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Methods and Procedures of Sampling, Preservation and Identification for Fish Taxonomy Studies

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Abstract: Taxonomyhas two important roles: to name organisms and to classify them. Classifications are useful because they contain information about relationships.All species in the same genus should share many behavioral, biochemical, ecological and biological properties because they are closely related evolutionarily. The effect of pollution on a species at one location should be similar to the effect on a close relative living in a different area. Those in the same family (next primary category up) similarly shares many but fewer features. Classifications thereby have predictive value. The changing nature of classifications and scientific names (because of changing ideas of relationships and because of technical [nomenclatural] rules changes) makes it almost impossible to know under which species, genus, or even family names one will find pertinent information in the prior literature or in specimen collections.Another problem is that scientific names are frequently misspelled in scientific publications, in collection records for museum holdings and by abstracting services. Often a name is misspelled because the spelling as originally presented was not verified by subsequent workers. Therefor, proper identification of organisms is necessary to describe the species at any level, if decisions are to be made about preserving species, then relationships among species must be known to determine the evolutionary uniqueness of the species.

Key words: Taxonomy · Classification · Nomenclature · Scientific name

INTRODUCTION

Taxonomy is the science of the description and classification of organisms, essential in theoretical and applied biology. The word taxonomy is derived from the Greek words *taxis* (=arrangements) and *nomos* (=law). Taxonomy and systematic have two main goals: 1. primarily of academic interest: the study of the diversity of living organisms and their phylogenetic relationships; 2. immediate practical interest: inventories, surveys, documentation of biodiversity and the compilation of identification tool. For the proper management of natural resources, we need information on the numberof species and their identification [1].

Correct species identification is the basic starting point for any type of biological study, particularly on wild populations and it is important that each name applies to only a single species and that each species is known by a single name [2]. Specific rules have been established for recognizing, naming and classifying species to avoid redundant descriptions or the use of the same name for more than one species. Some people who fail to differentiate between two species by human eye often name them as cryptic species and molecular techniques and complex statistics are used to justify recognition of species. However, these so called cryptic species because no trained taxonomist ever had an opportunity to examine them [1].The rapid and accurate characterization of species using morphological data is a critical constraint. To overcome this, species identification using molecular tools has been supplemented in many studies in present era [3, 4]. Species identification by DNA bar-coding is based on sequencing a short standardized genomic region of the target specimen and comparing this information to asequence library from known species [3]. DNA bar-coding is an alternative to traditional taxonomic methods thatcould become a useful tool for coral reef conservation [4, 5].

The general interest about biodiversity conservation, the advances of internet and web pages, progress in molecular techniques, the development of statistics in phylogeny and a global perspective on taxonomy is

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giving some lights in taxonomy and it is becoming fashionable again. Identification, cataloguing, studies on the biology of the fishes, assessment and evaluation for their criteria has become inevitable for their conservation and sustainable utilization. The chapter gives the systematic approaches towards a classical fish taxonomy and aims at easy identification of freshwater fishes.

Fish Sampling for Identification

Collection of Specimens: In order to collect the specimenone must have the knowledge of all possible geographic information of the surveyed place, including the distribution of various types of vegetation, altitudes, seasons, means of transport, lodging, etc. However, main emphasis should be given to the basin concept not to the political boundaries of the aquatic system. It is also necessary to examine the previous collection of the concerned group to know the various localities of the already collected materials.The collection should be made from all zones of water body, including surface, bottom, middle, upstream, midstream and downstream.

Methods of Collection: There are numerous methods to collect fish specimens round the year. Fishes were collected using nets, traps, hooks and lines, electro-fishing equipment, hand picking, buying from local fisherman and from local markets, etc.

Data Collection: The specimens which are being collected must bear collection data. A specimen without such data is completely useless for a taxonomist. Thus, every specimen collected must be labeled having the following data:

Geographical Location: Country, state, village, drainage basin, name of river, lake, etc. A fish taxonomist should have a rich knowledge of the drainage concept. Some fish are endemic to a particular basin and they are not found in another basin.

Date of Collection: Date on which the specimen was collected

Name of the Collector: Name of the fisherman, scientist, etc.

Coordinates: To be noted using GPS

Colour: Colour of the specimen in fresh should be noted.

