became clear that the population had stopped growing for unknown reasons and was likely declining. Factors that may be contributing to the lack of growth are a new and rapidly expanding live-fish fishery that sets traps near shore, pollutants (Jarman et al. 1996), and infectious diseases and parasites (Thomas & Cole 1996).

In 1998 over 100 otters moved southward into the no-otter zone. Fishermen protested vigorously. FWS legal counsel advised capturing and returning the errant otters back into the mainland otter zone. The recovery team strongly advised against this because it would have a detrimental effect on an already declining population by disrupting the existing social structure and increasing competition for food resources. Furthermore, it would not solve the fishermen's problem because many of the otters would return to the no-otter zone.

FUTURE AND PROGNOSIS

The prospects for recovery of the southern sea otter population are brighter than those for many endangered species. The population is capable of growing at 5% per year, and unoccupied habitat extends north and south of its current range. There are many advocates for its recovery, including the Friends of the Sea Otter, the MMC, the recovery team, and a large public constituency. Although conflicts with fisheries have existed for decades, they have not seriously hampered recovery.

The most pressing need is to identify and correct the factors responsible for the current lack of population growth. The recovery plan should be revised to reflect current circumstances. Furthermore, the FWS should declare the translocation a failure and thus eliminate the no-otter zone. All the stakeholders need to admit that zonal management by nonlethal means is impossible.

If the southern sea otter population resumes growth, it should reach the proposed ESA delisting criterion of 2,650 individuals within a relatively short time. The major societal issues regarding sea otters, such as conflicts with shellfisheries, will probably not be resolved under the ESA, but rather in the process of determining that the population is no longer depleted under MMPA.

Sturgeons and Paddlefishes (Acipenseriformes)

Vadim J. Birstein

This case deals with a group of threatened animals: 25 species of sturgeons and 2 species of paddlefishes (Pisces, *Class*: Actinopterygii, *Order*: Acipenseriformes). Their common English and scientific names, as well as their distribution and threatened status, are given in Table 2.

DESCRIPTION

Sturgeons and their close relatives, paddlefishes, are the most numerous group of ancient fishes named "living fossils" (Gardiner 1984). Sturgeons are usually large (on average, 1.5–2.0 m), spindle-shaped fishes with a developed snout. They have five longitudinal rows of large bony scales (scutes). Caudal fins (tails) have a well-developed upper lobe. Skeleton and skull are cartilaginous. The mouth faces downward. Paddlefishes do not have scutes and have long, paddle-shaped snouts.

NATURAL HISTORY

Many sturgeon species belonging to the genera *Acipenser* and *Huso* are anadromous fishes; that is, they live mainly in the sea and migrate into rivers for reproduction. Others are amphidromous fishes; that is, they live mostly in the rivers and migrate to semi–salt water estuaries. Species of *Scaphirhynchus, Pseudoscaphirhynchus,* and two paddlefishes are potamodromous; that is, they migrate within a river system to breed and forage.

All sturgeons and paddlefishes have long life cycles and mature late (at 7 to 18 years). Eggs are usually deposited on gravel. Embryonic development lasts several days. Larvae of anadromous species migrate downstream to the sea for feeding. Most sturgeon species feed on bottom organisms, but the beluga (*Huso huso*) is predatory. Sturgeons hybridize easily, and some hybrids, especially between beluga and sterlet (*A. ruthenus*), are fertile.

Sturgeons and paddlefishes live in the Northern Hemisphere only (Bemis et al. 1997). Currently all species are endangered (Birstein 1993). Several species are on the brink of extinction in the wild (Table 2). The phylogenetic or evolutionary relationships between different sturgeon species, based

Table 2. Sturgeons and Paddlefishes of the World: Their Current Distribution and IUCN Status (1996)

