

MORPHOLOGICAL CHARACTERISTICS OF FISH

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Abstract. *This article provides a comprehensive analysis of the morphological features of fishes. The external and internal structure, skeletal system, muscle activity, respiration, blood circulation, sensory organs, and reproductive processes are examined in detail. The morphology of fishes is discussed in connection with their adaptation to aquatic environments, ecological role, and economic importance. The paper serves as a theoretical basis for the development of ichthyology and for practical applications in fisheries.*

Keywords: *fish morphology, skeletal system, fins, gills, scales, nervous system, reproduction.*

Introduction. In nature, fish occupy a special place in the biocenosis of water bodies. They are one of the oldest classes of vertebrates, first appearing 500 million years ago. Today, there are more than 34 thousand species of fish in the world, which is more than the total number of species of mammals, birds, and reptiles. Fish are important in ecological systems as an important link in the food chain: they feed on plankton, insects, aquatic plants, and in turn serve as an important food source for birds, mammals, and humans.

The external and internal morphological characteristics of fish determine their lifestyle, habitat, type of nutrition, and level of evolutionary development. For example, fish living in different layers of water, adapted to deep life, or distributed in fast-flowing rivers differ

significantly morphologically. Therefore, in-depth study of fish morphology is also relevant from the point of view of zoology, ecology, and agriculture.

Literature review. D'Arcy Wentworth Thompson was one of the first scientists to apply the laws of mathematics and physics to biological forms. His work "On Growth and Form" played an important role in the analysis of the formed structural morphology of fish, and is also of great importance in the analysis of forms.

Georges Cuvier created a monumental 22-volume work entitled "Histoire naturelle des Poissons"; this work provides information about more than 4,500 fish species.

David Starr Jordan, author of more than 650 articles and books, is a leading researcher in fish systematics and morphology. The author of the scientific textbook "Fishes of the World," recognized as "classical," by Joseph S. Nelson, is considered one of the standard sources of modern ichthyology.

Research methodology. In this study, the following methods were used to study the morphological characteristics of fish:

In order to observe the external structure, shape, and size of body parts of fish in natural and laboratory conditions, the observation method was used, the comparison method was used to identify common and distinctive features by comparing morphological characteristics of different fish species, and the statistical analysis method was used to record and mathematically and statistically analyze such indicators as body length, weight, and fin size.

Analysis and results. When it comes to the external morphology of fish

it should be noted that their body consists of three main parts: head, trunk, and tail. For free movement in the aquatic environment, it is important that the body of fish has an aerodynamic shape. The most common body shape is torpedo or fusiform. At the same time, adapted to various habitats, the following forms are encountered:

- Long-bodied fish (for example, eel) - adapted to navigating narrow sections of the water's bottom.
- Flat-bodied fish (for example, beaver, skate) - hide from enemies by living on the bottom, buried in sand and mud.
- Thick and round-bodied fish (caras, carp) - characteristic of calm water bodies, adapted to accumulating and consuming food.

The body is covered with scales. The structure of the scales indicates the degree of evolutionary development:

- Ganoid scales - found in ancient species.

Cycloid scales are characteristic of most bony fish.

- Ctenoid scales - found in predatory fish and perform an additional protective function.

In addition, many fish have mucus-secreting glands on their skin. This mucus makes the body slippery, protects against mechanical damage, and protects against microorganisms.

The skeletal system and fins of fish should also be analyzed separately. That is, fish skeletons are of two types: cartilaginous and bony. The skeleton of cartilaginous fish (shark, skate) is light and elastic, which allows them to move quickly. Bony fish, on the other hand, have a more perfect skeleton.

The skeleton consists of:

- skull,
- spine,

- ribs,
- bony rays supporting the fins.

The fins provide movement and balance in fish:

- Paired fins - thoracic and abdominal fins; they help to rotate and slow down during movement.
- Single fins - dorsal, caudal, and anal fins; they provide the main forward movement of the fish.

The caudal fin is the most important in fish, determining their swimming speed and strength.

The muscular system and motor characteristics of fish also have their own peculiarities. The body of fish consists of strong muscles, which are divided into segments (myotomes). Each muscle segment is supplied with nerve fibers.

The mechanism of movement is as follows: as a result of alternating muscle contractions, the body bends and pushes into the water with the help of the caudal fin. In this way, the fish moves forward.

The speed of movement of fish varies greatly depending on the species: tuna swim very fast, but fish, such as carp or carp, move slowly. This depends on their ecological role and habitat.

In fish, the digestive organs differ depending on the type of nutrition. Predatory fish have a wide oral cavity, sharp teeth, and are adapted to predation. In herbivorous fish, teeth are small or absent altogether, and the intestines are long. General structure of the digestive system:

- mouth,
- swallow,
- esophagus,
- stomach,

- intestine,
- liver and pancreas.

The degree of food digestion depends on the fish's activity and living conditions.

Also, in fish, the central nervous system consists of the brain and spinal cord. Although the brain has a relatively simple structure, the sensory organs are very well developed.

Sensory organs:

- Eyes adapted for good underwater vision but cannot accurately estimate distance.
- Olfactory organs - developed, sense food from a long distance.
- The organ of the lateral line - senses water vibrations and pressure changes.
- Inner ear - ensures hearing and balance.

Some fish also have electrical organs (for example, the electric skate), which are used for protection and hunting.

Fish reproduce mainly by laying eggs. Some species have external fertilization (carp, carp), while others have internal fertilization (shark, skate). The number of eggs varies greatly by species: small fish can lay several hundred eggs, while large fish can lay millions.

Some species also have live births. For example, aquarium fish, such as guppi, give birth to live offspring.

Conclusion. Fish are the most widespread class among aquatic vertebrates, distinguished by their external and internal morphological characteristics. Body shape, skeletal and muscular systems, respiratory, circulatory, and sensory organs ensure their adaptation to various living environments.

The study of fish morphology is an important scientific basis not only for zoology, but also for practical fisheries, artificial breeding, biodiversity conservation, and ensuring ecological balance.

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