and municipal and industrial use have significantly changed most large rivers in North America. Few rivers today provide the proper combinations of flow, temperature and gravel substrates suitable for paddlefish spawning. In many states, paddlefish populations have been greatly reduced or even eliminated because of lost spawning habitat.

**WHY NOT JUST STOCK MORE PADDLEFISH?**

Stocking efforts to bolster or reestablish populations have yielded mixed results in North Dakota. In 1995 and 1997 paddlefish were stocked in the Williston area. Even though some of the fish stocked in 1995 have been recovered, naturally recruited fish make up the vast majority of this year-class. No fish stocked in 1997 have been recovered. This stocking appears to have been unsuccessful. The most recent stocking of paddlefish occurred in 2007, in an attempt to bolster juvenile paddlefish numbers after several years of low flows and lake levels resulted in poor natural recruitment. Although success of this stocking is yet to be determined, habitat conditions at the time of stocking weren’t favorable for good survival. The best management approach for long-term sustainability of paddlefish in North Dakota is to maintain quality habitat that allows for sufficient natural reproduction and recruitment.

**IS THE YELLOWSTONE-SAKAKAWEA PADDLEFISH POPULATION INCREASING OR DECREASING?**

The paddlefish population in the Yellowstone and Missouri rivers prior to construction of Garrison Dam was thought to have been much smaller than the booming population which developed during the years when Lake Sakakawea first filled. Initial flooding of productive uplands released many nutrients into the newly-formed reservoir, resulting in excellent rearing conditions for paddlefish. In the years since the late 1960s after the reservoir filled, however, the population has gradually declined as a result of lower productivity (a natural process in reservoirs), and harvest and natural mortality of fish produced during the filling period.

Population estimates indicate that the adult population has declined from more than 100,000 fish in the late 1970s to about 50,000 in recent years. Studies have shown that although paddlefish reproduction is occurring, the overall recruitment of young fish hasn’t been high enough to counteract adult fish. Fortunately, the 1995 year-class has reversed the downward population trend. This robust year-class was produced under ideal conditions of high Yellowstone River flows and rising water levels in Lake Sakakawea. From 1999 through 2007, drought and water depletions greatly reduced Yellowstone River flows, which in turn negatively affected paddlefish spawning and reproduction. The lower than normal inflows, coupled with excessive rates of water discharge by the U.S. Army Corps of Engineers, consequently lowered Lake Sakakawea to a water level far lower than desired for good paddlefish recruitment and growth. Although greatly improved water flows and lake levels since 2008 have provided excellent conditions for successful reproduction and recruitment, this has not yet been documented to have occurred.

**WHAT IS THE GREATEST THREAT TO PADDLEFISH?**

The greatest threat is the loss of habitat. Successful spawning and recruitment appear to be the primary limiting factors. Paddlefish need natural, free-flowing rivers to reproduce effectively. Without spawning habitat, there’s really little that can be done to maintain viable populations over the long-term. Water withdrawals from the Missouri and Yellowstone rivers are reducing available habitat. Protecting and enhancing habitat and flows in these rivers are critically important for the long term survival of the stock.

Snag fisheries are regulated to ensure that the Yellowstone-Sakakawea stock is not overharvested. Illegal fishing is a major threat, however, and has been documented in several other states. Any illegal harvest activities are detrimental and should be reported.

**WHY IS THERE A 1,000 FISH PER STATE HARVEST CAP?**

The harvest cap is intended to keep the adult population from dropping below its current level. Age information is used to estimate how many newly-recruited adult fish are entering the population compared to the number of fish being harvested or lost to natural mortality. A harvest cap of 2,000 fish, equally split between Montana and North Dakota, is approximate based upon current rates of recruitment. Changes in the allowable harvest will be made, as necessary, to prevent the population from declining.

**HOW DO RESEARCH AND MONITORING LEAD TO BETTER PADDLEFISH MANAGEMENT?**

Unique and important fisheries resources such as paddlefish need to be managed carefully and conservatively. Intensive research and monitoring are necessary to properly manage this resource. Because the Yellowstone-Sakakawea stock is a shared resource between North Dakota and Montana, fisheries staff from both states and scientists from the University of Idaho work together to research and manage this stock.

This brochure was produced to answer some commonly asked questions about paddlefish. The information was prepared by Dennis L. Scarnecchia, Professor of Fisheries at the University of Idaho and Fred Ryckman, northwest district fisheries supervisor for the North Dakota Game and Fish Department. These two individuals jointly conduct research and monitoring activities on paddlefish in the Missouri and Yellowstone rivers and in Lake Sakakawea within North Dakota.

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WHAT IS A PADDLEFISH, AND WHERE ARE THEY FOUND?

Paddlefish represent an ancient lineage of fish most closely related to sturgeons. There are only two species of paddlefish in the world; an extremely endangered (possibly extinct) species found only in portions of the Yangtze River drainage in China, and a species native to North America found in 22 states throughout the Missouri and Mississippi river basins. The North American species has also recently been introduced into several rivers in Europe and Asia. Fossils of extinct paddlefish species from 60 million years ago have been found in the Missouri River basin near Fort Peck Reservoir. The North American species has a mostly cartilaginous anatomy, an elongated, flat, paddle-shaped rostrum, smooth skin, small eyes, and a large, toothless (except when very young) mouth. Their overall coloration ranges from light bluish gray to blackish, with a whitish belly.

Within North Dakota, paddlefish are found in the Yellowstone River and throughout the Missouri River mainstream. The population that resides within Lake Sakakawea and upstream in the Missouri and Yellowstone rivers (known as the Yellowstone-Sakakawea stock) is the only stock in North Dakota which currently supports a snag fishery. There is another smaller stock in North Dakota which inhabits Lake Oahe and the Missouri River below Garrison Dam.