Species (Latin Name)	English Name	Distribution	IUCN Status	CITES†
Family: Acipenseridae	**Sturgeons**			
1. *Acipenser baerii*	Siberian Sturgeon	Siberia (Russia), Kazakhstan, China	Vulnerable	II
A. b. baerii	Siberian Sturgeon	Ob River system (Siberia)	Endangered	
A. b. baikalensis	Baikal Sturgeon	Lake Baikal (Siberia)	Endangered	
A. b. stenorrhynchus	Lena River Sturgeon (Siberia)	Yenisei, Lena, Indigirka, and Kolyma Rivers	Vulnerable	
2. *Acipenser brevirostrum*	Shortnose Sturgeon	Rivers, estuaries, and ocean along the eastern coast of North America from Indian River (Florida) to Saint John's River (New Brunswick)	Vulnerable	I
3. *Acipenser dabryanus*	Yangtze/Dabry Sturgeon	Yangtze River (China)	Critically Endangered	II
4. *Acipenser fulvescens*	Lake Sturgeon	Great Lakes, lakes of southern Canada, and river systems connected with them	Vulnerable	II
5. *Acipenser guldenstaedtii*	Russian Sturgeon	Caspian, Black, Azov Seas, and rivers entering into them	Endangered	II
		Caspian Sea stock	Endangered	
		Sea of Azov stock	Endangered	
		Black Sea stock	Endangered	

Species (Latin Name)	English Name	Distribution	IUCN Status	CITES†
6. *Acipenser medirostris*	Green Sturgeon	Pacific coast of North America from the Aleutian Islands and Gulf of Alaska to the Ensenanda (Mexico), Rogue (Oregon), Sacramento, and Klamath (Calif.) Rivers	Vulnerable	II
7. *Acipenser mikadoi*	Sakhalin Sturgeon	Pacific Ocean from the Amur River to northern Japan, Bering Sea, Tumnin (Datta) River	Endangered	II
8. *Acipenser naccarii*	Adriatic Sturgeon	Adriatic Sea; Po and Adige Rivers	Vulnerable	II
9. *Acipenser nudiventris*	Ship Sturgeon	Caspian, Black, and Aral Seas, and rivers entering into them	Endangered	II
		Black Sea stock	Endangered	
		Caspian Sea stock	Endangered	
		Aral Sea stock	Extinct	
		Danube River population	Critically Endangered	
10. *Acipenser oxyrinchus*	Atlantic Sturgeon	Eastern coast of North America	Lower Risk	II
A. o. desotoi	Gulf Sturgeon	Gulf of Mexico and northern coast of South America	Lower Risk	
A. o. oxyrinchus	Atlantic Sturgeon	Rivers, estuaries, and ocean along the east coast of North America from the St. John's River (Florida) to Hamilton Inlet (Labrador)	Lower Risk	

Table 2. (*continued*)

Species (Latin Name)	English Name	Distribution	IUCN Status	CITES[†]
11. *Acipenser persicus*	Persian Sturgeon	Black and Caspian Seas and rivers entering into them	Endangered	II
		Black Sea stock	Endangered	
		Caspian Sea stock	Vulnerable	
12. *Acipenser ruthenus*	Sterlet	Most of central and eastern European and western Siberian rivers	Vulnerable	II
		Caspian and Black Sea drainage stock (Volga, Danube)	Vulnerable	
		Ob, Irtysh, and Yenisei Rivers (Siberia, Russia)	Vulnerable	
13. *Acipenser schrenckii*	Amur River Sturgeon	Amur River system (Siberia, Russia, and China)	Endangered	II
14. *Acipenser sinensis*	Chinese Sturgeon	Yangtze River (China)	Endangered	II
15. *Acipenser stellatus*	Stellate Sturgeon or Sevruga	Caspian, Black, and Azov Seas, and rivers entering into them	Endangered	II
		Caspian Sea stock	Vulnerable	
		Sea of Azov stock	Endangered	
		Black Sea stock	Endangered	
16. *Acipenser sturio*	European Atlantic or Baltic Sturgeon	Baltic, Eastern North Atlantic, Mediterranean, and Black Seas, and rivers entering into them	Critically Endangered	I

Species (Latin Name)	English Name	Distribution	IUCN Status	CITES[†]
17. *Acipenser transmontanus*	White Sturgeon	Rivers and Pacific coast of North America from the Gulf of Alaska to Baja California	Lower Risk	II
		Kootenai River population (USA)	Endangered	
18. *Huso dauricus*	Kaluga Sturgeon	Amur River system (Siberia: Russia, and China)	Endangered	II
19. *Huso huso*	Giant or Beluga Sturgeon	Caspian, Black, and Azov Seas, and rivers entering into them	Endangered	II
		Caspian Sea stock	Endangered	
		Sea of Azov stock	Critically Endangered	
		Black Sea stock	Endangered	
		Adriatic Sea stock	Extinct	
20. *Pseudoscaphirhynchus fedtschenkoi*	Syr-Dar Shovelnose Sturgeon	Syr-Darya River (Kazakhstan, Central Asia)	Critically Endangered	II
21. *Pseudoscaphirhynchus hermanni*	Small Amu-Dar Shovelnose Sturgeon	Amu-Darya River (Uzbekistan and Turkmenistan, Central Asia)	Critically Endangered	II
22. *Pseudoscaphirhynchus kaufmanni*	Large Amu-Dar Shovelnose Sturgeon	Amu-Darya River (Uzbekistan and Turkmenistan, Central Asia)	Endangered	II
23. *Scaphirhynchus albus*	Pallid Sturgeon	Missouri and Mississippi River basins	Endangered	II

