memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with § 1.1206(b) of the Commission's rules. In proceedings governed by § 1.49(f) of the rules or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing oral ex parte presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (*e.g.,* .doc, .xml., .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules.

Synopsis

On May 13, 2022, the Competitive Carriers Association (CCA) filed a Petition for Declaratory Ruling or Limited Waiver asking the Commission to clarify that Broadband Data Collection (BDC) filings may be certified by a qualified professional engineer or an otherwise-qualified engineer that is not a licensed professional engineer accredited by a state licensure board. The Commission's rules require that an engineer review and certify the accuracy of the broadband availability data submitted by mobile and fixed providers as part of the BDC. In particular, the Commission requires each mobile and fixed service provider to include certifications as to the accuracy of its data submissions by a certified professional engineer or corporate engineering officer, in which the engineer certifies ''that he or she has examined the information contained in the submission and that, to the best of the engineer's actual knowledge, information, and belief, all statements of fact contained in the submission are true and correct and in accordance with the service provider's ordinary course of network design and engineering.'' This certification is in addition to the corporate officer certification required by the Broadband DATA Act. For government and other third-party entities that submit verified broadband availability data, the engineering certification must also include a certification by a certified professional engineer that he or she is employed by the government or other third-party entity submitting the verified broadband availability data and has direct knowledge of, or responsibility for, the generation of the government or other entity's Broadband Data Collection coverage maps.

In its petition, CCA asserts that the ''experience and expertise developed by [Radio Frequency (RF)] engineers through their work provides comprehensive skills relevant to broadband deployment [and] provides skills comparable to, and perhaps more relevant than, general licensure through the PE . . . exam process.'' CCA therefore requests that the Commission clarify that the requirement in 47 CFR 1.7004(d) that all providers must include as part of their BDC filing a certification of the accuracy of its submissions by a certified professional engineer may be completed by either a licensed professional engineer or an otherwise qualified engineer who possesses the appropriate engineering expertise but does not hold a professional engineer license. Additionally, CCA requests that the Commission clarify that the term ''corporate engineering officer'' may be any employee who has ''direct knowledge'' and is ''responsible for'' the carrier's network design and construction and who possesses a Bachelor of Science degree in Engineering. Alternatively, CCA requests a limited waiver of the requirement that BDC data be certified by a licensed professional engineer, and instead allow mobile providers to certify their data with an RF engineering professional with specified qualifications that are directly relevant to broadband availability assessment. CCA recommends that if the Commission seeks to specify qualification standards or requirements for engineers to certify broadband availability, it should adopt standards that specifically relate to broadband availability assessment, such as academic and employment experience, RF and propagation modeling experience, and knowledge relevant to wireless carriers' networks.

Federal Communications Commission.

Amy Brett,

Acting Chief of Staff, Wireless Telecommunications Bureau.

[FR Doc. 2022–11193 Filed 5–24–22; 8:45 am]

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DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–HQ–ES–2021–0073; FF09E22000 FXES1111090FEDR 223]

RIN 1018–BF34

Endangered and Threatened Wildlife and Plants; Endangered Species Status for Russian, Ship, Persian, and Stellate Sturgeon

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to list four species of Eurasian sturgeon as endangered species under the Endangered Species Act of 1973, as amended (Act). Specifically, we are proposing to list the Russian sturgeon (*Acipenser gueldenstaedtii*), ship sturgeon (*A. nudiventris*), Persian sturgeon (*A. persicus*), and stellate sturgeon (*A. stellatus*), all large fish native to the Black, Azov, Aral, Caspian, and northern Aegean Sea basins and their rivers in Europe and western Asia. This determination also serves as our 12-month finding on a petition to list these four species. After a review of the best scientific and commercial information available, we find that listing all four species is warranted. Accordingly, we propose to list the Russian, ship, Persian, and stellate sturgeon as endangered species under the Act. If we finalize this rule as proposed, it would add these species to the List of Endangered and Threatened Wildlife and extend the Act's protections to the four species.

DATES: We will accept comments received or postmarked on or before July 25, 2022. Comments submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. eastern time on the closing date. We must receive requests for a public hearing, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by July 11, 2022.

ADDRESSES: You may submit comments by one of the following methods:

(1) *Electronically:* Go to the Federal eRulemaking Portal: *https://www.regulations.gov.* In the Search box, enter FWS–HQ–ES–2021–0073, which is the docket number for this rulemaking. Then, click on the Search button. On the resulting page, in the panel on the left side of the screen, under the Document Type heading,

check the Proposed Rule box to locate this document. You may submit a comment by clicking on ''Comment.''

(2) *By hard copy:* Submit by U.S. mail to: Public Comments Processing, Attn: FWS–HQ–ES–2021–0073, U.S. Fish and Wildlife Service, MS: PRB/3W, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *https://www.regulations.gov.* This generally means that we will post any personal information you provide us (see Information Requested, below, for more information).

Availability of supporting materials: This proposed rule and supporting documents, including the species status assessment (SSA) report, are available at *https://www.regulations.gov* under Docket No. FWS–HQ–ES–2021–0073.

FOR FURTHER INFORMATION CONTACT:

Elizabeth Maclin, Chief, Branch of Delisting and Foreign Species, Ecological Services, U.S. Fish and Wildlife Service, MS: ES, 5275 Leesburg Pike, Falls Church, VA 22041–3803; telephone, 703–358–2171. Individuals in the United States who are deaf, deafblind, hard of hearing, or have a speech disability may dial 711 (TTY, TDD, or TeleBraille) to access telecommunications relay services. Individuals outside the United States should use the relay services offered within their country to make international calls to the point-of-contact in the United States.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rulemaking. Under the Act, if we determine that a species is warranted for listing, we are required to promptly publish a proposal in the **Federal Register**, unless doing so is precluded by higher priority actions and expeditious progress is being made to add and remove qualified species to or from the Lists of Endangered and Threatened Wildlife and Plants. The Service will make a determination on our proposal within 1 year. If there is substantial disagreement regarding the sufficiency and accuracy of the available data relevant to the proposed listing, we may extend the final determination for not more than 6 months. Listing a species as an endangered or threatened species can only be completed by issuing a rule.

What this document does. We propose to list four species of sturgeon—the Russian, ship, Persian, and stellate sturgeon—as endangered species under the Act. Together, we refer to the species as the ''Ponto-Caspian sturgeon,'' using the adjective that refers to the Black and Caspian Sea regions in which all four species are found. If finalized, the Act and our implementing regulations would prohibit with respect to listed endangered species of fish or wildlife: Import; export; take; possession and other acts with unlawfully taken specimens; delivery, receipt, carriage, transport, or shipment in interstate or foreign commerce, by any means whatsoever and in the course of a commercial activity; and sale or offer for sale in interstate or foreign commerce of the species and their parts and products. It would also be unlawful to attempt to commit, to solicit another to commit, or to cause to be committed any such conduct.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species because of any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We have determined that habitat destruction and loss due to construction of dams (Factor A), and to a lesser extent due to pollution (Factor A), decades of overharvest for the caviar and sturgeon meat trade (Factor B), ineffective fisheries regulation and enforcement (Factor D), invasive species' impacts on sturgeon prey (Factor E), and hybridization (Factor E) all put the four species at risk of extinction.

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments or information from other governmental agencies (including those in the species' range countries), Native American Tribes, the scientific community, industry, or any other interested parties concerning this proposed rule.

We particularly seek comments concerning:

(1) The biology, range, and population trends of the species, including:

(a) Biological or ecological requirements of the species, including habitat requirements for feeding, breeding, and sheltering;

(b) Taxonomy;

(c) Historical and current range, including distribution patterns;

(d) Historical and current population levels, and current and projected trends;

(e) Past and ongoing conservation measures for the species, their habitat, or both;

(f) Genetics and evolutionary capacity to adapt to changing environments.

(2) Factors that may affect the continued existence of the species, which may include destruction, modification, or curtailment of habitat or range, overutilization for commercial, recreational, scientific, or educational purposes, disease, predation, the inadequacy of existing regulatory mechanisms, or other natural or manmade factors.

(3) Biological, commercial trade, or other relevant data concerning any threats (or lack thereof) to this species and existing regulations that may be addressing those threats.

(4) Additional information concerning the historical and current status, range, distribution, and population size of this species, including the locations of any additional populations of this species.

(5) The impacts (positive or negative) of commercial sturgeon farming on conservation and restoration of the species, including:

(a) Ongoing efforts to restock wild populations using aquacultured fish and the success or lack of success of these activities for establishing self-sustaining wild populations;

(b) The degree to which commercial production of the species' meat and caviar contributes to or relieves wild stocks from harvest pressure;

(c) Whether and under what circumstances the production of the species in commercial aquaculture continues to use wild-caught fish as broodstock; and

(d) How the production and trade of interspecific hybrids with parentage from the species affects conservation of the pure species in the wild.

(6) Whether hybrid offspring produced from interspecific mating of a Ponto-Caspian sturgeon species with a non-listed species should be included in the listed (and therefore regulated) entity (see ''Hybridization'' under *Summary of Biological Status and Threats* below).

Please include sufficient information with your submission (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include.

Please note that submissions merely stating support for, or opposition to, the action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is an endangered or a threatened species must be made ''solely on the basis of the best scientific and commercial data available.''

You may submit your comments and materials concerning this proposed rule by one of the methods listed in **ADDRESSES**. We request that you send comments only by the methods described in **ADDRESSES**.

If you submit information via *https://www.regulations.gov,* your entire submission—including any personal identifying information—will be posted on the website. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on *https://www.regulations.gov.*

Comments and materials we receive, as well as supporting documentation we used in preparing this proposed rule, will be available for public inspection on *https://www.regulations.gov.*

Because we will consider all comments and information we receive during the comment period, our final determinations may differ from this proposal. Based on the new information we receive (and any comments on that new information), we may conclude that any of the four species is threatened instead of endangered, or we may conclude that any of the four species does not warrant listing as either an endangered species or a threatened species.

Public Hearing

Section 4(b)(5) of the Act provides for a public hearing on this proposal, if requested. Requests must be received by the date specified in **DATES**. Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule a public hearing on this proposal, if requested, and announce the date, time, and place of the hearing, as well as how to obtain reasonable accommodations, in the **Federal Register** at least 15 days before the hearing. For the immediate future, we will provide these public hearings using webinars that will be announced on the Service's website, in addition to the **Federal Register**. The use of these virtual public hearings is consistent with our regulations at 50 CFR 424.16(c)(3).

Previous Federal Actions

On March 12, 2012, the National Marine Fisheries Service (NMFS) received a petition dated March 8, 2012, from Friends of Animals and WildEarth Guardians to list the Russian, ship, Persian, and stellate sturgeon and 11 related sturgeon species as endangered or threatened species under the Act. Although the petition was initially sent to NMFS, 10 of the 15 petitioned sturgeon species—including the Russian, ship, Persian, and stellate sturgeon species—are under the jurisdiction of the Service pursuant to an August 28, 1974, memorandum of understanding between the Service and NMFS outlining our respective jurisdictional responsibilities under the Act. On September 24, 2013, we announced in the **Federal Register** (78 FR 58507) our 90-day finding that the petition presented substantial scientific and commercial information indicating that the petitioned action may be warranted for these 10 sturgeon species.

This document constitutes our review and determination of the status of the Russian, ship, Persian, and stellate sturgeon, our 12-month finding on each of these species as required by the Act's section 4(b)(3)(B), and our proposed rule to list these species.

Supporting Documents

We prepared a species status assessment (SSA) report for the four Ponto-Caspian sturgeon. The SSA analysis was led by a Service biologist in consultation with other Service staff and species experts. The SSA report represents a compilation of the best scientific and commercial data available concerning the status of the species, including the impacts of past, present, and future factors (both negative and beneficial) affecting the species. In accordance with our joint policy on peer review published in the **Federal Register** on July 1, 1994 (59 FR 34270), and our August 22, 2016, memorandum updating and clarifying the role of peer review of listing actions under the Act, we sought the expert opinions of four appropriate specialists regarding the SSA and received three responses.

I. Proposed Listing Determination

Background

A thorough review of the taxonomy, life history, and ecology of the Ponto-Caspian sturgeon is presented in the SSA report (Service 2021, pp. 11–23, available at *https://www.regulations.gov*). The following discussion is a summary of the biological background on the species from the SSA report.

Taxonomy

The Ponto-Caspian sturgeon are 4 of 27 species of sturgeon in the family Acipenseridae (Fricke et al. 2019, not paginated). Based on a review of the best available scientific information concerning current taxonomic classification, we determined that all four Ponto-Caspian sturgeon are valid entities for listing under the Act. Russian (*Acipenser gueldenstaedtii*), ship (*A. nudiventris*), and stellate (*A. stellatus*) sturgeon are all full species (Integrated Taxonomic Information System (ITIS) 2020, not paginated; Fricke et al. 2019, not paginated). As of 2021, ichthyological and general taxonomic authorities continue to consider Persian sturgeon endemic to the Caspian basin as a separate species (ITIS 2021, not paginated; Fricke et al. 2019, not paginated; Esmaeli et al. 2018, p. 7), although it was formerly considered a subspecies of Russian sturgeon until 1973 (Lukyanenko and Korotaeva 1973 cited in Gessner et al. 2010c, not paginated).

Many sturgeon species can produce offspring from interspecific mating events (Sergeev et al. 2019, p. 2; Havelka et al. 2011, entire; Saber et al. 2015, entire), and Russian sturgeon can even breed with fish of related families (Kaldy et al. 2020, entire). Such matings occur in the wild and in captivity (*e.g.,* Bronzi et al. 2019, pp. 259–264; Billard and Lecointre 2000, p. 363).

Physical Description

All sturgeon have an elongate body form with a flattened underside and downward-facing mouth. As adults, their bodies are at least partially covered with bony plates and they have tactile barbels hanging beneath the snout (Billard and Lecointre 2000, p. 363). Sturgeon have small eyes—characteristic of species that live in their low-light river- and lake-bottom habitats—and a cartilaginous skeleton (Billard and Lecointre 2000, p. 363). Specific morphological differences among Acipenseridae species are described in Billard and Lecointre (2000, entire) and in the references within the sturgeon family account in Fricke et al. 2019. Ponto-Caspian sturgeon attain sexual maturity at around 1 meter (m) (3 feet (ft)) in length but can grow to be 2–2.4 m (6–8 ft) long and to weigh 70–120 kilograms (kg) (150–260 pounds (lb); table 1; Gessner et al. 2010a–c, not paginated; Qiwei 2010, not paginated).

Range

The Ponto-Caspian sturgeon are native to rivers of more than 20 countries in the Black, Azov, Caspian, and Aral Sea basins (fig. 1–3; table 1; Gessner et al. 2010a–c, not paginated; Qiwei 2010, not paginated). Among the world's largest inland waterbodies (Kostianoy et al. 2005, p. 1; Kideys 2002, p. 1482), the Black and Caspian Seas are fed by rivers including Europe's two longest: The Danube, which flows from Germany to Romania and into the Black Sea, and the Volga, which runs 3,500 kilometers (km) (2,200 miles (mi)) through western Russia into the Caspian. The Volga is the largest in the Caspian basin, contributes 82 percent of freshwater discharge to the Caspian (Dumont 1995, p. 674), and formerly accounted for 75 percent of sturgeon harvest in the Caspian Sea, primarily Russian and stellate sturgeon, but also some ship and Persian sturgeon (Ruban and Khodorevskaya 2011, p. 202; Lagutov and Lagutov 2008, p. 201). Together, discharge from the Danube, Dnieper, and Dniester Rivers accounts for about 85 percent of water entering the Black Sea (Sorokin 2002 cited in Kideys 2002, p. 1482).

