

WHAT FISH IS THAT?

This module facilitates identification of unknown fishes using four distinct tools (Figure 4).

Find a Fish


This tool allows users who are not scientifically trained to identify an unfamiliar fish by choosing among the following in any order or combination, with the ability to back-up steps: **Where was it?**—select location and size of area in question on a database map—and combinations of **Body Shape**, **Color Pattern**, and **Colors**. Each step narrows the list of possibilities, with each species on the possibilities list linked to its image, and hence to its species page.

Identification Keys Search

Illustrated dichotomous keys are provided for the genera and species in the two families with the largest number of species: Gobiidae (88 species in 27 genera) and Sciaenidae (82 species in 26 genera). Search results link to species pages.

Compare Images of Fishes

This function allows simultaneous comparison of images of any two to six families, genera, or species selected. The feature enables users to compare "apples" with "oranges," whereas the comparison of designated similar taxa on taxon pages limits users to comparing only "apples." Resultant images are linked to taxon pages.


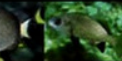




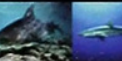




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Identification-Keys Search

Common Names Search

Included Species

- Ablennes hians
- Aboma etheostoma
- Abudefduf concolor
- Abudefduf declivifrons
- Abudefduf troschelii
- Acanthemblemaria atrata
- Acanthemblemaria balanorum
- Acanthemblemaria castroi
- Acanthemblemaria crockeri
- Acanthemblemaria exilispinus
- Acanthemblemaria hancocki
- Acanthemblemaria macropsilus
- Acanthemblemaria mangognat
- Acanthemblemaria stephensi
- Acanthistius pictus
- Acanthocybium solandri
- Acanthurus achilles
- Acanthurus guttatus
- Acanthurus nigricans
- Acanthurus triostegus triostegu
- Acanthurus xanthopterus
- Achirus klunzingeri
- Achirus mazatlanus

Total: 1287

Species excluded by previous step

Total: 0

All excluded species

Total: 0


Selection Criteria [Reset All](#) R = remove criterium

Where was it?

Body Shape

Color Pattern

Colors



Map Color Settings

Paintbrush
(1~1? x 1?)

- 0.5
- 1
- 1.5
- 2
- 3
- 4
- 5
- 6
- 8
- 12
- 16
- 24

Find

Clear Map

Report: includes selection criteria and included-species list.

Sort species list: Systematic Alphabetic

[Create Report](#)

FIGURE 4. Screen capture from the “What Fish Is That?” module.

Common Names Search

Searches can be made for families, genera, and species from pull-down lists of common names, with results linked to taxon pages. The systematic tree or taxonomic hierarchy (see “The Fishes” module) also functions with the use of either common names or scientific names. The use of common names in this hierarchy helps users who are not scientifically trained to appreciate the relationships among fishes.

GLOSSARY

An interactive glossary of taxonomic terms is provided that uses a combination of images and text to explain basic terms relating primarily to morphological characteristics that are used in the identification of fishes. In addition the usage of scientific jargon has been reduced as much as possible throughout the taxon pages by using simple descriptive phrases from everyday English to replace technical terms.

RESEARCH ENGINE

This module provides a variety of types of zoogeographical data and the ability to generate maps and site-specific species-lists based on complex queries constructed by the user (Figure 5).

Taxon Range Maps

This feature provides overlaid displays of the regional ranges of up to three taxa (species, genera, families, or a mixture thereof). In addition, maps can be generated of the geographic distribution of all species-range centroids (both point and point data) and of all geo-referenced sampling points in the system’s database.

Species Richness Displays

This feature provides maps with color-coded overlays of patterns of variation in species richness throughout the region. Those patterns include richness of individual families and richness of species in specified “functional groups” (e.g., species sharing one or more biogeographic and ecological attribute). Richness displays can indicate either absolute richness (number of species) or relative richness (number of species as a percentage of the local fauna). A display of relative sampling intensity indicates the number of species recorded at minimally one site within each unit of area (1° of latitude \times 1° of longitude) as a percentage of the number of species whose ranges encompass that unit.