Table 2. (*continued*)

Species (Latin Name)	English Name	Distribution	IUCN Status	CITES†
24. *Scaphirhynchus platorynchus*	Shovelnose Sturgeon	Missouri and Mississippi River basins	Vulnerable	II
25. *Scaphirhynchus suttkusi*	Alabama Sturgeon	Mobile River basin (Alabama and Mississippi)	Critically Endangered	II
Family: Polyodontidae	**Paddlefishes**			
1. *Polyodon spathula*	American Paddlefish	Mississippi River system	Vulnerable	II
2. *Psephurus gladius*	Chinese Paddlefish	Yangtze River (China)	Critically Endangered	II

† The listing of all sturgeon and paddlefish species on the Convention on the International Trade of Endangered Species of Flora and Fauna (CITES) appendices was adopted at the CITES COP10 meeting in Harare, Zimbabwe in June 1997. It came into force on April 1, 1998. Species listed on Appendix I are threatened with extinction. Species on Appendix II may become threatened with extinction if trade is not regulated.

on DNA sequence data, were determined only recently (Birstein & DeSalle 1998).

CONFLICTING ISSUES

Historically, three main factors caused sturgeon and paddlefish depletion: dam and channel construction in rivers, overfishing, and pollution (Birstein 1993). Construction of dams cut sturgeons off from their spawning sites. Thus the beluga sturgeon has not been able to reproduce in the Volga River for 30 years. Pollution in rivers and seas has had a serious impact on sturgeons and their reproduction (Birstein, Bemis, & Waldman 1997; Khodorevskaya et al. 1997). During the last few years the level of pollution has decreased in the major rivers of sturgeon spawning, although for varying reasons. The Volga River has seen a drastic drop in industrial activity since the breakup of the former Soviet Union. Pollution in the Danube River and the Missouri-Mississippi river system has decreased owing to local environmental action.

The recent rising of the Caspian Sea water level resulted in an increase in oil pollution throughout the whole basin, but especially in the western part that is used by young sturgeons (Dumont 1995). Rising water covered oil pools and other wastes close to shore. In the past year the sea has stopped rising, so the pollution level may stabilize. However, development of oil production in the northern (Kazakh and especially Russian) part of the Caspian Sea is planned by 2001, and this could have a highly destructive impact on sturgeons because the feeding grounds of sturgeons during their first year are located in the area of oilfields. The drying of the Aral Sea in Central Asia has caused the disappearance of the ship sturgeon (*A. nudiventris*) from the region, the possible extinction of the endemic Syr-Dar shovelnose sturgeon (*Pseudoscaphirhynchus fedtschenkoi*), and a sharp depletion in the population size of two Amu-Dar shovelenose sturgeons, *P. hermanni* and *P. kaufmanni* (Zholdasova 1997).

Today, legal and illegal overfishing is the most devastating factor. Overfishing at the turn of the 20th century caused the almost complete disappearance of the European Atlantic sturgeon (*A. sturio*) from its entire historic range (Birstein, Betts, & DeSalle 1998). At the same time, overfishing on the U.S. Pacific coast resulted in a sharp decline in the commercial sturgeon catch and caviar production (Ryder 1888/1890). Caviar export from the United States to Europe stopped and has not recovered since then. At present the international caviar market stimulates poaching in the Black, Azov, and Caspian Seas and in the Amur River (Birstein 1997). The decrease in natural stocks of the beluga, the Russian sturgeon (*A. gueldenstaedtii*), and the stellate sturgeon (*A. stellatus*) has already led to the use of eggs of other sturgeon species as replacements for expensive types of caviar (DeSalle & Birstein 1996; Birstein, Doukakis, et al. 1998).

