Strategic Plan

of the Reservoir Fisheries Habitat Partnership/
Friends of Reservoirs
For 2018-2022

A Framework for Strategic Conservation of Fish Habitat
In Reservoir Systems of the United States

RESERVOIR FISHERIES HABITAT PARTNERSHIP

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Executive Summary

Reservoirs are inextricable parts of our natural landscapes. Constructed to meet a variety of human needs, they impact almost every major river system in the United States, affecting to various degrees habitat for fish and other aquatic species and, in turn, are affected by the health of the watershed in which they reside. Reservoirs, their associated watersheds, and their downstream flows constitute interdependent, functioning systems. Effective management of these *reservoir systems* – maintaining their ecological function and biological health – is essential to the conservation of our nation's aquatic resources and their habitats. It requires that we minimize the adverse impacts of reservoirs on their watersheds and maximize their utility for aquatic habitat.

Conservation of reservoir systems is also essential to maintaining the quality of life for the American people. Reservoirs provide essential infrastructure services, from the storage and delivery of water to the generation of power to the reduction of flood risk in downstream communities. Reservoirs are focal points of recreation for tens of millions of Americans, from anglers to birdwatchers, and they generate tens of billions of dollars for local economies and national recreational industries. Innumerable species of fish and wildlife, too, benefit from the habitat that reservoirs provide.

The RFHP is a national collaborative partnership established to promote the protection, restoration, and enhancement of habitat for fish and other aquatic species and communities in reservoir systems through cooperative and voluntary actions. The RFHP provides strategic coordination and direction in the conservation of fish and aquatic habitat in reservoir systems. It is committed to integrating watershed conservation, in-reservoir management, and the management of downstream flows to attain more holistic and coherent strategies for addressing aquatic habitat impairment issues in reservoir systems. The RFHP works through partnerships to implement conservation actions needed to achieve and sustain healthy reservoir systems. It does this by facilitating, informing, equipping, and supporting a bottom-up approach to implementation of conservation – enabled, in turn, by the partnership's wealth of technical expertise.

The RFHP governance structure has three major parts. An Executive Committee supported by staff and working committees sets policy and guidance, and determines conservation priorities and project funding allocations. Four Regional Workgroups, each corresponding to one of the four regional Association of Fish and Wildlife Agencies (AFWA) associations, rank project proposals within their respective regions and help recruit membership in Friends of Reservoirs, a 501 (c) (3) corporation and the third pillar of the partnership, provides multiple paths to reservoir stakeholders to participate in the RFHP and, in turn, to support the RFHP in the long-term through fund raising and volunteer contributions.

The RFHP strategic plan derives its purpose and structure from the conservation mission, goals, and objectives of the National Fish Habitat Partnership. It is the partnership's roadmap to healthy reservoir systems. It sets forth goals, objectives and targets to guide the partnership into the future. It includes, too, conservation actions for its second 5-year planning phase and monitoring and performance reporting protocols. The process and criteria to strategically identify conservation priorities and to select and implement conservation actions and projects is included.

Introduction

The Reservoir Fisheries Habitat Partnership (RFHP; www.friendsofreservoirs.com) is one of 20 recognized Fish Habitat Partnerships (FHP) of the National Fish Habitat Partnership (NFHP; www.fishhabitat.org). It evolved from three years of discussions, meetings, and collaboration among State and Federal agencies, conservation organizations, private sector businesses, and committed individuals. A common interest in the health of the nation's reservoir systems brought people of differing outlooks and wide-ranging locales together for a shared cause. From its first meeting in Atlanta, Georgia, in June, 2007 at the 4th International Reservoir Symposium to meetings in Louisville, Kentucky (2007), Chicago, Illinois (2007), the National Conservation Training Center in Shepherdstown, West Virginia (2008), the 2009 North American Wildlife and Natural Resources Conference in Arlington, Virginia, and Big Cedar Lodge in Ridgedale, Missouri (2009), the partnership articulated a vision and created a strategic framework to protect, restore, and enhance fish and aquatic communities within reservoirs and their watersheds. RFHP was recognized by the NFHP Board as a FHP in October 2009.

Shared scientific values and a common understanding of the importance of reservoirs structured the dialogue that initiated and developed the partnership. In particular, three core facts guided the formation of the partnership. First, reservoirs are ubiquitous; found in almost every major river system in the United States, they number in the tens of thousands. They have often dramatically altered the ecological functions and processes upon which aquatic species rely. Two, reservoirs are persistent, albeit human-made, features of the natural landscape. Over time a small number will be removed, but across the lifespan of multiple human generations the majority of reservoirs will remain intact. Three, reservoirs provide important services to people and their communities, from drinking water to flood risk reduction, to navigation, to power generation, to fishing and boating and other forms of recreation. Reservoirs add to the quality of human life.

The RFHP is committed to advancing the quality of life for all species. We believe that reservoirs in conjunction with their downstream and watershed components – what we term the *reservoir system* – can, through considered and strategic conservation, provide for the needs of both human and aquatic communities. Yet, the barriers to do so – *all of which are related to how we govern and make decisions about our reservoirs* – are substantial and daunting. For example:

- Reservoir responsibilities are divided among dozens of agencies and across multiple jurisdictions, fragmenting reservoir management and often disconnecting that management from the health of downstream waters and the upstream land uses and flows that ultimately determine their longevity and health.
- Data that are essential to conservation of fish habitat in reservoirs, downstream, and in watershed tributaries are scattered and incomplete, challenging management agencies in need of sound data to implement best management practices.
- Communication and networking among reservoir managers nationwide needs to be improved to facilitate the sharing of information and the development and testing of best management practices and new restoration technologies.
- Reservoirs are key habitat types, yet information regarding them is either missing from or not integrated into our national aquatic landscape models, plans, and conservation strategies.
- Public awareness and understanding of the role of reservoirs in watershed health, and the importance of healthy reservoir systems to overall human well-being, is insufficient and incomplete, impeding the progress of effective public policy needed to address the many issues challenging reservoirs and their watersheds.

Institutional barriers to reservoir management are not the only threat to quality of life: environmental challenges are multi-faceted and increasing. Quality of life for aquatic organisms and people is threatened when:

- Ailing watersheds deliver water to reservoirs at the wrong time and in the wrong amounts.
- Bad watershed management practices accumulate *unnatural* nutrient loads and sediments in reservoirs and downstream waters.
- Human actions result in the spread of invasive aquatic species throughout reservoir systems.
- Timing and quantities of downstream flows are disconnected from the needs of downstream human and aquatic communities.
- Reservoirs age, fish habitat structures disappear, and prey availability declines.
- Human development erodes or directly destroys riparian and nearshore aquatic habitat along reservoir shorelines.
- Waters warm due to the effects of climate change, which has the ability to change fish species composition and alter aquatic communities.
- Ecological functions essential to aquatic life and its habitat falter under the cumulative burden of all of these transformations.

The RFHP is a unified and collaborative response to the governance barriers and environmental challenges that threaten the quality of our lives. Collectively, these threats are systemic, affecting every impounded river and associated watershed in the nation, from the coastal and piedmont region of the south to the prairies of the Midwest to the Rocky Mountains and intermountain West to the far western Pacific ranges and valleys to the distant landmasses in Alaska and the Pacific Islands. Our partnership is, by necessity, national in scope and will be active wherever there are willing partners. It embraces the commonalities that unite reservoirs nationwide – from physically similar systems to shared environmental threats and habitat issues to the pressing challenges presented by complex and overlapping jurisdictions, varied and impassioned human uses, and national security and public policy themes. All of these factors bind U.S. reservoirs together as a single natural resource of great national importance.

Although our partnership is national in scope, cutting across the human-made boundaries that divide our nation into political jurisdictions, natural boundaries exist that are critical to structuring our partnership, determining who we are, what we do, and how we do it. Watershed boundaries are pre-eminent in our conservation strategy. Our immediate target is the health of reservoirs and associated fisheries, but our long-term focus is on the health of the waters that feed, reside in, and flow from those impoundments. We will address both by collecting management information on reservoir systems and developing improved management practices based upon it.

Reservoir health is a direct reflection of the health of the watershed in which it is located. We know that we can best protect, restore, and enhance fish and aquatic communities when our habitat conservation strategies and actions contribute to the ecological integrity and function of the watersheds in which our reservoirs reside. Structurally-intact and well-functioning watersheds yield cascading benefits, from healthier reservoirs to healthy fish habitat to a healthful day of fishing – a facet among many to the quality of life we seek as a nation.

Partnership boundaries are also vital to our purpose. They may be small or large, focused on a species or a geographic area. However constituted, they demarcate the places where those partnerships practice their conservation. For the RFHP this is critical: to achieve our reservoir-based mission we must work with other partnerships in the places where they work. Their boundaries create opportunities for us – *opportunities to work collaboratively with them in their areas of operation and expertise to implement fish habitat conservation that coincides with our strategic reservoir priorities.*

As a national entity, we can fill a unique niche. Operating across all States, and functioning as a system-based rather than geographic-rooted Fish Habitat Partnership of the NFHAP, we are well positioned to:

- Identify national and regional reservoir conservation priorities and support the reservoir priorities of other partnerships;
- Network and connect people, ideas, and technologies to enhance the science and practice of reservoir and fisheries management;
- Collect, refine, and process information for reservoir and fisheries management;
- Tap new sources of funding for strategic reservoir protection, restoration and enhancement;
- Work collaboratively with all participating partners to support the continued development of reservoir habitat protection/restoration programs, including (1) the incorporation of reservoir conservation issues and priorities into those plans and (2) the identification of Regional Priority Reservoir Habitat Impairments;
- Guide and influence public opinion and public policy on the importance of *healthy reservoir systems* to quality of life, national security, and human welfare.

Where our role ends, however, is with the implementation of on-the-ground fish habitat conservation at the reservoir level. Our mission is to catalyze and enable strategic fish habitat conservation by addressing priority reservoir habitat impairments. To make this happen, we adopt a "bottom-up" approach; we select and implement conservation projects by supporting local, hands-on efforts to protect, restore and enhance key fish habitats. In coordination with our partners – whether members of the RFHP, State Fish and Wildlife Management Agencies, other Fish Habitat Partnerships of the NFHAP, or unaffiliated local, State or regional groups – we will identify potential projects consistent with our goals, assess them by scientifically-based and transparent scoring criteria, and fund them if they are selected. We will support them, too, with information networks, conservation guidance, databases, technological assistance, and landscape-level coordination among critical jurisdictions and ownerships. We will also evaluate our actions on a regular basis to ensure consistency with the National Fish Habitat Partnership and the Science and Data *Framework for Assessing the Nation's Fish Habitat*, and to continually improve our conservation efforts.

Our reliance on natural systems and place-based partnerships to structure and implement the RFHP underscores our commitment to the science-based, cooperative, and landscape-scale conservation approach of NFHP. We occupy an essential niche in the NFHP structure and its predominantly geographic based-partnerships: we address a structural component of aquatic systems that impacts every Fish Habitat Partnership and for which there is often a need for tools, technologies and skills to address reservoir-related issues. This puts us in the position to help other partnerships at the points where our reservoir and fisheries' interests intersect their interests.

We have the unique opportunity to learn how the processes detailed in the NFHP plan and framework are affected by reservoirs and how best to develop management strategies to reduce reservoir-related impairments. We will work closely with and continually support the efforts of the National Fish Habitat Assessment and the NFHP Science and Data Committee in matters concerning reservoir systems. We will support, not supplant, the decisive role of place-based partnerships in delivering conservation within reservoir systems, whether to target reservoir-issues head-on or to address them as intermediate steps to another fisheries goal. It is at the intersection of our interests and those of other partnerships – where threats to aquatic systems and the fisheries they sustain are often most acute – that the reservoir specific data, practices, and technologies that we offer are most needed.

Reservoir Challenges to Fish Habitat

The Conservation Challenge

Science-based conservation of reservoir systems for the health of fish habitat is the primary goal of the RFHP. Reservoirs are human modifications of watershed systems resulting from the damming or impounding of a free-flowing stream or river, and are designed to deliver water, navigation, hydro-power, flood risk reduction, and other services to communities. These impoundments alter and transform natural streams or river systems, affecting (even eliminating) resident populations of aquatic species and the ecological functions and habitat upon which those populations depend (IUCN, 1997). In time, reservoir functions are affected by land uses in the watershed that affect, in turn, water quantity and quality.

These cumulative impairments – whether caused by reservoirs or evidenced in their health and the health of their watersheds – must be properly measured and addressed to protect, restore, and enhance habitat for fish and other aquatic species. In some cases, the best course of action is to remove reservoirs from watershed systems, especially when science and social opinions concur. In most other cases, removal of reservoirs is not an option; they are, in effect, virtually permanent, *naturalized components* of their watersheds, and the impairments associated with them must be addressed both within and beyond their spatial boundaries.

Most reservoirs are built for one or more of four primary uses: hydropower, flood risk reduction, irrigation water, or as a drinking-water resource. Once constructed, these water bodies are also used for wildlife and fisheries habitat, aquaculture, recreation, transportation, land development, and to provide aesthetic values for people. Research suggests that reservoirs also function as sites for carbon sequestration (Dean and Gorham, 1998; Einsele and others, 2001) and, if properly managed, can be used to offset local and even regional carbon emissions, reducing the carbon footprint of the communities surrounding them. Traditionally, the four primary reservoir uses and their management take precedent over secondary and competing uses, constraining other conservation objectives – including fish habitat conservation. As a result, management of fisheries habitat in reservoirs is challenged: it must be pursued and optimized consistent with delivery of the primary uses. A greater knowledge of the true value of reservoir fisheries may, in time, alter the balance of uses.

Why Reservoirs Are Important

Water that is stored in reservoirs and regulated by dams provides a number of essential benefits to society, including water supply (agricultural and domestic), navigation, hydroelectric power production, flood risk reduction, outdoor recreation, sport fishing, tourism, fish and wildlife habitat, and an aesthetically pleasing setting. Water from reservoirs is used to improve crop yields, provide drinking water, generate renewable and environmentally clean energy, and offer drought and flood mitigation. These reservoir services help sustain our economy and our civilization.

For example, reservoirs enhance the economic growth of both local and regional communities that lie adjacent to them or in their general proximity. The population growth and quality of life in northwest Arkansas, home of WalMart, Tyson Foods, and other major industries, would not be the same without the attraction and benefits of Beaver Lake, a U.S. Army Corps of Engineers hydroelectric power generation, flood-risk-reduction, and water-supply reservoir. The same is true for the communities between and including Branson and Springfield, Missouri. There, Table Rock Lake - the reservoir immediately downstream from Beaver Lake – adds enormously to the livability and attractiveness of those towns and cities. Elsewhere, the same story is repeated: reservoirs enrich the quality of life for many Americans across the nation.

Why Reservoirs Cannot Be Ignored

Sportfishing alone brings in billions of dollars per year into the U.S. economy. The American Sportfishing Association analyzed the economic effect of reservoirs in 2006 (American Sportfishing Association, 2008) and found that America's nearly 40 million anglers spent over $45 billion per year on fishing equipment, transportation, lodging, and other expenses, much of it directly attributable to reservoirs. These expenditures, in turn, generated $125 billion annually for the national economy and supported over 1 million jobs – jobs that generated $34 billion in yearly wages and $16 billion in annual taxes. Of fishing's total economic impact, about 70 percent is attributable to freshwater activities (not including the Great Lakes), and of that percentage the majority is attributable to reservoir sportfishing. Significantly, almost $1.2 billion of annual sportfishing revenue has been reinvested into aquatic conservation and protection programs in recent years. Today, these dollars are the primary source of funding to improve fish habitat, ensure adequate public access to waterways, and provide environmental education.

Sport-fishing enthusiasts are not the only ones to benefit from reservoir-based recreation. Over 75 million Americans, including 47 million bird watchers, rely on reservoirs to provide an array of non-fishing, outdoor activities – extending from picnics to boating to trail hiking to nature photography and viewing. In their pursuit of wildlife viewing, alone, Americans spend nearly $45 billion a year, matching the expenditures of anglers – and, according to projections, likely to exceed those expenditures in the future. In many ways, reservoirs are the nation's multi-use gateways to nature and wildlife for a growing number of Americans whose exposure to the outdoors is increasingly constrained by population growth, development, and urbanization.