Species – List Assembly

Family and genus lists can be constructed for single locations. Species lists for “functional groups” of fishes for a particular location can be constructed using any combination of biogeographic and ecological attributes. Species lists include both single-location lists and lists of species found or not found at two locations. The spatial scale of a location in such a search varies from a single island to an area of variable shape and size, to the entire TEP or map. Locations are defined by the user employing a library of approximately 300 preformed templates that include geographic entities (e.g., shoreline, continental shelf, named gulfs), habitat features (e.g., mangroves, rocky shores, upwelling areas), islands (individual and archipelagos), biogeographic entities (provinces of the TEP), political areas (Exclusive Economic Zones and parts thereof), and marine reserves (individual reserves, combine country reserves). In addition, quadrants of varying sizes (12 groups ranging from 0.5° latitude \times 0.5° longitude to $24^\circ \times 24^\circ$) used by the map of the **Find a Fish** tool in the “What Fish Is That?” module provide approximately 5,000 additional [square] templates.

Unconfirmed/Confirmed Occurrences

Single-area species lists indicate both likely occurrences (species whose ranges include the selected area) and confirmed occurrences (species with at least one collection record in the same area).

Local Endemism Indicator

This feature provides a list of species found only within one or two template areas, and nowhere else on the system’s map.

List and Map Exports


Lists and Maps produced by searches are exportable/printable. Lists may be arranged alphabetically or systematically (genera and species arranged alphabetically within families arranged in systematic order).

Species Range Maps and Range Data

A database map on each taxon page incorporates two types of data: a two-dimensional painted representation of the geographic range based on museum and literature records of occurrence and range maps, and our own field surveys in Mexico, El Salvador, Costa Rica, Panama, Colombia, Ecuador, the Revillagigedos, Clipperton, Cocos,

Research Engine Taxon - Range Maps Species - Richness Displays Species - List Assembly Home

Interactive Mapper



Map Color Settings

Local Endemism: members of regional fauna found either exclusively inside or exclusively outside A (A = one or more areas defined on map)

Only inside A
 Only outside A

Taxonomic/Functional Group Lists

All Species
 All Genera
 All Families
 Species Functional Group (define)

R 1: Length Max < 100
R 2: Feeding - Feeding Group is Carnivore
R 3: Reproduction - Egg Type is Benthic

Species Functional Groups Options

- Size
- Habitat
- Depth
- Feeding
- Reproduction
- Zoogeography
- Range
- Conservation status

Define question to generate list

Inside A
 Combined total in A and B
 Present in both A and B
 Present in A but not in B

Define Area(s) on Map using variably-sized quadrats or by adding/removing area-templates

Single Quadrat
Template Category
Gulf of Panama

A = B = Both =

Area A Area B

Clear Map Clear A Clear B

Map Functions

Lat/Long Grid -6.37, -77.23
Add Coastline

Report: includes map, group type and species list

Sort taxa list
 Systematic
 Alphabetic

Create Report

Loading.....

FIGURE 5. Screen capture from the "Research Engine" module.

Malpelo, and the Galapagos; and points indicating site records from museum collections, the scientific literature, and our own field surveys. Geographic-range statistics derived from these two offsets of data and presented on species pages include: latitudinal and longitudinal limits, ranges and midpoints based on paint data, and, separately, site records; data on range characteristics derived from paint data have been adjusted in species that occur in the eastern Pacific beyond the limits of the system's base map; habitat area, based on number of painted pixels in the species range map; and separate range-area polygons with centroids based on painted data and site record data.

Continental Ranges

Comprehensive faunal lists exist for few locations, and large sections of the coastline and continental platform of the TEP remain poorly sampled, a situation that will not be rectified in the near future. Hence the range of most species on the continental shelf is derived from data on the northern and southern limits of occurrence. Thus painted areas on taxon page maps represent the potential range and potential habitat area, and a species is assumed to be present *in appropriate habitat* anywhere between those limits. Exceptions include species that are known to have wide gaps in their distributions, such as some well-known anti-tropical species. Those gaps are represented in the range maps of such species.