TABLE 1—GEOGRAPHIC RANGE AND KEY LIFE-HISTORY CHARACTERISTICS OF FOUR PONTO-CASPIAN STURGEON SPECIES

	Russian sturgeon	Ship sturgeon	Persian sturgeon	Stellate sturgeon
Native sea basins	Azov, Black, and Caspian Sea basins.	More common historically in Caspian and Aral than Black and Azov Sea basins.	Caspian basin, esp. its southern extent.	Azov, Black, and Caspian Sea basins.
Countries inhabited (countries with extirpated wild populations in *italics;* the country with introduced and established wild populations is CAPITALIZED).	Armenia; *Austria;* Azerbaijan; *Belarus; Bosnia & Herzegovina;* Bulgaria; *Croatia; Hungary;* Georgia; *Germany;* Iran (Islamic Republic of); Kazakhstan (Republic of); Moldova; Romania; Russian Federation (Russia); Serbia; *Slovakia;* Turkey; Turkmenistan; Ukraine.	*Armenia;* Azerbaijan; *Bosnia & Herzegovina; Bulgaria;* CHINA; *Croatia;* Georgia; *Hungary;* Iran, Kazakhstan (Republic of); *Moldova;* Russian Federation (Russia); *Romania; Serbia; Turkey; Ukraine; Uzbekistan; Turkmenistan.*	Armenia; Azerbaijan; Iran (Islamic Republic of); Kazakhstan (Republic of); Russian Federation (Russia); Turkmenistan.	Armenia; *Austria;* Azerbaijan; *Belarus; Bosnia & Herzegovina;* Bulgaria; *Croatia; Hungary;* Georgia; *Germany;* Iran (Islamic Republic of); Kazakhstan (Republic of); Moldova; Romania; Russian Federation (Russia); Serbia; *Slovakia;* Turkey; Turkmenistan; Ukraine.
Age at maturity, years (male/female).	8–13/10–16	9/12–18	8–15/12–18	6–12/7–14.
Reproductive frequency, years (male/female).	2–3/4–6	1–2/2–3	2–4/2–4	2–3/3–4.
Maximum longevity (male/female).	>50; now rarely reaches 40, due to harvest.	32	60–70; now rarely reaches 40, due to harvest.	41; now rarely reaches 30, due to harvest.
Female fecundity (mean # of eggs, varies with female body size).	350,000	400,000–850,000; 10–22% of body mass.	320,000	Up to 1.5 million.

Notes on Table 1: Sources for information in the table are: Gessner, 2021, in litt.; World Sturgeon Conservation Society (WSCS) and World Wildlife Fund (WWF) 2018, p. 41; WWF 2012, not paginated; Gessner et al. 2010a–c, not paginated; Qiwei 2010, not paginated; Lagutov and Lagutov 2008, p. 200; Billard and Lecointre 2000, pp. 357–360; Putilina and Artyukhin 1985 cited in Khoshkholgh et al. 2013.

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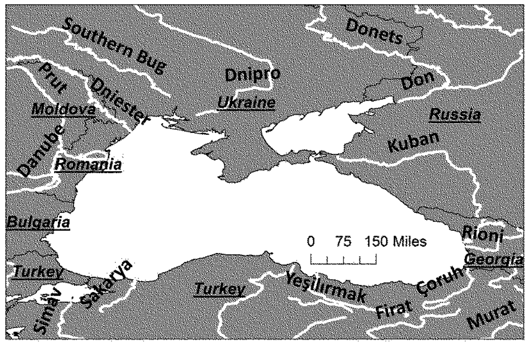

Figure 1—The Black (southern) and Azov (northern) Seas and their major rivers.

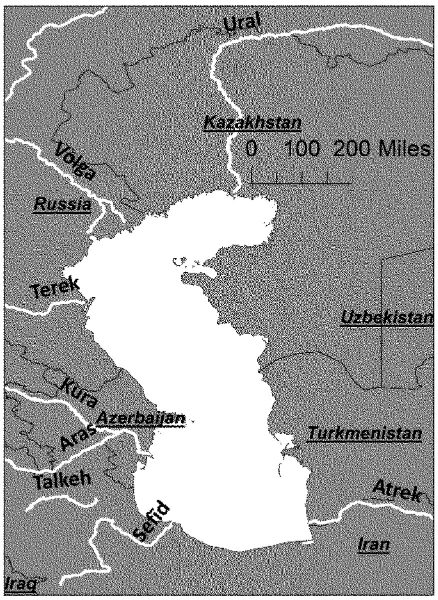

Figure 2—The Caspian Sea and its major rivers.

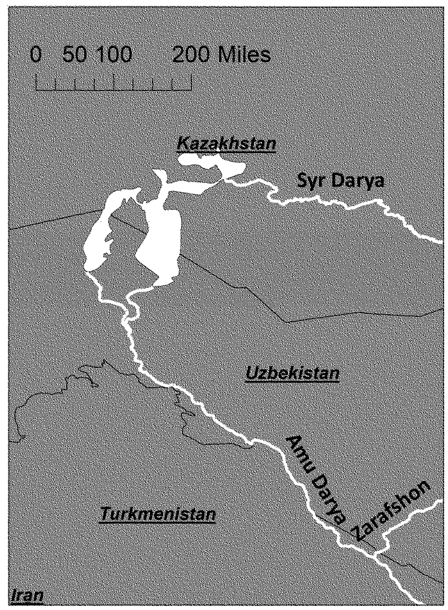

Figure 3—The Aral Sea and its major rivers.

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Life History

All four Ponto-Caspian sturgeon species use both rivers and seas (Billard and Lecointre 2000, pp. 371–374). Adults generally live and feed in saline seas but migrate several hundred kilometers (and up to 2,000 km (1,200 mi) in the Volga River) upstream into freshwater rivers—specifically the river in which they were born (Lagutov and Lagutov 2008, p. 197)—to spawn. A small number of populations, especially of ship sturgeon, live only in freshwater (WSCS and WWF 2018, p. 35; Billard and Lecointre 2000, p. 371).

Adult Ponto-Caspian sturgeon migrate into rivers in the spring or fall, then spawn in late spring (Gessner et al. 2010a–c, not paginated; Qiwei 2010, not paginated). Spawners that migrate in fall overwinter in their river before spawning. After spawning, adults return to the sea (Qiwei 2010c, not paginated).

If water temperature, flow, depth, turbidity, and cleanliness are not appropriate, females will fail to lay eggs (Ruban et al. 2019, p. 389; Chebanov et al. 2011 cited in Friedrich et al. 2019, p. 1060). Water temperatures are especially key to spawning success. Russian, ship, and stellate sturgeon all prefer water of 8–16 °C (Gessner et al. 2010a, not paginated; Gessner et al. 2010b, not paginated, Qiwei 2010, not paginated), whereas Persian sturgeon breed beginning at 16 °C and stop at 25 °C (Gessner et al. 2010c, not paginated).

Eggs between 2 and 4 millimeters (0.1–0.2 inches) in diameter are deposited in gravelly or sometimes sandy river bottoms (Billard and Lecointre 2000, p. 360). Cool, flowing water is necessary to oxygenate the eggs and avoid sediment accumulation (Lagutov and Lagutov 2008, p. 232). Depending on the species, a 50-kg (110-lb) female will lay from a few hundred thousand to 1.5 million eggs (table 1).

Once eggs hatch (approximately 8–11 days post-spawning, dependent on the species and the water temperature; Billard and Lecointre 2000 p. 360), larva drift downstream before settling among sediments while using the energy reserves of their yolk sack (2–8 days depending on the species; Billard and Lecointre 2000, p. 360). Fry then begin feeding; they and juvenile sturgeon tend to use shallower areas than adults (Gessner et al. 2010b, not paginated). Juvenile Russian sturgeon can remain in their natal river for as long as 4 years before reaching the sea (Khodorevskaya et al. 2009 cited in Ruban et al. 2019,

p. 389). Ship sturgeon also have a long period spent in freshwater as juveniles (Gessner 2021, in litt.), but some Ponto-Caspian sturgeon may spend only their first year in the river (Lagutov and Lagutov 2008, p. 199).

Ponto-Caspian sturgeons' high fecundity is balanced by very high mortality of early life stages. Based on values for related species, it is reasonable to expect that no more than 1 in 2,000 fish survive their first year (Jaric and Gessner 2013, pp. 485–486; Jager et al. 2001, p. 351). Juvenile and adult sturgeon have much higher natural survival rates (20–90 percent per year for several *Acipenser* spp.; Jaric and Gessner 2013, pp. 485–486; Jager et al. 2001, p. 351), although mature fish are heavily harvested for their roe, which is sold as caviar (see *Summary of Biological Status and Threats;* Van Eenennaam et al. 2004, p. 302).

Ponto-Caspian sturgeon continue to grow and reach sexual maturity after 6 to 22 years (table 1) with males reproducing one to a few years earlier than females (Gessner et al. 2010a–c, not paginated; Qiwei 2010, not paginated). Most female sturgeon spawn every 2–4 years, although Russian sturgeon females may wait up to 6 years between spawning bouts (Gessner et al. 2010a–c, not paginated; Qiwei 2010, not paginated). Sturgeons' long times to maturity and intervals between reproductive bouts limit their capacities to rebound from population declines.

Diet

Adult Ponto-Caspian sturgeon diets vary between species and locations but generally include small fish, mollusks, worms, and crustaceans (Billard and Lecointre 2000, p. 373; Polyaninova and Molodtseva 1995 cited in Billard and Lecointre 2000, p. 374). In the Caspian and Black Sea regions, this includes herring (Clupeidae), gobies (Gobiidae), crabs (Brachyura), mysids (Mysidae), annelids, and other taxa (Gessner et al. 2010a–c, not paginated; Qiwei 2010, not paginated).

Population Biology

The viability of Ponto-Caspian sturgeon populations is highly sensitive to:

• Abundance of adult females in a population;
• Adult sex ratio in the population;
• Age of females at first reproduction;
• Female fecundity (number of eggs laid);
• Natural mortality rate of the youngest age classes;
• Female spawning frequency; and
• Adult mortality rate (Jaric et al. 2010, pp. 219–227).

Ponto-Caspian sturgeon likely have separate populations that travel up and spawn within different rivers (Norouzi and Pourkazemi 2016, pp. 691–696; Norouzi et al. 2015, pp. 96–99; Khoshkholgh et al. 2013, pp. 33–35). This conclusion is reasonable because sturgeon return to breed in their natal river (Gessner and Ludwig 2020, pers. comm.; Pikitch et al. 2005, p. 243). Therefore, we assess the status of the four Ponto-Caspian sturgeon species within each of the major rivers that they presently inhabit or historically inhabited and consider each river to hold a separate population of each inhabiting species.

Nonetheless, some data (*e.g.,* some fisheries landing records) are recorded for entire sea basins. In the absence of finer scale data, we use these coarser records. Similarly, some authors indicate distinct populations within rivers, delineated by their winter or spring migration (Friedrich et al. 2019, p. 1060), but the strength of this separation and its frequency across rivers is uncertain.

Regulatory and Analytical Framework

Regulatory Framework

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species is an endangered species or a threatened species. The Act defines an endangered species as a species that is ''in danger of extinction throughout all or a significant portion of its range'' and a threatened species as a species that is ''likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' The Act requires that we determine whether any species is an endangered species or a threatened species because of any of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;
(B) Overutilization for commercial, recreational, scientific, or educational purposes;
(C) Disease or predation;
(D) The inadequacy of existing regulatory mechanisms; or
(E) Other natural or manmade factors affecting its continued existence.

These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term ''threat'' to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term ''threat'' includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those that affect individuals through alteration of their habitat or required resources (stressors). The term ''threat'' may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an ''endangered species'' or a ''threatened species.'' In determining whether a species meets either definition, we must evaluate all identified threats by considering the expected response by the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species, such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an ''endangered species'' or a ''threatened species'' only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

The Act does not define the term ''foreseeable future,'' which appears in the statutory definition of ''threatened species.'' Our implementing regulations at 50 CFR 424.11(d) set forth a framework for evaluating the foreseeable future on a case-by-case basis. The term ''foreseeable future'' extends only so far into the future as the Service can reasonably determine that both the future threats and the species' responses to those threats are likely. In other words, the foreseeable future is the period of time in which we can make reliable predictions. ''Reliable'' does not mean ''certain''; it means sufficient to provide a reasonable degree of confidence in the prediction. Thus, a prediction is reliable if it is reasonable to depend on it when making decisions.

It is not always possible or necessary to define foreseeable future as a particular number of years. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species' biological response include species-specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

Analytical Framework

The SSA report documents the results of our comprehensive biological review of the best scientific and commercial data regarding the status of the species, including an assessment of the potential threats to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for listing as an endangered or threatened species under the Act. However, it does provide the scientific basis that informs our regulatory decisions, which involve the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found at Docket No. FWS–HQ–ES–2021–0073 on *https://www.regulations.gov.*

To assess Ponto-Caspian sturgeon viability, we used the three conservation biology principles of resiliency, redundancy, and representation (Shaffer and Stein 2000, pp. 306–310). Briefly, resiliency supports the ability of the species to withstand environmental and demographic stochasticity (for example, wet or dry, warm or cold years), redundancy supports the ability of the species to withstand catastrophic events (for example, droughts, large pollution events), and representation supports the ability of the species to adapt over time to long-term changes in the environment (for example, climate changes). In general, the more resilient and redundant a species is and the more representation it has, the more likely it is to sustain populations over time, even under changing environmental conditions. Using these principles, we identified the species' ecological requirements for survival and reproduction at the individual, population, and species levels, and described the beneficial and risk factors influencing the species' viability.

The SSA process can be categorized into three sequential stages. During the first stage, we evaluated the individual species' life-history needs. The next stage involved an assessment of the historical and current condition of the species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. The final stage of the SSA involved making predictions about the species' responses to positive and negative environmental and anthropogenic influences. Throughout all of these stages, we used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We use this information to inform our regulatory decision.

Summary of Biological Status and Threats

In this discussion, we review the biological condition of the species and their resources, and the threats that influence the species' current and future conditions to assess the species' overall viability and the risks to their viability.