Economics elevates the importance of reservoirs, but it does not explain the ecological significance of reservoirs to the management of America's fisheries. As unnatural intrusions into natural streams and rivers, reservoirs transform water flows, vegetation, structure, sedimentation rates, oxygen levels, temperature stratification, and other physical and biological parameters that are essential to healthy fish habitat. As such, they affect resident fish populations, alter downstream aquatic environments and, in turn, are affected by the health of the watershed above, making them indisputable features of the human and natural landscape. Reservoirs shape and are shaped by the respective watershed in which each of them exists.

Ailing reservoirs usually mean ailing watersheds; causatively, the two go hand-in-hand, almost always inseparable. In contrast, a healthy reservoir – *the principle goal of this partnership* – implies a healthy watershed, the product of which is a healthy reservoir system. For our partnership, healthy reservoir systems mean (1) downstream flows are adequate to sustain below-dam native and naturalized flora and fauna; (2) watersheds above the reservoir yield flows and water-borne materials (e.g., sediments and woody debris) that are appropriate in timing, quantity, and quality to sustain fish and other aquatic communities; and (3) aquatic habitat within the impoundment supports rich and diverse aquatic communities. Reservoirs are the metaphorical canary in the labyrinth of waterways that comprise reservoir systems; they can be ignored only at great peril to the nation's freshwater fish and other aquatic life.

Reservoir Management Constraints

As noted above, most reservoirs are built for one or more of four primary uses: generation of power, flood risk reduction, irrigation water, or as a drinking water resource. There are, of course, secondary benefits and uses linked to reservoirs, some of which are purposeful and others incidental. Reservoirs can provide wildlife and fisheries habitat, aesthetic values and experiences, and opportunities for aquaculture, recreation, transportation, and land development. As is often the case, these secondary benefits and uses may exceed the economic and social value of the primary uses to which the reservoir was originally dedicated. This can be a divisive issue within local and regional communities when demographic changes

result in new and discordant perspectives on what uses and benefits reservoirs should prioritize and deliver. Despite shifts in values and perspectives toward secondary benefits and uses, most reservoirs continue to be managed and operated based on their designated primary uses, and the constraints those primary uses impose on secondary products. This imbalance between uses impinges upon our conservation options; it must be addressed. This is the ultimate challenge our partnership faces as it moves forward to conserve fish habitat in reservoirs: we must achieve our mission within the constraints set by the governing purpose of each reservoir.

Reservoir Challenges and Issues

When a river is impounded, the river valley becomes submerged beneath the surface of the reservoir pool. Nutrients and organic matter in the soil and from the decomposition of pre-existing terrestrial vegetation provide an abundant energy source for primary production (Kimmel and Groeger, 1986). This energy moves through the food chain allowing for rapid and luxuriant growth of phyto- and zooplankton and benthic invertebrates, the food source of prey species, which in turn become the food source for piscivorous fish. The submerged trees and shrubs and other landscape features provide habitat for spawning and protection from predators for eggs and larval fish. This classic habitat progression that follows impoundment is called the "trophic upsurge." After five to twenty years, the initial biomass and production of fish declines in what is called the "trophic decline." Much of the original habitat structure decomposes and is eliminated, or it is covered up with silt and sediments. The reservoir eventually reaches an equilibrium level of low productivity and limited success for sport fishing.

Reservoirs face many challenges pertaining to healthy fish habitat. These challenges can be grouped into six habitat impairment categories, each of which corresponds to habitat improvement objectives addressed in the RFHP conservation strategy and ecosystem processes detailed in the NFHP Science and Data Committee *Framework for Assessing the Nation's Fish Habitat.*

- Riparian, Shoreline, and Littoral Zone Hydrologic Conditions (Material Recruitment, Hydrology, and Bottom Form in the NFHP framework document). Water levels in reservoirs often fluctuate significantly in frequency and can vary widely in height – the outcome of weather extremes, irrigation schedules, watershed condition, and power generation. Regardless of the cause, fluctuating water levels affect the spatial positions, temporal extent, and function of the wetted riparian, shoreline, and littoral zones. In the shallow littoral zone, gravel beds occur in the top few meters where wave action keeps the bottom free of silt. Persistent drawdown below this level minimizes vegetation and alters bottom structure. Soil type, wave action, shoreline erosion, and high turbidity further impact littoral zone plant and bottom substrate. Less vegetation and altered bottom substrate reduces spawning habitat (and spawning success) for nest building fish or any fish in which the eggs attach to a particular substrate (O'Brien, 1990). Increasing water levels in the spring through watershed restoration or reservoir pool management may improve spawning success by inundating gravel areas and terrestrial vegetation. Degradation of riparian and shoreline habitat caused by persistent water fluctuations is incremental and cumulative (Jennings et al., 1999). Loss of riparian buffer strips and associated erosion of shoreline zones impact vegetation and other physical structure, diminishing spawning habitat and nursery and feeding areas and increasing the vulnerability of larval fish – highly dependent on vegetation for protective cover – to predators (O'Brien, 1990). Poor development or loss of riparian zones, and diminishment of the functional role they would otherwise play in filtering runoff water, may also lead to turbidity and nutrient levels above that expected if natural process were intact in reservoirs. This, in turn, may further prevent establishment of macrophytes, causing a shift toward algal-based primary production. Severe water fluctuations also impact angler access, habitat connectivity, downstream flow, and other key habitat issues.
- Watershed Connectivity. Irregular water level fluctuations affect the hydrologic connectivity reservoirs have with their watersheds, impacting (1) resident and fluvial reservoir fish populations and (2) diadromous and fluvial populations in impounded rivers. The life history of many reservoir fish species requires access to backwater areas and other littoral habitats, as well as upstream and

downstream rivers and streams. For some species, these areas are critical to spawning and recruitment. Reservoir system operations related to flood risk reduction, water supply, and hydropower generation can impact availability of these key habitats. Sometimes, multiple reservoirs are located on a major river system, forming a chain or cascade of reservoirs. Under these circumstances, watershed connectivity is almost totally absent in downstream reservoirs where inflows are controlled by upstream dams. These controlled flows, in turn, create substantial barriers to fish passage and can severely impact loading of materials such as sediment, nutrients, and organic matter. Reductions in these functions impact the energy flow and food web of the receiving reservoir (Ward and Stanford, 1983), further impacting fish habitat. Other fish passage barriers such as low head dams, concrete channels, and poorly designed culverts further fragment these systems, reducing available habitat. Additionally, the thermal regime of the inflow will be altered if in close proximity to the upstream bottom-release reservoir. No less important, human activities and land uses within the watershed can accelerate erosion, and result in sedimentation that creates further barriers to fish passage.

- Water Quality. The health of a reservoir system is strongly influenced by the quality of water that enters and flows through it. Land use practices, point and non-point source pollution, nutrient loading, internal reservoir processes and dam releases all influence water quality in a reservoir system. Water temperature and dissolved oxygen dynamics in reservoirs follow patterns similar to those in natural lakes as described in the limnology texts, but differ in many aspects as a result of the retention times and chemical release dynamics of each unique reservoir system (Cole and Hannan, 1990). Turbidity and nutrient levels can impact the volume of hypoxic water in a reservoir which, in turn, limits the habitat available to fish. These same parameters can also influence the type and amount of aquatic macrophytes present in the reservoir system as well as the degree of impact of nuisance plant species. Point and non-point source pollution, and the pathogens contained within, can lead to fish and human health advisories. Nutrient enrichment can also produce toxic or harmful algal blooms that detract from the economic and social benefits that reservoir systems provide. However, when considering fish habitat, it is important to note that reducing nutrient inputs below historical levels can lead to trophic decline – a depression in the reservoir feeding base and a subsequent reduction in fish production (Ney, 1996; Maceina and Bayne, 2001). Maintaining systems within the bounds of their natural variations is critical (NFHP framework document).

Dam operations impact water quality upstream and downstream. Bottom release withdrawal at the dam accelerates the development of the anoxic zone in the hypolimnion, by influencing water temperature and the volume of the hypolimnion (the more rapidly that water is discharged downstream, the greater is the anoxic zone near the dam). The cold, oxygenated water that is mined out of the hypolimnion is replaced by warmer, less oxygenated water from above. All of this will determine the size and extent of the thermal refuge in the reservoir upstream of the dam during and throughout the stratification season. Dam operations will also affect habitat conditions downstream in the tailwater because of changes in temperature, dissolved oxygen, and flow regimes, all influencing fish and invertebrate assemblages.

- Sediment Inputs (Material Recruitment in the NFHP framework document). Longitudinal connectivity in river systems is disrupted by transformation of rivers into reservoir cascades (Ward and Stanford, 1983; Miranda et al., 2008). As a result, natural sediment flows are disrupted both in the river system and in each reservoir sub-system. In many cases, sediments may be trapped in the upper reservoir and not distributed naturally downstream, leading to a loss of habitat or creating sediment hungry systems that degrade the bed elevations of tailwater areas. Sediment deficits typically contribute to incision, downcutting, armoring, and narrowing of channels in areas downstream from dams. Accelerated sediment yields resulting from watershed land use practices not only lead to excessive sedimentation in the upper reservoir, but can alter water flows in reservoir tributaries. Such sediments often carry with them nutrients, pathogens, metals, and other inorganic and organic contaminants impacting the water quality of the receiving reservoir.
- Physical Habitat (Bottom Form and Living Habitat in the NFHP framework document). Physical habitat may include gravel/boulder substrates, submergent or emergent aquatic vegetation, large

woody debris or other forms of structural habitat, all of which are critical to some aspect of a fish species' life history. Preferred habitat types will vary among species, but in all cases they will play some role in spawning, recruitment, feeding, staging, and other activities. Overall, physical habitat can help reduce near shore erosion and sedimentation, and provide anglers with essential fishing structure. Many southern reservoirs are lacking complex physical habitat due to basin clearing during construction (Jenkins, 1970). Other reservoirs may be lacking this type of habitat due to residential development in the riparian zone (Barwick, 2004). Ultimately, as reservoirs age, some forms of physical habitat will degrade while others may proliferate (e.g., native and/or invasive aquatic vegetation).

- Nuisance Species (Food Webs and Energy Flows in the NFHP framework document). The presence of invasive nuisance species can negatively impact reservoir ecosystems, degrade reservoir infrastructure and present other problems to reservoir managers. When nuisance species become prevalent in a reservoir, the native species tend to suffer. In the case of fish and other aquatic organisms, the nuisance species may displace native and naturalized species through predation, competition, or their ability to tolerate greater variations in reservoir conditions, often caused by existing reservoir system habitat issues. Nuisance aquatic plant species may displace native species through crowding and shading. Dense populations of nuisance aquatic macrophytes can provide greater protection, and therefore survivorship, of prey species, reducing sport fish production (O'Brien, 1990). Nuisance aquatic and riparian species not only pose a threat to native species, but they may reduce the recreational quality of a reservoir system and affect downstream resources. Quagga and zebra mussels, for example, broadly impact dam functions, including power and water delivery. This, in turn, can impact recreation through boating and other reservoir-use restrictions.

Importance of Healthy Reservoirs

Renewable water resources are becoming increasingly valuable as human population continues to increase and shifts to concentrated urban and metropolitan areas. In 2007, the world population moved from a rural to an urban majority. The U.S. Census Bureau projects that world population will grow from 6.1 billion in 2000 to 9.4 billion by 2050 – a 50 percent increase. The demand for abundant, clean water will accelerate in tandem with population growth and urban demands. As a result, the need for large and sustainable potable water-supply sources will continue to grow, stressing our existing multi-purpose reservoir systems, and prompting either the development of new reservoirs or inter-basin transfer of water from one reservoir to another. Water stored in reservoirs will increasingly be the primary source to supply and meet mounting human demands, while satisfying the habitat needs of fish and other aquatic organisms. Given the financial and environmental costs of constructing new reservoirs, it is particularly critical that our existing reservoirs and their supplying watersheds remain healthy, and that those impoundments remain clean and at full capacity to sustain multiple and often conflicting purposes.

Additionally, as population centers become more concentrated around reservoirs and more dependent on them for their water-supply, recreation, and leisure benefits, proper management of these reservoirs and their watersheds will be critical to not only sustain these benefits but to meet downstream resource needs, including healthy habitat for fish and other aquatic organisms. Inter-basin transfer of water between reservoirs will be required to deliver water to areas of greatest need. Mixing waters of different qualities and contents will have its problems, including the transfer of exotic species, pathogens and viruses, contaminants, and other physical and biotic components. Maintaining healthy reservoirs and properly functioning watersheds is critical today; but it will become even more important as a *social priority* in the future, one with broad economic and ecological ramifications.

Climate Change

Climate change models predict an increase in average global air temperature causing wider swings in regional air temperatures and mild to dramatic variations in precipitation amounts and long-term rainfall trends (Bates et al., 2008). Excessive precipitation in some areas of the U.S. is expected to amplify the

intensity and frequency of flooding. Enlarging reservoir storage capacities, creating new reservoirs, or making room for floodwaters in reservoirs are a few of the ways in which reservoirs will become tremendously important. In other areas of the country, winters will become warmer, shorter, and produce less snow influencing the amount and timing of reservoir water storage. Excessive heatwaves and prolonged droughts will also exhaust water storage at an accelerated rate. Better planning, use, and conservation of stored water (for irrigation, hydropower, municipal, etc.) will help reduce the vulnerability of reservoirs and their fisheries' to climate change.

Reservoirs can combat some of the effects of climate extremes through their capacity to store usable water and ability to diminish flood risks (DHI, 2016). Additionally, deep-water releases from dams become increasingly valuable by maintaining coldwater relief to downstream fish communities (Cummings et al. 2013). Reservoirs also become repositories of greenhouse gases (Dean and Gorham, 1998; Einsele et al., 2001) where large amounts of carbon dioxide can be removed from the atmosphere and fixed by reservoir phytoplankton and littoral vegetation. Upon decomposition of organic matter, carbon dioxide and methane become trapped in the sediments (Palau and Alonso, 2008).

Habitat degradation resulting from climate change affects is expected to negatively influence aquatic life, recreational fishing, and other water-based recreational activities (Jones et al., 2013; NWF, 2013; Boyer et al., 2017). Climate change impacts, therefore, will further challenge fisheries management in multiple-use reservoirs (NWF, 2013; DHI, 2016) and with fish species occupying the edge of their tolerance ranges (NWF, 2013). Critical changes are likely to occur with the physical and chemical make-up of reservoirs resulting in larger and more frequent water level fluctuations, warmer water temperatures, higher nutrient loading, higher trophic state, stronger stratification, and greater turbidity among other diminished environmental conditions. This may require shifting water management strategies to accommodate for the habitat needs of a different aquatic community. For example, with an expected warming trend, reservoirs that have historically maintained coldwater species (e.g., salmonids) may begin to experience their decline due to water conditions that are more suitable for supporting either cool- or warmwater fish assemblages (see NWF, 2013). Moreover, coolwater and warmwater species are typically reliant on in-reservoir spawning and rearing habitats, hence managing for specific water regimes are essential in maintaining connectivity to these habitats (Miranda, 2017). Aquatic invasive species also have immense abilities to expand rapidly, dominate in unoccupied habitats, and displace other organisms and, therefore, prevention, early detection, elimination, and containment become extremely important for protecting an existing fish community, fish habitat, recreational access, or other public uses in reservoirs (Magnuson, 2007; Burgiel and Muir, 2010; NWF, 2013).

One of the critical impacts predicted in reservoirs from climate change is the degradation of water quality towards eutrophication, which is related to increased warming, reservoir location in the basin, lower water levels, or greater input of nutrients/organic matter (Vincent, 2009; DHI, 2016; Hayes et al. 2017). With this, there will be even larger contributions of greenhouse gas emissions resulting from the decomposition of large amounts of autochthonous and allochthonous organic matter into carbon dioxide and methane that become readily available under anaerobic conditions (Palau and Alonso, 2008; Vincent, 2009). Positive management actions can include hypolimnetic aeration promoting mixing and the elimination of oxygen-depleted strata or through the eradication of benthivorous fishes such as common carp to prevent disturbing the bottom (see Hayes et al. 2017). Intensified flooding or watershed runoff events are expected to increase the influx of organic matter and nutrients as well. These additions will contribute more to the store of carbon dioxide, methane, and nitrous oxide in reservoirs (see Palau and Alonso, 2008; Vincent, 2009, Adamczyk and Shurin, 2015). Proper watershed management can protect vulnerable upland habitats affected by heavy or prolonged rain events (DHI, 2016) and reduce loading of nutrients, organic matter, and other pollutants in reservoirs (see Palau and Alonso, 2008). Promoting healthier water quality, preventing eutrophication, and consciously managing water levels during times of wild climate swings will also provide a healthier environment and greater spatial habitat for fishes in reservoirs (NWF, 2013; Miranda, 2017).

