

Taxonomy of Himalayan fishes

Towards best practices



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&
International Union for Conservation of Nature/IUCN

What's in a name?

“A fish by any other name will smell just as fishy”

Unexplored and unknown species are not accounted for in biodiversity conservation

Species trapped in ‘species complexes’ can get neglected

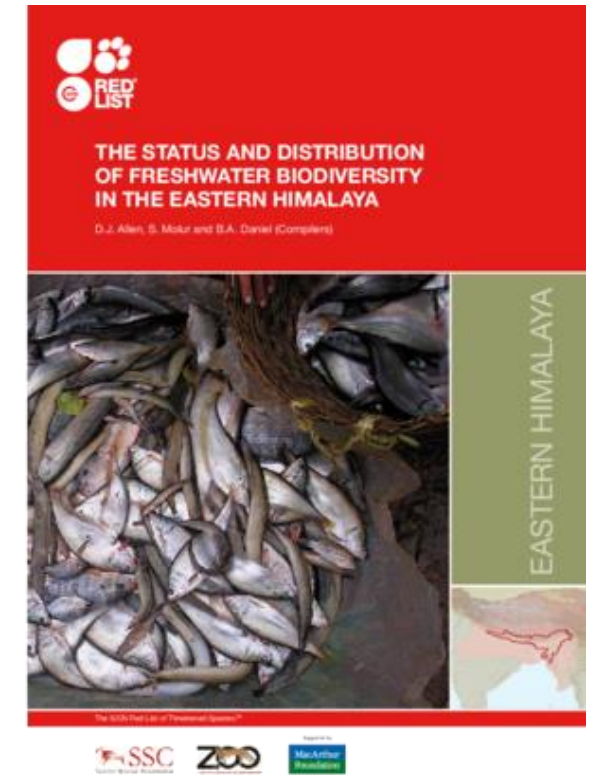
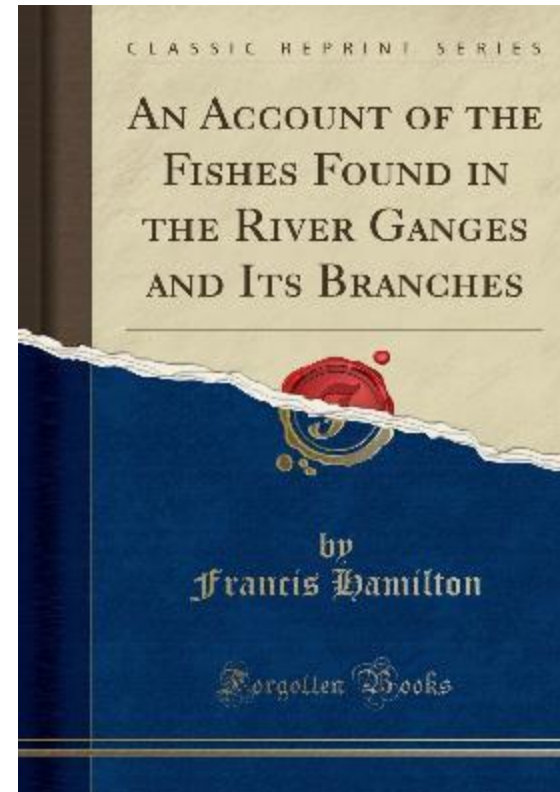
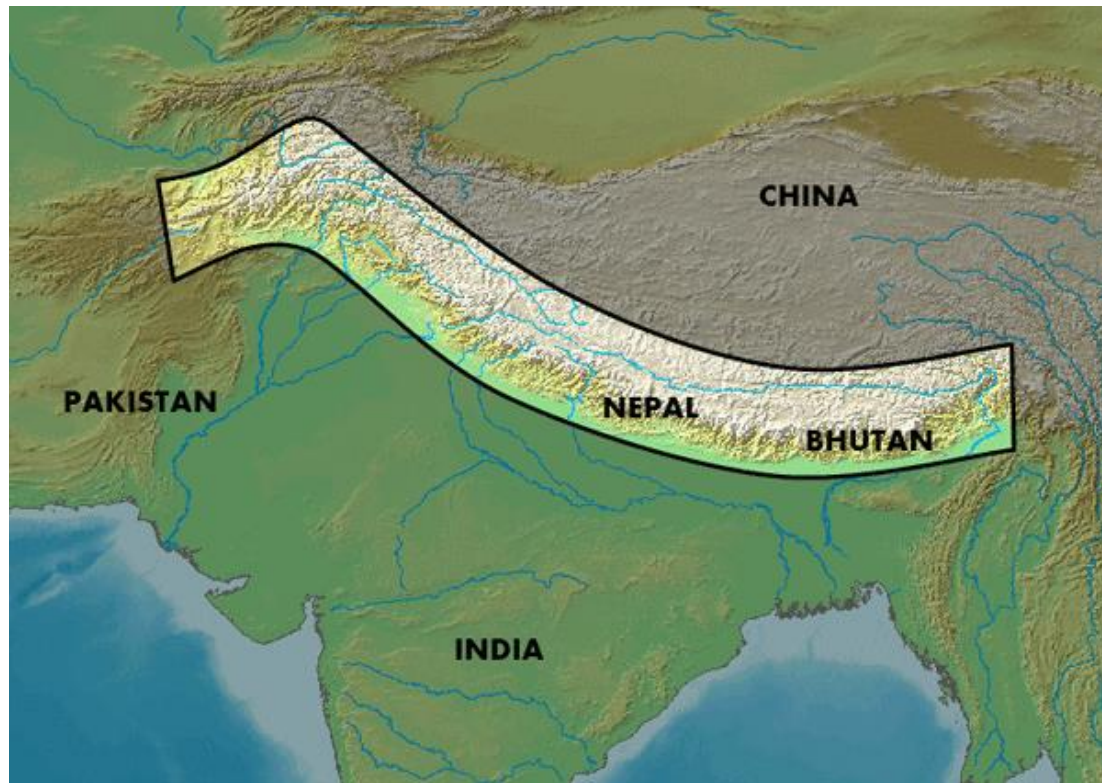
Wrong synonymization can hamper conservation efforts

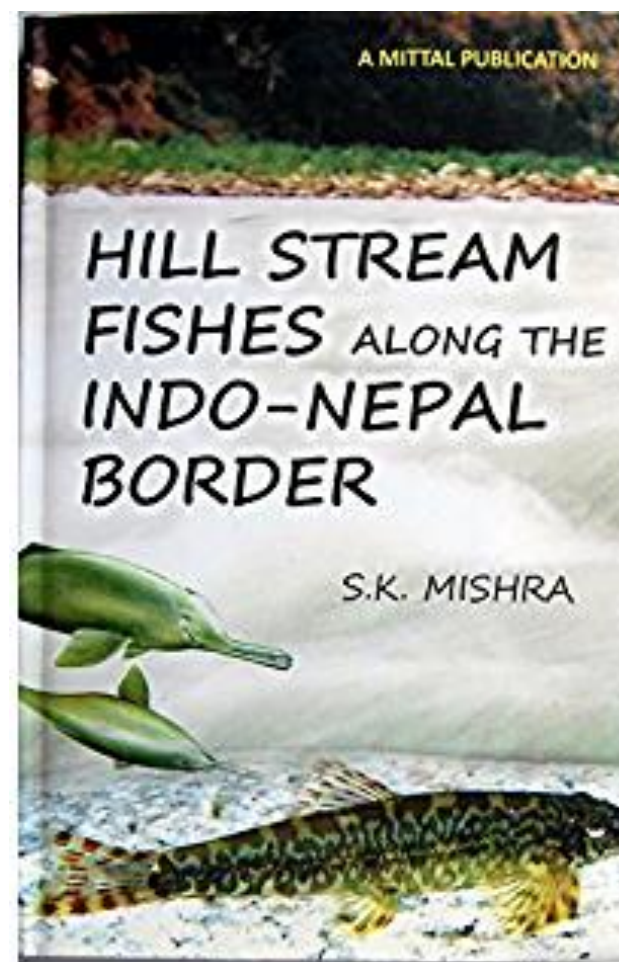
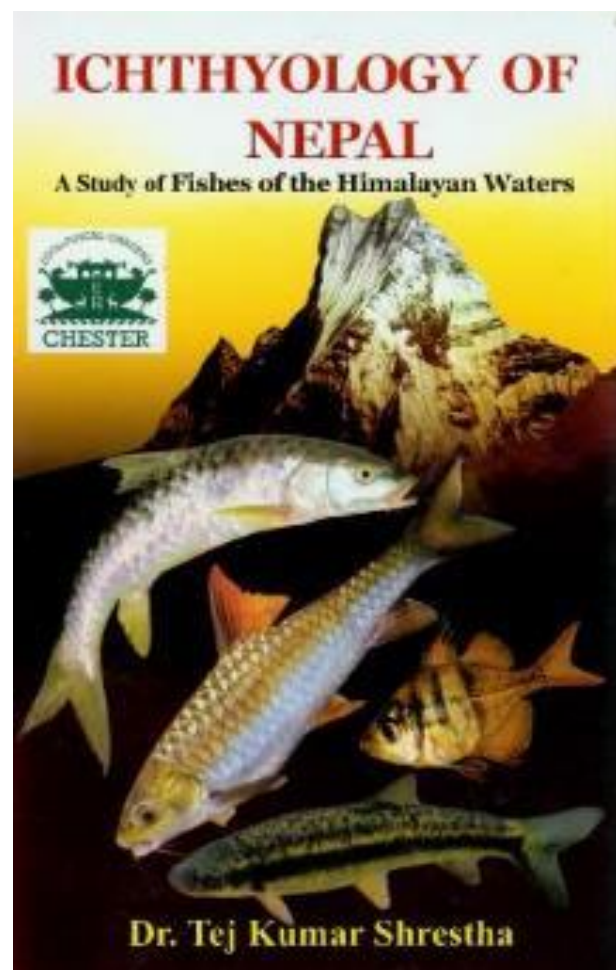
Taxonomic changes can help in prioritizing species for conservation

Names have legal value (Red List, CITES)

200 years of Ichthyology

How many species?







