Solving
of Fort

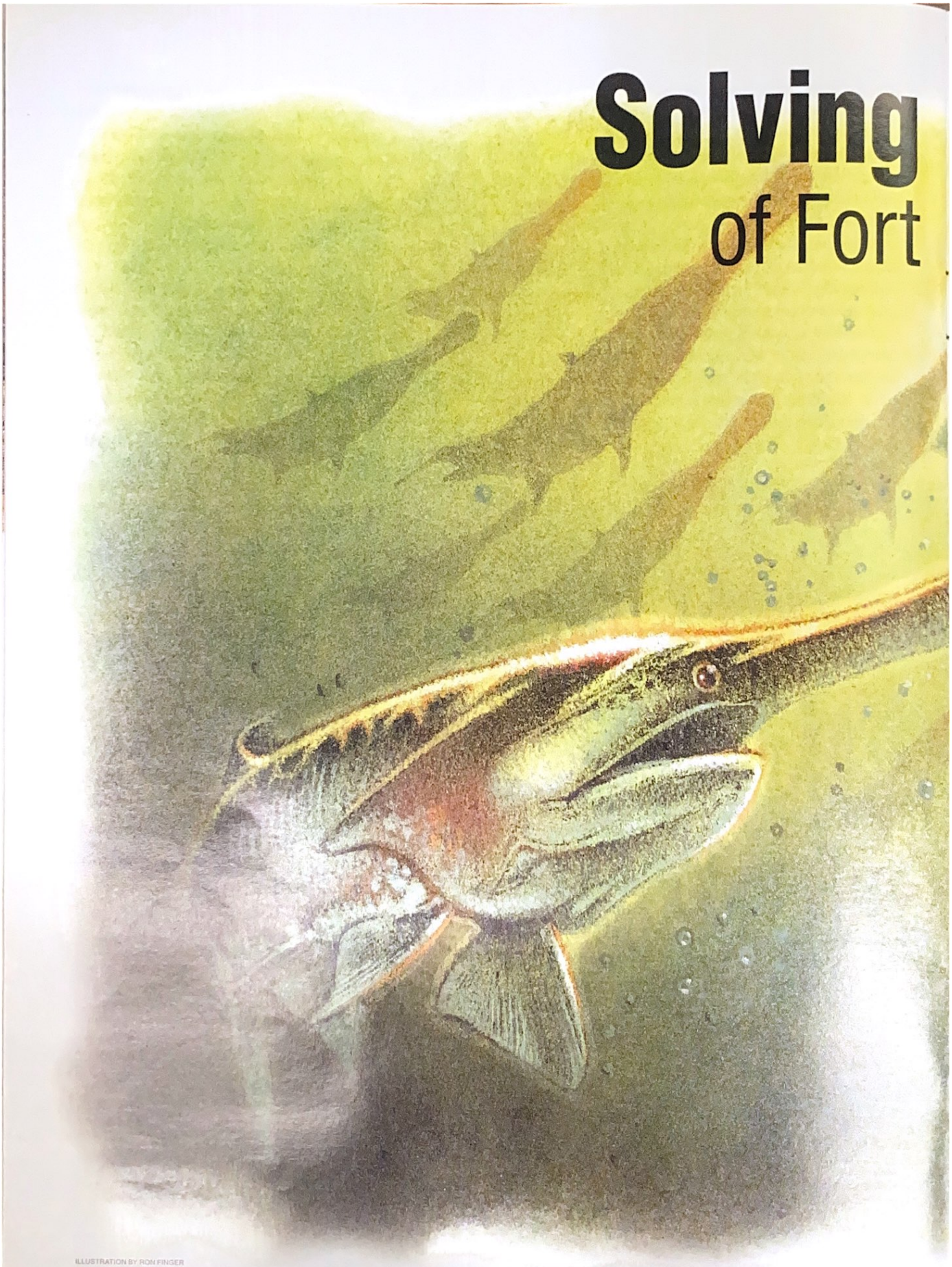


ILLUSTRATION BY RON FINGER

the puzzle
Peck's young paddlefish

By Joe Kozfkay, Dennis Scarnecchia, Kent Gilge, and Bill Wiedenheft

Because young paddlefish are so elusive, biologists couldn't monitor these fish—until now

When anglers discuss big fish, the talk usually turns to trout, walleye, and northern pike. It really should turn to paddlefish. Although Montana's record brown trout weighed 29 pounds, walleye 16.63 pounds, and northern 37.5 pounds, the biggest paddlefish weighed more than three times the largest of those fish. And paddlefish are more than just big. Paddlefish fossils dating back 60 million years or more have been found near present-day Fort Peck Reservoir, making this prehistoric remnant one of Montana's oldest fish species.