Individual Ponto-Caspian sturgeon require well-oxygenated, low-turbidity, unpolluted water for respiration (Ruban et al. 2019, p. 389). The species feed on larval insects, small mollusks, crustaceans, and fish (Gessner et al. 2010a–c, not paginated; Qiwei 2010, not paginated; Billard and Lecointre 2000, pp. 373–374). At the population level, all four species rely on connectivity of feeding and spawning grounds, usually several hundred kilometers (several hundred miles) or more up the natal river (Lagutov and Lagutov 2008, p. 197; Billard and Lecointre 2000, pp. 371–374). Successful spawning and reproduction is dependent on having large areas of loose gravel substrate 2–25 m (6.6–82 ft) below the surface to shelter eggs and embryos and with sufficient interstitial flow for eggs to be oxygenated (Lagutov and Lagutov 2008, p. 232; Billard and Lecointre 2000, pp. 360–361). The viability of the species depends on having adaptive capacity to respond ecologically and/or evolutionarily to changing environments. This is partially related to population size and to the persistence of multiple distinct, wide-ranging populations to reduce susceptibility to catastrophes (Smith et al. 2018, pp. 304–305).

Dams and Other Hydrological Engineering

All major rivers in the Ponto-Caspian region are dammed. Nearly 100 dams at least 8 m (26 ft) tall are present in the Caspian and Aral Sea Basins, and approximately 300 such dams dot the Black and Azov Sea basins (Service 2021, pp. 22–28; GRanD 2019, not paginated; Lehner et al. 2011, pp. 494–502). These dams are effectively impassable for sturgeon, eliminating the fishes' ability to migrate to and from spawning grounds upstream of such barriers (WSCS and WWF 2018, p. 48; He et al. 2017, p. 12 and references therein; WWF 2016, p. 19; Fashchevsky 2004, p. 185). Among the many impacts of large dams are that fish that cannot reach their historical spawning grounds may not reproduce successfully at downstream locations, and reduced water flow may hinder proper navigation during migration (Gessner 2021, in litt.; WSCS and WWF 2018, p. 48; He et al. 2017, p. 12 and references therein; WWF 2016, p. 19; Fashchevsky 2004, p. 185).

As the foremost example, the Volgograd Dam was built on the Volga River between 1958 and 1961, destroying access to 60–80 percent of the river's Russian sturgeon spawning grounds and 40–60 percent of those for stellate sturgeon (Vlasenko 1982 cited in Ruban et al. 2019, p. 389; Ruban and Khodorevskaya 2011, pp. 199–204; Fashchevsky 2004, p. 195). It is now the final dam of about 10 that impede the flow of the Volga and its tributaries to the Caspian Sea (GRanD 2019, not paginated; Lehner et al. 2011, pp. 494–502). As mentioned above, the Volga River is the primary input to the Caspian Sea, historically accounting for more than 80 percent of freshwater discharge (Dumont 1995, p. 674) and 75 percent of sturgeons harvested from the Caspian Sea (Ruban and Khodorevskaya 2011, p. 202). Following the Volgograd's completion, areas downstream of the dam became overcrowded, as fish that once migrated farther upstream were forced to stop here (Slivka and Pavlov 1982 cited in Ruban and Khodorevskaya 2011, p. 203). Up to 70 percent of eggs laid in these spawning grounds did not hatch (Khoroshko 1972 and Novikova 1989 cited in Ruban and Khodorevskaya 2011, p. 203).

In the Volga's remaining spawning grounds downstream of the dam, the annual sturgeon reproductive output now depends heavily on the volume and timing of water released from the upstream reservoir (Veshchev et al. 2012, entire). In the first 40 years of dam operation, only 13 years saw the downstream spawning grounds flooded. In relatively dry years, sturgeon numbers recruited into the population can be six to seven times lower than in relatively wet years, although productivity is greatly depleted in all years compared to before dam construction (Khodorevskaya and Kalmykov 2014, p. 578).

The spring peak water levels in the Volga used to follow snowmelt but now follow the water release schedule of dam operators, creating a compressed spring high-flow period (Fashchevsky 2004, p. 192). This change forces juvenile sturgeon to migrate away from shallow spawning grounds earlier than they naturally would and those that survive arrive in the Caspian Sea at smaller size (Khodorevskaya et al. 2009 cited in Ruban et al. 2019, p. 389), likely more susceptible to predation and other threats. A lower volume spring flood also reduces the initial size of spawning grounds and migration intensity, decreasing egg and larval survival (Ruban et al. 2019, p. 389).

Managed water releases from the Volgograd dam for electricity generation homogenize flows across the year, limiting flow relative to natural spring peaks and increasing winter flow rates compared to the pre-dam baseline. Up to 30 percent of Russian sturgeon that overwinter below the dam fail to spawn after exhausting their energy reserves fighting the high velocity of dam outflows (Altufiev et al. 1984 cited in Ruban et al. 2019, p. 389).

Similar impacts of other dams are prevalent across the Ponto-Caspian sturgeons' ranges. In the Caspian basin, fewer than 2,000 hectares (5000 acres) of spawning habitat remained in the Caspian's major rivers as of 2008, with about 75 percent of what was left in the Volga and Ural (Lagutov and Lagutov 2008, p. 230). Of the remaining 25 percent, two-thirds is in rivers where sturgeon failed to spawn for at least 25 years (Lagutov and Lagutov 2008, p. 230). As another example from the Black Sea basin, the Kakhov Dam was constructed on the Black Sea's Dnieper River in Ukraine in the early 1950s; immediately following its completion, the catch of migratory fish including Russian and stellate sturgeon as well as beluga sturgeon (*Huso huso*) and herring (Clupeida) fell by 80 percent (Fashchevsky 2004, p. 195).

The Danube River, responsible for over 50 percent of discharge to the Black Sea, is another representative case of the extent and impacts of damming in the Ponto-Caspian region. No fewer than 31 dams cross the Danube (Friedrich et al. 2019, p. 1061; Bacalbasa-Dobrovici 1997, p. 201). The Iron Gates Dams built in 1970 and 1984 (Bacalbasa-Dobrovici 1997, p. 201) created an isolated and now extirpated population of Russian sturgeon in the middle Danube (Billard and Lecointre 2000, p. 373). Danube Russian sturgeon fishery landings declined by 90 percent in 1985, the year after the second of two Iron Gates Dams went into place (Gessner et al. 2010a, not paginated).

To date, most fish passage structures built or retrofitted into dams to aid fish movement past the barrier have been unsuccessful at facilitating passage of sturgeon; slow-moving sturgeon rarely move through fast-flowing spillways (Fashchevsky 2004, p. 185; Billard and Lecointre 2000, p. 380). Such structures require low-flow resting pools and wide berths, if they are to aid sturgeon migration (Cai et al. 2013, p. 153). In addition, long-stagnant reservoirs behind dams may be low in oxygen and/or high in pollutants, either of which can confuse migratory navigation (Gessner 2021, in litt.). Few concrete plans exist to mitigate dam impacts, although planning for improved passage opportunities at the Iron Gates Dam is underway (International Commission for the Protection of the Danube River 2018, p. 9) and regional action plans call for increased investment in research and implementation of measures to improve river connectivity (*e.g.,* WSCS and WWF 2018, pp. 13–14, 21–22).

Dams are far from the only water-control structures engineered into Ponto-Caspian rivers, and all of irrigation and pumping stations, dredging, watercourse straightening, and water transfers between waterbodies affect sturgeon. For instance, since the mid-1980s, 85 percent of floodplains in the lower Danube have been diked (Botzan 1984 cited in Bacalbasa-Dobrovici 1997, p. 203). Dikes increase water depths and flow rates, which causes both migrating and recently hatched sturgeon to struggle, and prevent water from entering the natural floodplain, greatly reducing the availability of invertebrate prey for sturgeon (WSCS and WWF 2018, p. 49).

Massive withdrawals for irrigation or drinking water can dry out or alter the timing of flooding on spawning grounds; for instance, 40–60 percent of the Ural's discharge was diverted in the early 2000s, although this river is actually better off than most in the region because the lower 1,800 km (1,100 mi) has not been dammed (Lagutov and Lagutov 2008, p. 197; Fashchevsky 2004, pp. 194–196). Still, water levels have continued to drop in the Ural, due to intensive water use for irrigation, industry, and drinking water (Trotsenko and Melnikova 2019, not paginated).

Water withdrawals from the inlets to the Aral Sea, where ship sturgeon was native, have had particularly devastating impacts. Beginning in the 1960s, diversion of water from the Syr-Darya and Amu-Darya Rivers in what is now Kazakhstahn and Uzbekistan greatly limited the volume of water entering the Aral Sea (Micklin 2007, entire). The sea shrank from over 67,000 km^2 (26,000 mi^2) in 1960 to just over 14,000 km^2 (5,400 mi^2; nearly an 80 percent decline) by 2006 (Micklin 2007, p. 53). For at least 13 years (1974–1986), the Syr-Darya dried up before reaching the Aral Sea, and the same was true of the Amu-Darya for 5 years in the 1980s (Micklin 2007, p. 51). Extensive restoration is unlikely given the value of continued water withdrawals for agriculture (Micklin 2007, pp. 60–61). Moreover, dams in both the Syr-Darya (just 20 km (12 mi) from its mouth) and the Amu-Darya block the migration path to most former spawning sites (Ermakhanov et al. 2012, p. 6; Zholdasova 1997, p. 374).

Canals built for shipping access connect previously separate waterways, shifting the composition of ecological communities of which sturgeon are members. In the case of the Volga-Don navigational canal, connection of these two rivers spread an invasive species, the western Atlantic comb jelly *Mnemiopsis leidyi,* with grave environmental impact (see *Invasive species* below; Ivanov et al. 2000, p. 255). Ship noise and collisions in canals and elsewhere can also injure or kill sturgeon and interrupt their migration and other behavior (WSCS and WWF 2018, p. 49; He et al. 2017, p. 9).

Overfishing and the Trade in Ponto-Caspian Sturgeon Caviar and Meat

Heavy fishing pressure has for several decades or even centuries severely strained Ponto-Caspian sturgeon populations. Most data supporting the historical impact of overfishing come from fisheries landing records, and declines in commercial catch volume are widely believed to reflect population size in sturgeon (Qiwei 2010, not paginated). The black-market trade continues to negatively affect the species in the wild, despite existing Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) regulations and national and regional conservation agreements. Today, the primary threat from trade is due to domestic trade in the species' range states, although some international illegal trade likely still occurs.

History of Caspian Sea Sturgeon Fisheries

Commercial fisheries have long threatened the Ponto-Caspian sturgeon (Khodorevskaya and Kalmykov 2014, p. 577; Ruban and Khodorevskaya 2011, p. 199), and the threat stems primarily from lethal harvest to meet consumer demand for caviar, as well as sturgeon meat. Recent global caviar demand (from all sturgeon species) requires production from well over 1.5 million fish annually (Service 2021, p. 28; Gessner 2021, in litt.; Gessner et al. 2002, p. 665), and sturgeon overfishing is considered worst in the Ponto-Caspian (Reinartz and Slavcheva 2016, p. 16).

Russian sturgeon—sometimes combined with Persian sturgeon due to the historical taxonomic uncertainty—has been the most abundant species in Caspian basin catches (around 50 percent of the fishery for the four species assessed here plus beluga (*Huso huso*) and sterlet (*Acipenser ruthenus*) in most years since at least 1930, primarily in Russian waters; Ruban et al. 2011 entire; Ruban and Khodorevskaya 2011, pp. 200–202), with stellate sturgeon the next most common (mostly from Kazakh territory; Ruban and Khodorevskaya 2011, pp. 200–203). Ship sturgeon has long accounted for minimal catch volume in the Caspian.

Overfishing led to a decline in sturgeon abundance and catch in the Caspian as early as 1914 (Khodorevskaya and Kalmykov 2014, p. 577; Korobochkina 1964 cited in Ruban and Khodorevskaya 2011, p. 199). Although a reduction in fishing pressure during World War I and during the Soviet revolution immediately thereafter allowed some stocks to rebound, by the late 1930s, the average size of Russian sturgeon caught had fallen by 50 percent from the period 1928–1930 (Ruban and Khodorevskaya 2011, p. 199), an indicator of an over-exploited fishery (Koshelev et al. 2014, pp. 1129–1130; Shackell et al. 2010, p. 1357; McClenachan 2009a pp. 636–643; McClenachan 2009b, pp. 175–181). Smaller females lay fewer eggs (Gessner 2021 in litt.), meaning a greater number of fish were likely required to satisfy demand for wild-caught caviar, and that the ability of wild populations to withstand harvest was likely reduced. Quotas and minimum fish size limits imposed on southern and central Caspian Sea sturgeon harvesting in 1938 combined with a strong downturn in fishing during World War II (Service 2021, figs. 3.5, 3.6) to allow limited recovery of sturgeon stocks (Ruban and Khodorevskaya 2011, p. 199).

Over the ensuing three decades, sturgeon landings in the Caspian generally rebounded to approximately 30,000 metric tons (33,000 U.S. tons) annually in 1977, similar to the catch in 1914–1915 (but 40 percent less than the annual Volga River catch alone in the 1600s; Korobochkina 1964 cited in Khodorevskaya and Kalmykov 2014, p. 577; Ruban and Khodorevskaya 2011, p. 199). This recovery may have been aided by a near-complete ban on sturgeon fishing in the Caspian Sea that was in place during 1962–1965 (Ruban and Khodorevskaya 2011, p. 199; Abdolhay 2004, p. 137) . The increased catch may also have been due to increased efficiency of fishing operations (Lagutov and Lagutov 2008, p. 212).

From the 1960s until the early 1980s, the Caspian fishery focused intensely on harvesting spring migrants moving into rivers (Ruban and Khodorevskaya 2011, p. 204). Despite the Volgograd Dam's impacts, the Volga River remained the primary fishery location, accounting for 90 percent of all Soviet sturgeon harvest, with 80 to 95 percent of Volga River spawners captured yearly (note that not all adults spawn each year, so this is not 80–95 percent of all adults; Ruban and Khodorevskaya 2011, p. 204).

The collapse of the Soviet Union and the economic hardships that followed encouraged sturgeon poaching in the former Soviet territories (Ruban and Khodorevskaya 2011, p. 204). By the late 1990s, the illegal catch of all sturgeon species was estimated to be 6 to 10 times the permitted fishery (CITES Animals Committee 2000, p. 47; Fashchevsky 2004, p. 186). Others estimate that the illicit catch may have been as much as 35 times greater than the total legal catch (Bobyrev et al. cited in Ruban et al. 2019, p. 389).

The fishery history in the Ural River parallels those of the Volga and of the Caspian as a whole. In the late 1800s and early 1900s, the Ural River fishery was strictly controlled by the Cossack military government (Lagutov and Lagutov 2008, p. 209). However, by the 1950s, the Ural was heavily overfished (Lagutov and Lagutov 2008, p. 209) and the 1962 Soviet ban on sturgeon fishing in the sea increased pressure on the Ural River fishery (Lagutov and Lagutov 2008, p. 212), which was dominated by stellate sturgeon (Lagutov and Lagutov 2008, p. 220).

The Ural River sturgeon catch (all species) peaked in the late 1970s at about 10,000 metric tons (11,000 U.S. tons), 30 percent of the Caspian harvest (Lagutov and Lagutov 2008, p. 213). Thereafter, the catch continuously declined to near-zero by the early 2000s (Lagutov and Lagutov 2008, p. 213). In the late 1990s, as the Soviet collapse encouraged increased poaching, up to 60 percent of spawning ship sturgeon plus beluga sturgeon were caught in the Ural annually (Lagutov and Lagutov 2008, p. 219). From 1993 through 2007, ever-shrinking Kazakh quotas for sturgeon harvest in the Ural basin were generally not met because too few fish remained (Lagutov and Lagutov 2008, p. 213).