Shreshta 1999
59 native + 2 exotic

Medha Vol.2, 2002 A.D.

A CHECK-LIST OF FISHES OF NEPAL

*Rakesh Prasad Bhagat

Abstract

A check-list of 185 species of indigenous and 12 species of exotic fishes have been prepared.

Introduction

The Himalayan Kingdom of Nepal is rich in freshwater resources comprising both lotic, that is, running (increeps, fountains, glaciers, springs, rivulets, tunnels, streams, and rivers) and lentic, that is, confined or stagnant or still (ponds, pools, ditches, dahus, reservoirs, swamps or marshy lands, and nullahs) habitats and has got fascinating freshwater fish fauna of both indigenous and exotic fish species. Many workers explored available freshwater fish fauna of Nepal, the review of which has been described by Bhagat (1978, 1984), Menon (1974), Majumdar (1998), Shreshta (1991, 1994), and Shreshta (1995). Again, these explorers presented location-wise check-lists of freshwater fish fauna of different regions of Nepal, with particular references to places, districts, zones, regions, rivers, streams, lakes, and so on. But Shreshta (1994) is the one among them who presented a nation-wise concise list of fishes of Nepal.

Although Shreshta (1994) published a concise list of fishes of Nepal, but there was still some addendum (of few species) to include to complete the list. Therefore, the main objective of preparing such a check-list of fishes of Nepal, was to present a complete list of indigenous (Table-1) and exotic (Table-2) fishes of Nepal. This list may be helpful in many ways and may also facilitate students, teachers, researchers, planners, and enthusiasts who have little or more concern with freshwater fish fauna of Nepal in what ways they need.

Discussion

Shreshta (1994) published a check-list of 179 species of indigenous fishes and 9 species of exotic fishes and another list of 179 species of indigenous fishes, however, the present check-list comprises 185 species of indigenous and 12 species of exotic fishes. Two species of fishes *Carassius auratus* (Linnaeus) and *Gambusia affinis* (Baird) kept by Shreshta (1984, 1994) in the list of indigenous fishes are exotic. *Carassius auratus* (Linnaeus) was introduced from China and Japan and became domesticated later on reproducing naturally. *Gambusia affinis* (Baird) was introduced in the Indian sub-continent for the first time in the then "British India" from Europe in 1850 in the regime of "East India Company" for the

Bhagat 2002
185 native + 12 exotic



Freshwater fishes, fisheries, and habitat prospects of Nepal

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P.O. Box 5003, NO-1432 Aas, Norway
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This paper deals with the status of fish, fisheries, and habitats in Nepal. Being a landlocked country, it has only freshwater habitats covering an area of 745,000 hectares (5% of the total area) that includes rivers, lakes, ponds, wetlands, reservoirs, and irrigated rice fields. It has a diverse fish species totaling 200 fish species, of which 191 are indigenous and nine exotic. Thirty-four fish species were categorized as threatened (IUCN categories), requiring due attention for the conservation. Legal protection is recommended for ten fish species in the endangered and vulnerable categories. Fish harvests are mainly based on the subsistence fish farming, and from capture fisheries. National fish production in the year 2000/01 was 33,270 metric tons. Lowland areas are most suitable for aquaculture, whereas hill streams have a great attraction for sport fishing. Some destructive fishing methods are in use in capture fishery, e.g., electric fishing, explosives and poisons. In Nepal, some of the major fish habitats are in protected conservation areas, e.g., national parks and World Ramsar Sites. However, proper consideration has not been given for fish habitat management. The national plan includes a fisheries/aquaculture sub sector mainly for supplying animal protein, and for generating self-employment and income of small-scale farmers. The number of people involved in the capture fisheries has increased and included 142,000 men and 223,000 women in the year 2000/01. At the same time, commercial trout farming in the private sector has increased. Long-term perspectives in the fields of aquatic ecology, genetics, biotechnology and ecotoxicology are essential to enhance the fish and fisheries science in the country.

[Supplementary material is available for this article. Go to the publisher's online edition of Aquatic

Sharma 2008
191 native + 9 exotic



Froese & Pauly 2021
240 native + 16 exotic

Talk today

Rayamajhi 2021
236 species

Hard facts

1. Taxonomy **IS NOT** identification!
2. 90% of taxonomists (!) (or rather those working on taxonomy!) have absolutely **no idea about principles and practices of taxonomy, systematics or nomenclature**
3. 90% of taxonomy works in the Indian subcontinent are carried out by supervisors and students who **simply carry out identification – NOT TAXONOMY!**

SPECIMENS | SPECIMENS | SPECIMENS | SPECIMENS | SPECIMENS | SPECIMENS

Taxonomy is **not** based on books – **nor** is it based on photographs/images

Specimens NOT books is the basis of taxonomy

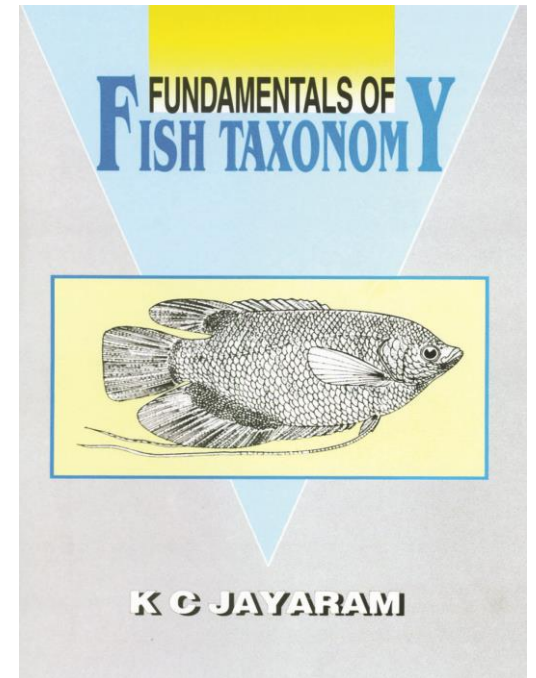
Never compare a specimen with a book!

Two books may never agree!

Characters, attributes and analyses

The number of characters that can be observed on a specimen is virtually unlimited

Characters need to be selected based on a comprehensive review of literature (i.e. description papers NOT books!)





Zootaxa 3586: 8–16 (2012)
www.mapress.com/zootaxa/

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ISSN 1175-5326 (print edition)

ZOOTAXA

ISSN 1175-5334 (online edition)

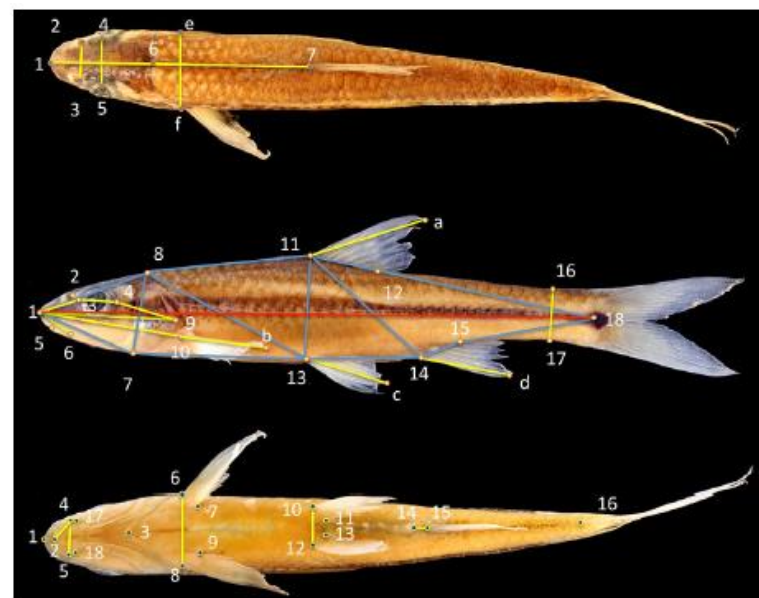
Article

urn:lsid:zoobank.org:pub:7EE352D9-4FC3-49E9-A3CB-08694F4BC783

Standardized measurements, landmarks, and meristic counts for cypriniform fishes

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Taxonomy as a comparative discipline

New species cannot be characterised alone, in an **absolute way**', but only in a '**relative way**', through detailed comparisons with all other closely related or similar species.

All diagnoses of taxa are relative to one another

Comparisons should always be made **between specimens, not between specimens and descriptions.**

Taxonomy is in flux

Linnean system of taxonomy is by definition unstable, as a taxon name that has been used for a long time can be replaced by new findings.

Constantly updated with new insights on the phylogenetic relationships between organisms, and the discovery of new species

As a result, old identification keys based solely on the ranges of morphometrics and meristics, are subject to change, as more information on the inter- and intra-specific variations becomes clear

Most old identification keys fail to identify newly described species

Why do names change?