Overfishing is aggravated by two factors. First, the number of countries catching sturgeons in the Caspian, Black, and Azov Seas rose after the breakup of the former Soviet Union. Second, endemic corruption in the former Soviet Union has led to the involvement of governmental agencies and officials in the illegal sturgeon catch and caviar trade (Anonymous 1997c). Beginning in 1990, the number of sturgeons killed for caviar increased dramatically, and markets for sturgeon products have expanded into new areas (De Meulenaer & Raymakers 1996; Taylor 1997). However, according to experts, the quality of caviar has dropped partly because it is produced from the roe of immature fish.

The current sturgeon crisis has become a challenge for the international conservation community, including the IUCN (World Conservation Union) and TRAFFIC International. In 1994 the International Conference on Sturgeon Biodiversity and Conservation (New York) attracted the attention of conservationists to the crisis. In 1996, at the 13th meeting of the CITES Animals Committee (Pruhonice, Czech Republic), the sturgeon crisis was discussed, as was the possibility of using a molecular method of caviar species identification developed at the American Museum of Natural History (New York) as a possible tool for the CITES implementation (DeSalle and Birstein 1996). At the 10th meeting of the Conference of the Parties in June 1997 (Harare, Zimbabwe), a proposal for inclusion of sturgeons in CITES Appendix II (controlled trade) was presented by Germany and the United States. However, the scientific community was not given an opportunity to review the final version of the proposal, and it was adopted with mistakes (Mrosovsky 1997). The CITES sturgeon listing came into force on 1 April 1998.

Most parties to the CITES convention were not prepared to implement the sturgeon listing, and coordination between countries on implementation efforts is not presently achievable. The U.S. Fish and Wildlife Service announced that it had its own method of caviar species identification in November 1997 (Anonymous 1997a), although this method was developed without tissue samples from the three commercial sturgeon species and/or the necessary DNA sequence data (which were not publicly available at the time of the announcement). Additionally, the method has not been published or scientifically peer reviewed. Other countries, such as Germany and France, have decided to develop their own methods of identification. The opportunity to use an available, precise (only a single caviar egg is required), and inexpensive method (DeSalle & Birstein 1996; Birstein, Doukakis, et al. 1998) as a standard international tool for the CITES implementation has been lost.

Another problem for implementation is the lack of scientifically based data on the population size of sturgeons in the Caspian and Black Seas. The CITES Secretariat needs these data for international, independent regulation of the catch and caviar trade quotas. In the former Soviet Union all sturgeon issues, from estimation of stocks and catch quotas to caviar production, were "top secret" and controlled by the Ministry of Fisheries. In a decree issued in September 1997, President Yeltsin ordered that responsibility for overseeing sturgeon catch be moved from the successor of this ministry, the Department of Fisheries, to the Border Guard Troops (Anonymous 1997b). At that time he characterized the Department of Fisheries as one of the most corrupt structures in Russia. The previous history of secrecy surrounding sturgeons resulted in the use of the outdated, inaccurate population size estimation methods, which have never been peer reviewed by international experts. Therefore there are no reliable data on sturgeon populations for the CITES Secretariat. Despite this history, the World Bank plans to put Russia in charge of controlling fisheries and legal regulations for the whole Caspian Sea basin (Wilczynski 1998).

Continuation of restocking programs in the Caspian, Azov, and Black Seas is one more controversial issue. In the early 1960s the Soviet Union began a massive program to release sturgeon juveniles from 28 specially built hatcheries (Khodorevskaya et al. 1997). These juveniles were obtained from sturgeon spawners caught in the wild and artificially bred at the hatcheries. In the 1980s approximately 100 million hatchery-raised juveniles were released annually into the Caspian Sea. Since 1990 the number of released juveniles has dropped by 50% because of economic problems in Russia. Only half of the hatcheries are operational now, and all the hatcheries desperately need modernization.

The efficiency of the Soviet sturgeon restocking program has never been evaluated by means of modern experimental methods. The only evidence that it worked at all is the presence of beluga sturgeon in the Caspian Sea despite the end of natural reproduction in the Volga River 30 years ago. However, the size of beluga sturgeon from stocked generations is considerably smaller than that of naturally reproduced individuals (Khodorevskaya & Novikova 1995). It is not known which factor caused this reduction. American conservationists are very cautious about sturgeon restocking because of genetic concerns (Waldman & Wirgin 1998).

