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STURGEONS – CONTEMPORARIES OF DINOSAURS

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INTRODUCTION

TheCaspian Sea is abundant with its natural unique gems, the most famous being sturgeons and oil. But, as the old wisdom says, wealth alone will make no one happy, especially if used without thinking of future.

All natural resources can be categorized as renewables and nonrenewables.

Renewables are such resources that can regenerate through reproduction or through the nature renewal cycles over the time frame comparable with the pace of huuman economical activity. . Examples of such resources are sturgeons.

Nonrenewables are such resources that cannot regenerate over the natural cycle over the time frame comparable with the pace of human economical activity. Oil reserves are such nonrenewable resources. Oil has now been actively developed and produced. Big money is being spent for the development of hydrocarbon exploration, production and transportation technologies. But hydrocarbon reserves sooner or later will deplete.

As for sturgeons, their stock is being gradually decreased because of irrational catch, reduction of feeding and spawning areas, and contamination of the water environment - and oil industry has contributed greatly to it. However, this problem has currently not been addressed properly although preservation of sturgeon reserves requires less investment but promises continuously high profits at all times.

Unfortunately, not everyone, including those who live at the Caspian Sea, understands this. Most people have insufficient knowledge about sturgeons, but view sturgeons as a source of food. We will try to inform the readers about the life of this unique fish. We will tell you the following:

What are these species that have left such a noticeable footprint in the history of mankind? What y interest (other than being a source of food) do they present? Will they be preserved for future generations, or disappear as did their contemporaries – the dinosaurs?

GOING BACK TO HISTORY

Sturgeon catching has been known since ancient times. Ancient Egyptians, who lived more than four thousand years ago, and Phoenician merchants, who traded with the ancient Egypt, salted and pickled fish and caviar and then consumed this food during wars, famine and long sea journeys. Bas-reliefs on the walls of old tombs at the settlement of Ti, near the pyramid in Saqqara, depict fishers catching and gutting fish and extracting fish roe.

In ancient Egypt and China, sturgeons could only be served to pharaohs and emperors. Ancient Chinese believed that sturgeons turned into dragons.

Coins dating back to 600 B.C. and minted in Carthage – an ancient Phoenician port city located in the territory of modern Tunisia – depict a fish belonging to sturgeon species. In 400 B.C in Panticapaeum, the capital of Thracian Kingdom, they minted coins depicting fish. . Images of sturgeon heads can be seen on ancient coins found in the burial mounds of the northern areas of the Black Sea region, along with the profiles of Roman emperors and Scythian kings.

In the 2nd century B.C., the Greek orator Claudius Elian describing his journey along the Danube River on the Balkan Peninsula praised beluga – one of the species of sturgeons. In his works, we see references to a sturgeon catching technique used those times, which involved application of special fishing lines with hooks attached to a rope, which was thrown across the river, so-called set line. Beluga was so large and heavy that the set lines and nets were dragged out of river using horses and oxen.

No feast in ancient Greece was served without sturgeon dishes. According to ancient manuscripts, this fish was so highly valued that one amphora (jug) of sturgeon cost more than a hecatomb, which was equal to the price of a hundred of sheep or one bull.

During the times of prosperity and power of the Roman Empire (beginning from the 4th century B.C.), many scholars and philosophers wrote about sturgeons. Aristotle (384-322 B.C.), noting the tastiness of sturgeon, wrote the gelatin produced from the gas bladder was used as a glue and also wine purification device. Today, this gelatin is called 'fish glue.'

Cicero (106-43 B.C.) complained about extremely high cost of sturgeon when he was purchasing it for feasts, while poet Ovid (45 B.C. -17 A.D.) was characterizing the sturgeon as a noble fish. According to Pliny the Elder (23-79 A.D.), during feasts whole sturgeon, decorated with flowers, would be brought into the hall and placed on the table by the accompaniment of flutes and trumpets. According to the Greek writer Athenaeus, in the 2nd century A.D. the sturgeon was the favorite dish at important festivals and feasts. Moreover, excavations of Roman settlements in Wales provide evidence that breeding of sturgeons was a common practice even at such remote frontiers of the Roman Empire.

In the Middle Ages large shoals of sturgeons moved up many European rivers, including the Thames in England, the Seine and Gironde in France, the Po in Italy, the Ebro and Guadalquivir in Spain, and the upper reach of the Danube.

There were so many sturgeons in Germany that labor contracts stipulated a provision, according to which it was banned to force a worker to eat fish more than twice a week.

And still sturgeons were highly valued. The rulers of many countries, such as Russia, China, Germany, Denmark, France and England, obliged fishers to sell them sturgeons at fixed prices, making this fish one of the most important dishes of the nobility.

According to the order, issued by the King of England Henry the Second (1133-1189), sturgeon was taken under protection of the Royal Crown. Later, in the 14th century, Edward the Second (1284-1327) issued a decree on the "kingfish." A copy of this document is kept in the Royal Windsor Library. Nowadays, when sturgeons can be (although rarely) found in British waters, the monarch is still entitled to the first catch (even though a fisherman can leave the fish with himself).

Old manuscripts testify that in1240 Batu Khan (the grandson of Genghis Khan who was renowned not only for his deeds, but also for inventing a special culinary recipe – he placed slabs of meat on a horse's back under saddle bags and rode this way all through the day, thus making the meat very tender) arranged a feast that included a fish soup made of sterlets, a large fried sturgeon, an eel pie, pastries filled with finely chopped mushrooms, followed by caviar and candied apples.

Crowned heads in many countries, for example France and Denmark, declared their rights for sturgeons catch. In 1165, the King of Aragon Alfonso II allowed his people to fish in the river Ebro, but reserved the royal right for the catch. In France, the term "*le droit d'esturgeon*" meant that, according to the king's decree, the right to possess all sturgeons caught in the Seine and Rhone Rivers had been granted to nobility and church. In the 17th century, the famous Minister of Finance Jean-Baptiste Colbert imposed special restrictions aimed at protecting sturgeons, which are in force up to now.

And Russia did its part. People learned how to process the sturgeon caviar in the 12th century, and during the times of Ivan the Terrible, fishermen were obliged to deliver sturgeons to the czar's table. Besides, there also existed the so- called 'caviar tribute', which fishermen paid the czar. According to Czar Aleksey Nikhaylovich's 1672 decree, each of the court's 50 fishermen should have provided the czar 30 sturgeons per year. Moreover, in Russia and Hungary, monarchs granted areas of rivers, inhabited by beluga, to their vassals for special achievements.

The tradition of viewing the sturgeon as a "czar's fish" continued in Russia up to the October revolution. Each fisherman was obliged to give 11 tons of black caviar per year to Nicholas II. For this, Nicholas II had to thank his ancestor Peter I, who ordered that "the Great Czar should take upon himself all fishing;" i.e., to create a state monopoly on fishery. This primarily applied to sturgeons.

Until the end 19th century in Russia the cheapest and most available food products was fish, not the least of which was sturgeon. Famous Russian writer Chekhov, describing his trip to Sakhalin, noted: "You can find salted beluga with horseradish in every road inn. How much beluga is being salted in Russia!..."

Some 2,500 years ago Herodotus wrote that Scythian tribes caught sturgeons in the Black Sea, Sea of Azov, and the Caspian Sea. Up to nowadays, the main source (89% of the world's reserves) of sturgeons is the Caspian Sea, and, to a lesser degree, the Sea of Azov and the Black Sea.

The Arab writer Ibn al-Fakih writes in his “Book of Countries” about the Caspian Sea as the main source of sturgeons, as do European travelers, particularly Marco Polo and Olearius. Claudius Elian mentions a huge lake on the “land of the Caspians, which is inhabited by large sharp-nosed fish, whose length reaches 8 cubits (3-4 meters). They are caught and brought for sale. Their fat makes a splendid ointment and boiled internal organs make clear and strong glue.

Let us talk about the peculiarities of the Caspian Sea.

THE CASPIAN SEA AND ITS MISTERIES

The name Caspian Sea was mentioned back to Herodotus' time, but in subsequent periods other names are also mentioned, such as Girkan, Khazar and Khvalyn (the latter was used in Russia until up to the 17th century); the Turks know it as Kutsgun Denizi, the Tatars – as Ak-Deniz, the Persians – as Dortsa and Shizir, and the Turkmens – as Kyukkyuz. Over centuries the Caspian Sea had different names (nearly 70 names), namely the Abeskun Sea, the Alban Sea, the Guzgun Sea, the Baku Sea, the Gilyan Sea, the Gyurgyan Sea, the Mugan Sea, etc.

Khazar Sea is the name of the Caspian Sea in Arabic (*Bahr-al-hazar*), Persian (*Daryâ hazar*), Turkish and Azerbaijani (*Khazar deniz*) languages. It originates from the name of people called Khazars, who in VII-X centuries established the Khazar Khaganate – a powerful state on the northwest coast of the Caspian.

This name appears first in the Arabic geographical treatises of the IX century written byIbn Khordadbeh and his followers, Ibn al-Fakih and Kudama Ibn Ja'far. Initially, the Black Sea and, less frequently, the Sea of Azov, were called Khazar (the positions of the Khazars in the Crimea were strong at that time). Beginning with the X century, this name was attributed to the Caspian Sea. It is worth noting that the Khazars themselves have never sailed on the seas and had no fleet. The fact that their name remained in history is evidence of the extraordinary role they played in the history of the region. In the VII-VIII centuries, the domination of the Khazars was shown through their regular invasions, and later (in IX-X centuries) - through active sea trade. The capital of Khazar khaganate, city of Itil, was a major trading post of the Muslim merchants in the delta of the Volga River.

The written sources of those times also mention other names of the Caspian, derived from the names of the tribes living along its coasts. These 'local' names include the Tabaristan Sea, the Delaim Sea, the Shirvan Sea, with the most common being the Jurjan Sea. It is notable that this name is mentioned in the Khazar manuscript - a letter of Khazar Czar Joseph ben Aaron.

After the fall of Khazar khaganate, the sea was frequently referred to as the Sea of Khvarezm, sounding as Khvalin Sea in Russian language. The Khvalin Sea is the ancient Russian name of the Caspian Sea, derived from the name of inhabitants of Khwarezm who traded on the Caspian; the Russians called them the Khvalis.

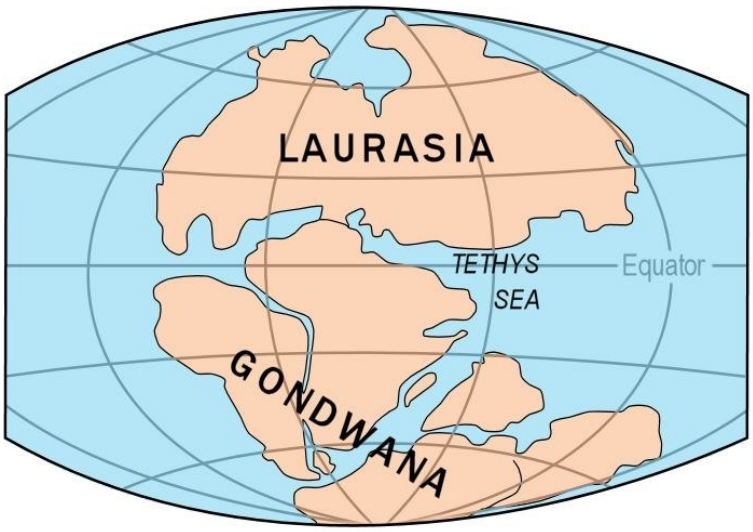
Currently the Caspian Sea is the world's largest inland body of water. It is bigger than the area of the Great Lakes of America or Lake Victoria in Eastern Africa. The Caspian is located in the depression at the border of the European and Asian continents, between 47° 07' and 36° 33' North latitude and 45° 43' and 54° 20' East longitude. The Caspian is approximately 1,030 km long; its maximum width is 435 km, and minimum – 196 km. The sea is not linked to the World Ocean. It's level is currently some 26.5 meters below the average level of the World Ocean. The coastline of the Caspian Sea is almost 7,000 km long; it covers an area of about 386,400 square km and contains some 78,700 cubic km of water.

Over 130 large and small rivers flow into the Caspian Sea - mostlyy from the north and west. The largest, the Volga river, flows into to the sea from north and has a water basin area of 1,400,000 km^2. Three rivers account for 90% of the total annual flow into the sea: the Volga river – 241 km^3, the Kura River – 13 km^3, the Terek River - 8.5 km^3, the Ural River – 8.1 km^3, and the Sulak River – 4 km^3. The remainder comes in from the minor

rivers and streams of Iran; the sea's eastern shore does not have rivers permanently flowing into it.

Nevertheless, the Caspian Sea is characterized by brackish water; the salinity of the surface waters at the eastern shore is 1.4%; at southern and western shores - 1%; in the middle - 3.5%; and at the northern shore - 0.75%. The ratio of the salinity of the Caspian Sea and World Ocean is 3 to 8, whilst the Caspian Sea is abundant with sulfuric salts. But why is the water of the Caspian Sea saline?

It is believed that the Caspian Sea is part of the ancient Tethys Sea (Fig.1).



Tethys Sea

Tethys Sea (named after Poseidon's daughter, the sea goddess Thetis) existed during late Paleozoic - Mesozoic periods (i.e., 320 to 66.5 million years ago), and it divided the ancient continents of Gondwana and Laurasia. Tens of millions of years ago, this ancient giant sea covered the areas of the Mediterranean Sea, the Sea of Marmara, the Black Sea, the Sea of Azov, the Caspian Sea, and the Aral Sea. Tethys Sea consisted of two parts: a) the western – the area of the modern Mediterranean Sea, which was saline; and b) the eastern, freshwater area where many rivers used to flow.

Approximately 280 million years ago, a so-called Cimmerian continent separated from Gondwana, and, gradually crossing the Tethys Sea, it collided with Laurasia about 200 million years ago. Finally, about 66.5 million years ago, the collision of Gondwana with Laurasia resulted in the formation of the Alpine-Himalayan belt. After the collision of continents, Tethys Sea remained a shallow water reservoir covering the large part of the south Eurasia.

About 13 million years ago, when the Alps were formed, the link between the two parts of the Tethys Sea was broken. The fresh watered Sarmatian Sea was formed in place of the eastern part of the Tethys Sea, with its species partly extinct and partly adapted to the freshwater. The Sarmatian Sea existed for 2-5 million years, and exactly within this time frame the fresh water flora and fauna formed, the remains of which have been preserved to the present day.

About 10 million years ago, the area of the sea gradually evolved, and its salinity increased significantly. Its inhabitants changed too; some of them adapted to the new salinity, some became extinct, and others moved closer to the rivers.

8 million years ago, the Pontic Sea formed, which included the modern Black and Caspian Seas. Modern Caucasus and Crimean mountains were shaped in the form of islands. The Pontic Sea was almost a freshwater reservoir (its salinity was less than the current salinity of the Caspian Sea).

One million years ago a further land elevation occurred, which finally separated the Black and Caspian Seas; with the Caspian maintaining freshwater peculiarity of the Pontic Sea.

The eastern part of the Mediterranean, Black and Caspian Seas, the Persian Gulf, as well as the sea of the Malay Archipelago - are all the remnants of the Tethys Sea. But the Caspian turned out to be cut off the World's ocean. Therefore, the salinity of the Caspian Sea can most likely be explained by the fact that it was originated from the ancient Tethys Sea.

At present, the Caspian is conditionally divided into three parts: Northern, Central, and Southern. The boundary between Northern and Central parts runs through Cheleken Island (near the river Terek estuary) and Cape Tiub-Karagan (port of Shevchenko). The boundary between the Central and Southern parts runs from the Absheron Peninsula, which connects Zhiloy Island on the west with Cape Kuuli on the east (to the north of Turkmenbashi city).

The Northern sector of the Caspian Sea occupies approximately 25% of the total area, while the Central and Southern – 37% each. However, the Northern Caspian accounts for only 0.5% of the total water volume, the Central Caspian – 33.9%, and the Southern Caspian – 65.6%. These numbers reflect the fluctuations of the Caspian Sea depths. The Northern Caspian is very shallow, with an average depth of less than 5 meters. The main peculiarity of the Central Caspian is the Derbent depression, with a depth of more than 500 m. The Southern Caspian includes the South Caspian depression, with its deepest point of 1,025 m below sea level.

The Caspian Sea is full of mysteries and legends. One of the main mysteries is the fluctuation of the sea level. The mysterious behavior of this unique water reservoir attracted many famous scientists. The German naturalist and traveler Alexander Humboldt, who travelled through Russia to the Urals, the Altai and the Caspian Sea in 1829, put forward a hypothesis that the sea level fluctuation occurred due to a pattern of regular repetition cycles of excessively arid and excessively humid periods. His countryman Peter Simon Pallas, who headed the expedition of the Petersburg Academy of Sciences to the central regions of Russia, the areas of Lower Volga region and the Caspian Sea lowland in 1768-1774, indicated that the sea level fluctuations depended on hydro-meteorological factors, such as temperature, wind, atmospheric precipitations, and the quantity of water brought in by rivers. Some fantastic hypotheses were also brought forward, such as "There is a hole in the Kara-Bogaz-Gol gulf through which the waters of the Caspian drain into the ocean."

The Caspian Sea level rise resulted in the change of physical and geographical conditions, which led to the downfall of the Khazar Khaganate and extinction of the Khazars, as the economy of the country had collapsed due to the loss of two-thirds of its territory. Lev Gumilev, a Russian historian, ethnologist and anthropologist, describes the downfall of the Khazar Khaganate in a following dramatic tone: "The combined attack of Russians, Oghuz Turks and Pechenegs against the Khazars in 965 brought an end to the independence of the semi-flooded nation."

The shape of the Caspian Sea constantly changes. The sea level had risen to an absolute elevation of 49 m and fallen to 50 m. At its highest sea level, a link was formed between the Caspian and the Black Sea via the Kumo-Manich depression. The unstable level of the Caspian Sea is evidenced by a number of archaeological excavations. For example, skeletons of Scythian soldiers buried in tombs in the 1st century B.C. were found during the construction of a dam beneath the bottom of Apsheron Bay.

According to the Italian geographer Marino Sanuto (1320), "The sea rose by several inches a year and flooded a number of good cities". The Caspian has recently experienced sharp rises and falls of the sea level as well. According to the Russian historian Vassily Tatishchev (1793), "in 1742, the sea level had rose by more than 8 feet since 1723"; i.e., 2.5 m over 19 years. According to academician L.S. Berg, the sea level fell by more than 2 m over the period between 1807 and 1824.

In the 1930s, the sea level started falling once again. In 1977, the lowest level for the last 300 years was recorded: -29.03 m. Since 1978, the level of the Caspian Sea has begin to rise; at present, it is at -27 m and, and the sea level continues to rise.