Improved understanding of taxonomy or systematics

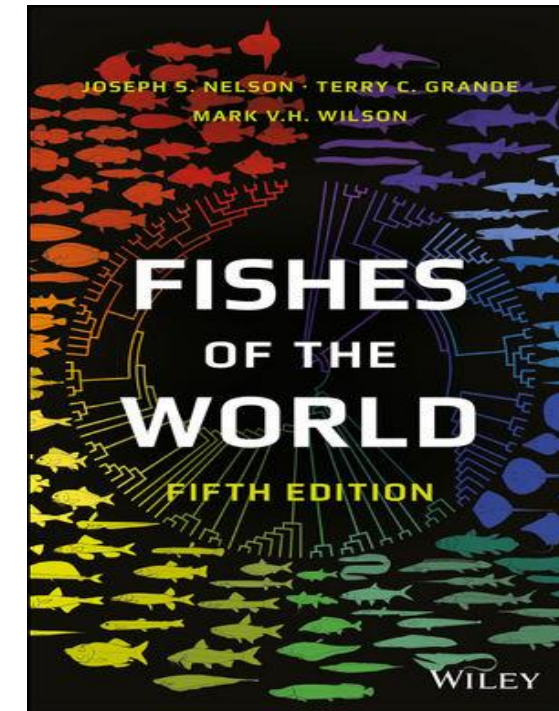
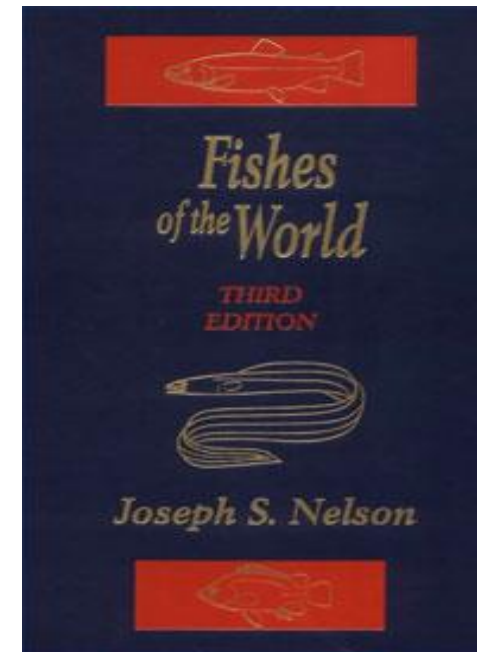
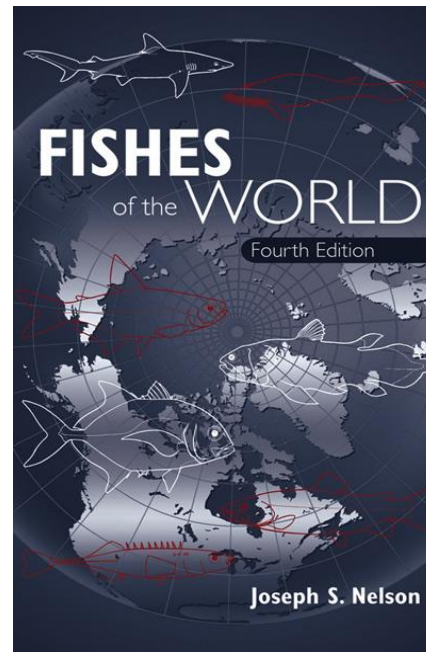
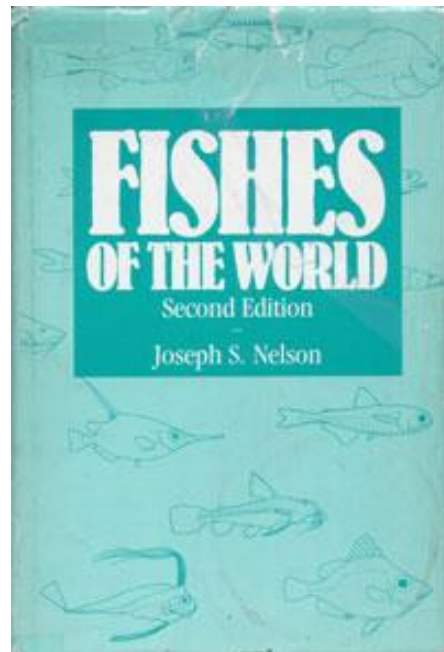
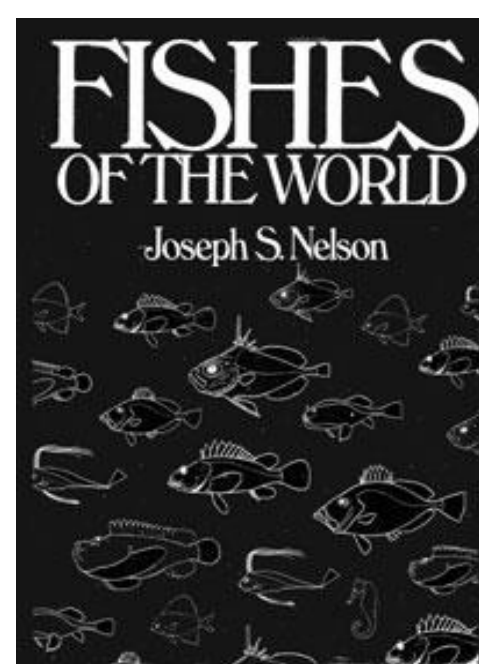
Correct application of ICZN rules

Correction of errors in spelling, etymology

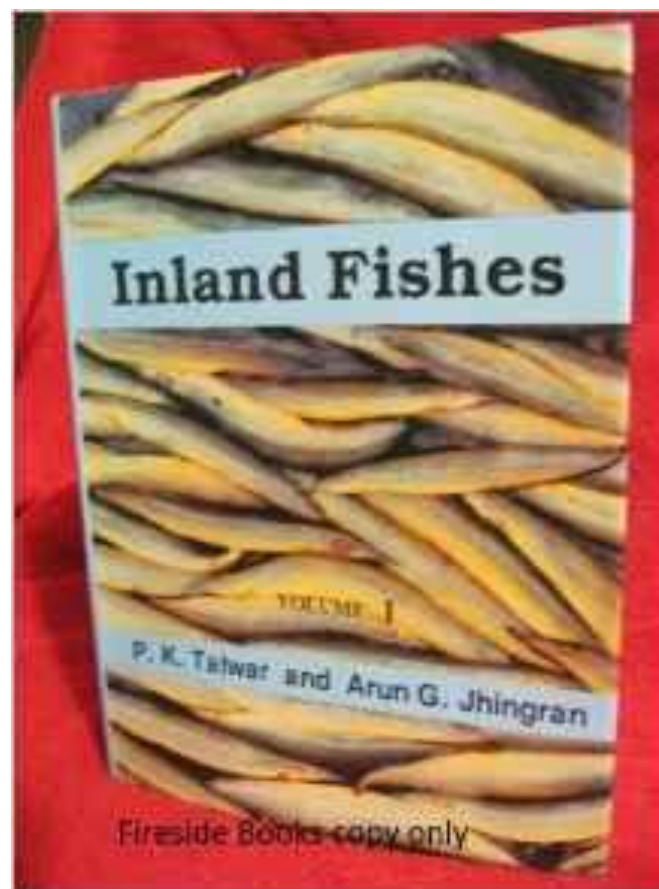
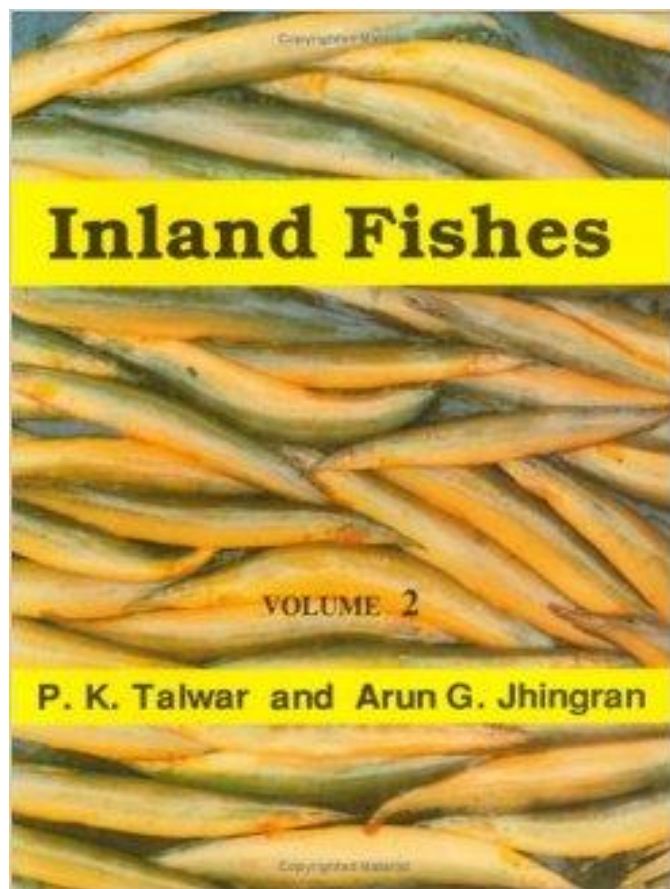
New synonyms and forgotten (but available) names

