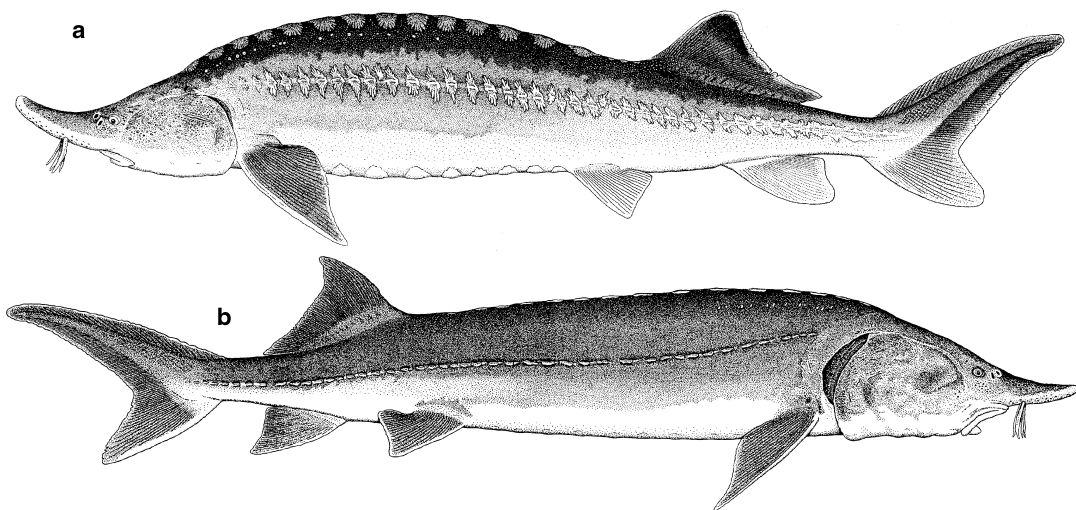


## Threatened fishes of the world: *Huso huso* (Linnaeus, 1758) (Acipenseridae)

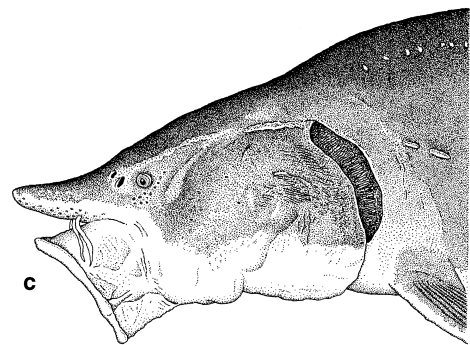
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**Common names:** Great sturgeon, beluga (E), grand esturgeon, beluga (F), viza (Hu), vyza velká (Cs), Hausen (G), morun (Ro), moruna (Bu), beluga (Ru), vyza (Slov), storione ladano (It). **Conservation status:** Now under Appendix II of Cites. Both IUCN and CITES listings rank most populations as Endangered while CITES lists the Azov Sea population as Critically Endangered. **Identification:** D 48-81, A 22-41 rays, dorsal scutes 9-17, lateral scutes 28-60 and ventral scutes 7-14. Body is heavy set, spindle-shaped with greatest body depth slightly anterior to midsection. Large individuals often appear humpbacked. Conical rostrum contains numerous sensory pits on both ventral and dorsal surfaces. Sensory pits not restricted to rostrum and are present in lesser numbers on the cheeks and posteriorly to the eye. Two pairs of barbells, long and laterally compressed with foliate appendages, originating midway or closer to the mouth than tip of snout. Enormous, crescent shaped mouth ventrally situated but unlike other acipenserids, projects forward. Upper lip continuous while lower lip is interrupted by large gap. Skin surface covered by fine denticles and five horizontal rows of scutes. On adults, scutes undergo absorption. Pre-anal plates 0–3 in single file. Beluga may reach a maximum size of 1220 kg and 6 m in length (Balon 1967). Fully grown individuals have become exceedingly rare but a 960 kg, 3.4 m specimen was recently taken off the Mazandaran coast of the south Caspian Sea. Adult coloration is gray, blue gray or dark brown with silver or gray lateral surface. Dark dorsum contrasts strongly against rest of body. Large juveniles often exhibit a metallic sheen laterally which fades with age. Ventral surface is white or cream colored. Illustrations: (a) juvenile, hatchery origin 110 cm, (b) adult, Volga River 180-cm male, (c) Volga