The Caspian Sea level may increase by another 4-5 m compared to today's level due to climatic conditions. The sea water is likely to move inland by tens of kilometers. Currently, there is no consensus as to the reasons of the Caspian Sea level fluctuations

About 13 million years ago, the ancestors of the Caspian sturgeons inhabited the Sarmatian Sea along with tunas, mullets, dolphins and whales. There were only two sturgeon species, while the third species inhabited the rivers. However, over the past years the Caucasus Mountains formed, the lakes and the Mediterranean Sea turned into saline deserts, and the Akchagil Sea was located at the Ural Mountains. Glaciers were on the same latitude as the cities of Volgograd and Rostov-on-Don. The link between the Caspian and Pontic Seas was broken approximately 14 million years ago; the Aral Lake became isolated in the 13th century. Since then, each water basin had formed its own peculiarities.

The Caspian Sea was isolated from the World Ocean, resulting in the formation of its unique biocenosis. That is why the majority of the Caspian species are endemics. The Caspian biota can be divided into four groups.

The first group includes the descendants of ancient species that inhabited the Tethis Sea about 70 million years ago. These forms include the Caspian gobies and shads, some mollusks and most of the crustaceans. Of local crustaceans, the long-clawed crayfish (Artemia) are abundant in the Caspian Sea.

The second group of the Caspian fauna is comprised of the Arctic species that entered the Caspian from the north during the post-glacial period. Of invertebrates, this group includes mysids – small (5 to 2.5 mm) crustaceans that resemble shrimps, and tiny sea cockroaches belonging to the order of Isopoda (isopods).

Fish in this group include the Caspian brown trout and inconnu – the sole representative of the Cisco family in the Caspian. Nelma, the fish very close to inconnu, lives in the northern seas of Eurasia and America. Inconnu, the valuable commercial fish (130 cm, 14 kg) feeds on kilkas and offspring of other herrings. When spawning, inconnu swims upstream the Volga River, up to the Kama river.

The Arctic species also include the only marine mammal in the Caspian – the Caspian seal (Caspian phoca) from the seal family. Caspian seals live in herds and feed on small fish and crustaceans. The "northern" habits of seals become apparent during breeding. The white pups are born in winter in the northern Caspian and stay on the ice until they are

taught to swim and forage. The seals were intensively killed for their valuable fur. Until recently, they were under the threat of extinction. Now the number of seals is being restored.

The third group of species is the Mediterranean species that came (either independently or with the humans' help) to the Caspian from the Black Sea. These are: two types of mollusks – M*ytilaster* and *Abra*; crustaceans – amphipods (small, side-swimming crayfish); shrimps, Atlantic crab from the Black Sea, and the following fish – golden mullet and little mullet from the gray mullet family, the pipefish and the Black Sea turbot.

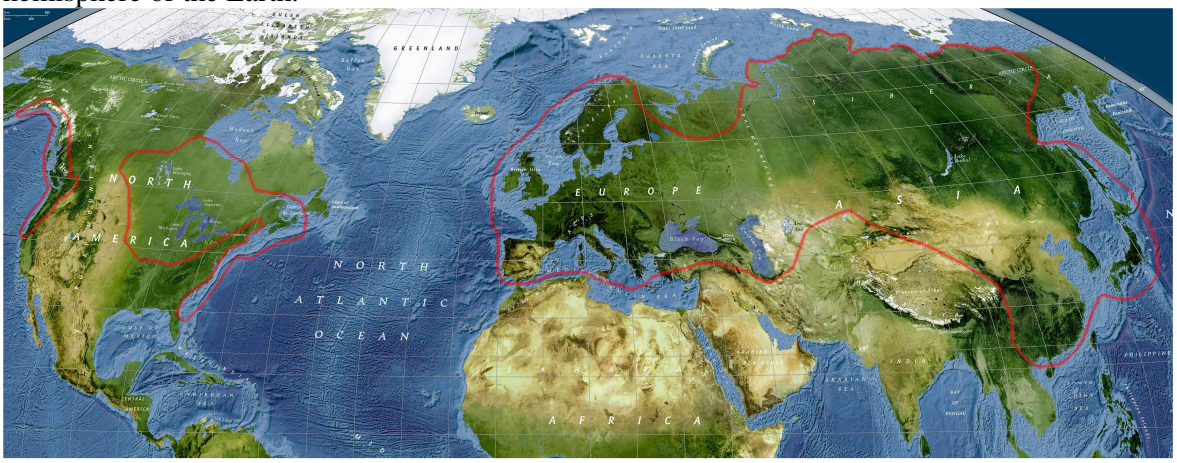
Finally, the fourth group includes the freshwater fish species. Having entered the Caspian Sea, they turned into seawater or diadromous (migrating upstream) fish. This group also comprises typical freshwater fish that enters saline waters. These species include catfish, sea sander, and fish of the carp family – Caspian barbel, Asp Caspian and Caspian vimba.

This group also includes Russian and Persian sturgeon, beluga and starred sturgeon. It should be noted that the Caspian Sea contains approximately 80% of the world's sturgeon populations. Caspian barbels (reaching 1m in length and 20 kg in weight) and vimba (50 m, 3 kg) are valuable commercial fish. They feed on benthic organisms – mollusks, larvae, crustaceans and small fish.

Sturgeons are undoubtedly the main treasure of the Caspian Sea. Our book is dedicated to them.

CONTEMPORARIES OF DINOSAURS

Sturgeon-like fish are the most ancient among the currently living vertebrates. Their ancestors swam in the seas as early as the Jurassic period. Their traces are found in the Cretaceous deposits. The most ancient of the known sturgeons is Chondrosteus of the early Jurassic period. Remains of this fish demonstrate that sturgeons did not change for millions of years. Regardless of their ancient origin and primitive morphology, until recently sturgeons have occupied a vast habitat area covering almost the whole Northern hemisphere of the Earth.



Areas of sturgeon distribution

Position of sturgeons in zootaxy:

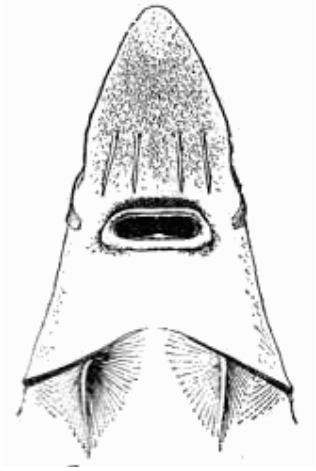
Type:	*Chordata* (Chordates)
Sub-type:	*Vertebrata* (Vertebrates)
Group:	*Pices* (Fish)
Sub-group:	*Actytoperygii* (Actinopterygian fish)
Superorder:	*Chondrostei* (Cartilaginous ganoids).
Order:	*Acipenseriformes* (Sturgeon-like)
Family:	*Acipenseridae* (Sturgeons);
Genuses:	*Huso* (Belugas) – 2 species; *Acipenser (*Sturgeons) – 18 species; *Scaphirhynchus* (Shovelnose sturgeons) – 2 species; *Pseudoscaphirhynchus* (False shovelnose sturgeons) – 3 species.
Family of Copepoda:	(*Polyodontidae*)
Two species:	Paddlefish (*Polyodon spathula)*; Chinese paddlefish (*Psephurus gladius).*

STURGEON FAMILY (*Acipenseridae)*

Sturgeons are diadromous, fluvial anadromous and freshwater fish; inhabit the waters of the Northern hemisphere – Europe, North Asia and North America. Four genera are distinguished: beluga, sturgeon, shovelnose and false shovelnose.

Sturgeon-like fishes have a number of features that are common with those of cartilaginous fishes, and they are slightly similar to squaloids in appearance.

Sturgeons have a long fusiform body covered with five rows of bony scutes: one dorsal, two lateral, and two ventral rows. Scattered between the rows of scutes are small bony granules and plates. The snout is elongated, conical or spatulate. The mouth is located on the lower part of the head and is edged by fleshy lips; some have a mouth that projects to the sides of the head. There are 4 barbels in a transverse row on the lower part of the snout. The mouth is protractile, toothless; however, juveniles do have weak teeth.



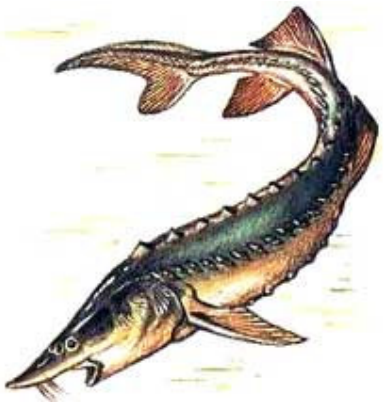
Head of sturgeon (ventral view)

The forward pectoral fin ray is strongly hardened and turned into a spine. The dorsal fin is set back. The swim bladder is usually well developed (some sturgeons, like shovelnoses, have a rudimentary swim bladder) and connected to the stomach or esophagus. The internal skeleton is cartilaginous, and the notochord, which is covered by a thick joined sheath, remains for the life of the fish. Vertebral centra do not develop, although lower and upper vertebral curves do exist.

As with sharks, the sturgeon's caudal fin is heterocercal.

The common feature that unites bony fishes and sturgeons is the presence of dermal bones in the neurocranium, which is covered with five rows of big plates (scutes). Sturgeons have a bony operculum and swim bladder, which is connected to the intestines.

Among other ray-finned fishes, sturgeons have the most archaic structural features, which are not observed in bony fishes. The sturgeons' axial skeleton is based on a permanent notochord, the internal skeleton is made of cartilage, the internal cranium to a great degree remains cartilaginous, and the tail fin is heterocercal with large upper peduncle. The body has five longitudinal bony scales - "scutes," which are vestiges of denticles. As with cartilaginous fishes, sturgeons retain a spiracle – a special aperture on the edge of the operculum, which leads to the branchial aperture. The heart has a conus arteriosus, and the intestine has a spiral valve – just like in squaloids.



Sturgeon family representative – Kaluga (*Huso dauricus*)

Based on these characteristics, some authors considered sturgeons to be a very primitive group, similar to cartilaginous fish. In other words, they thought that the sturgeons originated not from the ancestors common with bony fish, but from primitive cartilaginous fish, ancestors of squaloids.

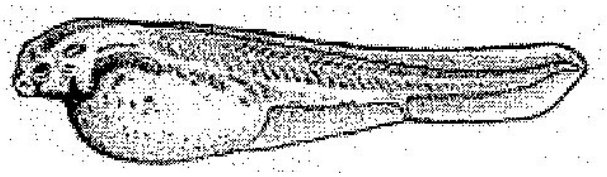
Such statements have had far-reaching consequences. When the numbers of sturgeons started to reduce drastically, and their preservation challenge was put forward, the following objections were voiced: 'If sturgeons are primitive, do we need to save them? Their extinction is a natural evolution process, and they simply fail to compete with higher organized bony fish."

However, academician Berg and other scientists put forth an opposite view derived on the basis of the comparative anatomical analysis of both fossils and present fish. According to them, the primitive characteristics of sturgeons had been preserved due to a fetalization; i.e. a drop-out of the final stage of evolution and acquisition of specific adaptations. Thus, the observed similarities between sturgeons and the cartilaginous fish are of secondary nature and may be viewed as a convergence.

Sturgeons, excluding sterlets, are long-living fish. Their maturity time is not the same in different basins and rivers. Sturgeons (excluding sterlets) do not spawn every year. Following spawning, breeders migrate down to the sea, grow, and again return to spawning, but this time they are larger in size and have more eggs. Sturgeons are normally slow-growing and late-maturing fish, but in terms of weight-growth rate, sturgeons rank among the fastest-growing fish. Even if they reach their maturity later than other fish, their large sizes (excluding sterlets and shovelnose sturgeons) compensate for the lag in maturity.

Maturity of the large size male species (starred sturgeon, sturgeon, and beluga) is reached at the age between 5-13 and 8-18 years; maturity of the female species – at the age between 8-12 and 16-21 years. Sturgeons entering the Don and Dnepr Rivers are the fastest matured, while those entering the Volga River are the slowest matured.

Spring and summer spawning takes place in the rivers (sturgeons do not reproduce in seawater) with a relatively high-flow river current; the sturgeon egg is gluey and it sticks firmly to gravel or rock, selected by the fish for spawning. Rare instances are known when starred sturgeon and sterlet exit the river to spawn in the flood plain.



Larva of sturgeon (Starred Sturgeon)

Breaking out of the egg, the sturgeon larvae have a yolk sac attached to their belly and are fed by it (endogenous feeding) when the yolk sac is being going down. This is followed by external active (exogenic) feeding. Then the larvae either migrate directly to the areas of the sea near the river mouths (e.g. starred sturgeon in the Kuban River) or stay for a while in the river. But normally, the sturgeon fry migrate to the sea the same summer.

In the river, the sturgeon larvae first feed on plankton (daphnids, etc.), and then - on crustaceans and worms. The beluga offspring move to predatory feeding while they are still in the river.

Further pre-mature fattening of sturgeons takes place in the sea. Thus, the Caspian Sea, the Sea of Azov, the Black Sea and other seas are some sort of large natural hatcheries for all groups of sturgeons. Breeders are also gaining weight in the sea between the periods of repeated spawning.

Sturgeons of the Siberian Rivers and of the Amur river permanently live in rivers, but by autumn they move down the river and reach the bays (Ob-Tazov Bay, Amur estuary), deltas, and pre-estuary river areas. Their upstream spawning migration takes place in spring. The adult Baikal sturgeon lives in the Baikal Lake but migrates to rivers (Selenga, Barguzin) for spawning.

The diadromous sturgeons form the early run and the later run. The sturgeons, which enter the river for spawning in one particular year, stay for winter time the same year and then spawn in the spring of the following year, are referred to as the early runs. The later run sturgeons enter the river normally in spring and spawn in spring and in the early summer of the same year.

These are the external characteristics of sturgeons, but there is also a variety of likely interesting peculiarities, identified in the result of modern embryological, physiological, biochemical, genetic and other studies.

Carl Linnaeus, the founder of modern taxonomy, attributed the sturgeons to the group of Amphibians (*Amphibia*).

Currently, sturgeons are related to the Fish (Pisces) group. However, modern embryological, physiological and genetic data point at numerous differences between sturgeons and both cartilaginous fishes and bony fishes. Thus, some peculiarity is observed in the embryonic development of sturgeons, which is different from fish, but similar to amphibians. There are peculiarities in their cerebrum structure, as well as in protein and lipid compositions of different tissues.

It has now been demonstrated that, for a variety of factors, these fish differ significantly from both cartilaginous fish and bony fish. Moreover, for a number of factors, their organization is superior to amphibians and is close not even to reptiles, but to mammals!

The sturgeons' genetic apparatus is unique as well. As recent surveys have shown, sturgeons are polyploidy species. The chromosome set of different species may be 4n (beluga, kaluga, barbel sturgeon, Persian sturgeon, starred sturgeon, greater shovelnose sturgeon, etc.), 8n (Russian, Siberian, Adriatic, lake and other sturgeons) and 16n (Sakhalin and short-nosed sturgeons). Moreover, the Sakhalin and short-nosed sturgeons are record-holders of the number of chromosomes among the vertebrate species– 500! At the same time, sturgeons have no sex chromosomes, and their differentiation is epigamic; i.e., under the influence of environmental factors.

According to the latest data, 24 sturgeon species currently inhabit the water bodies of the world. Six of them live in the basin of the Caspian Sea. One species – beluga (*Huso huso*) – is related to the Beluga genus, while the other five – to the Sturgeon genus.

CASPIAN STURGEONS

Beluga – Huso huso (Linnaeus, 1758)

Type: *Chordata*
Group: *Osteichtyes*
Order: *Acipenseriformes,* Berg, 1940
Family: *Acipenseridae* Bonaparte, 1832
Genus: *Huso* Bramdt, 1869

Common names: Russian – *beluga;* Azerbaijan – *Agh-kulag-nyarya, gyuzgi-burun;* Iranian –*Phil mahi, Beluga;* English –*great sturgeon*

Beluga has a torpedo-like body. The chorda is preserved. The caudal fin is heterocercal. Spiracles are well developed. Branchiostegal membranes are interconnected. The snout is short, pointed, slightly upturned, soft from above and on both sides, uncovered with bone scutes. The inferior mouth, which is crescent shaped when closed and half-moon-shaped when open, does not transition to the sides of the head; the lower lip is interrupted. Barbels have foliate appendages. The number of dorsal scutes is 10-15; lateral – 40-51; ventral – 9-11; gill rakers – 19-30.

Intraspecific forms. Subspecies *Huso huso ponticus* (Salnikov and Malyatskiy, 1934) – the Black Sea beluga. Subspecies *Huso huso maeoticus* (Salnikov and Malyatskiy, 1934) – the Sea of Azov beluga. Within the Caspian Sea, there are three forms: the Kura, Ural and Volga beluga. In terms of morphology, they are almost similar, but their maturity, length, and fertility differ. There are also the faster and slower run forms of beluga.

It inhabits water bodies all over the world; for spawning, it enters the rivers of the Caspian basin: Kura, Volga, Ural, Terek and Sefid Rud.

It is found in the basins of the Sea of Azov and the Black Sea; single specimens have been recorded in the southern part of the Adriatic Sea, and some species were found in the rivers of Anatolia. Beluga fattens in shallow waters at 1.5 - 30 m depths. In winter, belugas are found at 130-180 m depths, but most fish prefer 10-60 m depth. Beluga migrates within the area for spawning, wintering and feeding.

Beluga, as a predator, actively searches for and catches the food. Fry initially has mixed food: crustaceans, mollusks and fish. During the first month (June) of summer, beluga's

fry eats mostly crustaceans. However, due to shortage of crustaceans during the low-water season, the fry eats gobies.

Beluga fry (7.0-15.0 g), migrating down the river, feed on amphipods, larvae of chironomids, ephemeral flies and trichopterans, as well as oligochaetes, eggs and larvae of sturgeons and other fish. Larger species feed on the starred sturgeon and sturgeon fry.

When transitioning to active feeding, young beluga may show signs of anthropophagy (cannibalism). The adult beluga feeds mainly on fish. The beluga's food may differ depending on seasons and foraging sites. Some instances have been recorded when white-coat seal puppies were found in beluga stomach.

Beluga reaches maturity late. The majority of males reach maturity at the age of 12-15 years, and females – at the age of 15-20. In the Volga River, males reach maturity at the age of 10-15 years, and females – at the age of 16-22. The beluga lays its eggs on solid substratum: rocks, pebble, gravel, coarse sand, etc.

After the construction of the Mingechavir hydroelectric station, no natural spawning areas for beluga remained in the Kura River. The beluga's reproduction is being maintained only through breeding in commercial hatcheries.

For spawning, the Ural beluga uses pebble and gravel deposits upstream at a distance of 400-1200 km from the city of Atyrau. Approximately 70 spawning sites were preserved with a usable area of 922 hectares. The majority of fast run belugas spawn on channel ranges at 6 - 12 m depths - at the river section between the towns of Chapayevo (650 km from the Ural estuary) and Uralsk (850 km from the Ural estuary). Developing roes are found in the Ural River Delta, as well.

