How Much Does the Project Cost?

"...improvements to this fishery could increase its value by millions of dollars, which represents an excellent return on investment considering the cost of the project."

The Corps of Engineers pays approximately $200,000 per year for application of the fertilizer, lab analysis of water and plankton, and fees for a specialist who determines how much fertilizer to add to the reservoir each week. The majority of these funds come from the Bonneville Power Administration (BPA) and a small percentage from congressional appropriations.

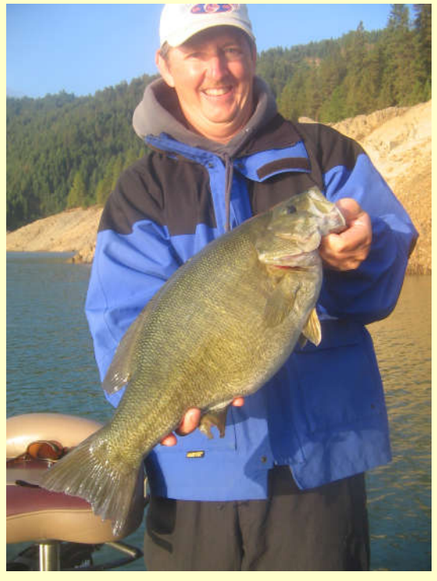
In addition, IDFG spends approximately $70,000 per year monitoring water quality, collecting plankton samples, and conducting kokanee surveys. These funds come from BPA to mitigate for the impacts that Dworshak Dam has had on the fishery. The IDFG will also continue to monitor and assess other fish populations in the reservoir, such as Smallmouth Bass and Bull Trout, as part of our regional management activities.

Clearly, this is not an inexpensive project and you might be wondering whether it is worth the cost. The IDFG conducted an economic survey in 2003 that estimated anglers spent $6 million fishing Dworshak that year. Another survey was conducted in 2011 and anglers spent an estimated $4 million fishing Dworshak that year. We believe the drop in spending was because the kokanee in Dworshak were both smaller and fewer in 2011, due to high losses of fish through the dam and poor reservoir productivity. This suggests that improvements to this fishery could increase its value by millions of dollars, which represents an excellent return on investment considering the cost of the project.

Acknowledgments:

We appreciate the partnerships and support from the many individuals, organizations, and agencies that help us to achieve our mission, including:

U.S. Army Corps of Engineers
Bonneville Power Administration (funding)
Advanced Eco-Solutions
Am-Test Laboratories
Countless IDFG staff and volunteers
Countless Corps staff
Dr. John Stockner
Dr. Frank Wilhelm
U.S. Environmental Protection Agency
Idaho Dept. of Environmental Quality
IDFG Clearwater Fish Hatchery
USFWS Dworshak National Fish Hatchery
Idaho Fish Health Lab



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Daphnia zooplankton

Dworshak Reservoir Fisheries Newsletter

This newsletter provides updated information about ongoing research and management of Dworshak Reservoir fisheries resources. If you have read past newsletters, you will find some of the same articles in this one. However, this issue contains some new articles and updated information for past articles. We encourage you to review the information provided, as it will help you better understand the program history, results to date, and our upcoming plans.

If you find this newsletter interesting, share it with others. If you have questions or want to share your thoughts, please give us a call or send us an email. Contact information for our program staff are listed on the left margin of this newsletter.

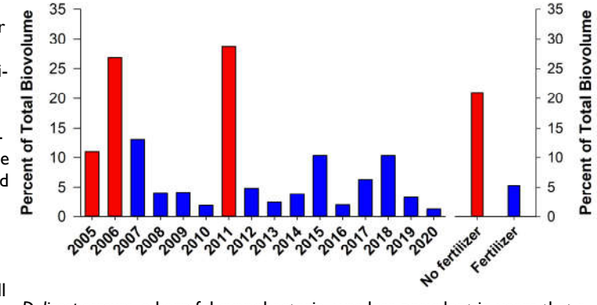
Dworshak Dam blocks access to the North Fork Clearwater River Basin for steelhead and salmon. These fish historically brought important nutrients from the ocean back to the basin.

Nutrient Restoration, an Ecological Balancing Act.

