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Introduction

Both from the taxonomic as well as the management point of view, a correct identification of marine fishes is important. The 'Folk taxonomies' that developed in earlier times contained 250 to 800 kinds of animals. The invention of printing in the fifteenth century and world explorations have made expansion of taxonomy both possible and inevitable. A number of attempts to classify animals were made, but were limited in scope until Linnaeus introduced the binomial nomenclature in the eighteenth century. He has recognised species as the basic unit in nature. This meant that it is necessary to describe only one individual to know of an entire species. But later Linnaeus and his successors have encountered natural variation within each species and they were forced to recognise 'varieties'. The scientific names based on binomial nomenclature provide names that are recognised all over the world. Each name has two parts: the genus name which is always capitalised and the trivial name or the species epithet which is not capitalised. The two names together constitute a species name.

Continuing the effort to catalog all kinds of animals, taxonomists are concerned not only with the description of new forms but also with the placing of each form within a taxonomic system that shows its relationship to other forms.
Morphometric Measurements

Morphometric and Meristic Characters

Reproductive isolation, hybridization, etc.

Test for patterns, 5. Karotype, 6. Electrophoreses and 7. Test for meristic counts, 3. Anatomical characteristics, 4. Count characters. These include: 1. Morphometric measurements and ratios, 2. The data are gathered using both old and new techniques, and adequate coverage of the characteristics are important, validating analysis of large amounts of data, especially when complex matrices are too large to be computed with current computing power. Laboratory data on morphometry and anatomy, foremost among these tools, are the most important. Computer programs are now being used to supplement and strengthen the more conventional analyses; computer software, geoastronomic databases, and geographic databases, from such varied fields as paleoclimatology, genetics, behavior, and modern taxonomists may be able to draw information up to the animal kingdom.

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describing fish species may be of limited usefulness.

Three overall length measurements in common use are 1. Standard length, 2. Fork length and 3. Total length. The latter two measurements are more commonly used in fishery biology. Overall length measurements are made between perpendiculors along the median longitudinal axis from snout (U, the position of the maxillary symphysis) or from the tip of the lower jaw (L, the mandibular symphysis), vide Fig. 3.2.1. Measurements from L are taken with the mouth closed. If the lower jaw is projecting, measurements from the symphysis may necessitate provision of a special stopped nose piece on the measuring board. Generally measurements are made on the left side of the fish, with the right side of the fish resting on the measuring board. For definitions of positions, reference may be made to the next section.

1. Standard Length: Taken from U to the tip of the hypural bone (urostyle). This varies from species to species.

2. Fork Length: Measured from U or L to the cartilaginous tip of shortest or median caudal ray.

3. Total Length: Measured from U or L to the longest caudal fin ray, upper or lower, or an average of them both.

Longitudinal measurements other than overall length are also made between perpendiculors using measuring board with, for example a sliding cursor. When these are made radially from point U, calipers are recommended. Point-to-point measurements are sometimes made on big fishes such as tunas by tapes. These would be indicated by the word 'Surface' as these are not generally recommended. All measurements from LX to LM and also their 'upper' equivalents are grouped under the general name 'total length' LT. LM has been called 'bilobular length' and total 'auxiliary length'. The word 'Extreme' is used in LX,
LX' instead of 'maximum length to avoid confusion with the asymptotic length. LF and LF' are also called 'median' length or 'midcaudal' length. The term 'depth' is used instead of 'height'. Again the term 'width' is not recommended as an alternative to 'breadth' but 'thickness' would be an ideal term. Pectoral and ventral fins are to be measured in the folded position opposed to the body side (to keep the rays straight) from foremost visible point of insertion to the distal tip of the membranous edge.

Definitions of position

U Maxillary symphysis.
L Mandibular symphysis.
OO Anterior edge of orbit.
O' Posterior edge of orbit.
J Posterior edge of mandible (buccal commissure).
Y Gill-cover notch.
G Posterior bony edge of operculum.
G' Posterior membranous edge of gill cover.
P Anterior point of insertion of the first pectoral fin ray.
D1 Insertion of anterior dorsal (intersection of anterior margin of first dorsal spine, fin held erect with the contour of the back).
D1' Position of last ray of anterior dorsal.
D2 Insertion of first ray of posterior dorsal.
D2' Position of last ray of posterior dorsal.
Z Anterior edge of cloaca.
A Insertion of first anal fin ray.
A' Position of last anal fin ray.
B Insertion of dorsal lobe of caudal fin.
S Posterior tip of urostyle (forward protuberance of hypural blade).
S' Posterior edge of fleshy peduncle or of pigmented zone.
S'' Point of upper caudal keel.
S''' Posterior limit of silvering (either last scale of the lateral line or the posterior zone limit of
the scale covered by the peduncle).

F Cartilaginous tip of shortest (median) caudal ray.

F' Membranous edge of caudal fin at fork.

N Distal tip of the longest caudal fin ray with lobe normally extended.

N' Distal tip of the longest ventral fin ray with lobe normally extended.

M Point where line NN' intersects median longitudinal axis.

M' Midpoint of line NN'.

X Distal tip of longest dorsal caudal fin ray, with the lobe brought to the median longitudinal axis.

X' Distal tip of the longest ventral caudal fin ray, with the lobe brought to the median longitudinal axis.

Overall length measurements:

LT and UT total length (any extreme or normal length).

LX Dorsal extreme length.

LX' Ventral extreme length.

LX'' Greater extreme length (LX or LX', whichever is greater).

LN Dorsal normal length.

LN' Ventral normal length.

LN'' Greater normal length (LN or LN', whichever is greater).

LM Median normal length.

LM' Mean normal length.

LF Midcaudal length.

LF' Fork length.

