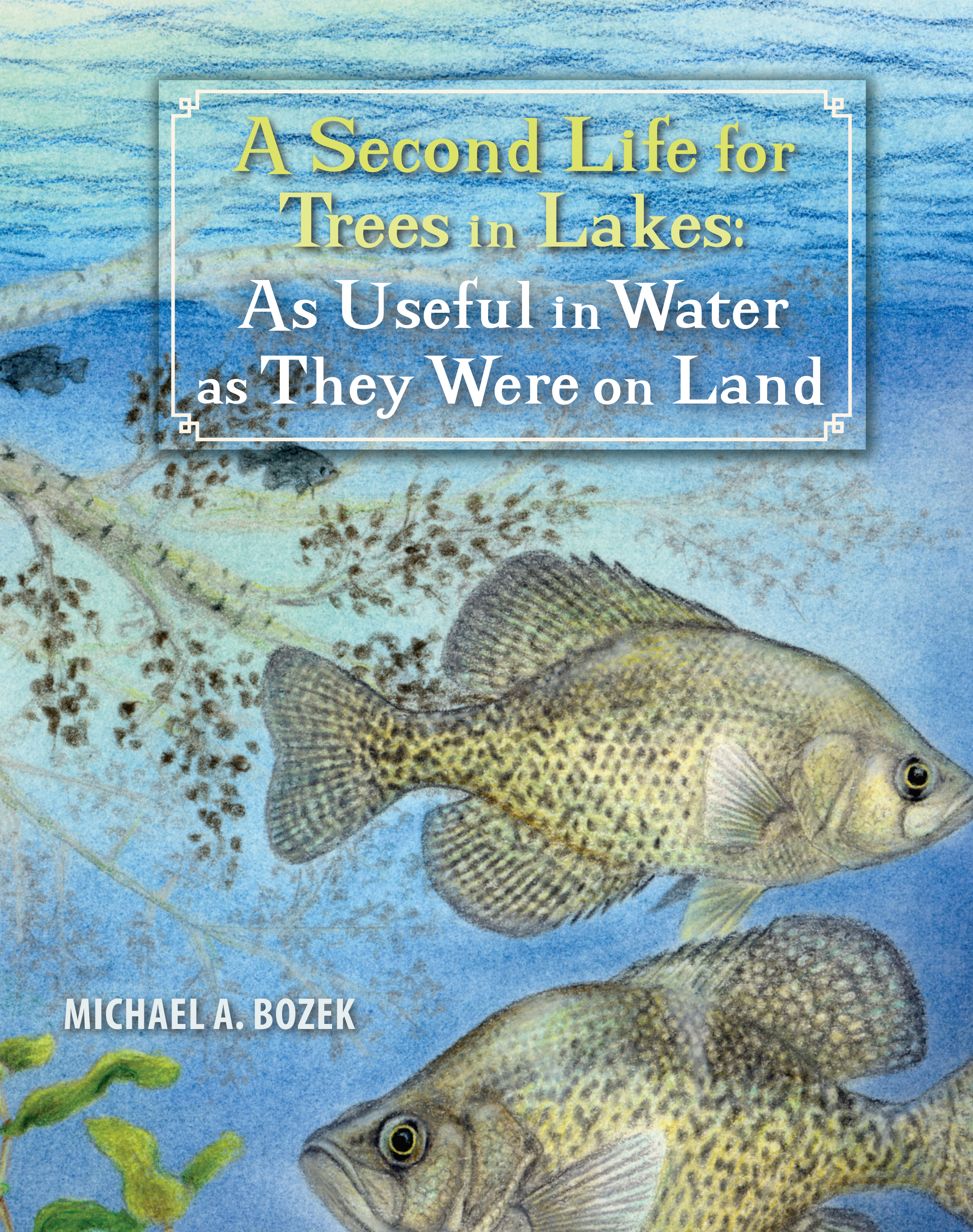


A Second Life for Trees in Lakes: As Useful in Water as They Were on Land

MICHAEL A. BOZEK

Ten thousand years ago, a tree grew on the shore of a lake somewhere in North America. For 140 years or more, fish swam in its shade and insects hatched on its branches and leaves; some were eaten by birds, some fell into the water to be eaten by fish, some survived to continue the cycle of life. Birds nested and foraged in its branches, perhaps kingfishers dropped like rocks, propelled by gravity to their next meal and eagles perched among its highest branches. A wood frog chorus would start each evening in spring near the first crotch, and often red squirrels would chatter for whatever reason red squirrels chatter. Then one day it happened: after years of increasing decay near the end of its life, the tree snapped at the butt during a windstorm, and fell with a thunderous crash into the lake; 140 years of silence and quiet rustling, punctuated by a single quick, loud finale. Within a minute, the waves that had acknowledged the tree's entry into the water subsided, and all was quiet again.