Spawning of the Volga beluga takes place in an unregulated section of the Volga River, downstream the Volgograd hydroelectric station dam – in an area between Volgograd and the settlement of Kamenny Yar. The spawning substratum consists of flagstone fragments, gaize, pebble, and coarse sand. Beluga spawns 10 - 30 m depths at the river high currents of 1-2.5 m/s.

Time of breeding. The faster matured beluga spawns at 7-11° C water temperature, while the slower matured – at 10-15° C.

No exact data is available on the frequency of beluga spawning. Males enter the river for re-spawning in 3-4 years, and females - in 4-6 years. Spawning of the Volga beluga takes place in early spring (end of April- beginning of May) at 6-16^{0}C water temperature.

Fecundity. The fecundity of females is determined according to their mass, length and age. The length of the Ural beluga varies from 136 to 405 cm; 200-260 cm-long fish are observed most frequently. In recent years, the average length of females has been 245.0 cm, and of males – 210.6 cm. Minimum age is 12 years; maximum – 39. The absolute length of adult species of the Volga beluga is 180 cm and more. The immature portion of the population dominates in the fattening areas. After reaching age of 11 (males) and 16 (females), individual species of beluga mature and begin migrating for spawning. At present, the maximum age of beluga males is 35-40 years; females are found at ages of between 16 and 50-55. The average weight of the Volga beluga ranges from 114.6 kg

(females) to 62.8 kg (males) and the length is 239.7 and 204.7 cm, respectively. The average age of male belugas – 22.7 years; female belugas – 17.7 years. Populational fecundity makes 1,971 million eggs. The older the belugas are, the higher their fecundity is. Currently, the average absolute fecundity of the Volga beluga varies from 680,000 to 800,000 eggs.

The beluga creates hybrid forms in nature, such as sterlet x beluga, beluga x sterlet, beluga x starred sturgeon, beluga x barbel sturgeon, and beluga x sturgeon.

The beluga x barbel sturgeon hybrid was obtained for the first time at the Kura Experimental Fish Farm in Azerbaijan. This hybrid was successfully introduced to the Ropshin Lake of the Leningrad Region (Russia).

Viable hybrids – beluga x sterlet (bester) – were obtained in the Volga and Don using artificial fertilization.

Beluga has few enemies in the sea. The embryonic, larva and fry life-cycle phases of beluga are the most vulnerable to contamination, oxygen deficiency, and predator fish.

Since young beluga in its first year of life in the river and in the sea is a benthophage species, it may compete in searching for food with the offspring of other sturgeon species, gobies and carps.

The adult beluga can compete in searching for food with seals and sanders, eating carps and, in particular, the Caspian roach. In the sea, beluga has most competitive trophic relations with another major predator – the Caspian seal. On the other hand, the young seals are the sources of food for large belugas, particularly in winter and early spring.

The beluga lives a very long life; certain species live up to 100 and more years.

A 1.5-ton beluga was caught in 1827 in the Volga-Caspian area. In 1924, a 1,228 kg fish was caught in the area of the Biryuchya Spit (Volga-Caspian). On May 11, 1922, a female beluga weighing up to 1,220 kg was caught in the area of the Volga River mouth. Belugas with an overall weight of 1,400 kg and whose ovaries weighed 400 kg have also been found. A case is recorded when a beluga with a weight exceeding 1,000 kg was caught near the Ural River mouth, and its caviar weighed 180 kg. In 1973, a scientist from the Azerbaijan Fishery and Sturgeon Breeding Research Institute caught a beluga weighing over 1,000 kg. In spring 1988, fishermen of the Neftchala region of Azerbaijan caught two belugas weighing 690 and 727 kg. In April 1986, a beluga weighing 867 kg was caught in the Urals, and its caviar weighed 156 kg.

DO YOU KNOW THAT….

Fish weighing 15 to 300 kg, which we now know as belugas, were called belyak by Ural Cossaks; beluzhatnik by Volga fishers, and polumerniy by fishery managers in the XIX century.

In ancient times, every sixth beluga caught in the Don River was over 4 m long, while every fifth beluga caught in the mid-Volga Region in the Middle Ages was 4-6 m long. In the XVIII century, academician S.G. Gmelin witnessed that 500 belugas weighing 655-820 kg were caught within just two hours. XX century records indicate that there were only about twenty cases of the catch of belugas weighing over 600 kg.

A stuffed 6.5 long beluga is displayed in a regional museum in Astrakhan. The fish was caught eight years ago near Astrakhan city and weighed 1,840 kg. The regional museum received this huge fish from… poachers who anonymously told by phone where the beluga could be taken from. The scientists claim that this beluga could have contained up to 250 kg of caviar.

The construction of hydro stations on the Volga River and the blocking of migration routes resulted in low replenishment of beluga stocks through natural reproduction. The beluga

has lost practically all of its spawning grounds, and more than 90% of it is now artificially reproduced at commercial hatcheries.

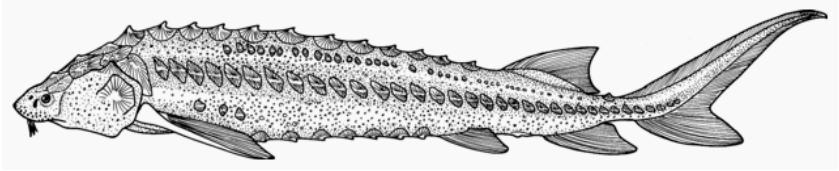
Overfishing, poaching, and pollution of the rivers and the Caspian Sea cause a sharp reduction of beluga populations. At present (since 2001), the commercial caught of beluga has been banned; however, poaching is widely spread, both in rivers and the Caspian Sea.

Sturgeon Genus – *Acipenser*

To date, 16 species are known in the genus ***Acipenser,*** and some of them are endangered. Five of them inhabit the Caspian Sea.

The Russian sturgeon is the most valuable and abundant sturgeon in the Caspian.

Russian Sturgeon – *Acipenser gueldenstaedtii* Brandt, 1833



Zootaxy position:
Type: *Chordata*
Group: *Osteichthyes*
Order: *Acipenseriformes* Berg, 1940
Family: *Acipenseridae* Bonaparte, 1832
Genus: *Acipenser* Linnaeus, 1758
Species: *Acipenser gueldenstaedtii Brandt, 1833*

Latin name is given in honor of the Russian naturalist I.A. Guldenshtedt.

Common names: Russian – *Russian sturgeon;* Azerbaijan *–nere, rus neresi; Iranian – khaviari rusi, tas;* English *–Russian sturgeon*

Related forms. The Persian sturgeon **–** *Acipenserpersius, Borodin;* the Atlantic sturgeon – *Acipenser sturio,* Linnaeus; the Siberian sturgeon – *Acipenser baeri baeri,* Brandt; the Baikal sturgeon – *Acipenser baeri baeri n.baicalensis,* A.Nikolskiy; the Amur sturgeon – *Acipenser schrencki,* Brandt; the Sakhalin sturgeon – *Acipenser medirostis,* Ayres; the Adriatic sturgeon – *Acipenser naccari,* Bonaparte; the Chinese sturgeon – *Acipenser sinensis, Gray*, *Acipenser dabrianus, Dumeril;* the Japanese sturgeon – *Acipenser kikuchii,* Tanaka, *Acipensermultisculatus;* the snub-nosed sturgeon – *Acipenser brevirostris,* Le Seuer; white sturgeon – *Acipenser transmontanus,* Richardson; the lake sturgeon – *Acipenser fulvescens,* Rafinesque.

Origin. There is no consensus on the origin of sturgeons. Some ichthyologists believe the genus *Acipenser*, as well as the genera *Polyodon* and *Scaphirnynchus*, originated in the territory of North America (the Mississippi River). According to other explorers, sturgeon-like fish originated in the territory of Central Asia in Tethys Sea basin.

Russian sturgeon

Distribution. The Russian sturgeon is endemic to the Pontic-Caspian basin; inhabits the waters of the Caspian Sea, Sea of Azov, and Black Sea.

There are diadromus and non-anadromous forms of sturgeon. The diadromus form has fast and slow matured varieties. Non-anadromous (permanent dwellers of the river) forms are in the Volga, Kama and, perhaps, in the Ural River. The Volga river population is most abundant in the Caspian.

In the Sea of Azov-Black Sea basin, sturgeon comprises the following populations: Black Sea-Caucasus (Rioni), Black Sea-Ukraine (Dnepr), and Azov.

The Russian sturgeon from the Caspian enters the Volga for spawning, fewer enter the Ural River, and very few enter the Terek, Sulak and Samur rivers. Along the Iranian coast the sturgeon enters the Sefid Rud River, and rarely the Gorgan, Babol, and other rivers.

The Kura River is the main spawning ground on the Azerbaijan coast. Sturgeons used to migrate up the Volga – upstream of Tver city, up the Dnepr – upstream of Kiev, and up the Kura – to Tbilisi.

From the Black Sea, sturgeons enter the Danube and Dnepr; very few enter the Rioni, Mzymta, Psou, or other rivers.

For spawning, sturgeons from the Sea of Azov enter the Don river and, in small numbers, the Kuban river. Recently,, the migration of sturgeon (and beluga) to the Kuban River has been increased.

Volga sturgeon males reach sexual maturity no earlier than the age of 10; for females – no earlier than 13.

Kura sturgeon males reach sexual maturity at the age of 13-14; for females – 19-30.

Sexual maturity for Azov sturgeons: males – 8-9 years; females – 10-14; the Dnepr sturgeon matures no earlier than the age of 11.

The maximum recorded age – 48 years; maximum length – 230 cm and weight (rarely) – up to 80 kg and even 120 kg.

The average commercial weight of the Volga sturgeon is 12-16 kg. In 1960, the average weight of the Volga sturgeon was 14.5 kg; in 1962, the average weight of migrating male sturgeon in the Volga was 11.7 kg, and that of females – 21.3 kg.

The average commercial weight of the Kura sturgeon is 22-24 kg; and that of the Azov sturgeon –approximately 15 kg.

The Russian sturgeon's fecundity varies from 84,000 to 837,000 eggs; it makes 250,000-350,000 eggs in average.

Sturgeon, as well as all sturgeon species, undergoes the following stages in its life circle: embrio, prolarva, larva, alevin, juvenile, and adult. Embrio undergoes the following five stages:

- fertilization,
- fission,
- gastrulation,
- post-gastrulation till pre-heart beat,
- heartbeat – egging from the beginning of the heart beating to the emergence from eggs.

The prolarva period begins with the embryo's release from membranes and ends with it transitioning to active exogenic feeding.

Sturgeon larvae that have all lateral and ventral scutes, rays along the dorsal blades of the caudal fin, a short, rounded snout that makes up less than 50% of the length of the head, and middle barbels that reach the snout edge, are considered as juveniles. A juvenile that reaches maturity is considered to be an adult.

In order to grow normally, sturgeon needs a set of favorable conditions of the aquatic environment, with certain amplitude in fluctuation; temperature and oxygen regime, reaction of the environment, water flow, and the absence of contamination and predators. With oxygen deficiency and reduction of oxygen concentrations in the water up to 5-6 mg/l, a delay in embryo development is observed. During spawning of sturgeon in the Volga River, oxygen concentrations in the water should be no less than 10.1-8.2 mg/l. Industrial waste water, oil and other pollutants of the river water may have an adverse effect on the development of embryos and juveniles of the Russian sturgeon, as well as of other sturgeon species. Oil, which settles on the river bed together with particles of suspended solids in the river, is particularly dangerous for developing eggs.

In the Caspian Sea, sturgeon at an early age feeds on invertebrates (crustaceans, mollusks, annelids, etc.) and, as it becomes mature, it begins to feed on mollusks and fish (gobies, shads, kilkas).

Sturgeon in nature gives rise to hybrid forms with beluga, starred sturgeon, barbel sturgeon, and sterlet species. Through artificial fertilization, viable hybrids have been achieved: sturgeon x sterlet, sterlet x sturgeon, sturgeon x beluga, and beluga x sturgeon.

Effect of anthropogenic factors on the species:

- regulated river stream flow;
- poaching industry;
- water contamination.

For a long time (1931-1940; 1951-1962), the commercial fishing of the sturgeon population in the Caspian Sea has been growing intensively. During river harvesting between 1962 and 1981, the rate of sturgeon extraction in the Volga-Caspian basin remained low. The numbers and biomass of the population were underutilized. With a new method of harvesting introduced in 1981, the intensity of fishing sharply increased, and as a result, the amount and biomass of the spawning population began to decrease, leading to the reduction of the natural reproduction. The high rate of harvesting in the Ural-Caspian basin in the 1970s-1980s also contributed to the reduction of the sturgeon population. Artificial breeding in hatcheries, initiated in the mid-1950s, was a counter measure for the preservation of the species.

Beginning in the 1990s, illegal poaching became the main factor of the sturgeon population reduction both in the sea and in the rivers.

RUSSIAN STURGEON has been recorded in the International Red List.

Persian sturgeon *Acipenser guldenstadti persius* Borodin, 1897

Related forms: other species of the *Acipenser* family**.**

Common names: Russian – *persidskiy osetr*; Azerbaijan *–neresi*; English *–Persian sturgeon*.

The Persian sturgeon lives in Middle and Southern Caspian, preferring the warm waters.

Unlike the Russian sturgeon, the Persian sturgeon's body is more elongated, bluish in shade, with a longer head – 17.6% of the total length, and a bigger snout and postorbital space. Its snout has a characteristic structure: in profile it is visibly bent downwards and comparatively short and pointed, but more bulky than that of the Russian sturgeon. The Persian sturgeon's body thickness and volume is larger than that of the Russian sturgeon. Large bony platelets are randomly distributed above the lateral row of scutes. The lateral rows have 20-42 scutes with radial grained ribs; the ventral rows have 7-14 scutes.

The Persian sturgeon can be 2 m long.

It is a valuable commercial species. The highest catches in the Azerbaijani waters of the Caspian were registered in 1936-1940. By the early 1950s, the catch decreased to 630 tons, and by the 1950s – to 310 tons. Catches in Iranian waters in the early 1950s amounted to 250 tons, but they grew to 920 tons by the early 1960s.

It performs feeding, spawning and post-spawning migrations. For spawning, it mainly enters the Kura River, and to a lesser extent – the Volga and Ural, the rivers of the Dagestan (Samur, Terek) and Azerbaijan (Lenkoranka, Astara), and the Sefid Rud River in Iran.

The Persian sturgeon feeds most actively during diurnal and nocturnal hours. Seasonal changes in diet are characteristic for this species. In spring, the main food intake is crustaceans and fish, mostly silverside.

In the Kura River, spawning grounds are located at the dam area of the Varvarinskiy Reservoir up to the village of Piraza; in the Aras River – 10 km below Bagramtapinskiy dam. Before runoff control activities, spawning grounds were located in the mid-flow of the Kura River at the town of Mingechaur (660 km from the mouth), and in the Aras River – at the village of Karadonly (330 km from the mouth).

The Persian sturgeon approaches the spawning grounds in the Kura between the second half of April to the middle of September, with the peak in August. The Persian sturgeon breeding efficiency depends on abiotic factors – hydrological regimes and water temperature. In the Kura River, spawning of the Persian sturgeon is interrupted from mid-summer to September due to a high water temperature.

During its development, the Persian sturgeon passes the same stages as all other sturgeon species: embryo, prolarva, larva, alevin, juvenile and adult.

The duration of the incubation period is the same as that of the Russian sturgeon. During embryonic and the early stages of the post-embryonic development, the spawn of the Persian sturgeon does not practically differ from the spawn of the Russian sturgeon. Embryonic development lasts from two to ten days. The time from hatching to active feeding is nine days. Having achieved 17-18 mm in length, the prolarva transitions to catching from outside. After juveniles have reached the pubescent state, they will become adult fish. In the Kura River, males reach maturity at the age of 7-8 years, and females – at the age of 10-11.

Persian sturgeon catches are drastically decreasing. Whereas in the 1980s its share in the total sturgeon catch in the Volga River was 4.0%, in 2000it was only 0.03%.. The catch in the Ural River did not exceed 5%. In offshore fishing near the Iranian coast, during the juveniles' catch, the number of the spawning population decreases, leading to the reduction of natural reproduction.

The main anthropogenic factors causing the reduction in the population of the Persian sturgeon include: runoff control activities in rivers and the loss of spawning grounds, and long-term increasing pollution of the Caspian basin. Offshore fishing in the Iranian sector of the Caspian was one of the reasons for a fall in the numbers of sturgeon.

Barbel sturgeon – *Acipenser nudiventris* Lovetsky, 1828

Common names: Russian – *ship*; Azerbaijan- *chalamo, chaya balygi, gyrt*; Iranian – *keshdi, shenavar*; English – *Ship sturgeon, Fringebarbel sturgeon, Spiny sturgeon*.

Fishermen in the Volga River call all cross-breeds (hybrids) of sturgeons by the name "ship." However, there is an independent species, named barbel sturgeon. The barbel sturgeon is a didromous fish. It inhabits the Caspian Sea, Aral Sea, Black Sea, and Sea of Azov basins, but it is very rarely found in the Black Sea and in the Sea of Azov in particular.

It has a torpedo-like body and a cone-shaped snout; gill membranes are connected to the isthmus. Its mouth is inferior, transversal, and exceeds half of the snout's width, forming a rostrum. Specific features include: large first scute and solid (not split in the middle) lower lip. Barbels are fringed and almost reach to the end of the snout. There are no platelets on the body between scute rows. The body is brownish; the coloration is similar to that of the sterlet and differs from other sturgeon species. The belly is white. There are five rows of large light scutes. The number of dorsal scutes is 11-16; lateral – 51-74; and ventral – 11-17.

The barbel sturgeon is not distinguished from sturgeons in a commercial net. In the Caspian Sea, the barbel sturgeon mainly inhabits the southern part, entering from there into the Kura River for spawning; in the Iranian sector, it enters into the Sefid Rud River.

The barbel sturgeon is rare in the Volga River, but enters the Ural River. Before the transfer of the Caspian starred sturgeon, the barbel sturgeon was the only representative of sturgeons in the Aral Sea. The barbel sturgeon only exists in the Aral Sea in early-run stocks. For spawning, the barbel sturgeon migrates from the Aral Sea to the Syr-Darya and Amu-Darya Rivers.

The barbel sturgeon lives up to 30 years and more, reaching 214 cm in length and 30 kg in weight. The age of the majority of barbel sturgeons caught in the Aral Sea is 12-21 years. It reaches sexual maturity at the age of 12-14 years. In the Kura River, the catch of barbel sturgeons is the fish at the age of 6-23 years; males - 9-16 years; females – 14-19. The average commercial weight of the barbel sturgeon in the Aral Sea is approximately 12-16 kg; in the Kura River – approximately 20 kg. Fecundity of the Aral barbel sturgeon varies from 216,000 to 388,000 eggs; and that of the Caspian barbel sturgeon – 280,000 to 1,290,000 eggs (593,000 eggs on average).