LS Standard length to urostyle (or to some external feature corresponding with it).

LS' Standard length to peduncle (or to the pigment under scales).

LS'' Standard length to keel.
LS''' Standard length to silvering.
LB (Dorsal) Body length.

Other longitudinal measurements
UJ Maxillary sheath length.
LJ' Mandibular length.
UO Snout length.
UY Upper head length.
LG Opercular head length.
Lg Greatest head length.
OO' Orbital diameter.
Id Longitudinal iris diameter (cf, Ih and Ig).
Ed Longitudinal pupil diameter (cf, Eh and Eg).
O'Y Postorbital distance.
UD1 Preanterior dorsal distance.
UP Prepectoral distance.
UV Preventral distance.
UD2 Preposterior dorsal distance.
D1D1' Anterior dorsal fin base length.
D2D2' Posterior dorsal fin base length.
UA Preanal distance.
AA' Anal fin base length.

Vertical measurements (Perpendicular unless otherwise stated)
Oh Orbital depth (from orbital crest to lower edge of maxillary, passing over middle of pupil).
Ih Perpendicular iris diameter.
Eh Perpendicular pupil diameter.
YJ' Head length.
D1P Back depth (oblique).
D1V Anterior dorsal depth (or dorsoventral depth).
h Greatest depth.
D2Z Posterior dorsal depth.
D2A Dorsoanal depth (slightly oblique).
h' Perpendicular anal depth.
q (Least) peduncle depth.
Lateral measurements

- PP: Pectoral breadth.
- \( b \): Greatest breadth.
- \( CO \): Interorbital distance (at level of pupil centre).

**Other measurements**

- \( D1h \): Anterior dorsal height distance from insertion to tip of longest spine.
- \( D2h \): Posterior dorsal height (distance from insertion to tip of longest spine).
- \( Ph \): Pectoral fin length.
- \( Vh \): Ventral fin length.
- \( Ah \): Anal fin height.
- \( Ch \): Dorsal caudal fin length.
- \( Ch' \): Ventral caudal fin length.
- \( Ch'' \): Greater caudal fin length.
- \( Ig \): Greatest iris diameter.
- \( Eg \): Greatest pupil diameter.
- \( g \): Greatest girth.
- \( VW \): Length of interventral flap.
- \( NN' \): Spread caudal distance.

Skeletal dimensions

- \( Ax \): Axial length (anterior face of vertebra 1 to tip of urostyle).
- \( Sk \): Skull length (maxillary symphysis to posterior occipital boundary).
- \( An \): Anatomical length (\( = Ax + Sk \)).

**Meristic counts**

These counts are generally considered to be the most reliable taxonomic characteristics because most are easy to make and reliable. It includes anything on a fish that can be counted, such as the number of vertebrae, fin rays, spines, scale rows, pyloric caecae, lateral line...
The first caudal vertebra is that with which possessing an elongate process or processus (and caudal portions) are inserted into procercoid (and caudal portions). They may be divided into species and within genera and species. They are usually vertebrate in function, and the number of vertebrae is equal to or more than the number of main segments of a vertebral column.

Without pecyples to other pecyples, the backbone to varying functions. Every structural feature of the vertebrae changes the form of the vertebrae into another. Hence the form of the vertebrae corresponds with other populations. The number of individuals as that of the mean, range and standard errors can be determined. If the figures involved are to be counted on adequate scales, poses, figures and diagrams. Since these are often considered vertebrata in these characteristics within species, poses, figures and diagrams.
the vertebrae may be grouped, but their number varies from fishes to fishes. The total number, number of vertebrae showing common features, their range and mean are important.

Some general features are as follows (Fig. 3.2.2):

1. The post cranial vertebrae bear stout neural arches and spines.

2. The mesabdominals follow the post cranials, bear ribs, but do not possess haemal arches.

3. The posterio-abdominals have closed haemal arches and bear ribs.

4. The anterio-caudals greatly resemble the posterio-abdominals except that they have lost the ribs and have developed haemal spines.

5. In the tail segment the vertebrae have their neural and haemal spines entering into the support of the caudal fin.

6. The hypural complex is almost symmetrical and fan like, receiving the rays of the caudal fin. The rays of the caudal fin are supported by altered vertebral elements (penultimate hypurals, epurals, urostyle).

The number and characters in each of these divisions in the vertebral column may be compared to arrive at meaningful conclusions.

Anatomical characteristics

These include features such as shape, completeness and position of the lateral line, position and size of the internal organs, special anatomical features (such as air bladder, air breathing apparatus, electric organs, otoliths, arrangement of the musculature etc.), secondary sexual characters (breeding tubercles in males, enlarged fin rays, etc.), shape size and interrelationship of bones and muscles.
Most of these are "yes" or "no" characters, either a fish has them or it does not have. These can be definitive characteristics for separating species as well as higher taxa.

**Colour patterns**

Colour patterns are quite variable with age, time or environment. These are part of the species description and are species-specific. The main problem in using colour pattern as a taxonomic tool is that it tends to fade in preservatives and descriptions of living fish tend to be highly subjective.

**Karyotype**

These are descriptions of the number and morphology of chromosomes. The number and position of chromosomes are conservative characters and so may be used as an indicator of the closeness of species interrelationship within families.

**Electrophoresis**

This technique of evaluating the protein similarities in fishes could be used as a taxonomic tool. The protein can be identified and genetic similarity of individuals and species can be compared.

**Taxonomic tools in racial investigations**

A combination of all or some of these taxonomic methods have been used for racial investigations from time to time with interesting and at times with negative results. These studies are important in fishery biology for evolving suitable management policies for judicious exploitation of the resources, among which the identification of the eggs and larvae to the species to which they belong is one important aspect.


References