Habitat Area Calculations

Maps constructed for the determination of habitat areas incorporate information on habitat usage and depth range as well as the extent of the geographic range. Continental areas of range maps were modified to exclude large areas of habitat that was inappropriate for the particular species; for example, shorelines composed primarily of sand and mud were excluded from ranges of reef-fishes and rocky shores were excluded from ranges of fishes living on beaches or in lagoons and mangroves. The depth ranges of individual species were also taken into account: ranges of demersal species restricted to very shallow water (less than ~20 m depth) are indicated by lines that follow coastlines. For habitat area calculations of such species, the coastal strip of habitat was taken to be 1 km wide. Ranges of coastal species found in deeper water on the continental and insular shelves are divided into three groups: those occurring down to ~60 m have maps that span the inner continental shelf; species that are limited to depths below ~60 m occur on the outer shelf; and the third group has depth ranges (and maps) that span the entire shelf. Maps for pelagic species variously include parts of the shelf and/or open ocean, depending on the biology of the species.

Mercator Projection Distortions and Adjustments to Habitat Area Calculations

Mercator projection maps, such as that used in this system, incorporate distortions of both latitude and longitude that affect estimation of habitat area. In such projections lines of longitude are shown as parallel rather than converging with increasing latitude, and lines of latitude diverge with increasing latitude instead of remaining a fixed distance apart. When calculating the habitat area for each species those two distortions were taken into account by making appropriate adjustments to the areas of individual pixels in different latitudinal bands. Range polygon areas were calculated independently using the GIS (Geographic Information System) ArcInfo system.

Cleanup of the Geo-Referenced Records Database

Both the scientific literature and databases from museums inevitably include erroneous records as a consequence of misidentification of fishes and sites, as well as bookkeeping errors. In addition museum specimens of demersal species include not only individuals collected in demersal habitats but also larvae collected in the open sea far from adult habitat, and, in some cases, far from the known adult geographic range (Robertson, 2008). Records from the multi-source database of ~67,000 collection site records included here that were adjacent to the currently known limits of the geographic range were used to adjust (by expanding) those ranges. However, we removed from the systems database those "suspect" records that were well outside the known habitat and geographic ranges of the "adult" phase of each species, based on extensive records from other sources, the biology of the species, and expert determinations of ranges. This cleanup process reduced the size of the database by approximately 6%. Points outside the current range were retained for some species that, because of overfishing, have had their historical ranges reduced. For example, historically the mackerel *Scomberomus concolor*, which currently occurs only in the northern Gulf of California, occurred throughout that gulf and also off California, USA (B. B. Collette, National Marine Fisheries Service Systematics Laboratory, personal communication, 2008).

LIBRARY

The library database (Figure 6) includes 1,143 citations. The citation for its original description is included for each species, along with citations of revisions of genera and families. Other citations include local and larger scale

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Library *Acanthemblemaria stephensi* 

Define search

Keyword Search Bussing Search in All Fields	Taxon Search Species Level Taxon Ablennes hians	Reset All List All
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Search Results

#	Ref ID/Author	Date	Title	Source
1	30 Bussing, W.A.	1972	Halichoeres aestuaricola, a replacement name for the tropical eastern Pacific labrid fish, <i>Iridio bimaculata</i> Wilson, with a redescription based on new material.	Brenesia (Nat. Mus. Nac. Costa Rica), Vol. 1, pp.3-8
2	31 Bussing, W.A.	1981	Elacatinus janssi, a new gobiid fish from Costa Rica.	Revista de Biologia Tropical, Vol. 29 issue 2, pp.251-256
3	32 Bussing, W.A.	1983	A new tropical eastern Pacific labrid fish, <i>Halichoeres discolor</i> endemic to Isla del Coco, Costa Rica.	Revista de Biologia Tropical, Vol. 31 issue 1, pp.19-23
4	33 Bussing, W.A.	1983	Evermannia erici, a new burrowing gobiid fish from the Pacific coast of Costa Rica.	Revista de Biologia Tropical, Vol. 31 issue 1, pp.125-131
5	34 Bussing, W.A.	1990	New species of gobiid fishes of the genera <i>Lythrypnus</i> , <i>Elacatinus</i> and <i>Chriolepis</i> from the eastern tropical Pacific.	Revista de Biologia Tropical, Vol. 38 issue 1, pp.99-118
6	35 Bussing, W.A.	1991	A new genus and two new species of tripterygiid fishes from Costa Rica.	Revista de Biologia Tropical, Vol. 39 issue 1, pp.77-85
7	36 Bussing, W.A.	1991	A new species of eastern Pacific moray eel (Pisces: Muraenidae).	Revista de Biologia Tropical, Vol. 39 issue 1,

