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## Biological traits and nutritional requirements of Siberian sturgeon (*Acipenser baerii*, Brandt, 1869)

Cătălina Teodora CÎRMACIU (FLOREA)<sup>1</sup>, Laurian Cristian COJOCARIU<sup>1</sup>, Cătălin Emilian NISTOR<sup>1</sup>, Benone PĂȘĂRIN<sup>1</sup>

<sup>1</sup>„Ion Ionescu de la Brad” Iași University of Life Sciences

**Abstract.** The Siberian sturgeon (*Acipenser baerii*) is an economically valuable species increasingly used in Romanian aquaculture due to its adaptability to controlled farming conditions. Biologically, it is a benthic fish with slow growth, late sexual maturation, and high tolerance to environmental variations. Physiologically, its metabolism and growth are strongly influenced by water temperature, oxygen availability, and overall water quality. Nutritionally, the species requires protein-rich diets and efficiently utilizes lipids, while showing limited carbohydrate metabolism. Understanding these biological, physiological, and nutritional traits is essential for improving sustainable and efficient aquaculture practices.

### Introduction

Sturgeons are considered “living fossils” due to the retention of ancestral morphological characteristics over millions of years of evolution. The Siberian sturgeon (*Acipenser baerii*) is one of the few sturgeon species fully adapted to freshwater ecosystems, naturally inhabiting the major Siberian river basins. Its current distribution has been shaped by historical paleogeographic and glacial processes, while its ecological success is linked to remarkable environmental adaptability. The species displays benthic feeding behavior, relying mainly on aquatic invertebrates, with dietary variability depending on developmental stage and habitat conditions. These characteristics support its growing importance in aquaculture and emphasize the need for optimized nutritional and management strategies.

### Material and method

A systematic review was conducted using major international scientific databases and authoritative institutional sources, including Google Scholar, ScienceDirect, Web of Science, Scopus, PubMed, ResearchGate, as well as reports and data from the Food and Agriculture Organization (FAO) and the International Union for Conservation of Nature (IUCN). The literature search was performed using predefined keywords and was further refined according to publication year and article type. Following the application of inclusion and exclusion criteria, 62 studies were deemed relevant and included in the final analysis.

### Results and discussions

**A. Biology.** The Siberian sturgeon (*Acipenser baerii*) exhibits several primitive biological and anatomical characteristics specific to sturgeons. The species has an elongated fusiform body adapted to benthic life, protected by five longitudinal rows of bony scutes instead of typical scales, while primitive ganoid structures remain only on the upper lobe of the caudal fin (Figure 1). Its skeleton is predominantly cartilaginous, with persistence of the notochord and a heterocercal tail. The species possesses a ventrally positioned, protrusible, toothless mouth with sensory barbels adapted for suction feeding on benthic organisms. Reproduction is characterized by late sexual maturation, intermittent spawning, adhesive eggs deposited on hard substrates, and a high capacity for hybridization with other sturgeon species.