In the Aral Sea, the barbel sturgeon feeds mainly on mollusks, and in the Caspian – on fish and mollusks. In Lake Balkhash, the barbel sturgeon is a predator; and, as in the Aral Sea,

only early-run stocks can be found here. In 1933-1934, 289 adult Aral barbel sturgeons, weighing 6.7-30 kg, were released into the Ili River. In 1934, the barbel sturgeons spawned in the Ili River and produced offspring that again entered again the Ili River at the age of 12-13. In Lake Balkhash, a barbel sturgeon at the age of 11 reaches 130 cm in length and 9-9.5 kg in weight. It is an aggressive predator and euryphagous. In the sea, adults mainly feed on fish (90%), pugolovka, sand smelt, kilka and gobies. Their diet also includes different kinds of minor crustaceans; the consumption of crabs and shrimps has been observed in particular; mollusks are found in their diet, as well. Juveniles feed on zoobenthos.

The spawning grounds of the barbel sturgeon in the Kura River are located at a distance of 600 km from its mouth. The spawning substrate includes gravel, sandstone, coarse sand, and stiff clays with a shell mixture.

The barbel sturgeon's migration to the Kura River is observed throughout the year with two peaks: the main – in March-April, and the less intense – in October- December. The spring migration to the Kura River commences when the water temperature reaches 6.2-10.4° C, and the peak of migration is observed at 7.4-16.4° C. The autumn migration peak is observed at temperatures of 17.9-12.1° C. Breeding takes place in May-June at temperatures of 15-25° C. The average fecundity of the Kura barbel sturgeon is 594,000 eggs (between 280,000 and 1,003,000 eggs). Embryonic development of the barbel sturgeon takes place at a water temperature of between 19.5 and 21.9° C.

The barbel sturgeon passes the same stages as all sturgeon species: embryonic, prolarva, larva, alevin, juvenile and adult.

A significant amount of juveniles winters in the river. They mainly inhabit large, deep holes (10-18 m) with low flow rates. A portion of juveniles migrates to the sea the following year. Species that have wintered in the river for a second time stay in this river permanently, turning into a non-migratory type. Larvae stay on the Kura spawning grounds for several months and longer (up to 8 years). In the rivers barbel sturgeon juveniles are eaten by catfish and sander. The survival rate of barbel sturgeon juvenile is lower than that of other sturgeon species because it stays in the river for a longer time.

Males of the Kura barbel sturgeon reach maturity at the age of 9 years; females usually mature at the age of 14, and in rare case, at the age of 12-13.

The barbel sturgeon yields hybrid forms in nature with the beluga, the starred sturgeon ("starred sturgeon ship"), and the sturgeon. Through artificial fertilization, viable hybrids have been achieved in the Kura River: barbel sturgeon x sturgeon, barbel sturgeon x starred sturgeon, barbel sturgeon x beluga, and beluga x barbel sturgeon.

The Kura barbel sturgeon population is steadily declining. In 1980, between 66 and 112 specimens of barbel sturgeon entered the Kura River for spawning. In 1988-2000, they were found in single numbers.

The main causes for the catastrophic reduction of barbel sturgeon catches in the Kura River include:

- runoff control activities in rivers (1953) and loss of large spawning grounds; non-recoverable water consumption, which causes the river's low water levels;
- offshore harvesting of "precious" fish, which continued until 1962;
- offshore seismic surveys;
- pollution of the sea, which has resulted in a loss of significant areas of spawning grounds for sturgeons, including barbel sturgeons (the area near Sumgait, the shallow water from Absheron to the Kura River mouth, etc.);
- poaching.

The species BARBEL STURGEON has been placed on the Red List of Azerbaijan
The species BARBEL STURGEON has been placed on the Red List of Russia
The species BARBEL STURGEON has been placed on the International Red List

Starred sturgeon – *Acipenser stellatus* Pallas, 1771

Common names: Russian: *sevruga;* Azerbaijan: *uzun-burun, ag-balyg;* Iranian: *ozoon-boroon;* English: *starred (stellate) sturgeon*

The starred sturgeon is easily distinguished from all other sturgeon species by its unusually long nose, which almost has the form of a dirk and gives the fish a rather strange appearance. Its forehead is rather prominent. Its body is elongated, spindly, with five longitudinal rows of bony scutes. Number od scutes: dorsal – 9-16; lateral – 26-43, which rise towards the tail end and extend to form the hamulus; and ventral – 9-14. The sides between rows of scutes are covered with light starry platelets. The top of the head is covered with bony shields. Snout is elongated and its length is more than half of the length of the head. Mouth is protractile and appears as a transverse slit; the lower lip is non-continuous. There are four barbels beneath the snout. The barbels have no fringe. The average number of gill rakers on the arch is 24.7-25.5. The dorsal fin is taken far backwards and located above the anal fin. Rhombic scales are found on the upper lobe of the caudal fin.

The body has a sorrel color with a bluish-black hue; the sides and belly are white. However, the length and form of its snout considerably change; so female and juvenile snouts are always shorter, but starred sturgeons in the Sea of Azov, which generally reach their maximum growth here, are distinguished by their short snouts.

Generally, in terms of its length and weight, this fish ranks between the sterlet and the sturgeon. The starred sturgeon ranks significantly below the sturgeon in size and never exceeds 5-5.5 m in length and 47 kg in weight. The average weight of this fish in the Caspian is 5.2-5.6 kg; in the Sea of Azov, where it is more abundant – 8 kg. With its similar weight, the starred sturgeon is always significantly longer than similar sturgeon species, and the starred sturgeon with 24 kg weight can be up to 2 m in length.

In the Caspian Sea, the starred sturgeon is found in three populations: Volga, Ural and Kura. Fish of Volga River origin prevail in the sea.

This sturgeon species is spread throughout the Caspian Sea. For spawning, it enters the Volga, Ural, Terek, Sulak, Samur, Lenkoranka, Sefid Rud, Kura, Aras and rivers of the southern coast as far as Gorgan.

Ac. stellatus is found in the Caspian Sea, the Black Sea, and the Sea of Azov, and very rarely in the Adriatic and Marmora Seas.

The starred sturgeon is a more pelagic species than sturgeon. Moving in large depths in sea and river, it prefers to be kept in the water column. Within its geographic range, the starred sturgeon taps the food-rich ridges and the shelf zone of the sea, preferring the sea bottoms covered with silt or silt/sand, which are rich in different species of minor crustaceans. It spawns on river beds, mainly on stony ridges.

In spring, it makes spawning (anadromous) migrations from the Middle and Southern Caspian to the Northern Caspian, from where mature fish enter the Volga, Ural and Dagestani shoreline rivers to spawn. After spawning, they migrate downstream into the sea to feed. Feeding migrations are continuous movements of fish from one part of the sea to another in search of food. Pre-wintering migrations of starred sturgeon begin earlier than those of other sturgeons, namely – in August. The Ural starred sturgeon winters in the Ural and Mangyshlak deep trenches; the Volga starred sturgeon – along the Dagestani and Azerbaijani shores. Immature species prefer the Turkmen shelf zone, where the water is warmer in winter.

Downstream migration of larval starred sturgeon to the Volga River occurs in June-August, predominantly within a 3-m layer of water. It feeds mainly on benthic organisms and fish. The starred sturgeon has a well-developed olfactory organ. When searching for food, the juvenile is constantly moving above the bottom and trying the substrate using tactile and taste receptors located on barbels and lips. The adult starred sturgeon and adolescent fish use the rostrum for digging into bottom sediments. When food item is detected, the fish makes a rapid seizing-sucking movement with its protractile mouth. Unlike other sturgeon species, the starred sturgeon's capability to suck in food objects is strongly developed.

The larvae transition to active feeding on the 5^{th}-9^{th} day after hatching when their bodies reach 18-19 mm in length. The main food items are Oligochaetae, Polychaetae, Crustacea, as well as larvae and pupae of Chironomidae. During the first month in the sea, the juvenile feeds mainly on amphipods. In the Northern Caspian, crustaceans prevail in the food diet of the young starred sturgeon, whose body is up to 10 cm in length. In all subsequent years, the nereis together with higher crustaceans are the main food of the starred sturgeon; however, alongside with nereis and mollusks, fish - mainly herrings and gobies - play a significant role in the food supply of starred sturgeons at feeding grounds of the Middle and Southern Caspian.. Of herrings, the starred sturgeon prefers common and anchovy kilkas and gobies.

There are early- and late-run starred sturgeon stocks; spawning occurs from April to September. Spawning grounds are located on a pebbled bottom. Following runoff control activities, only five channel spawning grounds, with an area of 112.8 hectares, survived out of 53 hectares of spawning grounds for sturgeons in the Kura River and 290 hectares in the Aras River. In the Volga River, the area of spawning grounds has been reduced by a

factor of seven, which has led to a sharp decrease in the number of sturgeons, including starred sturgeon.

The fecundity of females is between 30,000 and 600,000 eggs. After spawning, juveniles and spawners migrate to the sea.

Due to the damming of many rivers through a chain of hydroelectric power plants, the eggs of starred sturgeons are incubated in hatcheries, and the bred juveniles are released into natural water reservoirs.

The minimum age of starred sturgeon males in the commercial sites on the Ural and Volga Rivers is 5-6 years. En masse males reach sexual maturity at the age of 11-15 years; females – at 14-18. The number of males younger than 12 years of age found in catches is approximately 10 times higher that of females. At the age of 12-15, the preponderance of males over females is reduced by a factor of two; from the age of 15 – females dominate over males. After 25 years, the share of males and females does not exceed 0.3-1.1%. The maximum age of males in the population is 27 years; of females – 30-31. The starred sturgeon easily cross-breeds with the sterlet and barbel sturgeon.

Starred sturgeon meat has high taste qualities, may be kept in cold and frozen forms, and can be used for preparing dried and smoked balyk products. The caviar is used for the production of pressed and granular caviar, as it is finer and less valuable than the caviar of the sturgeon and beluga.

The starred sturgeon swim bladder makes the best isinglass.

STERLET – *Acipenser ruthenus* Linn'e, 1758

Common names: Russian – *sterlyad*; Azerbaijan – *chyakya*; English – *starlet, or sterlet*.

In general the sterlet inhabits the rivers of the Caspian Sea, Sea of Azov, Black Sea, and Baltic Sea basins. It is a freshwater fish that consistently lives in the Volga and its tributaries, as well as the Ob and Irtysh rivers. It also is found, although rarely, at the western coast of the Caspian. The sterlet was recorded in the Baku and Kizil-Agach bays, from where occasional species enter the Kura River. The sterlet is well-known in the Danube – as far upstream as Vienna. There are historical records of the presence of sterlets in the Kvaerner Gulf (northern part of the Adriatic Sea). Through a system of channels, sterlets entered the Northern Dvina, as well as Lake Ladoga and Lake Onega basins. In Siberia, this fish is found in the Ob, Irtysh and Yenisei Rivers. There are no sterlets in the Pyasin, Khatang, or Lena, nor in rivers further to the east, as well as the Amur (the Ob sterlet was transferred to the Amur River).

The sterlet is easily distinguished from all other sturgeon species by its size and its long narrow snout, long fringed barbels reaching the mouth, bi-septate lower lip, and contacting side scutes. As already stated, instead of the usual scales, all sturgeon species are covered with bony plates (scutes), arranged on the body in five lateral rows, of which one occupies the middle of the fish back, two are located on each side, and two – on the belly along its edges; the area of skin between these scutes either is bare or covered with minor bone scutes of various forms. Additionally, the sterlet's dorsal scutes are closely spaced; they number between 13 and 17, and each ends behind with a rather sharp spine. The sterlet has very many lateral scutes – between 60 and 70, as well as 13-15 ventral scutes, and the latter do not contact one another.

The color of sterlet changes, subject to the location, and may be more or less yellow. But the usual color of its back is grayish-brown or dark-brown; its belly – yellow-white; its fins – gray. The length of the sterlet's snout is also subject to significant changes, and in many areas fishermen differentiate the sharp-nosed sterlet and the tube-nosed sterlet.

Most rivers are inhabited by sharp-nosed (typical form, according to Berg) and tube-nosed sterlet forms. The sterlets were transferred from the Northern Dvina to the Daugava River (Western Dvina), as well as to the Mezen, Neman, Onega and Pechora Rivers and to the Shuya (Onega Lake basin). In addition, the Ob sterlet and the sterlet-sturgeon hybrid were transferred from the Ob to the Amur. The sterlet was transferred to some lakes as well. The tube-nosed (early-run) sterlet in the Volga and Kama grows quicker that the sharp-nosed; it is more well-nourished and fertile. Usually, a commercial sterlet is 0.5-2 kg in weight and 30-65 cm in length; it rarely is 3-4 kg in weight and 80-90 cm in length, and a 6-8 kg sterlet is an exception. The maximum weight of the sterlet is 16 kg; maximum length – 100-125 cm.

The sterlet prefers to live at the deepest spots in rivers, always staying (creeping)at the bottom, and leads a very hidden life. It moves to shallow areas (into grass and towards shores) only in the evenings or at nights, and it either searches all holes and burrows of the river bans or rises to the surface and gingerly, as if on the prowl, turns belly up and catches with its mouth the insects falling into the water.

Sterlet males reach sexual maturity at the age of 3-7 (mostly at 4-5) years; females – at 5-12 years (mostly at 7-9) after reaching a length of 28-34 cm. Fecundity of the Ob sterlet is between 6,000 and 45,000 eggs; the Irtysh sterlet – between 6,000 and 16,000 eggs; and the Northern Dvina sterlet – between 4,000 and 140,000 eggs. Sterlets spawn in 1-2 years.

Males in the Volga become adults at the age of 3 years; females spawn in the sixth year of their life. The Volga has both the early- and the late-run types of sterlet. Spawning takes place in spring, from late-April to June, at a water temperature of between 7-10 and 20° C, on a pebbly floor with a high water flow rate. An egg is gluey, 1.9-2 mm in diameter. The incubation stage lasts four-five days. The prolarva yolk sac is absorbed, depending on the temperature, over 6-10 days.

The sterlet feeds on invertebrates, mainly insect larvae, resting on submerged snags. It devours the larvae of chironomids.

In nature the sterlet yields hybrid forms with sturgeon and starred sturgeon (sturgeon ship, starred sturgeon ship). The sturgeon ship is rather common in the Volga; the starred sturgeon ship is common in the Volga, Don, and Danube Rivers. A hybrid of the Siberian sturgeon and the Siberian sterlet (the so-called “koster”) is well-known in the Ob and Yenisei Rivers. In the Volga, through artificial fertilization, viable hybrids have been achieved: sturgeon x sterlet and sterlet x sturgeon. Beluga-sterlet hybrids named “bester” were moved to the Sea of Azov and some water reservoirs.

Nowadays, the number of sterlets in the Dnepr, Don, Kuban, Ural, Sura, and the Upper and Middle Kama Rivers has fallen considerably, and it has become a protected species here.

Sturgeons in water reservoirs of our planet

Apart from the six species of sturgeon inhabiting the Caspian basin described above, at least 18 more species relating to the order *Acipenseriformes* are currently classified. These include the representatives of the **sturgeon** (*Acipenseridae)* and spadefish (*Polyodontidae*) families.

Adriatic sturgeon *(Acipenser Naccaril Bonaparte,* 1836):

A rare, poorly studied species. Not large: as an exception, it can reach 2 m in length and 25 kg in weight, but usually is far less.

It is very similar to the Russian sturgeon *A. gueldenstaedti*, may be its deviated intraspecific form. It has larger number of gill rakers – 30-35, while the Russian sturgeon usually has less than 30. The Adriatic sturgeon has 10-14 dorsal scutes, 32-42 lateral scutesand 8-11 ventral scutes. The dorsal fin contains 36-48 rays, and the anal fin – 24-31 rays. The body color varies from grayish-brown to almost black; the belly is whitish.

It is a diadromous species. For spawning, it enters the Po, Adije, Brenta, Liventsa, Tsetina, and other rivers of northern Italy, Yugoslavia, and Albania.. In seas, it stays near the shore, at depths of between 10 and 40 m, usually in close proximity to river mouths. It migrates to the rivers of Italy during the first months of the year and stays in fresh water until October. Spawning takes place in February-March. Its growth, reproduction, fecundity, egg development, feeding, and other aspects of its biology have not been studied.

Due to its rarity, this sturgeon species has no commercially value. No data on its numbers is available. Currently, attempts at artificial breeding are being made.

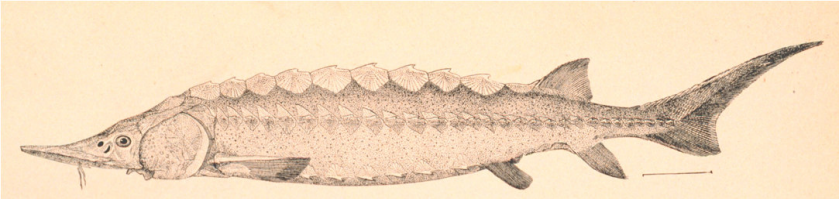
Amur sturgeon (*A.schrenckii*) – Amur River basin.

Common name: Buryat – *kilimy*; Chinese – *tsilifu*.

The Amur sturgeon is very close to the Siberian sturgeon, from which it differs in the form of its gill rakers: they are not rhipidate, but unimucronate and smooth. It is possible that the Amur sturgeon is just a subspecies of the Siberian sturgeon.

It is common in the Amur River basin, from the estuary to the Shilka and Argun Rivers. It has semi-anadromous and non-anadromous forms; the latter is represented with a number of local populations. It is 2 m in length and up to 50 kg in weight (up to 160 kg in the past). Males reach sexual maturity at the age of 10-13 years; females – at the age of 11-14. Spawning takes place in the Amur River channel in May-June. Main spawning grounds are located upstream from the city of Nikolayevsk-na-Amure. Fecundity makes between 29,000 and 434,000 eggs. Based on the nature of its diet, the Amur sturgeon is a typical benthic feeder.

Atlantic sturgeon *Acipenser sturio* L., 1758



Common names: Baltic or German *osetr* (Russian); *sturgeon* (English); *Stor* (German); *stb'rje* Norwegian); *jesiotr* (Polish); *sampi* (Finnish); e*sturgeon* (French)

Endangered species. Placed on the Red List of the International Union for Conservation of Nature and Natural Resources (IUCN) (Category I), the Red List of the USSR, and on a list of specially protected species of fish in Europe.

Very large sturgeon, exceeding 3 m in length and 300 kg in weight. It has 9-16 dorsal, 24-40 lateral, and 8-14 ventral scutes, as well as 15-29 gill rakers. The dorsal fin contains 30-50 rays, and the anal fin – 22-33 rays. Its scutes are larger and thicker than those of a Russian sturgeon of the same size, and they are radially striated. The spine in the pectoral fin is very strong. The snout is more elongated than that of the Russian sturgeon. Barbels are located closer to the mouth than to the snout end. The body color of adult fish varies from grayish-green and grayish-brown to bluish-black.