Nutrient restoration has become an important management strategy for maintaining water quality and fisheries in Dworshak Reservoir. More than 15 years ago, nutrient levels in the reservoir were found to be declining and out of balance. The imbalance was leading to the growth of harmful algae, and the lack of beneficial algae was resulting in poor growth for kokanee. In order to bring nutrient levels back into balance, reduce harmful algae, and increase beneficial algae, the U.S. Army Corps of Engineers (Corps) and Idaho Department of Fish and Game (IDFG) collaborated to conduct the current nutrient restoration efforts.

For these efforts, the Corps applies fertilizer (see page 7) and IDFG monitors the results. IDFG crews monitor water quality on a regular basis from April through November each year. These data are then sent to Advanced Eco-Solutions to assess the conditions and plankton populations in the reservoir and prescribe the correct amount of fertilizer to add each week. IDFG further monitors the fish populations and fisheries in the reservoir to assess how the project benefits the fisheries.

Although we are adding nutrients to the reservoir on a regular basis throughout the growing season, we have not detected any increase, as these nutrients are rapidly absorbed and used by the algae in the reservoir. One might expect adding fertilizer would increase the amount of algae in the water, and in turn decrease water clarity. However, we have not observed any increases in the amount of algae or decreases in water clarity. Instead, the better balance of nutrients has resulted in less harmful cyanobacteria (also known as blue-green algae), and more beneficial algae. These beneficial algae are ready grazed by plankton, and therefore do not accumulate in the water like harmful varieties. Better quality grazing for plankton means that there are more plankton for fish to eat. So has all this made fishing any better? See page 6 for answers.



Dolicospermum, a harmful cyanobacteria, was less prevalent in years that a nitrogen based fertilizer was added to the reservoir (blue bars) than years that it was not (red bars).

Dworshak Reservoir Fishing Forecast for 2021

Kokanee

Although harvest opportunities for Chinook salmon will be limited this year in Idaho, that doesn't mean you can't put some fresh salmon on the table. Catching kokanee may not compare to fighting a huge Chinook, but they can provide a delicious alternative. If you're an avid kokanee angler, you're probably looking forward to filling your cooler with some tasty "blueback". Either way, here's what to expect if you fish Dworshak this year.

We expect around 700,000 adult kokanee this year if survival is average, which should produce high catch rates compared to the 400,000 fish average, or the 560,000 we estimated last year. Keep in mind there are many factors that can affect what the actual number of fish is compared to what we estimate. For example, if a bunch of fish are flushed out through the dam (also known as entrainment), or just don't survive as well as expected, we may have a lot less. Still, even if we have half as many as expected, which can happen, we should still come in close to an average year in terms of abundance.

The other side of the coin is fish size. As avid kokanee anglers know, more kokanee also means smaller kokanee. With that many more mouths to feed, we should expect slower growth this year. Fortunately, these fish got a good jump on growth last year. As of this March, kokanee were averaging almost 9 ½ inches in the fishery. In a year with lower densities, I would expect these fish to be 11 to 12 inches by summer. However, with a record number of age-1 fish on their tails, I expect these fish will fill out as the plankton blooms and feed is more plentiful, but they may not put on much length.

These kokanee were caught in Dworshak Reservoir during March 2021. Due to the extremely high abundance, these fish will likely

If you fish early on, before the water warms up, remember that the kokanee can be very shallow. On a recent trip, almost all the fish were caught longlining with no weight, or 70 feet behind a downrigger that was only down 7 feet or less. It's also unlikely to mark fish on your fish finder when they are up shallow, so try fishing likely places even if you're not marking fish, and be on the lookout for fish hitting the surface. As the water warms, the fish will go deeper and be easier to mark. However, kokanee can come up shallow to feed at almost any time of year, so it doesn't hurt to run a shallow setup even when you're marking fish deeper.

Smallmouth

Bass anglers rejoice! The primary prey for big Smallmouth is kokanee. The more abundant the kokanee, the bigger the bass will get. This year should be as good as it gets for growing bass. While the fruits of this growth tend to lag a year, bass fishing should start getting better this year, and only continue to improve as we move into next year. The last time we had this many kokanee in the reservoir, the state record was nearly broken. With even more kokanee, maybe we'll see a new record in the next couple of years. So if you like to catch big Smallmouth, Dworshak should be on your list for these next couple of years.