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Our Reservoir Habitat Assessment

Background

The Science & Data Committee of the Reservoir Fisheries Habitat Partnership is leading efforts to gather baseline data about reservoirs nationwide, in order to assess their current conditions and to classify them quantitatively. Specific objectives of the completed study include (1) identify and compile relevant habitat impairment metrics; and (2) develop a science-based reservoir classification system that is based on impairment but integrates environmental descriptors. Both objectives were met and completed.

In order to prioritize projects using a scientific approach, the partnership created a nationwide survey of reservoir fish habitat which could be used to classify and assess the current state of reservoirs. This assessment was based principally on an opinion survey of reservoir managers developed by Miranda and Hunt (2010)[1]. The survey was expanded by the RFHP Science and Data Subcommittee and applied to reservoirs in eight states. Experience gained during these two surveys was used to expand and focus the completed assessment. Expansion of the survey focused on (1) increasing the number of questions to improve definition of impairment factors, (2) include recognition of impairment caused by the reservoirs in upstream tributaries and the river below the dam, and (3) improve standardization of responses to facilitate comparison across geographic scales. In May 2010, a graduate project (Rebecca M. Krogman, M.S.[2]) was initiated at Mississippi State University to spearhead the survey under the advisement of Dr. Leandro E. Miranda. An online fish habitat survey was designed to survey all public reservoirs with a surface area greater than or equal to 100 hectares (250 acres). The survey included questions regarding fish habitat, the fish community, and the recreational fishery. The link for the online survey was distributed between June and December 2010 to state natural resource agency fish biologists responsible for managing fish in reservoirs. Almost 1,600 responses were received; of those, 1,302 matched the study scope and were complete enough for data analysis.

Classification

Reservoirs were classified using a multi-step approach. First, broad-scale similarities in fish habitat impairment were examined, and a spatial framework was selected which reflected the greatest differences in reservoir habitat impairment among geographical regions. The EPA Wadeable Streams Assessment framework was selected because it best encompassed major regional differences in habitat impairments and was the regional breakout used by NFHP's Science and Data Committee for the national assessment. Second, habitat impairment patterns within regions were investigated using cluster analysis to identify relevant reservoir classes; this process yielded 24 clusters or classes distributed throughout the nine WSA regions (Figure 1). Each region reflects a separate geographical section in the U.S., and each class within a section is defined by a unique ensemble of habitat impairments. Each class had a unique set of habitat impairment issues and varied in terms of fish community and recreational fishery characteristics. Furthermore, classes differed in terms of reservoir morphology and watershed characteristics. The system is hierarchical in that the classes are organized by region. Finally, a method for classifying new reservoirs not included in the original sample was developed. A classification tree, which could be used with any new survey responses, yielded overall classification accuracy of 75%. This classification provides a large-scale understanding of the factors afflicting reservoir habitat in the U.S., and may help guide research, management, and allocation of resources. Potentially, the broader vision obtained through a large-scale spatial classification can generate hypotheses and management strategies to be tested at smaller scales or single reservoirs.

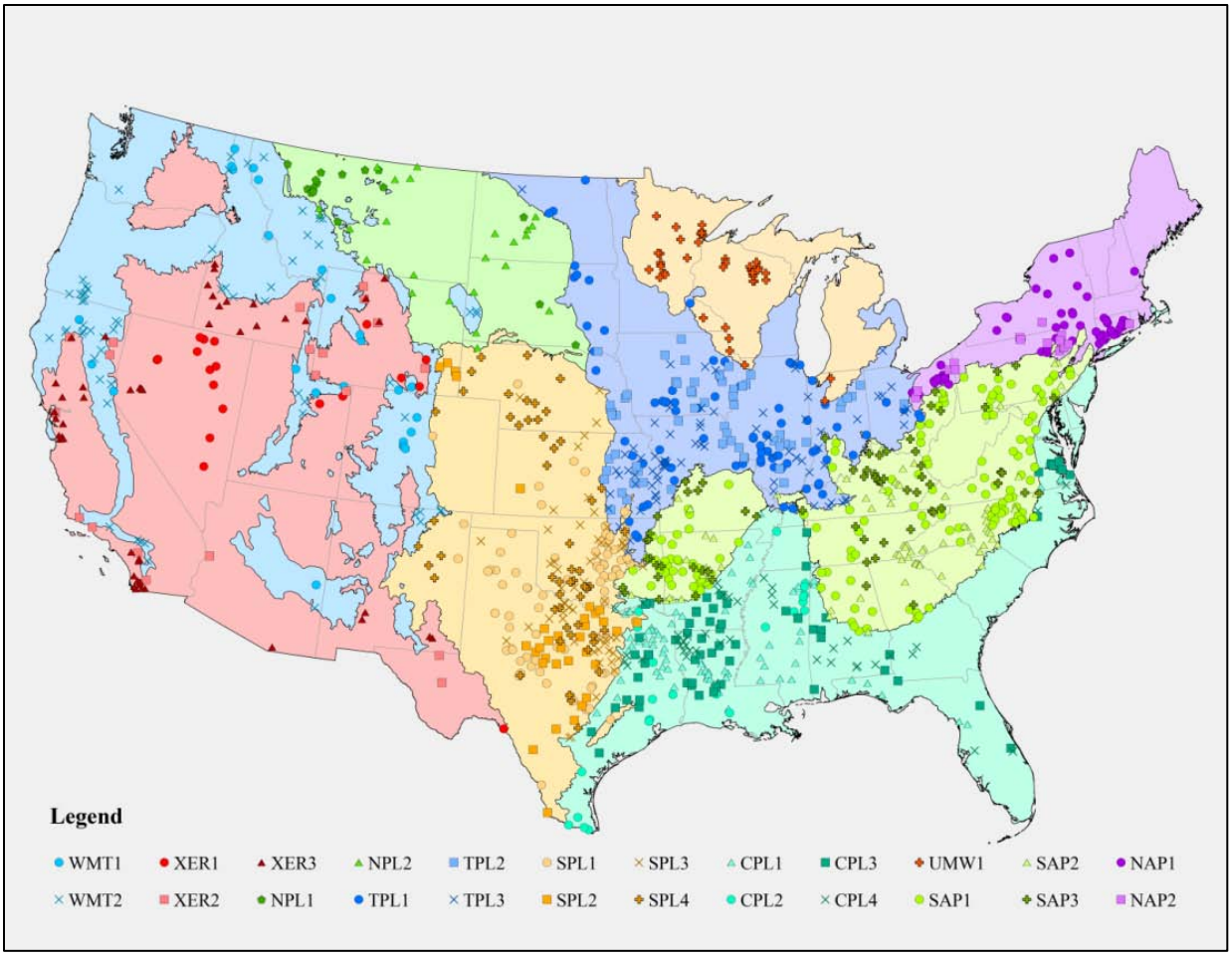


Figure 1. Reservoir classes representing different suites of fish habitat impairment, distributed among nine geographic regions.

Although efforts at reservoir classification have been made in the past, our classification system is the first to directly address fish habitat impairments for the purpose of enhancing large-scale conservation planning. It is applicable to large reservoirs≥100 ha in the conterminous U.S. It should be used early in the conservation planning process to facilitate assessment of project reservoirs. Membership in a reservoir class can help pinpoint major habitat impairments, indicate potential for additional impairments, and identify management strategies that target impairments directly. For example, classification of a reservoir into a class wrought by siltation-related impairments may indicate the long-term need for watershed planning and collaboration with land-use agencies, as well as pointing to in-lake sediment removal strategies. In contrast, a class less prone to siltation but lacking in substrate diversity for other reasons may benefit long-term by installation of gravel beds or other bottom structures.

Index of Reservoir Habitat Impairment (IRHI)

With a classification system in place which recognizes inherently different reservoir groups, an assessment system could be created. Using responses to reservoir fish habitat surveys, latent structure analysis was applied to reduce the numerous habitat variables to major habitat impairment constructs. This yielded twelve constructs which explained 61.4% of variation in the dataset (**Table 1**). An index of reservoir habitat impairment (IRHI) was created using methods similar to Miranda and Hunt (2010), wherein constructs representing major habitat impairments were added to create a simple composite index.

Table 1. Constructs representing major reservoir habitat impairments, based on a nationwide reservoir fish habitat survey.

Construct	Description
Point source pollution (C1)	Characterizes reservoirs with point source pollutants stemming from watershed activities, thermal inputs, and contaminants
Nonpoint source pollution (C2)	Characterizes reservoirs with nonpoint source pollutants, especially nutrients, stemming from watershed activities
Excessive nutrient inputs (C3)	Characterizes reservoirs with excessive nutrient inputs
Low dissolved oxygen (C4)	Characterizes reservoirs with insufficient oxygen levels
Siltation (C5)	Characterizes reservoirs with siltation, high turbidity, and resultant loss of habitat
Oligotrophication (C6)	Characterizes reservoirs with a lack of sufficient nutrient inputs
Mudflats and shallowness(C7)	Characterizes reservoirs which are excessively shallow including in the littoral zone, as well as extensive mudflats
Insufficient connectivity to adjacent habitats(C8)	Characterizes reservoirs with a lack or loss of connectivity to adjacent habitats, including backwaters and tributaries
Insufficient structural habitat diversity (C9)	Characterizes reservoirs with insufficient physical structure
Colonial species (C10)	Characterizes reservoirs with aggressively expanding plant or animal species
Frequent water fluctuations (C11)	Characterizes reservoirs with frequent or poorly-timed fluctuations
Extreme water fluctuations (C12)	Characterizes reservoirs with high or long-duration water level fluctuations

The IRHI reflected a variety of fish habitat impairments in reservoirs nationwide, with impairments changing spatially across wide geographic ranges in their relative importance (**Figure** 2). Certain impairments were widespread, affecting all or nearly all reservoir classes, and were often associated with inputs from upstream watersheds (e.g., sedimentation and non-point source pollution). Reservoirs receive relatively greater inputs from their watersheds than natural lakes, and many reservoirs have much larger ratios of watershed area to surface area due to their location and construction purpose. Accordingly, nutrient and sediment loading into reservoirs contribute directly to siltation, eutrophication, high turbidity, and loss of habitat diversity due to sediment deposition. In addition, high turbidity related to suspended sediments and phytoplankton production inhibits photosynthesis of submerged macrophytes, resulting in a lack of macrophyte structure.

IRHI scores are not used in the Project Selection Criteria because the IRHI is a composite score of all impairments, serving only as an indicator of the relative habitat condition of a reservoir. RFHP feels that project objectives need to be focused on individual impairments due to a variety of factors, the most important of which is cost. Consequently, proposal ranking is focused on priority regional impairments. However, addressing individual impairments should lower the overall IRHI score. Future iterations of the survey (~10-year intervals) will analyze changes in IRHI scores of NFHP-funded projects.

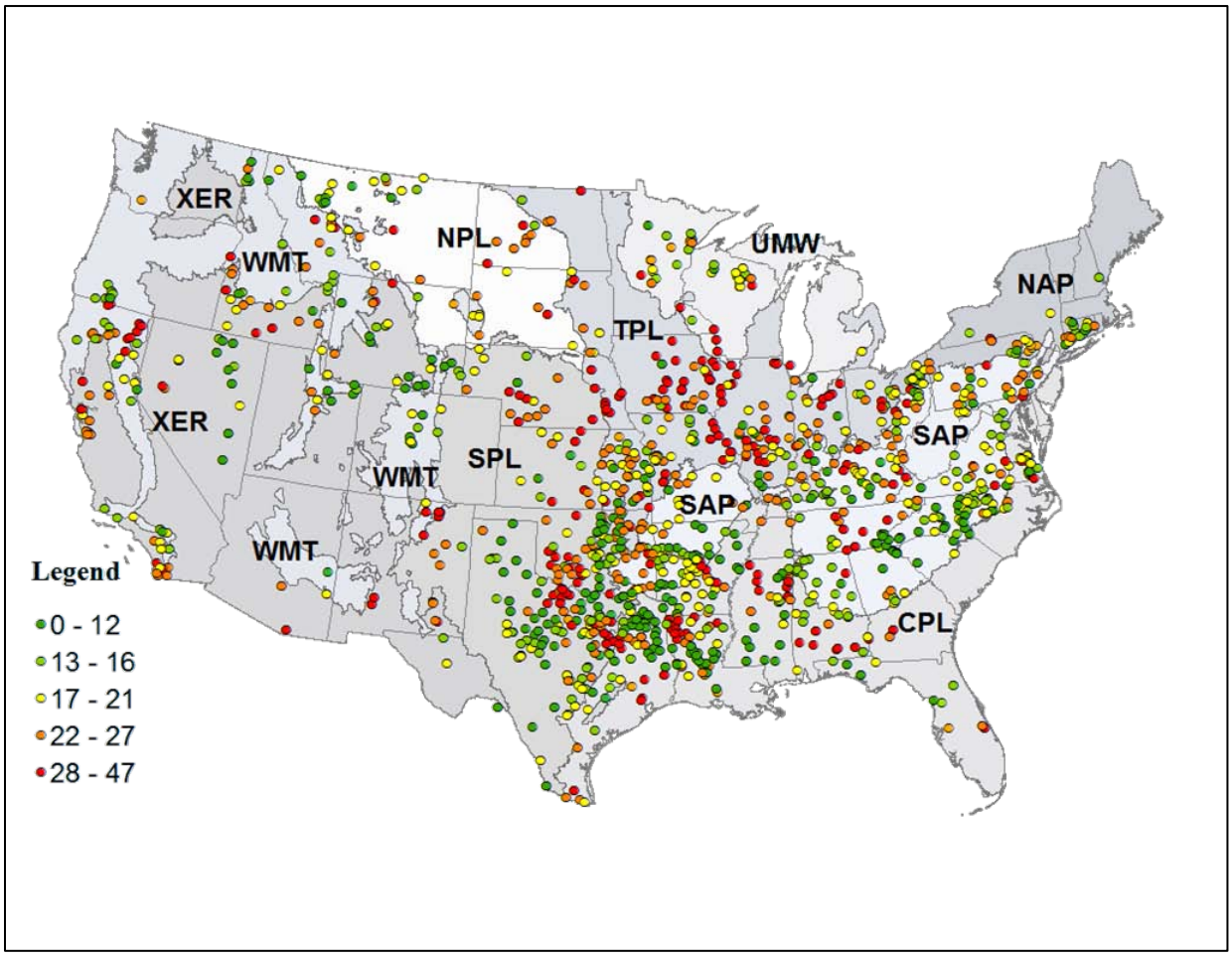


Figure 2. IRHI scores for 1,302 large U.S. reservoirs.

RFHP has been consolidating data by reservoir, state and region to be placed on the web and shared with partners. This work is on-going. Data gaps in the habitat impairment survey (largely related to low participation in certain regions [Xeric, Western Mountains, Upper Midwest and Northern Appalachians]) have been identified. Efforts are being made to expand the number of reservoir systems in these areas and new information is continually added to the database and reanalyzed. The regional priority impairments have been updated since the first analysis and new information is included in RFHP's updated Project Selection Criteria. Regional priority impairments were used for the first time to prioritize project proposals for the FY2014 funding cycle and proposals addressing the priority impairments receive higher scores in the ranking system.

Priority Fish Species

The same nationwide survey of large reservoirs ≥ 250 acres yielded 1,250 responses which included fishery species information. For each reservoir surveyed, the first-, second- and third-most important recreational fish species were identified. These rankings were combined using the following formula:

$$R_j = \text{Relative popularity}_j = \frac{\sum_{r=1}^{3} \frac{n_{rj}}{r}}{\sum_{i=1}^{k} \sum_{r=1}^{3} \frac{n_{ri}}{r}}$$

where:

$i =$ species in the recreational fishery, numbered from 1 to k
$j =$ focal species for which score is being calculated
$k =$ number of fish species considered
$r =$ rank of species j in the reservoir's recreational fishery
$n_{ri} =$ number of reservoirs with rank r for species i
$n_{rj} =$ number of reservoirs with rank r for focal species j

In this survey rank r ranges from 1 to 3 because survey respondents identified only the first, second, and third most important recreational species in each reservoir. The index range differs based on the ranges of input variables and yields a relative value meaningful to the n_{ri} locations and k species considered.