Today, the paddlefish is found in the mainstem Missouri River (above and below Fort Peck Dam), the lower Milk River, and the lower Yellowstone River from Forsyth to the eastern border. The completion of Fort Peck Dam in the 1930s resulted in the separation of Montana's paddlefish into two stocks: one from below Fort Peck Dam eastward (downriver) into the Missouri and Yellowstone rivers, and the other from Fort Peck Dam westward (upriver) into the upper Missouri River.

Historically the latter stock, known as the Fort Peck stock, has had the largest fish. The Montana record, caught

in 1973, weighed 142.5 pounds.

Because paddlefish eat only microscopic zooplankton—which they filter from water with comb-like rakers near their gills—these fish are almost never caught by hook and line. Rather, anglers at popular fishing sites such as the Fred Robinson Bridge (U.S. Highway 191) use weighted treble hooks and stout line to snag the fish and haul them in. A typical year's total harvest from the Fort Peck stock is several hundred fish. These large, sexually mature (adult) fish are caught while migrating upstream into the Missouri River to spawn from their feeding grounds in the reservoir.

To ensure that anglers don't overfish the paddlefish population, Montana Fish, Wildlife & Parks (FWP) biologists monitor paddlefish to see how the population is faring from year to year. Biologists attach small tags to migrating adult fish and then monitor the harvest rates of tagged fish, which anglers are urged to report. In addition, creel clerks ask anglers about the length and weight of fish caught, which provides information on the size structure of the paddlefish population. Biologists also estimate the age of harvested fish by collecting lower jaw bones (known as dentaries) and counting annual rings on cross sections of those bones (similar to how harvested trees are aged).

Although anglers naturally focus on the large adult fish, fishery managers must also pay attention to the fish anglers seldom see: small, young, immature paddlefish feeding in Fort Peck Reservoir. Only by monitoring young paddlefish numbers each year can managers know if adult paddlefish are successfully reproducing. For example, if spawning success or survival of several generations of young paddlefish (called year classes) declines, adult fish monitoring would not detect the problem until many years later, when those fish had reached spawning size and were susceptible to snagging. But by then it might be too late to reduce harvest or to learn why those year classes had done poorly.

Only mature paddlefish migrate to spawning areas and get harvested, so traditional monitoring techniques supply information only on the status of the adults. Because the young paddlefish are too elusive to find and count, biologists at Fort Peck have been unable to solve the mystery of their population status. Until now.

Foiled by their rostrum

For more than a century, scientists nationwide have tried to learn about wild young-of-the-year paddlefish (those that were hatched earlier in a year). Most efforts end in failure. A breakthrough came in the early 1990s in Lake Sakakawea, the Missouri River mainstem reservoir in North Dakota, downstream from Fort Peck. Biologists and anglers there noticed that when young (but at least five-inch-long) paddlefish feeding near the surface were approached by a slow-moving motorboat, the fish stayed at the surface.

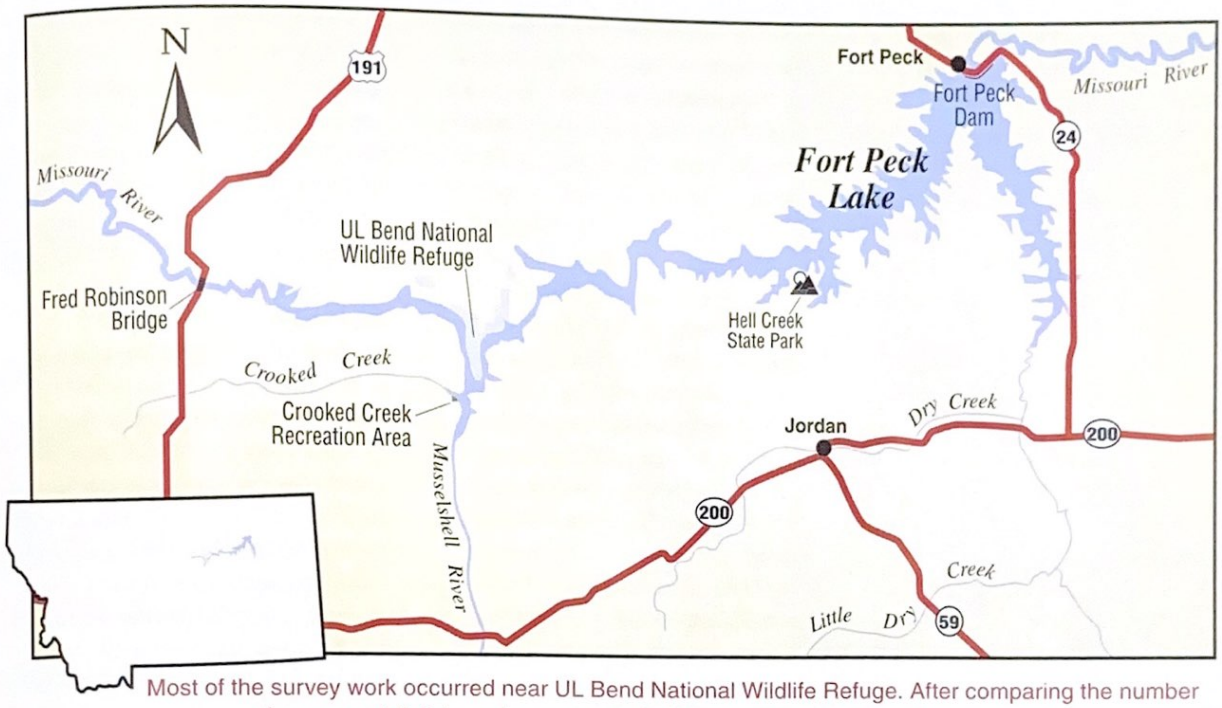
Most fish species can flee danger from above by diving quickly, but a paddlefish is different. At the front of its head is a long, paddle-shaped structure called a rostrum. An adult fish uses its rostrum to sense zooplankton, which it then consumes by swimming open-mouthed through schools of the tiny organisms. What the paddle also does, when the fish swims quickly, is to act like an airplane wing and force the paddlefish up instead of down. Biologists found that when young paddlefish rushed to escape an approaching boat, their anatomy propelled them to the surface where they could be counted or captured with long-handled dip nets.