River 200-cm adult female showing forward projecting mouth. All illustrations by Paul Vecsei. **Distribution:** Widely distributed in the Black, Azov, Caspian and Adriatic seas. Although spawning beluga once ascended most large tributaries of the Ponto-Caspian basin, widespread construction of hydroelectric dams has greatly diminished the species' range over the past century. Historically, the Danube supported one of the largest known beluga spawning migrations (Balon 1967), however, construction of the Iron Gate Dams in 1970–1984 blocked upstream access to the middle and upper Danube. Similar habitat loss has occurred on most other major beluga rivers including the Dnieper, Don, Kuban, Volga. The Ural River, Khazistahn, is now the only large free-flowing river available for spawning beluga. Other less important spawning rivers include the Kura River of Azerbaijan, the Sefidrud, Gorganrud and Tajen rivers of Iran, and the Coruh, Yesilirmak and Kizilirmak rivers of Turkey. In the Adriatic, beluga were always rare but were occasionally taken from coastal waters of Venice and Albania with the last recorded harvest from the Po River in 1972 (Rossi et al. 1991). **Abundance:** Greatest numbers currently reside in the Caspian Sea; Azov Sea stock is nearly extirpated. Most Black Sea populations are nearly extirpated, however 884 specimens (106 tons) were harvested from the lower Danube in 1997 (Zakura & Tsuladze 1999), suggesting this stock may be larger than previously reported. Furthermore, recent surveys of juvenile abundance confirm that beluga are still reproducing in several reaches of the lower Danube. Continued spawning success of this population almost certainly results from the relatively lengthy expanse (850 km) of uninterrupted spawning habitat available to beluga in this system. **Habitat and ecology:** Unlike sturgeon of the genus *Acipenser*, the adult beluga is a pelagic predator, feeding primarily on the larger species within the genera *Alosa*, *Aspius* and *Engraulis*. Seasonal changes in diet have been observed throughout the beluga's range, and additional food items may include aquatic birds and young seals (Pirogovskii et al. 1989). Because adult beluga forage primarily within the pelagic zone, bottom substrates do not influence distribution at sea. During their first 3 months, juveniles remain in shallow coastal waters where they rely on a diet of benthic invertebrates. During this period they grow quickly, and after reaching 8–10 cm they become largely piscivorous (Pirogovskii et al. 1989). Environmental factors affecting beluga recruitment are poorly understood, however, predation and food availability are undoubtedly key factors. Although juveniles typically migrate to the sea shortly after the onset of exogenous feeding, Kynard et al. (2002) reported significant numbers of age-0 juveniles over-wintering in the main channel of the lower Danube. Like many other sturgeon species, beluga are long lived, with the oldest recorded specimen estimated to be 110 years (Berg 1948). This life-history style of delayed maturation coupled with extreme longevity results in a complex population age structure typified by spawning migrations consisting of up to 60 age classes. Recent observations of individual beluga captured from the Volga River, reveal that spawning migrations now comprised almost entirely of first-time spawners. The dramatic simplification of beluga population age structures throughout the Ponto-Caspian provides strong evidence that modern beluga fisheries (both legal and otherwise) are unsustainable. **Reproduction:** Males reach sexual maturity at age 12–16, after which spawning occurs every 4–7 years. First spawning for females occurs at age 16–22 with spawning intervals of 5–7 years thereafter. Spawning occurs in spring when river temperatures reach 9–17°C (Pirogovskii et al. 1989). Both spring and winter races of beluga are found throughout the Ponto-Caspian. While the spring race spawns within a few weeks after entering natal rivers, migration patterns of the winter race are more complex, with prespawning adults beginning their upstream migration in late summer. Throughout the winter period, these fish stay in deep pools near spawning areas that are easily accessible the following spring. This 'two-step' migration pattern apparently enables some beluga to reach distant spawning grounds while environmental conditions are still favorable for reproduction. Unfortunately, this same style, evolved to ensure survival, has exacerbated the negative impacts dams have had on many beluga stocks. Historically, the beluga migrated great distances for spawning and upstream movements in excess of 1000 km were common. Over the past 50 years, however, construction of dams on nearly all major spawning tributaries has blocked many of these historic spawning routes. Spawning occurs at depths of 4–40 m at current velocities of 1.5–2 m s<sup>-1</sup>. Preferred spawning substrate consists of gravel or cobble. Adhesive eggs remain on the substrate for 10–14 days until embryo hatching. Upon emergence, embryos are 11–14 mm and weigh 17–32 mg. The yolk sac is absorbed within 10–14 days after hatching and exogenous feeding begins when beluga reach 18–20 mm. Actively feeding larvae move downstream, often descending at a speed up to 60 km per day (Hochleithner & Gessner 1996). **Threats:** Over-fishing and construction of dams on nearly every spawning river have decimated most beluga populations. In the early 1950s the Soviet Union initiated an extensive stocking program in an effort to counter widespread population declines. Until 1991, intense stocking and strict Soviet control of the fishery maintained annual beluga harvests at 150–250 metric tons. In recent years, uncontrolled poaching has caused widespread fishery collapses and today, continued stocking efforts are needed to prevent extirpation of all