Although 4–5 tons of ship sturgeon were caught per year in the Kura River in the 1980s (Lagutov and Lagutov 2008, p. 227), the Terek, Kura, and Sefid-Rud Rivers' fishery volumes never approached those of the Volga and Ural (Lagutov and Lagutov 2008, p. 198). These rivers' fish populations have similarly been fished to near-extirpation (Lagutov and Lagutov 2008, p. 223).

In the late 1970s and early 1980s, sturgeon catches in the Caspian began to collapse. From their peak of around 30,000 metric tons (33,000 U.S. tons) in the mid-1970s, landings of Russian, Persian, and stellate sturgeon fell to 1,000–2,000 metric tons (1,100–2,200 U.S. tons) per year by the early 2000s (Service 2021, figs. 3.5, 3.6). Although these catch declines appear to mirror those in the 1930s and 1940s from which sturgeon fisheries rebounded, there are important distinctions. The drop in fisheries landings during the 1930s to 1940s were largely the result of a strong downturn in fishing effort during World War II (Service 2021, figs. 3.5, 3.6; Ruban and Khodorevskaya 2011, p. 199). No analogous event occurred during the late 1970s and early 1980s. Additionally, by the 1970s sturgeon populations were also heavily impacted by dams constructed between World War II and the 1970s (see *Dams and other hydrological engineering*), rendering a potential recovery in numbers even less likely.

In response to declining landings, some types of fishing equipment were banned seasonally n 1981 by Soviet authorities in portions of the Volga, including upstream of Astrakhan and on Glavnyi Bank (Ruban and Khodorevskaya 2011, p. 204). Still-stricter regulations began in 1986 (Ruban and Khodorevskaya 2011, p. 204), but the Caspian basin catch continued crashing fast, largely due to increased poaching and overfishing in both the sea itself and in rivers (Ruban and Khodorevskaya 2011, pp. 200–201, 204).

Overall, Caspian Sea sturgeon landings declined by more than 95 percent from their 1977 peak to 2003, when only about 1,000–2,000 metric tons (1,100–2,200 U.S. tons) were captured in the Caspian basin (Ruban and Khodorevskaya 2011, p. 200). This amount is 2 percent of the volume caught in just the Volga River in the 1600s and just over 3 percent of that caught a little over a century ago (Khodorevskaya and Kalmykov 2014, p. 577; Korobochkina 1964 cited in Ruban and Khodorevskaya 2011, p. 199; Ruban and Khodorevskaya 2011, p. 199).

History of Aral Sea Sturgeon Fisheries

From 1928 through 1935, 3,000–4,000 metric tons (3,300–4,400 U.S. tons) of ship sturgeon were harvested from the Aral Sea basin annually (Zholdasova 1997, p. 379). Following decimation of the region's ship sturgeon stock by the introduced parasite *Nitzschia* (see *Disease* below), the fishery was closed from 1940 until at least 1960, and resumed only at very low levels (0.7–9 metric tons (0.8–1.0 U.S. tons) per year; Zholdasova 1997, p. 379). From the 1970s on, intensive illegal fishing caused the extirpation of the population, and by 1984 no Aral basin fishery remained (Zholdasova et al. 1997, pp. 376–379).

History of Black and Azov Sea Sturgeon Fisheries

As in the Caspian Basin's Volga River, sturgeon catch records indicate prodigious volumes of the fish were caught in the Black Sea basin several centuries ago. Remarkably, in 1548, the Vienna, Austria, fish market once sold 50,000 metric tons (55,000 U.S. tons) of sturgeon from the Danube River (including the four species assessed here plus sterlet, beluga, and European sturgeon) in just a few days (Krisch 1900 cited in Friedrich et al. 2019, p. 1060). However, large sturgeon were already rare in the middle and upstream portions of the Danube by the 1800s (Heckel and Kner 1858 and Schmall and Friedrich 2014 cited in Friedrich 2019, p. 1060) with population declines due to overfishing underway (Bacalbasa-Dobrovici 1997, p. 202).

Sturgeon fishing on Romania's portion of the lower Danube was tightly controlled beginning with Communist rule in 1947, but even so, the catch declined precipitously during the second half of the 20th century. Whereas nearly 300 metric tons (330 U.S. tons) of sturgeon (all species) were caught in 1960 and 1965, this amount fell to less than 25 metric tons (28 U.S. tons) by 1990 (Bacalbasa-Dobrovici 1997, p. 203). Similar catastrophic declines in catch volume occurred on the Ukranian Danube, with almost no fish caught by 2000 (Reinartz et al. 2020a, p. 8).

The abundances of Russian, ship, and stellate sturgeon have all declined greatly in the lower Danube (Bacalbasa-Dobrovici 1997, p. 203). Historically, fishing was done with hooklines, but the introduction of large nets was a game-changer; one fisherman called them ''endless fences in the Black Sea'' (Luca et al. 2020, not paginated). Despite the much-decreased catch, by 2000, over 80 fishing sites remained along many hundreds of kilometers (hundreds of miles) of the Romanian Danube (Suciu 2008, p. 11). However, by 2006, no commercial fishing of sturgeon was permitted in the country (Suciu 2008, p. 17).

Trawl nets in the Danube estuary and surrounding seabed destroyed bottom habitats (Bacalbasa-Dobrovici 1997, pp. 205–206). Compared to the 1930s, by the 1980s, over two-thirds of river-bottom species and about 60 percent of their abundance had been lost; many of these are sturgeon prey items (Bacalbasa-Dobrovici 1997, pp. 205–206).

In the Kizilirmak and other Turkish Rivers, overfishing coupled with dams led to a collapse of the fishery in the 1970s (Memis 2014, p. 1552). Whereas legal Turkish sturgeon landings (all sturgeon species) were as high as 300 metric tons (330 U.S. tons) in the early 1960s, this volume dropped to just 4 metric tons (4.4 U.S. tons) in 1979 (Memis 2014, p. 1555). Despite a ban since 1980 on catching Ponto-Caspian sturgeon above 140 centimeters (4 ft 7 in) in length, illegal fishing continued to reap up to 15 metric tons (17 U.S. tons) of all sturgeon species from nearby coastal fisheries annually in the 1990s (Memis 2014, p. 1555). Illegal fishing is said to have slowed, then ceased in 2005 (Memis 2014, p. 1555), although it is not clear whether this is because of better enforcement or the exhaustion of the sturgeon population. By the late 1990s, as in the Caspian Sea, the illegal catch of all sturgeon species in the Black and Azov Sea basins was estimated to be 6 to 10 times greater than the legal fishery (CITES Animals Committee 2000, p. 47; Fashchevsky 2004, p. 186).

Few historical sturgeon data specific to the Dnieper, Southern Bug, Dniester, and Rioni Rivers are available. However, the Ponto-Caspian sturgeon populations are much reduced in these rivers, where they also were not as abundant to begin with (Vecsei 2001, p. 362; Fauna and Flora International 2019a, entire).

Invasive Species

The warty comb jelly (*Mnemiopsis leadyi*) is a western Atlantic ctenophore (a comb jelly) and is by far the invasive species with the greatest impacts on the Ponto-Caspian sturgeon and their habitats. First documented in the Black Sea (Pereladov 1983 cited in Ivanov et al. 2000, p. 255) in 1982, the warty comb jelly was widespread and native in western hemisphere estuaries, but has had vast impacts on Ponto-Caspian food webs, including on sturgeon by reducing prey abundance (Shiganova et al. 2019, entire; Kamakin and Khodorevskaya 2018, entire; Ivanov 2000, entire). The warty comb jelly was very likely introduced to the Black Sea in ship ballast water and then spread and multiplied prolifically (Ivanov et al. 2000, p. 255).

By 1988, the biomass of the warty comb jelly in the Black Sea ballooned to 1.1 billion metric tons (1.2 billion U.S. tons), greater than all the fish caught worldwide that year (Sorokin et al. 2001 cited in Ivanov et al. 2000, p. 255). It spread through the Black Sea where it flourished and was found at densities as high as 21,000 individuals per m^2 (2,000 per ft^2; Mirsoyan et al. 2006 cited in Shiganova and Shirshov 2011, p. 35).

The warty comb jelly feeds on zooplankton, floating fish eggs (not those of sturgeon, which adhere to the benthos), and fish larva (Tzikhon-Lukanina et al. 1993 cited in Ivanov et al. 2000, p. 256). In a single day, warty comb jelly individuals may ingest over 10 times their own body mass (Kremer 1979 cited in Ivanov et al. 2000, p. 256).

The warty comb jelly blooms in both the Black and Azov Seas caused zooplankton abundance to decrease dramatically and pelagic fish stocks to crash because of both direct predation and the loss of their zooplankton prey (Shiganova and Bulgakova 2000 cited in Ivanov et al. 2000, p. 256). The pelagic fish impacted include mackerel, anchovy, and kilka, several species of which are favored sturgeon prey (Gessner et al. 2010a–c, not paginated; Qiwei 2010, not paginated).

In 1997, another jelly species, *Beroe ovata,* was deliberately introduced to the Black Sea as a biocontrol for the warty comb jelly. *B. ovata* is a predator of the warty comb jelly in their native range and has considerably reduced the abundance of the warty comb jelly in the Black Sea (Shiganova et al. 2019, p. 434). Although *B. ovata* depresses the abundance of the warty comb jelly, there is an annual lag in the abundance of *B. ovata,* so there remains a short 1–2-month period each year in which the warty comb jelly has pronounced effects on the Black Sea food web, reducing sturgeon prey availability (Shiganova and Shirshov 2011, p. 89).

By 1999, the warty comb jelly was also confirmed from the Caspian Sea (Ivanov et al. 2000, pp. 255–256). The species likely moved from the Sea of Azov through the human-made Volga-Don canal into the Caspian basin (Ivanov et al. 2000, p. 255). The abundance of the warty comb jelly grew more than 200-fold from 1999 to 2009, peaking near 300 individuals per m^2 (28 per ft^2) in the middle and southeastern portions of the Caspian (Kamakin and

Khodorevskaya 2018, p. 174), although some authors report as many as 8,085 warty comb jellies per m^2 (751 per ft^2) in the same region (Shiganova and Shirshov 2011, p. 36). The warty comb jelly tended to be least abundant in the cooler areas of the Caspian, including the north in winter and the central east (Shiganova and Shirshov 2011, p. 40). The eastern region was first invaded to a considerable degree only in 2008 (Shiganova and Shirshov 2011, p. 41).

The warty comb jelly impacts on the Caspian ecosystem have been greater than those in the Black Sea (Shiganova and Shirshov 2011, p. 44). Caspian zooplankton abundance crashed by up to 90 percent, and mollusk larva—which grow into important sturgeon prey—disappeared from major sturgeon feeding grounds (Kamakin and Khodorevskaya 2018, p. 173; Shiganova and Shirshov 2011, p. 51). In the northern Caspian, crustacean biomass was halved as warty comb jellies ate their planktonic larvae (Shiganova and Shirshov 2011, p. 52); in the south, crustaceans were nearly eliminated after having once been the dominant benthic taxa and sturgeon food item (Shiganova and Shirshov 2011, p. 53).

As in the Black and Azov Seas, Caspian Sea planktivorous fish declined heavily, due to both direct predation of eggs by the warty comb jelly and the loss of their zooplankton prey (Kamakin and Kohodoreskaya 2018, p. 175). In particular, several herring species (*Clupeonella* spp.) that previously formed a major component of sturgeon diets became rare, likely declining by 90 percent or more (Shiganova and Shirshov 2011, pp. 53–59).

As in the Black Sea, releasing *B. ovata* in the Caspian would likely help ameliorate warty comb jelly impacts on sturgeon and the broader food web (Shiganova and Shirsov 2011, pp. 105–113), although *B. ovata* may be limited to the southern edge of the northern Caspian because salinity is too low farther north (Shiganova and Shirshov 2011, p. 104). No release of *B. ovata* has yet occurred in the Caspian, to our knowledge.

Approximately 60 other nonnative species are present in the Caspian Basin (Shiganova and Shirshov 2011, p. 31). For instance, sturgeon feeding grounds are periodically colonized by invasive shellfish and polychaete worms (Ruban et al. 2019, p. 390). Whether sturgeon consume these as readily as they do native invertebrates is not known. Regardless, no nonnative species are considered nearly as consequential for sturgeon as is the warty comb jelly.

Pollution

Most Ponto-Caspian rivers and all four sea basins discussed here have been polluted to a considerable degree. While the vast range of impacts of the many different contaminants and their range of concentrations are not completely known, pollution most strongly affects eggs, embryos, young juveniles, and maturing and reproducing adults (WSCS and WWF 2018, p. 50); adults feeding in seas between reproductive bouts may be somewhat less susceptible. Because sturgeon live near sea and river bottoms, they are exposed to organic pollutants (*e.g.,* polychlorinated biphenyl (PCBs)) and heavy metals that accumulate in sediments and in the bottom-dwelling animals that sturgeon feed on (Kasymov 1994 cited in He et al. 2017, p. 10; Billard and Lecointre 2000, p. 366; Kocan et al. 1996, p. 161). Heavy metals, organochlorine compounds, and hydrocarbons can all accumulate in sturgeon tissues where they can cause disorders including but not limited to organ and reproductive failure (Jaric et al., 2011, Luk'yanenko and Khabarov 2005, and Poleksic et al. 2010 cited in Friedrich et al. 2019, pp. 1061–1062; WSCS and WWF 2018, p. 50; Gessner et al. 2010a, not paginated).

The Volga River has been heavily polluted since the 1980s and 1990s when 500–1,100 percent increases in the concentration of several heavy metals, some of which vastly exceeded Soviet and Russian maximum allowable concentrations (MACs; Makarova 2000 and Andreev et al. 1989 cited in Ruban et al. 2019, p. 389). River water quality was said to be ''unsatisfactory'' for aquatic species (Moiseenko et al. 2011, p. 21). Petroleum compounds accumulated in the river's sediments, surpassing MACs by 300–700 percent on Russian sturgeon spawning grounds (Andreev et al. 1989 and Khoroshko et al. 1997 cited in Ruban et al. 2019, p. 389). Heavy metals passed into sturgeon livers, kidneys, and spleens (Ruban et al. 2019, p. 389) and caused measurable physiological, reproductive, and morphological pathologies in bream (*Abramis brama*), a fish species used as an indicator of pollution impacts (Moiseenko et al. 2011, pp. 13–20). In sturgeon, eggshells were weakened, and muscular abnormalities were observed (Moiseenko et al. 2011, p. 2). There is no indication of material improvement in Volga River water quality since the 1980s.

In contrast, pollution is a relatively limited problem in the Ural River, because the human population in the region is relatively sparse (Lagutov and Lagutov 2008, p. 246). Still, upstream portions of the river (especially within Cheliabinsk Oblast, Russia) may be highly polluted by industrial and agricultural inputs (Lagutov 2008, p. 148), which could potentially affect sturgeon or their food resources downstream.