The following tables show a ranking of fish species by relative importance within each region. Again, the value of R_j is only meaningful relative to the locations considered; that is, the values of R_j within each WSA region can be compared to create a ranked list of priority species. The values of R_j should not be compared *between* WSA regions.

Table 2. Priority species by region as established by the Reservoir Fisheries Habitat Partnership's national assessment.

Coastal Plains	Southern Plains	Temperate Plains	Southern Appalachians	Northern Appalachians	Northern Plains	Upper Midwest	Xeric	Western Mts.
Largemouth Bass	Largemouth bass	Largemouth bass	Largemouth bass	Largemouth bass	Walleye	Walleye	Largemouth bass	Trout spp.
Crappie spp.	Catfish spp.	Catfish spp.	Crappie spp.	Smallmouth bass	Trout spp.	Crappie spp.	Trout spp.	Largemouth bass
Catfish spp.	Walleye	Crappie spp.	Catfish spp.	Walleye	Esox spp.	Sunfish spp.	Catfish spp.	Smallmouth bass
Sunfish spp.	Crappie spp.	Sunfish spp.	Walleye	Crappie spp.	Smallmouth bass	Smallmouth bass	Walleye	Crappie spp.
Spotted bass	Morone spp.	Walleye	Sunfish spp.	Sunfish spp.	Crappie spp.	Largemouth bass	Smallmouth bass	Yellow Perch
Morone spp.	Sunfish spp.	Morone spp.	Smallmouth bass	Trout spp.	Largemouth bass	Esox spp.	Sunfish spp.	Catfish spp.

Reservoir Metric Database

Many descriptors (measures) of surface-water reservoir basin features including physical, chemical, morphological, physiographic, hydrologic, and landscape characteristics are available that are likely to be related to reservoir eutrophication and impairment, reservoir fish habitat degradation, and invasive aquatic plant habitat infestation. USGS (Arkansas Water Science Center) was funded by FWS through the Reservoir Fisheries Habitat Partnership, to develop a Reservoir Metric Database (RMD) of surface-water reservoir measures and metrics for impounded water bodies greater than 250 acres across the 48 states. This database was updated in FY2015 and currently contains 114 measures and metrics for over 3,838 reservoirs across the 48 states. The use of geographical information systems (GIS), Microsoft Access and the statistical package JMP 10 aided in the RMD development. The RMD identifies reservoirs from the U.S. Army Corps of Engineers National Inventory of Dams (NID) joined with waterbodies from the USGS National Hydrography Dataset (NHD). Once the NID and the NHD were combined, they were intersected with the USGS Enhanced Riverreach File (ERF1_2). The intersecting of the ERF1_2 with the combined NID-NHD database enabled the connection of the USGS Spatially Referenced Regressions on Watershed attributes model and the completion of the RMD.

The database describes shape and form of individual reservoirs, within its watershed, as well as hydrologic measures. Information in the database can be used to estimate, for example, littoral zone size (shallow-water habitat) related to reservoir volume (index of reservoir permanence), shoreline development (measured reservoir shoreline distance relative to the circumference of a circle of the same surface area) and other metrics that can influence sediment and nutrient retention (eutrophication), fisheries habitat, invasive aquatic plant habitat infestation, and other functions and impairments. With the inclusion of watershed attributes from the various USGS major river basin SPARROW models, another 50 or more measures or characteristics related to each reservoir were included, like annualized nutrient loads and yields, sources and origins.

The RMD has been delivered to NFHP's Science and Data Committee and discussions on inclusion of this information (along with the aforementioned reservoir habitat impairment information) in the national assessment are ongoing. Our goal is to have this information incorporated into the national assessment in FY2017.

A more detailed description of the Reservoir Habitat Impairment Assessment along with a state by state breakdown of the data are housed on www.friendsofreservoirs.com/science. Copies of manuscripts developed from the Assessment can be found on the same site. The Reservoir Metric Database is housed on www.friendsofreservoirs.com/science. The RMD has been published as a U.S. Geological Survey Technical Series entitled "A reservoir morphology database for the conterminous United States"; Data Series 1062. The report was authored by Kirk D. Rodgers.

Our Partnership

RFHP leadership felt that to best meet the goal of ensuring healthy reservoir systems for future generations two separate but intricately connected organizational units were needed. The target audience of The Reservoir Fisheries Habitat Partnership, as outlined previously in this document, is the professional natural resource manager and conservationist. The focus of RFHP is the science behind reservoir habitat restoration efforts and communicating among professional resource managers how best to meet those challenges. Friends of Reservoirs is intended to be the financial and outreach arm of the RFHP. Its target audience is nonprofessional conservation and angler groups, reservoir-user groups, corporations, non-profits and policy-makers. The Mission and Vision of each entity differ to some degree and are outlined below.

Reservoir Fish Habitat Partnership

Mission

The Reservoir Fisheries Habitat Partnership is a national partnership which promotes and facilitates the conservation of habitat for fish and other aquatic species in reservoir systems through collaborative actions that contribute to:

- the ecological health and function of reservoirs and their associated waters and watersheds;
- healthy reservoir systems, critical to providing water in sufficient quantity and quality to support humans and their communities, and the aquatic life that thrives within their waters.
- the restoration, protection and enhancement of fish and other aquatic species and communities;
- the sustainability and enhancement of reservoir fisheries;
- public awareness of the conservation issues and challenges confronting reservoirs and associated waters and watershed management in the 21st Century;
- networking among professional fishery managers and Friends of Reservoirs (FOR) partners to provide best management practices, expertise, and guidance on project implementation; and
- the quality of life of the American people.

Vision

Clean water and healthy aquatic habitat in reservoirs and their connected waterways are not optional for our nation's future. Healthy reservoir systems are critical if we are to provide water in sufficient quantity and quality to support humans and their communities, and the aquatic life that thrives within their waters. *We envision a future of healthy reservoir systems that are sustained by collaborative action to benefit (1) people, their communities, and their economies and (2) fish and other aquatic species, and their communities, for future generations*. It is a future where:

- Our partnership leads in identifying and implementing, through collaborative partnerships, priority habitat projects within reservoirs and their associated waters to protect, restore, and enhance important fisheries;
- Sustainable management of reservoir systems is supported by broad public participation based on dialogue, collaboration, and consensus building;
- Partners who have not traditionally worked together in addressing reservoirs and connected lands and waters will now plan, fund, and support actions to protect aquatic habitat in those systems;
- Reservoirs are managed as part of encompassing natural systems that include both upstream and downstream flow components, and terrestrial areas impacting or influenced by those components;

- The value of healthy and sustainable reservoir systems are understood and appreciated by the millions of Americans who use them and the elected officials who determine the policies that govern them;
- Our partnership is instrumental in motivating and coalescing reservoir stakeholder groups and other conservation partnerships to support and implement actions that address priority aquatic habitat needs in reservoirs, downstream waters, and associated watersheds;
- Sustainable economic development is predominant and contributes toward the conservation of healthy reservoir systems nationwide;
- Adequate information systems and communication networks exist to support the development of best management practices and appropriate technologies to support the conservation of fish habitat in reservoir systems;
- Our partnership can scientifically contribute to informed policy decisions on the management of reservoir systems and their future modification;
- Recreational uses of reservoir systems are expanded, made more available to all Americans, and connected through volunteerism to the conservation of those systems;
- Regulatory agencies and ownership jurisdictions within reservoir systems cooperate to establish seamless management and conservation.

Commitment to Collaboration – Reservoirs, and the waters that feed into and flow from them, cross innumerable ownership jurisdictions and engage multiple agencies in their management and regulation. No single ownership or government entity has the authority or the capacity to manage reservoirs as parts of watershed systems. Moreover, our capability to conserve habitat that is vital to fish and other aquatic organisms that are associated with reservoir systems depends on our ability to access those systems and implement appropriate conservation actions.

Reservoir conservation is, by necessity, collaborative. The RFHP depends on collaborative conservation in two critical ways. One, our partnership must have the depth of membership and the expanse of inclusion to ensure that all of the key stakeholders are gathered under a single organizational umbrella, and that each of the constituent parts to our partnership have commitment to and ownership in the partnership and its goals and objectives. We address this in our strategic plan. Two, our partnership depends on collaboration with others to implement the strategic conservation actions we deem essential to achieve and sustain healthy reservoirs, associated waters, and related fisheries across the great expanse of our nation. We will help facilitate, inform, equip, and support a bottom-up approach to the implementation of our strategic targets through partnerships at the local, State, and regional level.

Friends of Reservoirs

To further the development of collaborative conservation of reservoir fisheries, the RFHP leadership recognized the need to have in place a financial support mechanism, independent of government funding, to facilitate collaborative actions. The Friends of Reservoirs (FOR) a 501(c) (3) corporation, was founded in August 2010 to provide a mechanism to procure non-governmental funding for reservoir fisheries habitat restoration efforts and create a formal partnership framework. FOR has a three-tiered membership program comprised of a) Chapter, b) Organizational or Group and c) Individual members. Chapter membership ($25 annual fee) is intended for entities that want to focus on a single reservoir, i.e., Friends of Lake X. Group membership ($100 annual fee) is for watershed, state-wide or region-wide groups that focus on larger geographic areas, i.e. a statewide conservation group such as Texas Black Bass Unlimited. Individual memberships ($25 annual fee) target individuals who simply want to contribute financially to reservoir habitat restoration with no particular body of water targeted. 100% of FOR memberships are designated for the FOR Small Grants Program that go into "on-the-ground" habitat restoration projects.

Friends of Reservoirs Membership Benefits:

1. Use of FOR's 501(c)(3) designation for fundraising efforts:

- Offer donors tax exemption;
- Enhanced fundraising capacity by certification and public exposure;
- Banking services.

2. Project Assistance

- Priority in applying for grants from RFHP;
- Small projects grants(cash and products available from sponsors) exclusively for FOR members;
- Grant writing/application assistance;
- Some grants require non-profit status (FOR).

3. Technical Support

- Web site and other services;
- Educational forums and meetings;
- Access to reservoir inventory, assessments and Best Management Practices;
- Networking with other FOR members and professional reservoir managers.

4. Recognition

- FOR logo, bumper stickers and other materials;
- Best project awards;
- Project/organization highlights on FOR website and newsletter.

Mission

Friends of Reservoirs raises awareness about the importance of ecologically healthy reservoirs in the United States. This is critical because, in addition to fishing and other recreational use, reservoirs provide municipal water supply, flood control, hydropower, irrigation, and a number of economic benefits to local communities. We identify and implement priority habitat projects within reservoirs and their associated waters to protect, restore, and enhance important fisheries.

We address this by:

- developing partnerships among all reservoir users to create and implement science-based projects that enhance reservoir habitats and connected lands and waters. These partnerships plan, fund, and support actions to establish and protect aquatic habitat in these systems;
- bringing together diverse partners to achieve common goals related to fish habitat improvement;
- promoting projects that contribute to a clean and abundant water supply that support local communities and aquatic life;
- creating programs and strategies to raise and manage funds that support habitat projects;
- informing policymakers on the importance of healthy reservoir systems and the economic value that they provide to their communities;
- sharing and exchanging information among current and potential FOR partners; and
- networking with professional fishery managers for best management practices, expertise, and guidance.

Vision

We envision a future of healthy reservoir systems to maintain fisheries and fish habitats, while preserving recreational and economic benefits for every American and future generations.

Scope of Action

The RFHP includes in its scope of action all manmade bodies of water formed by the impoundment of otherwise free-flowing rivers and streams that are accessible to the public and that support, or have the potential to support, a sport fishery. We include in this scope of action (1) those sections of downstream tailwaters, and adjacent wetlands and riparian areas that are affected measurably by dam releases and (2) the upstream headwaters, tributaries, and lands of the watershed whose flows and uses demonstrably impact the quality and quantity of water entering reservoirs.

We limit the scope of our action within reservoir systems in two important ways. One, the partnership will only address reservoirs that are accessible to the public. Reservoirs that are closed to public access by virtue of ownership or regulation are unlikely to afford opportunities for partnered conservation action. Moreover, public access is a principle that underscores this partnership's commitment to citizen participation in the conservation of reservoir resources. Two, the partnership excludes from its scope of action those reservoirs that do not support and do not have the potential to support a sport fishery. We are committed as a partnership to conserve fish habitat in order to protect, restore, and enhance fish and other aquatic populations. We are also committed to quality sport fish recreation and sustainable fisheries in the reservoirs we seek to protect, or return to healthy status. Reservoirs that do not or cannot support a sport fishery fall outside the scope of our conservation strategy.

We also limit our scope of action to impounded streams and rivers. We do this for two reasons. One, impounded streams and rivers have similar management issues and present a well-defined target for our conservation action. Two, the universe of impounded streams and rivers is enormous and includes tens of thousands of small to large reservoir bodies. Inventorying, classifying, and assessing these impoundments is a daunting prospect for a partnership in its formative stage. However, we are acutely aware that impounded streams and rivers share key habitat and fisheries characteristics with both natural lakes and impounded natural lakes. We are also aware that these bodies of water are no less important than reservoirs for fish and their habitat, that they are no less structural and functional parts of watershed systems, and that their exclusion from our scope of action is necessarily arbitrary, driven by pragmatic considerations.

Although our operational definition of *treatable* reservoirs narrows our scope of action, the pool of reservoirs (and their associated tailwaters and watersheds) available to us for fish habitat conservation is substantial, covering every state and major physiographic region of the U.S. The thousands of reservoirs currently in our inventory, or soon to be added, span and include the full typology of reservoir types found in the this country.

Structure and Governance

Details on the governance structure of the partnership are included in Appendix I.

Our partnership structure is made up of three parts:

- A national Executive Committee;
- Four **Regional Workgroups** (each corresponding to and associated with one of the four regional AFWA associations: the Northeast Association of Fish and Wildlife Agencies, the Southeast Association of Fish and Wildlife Agencies (represented by the Reservoir Committee of the Southern Division of the American Fisheries Society), the Midwest Association of Fish and Wildlife Agencies, and the Western Association of Fish and Wildlife Agencies;
- A **Friends of Reservoirs** national foundation with an affiliated network of local chapters.

The 15-member Executive Committee constitutes the governing structure of the partnership. Its role is to (1) implement the RFHP Strategic Plan; (2) set partnership policy; (3) establish national procedures and guidelines; (4) review and approve national conservation priorities; (4) request, acquire and allocate funds to projects; (5) provide oversight of and direction to Regional Workgroups, (6) conduct national assessments; (7) maintain a reservoir database coordinated with the NFHAP database; and (8) oversee monitoring and performance measurement and reporting. Three bodies serve the Executive Committee:

- *Staff* – a full-time paid coordinator (supported by voluntary staff from partnering agencies and organizations) who manages partnership operations
- *Science and Data Committee* – RFHP volunteers who provide scientific consultation on implementation of the strategic plan, assessments, databases, and consistency with the NFHAP national strategic plan
- *Outreach and Communication Committee* – RFHP volunteers who support partnership development, advance public education, and address policy issues and needs

The Regional Workgroups are established by each of the four regional AFWA associations. They identify regional priorities, participate in development and selection of projects, and facilitate, monitor, and report project implementation. In addition, Regional Workgroups implement policies and strategic actions determined by the Executive Committee and support the Committee in implementation of the strategic plan, national assessments and databases, and periodic performance reporting.

Friends of Reservoirs (FOR: www.friendsofreservoirs.com) is the third arm of governance of the RFHP. Its purpose is to create an institutional base upon which to build and sustain the partnership in the long-term. It will engage the national constituency of reservoir stakeholders – those who rely on reservoirs and their watersheds for an array of ecological, economic, and recreational services – in the conservation of healthy reservoir systems through both a national foundation and an affiliated network of State and reservoir-level chapters. FOR will provide the participatory channels, volunteer force, and long-term support required by the partnership to meet its mission. It will create entry points into the everyday operations of the RFHP for both national and local supporters. In turn, it will provide to the RFHP direction in the setting of reservoir conservation priorities. FOR membership categories include Chapter (groups focusing on a single reservoir), Group/Organization (groups, corporations, etc. that do not have a single system focus but wish to support RFHP efforts at a state, regional and/or national level), and individual memberships for those wishing to support FOR with a monetary contribution. Current (December 2017) Chapter and Group memberships in FOR are presented in Figure 3.