Now the tree began its second life…in the lake. Within hours, crayfish crawled beneath its partially submerged trunk, to be followed by a mudpuppy and tadpoles, while minnows and small fish hovered within the lattice of its branches. Within days, logperch, darters, sunfish, bass, burbot, pike and even walleye and muskellunge had also entered the complex network of the newly established community. Algae and diatoms began establishing colonies, while dragonfly nymphs and mayflies followed to forage among the branches. A wood duck competed with a softshell turtle for basking space on the bole that once contained its nest site cavity. Herons, green and blue, alternated use as well: the bole presented a fine place to access the fish below. Use of the tree by a variety of organisms would continue again for much longer than its life on land. Remarkably, the tree might last another 300 to 600 years, slowly changing shape over time as it yields to Father Time. Different organisms continue to use the tree until its cellulose has completely broken down and its chemical constituents have been fully integrated into the web of life in the lake.

For millennia, trees have fallen into lakes, and fish along with other aquatic organism have used them as habitat.

Trees in riparian areas emerge as seedlings, they grow and mature dropping seeds to establish future forest stands. When these trees die, many fall into lakes creating fish habitat, leaving seedlings in their wake, to again mature and replace dying trees, thus continuing the cycle that links these shoreline areas to lakes and streams.

However, humans have altered riparian areas of lakes at rapid rates across a large portion of the landscape, first by logging and more recently by lakeshore development: the former a temporary impact and the latter a more chronic problem. In the Upper Midwestern United States, forest stands in previously logged areas have more or less recovered, and now sustain healthy second-growth forests. In contrast, along developed shorelines of lakes, many riparian landowners have removed some or all of the trees from both the land and water, thus eliminating the self-perpetuating benefits trees provide to natural systems. Where landowners continue to remove new understory trees, seedlings and saplings, they prevent recovery of these shoreline areas to their natural state.

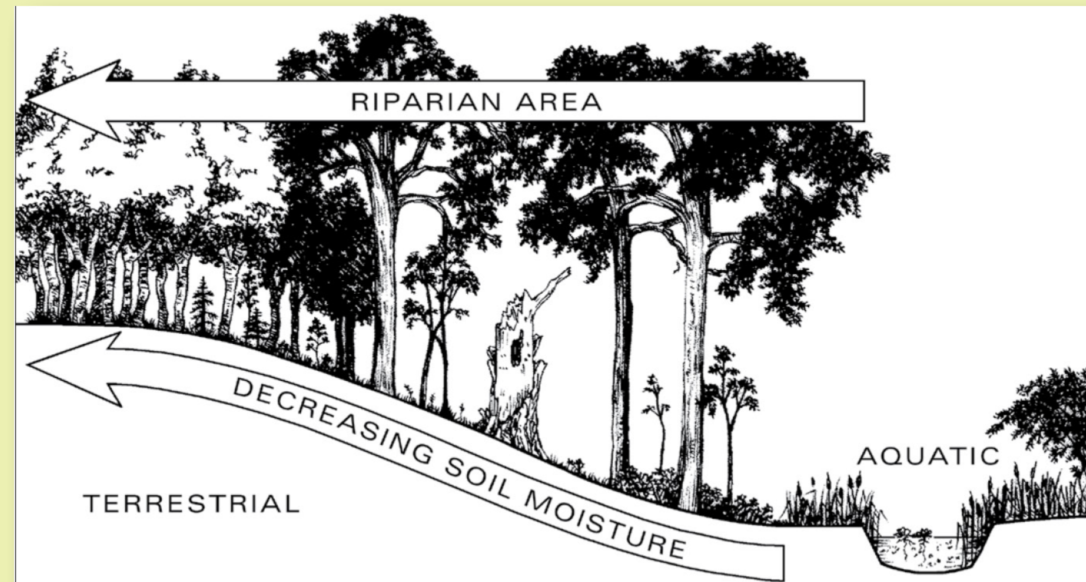
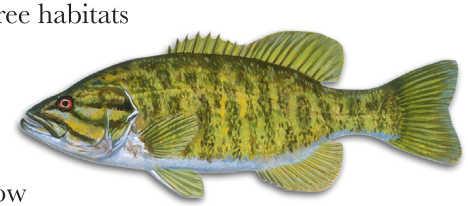


FIGURE 1: Transition from aquatic to terrestrial habitat in a riparian area.