Pollution in the Kura River is not well studied but is due to poorly treated municipal and industrial wastewater, agricultural and urban runoff, and mining residue (Bakradze et al. 2017, entire). Eutrophication (the process by which waters lose oxygen following extreme plant growth triggered by excessive nutrient inputs) appears not to be at emergency levels (Bakradze et al. 2017, p. 369). Heavy metal concentrations are elevated in upstream portions of the Kura, relative to other regional rivers; however, the Mingachevir dam and reservoir prevent most such pollution from entering the lower 200-plus km (120-plus mi) of river (Suleymanov et al. 2010, pp. 306–311). The Terek and Sefid-Rud Rivers may not have problematic levels of pollution (Askhabova et al. 2019, p. 557; Askhabova et al. 2018, p. 213), but the evidence base is not as complete for these rivers.

In the Azov Basin, the Don River receives considerable volumes of heavy metals and petroleum byproducts (*e.g.,* Dotsenko et al. 2018, entire; Sazykin et al. 2015, pp. 6–10), as do parts of the Kuban (Qdais et al. 2018, pp. 821–823). Since the 1970s, river inputs of nitrogen and phosphorus to the Azov have led to eutrophication in both rivers (Strokal and Kroeze 2013, p. 190). However, the degree to which pollution and eutrophication are affecting sturgeon health in the Azov basin is poorly characterized. That said, in 1990, 55,000 sturgeon of unspecified species composition were found dead along the shores of the Azov Sea, apparently due to pollution (Gessner et al. 2010a, not paginated). The event very likely killed even more fish that did not wash ashore.

The Dniester, Dnieper, and especially Danube Rivers in the northern Black Sea basin were all subject to large increases (300–700 percent) in nutrient and organic matter loading between the 1950s and 2000 (Bacalbasa-Dobrovici 1997, p. 205; Strokal and Kroeze 2013, p. 188). These increases typically resulted from fertilizer runoff and wastewater discharge and caused eutrophication that increased turbidity and decreased the availability of sturgeon prey (Zaitzev 1992 and 1993 cited in Bacalbasa-Dobrovici 1997, p. 205). Oxygen concentrations crashed, making several thousand square kilometers (over 1,000 square miles) between the Danube and Dniester deltas unable to support fish between 1973 and 1990 (Bacalbasa-Dobrovici 1997, p. 206). The so-called ''dead zones'' killed many of the benthic mollusks that sturgeon prey on (Strokal and Kroeze 2013, p. 179). In 2000, 14,000 km^2 (5,400 mi^2) in the northern Black Sea (approximately 3 percent of the sea) was hypoxic, although nutrient inputs to the region have decreased since the 1970s and are forecast to continue decreasing (Strokal and Kroeze 2013, pp. 179, 190). Clear data on more recent trends in Dnieper water quality are not available, to our knowledge.

Overall, pollution impacts on sturgeon in the Danube are considered severe (Banaduc et al. 2016, p. 144). Along the lower Danube River in Romania, a centuries-long history of deforestation has eroded riverbanks; consequently, water turbidity and sedimentation of sturgeons' gravel spawning grounds has increased (Bacalbasa-Dobrovici 1997, p. 203). In other sturgeon species, high sediment loads limit egg development (Li et al. 2012, p. 557); very likely the Ponto-Caspian sturgeon experience similar effects of sedimentation. Heavy metals accumulate in muscle and liver tissues of Danube River stellate and Russian sturgeon over time, and migrants that overwinter in the river for several months are likely exposed to heavily polluted fine sediments (Wachs 2000; Onara et al. 2013, p. 93).

Heavy metals from industry and the removal of gravel for sand mining have degraded spawning grounds in the Kizilirmak and Sakarya Rivers (Memis et al. 2019, pp. 53–59). Moreover, fast-increasing human population density, fertilizer use, and sewage outflows mean the southern Black Sea rivers are experiencing moderate pollution (Tiril and Memis 2018, pp. 142–143; Jin et al. 2013, p. 104) and are likely to see increasing nutrient inputs and eutrophication in the near future (Strokal and Kroeze 2013, pp. 186–187). Half the length of Turkey's Yesilirmak River was classified in 2008 as ''polluted'' or ''highly polluted'' with no clear trend since 1995 (Jin et al. 2013, pp. 111–114).

In Turkey's Coruh River, it is unclear the extent to which sturgeon are imperiled by pollution, but there is significant impairment of water quality due to heavy metals that leach from copper and gold mines and nutrient pollution from sewage and agriculture (Bayram 2017, entire; Secrieru et al. 2004, entire).

In the eastern part of the Black Sea basin, the Rioni River, especially its lower and middle reaches, is impacted by wastewater, persistent industrial organochlorine compounds, and mining residues (Global Water for Sustainability Program, Florida International University 2011, pp. 22–25), although the degree of the pollution and its effects on sturgeon are not well known.

In the northern Aegean Basin, the sediments of the Evros River are moderately to heavily polluted with heavy metals (Karaouzas et al. 2021, entire), and several industrial centers are likely discharging other pollutants in the river's upstream catchment (Nikolaou et al. 2008, pp. 309–310). However, it is unclear the extent to which this pollution contributed to the extirpation of stellate sturgeon from the river. The Struma receives organohaline and petrochemical pollutants in volumes sufficient to consider the river to have poor water quality (Litskas et al. 2012, entire), but the specific impacts on sturgeon are uncertain.

The Amu-Darya and Syr-Darya Rivers, which formerly entered the Aral Sea, were heavily polluted with agricultural and industrial chemicals from the 1970s to 1990s (Zholdasova 1997, pp. 374–375), as the ship sturgeon population was extirpated (Aladin et al. 2018, p. 2077; Ermakhanov et al. 2012, p. 4). Concentrations of phenols, nitrates, and heavy metals were all above Soviet MACs in the lower and middle Amu-Darya in 1989–1990, with especially polluted conditions at downstream locations. There, several such contaminants were present at dozens of times their MACs (Zholdasova 1997, p. 375). The massive evaporation that occurred in the Aral Sea and its inlets greatly increased dissolved mineral contents and salinity (up from 10 to 38 parts per thousand in 1961) to levels avoided by and even intolerable to sturgeon.

The Syr-Darya remains heavily polluted today. Intensive use of fertilizer and pesticides in the basin, especially for cotton farming, have made the water unsafe for fisheries (Taltakov 2015, pp. 137–138). Water withdrawals for irrigation have caused increased salinity of the remaining river water (Taltakov 2015, p. 137). Some warn that it will take over a decade to have safe water in the river, if and when cleaning begins (Taltakov 2015, pp. 135–138).

Climate Change

When and how progressing climate change will affect the species is uncertain. Global climate models (Karger et al. 2018, not paginated; Karger et al. 2017, entire) indicate that by 2041–2060 mean annual air temperature in the Caspian, Black, and Aral Sea basins will increase by 2–3 °C relative to the mean for the period 1979–2013 (Service 2021, pp. 50–52, 101–102). Precipitation projections over the same time period are less certain. The eastern Aral Sea basin may see slightly more precipitation, and the region between the Black and Caspian Seas is expected to become drier, as is that south of the Black Sea (Service 2021, pp. 50–52, 101–102). However, projections for most of the region indicate little directional change (Service 2021, pp. 50–52, 101–102).

Water in the remaining accessible spawning grounds will also become warmer, with potentially positive or negative effects on sturgeon reproduction. Surface waters (0–2-m depth) warm quickly in response to air temperature (McCombie 1959, pp. 254–258), and air temperatures in upstream regions of the Volga have warmed by up to 0.5 °C per decade since 1971 (Bui et al. 2018, p. 499). The lower Danube River is projected to warm by up to 1 °C by the year 2100 relative to 1961–1990 (van Vliet et al. 2013, p. 5). For deeper waters where sturgeon breed and feed, the exact concurrence between regional warming of air temperatures and local warming of water is uncertain, at least in calmer water where turbulence does not create mixing.

Increased water temperatures could eventually halt reproduction because Russian, ship, and stellate sturgeon spawn at 8–16 °C, whereas Persian sturgeon prefer warmer water of 16–25 °C (Gessner et al. 2010a, not paginated; Gessner et al. 2010b, not paginated, Gessner et al. 2010c, not paginated; Qiwei 2010, not paginated). Juvenile sturgeon may also struggle to survive in water above 25 °C (WSCS and WWF 2018, p. 51). For the most northerly Ponto-Caspian rivers including the Volga, daily mean temperatures rarely exceed 17 °C as of 2015 (Bui et al. 2018, p. 499), but the central and southern rivers are warmer (*e.g.,* Danube and Sefid-Rud: Gessner et al. 2010c, not paginated; Bonacci et al. 2008, p. 1016). It is unclear whether Ponto-Caspian sturgeon have the adaptive potential to shift their breeding phenology to match shifting temperatures, but temperature cues influence timing of spawning in other sturgeon (Bruch and Binkowski 2002, entire) and anadromous fish (Lombardo et al. 2019, entire).

In contrast, warming might speed Ponto-Caspian sturgeon growth and maturation, as it does for other sturgeon species (Krykhtin and Svirskii 1997, pp. 234–237; Nilo et al. 1997, p. 778). Any such benefits are likely to be of minimal impact to populations, given the ongoing and much greater negative impacts of dams and overfishing.

It is also uncertain whether increasing temperatures are the aspect of climate change to which Ponto-Caspian sturgeon are most sensitive. For instance, in the Caspian basin, increased evaporation is expected to continue causing a decrease in sea level, with consequent loss of shallow feeding areas (Chen et al. 2017, p. 6999), although increased rainfall may partially counterbalance this net decline in some years (Chen et al. 2017, p. 6999). Warmer water also holds less oxygen, and other sturgeon species outside the Ponto-Caspian region are projected to experience high enough water temperatures, and consequently low enough oxygen concentrations, to limit habitat availability as climate change progresses (Lyons et al. 2015, p. 1508; Hupfeld et al. 2015, pp. 1197–1200). We are not aware of studies assessing this possibility for Ponto-Caspian sturgeon, specifically.

Several rivers in the Ponto-Caspian sturgeons' ranges are fed by either snowmelt or glaciers. In the case of the Amu-Darya River, climate change progression is expected to speed glacier melting, creating an increase in year-to-year variability of river flow over the next few decades, followed by a decrease in flow when the glaciers are exhausted and snow is less abundant, possibly by the end of this century (White et al. 2014, p. 5274; Savitskiy et al. 2008, pp. 337–338). For the Syr-Darya, which is primarily snow-fed, increased temperatures are projected to limit snowfall and speed snowmelt, leading to reduced river flow and an earlier spring peak in flow (Savitskiy et al. 2008, pp. 337–338). Still, dams and irrigation are by far the main causes of flow decrease in the Aral Sea basin (White et al. 2014, p. 5268).

Disease

Although historically important to some populations, disease and parasites do not currently present Ponto-Caspian sturgeon with nearly the magnitude of threats posed by overfishing and dams (WSCS and WWF 2018, entire; Reinartz and Slavcheva 2016, entire; Gessner et al. 2010a–c, Qiwei 2010, not paginated). In 1934, 90 stellate sturgeon were transplanted into the Aral Sea, where only the ship sturgeon among the four Ponto-Caspian sturgeon taxa was native (Bauer et al. 2002, p. 422). The stellate sturgeon brought with them the monogeneid parasite *Nitzschia sturionis,* to which ship sturgeon lacked immune defenses (Bauer et al. 2002, pp. 422–423). The ship sturgeon population was decimated; people reported fish jumping out of the water and dying on the adjacent beaches (Bauer et al. 2002, p. 422). We are not aware of any additional *N. sturionis* outbreaks since 1934, and the ship sturgeon was extirpated from the Aral Sea basin in the 1980s. The SSA report has information on additional diseases and parasites affecting Ponto-Caspian sturgeon, although we do not determine any to be a current threat of even moderate magnitude for any of the four species (Service 2021, pp. 49–50).

Hybridization

Two processes can lead to hybridization among sturgeon species, which hinders the maintenance of species' distinct genetic character and potentially dilutes locally adapted evolutionary capacity. First, natural matings produce interspecific sturgeon hybrids that compose up to 3 percent of juveniles in the Volga River between 1965 and 1995; whether these hybrids mature and reproduce is unclear (Billard and Lecointre 2000, p. 363), but even the production of sterile individuals is wasted reproductive output by the parental fish (Allendorf et al. 2001, p. 616).

Second, sturgeon and their close relatives produced in commercial aquaculture sometimes escape aquaculture facilities and colonize wild Ponto-Caspian sturgeon habitats where interspecific hybridization can occur. For example, nonnative sturgeon and American paddlefish (*Polyodonta spathula*) may occasionally hybridize with Russian sturgeon as they escape from aquaculture facilities along the Danube (Kaldy et al. 2020, entire; Banaduc et al. 2016, p. 146). Neither mechanism of hybridization presents a threat that rises to the level posed by fishing and dams. Natural hybridization has presumably continued at a low rate over a long period of time as the species have evolved in sympatry. Its frequency relative to intraspecific matings could have increased as the fish become rare and mates are harder to find, but such data are not available. Hybridization in aquaculture facilities is problematic to the extent that such offspring escape into wild habitats.

Extra-Territorial Introductions

In the 1960s, ship sturgeon were introduced to China and Kazakhstan's Lake Balkhash and are now present in its tributary, the Ile River (Gessner et al. 2010b, not paginated). The species is now listed as a class II species under China's Wild Animal Protection Law, which restricts use to those cases permitted by regional, provincial, or local government (Harrish and Shiraishi 2018, pp. 46–47). Most approved fishing is for research or monitoring (Harris and Shiraishi 2018, p. 47). Fines for violating the regulations are 2 to 10 times the catch value (Harris and Shiraishi 2018, p. 47). Because the Ile River population has no hydrological connection to any water bodies in the ship sturgeon's native range, we place relatively little conservation value on this introduced population.

Russian sturgeon are aquacultured in Uruguay, and sporadic escapes followed by dispersal have led to a small number of observations of the species in the rivers of Uruguay, Argentina, and Brazil (Chuctaya et al. 2018, p. 397; Demonte et al. 2017, p. 1). Similarly, a very small number of Russian sturgeon have been caught in the Polish Baltic Sea basin since first being documented there in 1968 following introductions in the Soviet part of the Baltic Sea (Skóra and Arciszewski 2013, p. 365). Introductions also have occurred in Florida, Chile, China, Vietnam, The Arab Emirates, Italy, Germany, Spain, Czech Republic, Latvia, Lithuania, Finland, Greece, Madagascar, and elsewhere (Gessner 2021, in litt.), although there is no indication that the species is reproducing in these areas. We conclude that these introductions have low conservation value, but they also do not pose any threat to the species.

Current Condition

We determined the resilience of Ponto-Caspian sturgeon populations based on three characteristics, derived from the species' biological needs: (1) Its reproductive success (*i.e.,* likelihood of producing at least enough offspring to maintain a stable population size), (2) the connectivity for migration between seas and river spawning grounds, and (3) the habitat quality, based on water quality and prey abundance. No populations in the native range of the Ponto-Caspian sturgeon are considered to have better than low resilience presently, and we have determined that none of the populations have greater than a 50 percent chance of reproducing at a self-sustaining level, based on the best available science. Details of how we scored resilience based on these three criteria can be found in the SSA report (Service 2021, pp. 19–22).