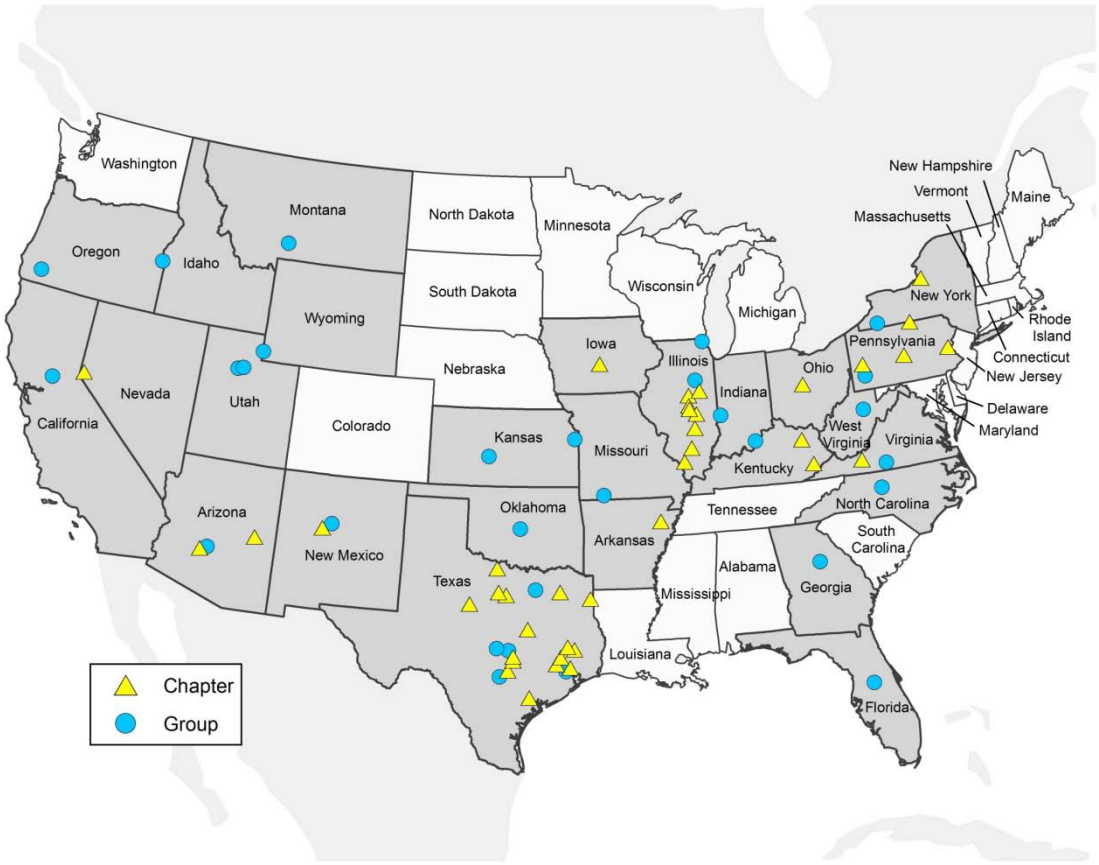


Figure 3. Members of Friends of Reservoirs as of December 2017.

Conservation Priorities

The Reservoir Fisheries Habitat Partnership (RFHP) recognizes that reservoirs are not a natural feature on the landscape. Nationwide, however, the societal value of services and recreational opportunities that reservoirs provide are unmatched by any other freshwater aquatic system. As reservoirs age, threats to these services and opportunities continue to grow; necessitating restoration efforts. The size of watersheds containing most reservoirs makes restoration efforts challenging from both financial and jurisdictional perspectives. Yet restoration efforts that ultimately improve reservoir fisheries habitat, particularly water quality, not only foster recreational (including angling) use and economic benefits but also benefit non-target species. RFHP intends to meet these challenges by focusing on the following Conservation Priorities:

1. The Reservoir Fisheries Habitat Partnership focuses on protecting/restoring habitat for fisheries in reservoir systems. As such, our primary partners include state and federal fisheries and reservoir management agencies, anglers, and the fishing industry.

2. Reservoir health directly reflects the health of the watershed in which it is located. We know that to best protect, restore, and enhance fish and aquatic communities, habitat conservation strategies and actions must enhance the ecological integrity and function of the watersheds in which the reservoir resides. Structurally-intact and well-functioning watersheds yield cascading benefits, from healthier reservoirs to healthy fish habitat to a healthful day of fishing.
    a. The RFHP will prioritize project proposals that target rehabilitative actions in the watershed and the reservoir proper with particular emphasis placed on those proposals that address priority regional impairments as outlined in RFHP's reservoir habitat

impairment. The RFHP recognizes that other Fish Habitat Partnerships (FHPs) target river and stream restoration efforts and thereby necessarily focus on watershed issues.

b. Consequently, RFHP will foster cooperative projects in priority areas designated by other FHPs that provide water quality improvements in downstream reservoirs.

3. RFHP will support outreach and education initiatives that advance public awareness and understanding of the value of healthy reservoir systems, including their watersheds, and help connect the public to the outdoors.

4. RFHP will develop and sustain institutional arrangements and sources of funding to support the long-term conservation of fish habitat in reservoir systems.

The above Conservation Priorities align with NFHPs Conservation Strategies below:

1. Protect intact and healthy waters.

   Example actions:

   a. Develop inventories and data support systems for priority waters;
   b. Participate in land and water use planning and decisions at all geographic and governmental levels to protect aquatic values;
   c. Incorporate climate change into development of land and water use plans;
   d. Acquire land, water rights/reservations, or easements;
   e. Implement management actions to maintain habitat values;
   f. Prevent direct habitat alteration;
   g. Avoid aquatic community alteration;
   h. Implement best management practices to minimize habitat alteration;
   i. Implement state and regional aquatic invasive species plans;
   j. Utilize applicable administrative and statutory opportunities at all governmental levels to protect habitat (hydrologic conditions, connectivity and water quality).

2. Restore hydrologic conditions for fish.

   Example actions:

   a. Restore natural variability in river and stream flows;
   b. Restore natural variability in estuary and natural lake surface water elevations;
   c. Secure favorable conditions for reservoirs;
   d. Secure favorable operating agreements on regulated systems;
   e. Acquire water rights for streams, lakes and reservoirs;
   f. Work with water users to incorporate fish habitat values into water management;
   g. Reconnect rivers to floodplains;
   h. Restore ground and surface water hydrologic connections;
   i. Manage vegetation to restore stream flow.

3. Reconnect fragmented fish habitats.

   Example actions:

   a. Identify access impairments to spawning, nursery, rearing and refugia areas;
   b. Facilitate fish passage through removal of physical barriers;
   c. Restore concrete stream channels to natural form and structure;
   d. Incorporate fish friendly designs in construction and rehabilitation of water diversion structures;
   e. Eliminate chemical/water quality barriers;

f. Restore habitat conditions (physical, temperature, lack of water, etc.) in degraded reaches that fragment systems;
g. Daylight currently buried stream segments.

4. Restore water quality.

   Example Actions:

   a. Identify sources of watershed degradation;
   b. Control excessive rates of sedimentation, phosphorus, nitrogen and toxic inputs to aquatic systems;
   c. Control thermal impairments;
   d. Control sources of pollutants;
   e. Control surface runoff through land use practices;
   f. Develop or maintain functioning wetlands and vegetation buffers.

Our Conservation Strategy

Healthy reservoir systems are vital to the security of the United States, to the quality of life of its citizens, and to the quality and quantity of aquatic habitat needed to sustain our native and sport fisheries. Our conservation strategy to protect, restore and enhance healthy reservoir systems – and the fish habitat that relies upon them – is built on the foundation of six goals:

- Protect, restore and enhance fish habitat in reservoir systems to support productive fisheries and healthy aquatic ecosystems including techniques to account for climate change effects on reservoir fisheries habitat;
- Continue to develop/refine the science behind reservoir habitat conservation/restoration, including development and communication of Best Management Practices;
- Manage reservoir systems to provide, protect and enrich quality of life for the American people;
- Develop and foster partnerships that implement landscape-scale approaches to the conservation of fish habitat in reservoir systems;
- Develop and sustain institutional arrangements and sources of funding to support the long-term conservation of fish habitat in reservoir systems;
- Support education and outreach initiatives that advance public awareness and understanding of the value of healthy reservoir systems.

To meet these goals, the RFHP is guided by four principles:

(1) Solutions to reservoir issues must be system-based. This means that the conservation actions we support to conserve fish habitat must address the causes, not the symptoms, of environmental, ecological and biological degradation in reservoir systems – and that this entails looking at causation across the watershed, not just within the reservoir proper. It also means that the role that people and their institutions play in managing reservoirs must be considered and addressed if conservation of fish habitat is to be meaningful and the health of reservoir systems sustained. Institutional, policy, and educational barriers to healthy reservoir systems must be rectified.

(2) Conservation actions must be sustainable. This principle flows from the first. The conservation actions we support must address not only primary causes of reservoir system decline but result in outcomes that persist. The RFHP seeks more than ephemeral changes in the status of fish habitat and associated fisheries. Our conservation actions – *if they are to be sustainable* – must withstand and effectively address the combined impacts of population growth, development, and projected shifts in local and regional climate.

(3) Conservation of reservoir systems must be collaborative and local. This principle is intrinsic to principles one and two. Our ability to function effectively and successfully at a watershed scale demands collaboration among the disparate authorities and interests responsible for and reliant upon any particular reservoir. Anything short of full stakeholder engagement impedes meaningful system-based conservation action. Moreover, our ability to deliver the conservation we identify as strategic relies on the driving force of local engagement.

(4) Conservation of reservoir systems relies on information sharing. Principles one, two and three are conditional on this last principle. Our ability to address fish habitat strategically, sustainably, and collaboratively within reservoir systems depends on information – and our success in disseminating that information among the thousands of reservoir managers and stakeholders who hold the future of those systems in their hands. Knowledge that informs reservoir managers of best practices, educates, entertains, and engages users in reservoir conservation, and enlightens, motivates and guides decision makers in promulgating good conservation policy is fundamental to everything we do.

The components of our conservation strategy that follow – our goals, objectives, and targets – establish the outline of a long-term road map to success, one which we believe will lead to the realization of our mission, our vision, and our principles. We acknowledge that many of the objectives and targets we set

forth must await subsequent 5-year revisions of the plan to be met and fulfilled. Accordingly, each goal is followed by a set of primary strategic actions that are scheduled to be implemented and met in the second planning cycle of the partnership (2018 – 2022). Some of these actions entail immediate information needs; others entail preparatory actions necessary to either initiate or meet portions of other targets – with the expectation that completion may lie beyond the previous and current 5-year planning cycles. By stepping down broad, multi-year targets to a set of primary actions that we can achieve in the coming 5 years, we can provide not only a road map of where we are headed, but a detailed look at our first stop along this long journey.

1. Goal One: Protect, restore and enhance fish habitat in reservoir systems to support healthy aquatic ecosystems and productive fisheries.
2. Goal Two: Continue to develop/refine the science behind reservoir habitat conservation/restoration, including development and communication of Best Management Practices.
3. Goal Three: Manage reservoir systems to protect human and environmental health, and to provide for and enrich quality of life for the American people.
4. Goal Four: Develop and foster partnerships to cooperatively address priority reservoir fisheries habitat impairments and implement landscape-scale approaches to the conservation of fish habitat in reservoir systems.
5. Goal Five: Develop and sustain institutional arrangements and sources of funding to support the long-term conservation of fish habitat in reservoir systems
6. Goal Six: Support education and outreach initiatives that advance public awareness and understanding of the value of healthy reservoir systems.

Goal One: Protect, restore and enhance fish habitat in reservoir systems to support healthy aquatic ecosystems and productive fisheries.

Reservoirs are human modifications of watershed systems designed to deliver water, navigation, power, flood risk reduction, recreation and other services. They alter and sometimes transform those systems, affecting resident populations of aquatic species and the ecological functions and structures upon which those populations depend. In turn, reservoirs are impacted by land uses in the watershed that affect water quantity and quality.

The objectives, targets and conservation actions that follow were derived from the reservoir-system impairments identified by the RFHP in its preliminary assessment.

Objective 1A – Protect, restore and enhance the structure and function of aquatic habitat in reservoir systems to support healthy aquatic ecosystems.

Target 1A1. Work with state and federal agencies with management/operations responsibility to increase the priority of habitat conservation/restoration within their respective programs.

Target 1A2. Communicate the assessment results to management/operations agencies to prioritize habitat work on reservoirs to key into major impairments and stress the importance of protecting the existing habitat status of reservoirs with low IRHI scores.

Target 1A3. Prioritize project proposals that address restoration efforts according to regional habitat impairment rankings as per the proposal scoring process.

Target 1A4. Modify RFHP's science-based prioritization process to select projects for support and implementation based on the best science available.

Target 1A5. Continue to seek additional funding sources for priority fish habitat restoration efforts.

Objective 1B – Identify, plan for, and promote reservoir management towards conservation of fish and fish habitat related to climate change.

Target 1B1. Provide better technical understanding of climate change in reservoirs to those working on and managing reservoirs, reservoir fisheries, and reservoir fish habitat.

Target 1B2. Support RFHP partners, local, state, federal, and tribal agencies, and other stakeholders (universities, NGOs; recreational industries, power generation authorities, reservoir homeowner associations and developers, municipalities and local businesses, watershed associations and conservation groups, irrigators) on activities such as monitoring programs, restoration projects, research, and management that diminish the effects of climate change on fish habitat or reduces greenhouse gas emissions in reservoirs.

Target 1B3. Promote conservation project proposals that include work objectives addressing the effects of or expected effects of climate change and climate variability. Priority will be given to those with the objectives of reducing, adapting to, or mitigating their impacts in reservoirs.

2018 – 2022 Primary Conservation Actions for Goal One

- NFHP funding for RFHP projects has been relatively stagnant over the past 8 years (~$100,000 annually). Based on the current level of funding RFHP will fund 3-4 priority habitat restoration/protection projects annually (Target 1A5).

- FOR created a "Small Grants Program" that provides $1000 cash to be awarded exclusively to FOR member organizations for small-scale habitat projects (typically structure habitat related). We hope to expand this program to award $10,000 in small projects grants by 2020 (Target 1A5).
- FOR currently has a "Mossback Grant" program where King Enterprises provides 3-$1000 product grants exclusively to FOR members. We hope to expand this program to include grant awards from other corporate sponsors (Target 1A5).
- Communicate results of assessment and projects at scientific meetings (Target 1A1,1A2)
- Complete 2nd iteration of the Reservoir Habitat Impairment Assessment by end of 2020 (Target 2A2)
- Develop a "Climate Change" chapter for the Reservoir Habitat Management Manual by end of 2018. Information should identify the relationship of climate change with hydrological conditions; physical and chemical habitats; shifts in fish distribution or community structure; food web dynamics; and the potential spread of aquatic invasive species in reservoirs. Offer recommended procedures and strategies for delaying, reducing, adapting, mitigating, or responding to climate change effects in reservoirs as they relate to fish, fish habitat, water quality and quantity, water regime, upland management, and reduction of greenhouse emissions. Provide case studies or projects having positive outcomes. Post Climate Change chapter on the www.friendsofreservoirs/science page (Target 1B1).
- Develop criteria and incorporate appropriate scoring points to the current project ranking criteria, which account for work that minimizes the influences of climate variability in reservoir fish habitats and reservoir fish, and reservoir habitat improvements that additionally reduce greenhouse emissions. Project descriptions and objectives should clearly state the direct relationship that the work has on responding to the impacts of climate variability or preparing for climate induced threats recognized in the BMPs (Target 1B3, 3A3, 3B1).
- RFHP staff and volunteers will engage with the USGS Regional Climate Centers to stay abreast of the latest developments in climate science.
- Develop a Best Management Practices Workshop as part of an information network and exchange for sharing and dissemination of best management practices by end of 2018. Deliver workshops at RFHP Annual Meetings and regional/national scientific meetings. (Target 1A1, 1A2, 1B1),

Goal Two: Continue to develop/refine the science behind reservoir habitat conservation/restoration, including development and communication of Best Management Practices.

