

Harvesting—Bounty Beyond the Shoreline

By Bruce Kania

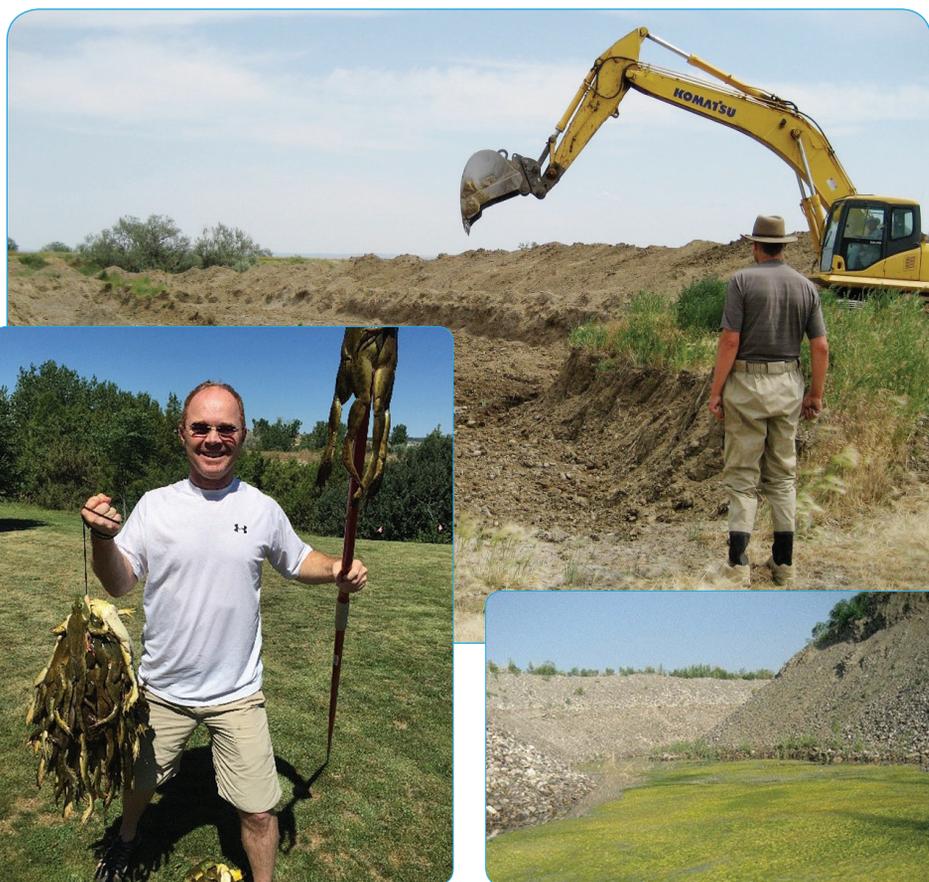
For a waterway to be in ideal condition, nutrients coming in must match nutrients going out. In fact, lakes and ponds really never achieve this perfect balance, but as pondmeisters know, if your pond gets too unbalanced in favor of nutrients coming in, then disaster looms! This is especially true if the nutrients enter in the form of mineral-based fertilizer.

Pondmeisters love fish. We want clean, healthy water, but fish are a main target—particularly big, sporty fish and all the fun that comes with them. But, here's a “what if...” What if we could have crystal clear water you could drink out of hand, and nice fish with nearly every cast? What if we could have both? Wouldn't that be just AWESOME?!

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Remember that line from the good book? It goes something like “To them that have, more will be given.” Well, Matthew knew what he was talking about, and when your system is healthy and nutrients are cycling through at a ferocious rate, this miracle of abundance materializes.

How do you make sure the food web is functioning well? That's the stuff of *Pond Boss*. There have been hundreds of previous articles dealing with pond management and stewardship in these hallowed pages! But for now, let's look at this idea: we must harvest in order to have more harvest. It's really that simple. We humans are a vital part of the food web, and if we don't accept responsibility that comes with our place near the top of the food web—in other words, if we don't steward and also harvest—the whole thing can come crashing down! This is abso-



Top: In 2005 what had been a seasonal pond is dug out. The pond receives about 60-80 gallons per minute of ground water. It doesn't leak! So 6.5 acre Fish Fry Lake is born. Tons of pit run gravel is screened, and ninety percent of the pond's bottom is lined with cobble or gravel. Bottom left: Average harvest of nearly 300 pounds of bullfrogs from Fish Fry Lake translates to another 1.5 pounds of phosphorus coming out of the lake annually. Bottom right: Over the next couple years the pond is filled and flushed three times. Residue fertilizer, think phosphorus, had accumulated in the draw that became the pond, and more comes in intermittently with ground water. So, water quality is bad—shore to shore carpet of algae and cyanobacteria. In between the blooms the water is turbid. (Fourteen inches on a Secchi disk.)

lutely what happens today, with fertilizer in such abundance. For right now, let's look at the HARVEST side of this conundrum.