More redundant species are those with a higher number of populations, especially those with moderate or high levels of resilience. Having populations spread among multiple sea basins and/or evidence of adaptive genetic capacity within the species was considered evidence for higher representation. Table 2 summarizes the current condition of the four Ponto-Caspian species.

TABLE 2—HIGHLIGHTS OF CURRENT PONTO-CASPIAN STURGEON RESILIENCY, REDUNDANCY, AND REPRESENTATION

RESILIENCY (large, connected populations; reproducing and able to withstand demographic stochasticity).	• Few, if any, populations breed at self-sustaining levels. • All four taxa are extirpated from upstream segments of most rivers due to river blockage by dams. • RUSSIAN: >90% decline in the abundance of wild Russian sturgeon between 1964 and 2009; females—harvested for their roe—comprise only 10% of mature fish in major populations. • SHIP: >80% decline over the last three generations (24–66 years). • PERSIAN: at least 80% decline over the last three generations (36–54 years). • STELLATE: 92% decline from 1960s–2008.
REDUNDANCY (number and distribution of populations to withstand catastrophic events).	• RUSSIAN: 9–10 extant populations, all with low or very low resiliency. • SHIP: 7 extant populations, all with low or very low resiliency. • PERSIAN: 3–5 extant populations, all with low or very low resiliency. • STELLATE: 9 extant populations, all likely with low or very low resiliency.
REPRESENTATION (ecological and genetic diversity; maintenance of adaptive potential).	• RUSSIAN: High intrapopulation genetic variation, but low inter-population diversity. Extirpated from upstream segments of most inhabited rivers. • SHIP: Extirpated from Aral Sea basin; freshwater population extirpated from Danube River; differentiated stocks remain in Caspian. • PERSIAN: Differentiated stocks remain when comparing stocks in Sefid-Rud and other, smaller south Caspian rivers. • STELLATE: Differentiated stocks remain among Caspian rivers.

Russian Sturgeon

The Russian sturgeon is presently found in 9–10 river basins and is extirpated from 7 or 8. Redundancy is interrelated with resiliency; low-resiliency populations cannot be considered to contribute to redundancy to the same degree, or with the same level of future certainty, as more resilient ones (Service 2021, pp. 19–22). Although at least 9 rivers retain populations of the species, all have low or very low resiliency and we consider the redundancy of the species to be low (Service 2021, pp. 59–62). All extant populations have low or very low resiliency because of the limited level of natural reproduction and the condition of connectivity and water quality in the species' habitats.

In the Volga River at the north of the Caspian Sea, the species' historical stronghold, Russian sturgeon biomass decreased by more than 80 percent between 1995 and 2010 (Lepelina et al. 2010 cited in Khodorevskaya and Kalmykov 2014, p. 578). Due to heavy harvesting pressure, as of 2011, females were only about 10 percent of mature fish in the Volga (Safaraliev et al. 2012 and Konopleya et al. 2007 cited in Khodorevskaya and Kalmykov 2014, p. 578), and females rarely live long enough to spawn more than once (Ruban et al. 2019, p. 391).

Russian sturgeon no longer reproduce every year in either the Volga or the other major north-Caspian River, the Ural (Sergeev et al. 2020, pp. 3–4; Lagutov and Lagutov 2008, p. 204). This follows approximately 90 percent declines in the number of spawners arriving yearly between 1964 and 2009 (Gessner et al. 2010a, not paginated) and a greater than 99 percent decrease in annual recruitment of Russian sturgeon juveniles from the Volga between 1966 and 2011 (Khodorevskaya and Kalmykov 2014, p. 579).

Today, fewer than 1 percent of all Caspian basin sturgeon (all species) are found outside the Volga and Caspian basins. In Azerbaijan, Russian sturgeon may be extirpated from the Kura River (Ruban and Khodorevskaya 2011, p. 202), and whether they have ever spawned there or in the Terek River is uncertain (Gessner et al. 2010a; Lagutov and Lagutov 2008, p. 223).

The Russian sturgeon is extirpated, or nearly so, from most of its former range in the Black and Azov basins, reducing its representation relative to past levels (WSCS and WWF 2018, pp. 10–12; fig. 3; Gessner et al. 2010a, not paginated); reproduction of the species is extremely rare in the Danube River—the largest entering the Black Sea—since at least 2010 (Reinartz et al. 2020d, pp. 6, 10; WSCS and WWF 2018, pp. 10–12, 30–31). Any remaining population in Georgia's Rioni River is on the brink of extirpation (Fauna and Flora International 2019a, p. 2), and the species only persists in the Don, Kuban, and Dnieper Rivers due to the continued release of aquacultured fish (WSCS and WWF 2018, pp. 10–12, 31).

Ship Sturgeon

Eight rivers retain populations of ship sturgeon, but the species is extirpated from 11 river basins. Their redundancy is, therefore, low, and resilience is low or very low in all extant native populations (Service 2021, pp. 62–64). Only one introduced population in China has moderate resilience; however, as stated previously, this population is of low conservation value because it is outside the native range of the species. Since the 1980s, the ship sturgeon has been extirpated from the Aral Sea and both its major tributaries, the Amu-Darya and Syr-Darya Rivers (Aladin et al. 2018, p. 2077; Ermakhanov et al. 2012, p. 4, Gessner et al. 2010b, not paginated). In the Caspian basin, ship sturgeon reproduction is only confirmed in the Ural River and as for all Ponto-Caspian sturgeon species, the ship sturgeon is extirpated, or nearly so, from the south and central rivers of this sea (WSCS and WWF 2018, p. 36; Aladin et al. 2018, p. 2069; Gessner et al. 2010b, not paginated).

Ship sturgeon are extirpated from several southern Black Sea rivers (Turkey's Kizilirmak, Yesilirmak, and Sakarya Rivers; WSCS and WWF 2018, pp. 10–12), and, as of 2018, the species had not been recorded in the Daube River for more than 10 years (WSCS and WWF 2018, p. 35). Loss of this fully freshwater (*i.e.,* not anadromous) population in the Danube contributed to a reduction in the species' representation, although there remains measurable genetic variation among extant populations (Qasemi et al. 2006, p. 164). As of 2009 (the most recent data available), the species was not found in Ukraine's Southern Bug, Dniester, and Dnieper Rivers for approximately 30 years (Gessner et al. 2010b, not paginated). Recent discovery of juveniles of the species in the Rioni River indicate reproduction is occurring there (Beridze et al. 2021, entire). Only restocking efforts maintain ship sturgeon in the Azov's two main rivers, the Don and the Kuban (Gessner 2021, in litt; Scheele 2020, pers. comm; Gessner et al. 2010b).

Persian Sturgeon

The Persian sturgeon, the most geographically restricted of the Ponto-Caspian sturgeon, remains present in the Ural, Kura, and Sefid-Rud Rivers of the Caspian basin. The species may still breed in the lower courses of the Sefid-Rud and Kura (Aladin et al. 2018, p. 2069), but this has not been confirmed for at least several years (Gessner 2021, in litt.). It may be extirpated from the Volga and Terek, and reproduction is less than likely in the Ural (Gessner et al. 2010c, not paginated). There has likely been a steady decline in the proportional abundance of females and their longevity, as for Russian sturgeon (Safaraliev et al. 2012 and Konopleya et al. 2007 cited in Khodorevskaya and Kalmykov 2014, p. 578). No extant population is likely to have natural reproduction occurring at a rate sufficient to allow population viability, and all extant populations have low or very low resilience (Service 2021, pp. 64–65). The restricted historical range of Persian sturgeon limits its potential redundancy severely. Relatively little is known about Persian sturgeon representation, but some level of genetic diversity remains in the species, as the Sefid-Rud River population is genetically differentiated from the species in other southern Caspian locations (Khoshkholgh et al. 2013, pp. 33–34; Chakmehdouz Ghasemi et al. 2011, p. 602).

Stellate Sturgeon

The stellate sturgeon is present in 9 river basins but extirpated from 10 others, giving the species' low redundancy. Because no extant populations are likely to have natural reproduction occurring at a rate sufficient for population viability, their resiliencies are all low or very low (Service 2021, pp. 65–66). In the Caspian basin, it is now rare for the stellate sturgeon to breed in the Volga River (Sergeev 2020, pp. 1–4; Reinartz and Slavcheva 2016, p. 48), and annual recruitment of stellate sturgeon juveniles from this river fell by more than 97 percent between 1966 and 2011 (Khodorevskaya and Kalmykov 2014, p. 579; Veshchev et al. 2012, entire). Most females in the Volga only live to spawn once due to heavy harvesting pressure, meaning average age of female spawners in the river is now less than half what it was 30 years ago (Ruban et al. 2019, p. 392). Only about 10 percent of mature stellate sturgeon in the Volga were female as of 2012 (Ruban et al. 2019, p. 392). Spawning is also very uncommon in the Ural River now (Reinartz and Slavcheva 2016, p. 48).

Small populations likely remain and breed in the Sefid-Rud and Kura Rivers, although reproduction rates are very low (Norouzi and Pourkazemi 2015, p. 95). Few recent data exist for the Terek River population, but it was said to be very small even in 1997 and there is no expectation that its situation has improved (Ruban and Khodorevskaya 2011, p. 202).

In the Black Sea basin, the stellate sturgeon was largely depleted in the Danube by the mid-1990s (Bacalbasa-Dobrovici 1997, pp. 201–203), and reproduction there is now minimal in most years (Reinartz et al. 2020d, p. 5). Ongoing reproduction was confirmed from the Rioni River in Georgia and the Sakarya River in Turkey in 2018 (WSCS and WWF 2018, p. 41), and the species still reproduces in the Azov basin's Kuban River, although the population is augmented by release of aquacultured stock (WSCS and WWF 2018, pp. 10–12). There is no indication that the remaining level of reproduction is sufficient to sustain any of these populations without such augmentation (Service 2021, pp. 66–68).

Despite the species' historical presence there, no records of stellate sturgeon are available for at least 10 years from each of the Don, Dnieper, Dniester, Southern Bug, Engui, Coruh, Yesilirmak, and Kizilirmak Rivers in the Black and Azov Seas or from the Struma and Evros Rivers that enter the Aegean Sea from Bulgaria and Greece (WSCS and WWF 2018, p. 41).

Stellate sturgeon representation is likely moderate-to-high, but with substantial uncertainty. As of 2005, there was considerable genetic diversity remaining Caspian-wide (Norouzi & Pourkazemi 2015 pp. 98–99; Doukakis et al. 2005, pp. 458–459); however, hybridization with related species may be diluting the species' genetic character in both the Caspian and Black Sea basins (Sergeev 2020, pp. 1–4; Banaduc et al. 2016, p. 146).

We note that, by using the SSA framework to guide our analysis of the scientific information documented in the SSA report, we have not only analyzed individual effects on the species, but we have also analyzed their potential cumulative effects. We incorporate the cumulative effects into our SSA analysis when we characterize the current and future condition of the species. To assess the current and future condition of the species, we undertake an iterative analysis that encompasses and incorporates the threats individually and then accumulates and evaluates the effects of all the factors that may be influencing the species, including threats and conservation efforts. Because the SSA framework considers not just the presence of the factors, but to what degree they collectively influence risk to the entire species, our assessment integrates the cumulative effects of the factors and replaces a standalone cumulative-effects analysis.

Conservation Efforts and Regulatory Mechanisms

Fisheries and trade regulations targeting the harvest, farming, and sale of the species have not effectively protected Ponto-Caspian sturgeon (WSCS and WWF 2018, p. 6). Many international agreements are non-binding, and economic interests, corruption, and the illegal trade all lessen the effectiveness of legal measures (WSCS and WWF 2018, p. 6; Mammadov et al. 2014, section 2.1; Lagutov and Lagutov 2008, p. 239).

CITES and the International Sturgeon Trade

The Ponto-Caspian sturgeon were all added to Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1998, along with all other species in the order Acipenseriformes not previously listed under Appendix I (CITES 1997). Except for Turkmenistan, all range countries are Parties to CITES, as is the United States. CITES Parties adopted a series of recommendations to improve regulation of the international sturgeon trade (Harris and Shirashi 2018, pp. 19–22), including reporting of scientifically based quotas for any legal wild-caught sturgeon (CITES 2015, entire; CITES 2010, entire) and a caviar labeling system to verify its legal origin (CITES 2015; 50 CFR 23.71; U.S. Fish and Wildlife Service Office of Law Enforcement 2008).

Since the inclusion of all sturgeon species in the CITES Appendices in 1998, the proportion of caviar in international trade reported to be of captive-bred origin has climbed from near zero to near 100 percent (CITES Trade database cited in Harris and Shiraishi 2018, p. 25; United Nations Environment Programme (UNEP)—World Conservation Monitoring Centre (WCMC) 2008 p. 31). Other than Iran, no country has reported a quota greater than zero since at least 2011 for any of the four Ponto-Caspian sturgeon (UNEP 2020, not paginated). In 2021, all quotas for the Ponto-Caspian species were zero or were not reported to CITES, except for a 50-kg quota for cultured caviar of ship sturgeon submitted by Iran (CITES 2021). When a quota is not reported, it is effectively set at zero (UNEP 2021, not paginated); thus, no wild-caught Ponto-

Caspian sturgeon can be legally traded internationally until relevant quotas are reestablished.

Still, wild-sourced caviar is very likely traded internationally using fraudulent labels or reporting (Irving 2021, pers. comm; Harris and Shiraishi 2018, entire; UNEP–WCMC 2012, p. 22). The sale of caviar and meat with mislabeled origin and/or species makes enforcement difficult (Harris and Shiraishi 2018, table 9), and it is very challenging for enforcement officials to confidently differentiate wild from cultured caviar (produced from aquacultured sturgeon; DePeters et al. 2013, pp. 130–131; Rehbein et al., 2008 entire; Czesny et al. 2000, pp. 147–148). Domestic sale of caviar of all sturgeon species (including in the United States and the many other sturgeon range countries) is not subject to CITES labeling requirements, likely facilitating trade in wild-sourced products within the range countries (Harris and Shiraishi 2018, p. 54). In addition, legitimate CITES labels and containers are resold for use in concealing transport of illegal caviar (van Uhm and Siegel 2016, p. 81).

The legal international trade in Ponto-Caspian sturgeon is now composed of aquacultured sturgeon caviar and meat (CITES Trade Database, 2020; Service 2021, pp. 35–40). In 2018, this included over 40 metric tons (44 U.S. tons) of Russian sturgeon caviar (CITES Trade Database, 2020). No ship sturgeon and only 353 kg (778 lb) of aquacultured stellate sturgeon were reported in the CITES Trade Database in 2018, the last year with complete data, as of the SSA report's compilation. Nearly all reported international trade in meat of the four Ponto-Caspian sturgeon since 2007 is also Russian sturgeon, with approximately 550 metric tons (600 U.S. tons) recorded in 2018 (CITES Trade Database, 2020). Less than 1 percent of this was reported as wild-sourced (CITES Trade Database, 2020). Three metric tons (3.3 U.S. tons) of aquacultured stellate sturgeon meat were traded internationally in 2018, but no such trade in ship or Persian sturgeon meat was reported (CITES Trade Database, 2020). Less than 10 kg (22 lb) of international trade in live eggs of each species was reported in 2018 (CITES Trade Database, 2020).