USE OF SUBMERGED TREES BY FISH

WALLEYE

YELLOW PERCH



SMALLMOUTH BASS

Fish use submerged trees in a variety of ways. Many species spawn on, adjacent to or under trees that provide cover which help some species protect their incubating brood. For example, smallmouth and largemouth bass preferentially build spawning nests near submerged trees, particularly large logs, while and rock bass place them next to or under logs.[1,2,3] Because male bass and sunfish defend their eggs and young in nests, placing nests adjacent to or under submerged trees reduces the nest perimeter that they need defend against predators. Once young have left the nest, newly hatched smallmouth bass will often inhabit submerged trees.[5] Declines in submerged tree habitats have been linked to reduced abundance of young smallmouth.[4]

Yellow perch use submerged wood along with aquatic vegetation to lay eggs; long ribbon-like strands can often be seen draped on them in early spring. Three studies found a decline in yellow perch abundance when trees were removed from lakes[6,7,8] Fathead minnows, an important food item of larger fish and fish-eating shorebirds, spawn on the underside of wood in cavities. The young of many species of fish often disperse throughout the branches for protection,[9,10] while predators, such as northern pike, muskellunge and largemouth bass[11] use the same trees for ambush foraging. Shade from branches and the bole provides daytime refuge for diurnal low-light species such as walleye. Use of trees can be species-, age-, and season-dependent, and trees provide many diverse habitats that attract fish for different reasons.

TABLE 1. Fish species found in one submerged white pine tree in Katherine Lake, Wisconsin

black crappie
smallmouth bass
largemouth bass
walleye
muskellunge
rock bass
bluegill
pumpkinseed
mottled sculpin
logperch
Johnny darter
yellow perch
white sucker
minnows*

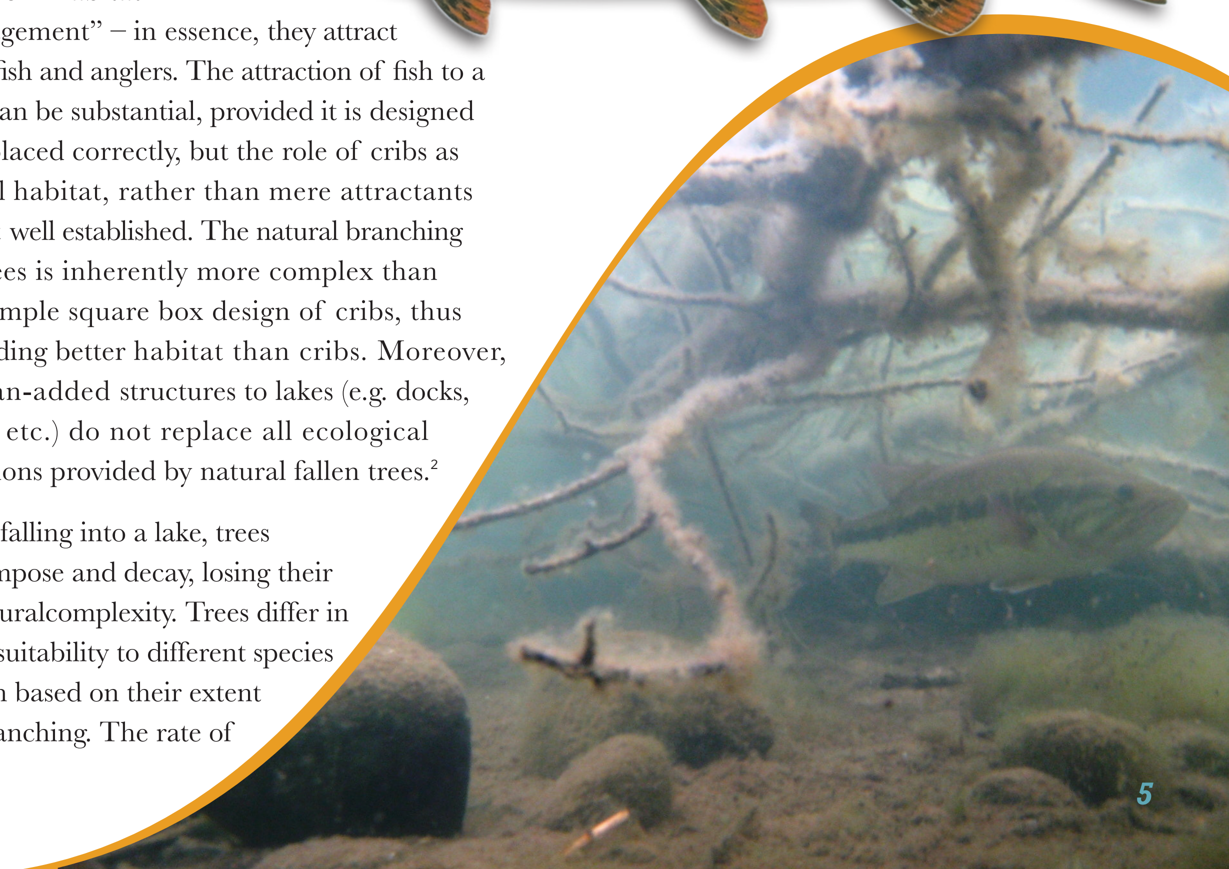
* Minnows are cyprinids, and in trees, they are often represented by multiple species, but can be difficult to visually identify during diving.