Integrative taxonomy

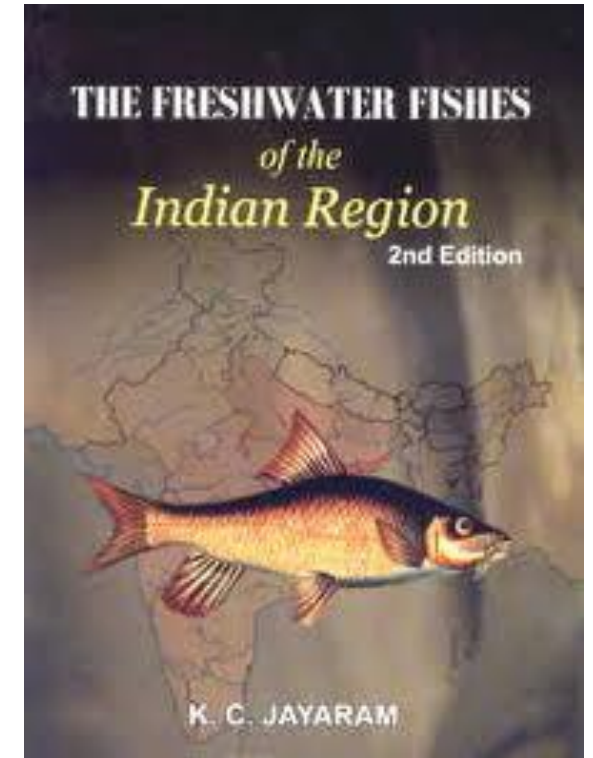
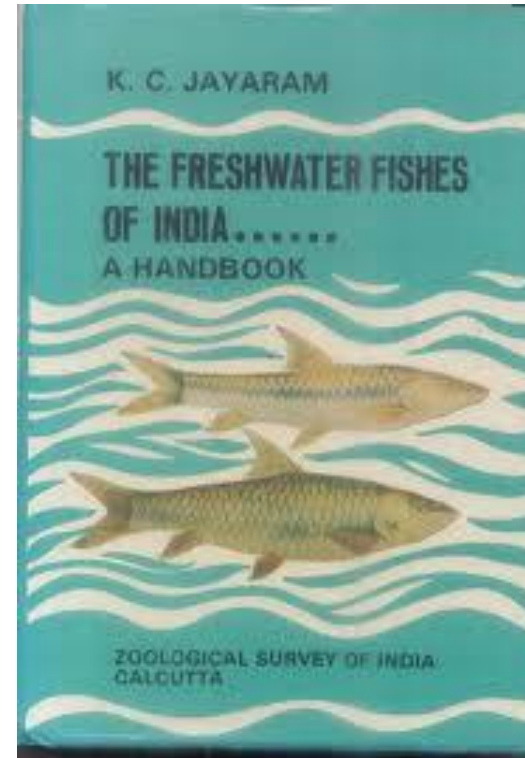
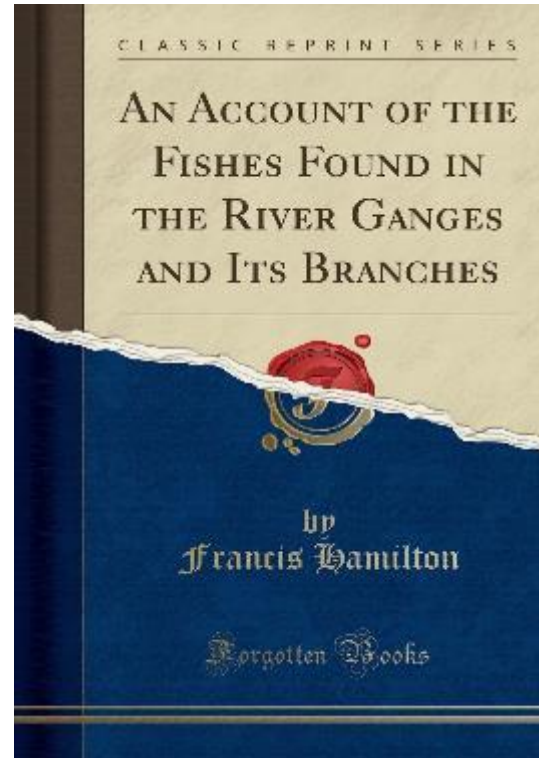
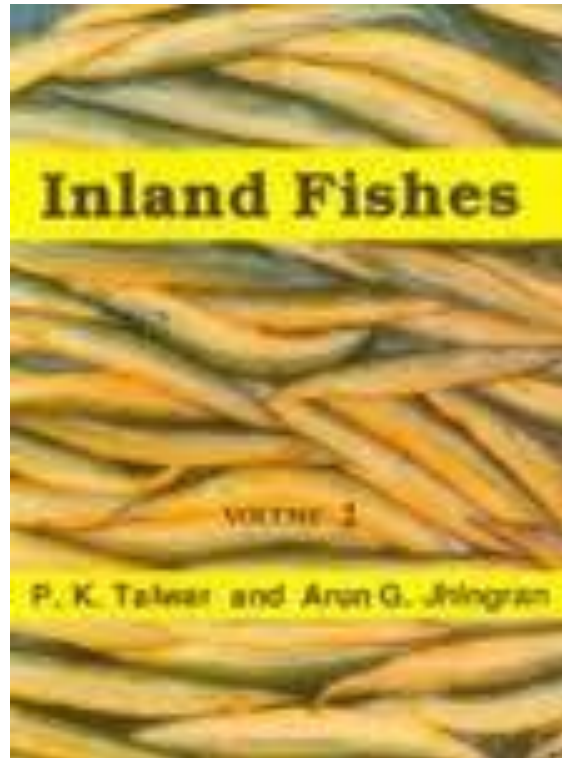
Updation is the key



Outdated by 28 years but widely used in the Indian subcontinent



How can you identify >50 species described during the last 20 years based on books published prior to 2000?



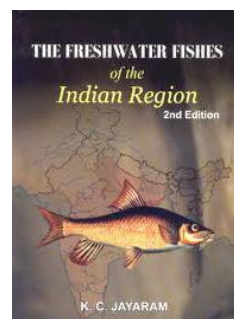
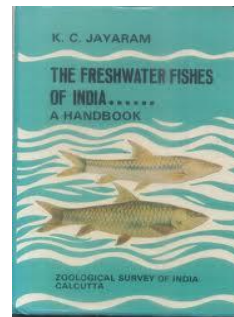
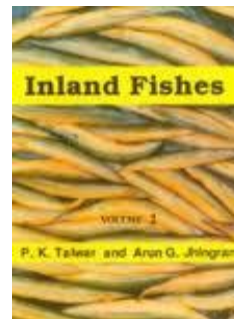
Fish taxonomy in the subcontinent 1800 to 1900

Colonial explorers – **very few poorly preserved specimens**

Lack of access to updated literature – many species described more than once

Lack of standardised procedures and techniques

Basic morphology – **detailed characters often ignored**



Journal of Fish Biology (2010) **76**, 1466–1473
doi:10.1111/j.1095-8649.2010.02575.x, available online at www.interscience.wiley.com

***Balitora eddsi*, a new species of hillstream loach (Ostariophysi: Balitoridae) from Nepal**

K. W. CONWAY* AND R. L. MAYDEN

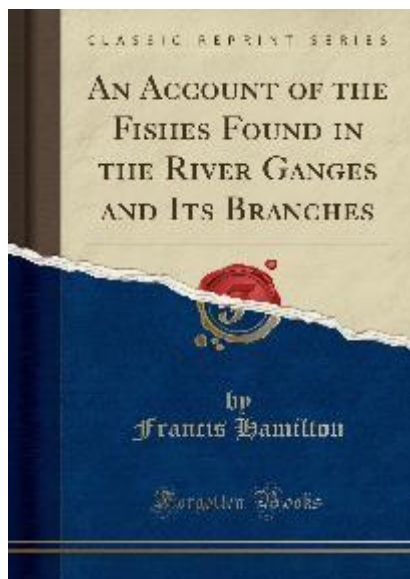
Department of Biology, Saint Louis University, 3507 Laclede Avenue, St Louis, MO 63109, U.S.A.

(Received 19 December 2008, Accepted 7 January 2010)

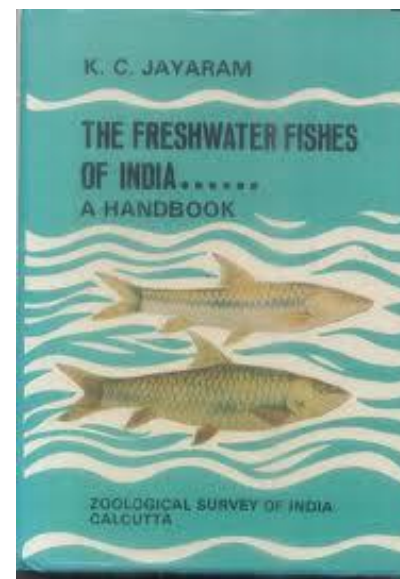
***Ditto Ticto*: complexity of Hamilton's Ticto barb**



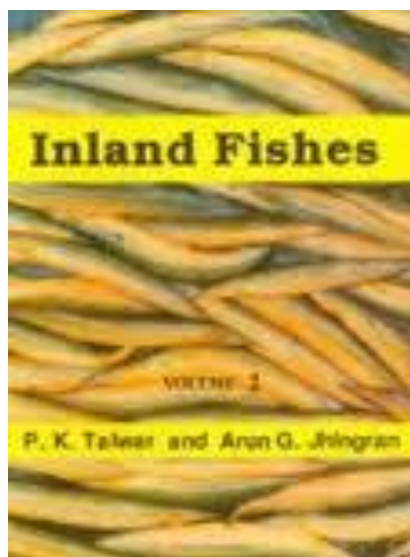
“an opaque *Cyprinus* of the *Puntius* kind, with one black spot on the lateral line above each pectoral fin, and another near the end of the tail; and with the back fin spotted, and its second ray indented behind”