Although interspecific hybrids of Ponto-Caspian sturgeon with each other and with other sturgeon species are commonly produced in aquaculture (Bronzi et al. 2019, pp. 257), the above-cited figures do not include sturgeon hybrids. The CITES Trade Database does not specify which sturgeon species are included in reported hybrids, so we cannot determine which shipments include the species assessed here.

Beyond the caviar and meat trade, aquacultured Russian sturgeon are exported in large numbers (250,000 annually) from Hungary (Gessner et al. 2010a, not paginated) for the ornamental pet trade (Gessner 2021, in litt.). The species' eggs are used as an ingredient in cosmetics and pharmaceuticals, and their skin is used for leather. Russian sturgeon cartilage is used in medicines, and their intestines for sauces and in the production of gelatin (Gessner et al. 2010a, not paginated). Their swim bladder can be used to make glue (Gessner et al. 2010a, not paginated).

The United States has been the largest importer of sturgeon and sturgeon products since 1998 (CITES Trade database 2020, not paginated; Harris and Shiraishi 2018, p. 26; UNEP–WCMC 2012, p. 22). Between 2016 and 2018, the U.S. share of caviar imports (223,000 kg (492,000 lb); all sturgeon species) was more than 80 percent higher than that of the next-largest importing country, Denmark (CITES Trade Database 2020, not paginated). China, Italy, Moldova, Armenia, and Uruguay were the biggest importers of sturgeon meat over this period (Harris and Shiraishi 2018, p. 28).

As is true at the global scale, U.S. imports of Ponto-Caspian sturgeon products (caviar, meat, live eggs, and extracts, likely for cosmetics) have been dominated by Russian sturgeon in recent years. Meat, live eggs, and extracts from other Ponto-Caspian taxa are imported to the United States in near-zero quantities (CITES Annual Report database, 2020).

Domestic and Ongoing Illegal Sturgeon Trade

Across the 20-plus countries that comprise the ranges of Ponto-Caspian sturgeons, various legal efforts are aimed at regulating the harvest, farming, and trade of the species. The rules are many (WSCS and WWF 2018, pp. 63–75; Mammadov et al. 2014, section 2.1), but they have rarely been effective for protecting and recovering diminished sturgeon populations (WSCS and WWF 2018, p. 6). Economic interests, corruption, the large profits available from illegal trade, a failure to act before sturgeon stocks crashed, unnecessary complexity, the largely voluntary nature of agreements, and a lack of public awareness all conspire to make most national and multilateral legislation ineffective (WSCS and WWF 2018, p. 6; Mammadov et al. 2014, section 2.1; Lagutov and Lagutov 2008, p. 239). We provide some examples of relevant legislation and their limitations in the SSA report (Service 2021, p. 43).

Although difficult to monitor (Harris and Shiraishi 2018, pp. 16–17), the illegal trade in sturgeon products is generally thought to be robust, potentially accounting worldwide and across sturgeon species for 10 times the volume of caviar as in legal trade (Nelleman et al. 2014 cited in Harris and Shiraishi 2018, p. 14). In the Ponto-Caspian region, illegal harvest continues (Reinartz et al. 2020c, entire; WSCS and WWF 2018, p. 8; Reinartz and Slavcheva 2016, pp. 44–49; Jahrl 2013, entire) and is estimated to yield over 100 metric tons (110 U.S. tons) of sturgeon (all species) per year in the northern Caspian basin alone (Ermolin and Svolkinas 2018, p. 17). Organized crime and extensive corruption associated with sturgeon poaching on the Ural has even led in exceptional cases to militant violence against enforcement officers (Lagutov and Lagutov 2008, pp. 228, 239).

Most illegally caught sturgeon and their caviar are now likely sold domestically, especially in Russia (Congiu 2021, in litt.; Gessner 2021, in litt.). Black-market sellers there and in the eastern Black Sea region (Georgia, northeast Turkey, and far southwestern Russia) can collect a premium price for wild-sourced products and do not have to take the risk of laundering fish through a legitimate caviar factory (Congiu 2021, in litt.; Fauna and Flora International 2019a, pp. 2–3). Although some consumers accept aquacultured caviar as equivalent to wild-sourced products (Harris and Shiraishi 2018, p. 39), most people prefer caviar from rarer species (Gault et al. 2008, pp. 202–205). This preference can help drive a continued market for illegal wild-sourced caviar and could drive species to extinction in the wild (Gault et al. 2008, pp. 202–205). It is this domestic black market that is presently the biggest fishery-based threat to the Ponto-Caspian species (Gessner 2021, in litt.), a market that CITES regulation of international trade does not address.

Some international caviar smuggling occurs but is not thought to be of nearly the same volume as domestic sales. Still, in 2013 and 2014, Service investigations of the U.S. caviar trade revealed that each year most major importers on the East Coast were illegally importing millions of dollars' worth of caviar (Wyler and Sheikh 2013, p. 10; Zabyelina, 2014 cited in Harris and Shiraishi 2018, p. 48). Between 2000 and 2016, U.S. authorities seized more than 18 metric tons (20 U.S. tons) of illegally traded caviar (CITES Trade Database, 2020). Russian sturgeon was a common species among those traded illegally to the United States (Harris and Shiraishi 2018, p. 8). Generally, seizures were made for improper CITES labeling or mislabeled species identity (Gessner 2021, in litt.); however, an unknown volume is likely wild-sourced fish (Irving 2021, pers. comm.).

Seizures of illegally traded caviar continue in the Black Sea basin (Kecse-Nagy 2011, pp. 10–11 and tables 6, 7). Between 2014 and 2019, Danube Delta Police confiscated 640 kg (1,400 lb) of poached sturgeon (Luca et al. 2020, not paginated). Among three lower Danube countries—Bulgaria, Romania, and Ukraine—175 sturgeon poaching incidents (all species present, including beluga and sterlet) were reported by law enforcement between 2016 and May 2020 (Reinartz et al. 2020b, p. 4). Fishermen in the region also use relatively sophisticated methods including sonar and explicitly banned techniques such as hooked lines (Jahrl 2013, p. 3).

Some range country aquaculture facilities were believed to retain wild-caught broodstock intended to be released after spawning and may even have killed these fish to sell their caviar (Jahrl 2013, pp. 12–16, 34–35). There is also speculation that some companies producing and selling aquacultured caviar may participate in laundering of wild-sourced illegal caviar into the legal market in Romania, Bulgaria, and the Caspian basin (Jahrl 2013, p. 12). Neither of these practices is likely common, because transport of live fish for spawning in captivity is a difficult and high-risk undertaking and because some range states have domestic black markets on which premium prices are paid for wild-sourced caviar sold as such.

Law enforcement capacity is weak in the eastern Black Sea (Fauna and Flora International 2019a, p. 4), and existing regulations may be poorly communicated (Gessner 2021, in litt.). Nongovernmental volunteers supplement official capabilities in this region but have not stopped the trade (Fauna and Flora International 2019a, pp. 2–4). Fish are likely smuggled from Georgian waters to Turkey (Fauna and Flora International 2019a, p. 4). Over 50 Turkish and Georgian boats fishing for anchovy are also suspected of collecting Black Sea sturgeon as bycatch (harvest caught in the process of fishing for other species; Fauna and Flora International 2019a, p. 7; Fauna and Flora International 2019b, p. 6).

Where reported caviar imported from a given country is higher than that country's reported exports, exporters may be skirting the established CITES regulations (Harris and Shiraishi 2018, p. 22). Data from several Ponto-Caspian range states (Iran, Azerbaijan, and Russia, among others) all had such discrepancies for some years between 2000 and 2010 (Harris and Shiraishi 2018, p. 23). Indeed, Iran, Russia, and Kazakhstan often did not report any caviar exports between 2006 and 2010, despite allowing sturgeon trade (Harris and Shiraishi 2018, p. 23).

Neither most Ponto-Caspian sturgeon range states nor the United States (Harris and Shiraishi 2018, pp. 35, 50) require the CITES-style labeling recommended for domestic caviar sales (Harris and Shiraishi 2018, p. 11). Without documentation of caviar origin, species, date of packaging, and trade permissions as required on CITES labels (WSCS and WWF 2018, p. 66; Harris and Shiraishi 2018, p. 9), fraudulent sale of sturgeon products whose origin is undocumented or misstated as being derived from aquaculture is facilitated (Harris and Shiraishi 2018, p. 48).

For additional details of ongoing illegal trade in the range states, see the SSA report (Service 2021, pp. 40–43).

Restocking

Large-scale efforts have been made to recover Ponto-Caspian sturgeon populations in some parts of the species' ranges by restocking rivers with aquacultured fish. Approximately 3.3 billion sturgeon (all species) were released into the Caspian basin between 1954 and 2011 (Khodorevskaya and Kalmykov 2014, p. 578). The four Ponto-Caspian sturgeon were produced by a combined 20-plus aquaculture facilities in the Caspian region as of 2014, with about half in Russia, one third in Iran, and fewer in Azerbaijan and Kazakhstan (Service 2021, p. 54; Khodorevskaya and Kalmykov 2014, p. 578).

We are not aware of any large-scale assessment of stocking success. Still, in 2018, three adult Russian sturgeon and one stellate sturgeon (all males) were captured 126 km (78 mi) from the mouth of the Danube (Iani et al. 2019, p. 35). These were the first adult sturgeons of hatchery origin confirmed to return for spawning in the Danube after being released into the river as early as 2005 (Iani et al. 2019, p. 35). However, although widely practiced and at least partially responsible for preventing extinction of Ponto-Caspian sturgeon to date, restocking is far from a perfect solution. In general, restocking produces ''put-and-take'' fisheries, where fish are released and then mostly caught before or just after reproducing for the first time (Vecsei 2001, p. 362; WSCS and WWF 2018, pp. 18, 42). True population recovery is unlikely without mitigating dam and fishing impacts (WSCS and WWF 2018, p. 6; Gessner et al. 2010a–c, not paginated). Indeed, for watercourses like the Danube, which have dozens of dams, some experts believe it is futile to consider restoration of the species and their migration to upstream reaches of such rivers (Friedrich et al. 2019, p. 1065). Restoration of downstream reaches through restocking and facilitated dam passage is more feasible (Friedrich et al. 2019, p. 1065). Most fish released are fingerlings, 1 to several months old (Gessner et al. 2010a, not paginated); these young fish naturally have extremely low first-year survival rates (around 1 in 2,000; Jaric and Gessner 2013, pp. 485–486; Jager et al. 2001, p. 351).

Another challenge is that releasing fish native to one region or river into another can dilute locally adaptive traits when wild-born native fish breed with these captive individuals (WSCS and WWF 2018, p. 50). This within-species hybridization can reduce the resiliency and representation of local populations if introduced individuals are maladapted to local conditions.

For example, translocation of fertilized eggs from the Caspian Sea to the Azov Sea likely diluted the local stellate sturgeon gene pool in the 1990s and early 2000s (Qiwei 2010, not paginated). For ship sturgeon, captive stocks are available only from Caspian basin rivers (WSCS and WWF 2018, p. 36). This lack of captive stock could make their restoration in the Black, Azov, and Aral Seas more difficult, if local adaptations and migration instincts limit the success in the wild of captive-reared fish released in these parts of the range. Stocking of the Don and Kuban Rivers with stellate sturgeon from Caspian stocks that naturally have lower population growth rates than the Azov's stellate sturgeon similarly reduces the species' representation (Tsvetnenko 1993, p. 1). Moreover, aquacultured fish may not have the navigational instincts to migrate to the ''correct'' river, if they are not derived from a local stock (Lagutov and Lagutov 2008, p. 262).

Several Ponto-Caspian countries (Russia, Armenia, Iran, Bulgaria, Azerbaijan, Hungary, and Germany) rank in the top 15 producers of aquacultured sturgeon globally, but significant participation of commercial aquaculture facilities in sturgeon conservation is presently rare (Jahrl and Streibel-Greiter pers. comm. 2020; WSCS and WWF 2018, pp. 31, 59).

Determination of Ponto-Caspian Sturgeon Status—Introduction

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of an endangered species or a threatened species. The Act defines an endangered species as a species ''in danger of extinction throughout all or a significant portion of its range,'' and a threatened species as a species ''likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' The Act requires that we determine whether a species meets the definition of an endangered species or a threatened species because of any of the following factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) Overutilization for commercial, recreational, scientific, or educational purposes; (C) Disease or predation; (D) The inadequacy of existing regulatory mechanisms; or (E) Other natural or manmade factors affecting its continued existence.

In conducting our status assessment of the Ponto-Caspian sturgeon, we evaluated all identified threats under the section 4(a)(1) factors and assessed how the cumulative impact of all threats acts on the viability of each of the four species. That is, all the anticipated effects from both habitat-based and direct mortality-based threats were examined in total and then evaluated in the context of what those combined negative effects will mean to the future condition of each of the species. In addition, we considered the effects of existing conservation and regulatory measures on the current and future condition of each of the species. We used the best available information to gauge the magnitude of each individual threat on each of the Ponto-Caspian sturgeon species, and then assessed how those effects combined (and as may be ameliorated by any existing regulatory mechanisms or conservation efforts) impact a species' viability.

Russian Sturgeon—Status Throughout All of Its Range

After evaluating threats to the species and assessing the cumulative effect of the threats under the section 4(a)(1) factors, we determined that the distribution and abundance of Russian sturgeon has been reduced across its range as demonstrated by both the number of occupied rivers and the estimated abundance of the species where it remains present. Historically, the species occurred within at least 16 river basins in the Caspian, Azov, Black, and Aegean Sea basins; currently, the species occurs in no more than 10 river basins, reducing the species' redundancy. The remaining extant populations are all considered to have low or very low resiliency (*i.e.,* it is more likely than not that no self-sustaining populations remain; Service 2021, pp. 59–62). Overall, the species' abundance is estimated to have declined by more than 80 percent in just the last three generations, with additional declines before that. Representation is likely moderate—multiple river and sea basins are occupied—but with considerable uncertainty regarding adaptive evolutionary capacity.

Ongoing threats are from habitat degradation or loss due to both the widespread presence of dams and pollution (Factor A), demographic impacts from past harvest and ongoing overutilization of wild populations (Factor B), existing national and international regulations not adequately halting illegal trade in the species or recovering wild populations (Factor D), and invasive, nonnative species that impact Russian sturgeons' prey base (Factor E). These threats are current, widespread across the species' range, and imperil the viability of the species now. The species does not fit the statutory definition of a threatened species because it is currently in danger of extinction, whereas threatened species are those likely to become in danger of extinction in the foreseeable future. Thus, after assessing the best available information, we conclude that the Russian sturgeon is in danger of extinction throughout all of its range.