Here at Shepherd, Montana, we are performing a long-term test. We measure a lot of stuff,

including our harvest. Check out the photos and data connected with them, and see if you notice a pattern unfolding:

Our water is heavily influenced by phosphorus due to nearby corn farming practices and irriga-



Harvesting plants.

tion. Water migrates through our property from nearby agricultural interests. We get their excess fertilizer.

Floating islands are developed and launched on Fish Fry Lake. They filter the water, improving clarity. Fertilizer from past years still present on the lake's bottom combine with sunlight, which due to clear water, now extends far deeper into the lake, resulting in explosive growth of aquatic vegetation. This is part of the lake's transition to health, as long as vegetation is harvested. Grass carp or manatees are not an option here! So it's up to our ducks, some kind of micro-harvester system scaled for a 6.5-acre pond, or the backs of our helpers to rake it up to use for a different purpose.

In our most ambitious year we harvested 43,700 pounds of aquatic weeds by hand and rake. All this work only translates to 6.8 pounds of phosphorus! Aquatic weeds are mostly water.

We bump up aeration/circulation in the lake with two floating streambed embodiments of floating islands. This allows for optimal cycling of nutrients through the islands, and it also allows for sufficient dissolved oxygen to keep warm water fish, like yellow perch, black crappie, bluegill, and redear sunfish alive. We average harvest of 1,400 pounds of fish a year. We initially focus on yellow perch, which translate to one pound of phosphorus per 105 pounds of perch. This translates to fish being our best means by which to harvest phosphorus, at about 12 pounds per year.

I can say from direct experience that hand/rake harvest of 43,700 pounds of aquatic vegetation over the course of one summer in 101 canoe loads is NOT a preferred method to harvest phosphorus! Our backs still ache.

On the other hand, feeding that aquatic vegetation into nightcrawlers has been a great hit! The worms provide bait and end up back in the lake, while the resulting worm castings are blended with fish residue and end up in the garden.

Here are some conclusions about what has really worked on Fish Fry. Hopefully these may give you some ideas for your water. But, if there's a single message or lesson here, it is that you, and the professionals you work with, really do want

Today Fish Fry Lake is keeping up with inflow nutrients. The catch rate on fish is off the chart. Water clarity is good—sometimes as much as twenty feet. Dissolved oxygen levels allow for fish to live, eat, and grow top to bottom in 95% of the lake. And, for the scientists out there, note that even though DO levels in the lake typically are above 5 mil/liter, biofilm present on the massive surface area provided by floating islands, which are made of a filter like matrix, includes an aerobic (outer), anoxic (middle) and anaerobic (bottom) layer. This means the complete nitrogen cycle, which requires some anoxic and anaerobic conditions, happens in the floating islands. This also means we do not lose most of the bottom of the lake to anaerobic conditions that fish can't live in.



Top: A children's swimming pool floats in the lake, and serves as a convenient worm bin. European nightcrawlers thrive on our mix of aquatic vegetation. Right: Worm castings, mixed with digested fish offal, are superb as organic plant food.



to measure what's happening, and working or not working, on your water!

FISH... For us, healthy and vigorous fish are the ultimate marker of success. While we know of no other waterway in Montana that approaches our harvest per acre-foot of water, we'd like to keep pushing the envelope. Northern yellow perch, black crappie, bluegill, and redear sunfish dominate today, but largemouth bass are coming on strong. They are helping us put size on the prolific bluegill too.

When we aren't fishing for a meal, we slot lim-

it harvest one and two year old fish, which make up most of the phosphorus removal on Fish Fry. Now however, we are considering cycling some of them back into the lake. They would be returned to the lake in the form of fish meal, blended with fermented grain and some organic flour from the property. We dry the fishmeal at low temperature to preserve food value, and form it into feedable pellets aimed particularly at bluegill and other sunfish. This is quite a departure from our wild, non-fed, fish strategy though, so we are



Above: Some of the bounty of fish harvested. Top left: A floating island in full growth. Bottom left: Tens of thousands of fathead minnows from the minnow pond.

still scratching our heads. A question that comes up for example: Is there a risk associated with feeding fish from fish that derive from the same place? Perch eat their own fry, but bluegill are less carnivorous. So far, there are no contraindications in the literature, and several prominent fisheries experts agree this is a reasonable idea!

While we recognize if we start feeding fish, our wild fish status will change, we also know the quality of the fishery, particularly growth rates of bluegill and redear sunfish, could be enhanced. All the feed, except a small fraction of fish oil, will derive from the property and will be trackable in terms of nutrients. Our goal is not to replace a natural diet, but to supplement and enhance fish diet, and thus enhance fish growth rate, especially of bluegill and sunfish. Growth rate of yellow perch is already off the charts, and we do not currently have growth rates of any kind on the black crappie.