commercially exploited stocks. Although limited access to spawning habitat continues to depress natural reproduction, the most immediate threat to beluga is the continued legal and illegal fishing in spawning rivers. As large adult females have become increasingly rare, the soaring price of beluga caviar has helped fuel a dramatic increase in poaching and sales of black market caviar. In recent years poaching on the Volga River has become so widespread that adult beluga no longer reach their once productive spawning grounds below the Volgograd Dam, thus jeopardizing continuation of the Russian stocking program (E. Artyukhin personal communication). Additionally, incidental bycatch of juveniles in coastal anchovy fisheries has further reduced beluga recruitment (Zakura & Tsuladze 1999). In addition to over-fishing and loss of spawning habitat, industrial pollution and diversion of freshwater inputs have significantly altered coastal habitats by expanding hypoxic zones within the Black Sea. **Conservation action:** The collapse of the USSR in the early 1990s caused a major decline of industrial activity along the Volga River. Although these economic changes have helped improve water quality, over-fishing has decimated all major beluga populations. From 1963 to 1975 Soviet hatcheries maintained the lucrative commercial fishery by stocking approximately 12 million juveniles into the Volga annually (Pirogovskii et al. 1989). Over the past decade, however, lack of government funding has severely curtailed hatchery operations and the species may soon face extinction unless law enforcement can halt illegal fishing. Recently, international funding has been secured to help restore hatchery programs throughout the Caspian basin. If attained, the new annual stocking target of 15 million juveniles could reverse stock declines, however, the scarcity of ripe adults remaining in the wild may limit the program's success. In an effort to completely halt further exploitation of remaining beluga stocks, the National Resources Defense Council, the Wildlife Conservation Society and Sea Web have recommended that the species status be upgraded to Appendix I under current CITES listings. Under an Appendix I listing, beluga would receive the highest protection possible, as international trade of beluga caviar would be outlawed. Alternatively, U.S. imports of beluga could be banned if it were listed as 'endangered' under the U.S. Endangered Species Act, in which even a foreign species may be listed if threatened with extinction in all or a significant part of its range. **Remarks:** While illegal harvest and trade of caviar poses a serious threat to remaining beluga stocks, Romanian authorities hope to protect populations in the Danube with compulsory tagging of all legally marketed fish. Although these measures will undoubtedly assist law enforcement officials in identification of illegal beluga products, regional management plans are needed to help protect and rehabilitate remaining stocks. Recent meetings of the seven Black Sea management authorities of CITES have established the Black Sea Sturgeon Management Action Group. This consultative organization, comprised of sturgeon biologist from each Black Sea nation, recently finalized preparations to establish a regional data base containing key fishery statistic and biological data on all Black and Azov Sea stocks. While such efforts are badly needed to control illegal beluga harvest, the immediate survival of wild stocks will likely depend on captive breeding programs until economic conditions within the former Soviet Republics have stabilized.

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