It is a diadromous fish and in the past it entered many large European rivers – the Neva, Western Dvina, Neman, Visla, Oder, Elba, Rhine, Seine, Thames, Trent, Loire, Gironde, Duero, Guadalquivir, Rhone, Po, Danube, and others. In the north, it was found as far north as Iceland and the White Sea; in the south – as far as the Mediterranean Sea and North Africa. It is likely that the non-anadromous form of this fish inhabited Lake Ladoga. Now this sturgeon species has completely disappeared in a vast portion of the geographic area (Map 9). Very sparse populations were preserved in the basis of the Gironde (France), Guadalquivir (Spain), Po (Italy), and Rioni (Georgia) Rivers.

It lives in waters of ocean salinity, has been observed at depths of 200 m, and makes lengthy migrations. The age of maturity differs in different parts of the area. Generally, the southern populations mature 2-6 years earlier than the northern populations. In the Gironde River, sturgeon males mature at the age of 13-15 years with a length of 125 cm; females – at 16-20 years with a length of 155 cm. In the Rioni River, male sturgeon become adults at 7-9 years with a length of 96-110 cm; females – 8-14 years with a length of 137 cm. It enters rivers from January through October; however, the migration peak falls on the spring flood (April-May). Males migrate first, usually 2-3 weeks earlier than the females. The Atlantic sturgeon would swim long distances up the large rivers: the Danube – almost 1,000 km; the Oder – 500 km; the Rhine – 850 km. Females prevail over males in populations. The sturgeon sex ratio in the Rioni River is 1.3:1; in the Guadalquivir – 3:1. The spawning period differs in different parts of the area. In the rivers of the Baltic Sea, spawning would take place from June through August, and in the Black Sea (the river Rioni) – in May-June.

Spawning grounds are stretches of a river that have a high-flow velocity and a rocky or pebbly bottom. It spawns in a wide range of temperatures – from 7.7 to 22° C. The

absolute fecundity significantly varies from 200,000 to 5.7 million eggs. For sturgeon from the Rioni River, the number is 790,000-1,820,000 eggs. Female sturgeon in Guadalquivir River lay between 289,000 up to 1,412,000 eggs. The eggs are from 2 to 3 mm in diameter. Depending on water temperature, egg development takes between 3 to 14 days. During the first year of life, juveniles migrate to river estuaries, where they live in brackish water up to the age of 2-4 years, after which they migrate to the sea.

The Atlantic sturgeon differs from other European sturgeon species by its more rapid growth, coming close to the beluga in this category. The highest recorded age of a sturgeon is 48 years.

Juveniles in rivers feed on maggots, worms, crustaceans, and mollusks. Adult sturgeons feed on benthic organisms (mollusks, polychaetes, shrimp) and minor fish (sand eels, gobies). In the Black Sea, anchovy *Engraulis encrasicholus* is the main prey. It continues feeding in winter, as well.

Back in the late 19th and early 20th centuries, the Atlantic sturgeon had commercial value in many European countries. Between 150 and 200 tons (or about 14,000-16,000 fish) of sturgeon were caught annually across the entire geographic area. But in the 1930s, catches fell to 50-60 tons. In the USSR (Baltic and Black Seas) during these years, approximately 8-10 tons were harvested. Overfishing, runoff control activities, and progressive pollution of rivers, where it entered for spawning, are reasons for the catastrophic decrease in numbers, and this has placed this fish on the brink of complete extinction. The total Atlantic sturgeon stocks in Gironde River at the beginning of the 1960s were determined to be only 1,000 fish. At present, the size of the largest preserved Rioni population of sturgeons apparently does not exceed 300 specimens. This species can be saved only by immediate, joint efforts of a number of countries directed to the artificial breeding. These measures are currently being determined. However, it is extremely difficult to catch even a few spawners in natural conditions to carry out this work.

Did you know …
… that the scientific name of sturgeons translated from Latin means 'precious'.
… that the sturgeon has lived on Earth for more than five million years, outliving even dinosaurs and mammoths.
… that in the time of Peter the GreatI it was ordered that bells should not ring and that oar blades should be wrapped in soft cloth to prevent scaring sturgeons during their spawning period.
… that the Atlantic sturgeon is undoubtedly the largest of all sturgeons. Back in 1939, a sturgeon 283 cm long and weighing 130 kg was caught in Lake Ladoga. The Atlantic sturgeon is on the list of fish which it is absolutely forbidden to capture.
… that the largest sturgeon ever caught by an angler weighed 212.28 kg. It was caught by Joey Pallotta on July 9, 1983 outside Benicia (California, USA.)
Few people know that sturgeons live for a very long time. They can live for up to 150 years, but they are currently endangered species.

Atlantic (long-nose) **sturgeon** (*A. oxyrinchus*) – Atlantic coast of America from Labrador to the Gulf of Mexico.

This is a near threatened species listed in the Red List of the International Union for Conservation of Nature and Natural Resources, under category II.

It is close to the Atlantic sturgeon *A. sturio* and sometimes considered a subspecies of the latter. It is widespread at the coast of North America. It is a very large sturgeon reaching 2.5-3.5 m in length and 160 kg in weight. Historical sources of the first half of last century mention catching giant fish weighing 270 kg (in 1932) and even 365 kg (in 1924).

It differs from the European Atlantic sturgeon by its longer upper tail fin blade. Young and adult fish have approximately the same coloring: dark blue (even black) head and back and lighter sides. The scutes are light and contrasting in color. The underside is white, sometimes with a pink hue. The range of these sturgeons extends along the Atlantic shores of North America from Labrador and the St. Lawrence River in the north to Florida, the Gulf of Mexico and lower Mississippi in the south.

This is typically a migratory fish. It goes to spawn upstream of many rivers in Canada and the USA: the St. Lawrence and its tributaries, St John, Delaware, Hudson, Potomac, Merrimac and relatively small rivers running from the Appalachians (North and South Carolina, Georgia, and Louisiana.). Its spawning travel is not that long, just 140-200 km from the sea. The vast majority of spawners go upstream in spring, but some start traveling in winter. In southern rivers spawning takes place in March and April and in those to the north (the tributaries of the St. Lawrence) - in June. The water temperature in the spawning period is 12-18^{0}C. The eggs are relatively small, more than 100 per 1g, and their diameter is between 2.5 and 2.7 mm. Fecundity is very high, up to 3.7 million; in large females it usually ranges from 800 thousand to 2.4 million. After laying their eggs the spawners immediately return to the ocean.

Juveniles grow quite quickly, and in August and September the under-yearlings (St. Lawrence River) reach 13-20 cm in length. They stay for a few years in the brackish waters of estuaries and then go out into the ocean after reaching a length of 76-92 cm.

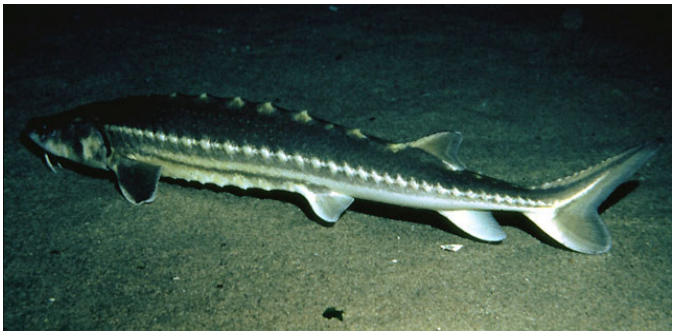
The fish do not achieve maturity before they reach a length of at least 122 cm. In estuaries the juveniles feed on chironomids, larvae and mollusks. Once in the sea, they feed on fish and mollusks.

There is no information available on the abundance of this species. Back in the late 1970s and early 1980s, about 60 tonnes of sturgeon were caught in South and North Carolina alone, while the total amount for the US and Canada was approximately 100 to 130 tonnes. There are different commercial fishing regulatory controls in different states: from absolute prohibition through to licensed fishing and unrestricted catching.

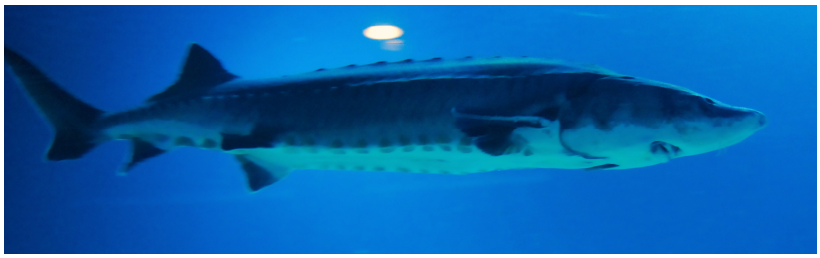
Additional biological data is required to implement wide-scale stock replacement of this sturgeon and to rear it artificially.

White sturgeon (*A. transmontanus*) – Pacific coast, from Alaska to California.

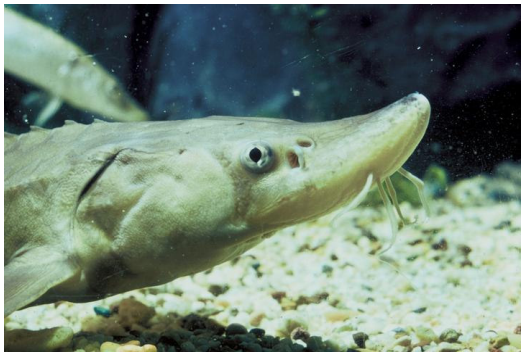
Green sturgeon (*A. medirostris*) - Pacific coast, from the Aleutians to the borders of Mexico.



Chinese sturgeon (*A. sinensis*) – Basins of Yangtze River, Pearl River and Chinese Sea.



Shortnose sturgeon (*A. brevirostrum*) – North Carolina and Florida, the USA.



Lake sturgeon (*A. fulvescens Rafinesgue, 1817*) - The Great Lakes, basin of St Lawrence River, the USA.

Common name: Lake Sturgeon, freshwater sturgeon, rock sturgeon, bony sturgeon.

Freshwater sturgeon: a near threatened species listed in the IUCN Red List, under category II. The fish reaches 206 cm in length and can weigh up to 86 kg. It differs from the shortnose sturgeon *A. brevirostrum*, which inhabits the same areas, by its longer sharpened nose and shorter upper tail fin blade. Its coloration depends on its age and habitat. Usually its sides and back are black and gray or olive-brown, and the underside is white or yellowish. Young specimen are lighter in coloration than adults and have dark spots on their sides and nose.

Freshwater sturgeon occurs across the basin of the Mississippi, in the Great Lakes, and in the St Lawrence to the north up to Hudson Bay, Lake Winnipeg, and the Saskatchewan River. It has also been introduced in a number of smaller lakes of North America: Mendota, Monona, Vingra, Big Cedar Lake etc.

The female sturgeons do not reach their maturity until the age of 20-25, when they are 120-140 cm long, and thereafter they lay eggs once every 4 to 6 years. The males reach their maturity at the age of 15-20 when they are 100-120 cm long, and then they go to spawn once every two years, while some of them spawn each year.

The females usually live longer than the males: females make up 97 percent of sturgeons above 30 years old. The sturgeons spawn in rivers on gravel between late April and mid-June. In the event of a high flood the spawning begins when the water temperature reaches 14^0C; while in case of low flood it begins at 14.5-15^0C. The males usually come to the spawning grounds before the females. They usually occur in groups of eight or more specimens. The spawning begins when a sexually mature female approaches the group. The fertilized eggs stick to pebbles and other solid substrate. The fertility of females weighing 5 to 51 kg ranges from 50,000 to 667,000 eggs. The diameter of the eggs is between 2.7 and 3.1 mm. The eggs take 5 to 8 days to develop.

The sturgeons fatten in the coastal areas of lakes and rivers at depths of not more than 10-15m. They eat mainly small bottom dwellers: mollusks, larvae, leeches, crustaceans and other invertebrates, and less frequently they feed on fish.

In the past, the commercial value of the lake sturgeon was greater than that of two other species of American sturgeons (the long-nose and short-nose) taken together. In 1880, 1,536 tonnes of this sturgeon was hauled in Lake Michigan. In 1893 the catch on Woods Lake (Canada) was 640 tonnes. Only 152 tonnes of this sturgeon was caught across its entire range of habitat in 1951. The main reasons for the decrease in the population of lake sturgeon in the XX century were intensive fishing, poaching and the pollution of water reservoirs. Sturgeon hauling is now limited by a quota that permits the catching of only sexually mature individuals. Some attempts at rearing are being made.

Sakhalin sturgeon (*A. mikado*) – Pacific Ocean, Sea of Japan.

Sakhalin sturgeon *Acipenser medirostris*

This is a very rare and poorly studied species that is threatened with extinction (category I). It is listed in the Red Book of the USSR and the Russian Federation. It is noted for its natural low abundance in its habitat. These sturgeons reach a length of over 2 m and weigh more than 60 kg. There are 8-10, 26-31 and 6-8 scutes on the back, side and the underside respectively. There are 36 to 40 rays in the dorsal fin and 25 to 29 in the proctal. They also have 18-20 gill rakers. These sturgeons are also called 'green surgeons' for the olive color of their back.

These sturgeons are widespread in the northern part of the Pacific Ocean along both the American and Asian coasts. Along the coast of America they occur from San Francisco to the Columbia River. Along the Asian coast they occur in the waters of the Sea of Japan, from Hokkaido to Wonsan (Korea). In Russian waters they occur from the Korean border to the estuary of the Amur River as well as in some rivers of Primorski Krai and Sakhalin. They are also recorded as having been caught in the Olyutor Bay of the Bering Sea.

This is a migratory fish that goes to spawn in small fast-flowing rivers and does not travel far upstream. In the Far East most sturgeons go up the Tumnin River that flows into the Tatar Strait. It apparently has two forms: early-run and later-run. The later-run fish enter the Tumnin River in May or June when the ice drift is over; the early-run fish go upstream in the fall, during September or October, and spend winter upstream. The spawning takes place in June or during the first half of July. For the first 4 or 5 years the juveniles live in fresh water and they differ vastly in biological terms from the juveniles of other migratory sturgeons; they are not mobile and spend most of the time at the bottom. This is possibly a form of species adaptation that protects juveniles from being carried downstream to the open sea and high salinity waters too soon.

They reach their sexual maturity quite late: males at the age of around 10 years with a weight of 8-10 kg and females - 2 or 3 years later, when they are greater in size. They do not spawn every year: the average interval between spawning seasons is 4 years for males and 5 years for females.

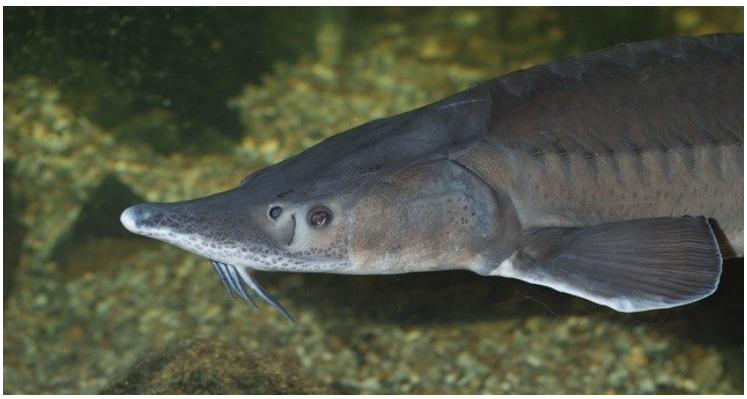
These sturgeons are distinguished by their rapid growth, surpassing that of the Amur and other sturgeons. A Sakhalin sturgeon can reach 25 kg by the age of 18.

In 1986-87 attempts were made to organize the farming of Sakhalin sturgeon. Several mature spawners (4 females and 2 males) were caught in the Tumnin River and their roe was obtained. The eggs were very big, close to those of the beluga in size, and weigh 25 to

34 mg. With a water temperature of 10-14^{0}C, their incubation lasted for 11 days. Unfortunately, almost all juveniles obtained this way subsequently died.

There is no available information on its abundance in its natural habitat. The main limiting factor is, apparently, the extremely limited available spawning ground. It is forbidden to catch this sturgeon, but it is caught by poachers. The main controls aimed at increasing the abundance of this rare species include increased protection of the spawning rivers and continued activity in the area of fish-farming.

Siberian sturgeon (*A. baerii*) lives in Siberian rivers from the Ob to Kolyma and in Lake Baikal.



Apart from the basin of the Ob with the Irtysh and Yenisei rivers, it occurs further to the east, up to Kolyma River and in Baikal Lake.

The Siberian sturgeon differs from the sterlet by having fewer side scutes (not more than 50); from the Russian sturgeon, to which the Siberian sturgeon is close, it differs with its fan-shaped gill rakers and sharper snout. However, the shape of its snout, just as with the sterlet, varies widely, and blunt-nosed individuals occur in the same areas as the sharp-nosed.

Sizes of the Siberian sturgeon are different in different basins. 180-200 kg sturgeons have been encountered in the Ob and Baikal; this figure was up to 100 kg and up to 60 kg - for the Yenisei and Lena rivers respectively. The average commercial weight of Ob sturgeon is 15-16 kg, compared to 4-6 and 2-3 kg for Yenisei and Lena sturgeon respectively.

The Siberian sturgeon is a catadromous fish. It fattens in the estuaries of Siberian Rivers and travels many hundreds of kilometers upstream for spawning: 2,500 km in the Ob up to the Novosibirsk hydroelectric power plant facilities; 1,500 km in the Yenisei and 500-700 km in the Lena. This migration lasts for more than a year and is interrupted by wintering in river beds (early-runs). Apart from anadromous forms, the Siberian sturgeon also has non-migratory species that reside in most rivers. It has been observed that sexually mature catadromous sturgeons going upstream to spawning grounds are gray or smoke-gray, while the resident sturgeon are usually gray-brown. Similar differences in the coloration of these two forms have been detected for Amur sturgeons. The Siberian sturgeon lives in very harsh conditions, and grows more slowly than the Russian sturgeon, reaching maturity quite late: males - not before 15-18 and females - at the age of 18-20. The Lena sturgeon matures more quickly: it reaches sexual maturity earlier (males - in 11-13 and females - in

13-15 years) but it is small in size, just like a sterlet (length of about 70 cm and weight of 1.5-2 kg). A few thousand years ago the Siberian sturgeon entered Lake Baikal (probably from the Yenisei basin through the lower Angara) and formed a unique fluvio-lacustrine form that fattens along the coasts of this lake (up to 150-200 m depth) and goes to the large tributaries to spawn (Selenga, Barguzin, Upper Angara). The main spawning river is the Selenga where the fish go 1,000 km upstream.

The sturgeons in Siberian rivers spawn in the summertime - in June or July; the Baikal sturgeon spawns a bit earlier - during late May or early June. Its fertility differs between water bodies: 174,000 to 420,000 eggs in the Ob, 79,000 to 250,000 in the Yenisei and 16,000 to 110,000 in the Lena.