Suddenly, fisheries biologists at Lake Sakakawea had a tool for assessing reproductive success, growth rates, and year-class strength of paddlefish. The big question for Fort Peck paddlefish biologists, however, was whether the method would work in their reservoir.

First attempts were promising. In 1995, biologists from FWP and the University of Idaho used the boat-chase

PHOTOS BY FRED RYCKMAN

When a young paddlefish (above) tries to flee an approaching boat, its paddle (rostrum) acts as a wing and forces the fish to the surface, where it can be netted by biologists (right).



Most of the survey work occurred near UL Bend National Wildlife Refuge. After comparing the number of young paddlefish each summer to the Missouri River's spring flow, scientists now suspect that more paddlefish are produced in years when the river runs high and turbid.

method to count more than 40 young paddlefish and capture nine fish in the area west of the UL Bend National Wildlife Refuge. Then, two years later, biologists counted more than 250 young-of-the-year paddlefish in one afternoon in the same area.

Why were so many more fish located in 1997? Biologists suspect that it indicated more young fish that year, due to spring river conditions that had allowed successful paddlefish spawning. In other words, the 1997 year class appeared to be stronger than the 1995 year class. However, biologists didn't have enough information to be sure of this hypothesis, so they decided to intensify their search for young paddlefish during the next two years.

In 1998, the search for young-of-the-year and yearling fish (those hatched the previous year, which have grown up to 16 inches long) began in mid-July along transects (standardized straight line routes) across the upper reservoir. After two weeks of extensive searching, the fisheries biologists finally located five- to seven-inch young-of-the-year paddlefish near Beauchamp Creek, 12 miles upstream of the Crooked Creek Recreation Area. By August, counts increased slightly as young-of-the-year fish moved down-reservoir (east) to near Crooked Creek, where waters were clearer and zooplankton were more abundant. By the end of September, counts had decreased as the fish dispersed to unknown wintering areas. When they finished the year's search, biologists had counted just 97 young-of-the-year fish along the transects, considerably fewer than in the previous year.

The flow factor

Biologists can't explain conclusively the reasons for yearly differences in young paddlefish numbers at Fort Peck, but they suspect that flow conditions are an important factor. In an average year in the area of the Missouri where the Fort Peck population spawns, high flows of over 14,000 cubic feet per second (cfs) are exceeded for 47 days, from May 18 to July 3. In 1997, the year observers saw many young paddlers, the Missouri River exceeded these flows and was exceptionally turbid for 65 days, from May 2 to July 5, much longer and higher than average. During 1998, however, when far fewer young paddlefish were spotted, flows of 14,000 cfs were exceeded for just 31 days, from June 18 to July 19. That year, the high flows came approximately one month later and lasted two weeks less than in an average year.

The pattern held in 1999. That spring, the 14,000 cfs discharge was first exceeded on June 3 and remained above this level for only 13 days, until June 15. Biologists expected to find few young paddlefish after that. Beginning in mid-July, they sampled the same transects as in 1998, and young-of-the-year fish were nowhere to be found. In all, they counted only three young-of-the-year paddlefish during July, August, and September of 1999.