Fixation and Preservation: The collected specimens should be first fixed in the preservatives (10% formalin or 70% ethanol) in a large container so that the specimen maintains its original shape after fixation. Preservation in tight containers distorts the shape. Fishes may also be preserved in buffered 10% formalin. Buffered formalin is prepared by adding three grams of borax per litre of 10% formalin solution. It retards the tissue shrinkage and prevents decalcification of the tissue. A general rule is maintained not to have more than 40% of biomass per container of formalin during fixation (Figure 1).

After fixation the specimens are put in a glassstoppered bottles or screw capped jars with the snout pointing downwards and then filled with freshly prepared preservative. An incision should be made on the abdominal wall of the fish length 10-30 cm to one side of the mid-ventral line with a scalpel knife or scissor. And for the fish longer than 30 cm undiluted concentrated formalin is injected with the help of a hypodermic syringe throughout the abdomen (Figure 1).

Tissue Sampling: Fresh tissue in the form of muscle, fins, etc. are collected from certain specimens and preserved in ethanol for molecular studies.

Morphometric and Meristic Characters: Morphometry refers to body proportions and meristics to counts.Measurements were made point to point on the left side of the specimen whenever possible.

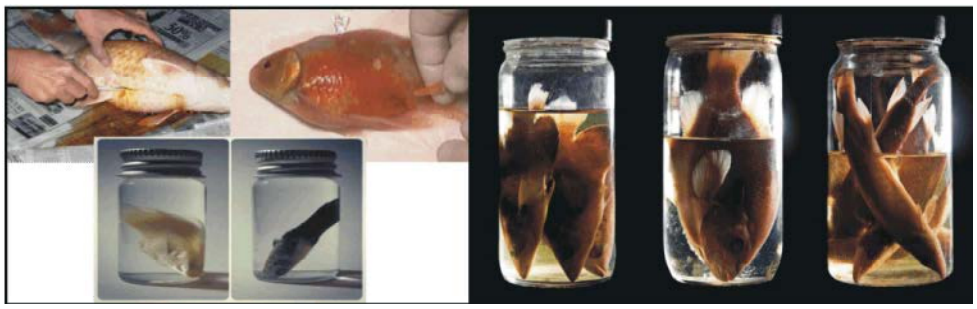

Fig. 1: Methods of fish preservation

Table 1: General format for cataloguing the fish specimens

Reg.No.	Zoological name	Family	Locality, latitude, longitude, etc.	Collector or donor	Date of collection	No. of specimen	Determined by	Date of entry	Remarks (whether holotype or paratype)
1									
2									
3									
4									

Proportion of body parts are expressed in per cent of standard length and parts of head in head length. Counts include fin rays: soft, hard, spinous, simple and branched; lateral line: longitudinal and transverse; predorsal scales, circumferential and circumpeduncular scales; branchiostegal rays, gill rakers, pharyngeal teeth, vertebrae, etc.counts and measurements usually followKottelat[6] unless it is modified by different workers for particular genus or family for convenience. The reading should be entered in a data sheet.

Osteology: Osteological data were taken from cleared and Alzarin stained specimens. Disarticulations of bones, without damaging their structure, are done by treating the fresh specimens directly in 2% KOH solution without any preservative. The specimens are suspended in the solution for 5-7 days to facilitate the natural decomposition of muscle and ligaments. Addition of preservatives should be avoided since it caused hardening of these tissues, which result in the damage of the bones at their sutures at the time of manual separation. After this treatment, the bones are stained with Alzarin. The stained bones are preserved in glycerine solution or 10% formaldehyde buffer solution. Identification of bones was based on Prokofiev [7, 8]. Rare specimens are not dissected. Instead radiographs may be taken for osteological studies.

Cataloguing of Specimens: The entries usually followed in cataloguing are consecutive museum number, scientific name, locality, date and collector. The entire specimen collected from one locality or district by one expedition are catalogued together. The specimens are usually catalogued after they are identified at least up to genus level.The museum register must have at least the following information (Table 1).

Comparison with the Nearest Congeners: The specimen under examination is compared with its congeners. Firstly, they are compared with the species from the same basin and then with the species of the same genus, the comparison is normally done with the type specimen from their respective type locality. The best means to identify the specimen is the direct comparison. When the literature on a species is not available, a specimen is compared with the already identified one. This approach is useful at any level. The type specimens are the most authentic at all. The original verbal descriptions of specimens are the permanent records of the attributes of a given species.