Objective 2A - Refine and expand existing scientific knowledge behind reservoir fisheries habitat restoration/protection.

Target 2A1. Work with NFHP's Science and Data Committee (SDC) to identify and fill data gaps and expand the analysis and comparison of watershed scores from NFHP's National Assessment (http://assessment.fishhabitat.org/) and RFHP's IRHI scores.

Target 2A2. Conduct the 2nd iteration of the Reservoir Habitat Impairment Survey in 2020. This would be 10 years after the first survey. Include recommendations from SDC to make the 2nd iteration meet the needs of the National Assessment and RFHP as much as possible. IA DNR will be comparing field-collected fish community and habitat measurements to "construct" scores from the 2010 assessment. Include "lessons learned" from this analysis in the 2nd iteration.

Target 2A3. Communicate, and refine existing and develop new Best Management Practices and protocols that create the most effective, efficient and long-lasting restoration and protection efforts in reservoir systems. BMPs will focus on the 12 constructs identified in the 2010 assessment as primary reservoir habitat impairments (Table 1).

Target 2A4. Develop BMPs for projects to include "Climate Change" consideration as part of overall project design.

2018 – 2022 Primary Conservation Actions for Goal Two

- Procure the initial analysis of IRHI and watershed scores from the National Assessment and develop a strategy to cooperatively address discrepancies and refine analyses prior to the 2nd Reservoir Habitat Impairment Assessment (2020; Target 2A1, 2A2).
- Work with Science and Data Committee to develop the 2nd iteration of the Reservoir Habitat Impairment Assessment incorporating lessons learned from the 1st iteration and new science available (2020; Target 2A1, 2A2).
- Update Science page on website to include additional assessment and BMP information (Target 2A1, 2A2, 2A3, 2A4).
- Host project reports on Science page to communicate latest developments in habitat restoration techniques (Targets 2A3, 2A4).

Goal Three: Manage reservoir systems to protect human and environmental health, and to provide for and enrich quality of life for the American people.

Our reservoir systems are ageing, filling up with sediments and nutrients, diminishing flood-risk reduction potential, accelerating eutrophication, resulting in more frequent and persistent harmful algal blooms, and other threats that affect environmental and public health. Over one half of the constructed reservoirs, 250 acres and greater, across the United States, and three quarters of the impounded volume are now around 40 to 70 years old. Internal nutrient loads, during the summer months when external loads are at their lowest, are becoming proportionally greater and more influential in driving algal production, including cyanobacteria and golden algae -- harmful algal blooms (HABs). Human health risks increase with HAB occurrences because of the associated algal toxins that are released into the water. These algal toxins often affect the fishery, as well. Recreational human contact advisories, warnings, and even lake closures resulting from HABs, reduce recreational opportunities and ecological health.

Reservoir systems draw millions of Americans each year to the outdoors by providing a multitude of recreational opportunities including fishing, swimming, boating and other forms of water-based recreation. As such, they serve as gateways to nature, offering endless opportunities to nurture an ethic of stewardship. Furthermore, they provide outdoor outlets for an increasingly urban population upon whose shoulders rests the future of conservation in America. The objectives and targets that follow address the quality of life issues that pertain to the social and economic contributions of reservoirs and to the recruitment of citizens to the stewardship of reservoirs and their associated watersheds.

Objective 3A **–** Maintain or restore water quality in reservoir systems.

> *Target 3A1*. Develop and refine tools and methodologies for evaluating water quality in reservoir systems, including the use of volunteer, citizen-science water-quality monitoring programs and early detection of HAB development.
>
> *Target 3A2*. Encourage State partners to participate in water quality standards development and review to provide consideration for the habitat needs of fish and aquatic organisms.
>
> *Target 3A3.* Provide points in the Project Selection Criteria specific to proposals that address water quality.

Objective 3B– Promote enhanced access, environmental amenities and nature experiences and opportunities on and adjacent to reservoir to enhance public awareness of the value of reservoirs.

> *Target 3B1*. Provide point incentives in project proposals for comprehensive restoration efforts that, not only have a habitat restoration objective(s), but include environmental amenities in the total project design.

Objective 3C – Promote conservation of fish and aquatic resources to boaters and other water-based recreationists.

> *Target 3C1*. Partner with the Recreational Boating and Fishing Foundation (RBFF) to develop a habitat restoration/conservation message within their promotional materials.

Objective 3D – Support recreational industries and related economic activities that contribute to the conservation of fisheries and aquatic habitats in reservoir systems.

> *Target 3D1*. Develop partnerships with industries and commercial endeavors that most affect or are most affected by reservoirs and their watersheds.
>
> *Target 3D2*. Seek corporate support for the RFHP operations and projects.

Target 3D3. Develop joint conservation/restoration ventures with corporate supporters.

2018 – 2022 Primary Conservation Actions for Goal Three

- Encourage FOR partners to become involved in water quality monitoring programs; make presentations at Annual RFHP meeting highlighted successful volunteer monitoring programs (Target 3A1)
- Contact RBFF's Communication Director to work on a shared water quality/habitat restoration message on our respective websites (Target 3C1)
- Promote corporate sponsorship of projects and meetings via the website (Target 3D2)
- Encourage project leaders to post signage at project locations recognizing corporate sponsors (Target 3D2)
- Work with project leaders to promote project sponsors through local media outlets (Target 3D2)
- Seek additional corporate project sponsorship programs similar to Shell Appalachia in Pennsylvania (Target 3D3)

Goal Four: Develop and foster partnerships to cooperatively address priority reservoir fisheries habitat impairments and implement landscape-scale approaches to the conservation of fish habitat in reservoir systems.

Given that impairments to fish habitat in reservoir systems are often the result of activities that occur within its watershed, conservation actions must occur at landscape scales. Many government agencies, private organizations, businesses, local communities, and citizens recognize the value of fishery and other aquatic resources in reservoir systems and work diligently to conserve them. However, previous efforts to halt their decline have often been conducted independently. Coordination and cooperation by partners will provide synergism to these fragmented efforts and enhance the overall outcome by leveraging knowledge and limited available resources.

The objectives and targets that follow address the development of the RFHP/FOR partnership base and its scientific and technical capacities to assist reservoir managers and support local partners in reservoir-related fish habitat conservation actions.

Objective 4A – Expand the partnership base of Friends of Reservoirs to include additional States, relevant federal and tribal agencies, non-profit and NGO's, recreational industries and industry associations, reservoir and power generation authorities, reservoir homeowner associations, municipalities and local businesses, local watershed associations and conservation groups, irrigators, and others affected by reservoirs.

> *Target 4A1*. RFHP currently has MOUs/Letters of Support from 53 state fish and wildlife agencies, federal agencies, NGOs, and corporations listed in Appendix III. A strategy to expand this list is needed.
>
> *Target 4A2*. Establish outreach and partnership developmental tools.

Objective 4B – Promote the information on the "Science" page on www.friendsofreservoirs.com as a tool for reservoir management agencies to prioritize habitat management efforts.

> *Target 4B1*. Encourage reservoir managers to make use of the Reservoir Habitat Management Manual in planning conservation/restoration efforts.
>
> *Target 4B2*. Promote the use of the Reservoir Metric Database (www.friendsofreservoirs.com/science) as a source of a wide range of reservoir and watershed morphological data.
>
> *Target 4B3*. The Reservoir Habitat Management Manual (www.friendsofreservoirs.com/science) is intended to be a living document. Updates will be made available as additional BMPs become available.
>
> *Target 4B4*. Develop a national listserve to foster communication and networking among reservoir managers, reservoir stakeholders, and partners.

Objective 4C – Support and participate in watershed planning initiatives to promote implementation of best management practices for conservation of fisheries and fish habitat in reservoir systems.

> *Target 4C1* – Partner with existing watershed alliances or facilitate the creation of watershed alliances in their absence.
>
> *Target 4C2* – Provide technical information/support to these watershed groups in promoting/implementing best management practices.

2018 – 2022 Primary Conservation Actions for Goal Four

- Promote Friends of Reservoirs membership to municipalities, chambers of commerce, county governments, etc. which would have a stake in enhanced recreational opportunities on reservoir systems. This has been most effective by encouraging agency biologists to seek local partnerships for projects (Target 4A1, 4A2).
- Continue membership in the American Sportfishing Association and increase FOR's involvement with their Trade Shows (ICAST) and Annual Summit. (Target 4A1)
- Expand partnership efforts with Bass Pro Shops (Targets 4A1).
  - ➢ Work to expand sponsorship of FOR's Small Projects Grant Program
  - ➢ Pursue large landscape-level project sponsorship
  - ➢ Work with BPS Conservation staff to promote Friends of Reservoirs within their retail outlets
- Continue to partner with Shell Appalachia on restoration projects in Pennsylvania
  - ➢ Seek out other corporate sponsorship opportunities
- Continue to work with King Enterprises to promote and expand the Mossback Small Grants Projects (Target 2D)
  - ➢ Expand program to include sponsorships by other artificial structure manufactures
    - Honey Hole
    - Fishhiding
- Highlight the content of (www.friendsofreservoirs.com) through electronic media (email, Facebook) and presentations at scientific meetings
- Pursue project potential through presentations at the Southwest Tribal Fish and Wildlife Meetings

Goal Five: Develop and sustain institutional arrangements and sources of funding to support the long-term conservation of fish habitat in reservoir systems

Large-scale habitat restoration and enhancement efforts are, by nature, long-term, expensive undertakings. Such projects typically cross jurisdictional boundaries and, hence, require a formal coordination process for implementation and efficient function. A stable, long-term source of funding is also needed to provide base funding and to leverage additional funds from agencies and local governmental and private partners. Institutional support for the RFHP will come from two primary sources: the National Fish Habitat Partnership (NFHP) and the Friends of Reservoirs Foundation and chapter affiliates. RFHP currently receives $75,000 for operations and approximately $100,000 annual for project funding from NFHP. NFHP's Beyond the Pond Foundation (BTP) is in its infancy and has yet to provide substantial funding for the Fish Habitat Partnerships. BTP may provide future support as NFHP's fundraising efforts develop. The current network of Fish Habitat Partnerships provides project development and local fund-raising support.

Objective 5A - Identify and develop funding opportunities for RFHP projects and operations.

Target 5A1. Maximize funding available through FWS and NFHP funding sources.

Target 5A2. Expand FOR membership and develop strategy to retain current/lapsed members.

Target 5A3. Promote the use of FOR as a banking source to hold project funds for partners and use the 3% fee associated with the service as a revenue stream.

Target 5A4. Identify traditional sources of funding from government and non-profit grant-making foundations.

Target 5A5. Identify business partners within the recreational boating and fishing industry and develop fundraising plan to meet intermediate- and long-term goals.

Target 5A6 Work with the NFHP to identify and pursue non-traditional funding sources.

Target 5A7. Establish a clearinghouse to match available funding sources and projects.

2010 – 2014 Primary Conservation Actions for Goal Five

- Select projects for funding that best meet RFHP conservation priorities while at the same time meet criteria for FWS Allocation Report (Target 5A1).
- Develop a recruitment and retention strategy for Friends of Reservoirs membership (Target 5A2)
  - ➢ Expand Small Projects Grant Program and Mossback-type product grants (Targets 1A5, 5A5)
  - ➢ Use www.friendsofreservoirs.com as a recruiting tool
- Continue to use the RFHP Annual Meeting as a tool to both recruit new and retain members/sponsors (Target 5A2)
  - ➢ Continue to provide free lodging for FOR members at meetings
  - ➢ Develop programs/agendas that are of interest to local FOR members
  - ➢ Invite potential sponsors to attend meetings and highlight their products/programs
  - ➢ Institute a registration fee for the Annual Meeting and waive the fee for FOR members in attendance
- Work with NFHP to secure funding through the Beyond the Pond Foundation (5A6)

Goal Six: Support education and outreach initiatives that advance public awareness and understanding of the value of healthy reservoir systems.

Effective conservation of fish habitat and aquatic resources in reservoir systems is dependent upon a public that is well-informed of the benefits of healthy reservoir systems and a citizenry that is well-prepared and properly enabled to act as stewards of those resources. Effective public outreach and education by the RFHP at the national, regional and local levels will ensure a well-informed public that will garner support for conservation of reservoir systems nationwide.

The objectives and targets that follow establish the public outreach, citizen education, and policy development functions of the RFHP.

Objective 6A – Advance public awareness of the economic, societal and ecological value and benefits of healthy reservoir systems

Target 6A1. Develop an outreach strategy, actions and support materials to improve public knowledge of the value of fishery and aquatic resources in reservoir systems.

Target 6A2. In support of the mission and principal goal of RFHP, develop programs, activities, and educational opportunities to ensure a broad base of public and political support for the conservation of fish habitat in reservoir systems.

Target 6A3. In partnership with others, develop web-based tools to increase public awareness of the location, access to and services provided by reservoirs.

Objective 6B – Advance public understanding of the connections between habitat quality in reservoir systems and land-use practices within their associated watersheds.

Target 6B1. Work with FHPs and watershed associations to promote use of watershed BMPs to reduce sediment and nutrients loads in reservoirs.

2018 – 2022 Primary Conservation Actions for Goal Six

- Highlight information on the Water Habitat Life pages of www.friendsofreservoirs.com (Target 6A1)
- Promote youth involvement in RFHP/FOR-sponsored projects by providing point incentives in the Project Selection Criteria (Target 6A2).
- Encourage FOR partners to engage policy makers in local/state/national aquatic habitat issues (Target 6A2).
- Direct visitors to www.friendsofreservoirs.com to the Recreational Fishing and Boating Partnership's site for reservoir-specific information (Target 6A3)

Appendix I: Governing Elements of the Reservoir Fish Habitat Partnership

The Executive Committee constitutes the governing structure of the RFHP. Its responsibilities are to:

- Implement the RFHP Strategic Plan
- Set partnership policy
- Review and approve national conservation priorities
- Request, acquire and allocate funds to projects
- Provide oversight of and direction to Regional Workgroups
- Conduct national assessments
- Maintain a reservoir database coordinated with the NFHP database
- Oversee monitoring and performance measurement and reporting

A. APPOINTMENT

The membership of the RFHP Executive Committee includes by category of organization:

- Four State agency members
- Up to six Federal agency members
- Up to four Non-Governmental Organizations (NGOs)
- Up to three Industry representatives
- One at large member; candidates include, but are not limited to Tribal Nations

Individual members of the Executive Committee will be selected, respectively, by the organizations that are assigned seats to the committee.

1. State and Federal agencies constitute eight (8) to 10 positions on the Executive Committee.
2. Executive Committee members will designate the specific organizations within stated categories for all other Executive Committee seats by a majority vote of a quorum of the Executive Committee.
3. Remaining Committee seats are designated by category for:
   a. Outdoor recreation and fishing industry
   b. Non-Governmental Organizations
   c. At-Large, including but not limited to Tribal Nations
4. Organizations and individuals from each of the categories mentioned in (3) above must be invited to join the Executive Committee.

B. MEMBERSHIP

The Executive Committee will consist of up to 15 members. Composition of membership by category will consist of the following:

1. Four State agency members representing each of the four Regional Associations of Fish and Wildlife Agencies. The Chair of the Executive Committee shall be selected from among these four members;
2. Four to six Federal agency members including the U.S. Fish & Wildlife Service, the Bureau of Reclamation, the Army Corps of Engineers, the Bureau of Land Management, U.S. Geological Survey, Environmental Protection Agency, Natural Resource Conservation Service, Forest Service;
3. Four Non-Governmental Organizations (NGO) to be designated by the Executive Committee;
4. Three industry representatives to be designated by the Executive Committee;

5. One at-large representative to be designated by Executive Committee.

In addition to the membership guidelines stated above, the Executive Committee will consist of a term-appointed Chair and two term-appointed Vice-Chairs. The Chair will be automatically filled by rotation in alphabetical order of the four Regional Associations. The first Chair will be selected by the Executive Committee and will determine the alphabetical starting point for subsequent Chair selections. In the event a Chair is not available in the following rotation, the next available Regional Association member will be selected. A quorum of Committee members will nominate and elect the two Vice-Chairs from among the non-State Executive Committee membership.