Ship Sturgeon—Status Throughout All of Its Range

After evaluating threats to the species and assessing the cumulative effect of the threats under the section 4(a)(1) factors, we determined that the distribution and abundance of ship sturgeon has been reduced across its range as demonstrated by both the number of occupied rivers and the estimated abundance of the species where it remains present. Historically, the species occurred within at least 18 river basins in the Caspian, Azov, Black, and Aral Sea basins; currently, the species occurs in 8 river basins, reducing the species' redundancy, and it is extirpated from the Aral Sea basin. The remaining extant populations are all considered to have low or very low resiliency (*i.e.,* it is more likely than not that no self-sustaining populations remain), except for one population introduced outside the historical range, which is considered to have moderate resiliency (Service 2021, pp. 62–64). Overall, the species' abundance is estimated to have declined by more than 80 percent in just the last three generations, with additional declines before that. Representation is uncertain in terms of adaptive evolutionary capacity but has been lowered by the extirpation of the species' Aral Sea basin and fully freshwater Danube River populations.

Ongoing threats are from habitat degradation or loss due to both the widespread presence of dams and pollution and water abstraction for irrigation (Factor A), demographic impacts from past harvest and ongoing overutilization of wild populations (Factor B), existing national and international regulations not adequately halting illegal trade in the species or recovering wild populations (Factor D), and invasive, nonnative species that impact the species' prey base (Factor E). These threats are current, widespread across the species' range, and imperil the viability of the species now. The species does not fit the statutory definition of a threatened species because it is currently in danger of extinction, whereas threatened species are those likely to become in danger of extinction in the foreseeable future. Thus, after assessing the best available information, we conclude that the ship sturgeon is in danger of extinction throughout all of its range.

Persian Sturgeon—Status Throughout All of Its Range

After evaluating threats to the species and assessing the cumulative effect of the threats under the section 4(a)(1) factors, we determined that the condition of Persian sturgeon has been reduced across its range as demonstrated by both the number of occupied rivers and the estimated abundance of the species where it remains present. Historically, the species occurred in five river basins in the Caspian Sea basin; currently, the species may occupy as few as three river basins, reducing the species' redundancy. The remaining extant populations are all considered to have low or very low resiliency (*i.e.,* it is more likely than not that no self-sustaining populations remain; Service 2021, pp. 64–65). Overall, the species' abundance is estimated to have declined by more than 80 percent in just the last three generations, with additional declines before that. Relatively little is known about Persian sturgeon representation The Sefid-Rud River population is genetically differentiated from the species in other southern Caspian locations (Khoshkholgh et al.

2013, pp. 33–34; Chakmehdouz Ghasemi et al. 2011, p. 602), indicating some level of genetic diversity in the species. However, the extent of diversity is unknown.

Ongoing threats are from habitat degradation or loss due to both the widespread presence of dams and pollution (Factor A), demographic impacts from past harvest and ongoing overutilization of wild populations (Factor B), existing national and international regulations not adequately halting illegal trade in the species or recovering wild populations (Factor D), and invasive, nonnative species that impact Persian sturgeons' prey base (Factor E). These threats are current, widespread across the species' range, and imperil the viability of the species now. The species does not fit the statutory definition of a threatened species because it is currently in danger of extinction, whereas threatened species are those likely to become in danger of extinction in the foreseeable future. Thus, after assessing the best available information, we conclude that the Persian sturgeon is in danger of extinction throughout all of its range.

Stellate Sturgeon—Status Throughout All of Its Range

After evaluating threats to the species and assessing the cumulative effect of the threats under the section 4(a)(1) factors, we determined that the distribution and abundance of stellate sturgeon has been reduced across its range as demonstrated by both the number of occupied rivers and the estimated abundance of the species where it remains present. Historically, the species occurred in 19 river basins in the Caspian, Azov, Black, and Aegean Sea basins; currently, the species occurs in 9 river basins, reducing the species' redundancy, and it is extirpated from the Aegean Sea basin. The remaining extant populations are all considered to have low or very low resiliency (*i.e.,* it is more likely than not that no self-sustaining populations remain; Service 2021, pp. 65–68). Overall, the species' abundance is estimated to have declined by more than 80 percent in just the last three generations, with additional declines before that. Representation is moderate to high, with measurable genetic diversity among populations, but is likely decreasing due to hybridization.

Ongoing threats are from habitat degradation or loss due to both the widespread presence of dams and pollution (Factor A), demographic impacts from past harvest and ongoing overutilization of wild populations (Factor B), existing national and international regulations not adequately halting illegal trade in the species or recovering wild populations (Factor D), and invasive, nonnative species that impact sturgeons' prey base (Factor E). These threats are current, widespread across the species' range, and imperil the viability of the species now. The species does not fit the statutory definition of a threatened species because it is currently in danger of extinction, whereas threatened species are those likely to become in danger of extinction in the foreseeable future. Thus, after assessing the best available information, we conclude that the stellate sturgeon is in danger of extinction throughout all of its range.

Status Throughout a Significant Portion of the Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range. We have determined that all four Ponto-Caspian sturgeon species are in danger of extinction throughout all of their ranges and accordingly did not undertake an analysis of any significant portion of the range for any of the four species. Because the Russian, ship, Persian, and stellate sturgeons each warrant listing as endangered throughout all of their ranges, our determinations are consistent with the decision in *Center for Biological Diversity* v. *Everson,* 2020 WL 437289 (D.D.C. Jan. 28, 2020), in which the court vacated the aspect of the Final Policy on Interpretation of the Phrase ''Significant Portion of Its Range'' in the Endangered Species Act's Definitions of ''Endangered Species'' and ''Threatened Species'' (79 FR 37578; July 1, 2014) that provided the Service does not undertake an analysis of significant portions of a species' range if the species warrants listing as threatened throughout all of its range.

Determination of Status

Our review of the best available scientific and commercial information indicates that each of the four Ponto-Caspian sturgeon species—the Russian, ship, Persian, and stellate sturgeon species—meet the definition of endangered species. Therefore, we propose to list the Russian sturgeon, ship sturgeon, Persian sturgeon, and stellate sturgeon as endangered species in accordance with sections 3(6) and 4(a)(1) of the Act.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened species under the Act include recognition, recovery actions, requirements for Federal protection and prohibitions against certain practices. Recognition through listing results in public awareness, and conservation by Federal, State, Tribal, and local agencies, foreign governments, private organizations, and individuals. The Act encourages cooperation with the States and other countries and calls for recovery actions to be carried out for listed species. The protection required by Federal agencies and the prohibitions against certain activities are discussed, in part, below.

Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as an endangered or threatened species and with respect to its critical habitat, if any is designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any action that is likely to jeopardize the continued existence of a species proposed for listing or result in destruction or adverse modification of proposed critical habitat. If a species is listed subsequently, section 7(a)(2) of the Act requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into consultation with the Service.

An ''action'' that is subject to the consultation provisions of section 7(a)(2) of the Act is defined in our implementing regulations at 50 CFR 402.02 as ''all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas.'' In view of this regulatory definition that clarifies that consultation requirements under section 7(a)(2) do not have extraterritorial application, we anticipate any ''actions'' involving the Ponto-Caspian sturgeon that require section 7 consultations would be limited to the Service's issuance of any section 10 permits under the Act. For example, in the event a person applies for a permit to import Ponto-Caspian sturgeon specimens into the United States for scientific purposes, or for enhancing the propagation or survival of the species under section 10(a)(1)(A) of the Act, authorization of the proposed activity would be a Federal action subject to consultation. Apart from consultations on section 10 permits, however, the Ponto Caspian sturgeon is unlikely to be the subject of section 7 consultations because the entire life of the species occurs in freshwater and nearshore marine areas outside of the United States. Additionally, no critical habitat will be designated for this species Additionally, no critical habitat will be designated for this species because, under 50 CFR 424.12(g), we will not designate critical habitat within foreign countries or in other areas outside of the jurisdiction of the United States.

Section 8(a) of the Act (16 U.S.C. 1537(a)) authorizes the provision of limited financial assistance for the development and management of programs that the Secretary of the Interior determines to be necessary or useful for the conservation of endangered or threatened species in foreign countries. Sections 8(b) and 8(c) of the Act (16 U.S.C. 1537(b) and (c)) authorize the Secretary to encourage conservation programs for foreign listed species and to provide assistance for such programs in the form of personnel and the training of personnel.

The Act and its implementing regulations set forth a series of general prohibitions and exceptions that apply to endangered wildlife. The prohibitions of section 9(a)(1) of the Act, codified at 50 CFR 17.21, make it illegal for any person subject to the jurisdiction of the United States to import; export; deliver, receive, carry, transport, or ship in interstate or foreign commerce, by any means whatsoever and in the course of commercial activity; or sell or offer for sale in interstate or foreign commerce any species listed as an endangered species. In addition, it is unlawful to take (which includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these) endangered wildlife within the United States or on the high seas. It is also illegal to possess, sell, deliver, carry, transport, or ship, by any means whatsoever any such wildlife that has been taken illegally. Certain exceptions apply to employees of the Service, NMFS, other Federal land management agencies, and State conservation agencies.

We may issue permits to carry out otherwise prohibited activities involving endangered wildlife under certain circumstances. Regulations governing permits are codified at 50 CFR 17.22. Regarding endangered wildlife, a permit may be issued for the following purposes: For scientific purposes, to enhance the propagation or survival of the species, and for incidental take in connection with otherwise lawful activities. The Service may also register persons subject to the jurisdiction of the United States through its captive-bred-wildlife (CBW) program if certain established requirements are met under the CBW regulations (50 CFR 17.21(g)). Through a CBW registration, the Service may allow a registrant to conduct certain otherwise prohibited activities with live wildlife specimens as part of conservation breeding activities that enhance the propagation or survival of the affected species: Take; export or re-import; deliver, receive, carry, transport or ship in interstate or foreign commerce, in the course of a commercial activity; or sell or offer for sale in interstate or foreign commerce. A CBW registration may authorize interstate purchase and sale only between entities that both hold a registration for the taxon concerned. The CBW program is available for species having a natural geographic distribution not including any part of the United States. The individual living specimens must have been born in captivity in the United States. The statute also contains certain exemptions from the prohibitions, which are found in sections 9 and 10 of the Act.

It is our policy, as published in the **Federal Register** on July 1, 1994 (59 FR 34272), to identify to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9(a) of the Act. The intent of this policy is to increase public awareness of the effect of a proposed listing on proposed and ongoing activities within the range of the species proposed for listing. Based on the best available information, the following actions are unlikely to result in a violation of section 9(a), if these activities are carried out in accordance with existing regulations and permit requirements; this list is not comprehensive:

(1) Take of any Ponto-Caspian sturgeon in its native range.

(2) Trade in any Ponto-Caspian sturgeon and its products that is both outside the United States and conducted by persons not subject to U.S. jurisdiction (although this activity would still be subject to CITES requirements).

(3) Activities with respect to hybrid fish or their products produced from hybridization to the second or subsequent generations of any Ponto-Caspian sturgeon and one or more other species not listed as threatened or endangered under the Act (although international trade would still be subject to CITES requirements). We do not consider hybrid fish produced from interspecific mating one of the Ponto-Caspian sturgeon species with a non-listed species to be part of the listing entity, although hybrid offspring of two Ponto-Caspian parent species or of one Ponto-Caspian sturgeon and another listed species, as well as all first generation hybrids, would be protected from all activities prohibited with endangered species of fish or wildlife under section 9(a)(1).

Based on the best available information, the following activities may potentially result in a violation of section 9 of the Act if they are not authorized in accordance with applicable law; this list is not comprehensive:

(1) Import into the United States of any Ponto-Caspian sturgeon and its products, including fish derived from the wild or captive-bred, and including hybrid offspring of two Ponto-Caspian parent species or of one Ponto-Caspian sturgeon and another listed species or of one Ponto-Caspian sturgeon and another species not listed as threatened or endangered under the Act (first generation hybrids), see 16 U.S.C. 1532(8); 1538(a)(1), without obtaining permits required under section 10 of the Act or without following applicable CITES requirements at 50 CFR part 23.

(2) Export of the Ponto-Caspian sturgeon and its products, whether derived from wild or captive-bred stock, and including hybrid offspring of two Ponto-Caspian parent species or of one Ponto-Caspian sturgeon and another listed species or of one Ponto-Caspian sturgeon and another species not listed as threatened or endangered under the Act (first generation hybrids), see 16 U.S.C. 1532(8); 1538(a)(1), from the United States without obtaining permits required under section 10 of the Act or without following applicable CITES requirements at 50 CFR part 23.

Separate from their proposed listing as endangered species, Ponto-Caspian sturgeon are also regulated as CITES-listed species: All international trade of these species by persons subject to the jurisdiction of the United States must also comply with CITES requirements pursuant to section 9(c) and (g) of the Act and 50 CFR part 23. Applicable wildlife import/export requirements established under section 9(d)(f) of the Act, the Lacey Act Amendments of 1981 (16 U.S.C. 3371, *et seq.*), and 50 CFR part 14 must also be met for imports and exports of any of the four Ponto-Caspian sturgeon species.

Questions regarding whether specific activities would constitute a violation of section 9 of the Act should be directed to Mary Cogliano, Chief of the Branch of Permits (*mary_cogliano@fws.gov;* 703–358–2104).

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(1) Be logically organized;

(2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help us revise the rulemaking, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

National Environmental Policy Act (42 U.S.C. 4321 et seq.)

It is our position that, outside the jurisdiction of the U.S. Court of Appeals for the Tenth Circuit, we do not need to prepare environmental analyses pursuant to the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*) in connection with regulations adopted pursuant to section 4(a) of the Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244). This position was upheld by the U.S. Court of Appeals for the Ninth Circuit (*Douglas County* v. *Babbitt,* 48 F.3d 1495 (9th Cir. 1995), cert. denied 516 U.S. 1042 (1996)).

References Cited

A complete list of references cited in this rulemaking is available on the internet at *https://www.regulations.gov* and upon request from the Branch of Delisting and Foreign Species, Headquarters Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this proposed rule are the staff members of the Fish and Wildlife Service's Species Assessment Team and the Branch of Delisting and Foreign Species.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

■ 1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

■ 2. Amend § 17.11(h) by adding entries for ''Sturgeon, Persian'', ''Sturgeon, Russian'', ''Sturgeon, ship'', and ''Sturgeon, stellate'' to the List of Endangered and Threatened Wildlife in alphabetical order under Fishes to read as set forth below:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Common name	Scientific name	Where listed	Status	Listing citations and applicable rules
* * *	* * *	*		
FISHES				
* * *	* * *	*		
Sturgeon, Persian	*Acipenser persicus*	Wherever found	E	[**Federal Register** citation when published as a final rule].
Sturgeon, Russian	*Acipenser gueldenstaedtii*	Wherever found	E	[**Federal Register** citation when published as a final rule].
* * *	* * *	*		
Sturgeon, ship	*Acipenser nudiventris*	Wherever found	E	[**Federal Register** citation when published as a final rule].
* * *	* * *	*		
Sturgeon, stellate	*Acipenser stellatus*	Wherever found	E	[**Federal Register** citation when published as a final rule].
* * *	* * *	*		

Martha Williams,

Director, U.S. Fish and Wildlife Service.

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