Data Sheet: Meristic counts (fin count, scale count), different body ratios, general body coloration, etc. are entered in a data sheet. The description is thus one of the most essential steps in the taxonomic studies. If a taxonomist described a new species, the description given by him will then serve as the basis to identify this new species for future workers. It includes diagnostic as well as those characters by which it can be differentiated from yet to be discovered species. Descriptions including meristic counts, different body ratios, etc. are written in a very elaborate manner. The colour of the specimen will be changed due to formalin preservation so a taxonomist should note the colour of the fish, spots, blotches, number and design of bands on the live fish itself and also after preservation.

Key: This is one of the most commonly used methods for identification. The new species is then studied and we see whether it fits into the available key of that particular genus, if not then we can easily prove that it is a new species.

Reporting: The species is reported bywell-organizeddescription. It normally includes original references based on which the species is identified and confirmed, records of materials examined, diagnosis, description, distribution etc. In case of new species, the registration number of new type species, size, locality of collection, collectors name, date of collection and museum where deposited should be mentioned.

Diagnosis: Diagnosis includes only few characters by which the species in question can be easily separated from other similar to its nearest congeners.

Systematic Description: A systematic description means description of the species based on the observation. It includes descriptions of different body parts in respect of shape, position, counts and proportions. Details of osteology, if done, may also be reported. Colour description in fresh and preserved state is important. The description should be supported by tables and illustrations of the whole body and the important parts to show its diagnostic characters.

Summary: Taxonomists have two important tasks: to name organisms and to classify them. The system of hierarchical classification and a two-word system for naming species began with Linnaeus in 1758. The two-word name for species consists of a generic name and a specific name. A genus may contain more than one species and species are placed together in a genus based on perceived genetic affinity (as determined mostly by morphological differences and similarities, although biochemical techniques are providing new, additional information). Subspecies are sometimes used to define smaller categories within a species. Taxonomists discover or describe species (1) by assembling specimens through fieldwork and/or by borrowing from museum collections, (2) by studying variation, (3) by grouping the specimens into species categories, (4) by comparing these with previously described species, (5) then naming the new species following specific rules (ITZN 1985, 1999) and (6) by publishing the information in scientific journals and books. Monographs contain thorough treatments of all the species in a larger group, such as a genus or family and monographs represent the latest summary of information for that group.

It is important to understand (1) why good taxonomic databases are essential for studying biodiversity, (2) what taxonomy entails, (3) why a hierarchical classification is useful and (4) why classifications and names change, thereby making it more difficult to accumulate and keep track of information for many purposes from conservation management to inventories, to species entering commerce, etc.

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REFERENCES

1. Kottelat, M., 2013. The fishes of the inland waters of Southeast Asia: a catalogue and core bibliography of the fishes known to occur in freshwaters, mangroves and estuaries. The Raffles Bulletin of Zoology Suppl., 27: 661-663.
2. Rainboth, W.J., 1996. Fishes of the Cambodian Mekong. FAO Species Identification Field Guide for Fishery Purposes. FAO, Rome. xi+265, 27 pis.
3. Chandra, S., A. Barat, M. Singh, B.K. Singh and R. Matura, 2012. DNA Bar-Coding of Indian Coldwater Fishes of Genus *Schizothorax* (Family: Cyprinidae) from Western Himalaya. World Journal of Fish and Marine Sciences, 4(4): 430-435.
4. Vinoth, R., M. Gopi, K.V. Dhaneesh and T.T. Ajithkumar, 2012. First Record of Yellowbelly Damselfish *Amblyglyphidodonleucogaster* (Bleeker, 1847) from the Lakshadweep, India. World Journal of Fish and Marine Sciences, 4(1): 07-10.
5. Vinoth, R., T.T. Ajith Kumar, M. Gopi, K.V. Dhaneesh, 2012. First Record of Yellowbelly Damselfish *Amblyglyphidodonleucogaster*(Bleeker, 1847) from the Lakshadweep, India. World Journal of Fish and Marine Sciences, 4(5): 439-442.
6. Kottelat, M., 2001. Fishes of Laos. WHT Publications (Pte) Ltd, Colombo, Sri Lanka.
7. Prokofiev, A.M., 2009. Problems of the classification and phylogeny of nemacheiline loaches of the group lacking the Preethmoid I (Cypriniformes: Balitoridae: Nemacheilinae). J. Ichthyol., 49: 874-898.
8. Prokofiev, A.M., 2010. Additions to the species composition of Morays of the Bay of NhaTrang (South China Sea, Central Vietnam). Journal of Ichthyology, 50: 38-43.