" This year should be as good as it gets for growing bass."

This smallmouth was caught during a spring tournament on Dworshak Reservoir and tagged by biologists after the weigh-in. Large bass like this should become more common in the coming years.

Whether you are looking to fill your cooler with kokanee or land a trophy Smallmouth, opportunities abound at Dworshak Reservoir. So stop thinking about it. Load up your gear, hitch up the boat, and go fish Dworshak.

Whether you are an experienced angler, or looking to spend time on the water with your family, Smallmouth Bass provide great angling opportunities.

How Are Nutrients Added to the Reservoir? Are They a Health Hazard?

The U.S. Army Corps of Engineers (Corps) handles all aspects of the nutrient applications. Nitrogen is the limiting nutrient in Dworshak Reservoir, so urea ammonium nitrate (a nitrogen fertilizer) is added to the reservoir. The liquid fertilizer is applied weekly, typically from May through September.

The Corps barge with fertilizer truck onboard. Nitrogen is applied from the tanker truck via pipes off the back of the barge and mixed into the water column by the prop wash.

After being ordered, the fertilizer is delivered to Dworshak Dam and stored in commercial agricultural tanks until it is used. The storage tanks are located behind locked gates and have secondary containment around them to prevent escape to the environment in the event of spills or leaks.

The fertilizer is transferred to an application truck and driven onto the Corps maintenance barge. Once on board, application hoses are connected to the tank, the tank is pressurized and the computer controlled application system is activated. The application system is an agricultural spray system that is linked to GPS satellites. This is the same system that is used in agricultural spray equipment across the country.

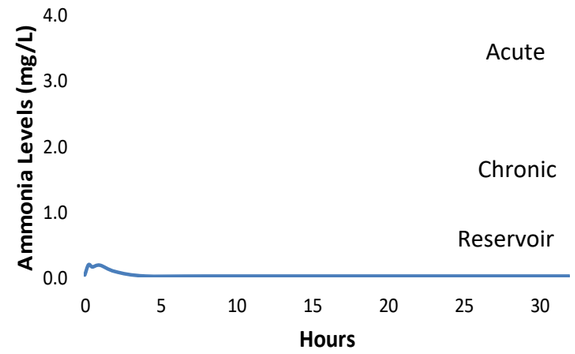
GPS linked application controller

The barge travels up the lake following the centerline of the reservoir at approximately 6 mph. The fertilizer application system automatically adjusts for variances in speed along the route to ensure proper dosing in each lake section. Prop wash from the barge allows for mixing of the fertilizer into the water column. This system has proven to be very accurate in evenly delivering fertilizer the length of the lake.

When the weekly fertilizer application is complete, the barge is tied off in the Grandad area to await the return trip downstream the following week. During this time, the barge is secured offshore and all valves are locked to prevent any unwanted tampering or vandalism. To date we have experienced no tampering or unexpected discharge of fertilizer.

So what happens to the fertilizer once it goes into the water? Some folks have expressed concerns over being exposed to it while they are swimming or recreating in the water. Could all this fertilizer going into the lake cause health problems?

Until recently, we have relied on reports from other projects that noted a rapid uptake of supplemented nutrients. In 2012, we took water samples behind the barge while it was making a normal fertilizer run. This was done in early September, when the amount of fertilizer being added was near the peak and the reservoir level was near its lowest. Samples were taken from a spot in the wake of the barge and two spots 20 yards to either side of the barge, which were located using a GPS. Water was collected from a depth of three feet and analyzed for ammonia content, along with other measures of nitrogen. As expected, ammonia levels in the water behind the barge spiked immediately after the application (see figure below). However, the additional ammonia could no longer be detected after two hours. At the sites to the sides of the barge wake, a spike of ammonia was detected an hour after the barge passed and lasted until four hours after the application. The highest level of ammonia detected was 0.19 mg/L. Under the conditions at the time of the application, humans should avoid long-term exposure to levels above 1.1 mg/L and short term exposure to levels above 3.8 mg/L. Therefore, even under a heavier application, the concentration of ammonia directly behind the barge is well below the long-term exposure limits and also does not come close to levels that cause alarm for short term exposure. This information further demonstrates that nutrient application is being done in a manner that does not pose a risk to human health for those recreating on the reservoir.