Despite the questions it raises, restocking may be the only opportunity to maintain and/or restore the main wild populations of Eurasian and American sturgeons and paddlefishes. For the Caspian, Azov, and Black Seas, and the Amur and Yangtze Rivers (China), restocking would only be possible through international projects and funding. A genetic study of sturgeons from these basins has begun recently (Birstein, Hanner, & DeSalle 1997; Birstein & DeSalle 1998; Birstein, Doukakis et al. 1998). Of all countries in these areas, only China and Romania are working together with American and European experts to estimate sturgeon stocks and find spawning sites by using modern technology.

Despite the urgent need for international professional geneticists and sturgeon biology experts to work together in the Caspian and Black Seas, the

IUCN continues to fund conferences and project plans full of generalities. Examples of that can be taken from the list of Pilot Projects suggested by the IUCN Task Force on the Caspian Sea Problems at its meeting in February 1998, a meeting that no professional sturgeon biologist attended.

FUTURE AND PROGNOSIS

There is little hope that CITES listing will improve the sturgeon crisis soon, because no country is ready to implement the listing. Illegal overfishing, at least in the Caspian Sea, Siberian rivers, and the Amur River, will probably continue until sturgeons are eliminated from these basins. The lack of sturgeons for caviar production in Eurasia might stimulate sturgeon poaching in the United States.

Ironically, it seems that business interests, not international conservation effort, are providing the only ray of hope for sturgeon survival. Sturgeon aquaculture is a rapidly growing industry in Europe, the United States, and Latin America. Caviar from aquacultured white sturgeon (*A. transmontanus*) is produced in California and Italy. In 1997 the French company Gie l'Esturgeon d'Aquitaine produced 1 ton of the aquacultured Siberian sturgeon (*A. baerii*) caviar, and it plans to increase caviar production to 10 to 15 tons (Sabeau 1997). The availability of, and lower prices for, aquacultured caviar may turn caviar consumers from the wild sturgeon caviar to aquacultured caviar. Perhaps this will lead to a decrease in the level of sturgeon overfishing in Eurasia. However, by the time the aquacultured caviar can be produced in sufficient quantities to take a significant part of the caviar market share, it may be too late for wild sturgeon populations.

Yuma Clapper Rail

Courtney J. Conway and William R. Eddleman

Common Name: Yuma clapper rail
Scientific Name: *Rallus longirostris yumanensis*
Order: Gruiformes
Family: Rallidae
Status: Endangered under the Endangered Species Act of the United States; Endangered in Mexico; Endangered in Arizona and California.
Threats: Habitat loss owing to water diversion and channelization for urban and agricultural uses and conversion of wetlands to crop land and urban development. Habitat quality is reduced when flood control by dams and fire suppression allows vegetative succession to different community types, contaminant accumulation from agricultural run-off, and invasion of marshlands by exotic salt cedar (*Tamarisk chinensis*).
Habitat: Emergent freshwater and brackish-water riverine wetlands exposed to periodic flooding (Todd 1986). Most commonly found in shallow, early and mid-successional cattail (*Typha* spp.) and bulrush (*Scirpus* spp.) marshes with high interspersion of both dense vegetation and open water/mudflat habitats (Conway 1990).
Distribution: Southwestern United States and northwestern Mexico. Historically, rails were found in extensive marshlands of the Colorado River delta and in backwater marshes and old oxbows of the lower Colorado and Gila Rivers. Currently, they reside in isolated Colorado River marshes from Needles, California, southward to the delta in Mexico, along the lower Gila River in Arizona, and in marshes associated with the Salton Sea in California (Todd 1986).

DESCRIPTION

The Yuma clapper rail is the size of a crow, with long, gray-brown legs and toes. The orange bill is long, thin, and slightly down-curved. The head, neck, and breast are gray-brown, and the back feathers are darker brown with black centers. Both the flanks and undertail covert feathers are distinctly marked with alternate black and white bars. Males and females are similar in plumage coloration. Adult mass varies seasonally, but males average 269 g and females 210 g. The body is laterally compressed, allowing rails to run quickly through dense emergent vegetation. The tail and wings are noticeably short and the legs are large and strong, evolutionary adaptations that allow birds to run through dense reeds or swim underwater to avoid danger.

ENDANGERED ANIMALS

A Reference Guide to Conflicting Issues

Edited by
Richard P. Reading and Brian Miller

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