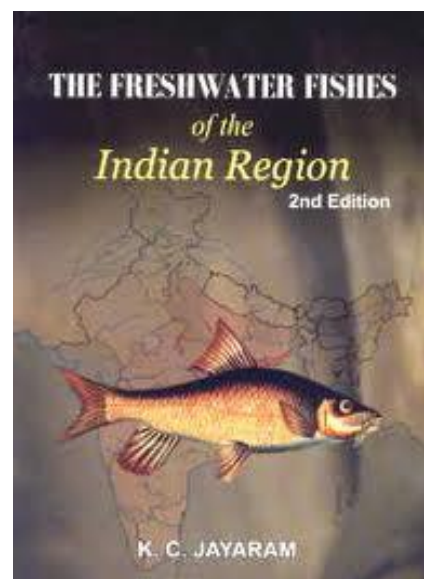
Cyprinus ticto



Puntius ticto

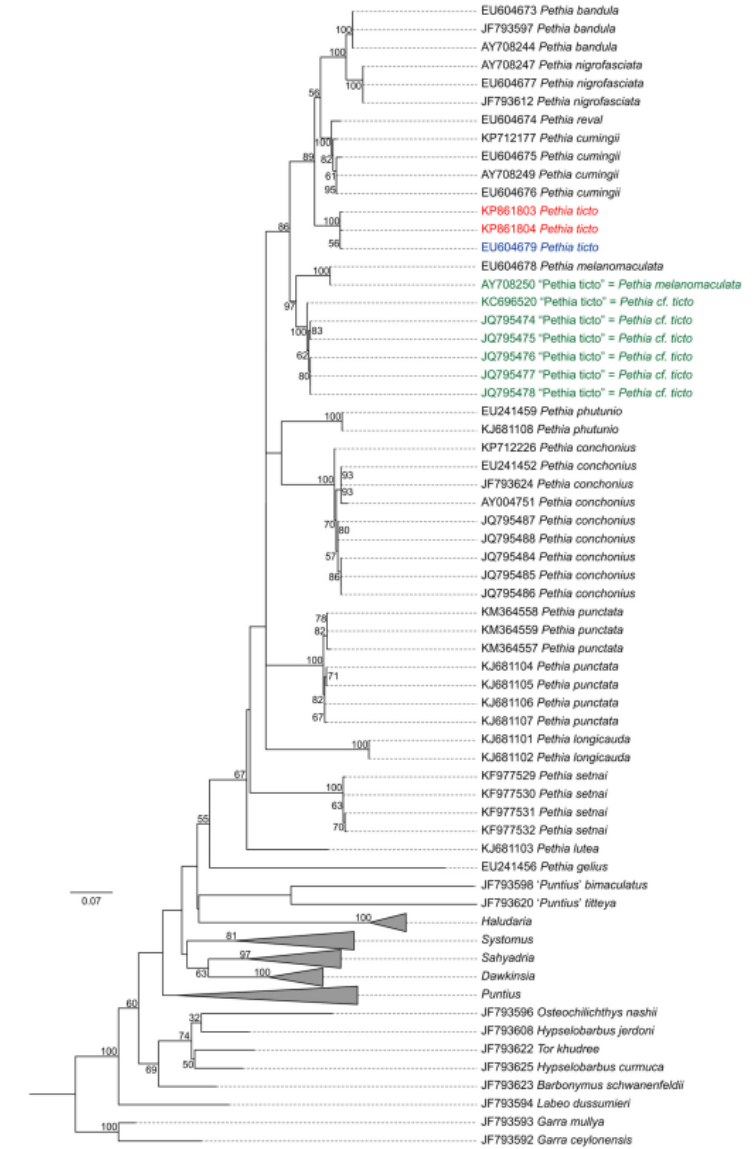
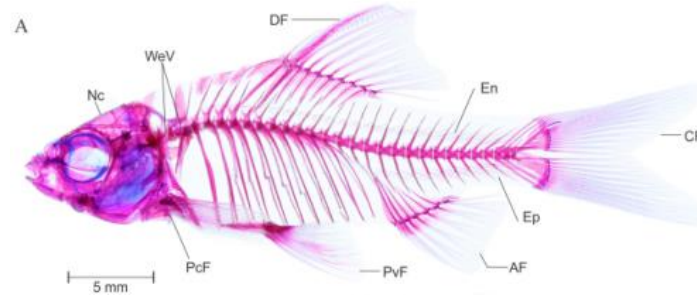
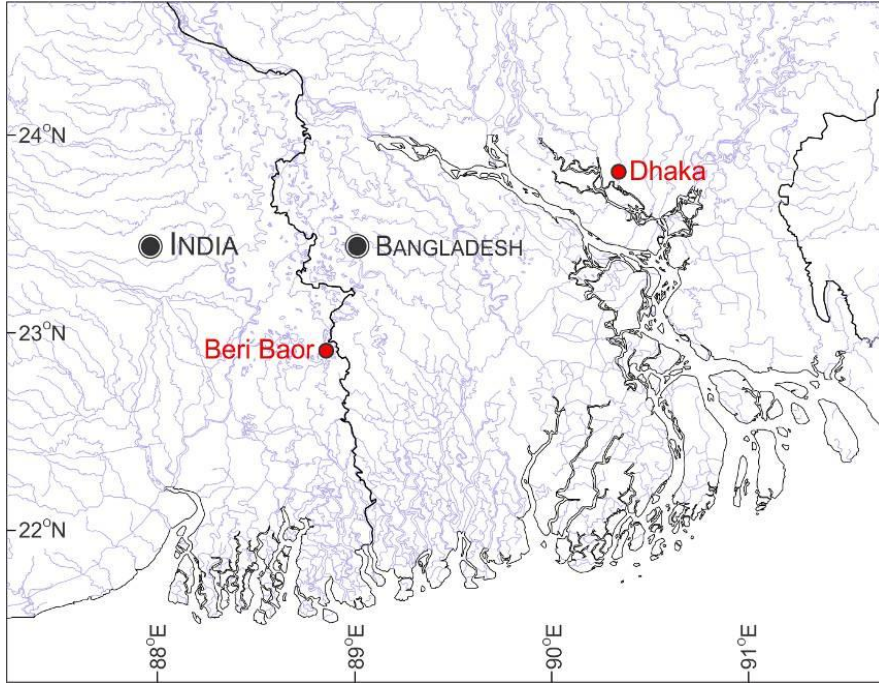


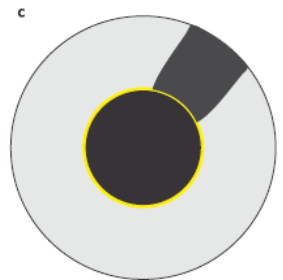
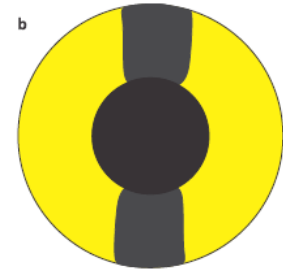
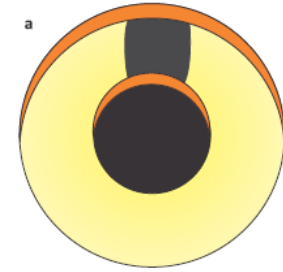
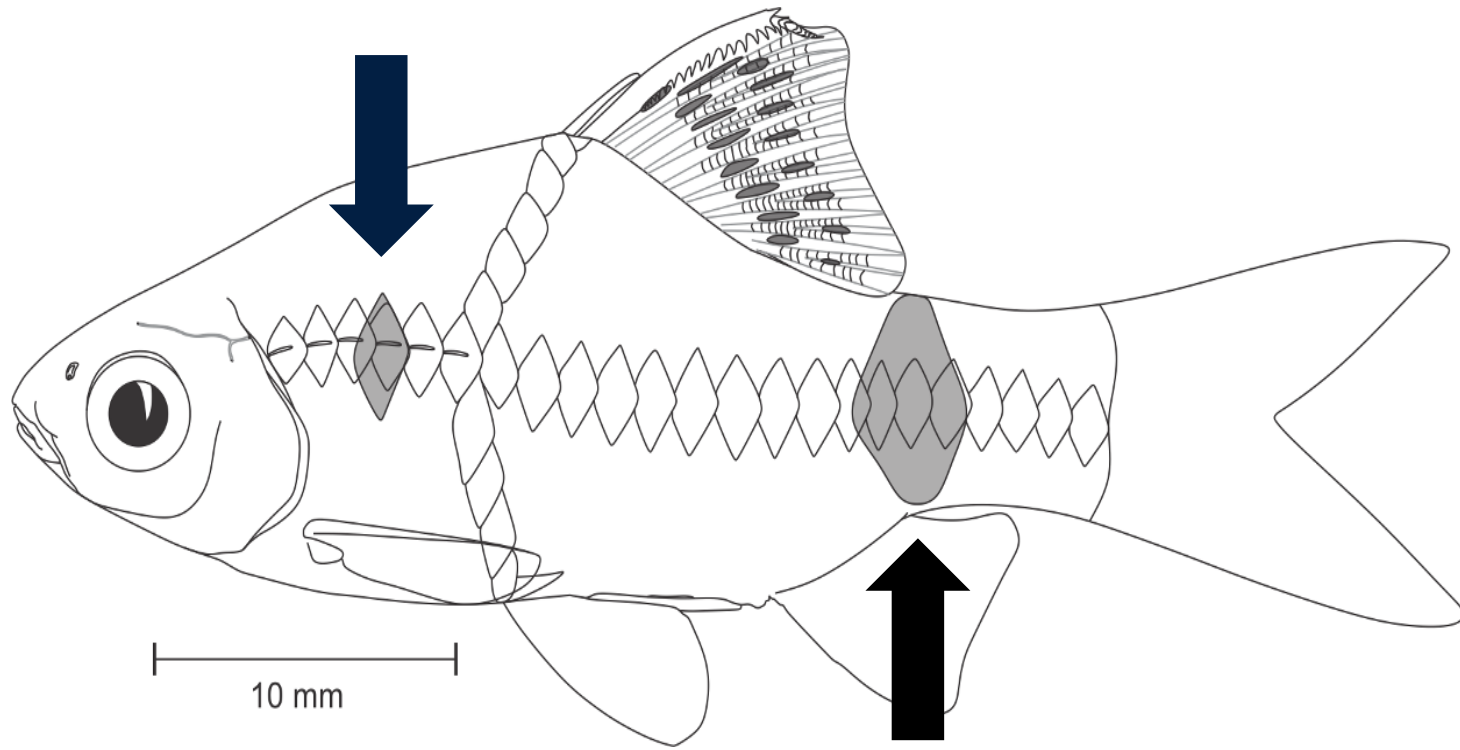
Puntius ticto