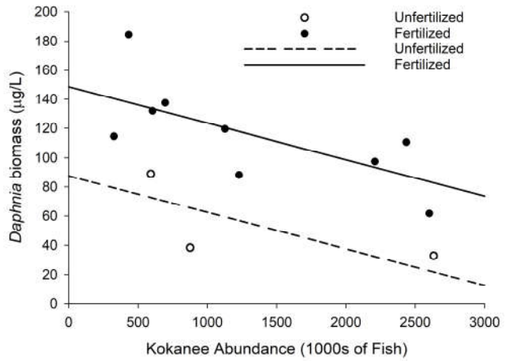


Ammonia concentrations (blue line) measured for up to 32 hours after the barge passed a point on the lower reservoir. The orange line denotes chronic (long-term) exposure limits and the red line acute (short-term) exposure limits.

Has the Nutrient Project Made Fishing Better?

More and bigger fish - that is what anglers usually want. But can nutrient restoration really make more and bigger fish? Does it really make a difference to anglers? Let's take a closer look.

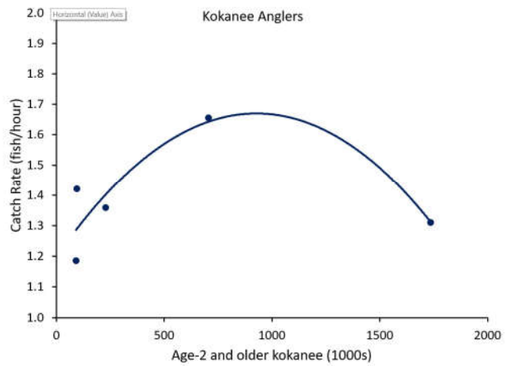
Kokanee anglers know that in years when there are more kokanee, they tend to be smaller, and in years when there are fewer kokanee, they tend to be bigger. This is driven by their food source. Kokanee prefer to eat plankton known as Daphnia. When there are a lot of kokanee, they drive the number of Daphnia down. When there are fewer kokanee, there are more Daphnia. But the nutrient project has increased the types of algae that provide nutritious food for Daphnia. As a result, there are more Daphnia for a given number of kokanee to eat. The more Daphnia, the better the kokanee grow. By producing more Daphnia for a given number of kokanee , the kokanee are now bigger than they would have been, and the reservoir can support a larger population of kokanee.



Daphnia, the primary food source of kokanee, declined as kokanee increased in number. But, when the reservoir was fertilized, there where more Daphnia for the same number of kokanee to eat, resulting in faster growth for kokanee.

This benefits kokanee anglers in two ways. On average, there were 23% more age-2 kokanee in the reservoir during years that it was fertilized. As kokanee numbers go up, catch rates go up, at least until there are too many to reach a 'catchable' size of about 8 inches. Currently, catch rates should peak at about 1 million age-2 kokanee. Previously, this many kokanee would have resulted in slow growth and poor fishing.

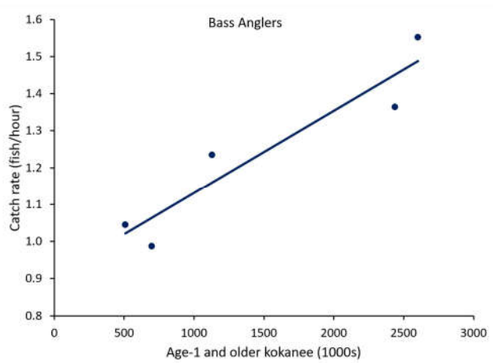
The other benefit to the kokanee fishery is size. Kokanee in northern Idaho tend to be small but tasty. Kokanee anglers are more likely to brag about how many jars of kokanee they put up last year than post pictures of the big fish they caught. As a result of nutrient restoration, the average kokanee is about an inch longer and an ounce and a half heavier. That's not much when you consider one fish. But that fish will yield a fillet that is an ounce heavier. The average angler who catches 12 kokanee will go home with an additional ¾ of a pound in fillets. The angler who catches a limit of 25 will go home with an additional pound and a half in fillets. What will you do with your additional fillets?