The sturgeons feed on various bottom-dwellers: larvae of chironomids, trichopterans, mayflies, amphipods, freshwater shrimps, worms, mollusks, and less frequently fish. The sturgeons do not cease feeding even in the wintertime under the ice. The Siberian sturgeon is very undemanding and has great potential for growth. The Lena sturgeons raised in the warm-water farms located near power plants are growing 7-9 times faster than in natural conditions.

Genus Beluga (*Huso*) - apart from the aforementioned beluga this includes one more species **Kaluga sturgeon** (*H. dauricus*), which is found only in the Amur River basin. It never goes out to the sea from the Amur estuary.

Common name: tsinhuan-yui (Chinese).

Kaluga sturgeon (Huso dauricus)

The Kaluga sturgeon is one of the largest freshwater fishe in the world, reaching a length of 3.7 m and weight of 380 kg; in the past, individual specimens over 5m long had been caught. The regular commercial weight of Kaluga sturgeon is 50 to 100 kg. The highest reported age is 55 years.

The Kaluga sturgeon reaches sexual maturity at 18-22 years. Lives for 48-55 years and reaches 3.7-5.6m length and might have weight of 382 kg and above. Spawns predominantly in spring. Average fertility is 1.5 million eggs.

The Kaluga sturgeon is a predator. As early as its first year of life, it feeds on small fishes and invertebrates, and the larger specimens eat even Siberian and humpback salmons. Instances of cannibalism peculiar to this fish have recently increased.

Subfamily of shovelnose sturgeons (*Scaphirhynchinae)*

Shovelnose sturgeon head (bottom view)

The shovelnose sturgeons belong to the family *Acipenseridae* and appear to represent a relic of the fauna of the prehistoric world. Indications of this are, on one hand, its strange shape, which resembles the shape of antediluvian creatures, and on the other hand, the fact that it exists in the Amu Darya and the Mississippi rivers - water bodies of two distant continents separated by a huge ocean. This fact confirms the assumption that these continents were most probably interconnected during one of the geological epochs.

The subfamily *Scaphirhynchinae* contains some unique types of fish, which are well adapted to living in a fast stream of water that carries a large quantity of suspended particles. The shovelnose sturgeons have very small eyes, often almost completely covered with skin, and eyesight does not play an important role in the lives of these fish. On the other hand, their sense of touch is well developed, for which they use long barbels and, apparently, the entire lower surface of the snout. Its big bony scutes, which form a kind of mail, provide good protection against mechanical damage and solid particles carried by the stream. The flat shovel-like snout helps the fish to retain stability in the fast stream: the above current running forces the fish to the bottom.

The shovelnose sturgeons are widespread in two regions of the globe: American shovelnose sturgeons (*Scaphirhynchinae*) live in the Mississippi River system, and false shovelnose sturgeons (*Pseudoscaphirhynchus*) occur in the basins of the Amu Darya and Syr Darya rivers. The Central Asian shovelnose sturgeons differ from their American counterparts with their shorter caudal peduncle, which is not entirely covered with spikes, as well as with their underdeveloped air bladder (American shovelnose sturgeons have a well-developed air bladder).

Genus shovelnose sturgeon (*Scaphirhynchus*)

The common shovelnose sturgeon (*S. platorynchus*) inhabits the Mississippi River and Missouri River systems. Its length is up to 90 cm. These sturgeons spawn in spring and

summer and for this purpose they travel to tributaries with rocky bottoms. They mainly feed on water insect larvae. Common shovelnose sturgeons were commercially important in the past. However, their abundance has now dramatically decreased.

Pallid sturgeon (*Scaphirhynchus albus* Forbes et Richardson, 1905) – Lower Missouri River basin.

Pallid sturgeon (*Scaphirhynchus albus*)

This is a very rare and endangered species, included in the IUCN Red List, category I.

Pallid sturgeons reach a length of 1.5 m and weight of about 32 kg. Like other sturgeons, pallid sturgeons have five rows of thick cartilage plates. They have a shovel-like snout and four barbels which descend from the snout in front of the mouth. The two inner barbels are approximately half as long as the outer ones. They do not have plates/scutes on their undersides.

Pallid sturgeons occur in the Mississippi and Missouri rivers within the states of Montana, Dakota, Kansas, Nebraska, Illinois, Arkansas and Missouri, as well as southward to Louisiana. They are considerably scarcer than the other shovelnose species which inhabits this area, *S. platorynchus*. Their biology remains poorly studied. These sturgeons live in fast-flowing rivers near solid sand or gravel bottom. In populations the females dominate (by 2:1). They spawn between the months of June and August. The eggs are very small

and are laid onto the bottom. The sturgeons feed on insect larvae and small fish and grow much faster than *S. platorynchusi.* Reasons of their low abundance are not known.

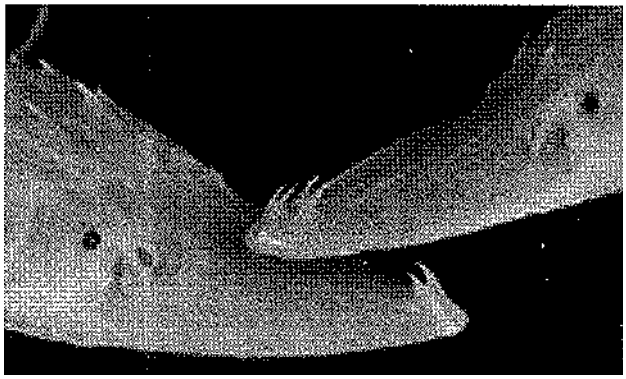
A number of US states (Missouri, Illinois, etc.) have banned the catch of this species. By way of control measures it is proposed to establish a size limit and hauling ban, at least for the spawning period.

Genus false shovelnose sturgeon (*Pseudoscaphirhynchus*)

Represented by three species, of which two - the large Amu-dar shovelnose (*Pseudoscaphirhynchus kaufmanni*) and small Amu-dar shovelnose sturgeon (*Pseudoscaphirhynchus hermanni*) - are found in the Amu Darya, and one - the Syr-darya shovelnose sturgeon (*Pseudoscaphirhynchus fedtschenkoi*) - in the Syr Darya. Two latter species have always been very rare. Scientists have learned about them only recently - late last century. A.P. Fedchenko, the eminent Russian geographer and traveler, discovered the Syr-darya shovelnose sturgeon in 1871; the large Amu-dar shovelnose was found in 1874 by the famous natural scientist M.N. Bodganov; and Academician I.A. Severtsov, a zoogeographer, discovered the small Amu-darya shovelnose sturgeon in 1876.

The false shovelnose sturgeons inhabit the plain stretches of these rivers, from the seashore to the piedmont regions. They do not enter the salty water of the Sea of Aral. The Central Asian shovelnose sturgeons are not very large. The largest of them, the large Amu-dar shovelnose, reaches 58 cm in length and 760 g in weight (as an exception, specimens weighing up to 2 kg have been encountered in the past.) The small shovelnose sturgeons are much smaller, up to 27 cm; their Syr Darya counterparts are of the same size.

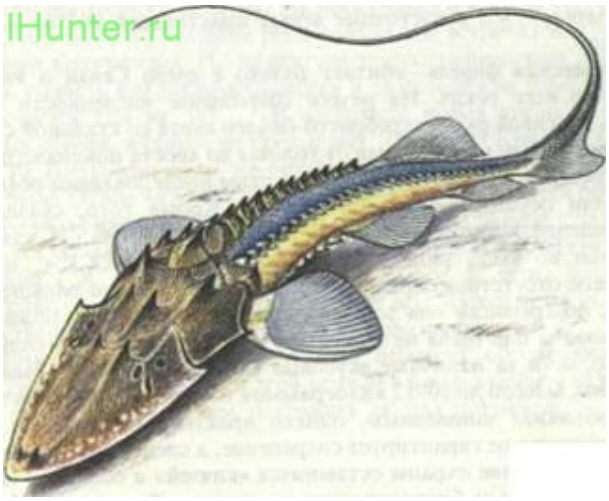
The false shovelnose sturgeons are typical river channel dwellers. They prefer to stay on sand and gravel shallows and in distributaries. To prevent being carried away by the stream, the small and Syr-darya shovelnose sturgeons have, apart from their wide and flat snout, the unique creasy shape of their pectoral fins, which act as a surculus. The large Amu-darya shovelnose sturgeons (and some specimens of Syr-darya sturgeons) have the upper blade of tail fin stretched into a long thread that apparently performs the function of a stabilizer.



Head of Shovelnose Sturgeon

The large shovelnose sturgeons also have 1 to 9 spikes on the tip of their snouts, which probably play an important role in spawning in a fast stream. The shovelnose sturgeons spawn on coarse-grain sand shallows and over scattered rocks in the river mouth in shallow water (1.5-2m.) Spawning takes place in early spring between March and April when the water temperature is 10-14^{0}C. The female shovelnose sturgeon may lay up to 15,000 eggs, but usually lays within 2,000; the Syr-darya shovelnose sturgeons lay up to 1,500 eggs; the fertility rate of the small shovelnose sturgeon is unknown. These sturgeons reach sexual maturity at the age of 6-7 years; males usually reach maturity a year before females. Apart from the regular form, the large shovelnose sturgeon also has a stunted dwarf form that reaches maturity at a length of 23-24cm and weight of only 39-40g. The favorite food for shovelnose sturgeons are small bottom-dwelling invertebrates (larvae of chironomids, trichopterans, mayflies) and fish roe. The large shovelnose sturgeons also feed on larger prey (the young of barb, razorfish, loach and ostroluchka (*Capoetabrama kuschakewitsch.*)

Large Amu-dar shovelnose sturgeon (*Pseudoscaphirhynchus kaufmanni Bogdanov, 1874*) - inhabits the Amu Darya River.



Common name: hackleback, small beluga (Russian); tash-bekre, donguz-balik (Uzbek).

This is a rare and endemic endangered species (category I), which is included in the Red List.

The largest of the central Asian shovelnose sturgeons attains a length of 58 cm (without the tail thread) and a weight of 760 g; individual specimens weighing up to 2 kg have been encountered in the past. This sturgeon has a very wide shovel-shaped snout. There are between 1 and 9 spikes on the tip of the snout. The upper blade of the tail fin stretches into a long thread that performs the function of a stabilizer. Just like other shovelnose sturgeons, large shovelnose sturgeons have very small eyes, often almost entirely covered with skin. The bony scutes on the body are very big and form a distinctive mail that protects the fish from mechanical damage. There are 9-15 scutes in the back row, 28-40 on the side, and 5-11 on the underside. The coloration varies significantly from dark-brown to black and gray. The underside is gray-white.

In the past these sturgeons were encountered in the entire lowland part of the Amu Darya from the Panj River to the seashore, as well as in the lower Vakhsh, Kafirnigan, Surkhandarya and Kyzylsu. Today, following the regulation of the Amu Darya and a number of its tributaries. it is preserved in small numbers only upstream of Chardzhou.

For a long time the indigenous people along the Amu Darya restrained from eating large shovelnose sturgeons due to their long ‘tail’ resembling that of a mouse or snake (hence the local name of this fish, which means mouse- or snake-tail.) It was the Ural Cossacks who resettled to the Amu Darya in the late XIX century who started catching shovelnose sturgeons. In terms of its taste their meat resembles that of a sterlet.

As with other shovelnose sturgeons, these sturgeons are typically fluvial fish that inhabit the coastal areas of the main channel on sand/gravel shallows or hard argillaceous bottom, often among the islands in the middle of the river. Their large lower mouth that protrudes in the form of a tube enables them to suck in small water invertebrates, like larvae and pupae of chironomids, trichopterans and mayflies, from the soil. The large shovelnose sturgeons also feed on small fish species such as the young of barb, razorfish, loach, ostroluchka (*Capoetabrama kuschakewitsch*). Their favorite food is the roe of other fish species. The have two environmental forms: large and small. The large form attains sexual maturity at the age of 6-7 and body length of over 40 cm; the small, stunted form attains

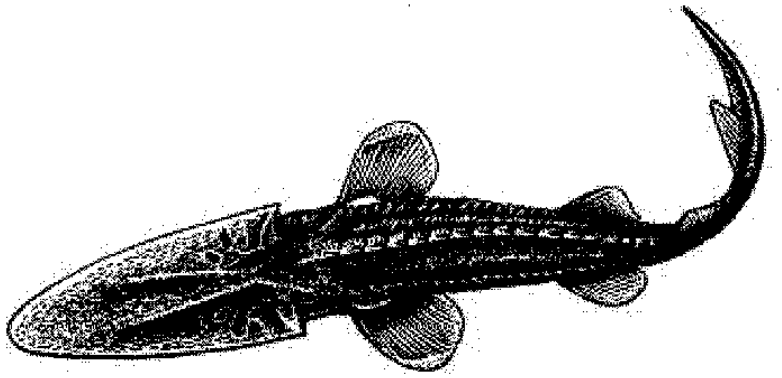
maturity at the same age but with a length of 23-30 cm. These two forms also differ in fertility: the large form may lay between 10,000 and 15,000 eggs, while the small lays 1,000 to 2,000 eggs. The males usually reach maturity a year before females.

The shovelnose sturgeons spawn on coarse-grain sand shallows and over scattered rocks in the river mouth in the fast stream. Spawning takes place in early spring between late March and April at a water temperature of 10-14 deg C. The roe is of a bottom type and adhesive, with a diameter of 1.5 to 2.7 mm. The sex ratio at the spawning grounds is 1:1.

The range of the shovelnose sturgeons has reduced and their abundance has fallen dramatically due to the construction of irrigation facilities that has caused irreparable damage to the natural reproduction of these fish. Many young individuals also die in the irrigation channels which they enter through water-intake facilities. Poaching has also caused a not inconsiderable amount of harm.

In recent years attempts have been made to keep and breed large shovelnose sturgeons in artificial conditions. The fish lived at the Moscow Zoo in special aquariums with a circular flow of water. They fed eagerly on bloodworms, earthworms, minced meat and fish and squid. Using hypophysial injections, the scientists managed to make the fish attain sexual maturity in experimental conditions and succeeded in obtaining fertilized eggs from them. These eggs were incubated for 77 hours at a water temperature of 20 deg C but all the hatched fries died due to technical problems. This experiment in keeping shovelnose sturgeons in captivity showed that these fish are extremely sensitive to a change in the water chemistry and to pollution. One of the main reasons why their abundance has decreased so dramatically may be that they were poisoned as a result of the large amount of chemical products associated with cotton growing (fertilizers, herbicides etc.) which are discharged into water bodies. Developing sturgeon farming technology is an exceptionally topical issue, as this is, essentially, the only way to save these wonderful fish. Measures to prevent their getting into water intakes need to be significantly stepped up, by installing fish protection structures at the intake of irrigation systems and at pumping stations. The river areas where these sturgeons are still preserved must be put under special protection.

Small Amu-darya shovelnose sturgeon (*Pseudoscaphirhynchus hermanni* Kessler, 1877) – inhabits the Amu Darya River.



Critically endangered species (category I).

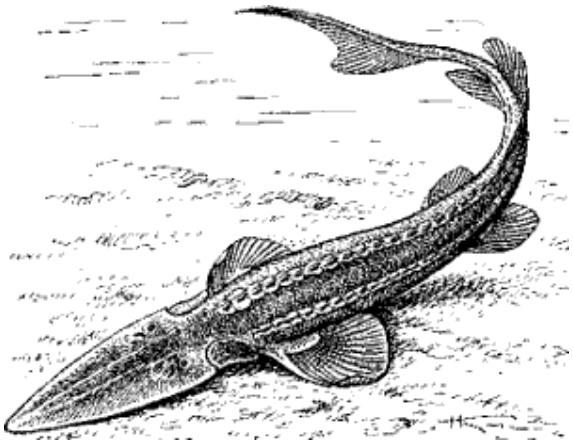
It was first described in 1876 by Academician A.N. Severtsov. The small shovelnose sturgeon is much rarer than the large. They reach a length of 27 cm. They differ from large shovelnose sturgeons by their smaller size, lack of tail thread and spikes on the snout; furthermore, their snout is longer and thinner. They also have distinctive creases on their pectoral fins, which act as a surculus to prevent the fish being carried away in a fast stream.

These sturgeons were widespread in the plain areas of the Amu Darya River system from the town of Termez to the mouth; they often occurred in the vicinity and upstream of Chardzhou. Unlike the large shovelnose sturgeons, they adhere to the deeper sections of the river channel where there are boulders, argillaceous rocks or pits.

Their biology is virtually unknown. They reach a length of 20 cm and weight of 15 kg at the age of 5. Their spawning grounds and periods are also unknown. Insect larvae and fish roe have been found in their guts. In natural conditions they apparently hybridize with large shovelnose sturgeons.

The reasons why this species is critically endangered are the same as for large shovelnose sturgeons. We know of no instances of this sturgeon being caught in recent years. It is possible that they still remain in the unregulated parts of the Amu Darya, upstream of Chardzhou.

Syr-darya shovelnose sturgeon (*Pseudoscaphirhynchus fedtschenkoi* Kessler, 1872) – inhabits the Syr Darya River.



Syr-darya false shovelnose sturgeon

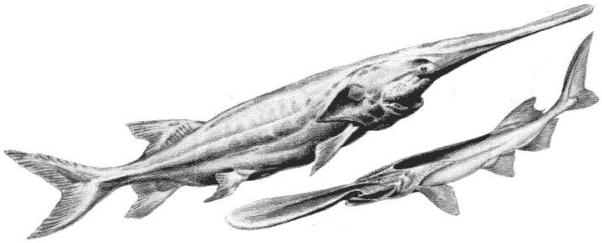
Very rare and possibly extinct species. Listed in the Red Book of the USSR.

This is the only sturgeon species represented in the Syr Darya. This sturgeon was discovered by the eminent Russian geographer and traveler A.P. Fedchenko in 1871. It is up to 27cm in length (without the tail thread). It differs from the small Amu-darya shovelnose sturgeon by the greater number of scutes on its back (15 to 20) and sides (37 to 46). In external appearance it is similar to the small Amu-darya shovelnose, having the same creasy shape on their pectoral fins. The snout shape varies significantly. Some individuals have a well-developed tail thread and some have none.

These sturgeons are typically fluvial fishes. They inhabited the plain stretches of the Syr Darya from the town of Balikchi to the mouth of the river. They occurred most frequently in the vicinity of Chinaz. Their favorite habitats are river areas with a sand bottom and fast-flowing stream. Initially they were noted within the fauna of the dammed lakes in the Syr Darya River basin: Chardarya, Farkhad and Kayrakkum. The sturgeons spawned during the second half of April, on the stream over rocky bottoms. They attained sexual maturity at the age of 6. The fertility rate is 850 to 1,500 eggs. The roe is small, 1.3-1.8 mm in diameter.