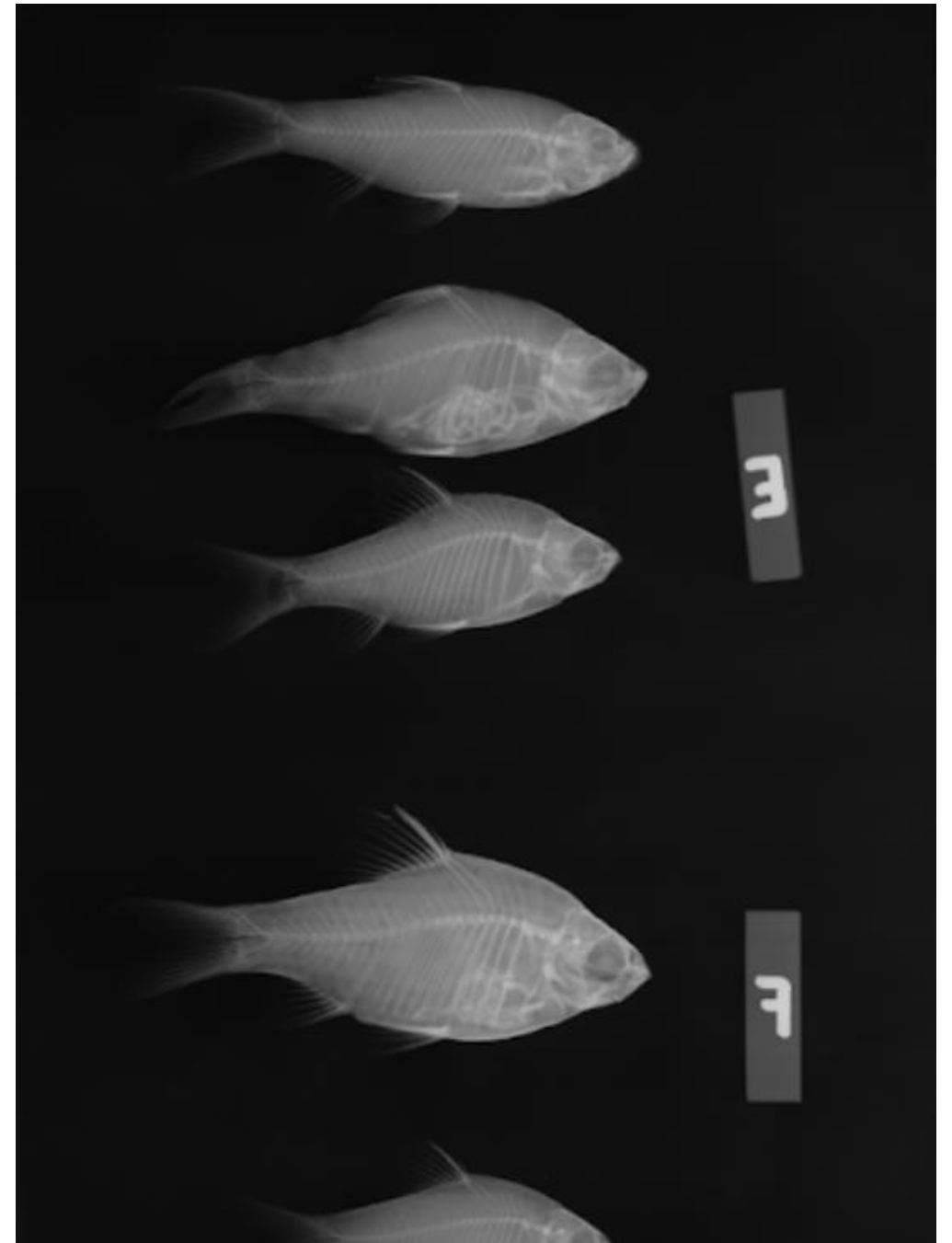


Puntius ticto











Zootaxa 4434 (3): 529–546

<http://www.mapress.com/j/zt/>

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Article

ISSN 1175-5326 (print edition)

ZOOTAXA

ISSN 1175-5334 (online edition)

<https://doi.org/10.11646/zootaxa.4434.3.8>

<http://zoobank.org/urn:lsid:zoobank.org:pub:58C8C3D8-EF95-4492-A3F2-15EA00E98DAC>

A new syntopic species of small barb from the Western Ghats of India (Teleostei: Cyprinidae)

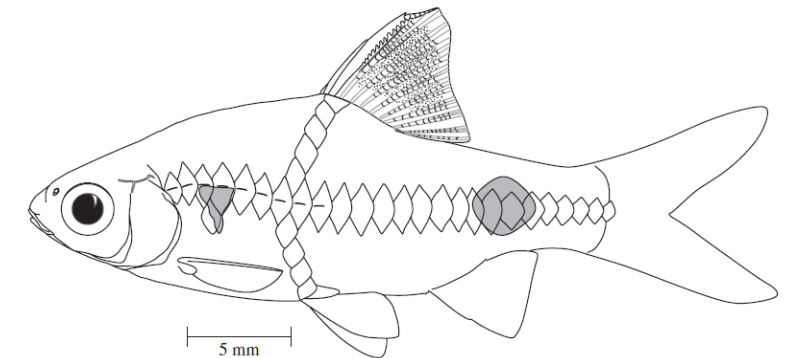
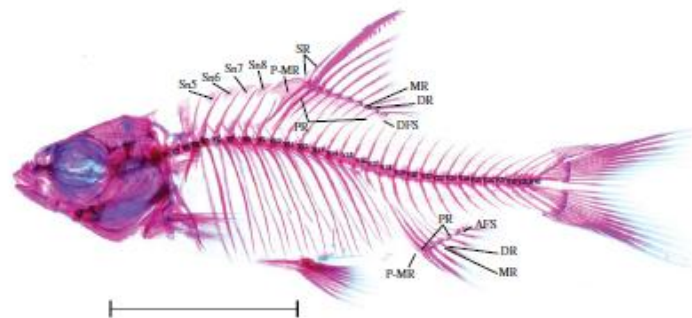
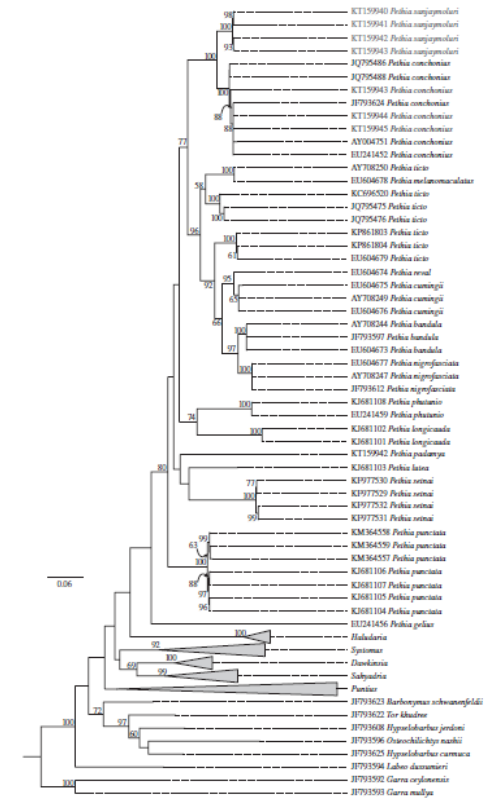
UNMESH KATWATE^{1,2}, PRADEEP KUMKAR³, RAJEEV RAGHAVAN^{4,7} & NEELESH DAHANUKAR^{5,6}



doi:10.1111/jfb.12980, available online at wileyonlinelibrary.com

***Pethia sanjaymoluri*, a new species of barb (Teleostei: Cyprinidae) from the northern Western Ghats, India**

U. KATWATE*, S. JADHAV†, P. KUMKAR‡, R. RAGHAVAN§ AND
N. DAHANUKAR||¶**



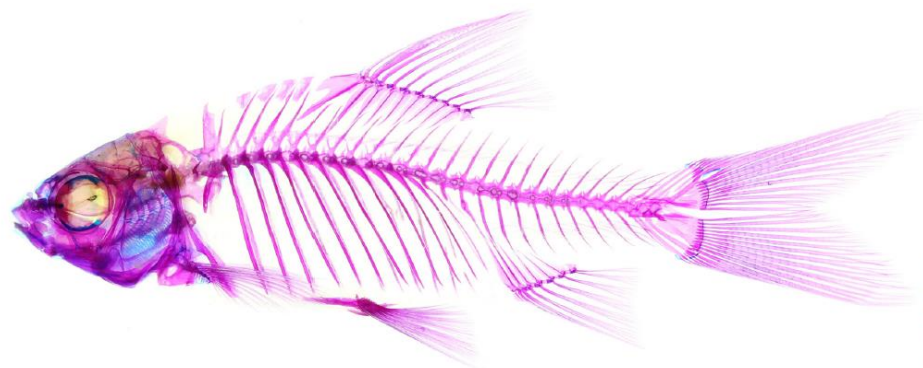
***PETHIA LUTEA*, A NEW SPECIES OF BARB (TELEOSTEI: CYPRINIDAE) AND NEW RECORDS OF *P. PUNCTATA* FROM NORTHERN WESTERN GHATS OF INDIA**