Current research has found that the association between fish and trees clearly is related to the complexity of branches and the location and position of the tree in water. More fish and more different species of fish use trees that have more complex branching[9,12] and in fact, individual, large, complex trees can host entire fish communities. In north temperate lakes, up to fifteen species or more may inhabit a single tree at a time (Table 1). Walleye and white suckers can be found beneath trees in deeper, darker water, adult smallmouth bass can be found beneath the bole, and many of the other species like cyprinids (i.e., minnows), bluegills, pumpkinseed, rock bass, muskellunge and more can be found throughout the complex web of branches.

Given these observations, we need to look beyond single trees to understand how they function in lakes. For instance, submerged trees located closer to other submerged trees result in greater numbers and diversity of fish compared to individual trees.[9] Larger numbers of submerged trees create a mosaic of diverse habitats over greater shoreline areas than single trees do. Similarly, trees located within or adjacent to aquatic plant beds create even more complex habitats. Therefore, we need to manage entire riparian areas that help develop complex littoral zone habitats, not just individual trees.[13] In lakes that have low abundance of natural habitat features, such as woody habitat, just about any structure, such as a fish crib or dock, will attract fish. Fish cribs (Lincoln-log type box structures weighed down with rocks) are often built to attract fish for anglers in the guise of "habitat management" – in essence, they attract both fish and anglers. The attraction of fish to a crib can be substantial, provided it is designed and placed correctly, but the role of cribs as actual habitat, rather than mere attractants is not well established. The natural branching of trees is inherently more complex than the simple square box design of cribs, thus providing better habitat than cribs. Moreover, human-added structures to lakes (e.g. docks, rafts, etc.) do not replace all ecological functions provided by natural fallen trees.[2]

After falling into a lake, trees decompose and decay, losing their structuralcomplexity. Trees differ in their suitability to different species of fish based on their extent of branching. The rate of decay differs among tree species with birch and aspen trees decaying the quickest. The number of species and the abundance of fish associated with a tree declines with this loss of complexity.[9] If trees are alive at the time they fall into the lake, and provided it is during the growing season, they will retain their leaves or needles intact for a short period of time (usually a season), and at that time will have the highest level of habitat complexity. Over time, they will lose the leaves and needles, followed by loss of fine branching first, followed in time by loss of progressively coarser branching, until a simple tree bole remains. The sight of these submerged boles in lakes gives us a retrospective view of changing fish habitat over time.