This sturgeon feeds mainly on small bottom-dwelling invertebrates. It has always been a rare species. The reasons for their decreasing numbers are the same as for false shovelnose sturgeons - regulation of the Syr Darya River flow, water off-take for irrigation purposes and violation of the conditions in which they reproduce. There have been no reported catches of the Syr-darya shovelnose sturgeon for the last twenty or thirty years. It could still remain in the upper unregulated part of the Syr Darya, which is still poorly studied. A fish survey needs to be performed in this area as soon as possible and if the shovelnose sturgeon has been preserved there this area must be put under special protection and declared a natural reserve.

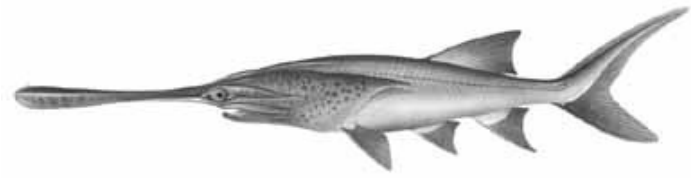
Paddlefish Family (*Polyodontidae*)



In contrast with sturgeon, paddlefishes do not have any scutes. They have an elongated and slender body, which is either 'naked' or covered with small scattered plates, and a very long snout in the shape of an oar or sword, with two small barbels on its lower surface. The side line grooves on the head and body are surrounded with bonelets. The young individuals have small teeth on their jaws. In respect of their other features they resemble sturgeon.

There are only two extant species of these fish: the American and the Chinese paddlefish.

The American paddlefish (*Polyodon spathula*) lives in the waters of lakes and rivers of the Eastern part of the USA down to Texas and in the Mississippi River system.



American paddlefish (bottom and side view)

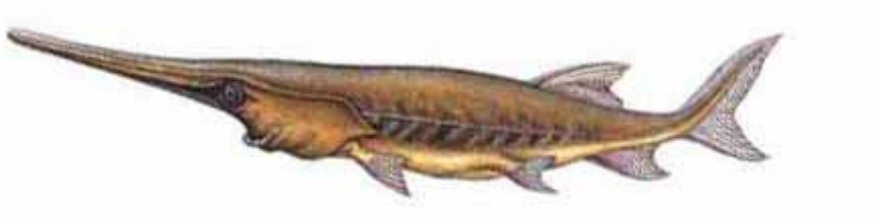
The American paddlefish (*Polyodon spathula*) is quite a large freshwater fish that reaches over 2m in length and can weigh over 70 kg; in the early 1960s the average fish weight in catches was 14 to 16 kg. They occur in the Mississippi River and its tributaries, the Ohio, Missouri and Illinois and in other rivers flowing to the Gulf of Mexico, as well as in a number of lakes connected to the Mississippi River system.

The distinguishing feature of the appearance of the American paddlefish is its long snout (rostrum) that has the shape of an oar and makes up to 1/3 of the entire body length. Its mouth is non-protractile.

The American paddlefish is the only species of sturgeon that feeds on zooplankton. It swims in the water column with its mouth open wide and filters pelagic crustaceans using its gill rakers which are long and closely spaced; here its flat snout plays the role of a trail cover. It is aptly called a living plankton sampler. Insect larvae are found much more rarely in the guts of the fish.

The American paddlefish spawn in the Mississippi between late April and early May at water temperature of 14-16 deg C. The eggs are laid on the gravel bottom at a depth of 4.5-6 m and hatch over 9 days at a temperature of 14 deg C. The fertility rate is between 82,000 and 269,000 eggs. In terms of their structure, color and how they develop the eggs are very similar to those of a sturgeon. Their diameter is approximately 2.5 mm. The American paddlefish gather in big shoals when they are going to spawn. This species does not spawn every year. The minimum length (age) of sexually mature males and females is 100cm (7 years) and 130 cm (13-14 years), respectively. In the early 1940s the annual haul of these fish in the USA amounted to about 10,000 hwt. Their roe was of special value. Later on anthropogenic factors resulted in this species diminishing, and some attempts were made to rear it artificially. The American paddlefish is also of interest in terms of its possible introduction in our southern water bodies and use in aquaculture.

The Chinese paddlefish (*Psephurus gladius***)** lives in the Yangtze River, China.



The Chinese paddlefish

Its biology is poorly studied. The largest freshwater fish in the world, the Chinese paddlefish reaches 7 m in length. It has a sword-shape rostrum that makes up to 1/3 of its entire body length. In contrast with the American paddlefish, the Chinese paddlefish has a protractile mouth and differs from the former not only in its size but in its tastes: it is not content to feed on plankton, but also hunts large fish.

This species is so rare that its habits are virtually unknown. Due to its rarity it is of insignificant commercial importance.

WHAT DOES MAN GET FROM STURGEON?

Fish has been one of the main sources of protein for man since long time. Its exceptional edibility and tastiness, and easy availability made the sturgeon a subject of hunting long before the beginning of our era. No any other fish family has ever been exploited by man for so long and so intensively! Today sturgeon is still a very valuable commercial commodity. Its caviar and meat are highly valued on the world market. For this reason commercial hauling of these fish has always been highly intensive.

In the Middle Ages large shoals of sturgeons moved up many European rivers including the Thames in England, the Seine and Gironde in France, the Po in Italy, the Ebro and Guadalquivir in Spain, as well as the upper reaches of the Danube. There were so many sturgeons in Germany that labor contracts even included a clause which prohibited making workers eat fish more than twice a week.

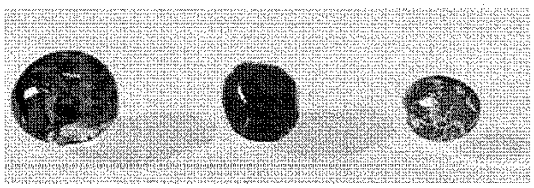
In Russia sturgeon was a source of food as early as the XII century, while the Europeans were afraid to consume it for another five centuries.

Don't believe it when people try to tell you that in Russia black caviar has long been a luxury delicacy. This is not exactly true. The traveler William Cox wrote that during the reign of Catherine II in the Summer Garden in St Petersburg on one of the feast-days the tables for common people 'were strewn with all kinds of delicacies: high pyramids of bread hunches with caviar, dried sturgeon, carp and other fish decorated with crayfish, onions and cucumbers.' The princes and boyars did not consider caviar a delicacy, preferring to have golden pike caviar on their tables. However, the common people did not shrink from eating sturgeon caviar. A universal food item was pressed and especially saccate caviar, which was purchased by poor people. Late XVIII century Prince Peter Bagration enlisted Marie-Antoine Careme, a recognized authority in European cookery, who had once worked in Cuba and had been a personal chef to the banker Rothschild, and even the British king. In his letters home the all-time king of all French chefs described in great detail the particular features of the Russian way of life and, of course, the cuisine. The chef mentioned various dishes made from vegetables, mushrooms, berries, but especially those made from fish. Among the latter he highlighted sturgeon caviar, which he genuinely admired. Thanks to him, the term *caviar* became international. The word *khavyar* from which the English term 'caviar' was supposedly derived, is first encountered in the records of Khan Baty, dated 1240. Khan himself learned this word from the Persians, who loved the dish called 'chav-jar', which can be roughly translated as 'meal of strength'.

The roe is obtained from the reproductive organs of the female, the ovaries. The ovaries consist of two symmetric flattened shaped cylinders. In terms of their weight the ovaries comprise a significant part of the body of the fish: up to 34.5 percent of a female sturgeon. However, roe cannot be obtained from every fish; first it must reach sexual maturity.

As they ripen, the egg shells harden and become stronger, and at certain stage become easily detached from the connective tissue of the ovary and from each other. At this stage the roe is considered the best to be prepared for caviar.

The yolk mass (protoplasm) of an egg represents a colloid system with its components presented as an emulsion. To prepare high-quality caviar the roe must be extracted straight after killing the fish and brined immediately.



A B

Layout and structure of sturgeon roe

Fig. A. shows a sturgeon egg consisting of a multilayer shell (1) and vitelline substance with fat drops. Fig. B shows the ripened sturgeon egg, which has a shell (1), vitelline substance (2), fat drops (3), and embryo vesicle (ocellus) (4).

The proteins in the roe are complete and mainly classified as those of the globulin or albumin class. The roe fat is characterized by a higher iodine absorption number than that of the meat of the same fish, and contains a large amount of very useful Omega-type polyunsaturated fatty acids. The roe fat contains a large amount of cholesterin (1.5 to 14.0 percent), lecithin (1.0 to 43 percent), as well as vitamins A, D, B, C. Furthermore, the roe contains significant amounts of S, K, Na, Ca, Mg, as well as Si, Zn, Fe, Mn, J, etc.

The human body ingests the proteins, fat and mineral substances from the roe much easier than those contained in the meat of the same fish, which is the main therapeutic advantage of caviar.

To remove the ovary with the roe from the fish belly, it is cut open and the fish, naturally, dies. Today more merciful method, called ‘sturgeon milking’, is used: the fish is caught and given a pain-killer shot, then the roe is removed, the belly stitched up, and the fish is returned to the water.

The caviar of each fish species is packed in cans with lids of a specified color.

Beluga and starlet caviar
blue lids

Russian sturgeon caviar
yellow lids

Starred sturgeon
red lids

According to their market value, beluga caviar is ranked No.1, followed by Russian sturgeon and starred sturgeon caviars.

According to the Russian classification, the bigger and lighter in color the eggs in the caviar, the higher the caviar is valued. A good example is beluga caviar, which is lighter in color and greater in size than the smaller caviar of the Russian sturgeon or starred sturgeon.

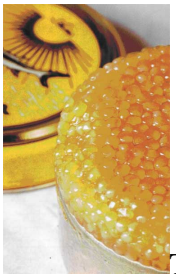
Unlike Russia, where sturgeon caviar is classified only by the species of fish from which it is extracted, European caviar experts have their own system of sturgeon caviar classification. According to them, the age of fish and its genetic and territorial origin are of great importance.

Experts can easily determine the difference between samples of caviar of one species of fish obtained from different water areas, or between samples of caviar taken from American, Russian and Iranian sturgeons. They do it according to DNA analysis technology to which caviar is subjected everywhere in the West, because people pay good money for the caviar and do not want to be cheated and instead of high quality caviar be provided with illegally produced caviar containing sand, dirty water and lots of bacteria.

For example, caviar gourmets say the very dark-grain caviar taken from 15-20 year old starred sturgeon differs in taste from that of the 30 year old fish of the same species. If the starred sturgeon is 35 years old, its caviar is called ‘classic gray’ and its grains are light in color. Starred sturgeon caviar has a distinctive taste that cannot be confused with that of other sturgeon caviars.

In the West Russian sturgeon caviar is also split into several types: the 20 year old sturgeon produces the “royal black caviar”, which is totally black in color. A 45-year old sturgeon produces Rogen Osietra, while a sturgeon more than 85 years old produces the gold-colored “Imperial caviar”. Sturgeon caviar may have a natural flavor resembling the taste of a walnut.

The beluga lays eggs of time-stained silver, from black and gray to silver-anthracite. Beluga caviar has large eggs with a thin skin and a fish-meat taste, softer than that of other sturgeons.

 The most exotic caviar of all sturgeons is **The Golden Caviar**. It has a goldish and amber color unmatched among the caviars of other fish. The most unusual in color, the goldish sturgeon caviar is called 'royal'. In past times royal caviar was supplied to the emperors of Manchuria, the tsars of Russia and even to the Vatican. In Iran it was served only to the Shah's table and anyone who tried to sell or eat gold caviar had his right hand cut off.

As for the stories of golden caviar from a hundred-year old beluga, these are just a fairy tale. In fact, the hue and color of sturgeon roe depends not on the age of the fish, but on the quantity of pigment in the ovule, specific to each individual species. It also depends on the individual life conditions and feeding specifics of each fish. Furthermore, sturgeons with 'royal' caviar do not necessarily have to be albinos. The main value of 'royal' caviar is not some distinct and heavenly taste but its scarcity.

As early as several hundred years ago people knew of the positive influence of caviar on human health. Even today it is given to children to prevent rickets and to patients undergoing post-surgical rehabilitation. In the past people extracted oils from the caviar and drank it, just as cod liver oil is drunk in Western Europe, thus obtaining the vitamins required for the body. The last Russian tsar, Nicolas II, believed in the curative properties of caviar so passionately that he made his children eat one spoon of this delicacy per day. The kids did not like the caviar, so the chef mixed it with mashed banana and spread it on French rolls.

Sturgeon is a valuable commercial commodity. Its caviar and meat are highly valued on the world market. For this reason the commercial hauling of these fish has always been highly intensive. However, not everyone knows that the sturgeon is not only meat and caviar. The organs and tissues of sturgeons are used to obtain very valuable drugs and products used in various spheres of human life.

From the earliest times isinglass has been obtained from the airbladder of the sturgeon. There are many sorts of isinglass classified by their origin: Russian, Indian, Brazilian and North American; however, all of them are obtained from the airbladders of various, predominantly large, fish. The most valuable isinglass is produced from the sturgeon airbladder. It is much stronger than other types of glue. Isinglass is used to glue antiques and, in a larger quantity, to fine, or to settle suspended solids in fermenting liquids, mainly expensive sorts of beer and wines; it is also used in the production of the most valuable sorts of candies.

The chord of a sturgeon is used to obtain a substance used to restore pictures and mosaics.

In the XIX century pharmacists in London made capsules with caviar-derived oil and sold them as vitamin additives.

In 1964, the French cosmetics company, Ingrid Millet, started to utilize the useful properties of caviar based on a study of the similarity between the chemical composition of caviar eggs and human skin cells. It was found that caviar greatly intensifies the production by skin layers of a special protein, collagen, which normally declines in quantity with ageing. Collagen is a part of the walls and structure of the cells and is responsible for skin strength. Another wonderful feature of caviar is that its cells have a configuration resembling that of the human skin, which greatly boosts the rejuvenating effect. Caviar contains an extremely high percentage of natural lecithin, 43%, as well as basic vitamins: A, B, D, E, C, B1, B2, B6, B44, B12 and PP. Furthermore, an extract from the 'black pearls' of white sturgeon contains very high quantities of mineral salts, such as sodium, potassium, phosphorus and calcium. Moreover, the extract contains significant amounts of Co, Cu, Si, Zn, S, Cl, Mg, Fe, Mn, J, as well as amino acids and other useful elements.

The company makes products based on the oils contained in caviar. Experts say the caviar extracts help fight the ageing process. Ingrid Millet uses only the highest-quality caviar to make its products.

The Swiss cosmetics company, La Prairie, is also famous for its products containing caviar.

La Verdie firm has produced an entire collection of cosmetics on the basis of extract from white sturgeon caviar which is saturated with vitamins and microelements.

At present some companies in Russia use sturgeon caviar to produce regenerating balsam *Ulma* that enhances immunity and greatly boosts rejuvenation processes. It strengthens blood vessels, kills bacteria and is anti-inflammatory. It also helps to dissolve pseudinoma and normalizes the work of the central and peripheral nervous system.

Scientists at the Institute of Physiology of Azerbaijan used the sturgeon gonad to obtain and introduce the drug Antiheparin (protamine sulfate), which is a natural antiheparin used to treat cardiovascular diseases.

The gonads are also used to obtain Polidan (sodium nucleospermate), which stimulates leucopoiesis and increases the quantity of mature leucocytes in blood.

Sturgeon sperm is used to obtain Derinat (sodium deoxyribonucleate), which is a sodium salt of the natural DNA extracted from sturgeon milt. This is a powerful cell regeneration stimulator and hemopoiesis stabilizer. It is a universal metabolic modulator. Derinat is also unique because its healing properties do not have analogues anywhere in the world. Originally, the drug was developed to protect against radiation exposure. Later on, during clinical tests and practical application it became clear that it not only activates but actually improves the body's immunity.

When treating oncological illnesses with Derinat, hematosis intensifies impeding cancerous growth; when used simultaneously with chemotherapy, the patient's health remains stable, with no feelings of nausea or faintness, and the hair does not fall out. In other words, Derinat does not allow the toxic antibiotics to suppress the cell.

This drug has proved itself in cardiology. It helps avert the course of coronary disease by significantly improving the blood supply. It can prevent a heart attack and its complications. It is known that some cells of the cardiac muscle die as a result of a heart attack. If Derinat is injected in time, the cells survive and restore their functionality.

Derinat is also effective in treating thermal burns. Its application relieves acute pain and helps avoid heavy infectious complications and restore the skin integument and elasticity. If the wounds are deep, Derinat shots are given to prevent the formation of abscesses in the tissues.

Therefore, the value of sturgeon for mankind is far from being limited to its gastronomic properties.

STURGEONS AND THE PROBLEM OF BIODIVERSITY PRESERVATION

Biodiversity – an abbreviation for *biological diversity*; means the variation of life forms in all its manifestations, from genes to the biosphere. A great deal of attention began to be paid to the study, use and preservation of biodiversity following the signing by many countries of the United Nations Convention on Biodiversity (United Nations Conference on Environment and Development (UNCED), Rio de Janeiro, 1992).

There are three main *levels of biodiversity*:

- **genetic diversity** reflecting intraspecific diversity and is caused by the variability of individuals;

- **species diversity** reflecting the diversity of life forms (plants, animals, mushrooms and microorganisms). At present around 1.7 million species have been described, although some estimates bring their total number up to 50 million;

- **ecosystem diversity** covering the diversities between different types of ecosystems, diverse habitats and ecological processes. Ecosystem diversity is identified not only in terms of structural or functional components but also in terms of scale, from microbiogeocenosis to the biosphere.

Sometimes **landscape diversity**, reflecting the specific features of an area and the impact of local, regional and national social cultures, is identified as a separate category.

All the levels of biological diversity are interconnected: genetic diversity promotes species diversity. Ecosystem and landscape diversities create the conditions for the evolution of new species. Enhancing species diversity leads to an increase in the overall genetic potential of life forms in the Biosphere. Each species contributes to the diversity, so from this point of view there is no such thing as a useless or harmful species.

Species are not distributed evenly over the Earth. Species diversity is consistently richer in the tropics and reduces towards the poles. The most species-rich ecosystems are the tropical rainforests, which cover nearly 7 percent of the surface of the globe and contain more than 90% of all species.

Through the geological history of the Earth the biosphere has experienced a constant process of species appearing and disappearing; all species have a finite period of existence. Extinction has been compensated for by the appearance of new species and, as a result, the total number of species within the biosphere rose. The extinction of species is a natural evolutionary process that takes place without human intervention.

In the last century human activity resulted in a species extinction rate estimated at 40,000 times the natural extinction rate (according to some estimates). The effect of anthropogenic factors is leading to a reduction in biodiversity due to the elimination (extinction or destruction) of species. The irreversible and unbalanced destruction of the unique gene pool of our planet is taking place.

Species elimination as a result of human activity may take place in two ways: direct extirpation (hunting, commercial fishing) and indirect extirpation (destruction of habitat

and disruption of trophic interactions). Over-hunting is the most obvious direct cause of biodiversity reduction; however as a cause of extinction it has much less impact than the indirect causes of habitat change (for example, those linked to the chemical pollution of rivers or devastation of forests).