C. TERMS OF SERVICE

1. Executive Committee members will remain seated on the committee until they are replaced by their respective agency. Members that have term appointments on the committee (i.e. the Chair and Vice-chairs) will serve one term, with the option of a second consecutive term at the Executive Committee's discretion. One term is equal to two consecutive years. Members whose term appointments have expired and they have not been replaced by their respective agency will remain seated on the committee until replaced by the agency they represent.
2. Vacancies - Any vacancy among the Executive Committee membership shall be filled through appointment by the respective organization or agency to which the respective seat is assigned. Any vacancy in a term appointment on the Executive
3. Committee shall be filled by the prescribed rotation, in the case of the Chair, or by the Executive Committee, in the case of the Vice Chairs, for a full two-year term.
4. Members assigned to the Executive Committee should represent a high administrative or executive level within their respective organizations or agencies to ensure the committee's authority to commit partners and partnership resources to the implementation of the RFHP strategic plan as consistent with the missions of each partnering entity and governing State and Federal laws.

Individual Executive Committee members may represent multiple organizations within their respective category but they can fill only one position and exercise only one vote on the Executive Committee, except in the case that an Executive Committee member is acting as a proxy for another Executive Committee member.

D. PROCEDURES

1. Selection of Executive Committee Chair - At the first meeting of the Executive Committee, the Executive Committee shall elect a Chair by majority vote from the four State Regional Association members. Thereafter, the Chair shall rotate alphabetically every two years among the State Regional Associations of Fish and Wildlife Agencies.
2. Term of Chair - The term of the Chair shall be two years. In the event that a chair must serve consecutive terms, he or she may not serve more than 2 consecutive terms.
3. Meetings - The Executive Committee will meet a minimum of two times a year, one time of which will be in person at a time and place to be determined by the Chair in consultation with its members and staff. Executive Committee members are expected to attend at their own expense. Financial support can be provided at the discretion of the Chair in cases of hardship.
   a. The Chair shall establish a proposed meeting schedule identifying potential meeting dates within the twelve-month period following each meeting of the Executive Committee.
   b. The Chair must give Executive Committee members at least two months' notice of an Executive Committee meeting and shall provide a draft agenda at that time. Notice must be provided in writing, email or facsimile to each Executive Committee member.
   c. The Chair with due cause may call the Executive Committee for emergency meetings, provided, however, that business of the meeting must be restricted to the reasons for which the meeting is called.

d. Executive Committee meetings shall be open to the public, provided, however, that the Executive Committee may meet in executive sessions closed to the public to discuss personnel, legal matters, or any other matter of a private or confidential nature. These closed sessions shall be clearly identified in the meeting announcement. Notification of Executive Committee meetings shall be made to members of the RFHP and other interested parties.

4. Quorum - A quorum of the Executive Committee is comprised of a simple majority of members in good standing. A quorum can be established using one or more approved proxy votes.
5. Participation and Attendance - A committee member's failure to attend three consecutive committee meetings, or teleconferences, can result in the member's suspension by majority vote and a request to the members' organization or agency to select a replacement.
6. Proxy - Committee members may appoint a proxy to act on his/her behalf in the event that the Committee member is unable to attend a meeting in person or via teleconference line.
   a. Notification of a proxy must be submitted to the Chair of the Executive Committee, in writing, prior to the meeting.
   b. The Chair must receive notification of an acting proxy at least two days before the scheduled meeting.
   c. Notification of a proxy can be sent via email, fax, or phone to the Chair
7. Voting - The committee will seek consensus on all business before it. In the absence of a consensus, a simple majority vote of the members present will carry the motion.
   a. Each Executive Committee member shall have one vote and all Executive Committee members have the right to vote on motions.
   b. Any Executive Committee member acting as a proxy can cast a vote for him/herself and one vote for the individual he/she is acting for.
   c. All voting shall proceed under Robert's Rules of Order. A motion set forth by the Committee can be carried by majority vote of the members present and participating in the meeting. This includes proxies and individuals participating via teleconferencing.
   d. The Executive Committee may extend the discussion period for items on the agenda, or consider items not on the proposed agenda for a meeting, provided that such changes to the agenda are approved by a vote at the time they are proposed.
   e. Executive Committee business, including motions and resolutions, may be conducted via e-mail, fax, or teleconference.
8. Other Procedures - The Executive Committee shall establish other procedures as needed to schedule meetings, develop agendas, and otherwise facilitate and conduct business, including those procedures or matters required to comply with any requirements resulting in accordance with the governance of Fish Habitat Partnerships under the National Fish Habitat Action Plan.
9. Chair's Responsibilities - In addition to such duties established elsewhere in these bylaws, the Chair shall:
   a. Prepare a written agenda of all matters to be considered by the Executive Committee at any meeting;
   b. Prepare and issue all notices, including notices of meetings, required to be given to the Executive Committee and public;
   c. Preside at all meetings of the Executive Committee and, unless otherwise directed by the Executive Committee, present items of business for consideration by the Executive Committee in the order listed on the agenda for the meeting;
   d. Conduct all meetings in accordance with Robert's Rules of Order and these bylaws;
   e. Appoint committees as required; and
   f. Perform other duties as requested by the Executive Committee.

E. EXECUTIVE COMMITTEE RESPONSIBILITIES

It is the responsibility of the RFHP Executive Committee to:

1. Coordinate with the NFHAP Board and its Fish Habitat Partnerships in the implementation of the National Fish Habitat Action Plan
2. Support the development and implementation of monitoring and evaluation protocols for reservoir systems, as well as fish habitat conservation actions at national, regional and local levels
3. Promote planning efforts for fish habitat conservation among partners and stakeholders by providing direction to Regional Workgroups on funding availability, categories of potential projects, and criteria for their prioritization
4. Support and recommend partnership projects to the National Fish Habitat Action Plan Board for funding
5. Provide direction and input to partnership committees and Regional Workgroups, and creating RFHP ad-hoc task groups as needed
6. Support the Regional Workgroups and the projects of the partnership with financial and/or staff resources as available
7. Participate in marketing efforts and information campaigns to garner additional resources to meet the RFHP objectives
8. Report to partners and stakeholders on the status and accomplishments of the RFHP
9. Establish and direct a Science and Data Committee to provide direction and support to the Executive Committee and the Regional Workgroups in the implementation of the strategic plan, the national reservoir assessment and database, monitoring, reporting, and performance assessment, and in the coordination of science and data related issues with the NFHAP Board, the Board's Science and Data Committee, and other Fish Habitat Partnerships
10. Establish and directing an Outreach and Communication Committee to further develop and expand the partnership, provide educational services, communicate the purpose, organization, activities and successes of the partnership to the public and policy makers, review and contribute to the development of policies impacting reservoir systems, and coordinate with and support Friends of Reservoirs
11. Establish other Committees as deemed necessary
12. Recruit and hire a full-time Coordinator to provide staff support to the Executive Committee, including dissemination of information, coordination and facilitation of actions and projects within the partnership, coordination of outreach activities, and pursuit of funding and grant opportunities
13. Establish and implement a national Friends of Reservoirs foundation and network of affiliated Friends chapters to support the RFHP and to sustain its operations through volunteer recruitment and fund-raising

F. FINANCIAL MANAGEMENT OF THE RFHP

1. The Reservoir Fish Habitat Partnership will be self-supporting through the contributions of the partnership members, grants, private donations and other gifts.
2. Friends of Reservoirs will be the banking institution for the RFHP. It will hold and distribute at the direction of the Chair and the Executive Committee all funds granted or donated to the partnership.
3. Funds raised through Friends of Reservoirs Foundation shall be managed and distributed by that entity by the procedures and for the purposes set forth in its charter.
4. The Chair and the RFHP coordinator will have joint discretionary spending authority for expenses not to exceed $1,000. For expenses in excess of $1,000, the approval of one Vice Chair will be required in addition.

G. ENTITIES SUPPORTING THE EXECUTIVE COMMITTEE

1. Staff - A full-time paid coordinator (supported by voluntary staff from partnering agencies and organizations will manages partnership operations. The Chair, in consultation with the Executive Committee, may accept additional staff or other support from other entities.
2. Science and Data Committee - The Executive Committee shall solicit information from the Science and Data Committee and incorporate that information, and other appropriate information, into the strategies and goals developed by the Executive Committee. The Executive Committee will support the Science and Data Team by providing necessary staff, funding, data and other resources needed to complete the national assessments and reports called for in the RFHP Strategic Plan.
3. Outreach and Communication Committee – The Outreach and Communication Committee shall establish and maintain a partnership website, expand partnership participation to all stakeholders, publicize and report on the partnership to policy makers and the public, maintain and publish newsletters and other publications promoting understanding and knowledge of the partnership, and establish, support and coordinate partnership activities with Friends of Reservoirs.
4. Fund Raising Committee – The Fund Raising Committee shall be responsible for identifying and pursuing sources of financial support for support of partnership programs and projects.
5. Project Selection and Ranking Committee – The Project Selection and Ranking Committee shall be responsible for establishing procedures and criteria for selecting and ranking projects for funding support by the partnership through the Executive Committee.

H. COMMITTEES

The Executive Committee may establish and otherwise manage other committees as needed to carry out the responsibilities of the Executive Committee. Such committees may include individuals who are not members of the Executive Committee.

I. BOARD AND COMMITTEE EXPENSES

Executive Committee members and RFHP partners will not be compensated for their time working on the Executive Committee, other Committees or work groups on the behalf of the Executive Committee. This includes any expenses accrued while conducting business or traveling to meetings. Travel expenses generally should be borne by the agency or other entity that employs the Executive Committee, Committee, or work group member, but reimbursement arrangements may be made at the discretion of the Chair if funds for this purpose are available.

J. REGIONAL WORKGROUPS

Regional Workgroups will be selected, staffed, and supported by or in coordination with the four Regional Associations of Fish and Wildlife Agencies (Southeastern, Northeastern, Midwest, and Western). Each Regional Association will organize and structure its respective Regional Workgroup to meet internal administrative requirements.

Regional Workgroups will be responsible for assembling stakeholders to guide development of local joint-venture projects that address fish habitat issues in reservoir systems described in the RFHP strategic plan.

Regional Workgroups will prioritize projects for submission to the Executive Committee for either national partnership funding or funding by the NFHP. Criteria used to prioritize regional projects will be developed from the national assessment and project criteria guidelines developed by the

partnership through its Executive Committee in consultation with the Science and Data and Project Selection and Ranking Committees.

Regional Workgroups may, at any time, collaborate with reservoir managers and local stakeholders to develop and fund opportunistic projects through non-partnership funds. Additionally, Regional Workgroups will promote and communicate RFHP strategic plan goals and objectives and meet the data needs established by the Executive Committee and those required by the NFHAP.

K. FRIENDS OF RESERVOIRS

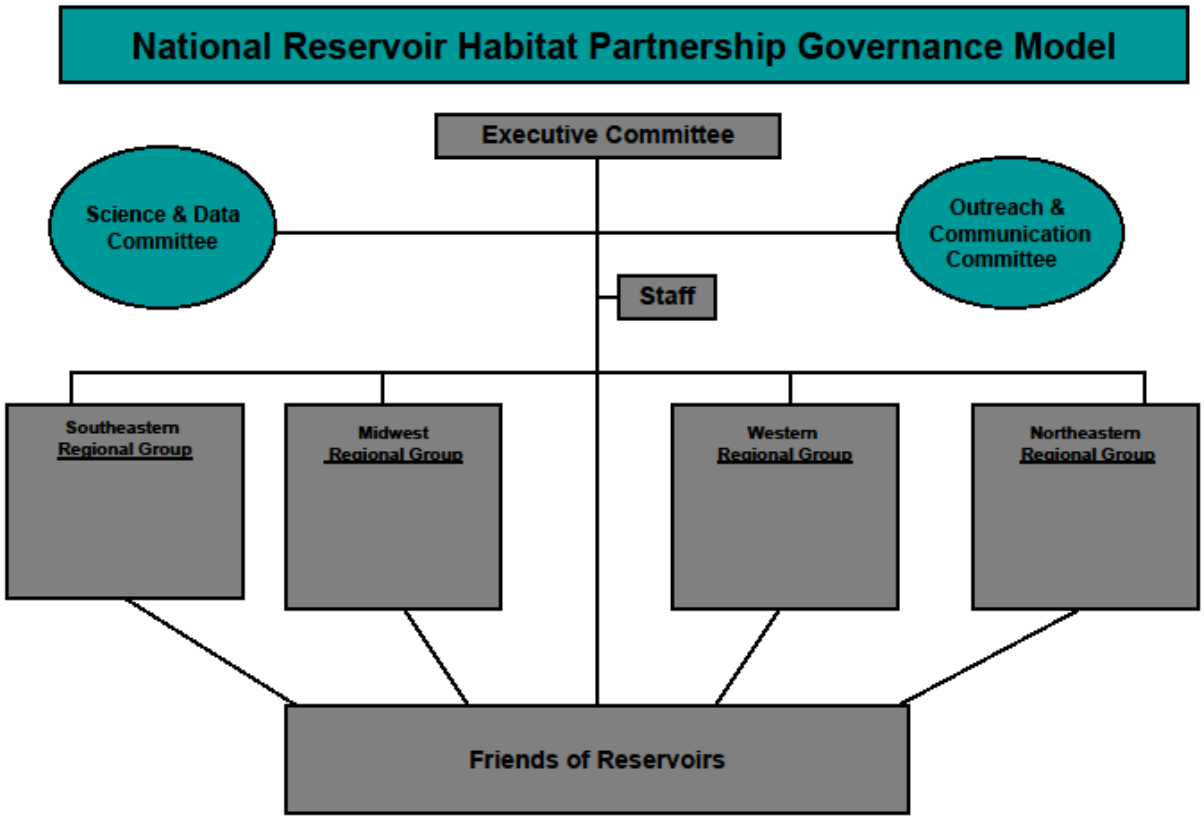
The Friends of Reservoirs national foundation and affiliated network of local chapters shall constitute the primary support institution for the RFHP. It shall provide the institutional means to include all stakeholders with interests in healthy reservoirs in the support, implementation, and governance of the RFHP. The role of Friends of Reservoirs shall be four-fold:

1. Provide supporters options to participate in the operation of the RFHP and to influence its governance through interaction with the Executive Committee, staff, and Regional Workgroups on the setting of reservoir conservation priorities, selection of fish habitat conservation projects, and long-term partnership goals and objectives;
2. Provide sustainable funding for RFHP operations and project implementation;
3. Help develop volunteer corps to support project implementation;
4. Facilitate delivery of outreach for public education, awareness, and service.

L. PROCEDURE TO AMEND CHARTER

The Executive Committee may decide to amend this charter by consensus or a two- thirds vote of all members present and voting. Any proposed change to this charter must be noted on the draft agenda that is sent out at the time the meeting is scheduled.