MUSKELLUNGE



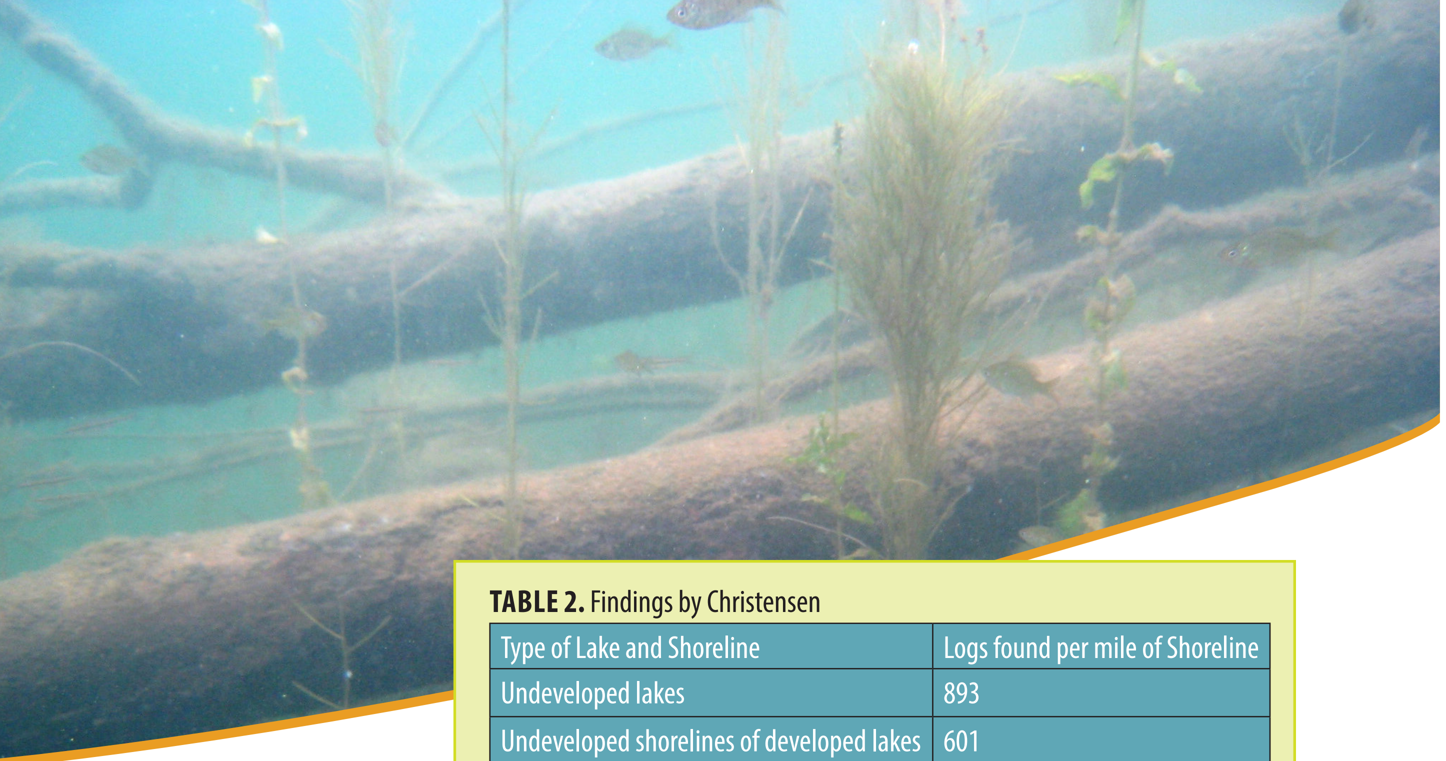


TABLE 2. Findings by Christensen

Type of Lake and Shoreline	Logs found per mile of Shoreline
Undeveloped lakes	893
Undeveloped shorelines of developed lakes	601
Shorelines where houses have been built	92

WHAT DETERMINES HOW MANY TREES ARE IN A LAKE?

The rate and pattern in which trees fall in the lakes depend upon the stand of trees in the riparian area, and activities of landowners. Trees in lakes tend to be most abundant (dense) in smaller lakes with undeveloped shorelines. Larger lakes have higher wind and wave energy which can break up trees faster and transport them offshore to deeper water. Greater development often results in landowners actively removing trees from shorelines and manicuring riparian areas.

In a study of undeveloped lakes in northern Wisconsin and the upper peninsula of Michigan, Christensen et al.[14] found that humans greatly reduced the abundance of trees in shallow, nearshore areas of lakes.

WHAT CAN WE DO?

Riparian trees are an amazing example of a renewable resource: valuable to us on land, then again in the water after they die while more trees are being regenerated on land…for free. We just need to understand and embrace this cycle as a long-term renewable source of habitat.