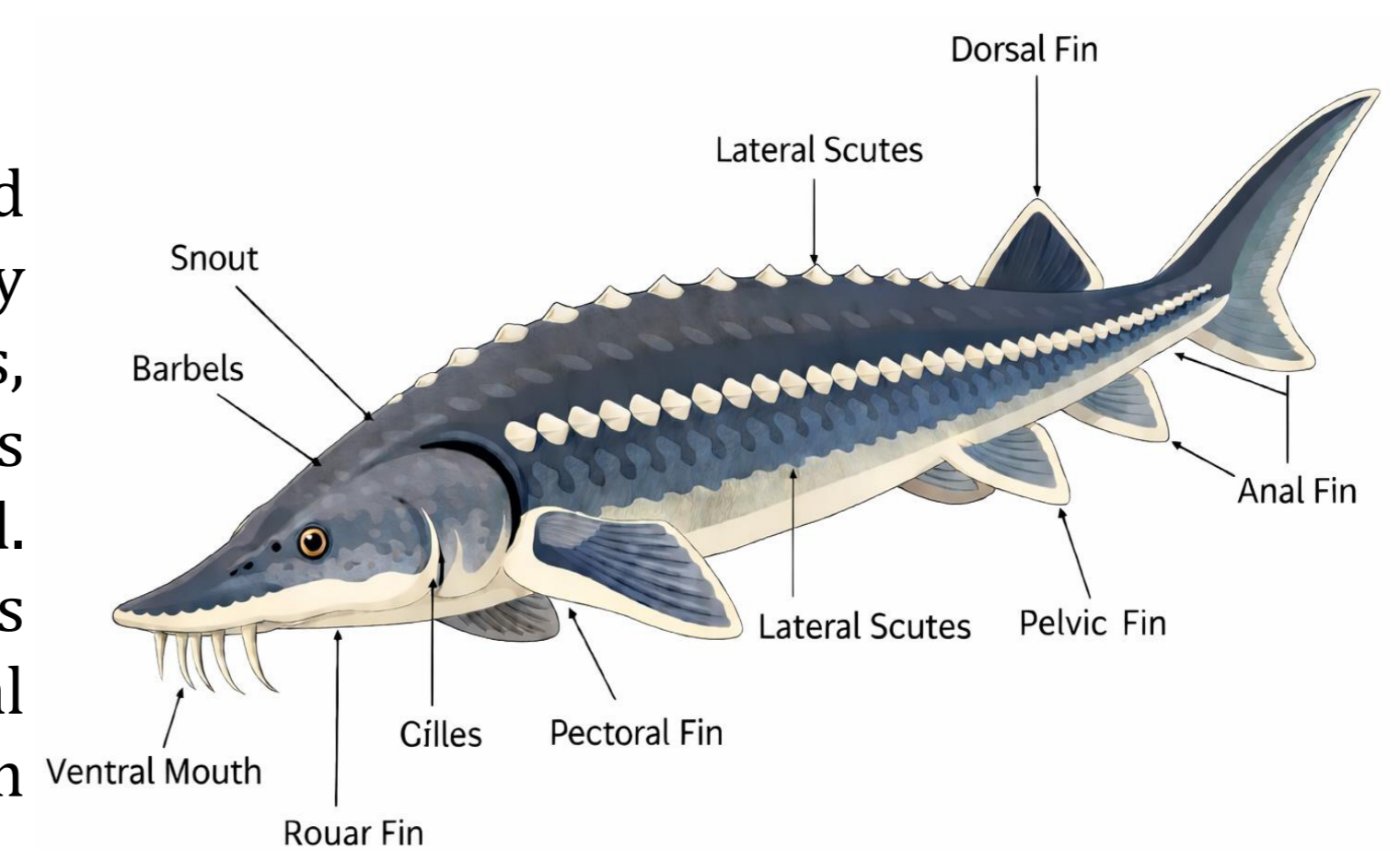


Fig. 1 Anatomy of siberian sturgeon (*Acipenser baerii*) (AI-generated image)