Unmesh Katwate¹, Chetana Katwate², Rajeev Raghavan³, Mandar S. Paingankar⁴ &
Neelesh Dahanukar⁵



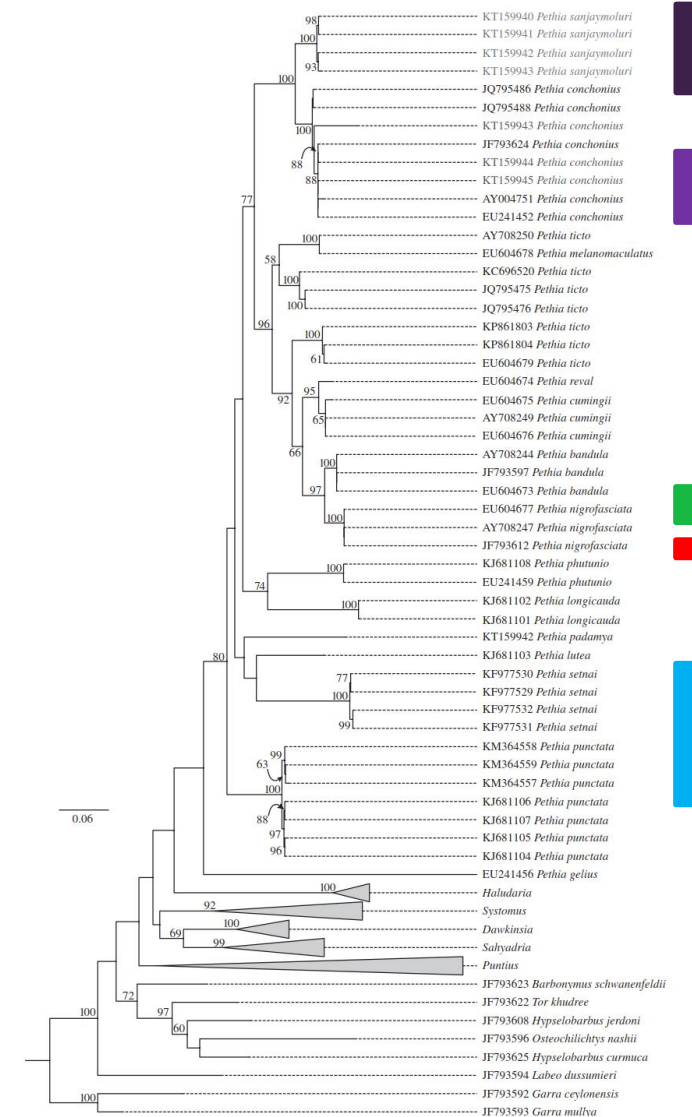
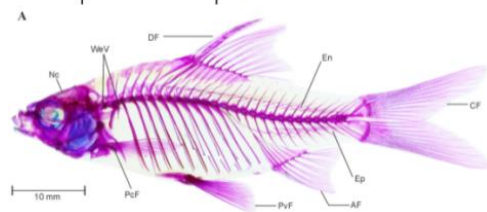
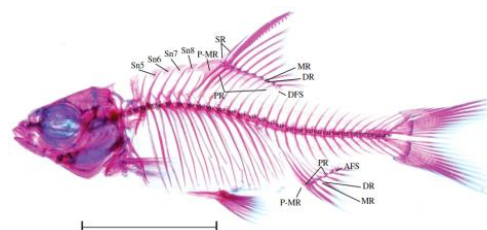
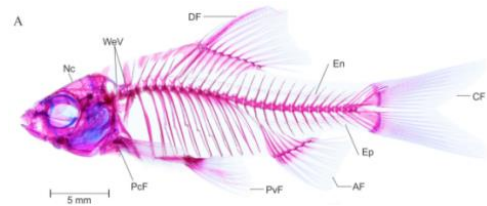
ISSN
Online 0974–7907
Print 0974–7893

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Katwate et al. (2016) *Journal of Fish Biology* 88: 2027 – 2050

Katwate et al. (2014) *Journal of Threatened Taxa* 6(6): 5797–5818

Katwate et al. (2015) *Zootaxa* 3964 (4): 401–418

Katwate et al. (2014) *Zootaxa* 3884(3): 201–221.

Katwate et al. (2014) *Zootaxa* 3846(2): 235–248.

Fin in a tube: But, what about the name?

The crappy world of barcode taxonomists



NCBI Resources How To Sign in to NCBI

GenBank Nucleotide Search

GenBank Submit Genomes WGS Metagenomes TPA TSA INSDC Other

GenBank Overview

What is GenBank?

GenBank[®] is the NIH genetic sequence database, an annotated collection of all publicly available DNA sequences ([Nucleic Acids Research, 2013 Jan;41\(D1\):D36-42](#)). GenBank is part of the [International Nucleotide Sequence Database Collaboration](#), which comprises the DNA DataBank of Japan (DDBJ), the European Nucleotide Archive (ENA), and GenBank at NCBI. These three organizations exchange data on a daily basis.

A GenBank release occurs every two months and is available from the [ftp site](#). The [release notes](#) for the current version of GenBank provide detailed information about the release and notifications of upcoming changes to GenBank. Release notes for [previous GenBank releases](#) are also available. GenBank growth statistics for both the traditional GenBank divisions and the WGS division are available from each release. GenBank growth [statistics](#) for both the traditional GenBank divisions and the WGS division are available from each release.

An [annotated sample GenBank record](#) for a *Saccharomyces cerevisiae* gene demonstrates many of the features of the GenBank flat file format.

Access to GenBank

There are several ways to search and retrieve data from GenBank.

- Search GenBank for sequence identifiers and annotations with [Entrez Nucleotide](#).
- Search and align GenBank sequences to a query sequence using [BLAST](#) (Basic Local Alignment Search Tool). BLAST searches CoreNucleotide, dbEST, and dbGSS independently; see [BLAST info](#) for more information about the numerous BLAST databases.
- Search, link, and download sequences programmatically using [NCBI e-utilities](#).
- The ASN.1 and flatfile formats are available at NCBI's anonymous FTP server: <ftp://ftp.ncbi.nlm.nih.gov/ncbi-asn1> and <ftp://ftp.ncbi.nlm.nih.gov/genbank>.

GenBank Data Usage

GenBank Resources

[GenBank Home](#)

[Submission Types](#)

[Submission Tools](#)

[Search GenBank](#)

[Update GenBank Records](#)

Not myths **BUT** truths!

Most researchers who work on 'molecular taxonomy' of fish have been trained as biotechnologists **NOT** biologists (and never taxonomists)!

Many institutions and research organizations carrying out work on molecular phylogeny of fishes **do not** have a trained taxonomist capable of proper identification!

> 50% of freshwater fish sequences from India deposited in GenBank have doubtful identity

Barcoding and molecular taxonomy is not a magic bullet!!

Rules for the BARCODE taxonomist!

Before putting a 'fin'/'tissue' in a tube, it is important to identify and give a name to the sample by inspecting the phenotype of the fish – **mostly never done!**

Voucher specimens are critical link between 'data' and 'taxa'

Every barcode has to be linked with a specimen stored in a publicly available and accessible collection – Museums or University collections

Importance of topotypes for molecular taxonomy

Genetic sequences should as far as possible be used from only **topotypic** material

Up to 15-20% genetic difference in sequences of topotypic vs. other material of the same species

Only <20% of the sequences of Indian freshwater fishes on GenBank originate from topotypic material

Phylogenetic position and relationships of mountain loaches (Teleostei: Balitoridae) of the Western Ghats as revealed by CO1 sequences

ARYA SIDHARTHAN^{1,7}, RAJEEV RAGHAVAN^{2,3*}, V. K. ANOOP^{1,8},
 ASHWINI KESKAR^{4,5} & NEELESH DAHANUKAR^{5,6}

Misidentifications in GenBank. Our study, which generated for the first time topotypic barcodes for several poorly known endemic balitorid species of the WG, and the resultant phylogenetic analysis, revealed that all 15 CO1 sequences of WG endemic balitorid loaches currently available in GenBank are misidentifications (species names in quotes in Fig. 2 and Table. 1). All currently available sequences assigned to *Ghatsa* and *Travancoria* in GenBank are misidentifications of the ‘*Bhavana australis* species complex’, which is widely distributed in the southern Western Ghats, as opposed to the restricted range of the two other genera (Fig. 2). Interestingly, one sequence of ‘*Bhavana australis*’ (MF591716) is an unidentified species of *Ghatsa* (Fig. 2). These misidentifications, however, are unjustifiable because *Bhavana*, *Ghatsa* and *Travancoria* have significant differences in overall morphology, specifically of the mouth structure (Fig. 3), which have long been considered diagnostic (Hora 1920; Randall & Page 2015). The 15 sequences mentioned above (and in quotes in Fig. 2 and Table 1) should, hereafter not be used for any phylogenetic analysis.