Catch rates for kokanee anglers increased with increasing abundance of age-2 kokanee to the point where fish could not obtain a catchable size of 8 inches.

Are you a bass angler? Maybe you're thinking "All this just for kokanee?" Well don't feel left out. We are still assessing the effects of nutrient restoration on bass fishing, but it appears that kokanee are an important food source for bass. Maybe you've caught big bass that regurgitated a kokanee or two? Bass tend to be in better condition and probably survive better once they get large enough to feed on kokanee. It also appears that larger bass tend to grow faster when there are more kokanee available. The end result? Catch rates for bass anglers are higher following years of high kokanee abundance. So go the kokanee, so go the bass.

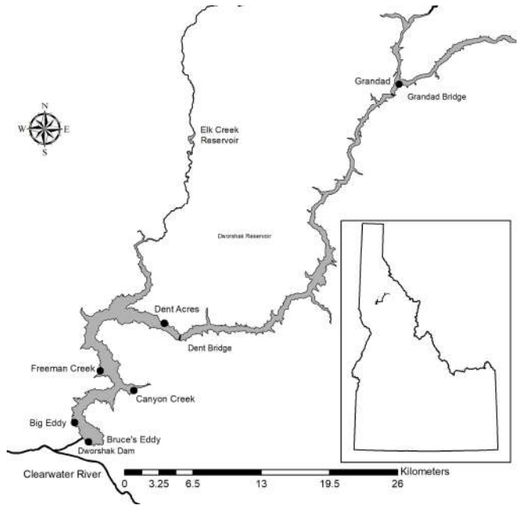
"The average angler who catches 12 kokanee will go home with an additional 3/4 of a pound in fillets"



Catch rates for bass anglers increased with increasing abundance of age-1 and older kokanee during the previous year.

Is the Boat Ramp Open?

The weekend is here and you've hitched up the boat, and loaded the family and fishing gear for a day on the water. The turn-off to Freeman Creek looms ahead so you slow down and put on the blinker in anticipation. But what's this? The sign says "Boat Ramp Closed." Aaaagh. Now where do you go to launch? You've worked all week and just want to get on lake and enjoy some fishing, not pull your boat all over creation looking for an open ramp. Dworshak has many options for boating access. What if you could know which ramps were open before you left the house? Well, with an internet connection, you can.



The location of each of seven boat ramps on Dworshak Reservoir.

Boat Ramp	Pool Elevation
Bruce's Eddy #1 (Colonel's Ramp)	1490 to 1600
Bruce's Eddy #2 (Double Ramp)	1560 to 1600
Big Eddy Ramp	1445 to 1600
Canyon Creek	1560 to 1600
Freeman Creek (Dworshak State Park)	1515 to 1600
Dent Acres	1485 to 1600
Grandad	1530 to 1600

Pool elevations at which each of the seven boat ramps around Dworshak Reservoir can be used.

The pool elevation of the reservoir will determine whether a given ramp can be put into operation. These elevations are listed for each ramp in the above table. But be aware that these elevations are approximate. USACE staff must evaluate whether it is safe for all boats to launch before they open a ramp. The actual elevation they open the ramp may vary by a few feet each year.

There are a couple of places to see what the current pool elevation is. The best place to find this is on the USACE website at:

https://www.nww.usace.army.mil/Missions/Water-Management/

Under "Water Control Information" look down until you find Dworshak. The "Daily" link is probably the most useful.

You can also find a graph with past, current, and predicted pool elevation here:

https://www.nwrfc.noaa.gov/river/station/flowplot/flowplot.cgi?DWRI1

Keep in mind that forecasted elevations are based on weather and flow forecasts, and are only as accurate as those predictions. So don't assume that the elevation predicted 10 days ago will be right; check before you go.

Help IDFG Manage Your Fishery!