In the case of the sturgeon we can observe both forms of elimination together. On the one hand, we have excessive, virtually uncontrolled, fishing. On the other hand, we have habitat disruption due to pollution by industrial and household wastes.

Many countries establish Red Books, lists of rare and nearly extinct life forms, to keep a record of species on the brink of extinction. Most sturgeon species are currently included in the International Red List.

There are many reasons why biodiversity must be preserved: the requirement for biological resources to satisfy the needs of mankind (food, materials, drugs etc.), for reasons of ethics and aesthetics (the inherent worth of life) and so on. However, the main reason why biodiversity must be preserved is that it plays a key role in ensuring the sustainability of ecosystems and the biosphere as whole (absorption of pollutants, climate stabilization, and providing conditions suitable for living in.)

Biodiversity performs a regulatory function in all the biogeochemical, climatic and other processes on Earth. Each species, no matter how insignificant it may seem, contributes to the sustainability of not only its 'own' local ecosystem, but also of the entire Biosphere. Biodiversity preservation is an inseparable part of the Sustainable Development of mankind.

The term '**sustainable development'** means the development of society in such a way that ensures that today's needs are met without damaging the ability of future generations to meet their needs.

Should we lose the Caspian sturgeons today, we will deprive ourselves and our successors of one of the most valuable sources of protein-based food; we will lose the unique gene pool of the sturgeon, which has evolved over millions of years, and, as the result, we lose genetic diversity.

SO HOW CAN WE SAVE THEM?

Long ago, sturgeons lived in all the rivers and seas of the Northern Hemisphere. In the mid-XIX century there was a sturgeon market in Hamburg (Germany), which sold between 4,000 and 5,000 adult fishes a year; these fishes were caught nearby, in the mouth of the Elba. During the first half of the XX century, the Caspian Sea accounted for 70% and in the second half for 90% of world's sturgeon catches. The fact that sturgeon hauling reduced from 400,000 hwt early in the XX century to 250,000 hwt in 1970 and to 9,000 hwt in 1999, is a numerical expression of the disaster that has befallen the sturgeon populations of the Caspian Sea.

Over-fishing in the densely populated areas of Europe and America has also greatly impacted the sturgeon populations.

Power station dams which blocked the natural migration routes of these species to the spawning grounds upstream in major rivers have significantly affected sturgeon populations. Dams built for the hydrostations on the Kura and Volga rivers have cut the fish off from the routes to spawning grounds further up these rivers. To compensate for this damage, the first experimental sturgeon plant was installed in the former USSR, on the Kura River in Azerbaijan. Scientifically substantiated methods of raising young sturgeon artificially were developed at this plant under the supervision of A.N. Derzhavin, N.L.Gerbilsky and R.Yu.Kasimov. Later on, similar plants were installed on the Volga, Don and Kuban, as well as in Iran and the USA. These plants are engaged in catching spawners, obtaining reproductive products, artificial incubation of roe, maturing fries and raising young individuals.

To synchronize spawning among the spawners they are given injections of acetonated pituitary. After the injection the spawners are kept at a constant temperature or in an increased temperature environment. The point when the female is ready (transition of roe to ovulation) is determined by visual inspection and pressing its belly.

CAVIAR PRODUCTION. The anatomic structure of the genital system of sturgeon females does not allow the ripened roe to be strained off as it is with carp or trout. Therefore, to extract the roe the fish belly is cut open and the roe is extracted. During this process the fish is put on a special bench where it is secured. Previously, after this operation the fish was sent to the fish-factory for processing.

Today, using the method developed by S. B. Podushkina the roe is extracted at the initial stage by straining, and then a cut is made in the rear section of the egg tube. Following this the roe can easily be strained off in the normal way.

The incision in the egg tube does not cause bleeding as it is a thin translucent membrane. The wound is quite insignificant and heals quickly. The survival rate of fish after this operation is close to 100%.

The sperm for roe impregnation is taken from three males and strained into a bowl with a catheter.

The sperm is diluted with water and mixed with roe at a rate of 10ml of sperm per 1 kg of roe.

ROE HATCHING. Special incubators with a capacity of up to 3 million eggs have been developed and put into operation to equip the fish hatcheries. Weis or Zamanov devices are used for the incubation of a smaller number of eggs. The optimum water temperature for incubation is selected depending on the sturgeon species, in a range of 13 to 18 deg C.

Starting from the second day of incubation, once every two days the eggs are subjected to preventive treatment using the Ch. Mamedov method in order to prevent saprolegniosis.

The hatched fries are placed in previously arranged trays.

DEVELOPMENT OF FRY. Sturgeon embryos have a big yolk sac, disproportionately large head and poorly developed internal organs. The eyes are only discernible as pigment spots. The movement of sturgeon fry resembles that of a tadpole. The fries react to light, move in the water column and often go down to the bottom to form large concentrations, or schools.

For approximately 7 days the fries develop by consuming the energy they receive from the yolk sac and then gradually move on to external nutrition. At this stage the fries feed on small aquatic life forms. In the absence of live food the fries go down to the bottom and feed on bottom sediments by extracting micro-organisms and organic particles from them.

The sturgeon fries are held in relatively long (up to 4 m) and narrow (between 0.5 and 0.8 m) trays with shallow water (up to 15-20 cm) and insignificant current. Round or square basins are also suitable for raising fries.

The fries are not very good swimmers and the current can press them against the nets at the water outlet. The fries have a surprising ability to escape the trays through the tiniest holes. Therefore fry-catching devices are installed at the basin water outlet.

When they reach 2.5 cm the fries expand their diet with bottom sediments. They dive, dig heaps with their noses and extract the food.

Sturgeons that have reached a length of 3.5-4 cm become strong and can withstand external exposure. They can be put into individual basins and fed with finished pelleted feed. Sterlets, Siberian sturgeons, belugas, besters and paddlefishes progress to pelleted feed quite easily. Other species have a hard time moving to artificial feed.

RAISING COMMERCIAL FISH. The raised young are either released directly into the river from which the spawners were taken or delivered to the estuary, to an area for further fattening. This technology made it possible to hold back the extinction of many commercial sturgeon species in the USSR by many years. At present there are 4 sturgeon plants operating in Azerbaijan.

Furthermore, a whole series of laws was drawn up to preserve sturgeon populations:

First of all, hauling of these fishes at sea was prohibited. It was permitted to haul the fishes only in rivers and during a strictly limited period of time.

The northern shallow-water area of the Caspian Sea, which is the fattening ground for adult sturgeons and the place where the young are raised, was declared a preservation area and all offshore operations within it were prohibited.

All explosive activity in the Caspian Sea, either industrial or military, has been banned.

However, the 1950s saw the appearance of a new threat to all life forms in the Caspian Sea, environmental pollution. Shortly after the end of the Great Patriotic War, large plants and factories were built on the Volga and in the towns on the shores of the Caspian Sea, with a corresponding growth in the population of these towns, with no thought given to treatment plants for industrial and household effluents. At the same time offshore exploration and production of oil and gas began. The Caspian Sea, a closed water body, became a huge trap for toxic substances. No less than 25 percent of all wastewaters from the entire FSU is discharged into the Volga-Caspian basin. Each year the waters of the Kura and other small rivers carry to the sea: around 5.24 thousand tonnes of chemical compounds, 2.36 thousand tonnes of suspended solids, 1.5 thousand tonnes of petroleum products, 150 tonnes of metal compounds and 110 tonnes of phenols; of these, the Kura accounts for over 96%. Moreover, the river pollution is 2 to 9 times the sanitary standard (sometimes this rate raises to 13.)

The consequences of the negative impact of petroleum products on thalassophili are clearly evident from the experience of many years of well operation off the coast of Azerbaijan. A sad consequence of the offshore oil exploration and production has been the complete loss of the value of the sections between the Cape of Bandovan and the Absheron Peninsula in terms of commercial fishing. Previously this area served as the fattening ground for young individuals of the Caspian salmon and small Kura fishes and a fishing ground for kutum and shad. Oil pollution has resulted in the disappearance of the pike perch and crawfishes that used to inhabit the areas around Chilov and Oil Rocks, and 25-30 thousand hwt of which used to be hauled per annum before offshore oil production started. Such valuable species as barbel sturgeon, beluga etc. are critically endangered.

As early as the 1980s Academician Hasan Aliyev proved that refraining from offshore oil and gas production in the Caspian, together with the development of sturgeon-breeding would provide greater and more stable profit for the government. Unfortunately, these appeals were not heard.

At present the average petroleum hydrocarbon concentration in the water of the Caspian Sea is 1.5-2 times the fishing industry's maximum permissible concentration (MPC); in areas of intensive oil production this indicator is dozens and even hundreds of times the MPC. The waters in vicinity of Oil Rocks have long been a dead zone.

The average hydrocarbon concentration in the South and Middle Caspian is 7-10 times the MPC, while in oil and gas production areas it is 30-100 times the MPC. Huge migrating oil spots are encountered in the Middle and South Caspian, where it is not possible to haul fish, the kilka in particular. Today the kilka are being lost on such a huge scale that it is possible to say that its commercial hauling has stopped.

Another unique inhabitant of the Caspian Sea, the Caspian seal (*Pusa caspica*), which is the only marine mammal in the Caspian, has also become a critically endangered species. They came to the Caspian Sea in time immemorial when the sea was connected to the

Arctic Ocean, and remained here forever. The Caspian seals form packs and feed on small fishes and crustaceans. During spawning the seals display their 'northern' habits. The white-coat seals are born in winter in the northern part of the Caspian and they stay on ice floats until they learn to swim and forage. The seals have been intensively hunted for their valuable fur. Today hunting has virtually ceased but the seal population continues to diminish.

Caspian Seal (*Phoca (Pusa) caspica* Gmelin, 1788)

Through the XX century there was a 2.5-fold decrease in the Caspian seal population, from 1 million to 400 thousand. Before hunting was restricted in 1970 the main factor that determined the population size was unregulated hunting. In the last quarter of the century the population began to be badly affected by anthropogenic factors, pollution in particular. Today the Caspian seal population is critically endangered. Scientists say the mass mortality of seals in 1997, 1998 and 2000 is explained by 'cumulative toxicosis'. i.e. the accumulation of toxic substances in their bodies.

So is it possible to save the inhabitants of the Caspian Sea?

Yes, it is. This requires the following:

1) Signing intergovernmental conventions on the joint hauling, protection and reproduction of cross-border reserves of sturgeons, as well as on expanding the scale of its natural and hatchery reproduction

2) Preservation of natural reproduction. The sturgeon spawning grounds in the Ural region require proper fishery management. Spawners amounting to at least 60% of the total population of barbel sturgeon must be let into the Ural River. Irretrievable water consumption in the Kura must be reduced and the water supply regulated effectively to increase the water content of the river.

3) Reinforcing the fight against poaching in the Volga, Ural and Kura, for which purpose an international fisheries conservation authority needs to be established.

4) A complete ban on sturgeon hauling at sea; use of offshore sturgeon populations in fish farming only.

BIOLOGICAL GLOSSARY

Bathymetry (from Greek *bathos*, deep) – an area of the seabed that matches corresponds to a continental slope.

Benthophage (from Greek *benthos,* depth and *phagos,* eater) – an animal that feeds on eats the organisms living on the bottom of a water body.

Biocoenosis (from Greek bios, *life* and coenosis, *common*) – an interacting population of micro-organisms, plants, mushrooms and animals living together in a more or less homogenous land area or in a water body. It is characterized with by certain relations of the organisms between each other and their adaptation to the environment.

Biota (from Greek *biota*, life) – 1) historically formed collection of life forms living in a geographic region, sometimes isolated with by barriers. As against In contrast with the notions of *biocoenosis* and *biom*, the biota does not imply any ecological bonds between species.

Caddisflies – order Trichoptera (with complete metamorphosis). Their larvae live in water. Some species are predators and some plant-eaters. They are the food for many species of valuable commercial fishes.

Clam worms - genus of polychaete worms. They are widespread in seas, tropical seas in particular, and sometimes in brackish waters. They have been successfully introduced in the Caspian Sea and Sea of Aral to improve the food reserve for sturgeons.

Convergence (from Latin *convergere***,** to incline together). This term pertains to the occurrence, as the result of natural selection, of matching anatomic and morphological, physiological and/or behavioral characteristics with in groups of organisms groups, which are relatively distant in terms of genetics. For example, the matching shapes of sharks and whales. The organs which acquired similarity in the course of Convergence are called analogues.

Delta (of river) – a low land area that is formed from the deposition of the sediment carried by the river at the mouth of a river with numerous distributaries and tributaries where that river flows into an ocean, sea, estuary, or lake.

Endemic (from Greek *endemos*, local) – local species or another classified category that lives in a given region only.

Endogenous nutrition (from Greek *endon*, inside) – process of digestion by an organism of so-called endogenic substances, i.e. the substances that comprise the organism itself. For sturgeon fries, these are the nourishments nutrients located in the yolk sac.

Epigamic sex determination (from Greek *epi*, after and *gamete*, germinal cell) – observed in heterosexual species with phenotypic sex determination, when direction of evolution towards the male or female sex is conditioned by the impact of external exposure following fertilization.

Estuary – a wide mouth of a river flowing into the a lake, sea or the ocean. It occurs in places where the adjoining part of the sea (lake, ocean) has a big depth is very deep, while

the sediments carried by the river are constantly removed by ocean currents. Cf. See *River delta.*

Euryphagous (from Greek *euros*, wide and *phagos*, eater) – omnivore.

Exogenous nutrition (from Greek *exo*, outside): external nutrition of fish fries, to which they pass progress when their yolk sac vanishes or shortly before it gets used out is exhausted.

Fetalization (from Latin fetus, embryo) – way method of evolutionary changes in of organisms resulting in the retention in the adult of characteristics that at an earlier stage of evolution were only infantile. An example can beis the cartilaginous skeleton of contemporary cartilaginous and round-mouthed fishes. FThe fetalization can affect any feature of the phenotype: morphological, physiological or behavioral. Fetalization **It** enables makes it possible to get rid of specialized features of the adult form, which proved disadvantageous for the organism in condition of changinge of environmental conditions.

Gonades: germ glands of males and females.

Herbicide (from Latin *herba*, grass and *caedere,* kill) – the a substance used for the selective elimination of undesirwanted plants. All herbicides are dangerous for humans and animals alike.

Hybride: an individual that occurred as the he result of interbreeding between two animals or plants of different species or taxa. Depending on the species and the nature of the genetic heredity, hybrids inherit the characteristics from both parents to the a different extent.

Mayflies – class Insecta (with incomplete metamorphosis). Their nymphs live in water and evolve develop over for 2 or 3 years. During mating, some species appear in a huge quantity above the water. The lifespan of an adult mayfly can vary from just a few hours to several days. Both the adults and nymphs have a great significance as the food for fish and other marine animals.

Mysidacea – class Malacostraca. Widespread in all seas and oceans. Some freshwater forms also exist. Due to their abundance they form an important part of the normal diet of many fishes.

Non-migratory (potamodromous) form: By their biology, the fishes are split divided into three forms: catadromous, diadromous and non-migratory. The range of catadromous fishes includes rivers with tributaries and near-mouth areas with desalted water. Catadromous fishes live both in fresh and brackish waters. Non-migratory fishes are those which live in fresh waters, and do not go on long migrationse too long; these are lacustrine and fluvio-lacustrine forms that occur both in flowing and still waters.

Oligochaetes: oligochaete annelids, biological phylum Annelida. They mainly live in soil and freshwaters. They are used as a food for young sturgeon individuals at the in hatcheries.

Pelagic species (from Greek *pelagos*, open sea) – the species living in the open sea.

Polychaetes (annelids) – class of annelid worms; generally marine, less often freshwater. They are a significant part of diet for eaten en masse by fishes and other animals. Of most The highest importance in the feeood balance is given to are calm worms and sandworms.

Spawning grounds: place of spawning, which is specific for all species of fish.

Spawning: laying of reproductive products by fishes; furthermore, most fishes have their eggs fertilized in water, outside the body of the female.

Spiracle (spiraculum) - small opening behind the eyes, which embryonically derived from the first gill opening (sharks, guitarfish, sturgeons).

Yolk sac: attributive inherent to embryos (fries) of fish; it contains the reserve of nourishment yolk, which is necessary until external (exogenous) nutrition begins. In bony fish embryos, the yolk sac is usually situated in the perigastrium, while sturgeon fries have it as a pear-shaped formation on the underside.

Reference

1. Yu.A. Abdurakhmanov. Freshwater Fish of Azerbaijan. Baku, 1962, 405pp.
2. F.S. Askerov, Y.Y. Zaitsev, R.Y. Kasimov, Z. Kuliyev. Amazing Caspian Fishes. Baku, 2001, 162 pp.
3. L. Vasilyeva. Sturgeons: The Past, Present and Future. (www.worldofanimals.ru/stLmenu/2/st4.html)
4. The Paddlefish, Or The Predator That Loves Turbidity and Noise. (http://fishworld.narod.ru/ap/Polyodontidae.html)
5. Species: Siberian Sturgeon (Achipenser baerii). (www.fishportal.ru/ih/ih_33.)
6. Sturgeon Breeding. (http://mshp.minsk.by/fish/html/tehno4.html)
7. Caviar: So Much in that Sound…(www.ikra.narod.ru/RUS/NATUR)
8. A. Mustafayev. The Return of Sturgeon. *Ogonek* magazine (www.ogoniok.com/archive/1996/4450-2/99-33-33)
9. A.Orujov. Sturgeons in the Caspian Sea. *WWF and CEPF for conservation in Caucasus*. Newsletter February 2005.
10. Sturgeons – materials from www.anim.clow.ru and www.caspianenvironment.org/biodb/rus/fishes/Acipenser%20gueldenstaedtii
11. Sturgeon, Fish of the Family Acipenseridae. (www.haleymartin.com/075/75154.htm)
12. V. Palgui. Sturgeons: The Actual Situation. *Russian Hunt Newspaper, April 05, 2006.*
13. A.Ponomarev. Family Acipenseridae. (www.internevod.com)
14. About Black Caviar. (http://uralbas.ru/rus/sturgeon.htm)
15. L.P. Sabaneev. Life and Catching Freshwater Fish. Kiev. 1976, 667 pp.
16. A.G. Tarasov. A Caspian Without Sturgeons is a Caspian Without a Future. *Wildlife Protection* magazine, #4 (34) 2005, pp. 13-16
17. A.M. Tokranov. Kaluga Sturgeon. (www.npacific.ru/np/library/enciclopedia/15/0017.htm)
18. Black Gold. Some Useful Information on Black Caviar. (www.wirud-cosmetic.com)
19. V. Shirokov. The Queen of the Amur Waters, Kaluga Sturgeon. In: *Amur Morning* weekly, online version. June 6, 2006 (#12).