Based on the results of preliminary studies in Fort Peck, and more extensive studies in Lake Sakakawea, it appears that greater reproductive suc-

---

Joe Kozfkay is a graduate research assistant and Dennis Scarnecchia is a professor of fisheries at the University of Idaho, Moscow. Kent Gilge is an FWP fisheries biologist and Bill Wiedenheft is FWP's regional fisheries manager at Glasgow.

cess of paddlefish is directly linked to higher river discharge in spring. When the river ran high and turbid, more young paddlefish were produced; when the river ran low and clear, few young paddlefish were produced.

FWP is continuing this research until scientists can better understand the relationship between spring spawning conditions and paddlefish reproduction success and year-class strength. Most important is learning if a critical amount of flow in spring is necessary to provide successful reproduction, and whether reservoir levels also influence early survival of paddlefish. Biologists are now hoping for several years of high spring flows and high reservoir levels to compare to recent years of low flows and low reservoir levels.

Paddlefish food

In addition to reproductive success, biologists also aim to learn more about the diet of young paddlefish. The food that fish eat affects their growth rate, survival, and year-class strength. In contrast to larger paddlefish, which feed by swimming with their mouth wide open and filtering zooplankton and other small invertebrates from the water, young-of-the-year paddlefish actively search out and pick individual prey from the water. Although the diet of adult paddlefish is well known, the diet of wild young-of-the-year paddlefish has remained largely a mystery, because the fish have been so infrequently captured for examination.

Once again, the "scare-'em-to-the-surface" monitoring technique paid off. After netting young-of-the-year and yearling paddlefish, biologists examined the stomach contents of the fish. They found that fish from turbid, more river-like habitats contained mostly chironomid larvae (blood worms) and immature mayflies. Stomachs of paddlefish that had moved into clearer, more lake-like habitats (which supported higher densities of zooplankton) contained mostly one species of zooplankton, *Leptodora kindtii*.

A relatively large, slow-moving zooplankton, *Leptodora* exists in low densities because it is a preferred food of many fish species. In the lake-like reaches of Fort Peck, this zooplankton species comprises less than 1 percent of the zooplankton organisms in the water. Yet stomachs from most young paddlefish sampled from these waters contained more than half, and sometimes only, *Leptodora*.

Not only did the young paddlefish of Fort Peck Lake select the largest zooplankton species available, they selected the largest individuals of *Leptodora*. The lengths of individual *Leptodora* in the stomachs of young paddlefish were nearly double those of the average *Leptodora* available in the water. Clearly the young paddlefish have a favorite food, and the larger the better.

Obtaining enough of this favorite food for rapid growth may be critical to the survival of these young fish. The faster young paddlefish grow, the sooner they reach sizes too large to be eaten by fish or birds. Estimated growth rates of young paddlefish roughly six inches long approached 0.4 inches in 10 days, a rapid rate compared to that of other young fish species. If small paddlefish can't get enough *Leptodora*, they may remain vulnerable to predators for a longer period of time. So there may be a connection between the abundance of *Leptodora* in a given year and the strength of that year's generation of paddlefish, or year class.

Because of the importance of *Leptodora* as food for young-of-the-year paddlefish, scientists continue to study this zooplankton in the upper reservoir.

Biologists made other discoveries as

Although their understanding of the paddlefish in Fort Peck is far from complete, biologists now know that reproductive success varies greatly among years, and that the difference could be a result of the species' specific requirements for spawning.

they picked through the stomach contents of small paddlefish. As they had with young-of-the-year paddlers, biologists found that yearling paddlefish also had selected individual aquatic insect larvae or *Leptodora* from the water. The yearlings, which were usually over nine inches long, had not yet begun filtering zooplankton with their gill rakers. The only filtering fish was a single two-year-old caught during the study. Biologists knew this because it was the only fish to have large numbers of common smaller zooplankton in its stomach and to contain different zooplankton species more in proportion to the natural abundance of the invertebrates in the reservoir.

Although their understanding of the paddlefish in Fort Peck is far from complete, biologists now know that reproductive success varies greatly among years, and that the difference could be a result of the species' specific requirements for spawning. They also know that the paddlefish is a picky eater during the critical first year of its life. Such information aids in biologists' ability to conserve this native species, which is not only a valuable recreational fish but also an important part of Montana's natural heritage. ■

JIM LIEBELT

KONRAD SCHMIDT

Scientists can gather information on adult paddlefish (above) because the large fish can be caught by [illegible]. However, until recently, scientists could only study young paddlefish [illegible] in aquariums. The eight-week-old paddlefish pictured here has a blunted rostrum from repeatedly bumping it into the glass side of the aquarium.