In addition to the 15 sequences for Western Ghats endemic balitorids, we also found that five sequences assigned to ‘*Balitora brucei*’ (HQ219171-HQ219175) available in GenBank, in fact belong of *Triplophysa kashmiensis*, a species of Nemacheilidae.

How to check for misidentified sequences?

Collate available sequences from GenBank

Include topotypic sequence with definite ID and backed by voucher specimens

Analysis: genetic distance and tree

Important for creating reference sequences for databases, eDNA studies

Some examples of bad taxonomic practices

Not examining type material

Not consulting original descriptions

Not understanding nomenclature

Describing species based on single specimen (unless this is extremely necessary; and the taxon is unique and very distinct)

Publishing in non peer reviewed journals (predatory online journals)

Not understanding sexual dimorphism (males and females of the same species treated as separate species)

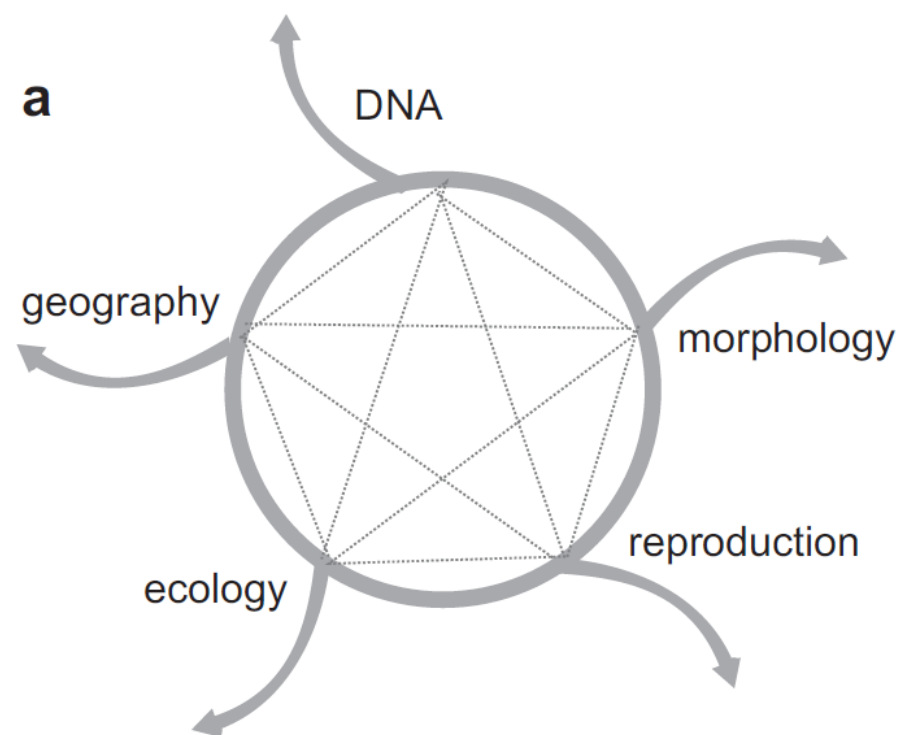


REVIEW

Open Access

The integrative future of taxonomy

José M Padial*¹, Aurélien Miralles², Ignacio De la Riva³ and Miguel Vences*²



Checklists: a word of caution

Always supported by voucher specimens and/or photographs

If in doubt – mention cf. OR aff. – and do not provide a definitive id

Publish in reputed taxonomy and biodiversity journals NOT predatory journals

Zootaxa, Ichthyological Exploration of Freshwaters, Checklist; Journal of Threatened Taxa

Not a taxonomic reference – use with caution

Mirrors : fishbase.org | fishbase.us | fishbase.de | fishbase.fr | fishbase.se | fishbase.tw | fishbase.cn | fishbase.sa | fishbase.ca

English | [Español](#) | [Português \(Br , Pt \)](#) | [Français](#) | [Deutsch](#) | [Italiano](#) | [Nederlands](#) | [简体中文](#) | [繁體中文](#) | [日本語](#) [[More...](#)]



FishBase

ver. (06/2016)

(33300 Species, 318500 Common names, 57400 Pictures,
53000 References, 2250 Collaborators, 700000
Visits/Month)



FishBase consortium

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[FishWatcher](#) | [Ichthyology Course](#) | [LarvalBase](#) | [Team](#) | [Collaborators](#) | [Quick Identification](#) | [Services](#)



Collaboration is the key to good taxonomy!

- Natural History Museum, London (BMNH)
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- Field Museum, Chicago (FMNH)
- Naturalis, Leiden, Netherlands (RMNH)
- Natural History Museum, Vienna, Austria (NMW)
- Museum of Comparative Zoology, Harvard (MCZ)
- California Academy of Sciences – Stanford University (CAS-SU)
- Raffles Museum of Biodiversity Research, Singapore (ZRC)
- Kunming Institute of Zoology (KIZ)
- Zoological Survey of India, Kolkata (ZSI) [Indian Museum]
- Bombay Natural History Society (BNHS)
- Rohan Pethiyagoda (cyprinids)
- Kevin Conway (cyprinids)
- Maurice Kottelat (loaches)
- Heok-Hui Tan (Loaches)
- Ralf Britz (Snakeheads, Badids, Sisorids)
- Heok-Hee Ng (Catfishes)
- Vishwanath Waikhom (Himalayan fishes)
- Jorg Freyhof (Garra, loaches)
- Sven Kullander (Cyprinids)
- Adrian Pinder (mahseer)

Catalog of Fishes

Institute for Biodiversity Science and Sustainability

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Online Version, Updated 30 August 2016

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Comments: [William Eschmeyer](#)

Catalog of Fishes - version of 30 August 2016 (Continuously updated since the early 1980s.)

Richard van der Laan is now a co-author of the Catalog of Fishes. This becomes Eschmeyer, W. N., R. Fricke, and R. van der Laan.

Other projects include Fricke (early references, new references, and corrections) and van der Laan (data entry and Bleeker literature).

In this edition, we provide 249 new species in 2016.

Bill Eschmeyer, Florida Museum of Natural History, 1659 Museum Road, Gainesville, FL 32611 USA and California Academy of Sciences. weschmeyer@calacademy.org

We are making additions to:

Van der Laan, R., W. N. Eschmeyer & R. Fricke (2014) (11 Nov.), **Family-group names of Recent fishes**. Zootaxa Monograph 3882 (1), 1-230. DOI 10.11646/zootaxa.3882.1.1

[Download the addenda to the family-group list as a PDF.](#)

See [Family Group Names](#) for future updates by R. van der Laan.



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Zoological Survey of India

भारत सरकार
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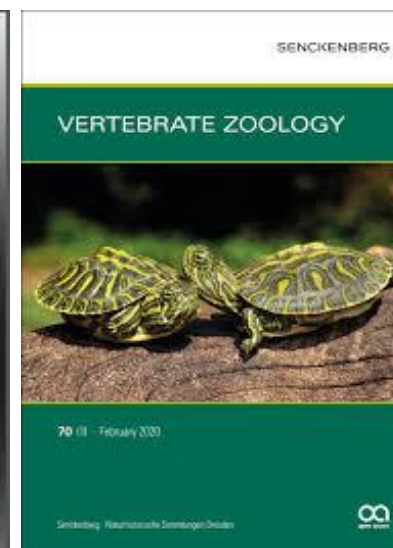
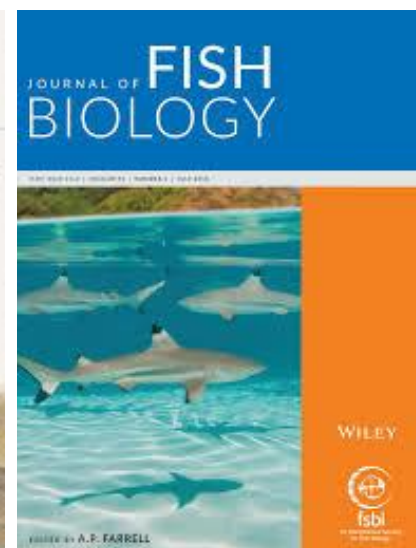
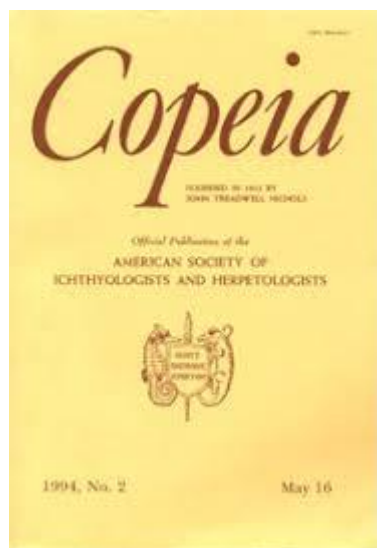
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Edited, with an introduction and commentary
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Thank you!