Isn't it ironic that on many lakes, we have reduced or eliminated trees in riparian areas thus preventing them from becoming habitat in lakes, only to then build fish cribs made of trees at substantial additional cost and energy? Riparian trees and shrubs are a "free commodity" provided by nature at no cost. All we need to do is recognize their benefits and let nature provide free fish habitat to its full potential.

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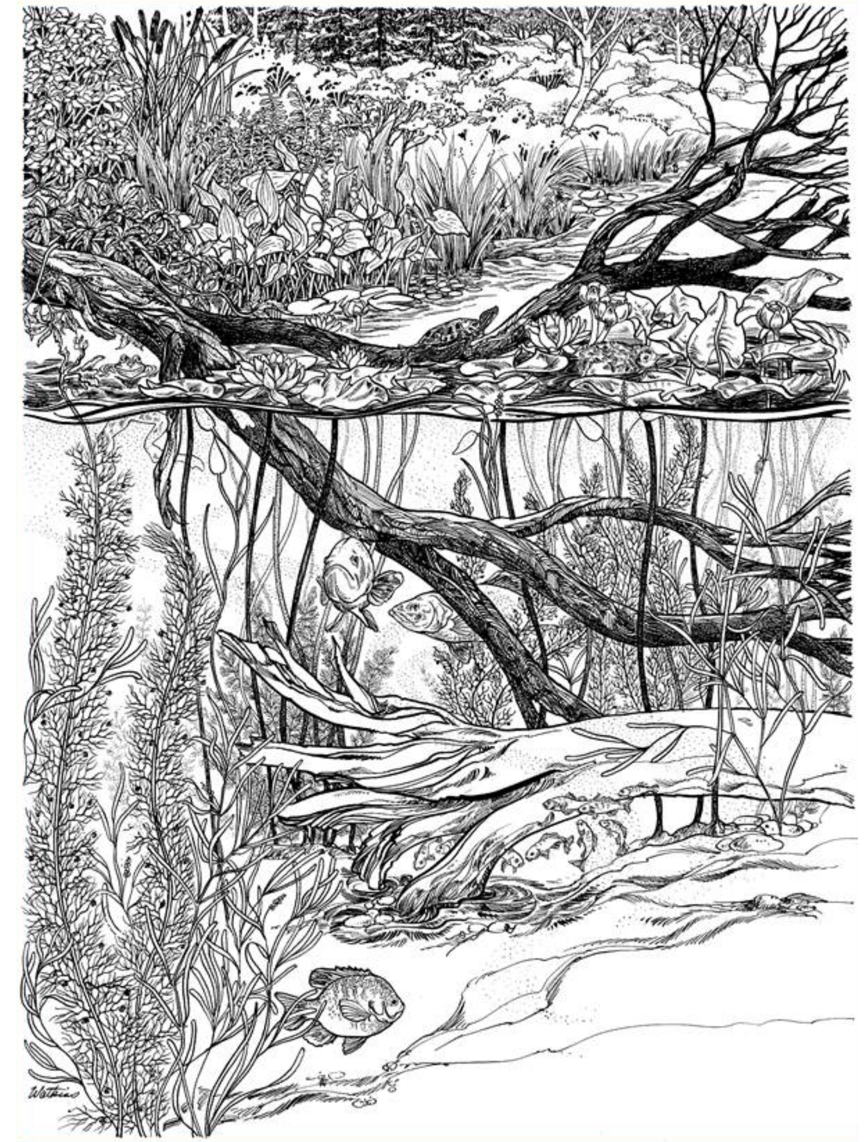

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SIMPLE STEPS WE CAN TAKE TO INCREASE FISH HABITAT:

- Leave trees that fall in the water in place.
- Do not cut branches of trees that stick above the water, even during winter as fuel for ice fishing. These branches will become valuable habitat as the tree settles further into the lake.
- Do not cut branches that are in the water to create pockets in branches for easier fishing.
- Leave natural trees, seedlings and saplings along lakeshores intact and allow them to mature.
- Where trees have been removed along shorelines, and in particular, where understory trees, seedlings and saplings are gone, plant trees and shrubs, which will become fish habitat for future generations. Partial shoreline restoration is better than none.
- Learn to appreciate more natural shorelines rather than highly manicured sites, and encourage others to do the same.

For the long-term health of lakes, we must first change our perception of what shoreline features are healthy and thus desirable. Accepting the look of "natural" shorelines with many trees and shrubs will be the first step toward restoring habitats for animals using these areas on shore, as well as fish using the trees when they fall in the water.

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