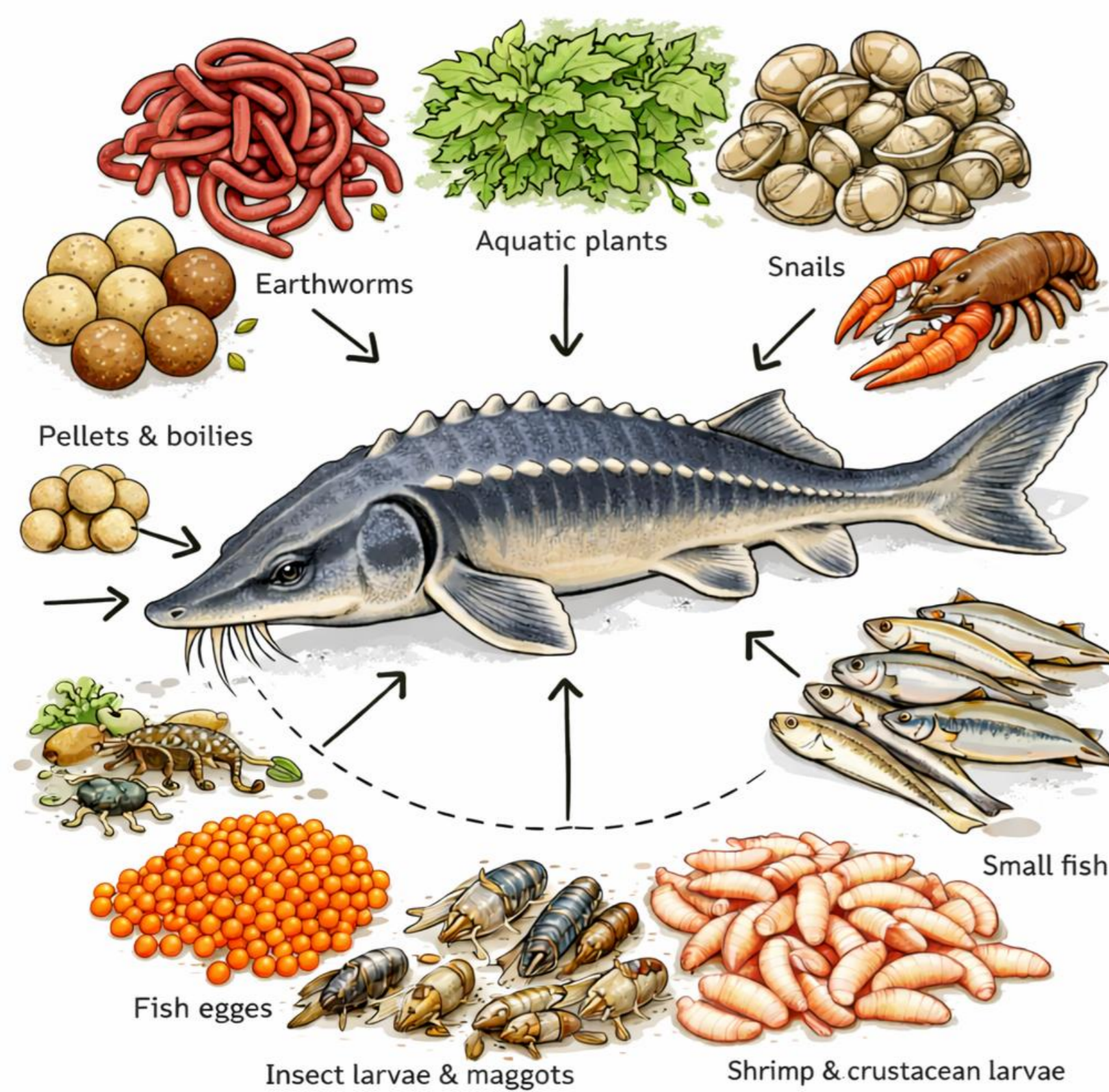


Fig. 2 Main feed sources for siberian sturgeon (*Acipenser baerii*) (AI-generated image)

**B. Physiology.** The Siberian sturgeon shows high ecological plasticity and complex physiological adaptations to benthic environments. Feeding relies mainly on sensory barbels and electroreceptors that facilitate prey detection in turbid waters. Early developmental stages are supported by adaptive mechanisms that improve fertilization success, larval survival, and transition to active feeding. Endocrine regulation plays a major role in growth, reproduction, stress response, and osmoregulation, although the species has limited tolerance to high salinity. Metabolism is based primarily on protein and lipid utilization, while hypoxic conditions trigger temporary anaerobic metabolic pathways.

**C. Nutrition.** The Siberian sturgeon is a euryphagous species with predominantly benthic feeding habits, consuming insect larvae, crustaceans, worms, and mollusks, as illustrated in Figure 2. The species shows high trophic plasticity, being capable of feeding year-round, including at very low temperatures, while older individuals may shift toward ichthyophagy. In aquaculture, optimal nutrition depends mainly on protein quality, lipid composition rich in omega-3 fatty acids, and reduced carbohydrate inclusion due to limited metabolic utilization. Early larval stages require live feed followed by gradual adaptation to commercial diets, while the comparative trophic characteristics under natural and farming conditions are summarized in Table 1. The use of functional additives, alternative protein sources, and locally available feed resources contributes to improved growth, health status, and sustainability in intensive sturgeon farming systems.

Table 1. Comparison of the trophic characteristics of the Siberian sturgeon (*Acipenser baerii*) in natural environments and aquaculture.

Parameter	Natural Environment	Aquaculture
Feeding type	Euryphagous, predominantly benthophagous	Euryphagous, adapted to compound feeds
Diet composition	Insect larvae (chironomids), crustaceans, worms, mollusks	Extruded feeds based on fish meal, plant proteins, and oils
Trophic plasticity	High, dependent on resource availability	Controlled through feed formulation
Feeding adaptations	Continuous feeding, including at low temperatures and during reproduction	Controlled feeding, depending on technological regime
Early stages	Polyphagous larvae, early feeding in natural environment	Starter feeds with high protein (50–55%) and lipid content (12–15%)
Juveniles	Diverse benthic diet	Proteins: 45–50%; Lipids: 12–18%
Adults	Predominantly benthophagous; in some ecosystems become ichthyophagous	Proteins: 40–45%; Lipids: 10–20%
Variability	High, influenced by habitat and resources	Reduced, controlled through nutritional management

### Conclusions

- The Siberian sturgeon is a valuable aquaculture species due to its adaptability to intensive and semi-intensive farming systems, although its growth and physiological performance are strongly influenced by water quality, temperature, oxygen levels, and stress factors.
- Efficient production depends on maintaining optimal environmental conditions and providing protein- and lipid-rich diets adapted to the species' limited carbohydrate metabolism, ensuring sustainable growth and fish welfare.