The Idaho Department of Fish and Game is charged with managing fish populations in public trust for the people of Idaho. In order for us to do our job well, we need help from you, the angling public. To effectively manage our fish populations, we not only need to know how many fish are in the lake, but how many people are fishing, what they are fishing for, and how many fish they catch. Imagine you were in charge of managing a large retail store. You would not only need to know what was on the shelves, but how many people were visiting the store, and what they were buying. In order to collect this information, we will be stationing creel clerks at boats ramps on a regular basis throughout the year. Creel clerks collect information about how many people are out fishing, what they are fishing for, and how successful they are. This is critical information for fish managers to assess how well management strategies are working and what changes may be needed in the future. Please take the time to give the creel clerks the information they request. The future of your fishery depends on it.

Creel clerks collect data that is vital to understanding and improving our fisheries.

Smallmouth Bass Studies

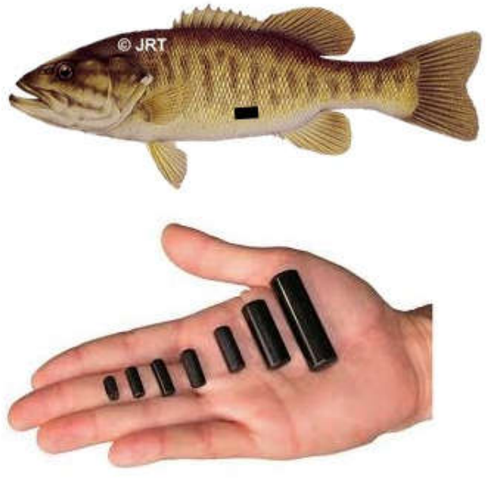
Dworshak Reservoir has produced some of the largest Smallmouth in the state, including the two most recent certified weight records and current catch and release record. These record fish aren't flukes, as other fish have been caught in recent years that were just shy of the current weight record. Although it can be a frustrating fishery at times, the chance of a record Smallmouth brings anglers back. So what is it about Dworshak that grows big bass and what needs to be done to keep the trophy component of this fishery going strong? That's what IDFG biologists strive to learn through continued surveys and research. Two important components of this research involve using two different types of tags.

IDFG biologists use Floy tags, which can be reported by anglers who later catch the fish, to learn about survival and harvest of fish like Smallmouth Bass (pictured here) and Rainbow Trout.

The current catch and release record Smallmouth Bass (22.75 inches) caught from Dworshak Reservoir in May 2020 by Dustin Shepherd of Lewiston.
Photograph CC by Dustin Shepherd

Tag-You're-It is a very successful program developed by our research staff that gives biologist a tool to measure use, or what percentage of fish are caught by anglers each year, and exploitation, or what percentage are harvested. For this, we tag fish with an orange 'Floy' tag that is attached below the rear portion of the dorsal fin in the same way that stores attach price tags to clothing. But instead of a price, these tags have a number that identifies the fish, letting us know when and where it was tagged. When an angler catches a tagged fish, they can report it using the phone number or website printed on the tag. Some tags will even earn you $50, but you must remove and return them to claim the reward. Information from tag returns provides valuable information to help managers improve fishing opportunities.

In 2021, IDFG will begin a new kind of tagging project in which we will surgically implant Smallmouth with acoustic tracking tags. These tags emit pulses of sound that can be picked up with underwater listening devices. The tags are programmed to identify individual fish and how deep they are. By tracking the movements of tagged fish, we will learn more about how Smallmouth move both daily and seasonally, as well as how many survive from one year to the next. Understanding Smallmouth movements will help us determine the best times and places to sample the population, thereby improving estimates of size and age structure, growth, and mortality. There likely won't be any external evidence that a particular Smallmouth has an acoustic tag. If you harvest any Smallmouth, pay close attention when cleaning them. It is unlikely you'll catch a tagged fish, but if you do, please return the tag to the regional office in Lewiston to collect a reward.



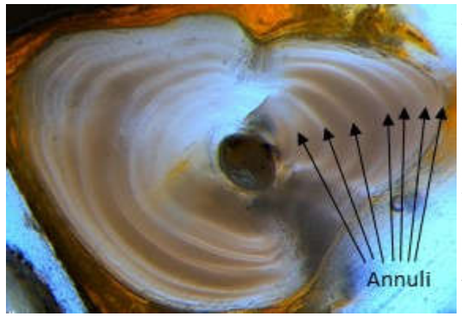
Biologists plan to learn about the movements of Smallmouth Bass in Dworshak Reservoir by implanting acoustic transmitters that will relay the location and depth of tagged fish.