AQUATIC VEGETATION... We view aquatic vegetation as an opportunity. It represents another way, if done efficiently, to cycle nutrients out of water.

Weed harvest is expensive compared to fish. On the other hand, worms eat this material, and the resulting worm castings are truly a remarkable organic supplement to our gardens.

MINNOWS... Today we have a 5,000 square foot pond above Fish Fry (aptly named MIN-

NOW POND) that generates between seventy and ninety thousand minnows per year. This translates to nearly three additional pounds of phosphorus prevented from entering Fish Fry, unless the minnows are released into the lake.

These guys make life bearable here in mosquito season, as they are terrific mosquito larvae predators. They also consume larvae of the midge that spreads Blue Tongue, a devastating whitetail deer disease. Although it took what felt like a special Papal Dispensation, Montana FWP did grant us a permit allowing dispersal of these native minnows into nineteen different mosquito generating water features across the property. So the fraction of minnows that don't end up back in Fish Fry Lake contribute to our nutrient uptake quota.

We also have visions of portions of Fish Fry Lake being developed into secure minnow production habitat so as to cycle nutrients into forage fish, and from there into the big guys we love to catch!

BULLFROGS... are another nutrient cycling opportunity! As a recent invasive species here in Montana, these guys are a new addition to our wildlife mix. We harvest between 5-600 per year, averaging 9 ounces each, which translates to 1.5 pounds of phosphorus per year.

ROUEN AND ROUEN HYBRID MALLARDS... They enjoy and thrive on our aquatic vegetation, and we enjoy them! Their organic

guano cycles directly into periphyton, which cycles into minnows as well as panfish fry, so our ducks seem to be a real fit. We learned organic nutrients are way easier to cycle into fish than mineral-based nutrients (fertilizer). Trying to balance a reasonable number of ducks with the aquatic vegetation growth, maximized by clear water, is challenging, but interesting. And, duck eggs are delicious!

Another idea being considered for testing involves hyper-accumulator plants. There are unique plant types that can pick up massive volumes of phosphorus. Growing these on our floating islands could be another strategic way to increase harvest of phosphorus, but then we have to harvest elephant grass. Another project on the horizon!

Over the last three years our measurements indicate Fish Fry is inflowing between 13 and 14 pounds of phosphorus per year. We average, between all the various harvests, 16 pounds coming out. Keep in mind, we have an unknown phosphorus inventory to work down from several decades of phosphorus accumulation in the soil around what is now Fish Fry lake, so without a lot more science, we don't know how many years of this harvest program are in front of us. We do know that if we don't harvest, aquatic vegetation and algae will take over, unless we choose to poison the lake. For me, that is not an option.



Top from left to right: Our organic castings and fish offal grow healthy plants. Using our ponds resources for more than things aquatic. Bounty from the garden. A mink catches a bullfrog. The food chain at work.

I'm sitting here on the computer. It's 4 a.m., and it's raining outside. Blessed rain! It's October, and September was totally dry. This rain means my farm's winter wheat will actually germinate! But also, during this quiet time, I can think back on the process of stewardship and harvest. I know that now that we've started this transition strategy on Fish Fry Lake, I won't stop it. I'm sure the lake would return to its original poor condition in a few short years. On the other hand, as noted earlier, I'm not sure how long we have to continue harvesting more than the inflow nutrients.

I do know that nature is helping us. Two summers ago we found fresh water sponge colonizing plant roots below a floating island. It's a very basic form of animal life, and it's a filter feeder, helping us towards even greater water clarity,

allowing sunlight to reach even deeper into the lake. I also see the fishery evolving. Largemouth spawned here this year, and with the large forage base are likely to become another serious factor connected with the harvest component of managing nutrient loads.

STEWARDSHIP...Fish Fry Lake will likely become more like a sport fishery instead of a research pond oriented around nutrient removal to achieve health.

The reason is that bass are a trophic level above bluegill. So where I could harvest a thousand pounds of bluegill, now I will only be able to harvest 100 pounds of bass. Much of the phosphorus associated with bluegill will continue to circulate in the lake. An interesting challenge, and I really look forward to watching all this unfold. It won't totally surprise me if the lake will support harvest

of the same 16 pounds of phosphorus, even with the largemouth bass factor.

I really don't know of anywhere else in North America where such measurement happens, except in aquaculture settings, where even more rigorous attention to water quality is required. The average pondmeister doesn't want to be harvesting canoe loads of aquatic weeds, much less measuring their phosphorus content! But if you do have mineral-based fertilizer getting into your pond, you have to do something. You have to harvest, or your fish will go away. My challenge, and maybe yours, is to figure out a way to make this harvest process fun! Good Luck!



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*LeighAnn Skipworth, Advertising & Marketing Director, Pond Boss Magazine, INC
www.pondboss.com, 800-687-6075*