WHAT DO PADDLEFISH EAT, AND HOW DO THEY DO IT?

Paddlefish feed mostly on tiny animals called zooplankton. Very young paddlefish, with help from their small teeth, selectively feed on individual zooplankton. After their first year, paddlefish use filament-like gill rakers to filter zooplankton from the water. Paddlefish also eat aquatic insects and, occasionally, small fish. Because paddlefish won't bite large bait, anglers hoping to harvest a paddlefish must participate in snagging.

WHAT IS THE LIFE CYCLE OF PADDLEFISH IN THE YELLOWSTONE-SAKAKAWEA STOCK?

Mature paddlefish migrate upstream out of Lake Sakakawea into the Yellowstone and Missouri rivers to spawn. Most fish make this migration in early spring, but some start the previous fall. They spawn during high runoff in late spring or early summer. Most fish deposit their eggs and start on flooded gravel bars in the lower Yellowstone River, but some fish migrate up the Missouri River and even on into the Milk River in Montana. Soon after spawning, adults typically move back downstream into Lake Sakakawea.

The eggs are fertilized by milt as they are released from the females. When exposed to water, the eggs become very sticky and adhere to gravel and cobble substrate. Incubation time varies depending upon water temperature; eggs hatch in about 7 days in 60 degrees Fahrenheit water. After hatching, young (larval) fish drift downstream with the current, eventually reaching the headwaters of Lake Sakakawea where they spend their first few months. Because of greater zooplankton abundance, older juvenile and adult fish also utilize the upper portions of Lake Sakakawea. With the exception of spawning migrations, paddlefish remain within Lake Sakakawea. Paddlefish typically mature at about age 9 or 10 for males, age 16 to 18 for females. Tagging studies have shown that males spawn more frequently than females. Males spawn every year or every other year, while females typically spawn every second or third year.

WHAT DO WE KNOW ABOUT YOUNG PADDLEFISH IN LAKE SAKAKAWEA?

Larval paddlefish grow rapidly. By late July they’re typically 5-6 inches long, and 10-12 inches by late September. From mid-July through September, they’re found in the headwaters of Lake Sakakawea. Young paddlefish swim in loose groups, selectively feeding mainly on zooplankton, and especially on a large zooplankton called Leptodora. The rapid first-year growth is an important survival tactic, since they’re comparatively weak swimmers and vulnerable to predaceous fish and birds. Studies have shown that young paddlefish grow faster in Lake Sakakawea’s warmer water. Elevations are high and rising, since zooplankton is more abundant under these conditions.

HOW CAN YOU TELL HOW OLD A PADDLEFISH IS, AND HOW LONG DO THEY LIVE?

The best way to determine age is to use the lower jaw bone called a dentary. Dentaries are removed from the majority of harvested fish during annual snagging seasons, then cleaned and cross-sectioned. Annual rings are counted on the cross sections (much like aging a tree using tree rings).

Paddlefish can live to age 60 or older, with females typically living longer than males. Most of the larger fish (more than 50 pounds) are females ranging in age from 15-40 years and averaging about 27 years, while most of the smaller fish (less than 40 pounds) are males from 9-40 years and averaging about 20 years. The presence of a wide range of ages is thought important to the overall health of the population.

HOW BIG DO PADDLEFISH GET, AND WHY ARE FEMALES TYPICALLY LARGER THAN MALES?

The largest paddlefish on record was speared in Lake Okoboji, Iowa in 1916. It was 85 inches and weighed an estimated 198 pounds. More recent official state records are a 144-pound fish snagged in 2004 in Kansas and a 142.5-pound fish snagged in 1973 in Montana. The current North Dakota record is a 130-pound fish snagged in 2010. Fish living in lakes and reservoirs often grow faster and larger than those living solely in rivers, because reservoirs usually contain more zooplankton.

Male and female paddlefish have evolved different strategies for passing genes on to the next generation. For a female, the larger she grows the more eggs she can develop and the more young paddlefish she can potentially produce. For a male a larger size is not nearly as advantageous, because even a small male produces millions of sperm, more than enough to fertilize all the eggs from the largest female. Males mature at a younger age than females so that they may reproduce more often.

WHAT IS THE PURPOSE OF THE ROSTRUM?

The rostrum serves as a framework to support an electro-sensory system that functions as an antenna to detect weak electrical fields. The rostrum, as well as the head and gill flaps, is covered with tiny sensory pores that detect the weak electrical field generated by food.

Very young fish do not even have a rostrum. But by the time a fish reaches 8 inches, the rostrum may be nearly half its total length. As fish get older and larger, the rostrum becomes comparatively shorter in terms of its proportion to the total length of the fish. Adult paddlefish can function and survive without a rostrum, but it appears that those fish that have lost all or part of their rostrum feed less efficiently and are thinner than those with intact rostrums.

WHY ARE PADDLEFISH RELATIVELY COMMON IN THE WILLISTON AREA WHEN THEY'RE SO RARE OR NO LONGER PRESENT IN OTHER AREAS WITHIN THEIR RANGE?

The short answer is habitat. The overall habitat quality for paddlefish is generally much better for all life stages in Lake Sakakawea and in the Yellowstone and Missouri rivers. Paddlefish are finicky spawners, requiring a combination of high flows, right water temperature, and a good substrate of clean gravel and cobble. The Yellowstone River is still a free-flowing, naturally fluctuating river that provides adequate spawning habitat for them in most years. When Lake Sakakawea has a high water level, paddlefish generally find abundant food for growth and maturation. During extended periods of low lake levels, however, plankton is far less abundant and survival of young paddlefish is greatly reduced.

In other parts of its range, habitat quality is generally much poorer. Dam construction, dredging, channelization, and/or excessive water withdrawals for irrigation...