How Old is that Bass?

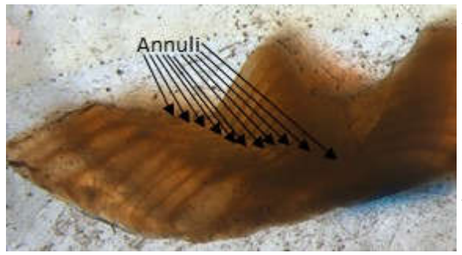
This is a question of interest to bass anglers, and a question of great importance to biologists. In order to know how fast a fish grew, or how long it survived, we have to know how old it is.

Historically, this was done by collecting scales. Scales are easy to collect, and can be removed without harming the fish, allowing it to live and be caught another day. However, scales can be difficult to read. As fish grow, they form circuli, or growth rings, on their scales. But these don't correspond with a year, like tree rings. There are many circuli for each year. When growth slows, typically during the winter, the circuli form closer together. When growth is fast, typically during the summer, circuli are spaced farther apart. Biologists identify annuli, marks indicating each year, by the spacing and other changes in the pattern of circuli. It takes a lot of experience to interpret these marks, and even experienced readers get some fish wrong.

Dorsal spines are an alternative to scales. When sections and viewed under a microscope, dorsal spines have annual rings like a tree, making them much easier to count. They can also be collected without killing the fish.



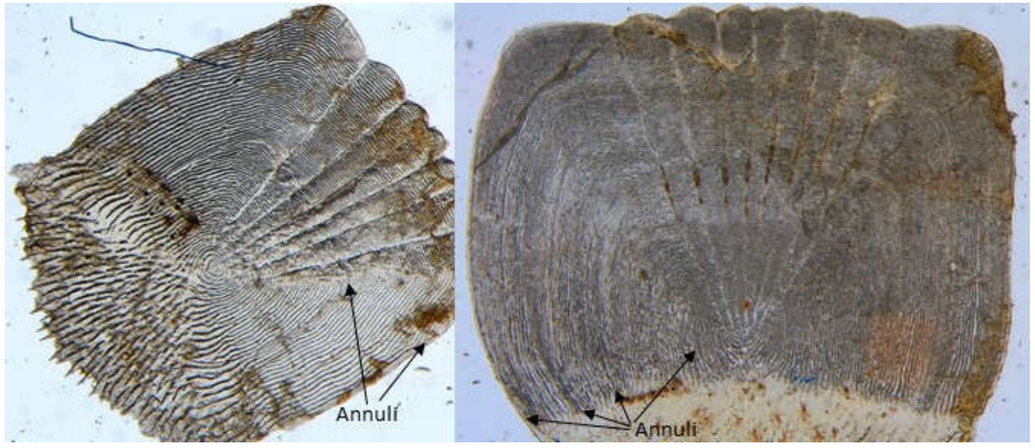
Cross section of a Smallmouth Bass dorsal spine showing annuli which are counted to determine the age of the fish.



Cross section of a Smallmouth Bass otolith showing annuli which are counted to determine the age of the fish.

Another structure used to determine age is the otolith, or ear bone. Otoliths are the "gold standard" in aging for many fish, and have been demonstrated to be accurate for Smallmouth. They can be sectioned and viewed under a microscope, and like spines, have annual rings that are easier to interpret than scales. However, it takes longer to process otoliths and spines, and removing otoliths is lethal to the fish, limiting our opportunities to collect them.

So which structure do we use to determine the age of Smallmouth? That's something we are currently working on. By comparing independent age readings from scales and spines to the age read from an otolith, we can determine the accuracy of spines and scales. Accuracy of spines and scales will likely change with age. For example, a scale may be accurate for young fish, but not for older fish. Once we determine the accuracy of these structures, we can determine which one is the best to use in a given situation. From there, we can more accurately determine what factors have the most influence on growth and survival.



Scales from two Smallmouth Bass showing annuli that are counted to determine the age of the fish.