Records where 'bussing' is in any field - 25 Records

Add All Clear Sort By View Taxon Details

My List

#	Ref ID/Author	Date	Title	Source
-1	30 Bussing, W.A.	1972	Halichoeres aestuaricola, a replacement name for the tropical eastern Pacific labrid fish, <i>Iridio bimaculata</i> Wilson, with a redescription based on new material.	Brenesia (Nat. Mus. Nac. Costa Rica), Vol. 1, pp.3-8
-2	31 Bussing, W.A.	1981	Elacatinus janssi, a new gobiid fish from Costa Rica.	Revista de Biologia Tropical, Vol. 29 issue 2, pp.251-256
-3	32 Bussing, W.A.	1983	A new tropical eastern Pacific labrid fish, <i>Halichoeres discolor</i> endemic to Isla del Coco, Costa Rica.	Revista de Biologia Tropical, Vol. 31 issue 1, pp.19-23
-4	33 Bussing, W.A.	1983	Evermannia erici, a new burrowing gobiid fish from the Pacific coast of Costa Rica.	Revista de Biologia Tropical, Vol. 31 issue 1, pp.125-131
-5	34 Bussing, W.A.	1990	New species of gobiid fishes of the genera <i>Lythrypnus</i> , <i>Elacatinus</i> and <i>Chriolepis</i> from the eastern tropical Pacific.	Revista de Biologia Tropical, Vol. 38 issue 1, pp.99-118
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-7	36 Bussing, W.A.	1991	A new species of eastern Pacific moray eel (Pisces: Muraenidae).	Revista de Biologia Tropical, Vol. 39 issue 1,

Clear Sort By

Report:

Report On: My List Search Results

Species Linked to Citation: Include Do not Include

Sort species list: Systematic Alphabetic

Report Type: View Export

Create Report

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FIGURE 6. Screen capture from "Library" module.

lists of species; identification guides to species; and publications about the biology and zoogeography of species inside and outside the TEP. Each citation is linked to the species it discusses (and hence to appropriate genera and families).

Exportable lists can be generated for:

- Citations linked to individual families, genera, and species.
- Species linked to a particular citation.
- Citations linked to a particular author, date, or source journal.
- The entire bibliography arranged alphabetically by author name.

RANDOM IMAGES

The image database incorporates 2,927 images. These include 2,346 color photographs that cover 83% of the fauna (1,068 of 1,237 species). In comparison, the 1994 book from which this system was developed included color images of 683 species and treated only 768 species.

This module presents color images in a randomized order.

Digital Manipulation of Images

The user should assume that all illustrations used in this system have been digitally manipulated to some extent, to increase their utility as identification aids. Such manipulation includes cropping, image sharpening, changes in lighting and contrast relationships of different parts of individual subjects, changes of subject-to-background contrast, changes of background to enhance subject visibility,

the (occasional) combination of multiple images of fishes in a montage to provide examples of variation in color patterns within the same image, and minor repairs to fin membranes and removal of body blemishes (scratches, minor cuts, blood spots) that resulted from capture handling.

Image Credits

All images are accompanied by a relevant ownership credit, copyright notice, and usage notice. Each image is accompanied by a link to either the owner's e-mail contact or website.

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LITERATURE CITED

- Allen, G. R., and D. R. Robertson. 1994. *Fishes of the Tropical Eastern Pacific*. Bathurst, Australia: Crawford House Press.
- . 1998. *Peces del Pacifico oriental tropical*. CONABIO, Mexico.
- Robertson, D. R. 2008. Global Biogeographic Data Bases on Marine Fishes: Caveat Emptor. *Diversity and Distributions* 14:891–892.
- Robertson, D. R., and G. R. Allen. 2002. *Shorefishes of the Tropical Eastern Pacific: An Information System*. CD-ROM. Balboa, Panama: Smithsonian Tropical Research Institute.
- . 2006. *Shorefishes of the Tropical Eastern Pacific: An Information System*. Version 2. DVD-ROM. Balboa, Panama: Smithsonian Tropical Research Institute.



Robertson, D. Ross. 2009. "Shorefishes of the Tropical Eastern Pacific Online Information System." *Proceedings of the Smithsonian Marine Science Symposium* 38, 197–208.

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