Reservoir Fisheries Habitat Partnership Governance Structure



Appendix II Project Selection Criteria (revised March 2016)

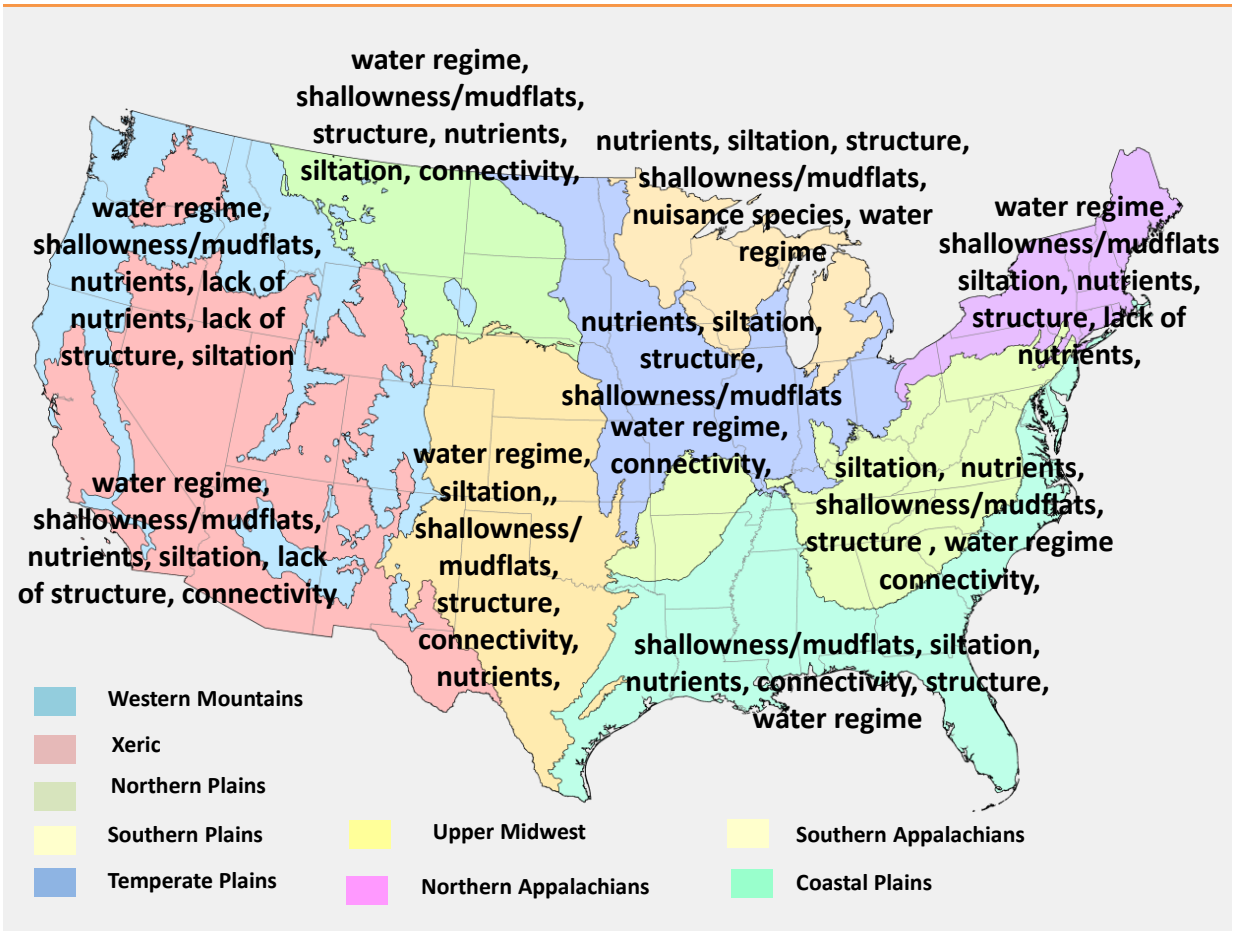
I. AQUATIC HABITAT RESTORATION/PROTECTION	**Points = 145**
I.1 Would the habitat project in question address the regional priority impairments identified in the RFHP habitat impairment assessment. Refer to the map and table attached.	
1st and/or 2nd Regional Priority Impairment = 50	
3rd and/or 4th Regional Priority Impairment = 25	
5tht and/or 6th Regional Priority Impairment = 10	
Does not address any of the top 6 Regional Priority Impairments = 0	
I.2 Are objectives and performance measures clearly defined in the proposal? (e.g., ft^2 of shoreline restored; quantified amount of structure added; number of native plants planted; changes in water quality parameters; changes in fish sampling catch rates in affected area, rates of recruitment, or population size structure; angler catch rates, harvest rates, and measures of directed fishing effort; measures of recreational use or economic benefit; etc)	
Clearly defined objectives and performance measures with reasonable likelihood of performance measures being met = 40	
Clearly defined objectives and performance measures with low likelihood of performance measures being met = 20	
Loosely defined objectives/performance measures=10	
No performance measures=0	
I.3 Are monitoring plans included in the proposal? (Are monitoring plans sufficient to evaluate the stated performance measures in the proposal? *Note: monitoring may be outside of the time scope of the project but should be included to receive maximum points. Are monitoring plans of sufficient duration to determine if project objectives are met?)	
Monitoring and evaluation adequate to evaluate performance measures = 40	
Monitoring and evaluation stated but insufficient to meet performance measures = 20	
No monitoring and evaluation included = 0	
I.4 Are project deliverables clearly stated and achievable based on objectives and methods?	
Deliverables clearly stated and likely to be achievable based on stated objectives and monitoring plan=15	
Deliverables clearly stated and unlikely to be achievable based on stated objectives and monitoring plan=5	
Deliverables not clearly stated =0	

II. QUALITY OF LIFE FOR AMERICANS	**Points = 50**
II.1 Would the habitat project in question help the RFHP achieve its objectives to provide, protect and enrich quality of life for all Americans? ***<u>Check all that apply</u>:*** o ***Develop environmental amenities, nature experiences, and wildlife-based activities and opportunities on lands adjacent to reservoir systems to engage and inform local communities and visiting public on the values and benefits of healthy reservoir systems.*** o ***Promote conservation of fish and aquatic resources to boaters and other water-based recreationists.*** o ***Maintain and enhance public access.*** o ***Support recreational industries and related economic activities that advance watershed health and contribute to conservation of fisheries and aquatic habitats in reservoir systems.***	
Yes, three or more objectives = 15	
Yes, two objectives = 10	
Yes, one objective = 5	
No = 0	
II-2 Would the project restore/enhance habitat that would directly support a priority species as identified in the RFHP Habitat Assessment for each of the nine WSA Regions?	
Ranked 1 or 2 in WSA Priority Fish Species = 20	
Ranked 3 or 4 in WSA Priority Fish Species = 15	
Ranked 5 or 6 in WSA Priority Fish Species = 10	
Ranked below 6 but still on the Priority List= 5	
No = 0	
II.3Would project outcomes lead to improvements in water quality or quantity for human health, recreational use, or ecological health of the reservoir system?	
Yes, direct and immediate improvement = 15	
Yes, indirect or delayed improvement = 10	
No = 0	

III. PARTNERSHIPS, FUND LEVERAGING, AND PROMOTION	**Points = 80**
III.1 Would the habitat project in question help the RFHP achieve its objectives to establish partnerships between management agencies and reservoir stakeholders; leverage outside sources of funding; and advance public awareness and understanding of the value of healthy reservoir systems? ***<u>Check all that apply</u>:*** o ***Establish national and regional technological assistance, data sharing and information network capacities to support development and adoption of best management practices among managers and among individuals and organizations engaged in the conservation of fish habitat in reservoir systems*** o ***Support and participate in watershed planning initiatives to promote implementation of best management practices for conservation of fisheries and fish habitat in reservoir systems*** o ***To ensure practitioner awareness of and access to RFHP and its support capacities, establish outreach to reservoir managers, relevant authorities and communities within reservoir systems, and other private and public stakeholders engaged in conservation of those systems and their fisheries*** o ***Develop and formalize institutional relationships between RFHP and principle partners to establish landscape-level networks of communication and governance that will facilitate effective, efficient, and sustaining conservation of aquatic habitat in reservoir systems*** o ***Identify and develop long-term funding opportunities for RFHP projects and operations*** o ***Advance public awareness of the economic, societal and ecological value and benefits of healthy reservoir systems*** o ***Advance public understanding of the connections between habitat quality in reservoir systems and land-use practices within their associated watersheds*** o ***Nurture a public that is well-informed and involved in current and emerging resource issues in reservoir systems***	
Yes, > 5 objectives = 15	
Yes, 3 - 5 objectives = 10	
Yes, 1 - 2 objective = 5	
No = 0	
III.2 How many partners are involved in the project? (Partners must be listed in the budget table and provide cash and/or in-kind contributions to be considered.)	
>5 = 15	
3-5 = 10	
1-2 = 5	
0 = 0	

III.3 Will this project bring together a diverse cross-section of partner types (State government, Federal government, City or County government, water controlling authorities, universities, angler groups or clubs, civic groups or clubs, private industry, or local businesses). If so, how many partner types are directly involved in the project?	
>5 = 15	
2-5 = 10	
1 = 0	
III.4 Are state and/or federal fish and wildlife management agencies actively engaged (providing financial or in-kind contribution) in this project and is the project compatible with a reservoir, watershed or land use management plan? If so, provide a copy or a link to the plan.	
Yes and plan = 10	
Yes, but no plan = 5	
No = 0	
III.5 What amount of funds are leveraged from other sources?	
>5:1 = 15	
5-2:1 = 10	
> 1 < 2:1 = 5	
<1:1 = 3	
No leveraging = 0	
III.6 Does the project involve a Friends of Reservoirs group or member? Name the FOR group or member.	
Yes = 10	
No = 0	
Point Total for Goal Category I (maximum of 145)	
Point Total for Goal Category II (maximum of 50)	
Point Total for Goal Category III (maximum of 80)	
Grand Point Total for Project (maximum of 275)	

Priority Impairments by Region



Regions above were used to differentiate priority impairments in the assessment.

- Lists of impairments are based on the percent of reservoirs in each region that were moderately to high or highly impaired for individual impairments.
- Lists of impairments for each region are in priority order (see table on next page).

Top 2 Impairments in each Region-50 pts; 3rd and 4th-25 pts; 5th and 6th-10 pts

REGION	IMPAIRMENT	POINTS
Western Mountain	Water Regime (extreme and/or mistimed fluctuations, low retention)	50
	Excessive mudflats/shallowness (little deep water refuge)	
	Excessive Nutrients (algae blooms)	25
	Limited nutrients	
	Limited littoral structure (lack of woody structure and vegetation, shoreline erosion)	10
	Siltation/Turbidity	
Xeric	Water Regime (extreme and/or mistimed fluctuations, low retention)	50
	Excessive mudflats/shallowness (little deep water refuge)	
	Excessive Nutrients (algae blooms)	25
	Siltation/Turbidity	
	Limited littoral structure (lack of woody structure and vegetation, shoreline erosion)	10
	Connectivity (lack of connection with embayments/backwaters, tributaries)	
Northern Plains	Water Regime (extreme and/or mistimed fluctuations, low retention)	50
	Excessive mudflats/shallowness (little deep water refuge)	
	Limited littoral structure (lack of woody structure and vegetation, shoreline erosion)	25
	Excessive Nutrients (algae blooms)	
	Siltation/Turbidity	10
	Connectivity	
Upper Midwest	Excessive Nutrients (algae blooms)	50
	Siltation/Turbidity	
	Limited littoral structure (lack of woody structure and vegetation, shoreline erosion)	25
	Excessive mudflats/shallowness (little deep water refuge)	
	Excessive Vegetation (typically invasive/non-native plants)	10
	Water Regime (extreme and/or mistimed fluctuations, low retention)	

Southern Plains	Water Regime (extreme and/or mistimed fluctuations, low retention)	50
	Siltation/Turbidity	
	Excessive mudflats/shallowness (little deep water refuge)	25
	Limited littoral structure (lack of woody structure and vegetation, shoreline erosion)	
	Connectivity	10
	Excessive Nutrients (algae blooms)	
Temperate Plains	Excessive Nutrients	50
	Siltation/Turbidity	
	Limited littoral structure (lack of woody structure and vegetation, shoreline erosion)	25
	Excessive mudflats/shallowness (little deep water refuge)	
	Water Regime (extreme and/or mistimed fluctuations, low retention)	10
	Connectivity	
Coastal Plains	Excessive mudflats/shallowness (little deep water refuge)	50
	Siltation/Turbidity	
	Excessive Nutrients	25
	Connectivity	
	Limited littoral structure (lack of woody structure and vegetation, shoreline erosion)	10
	Water Regime (extreme and/or mistimed fluctuations, low retention)	
Northern Appalachians	Water Regime (extreme and/or mistimed fluctuations, low retention)	50
	Excessive mudflats/shallowness (little deep water refuge)	
	Siltation/Turbidity	25
	Excessive Nutrients (algae blooms)	
	Limited littoral structure (lack of woody structure and vegetation, shoreline erosion)	10
	Limited Nutrients	
Southern Appalachians	Siltation/Turbidity	50
	Excessive Nutrients (algae blooms)	

	Excessive mudflats/shallowness (little deep water refuge)	25
	Limited littoral structure (lack of woody structure and vegetation, shoreline erosion)	
	Water Regime (extreme and/or mistimed fluctuations, low retention)	10
	Connectivity	

Appendix III: Partners

The RFHP built its partnership initially among State agencies, Federal agencies, and non-governmental organizations (NGOs) and industry representatives whose operations are national in scope. The support of State Fish and Wildlife agencies is critical to this effort: they have primary responsible for managing fish and wildlife resources within their jurisdictions and much of the data needed to set strategic priorities and to prioritize and justify conservation efforts are collected and housed within those State agencies. A number of key Federal agencies operate at a national scale to protect and manage publicly-owned aquatic resources; they are crucial to the partnership by virtue of their resource authorities and reservoir responsibilities. A number of non-profit organizations and NGOs were recruited to the partnership at the start of the RFHP: their conservation networks, expertise, and organizational skill are vital to success of the RFHP. National sportfishing conservation and industry groups were brought on board because of their interest in reservoir conservation and the support they have from the nation's anglers.

The second stage of partnership development will focus on engaging and recruiting the grassroots constituency the RFHP needs for success – whether as active members of the partnership or as participants in the Friends of Reservoirs national foundation and affiliated chapters. The RFHP will work with the States to recruit local conservation and watershed-based groups, tribal agencies, reservoir and power generation authorities, reservoir homeowner associations and developers, irrigators, municipalities, local businesses and communities adjacent to or affected by reservoirs, and others to build the partnership into a genuine grassroots movement and bottom-up organization.

The original contact list for candidate partners of the RFHP was developed by members of the RFHP interim steering committee, outreach and partnership working group, and those who attended the RFHP workshops at the National Conservation Training Center in Shepherdstown, WV, and Big Cedar Lodge on Table Rock Lake in southern Missouri. Ninety-one organizations/individuals were included in the original partner contact list. Each contact on the list was sent a letter of introduction, a fact sheet describing the partnership, and a Memorandum of Understanding (MOU) detailing the commitment entailed by the MOU between the RFHP signatory partners. Solicited partners were asked to sign and return the signature page of the MOU. A composite coversheet for the MOU and the MOU language is included below. Letters of endorsement were submitted to the RFHP in lieu of signed MOUs by some agencies.

The list of current signatories follows.

Memorandum of Understanding

Between

American Fisheries Society, Fisheries Administration Section
Alabama Division of Wildlife & Freshwater Fisheries
Aquatic Ecosystem Restoration Foundation
Arkansas Game and Fish Commission
BioSonics, Inc
California Department of Wildlife
Colorado Division of Wildlife
FLW Outdoors
Georgia Department of Natural Resources
Idaho Department of Fish & Game
Illinois Department of Natural Resources
Indiana Department of Natural Resources, Division of Fish and Wildlife
Iowa Department of Natural Resources
Kansas Department of Wildlife & Parks
Kentucky Fish and Wildlife Resources
Louisiana Department of Wildlife & Fisheries
Maryland Department of Resources, Fisheries Service
Michigan Department of Natural Resources
Missouri Department of Conservation
Nebraska Game and Parks Commission
Nevada Department of Wildlife
North Carolina Wildlife Resources Commission
North Dakota Game & Fish Department
Ohio Department of Natural Resources, Division of Wildlife
Oklahoma Department of Wildlife Conservation
Oregon Department of Fish and Wildlife
Pennsylvania Fish and Boat Commission
Pure-Fishing, Berkley Conservation Institute
South Dakota Game, Fish and Parks
Tennessee Wildlife Resources Agency
Texas Parks and Wildlife Department
United States Bureau of Land Management – Lake Havasu Fisheries Program
U.S. Department of Energy, Southwestern Power Administration
U.S. Army Corps of Engineers – Department of the Army
Utah Division of Wildlife Resources
Virginia Department of Game and inland Fisheries
West Virginia Division of Natural Resources
Wisconsin Department of Natural Resources

For

Support of the

Reservoir Fisheries Habitat Partnership

Letter of Endorsement to Reservoir Fisheries Habitat Partnership

Between

United States Department of Interior, Geological Survey
U. S. Department of Interior, Bureau of Land Management National Fisheries Program
United States Department of Interior, National Park Service
Southeastern Association of Fish and Wildlife Agencies
Midwest Association of Fish & Wildlife Agencies
Western Association of Fish and Wildlife Agencies
American Sportfishing Association
BASS Conservation
Bass Pro Shops
Arizona Game and Fish Department
California Natural Resources Agency, Department of Fish & Game
Florida Fish and Wildlife Conservation Commission
Mississippi Department of Wildlife, Fisheries, and Parks

Appendix IV: Abbreviations and Use of Terms

AFWA Association of Fish and Wildlife Agencies

Anoxic Zone Zone of water in a reservoir that is depleted of oxygen

Conservation Used in consistency with the National Fish Habitat Action Plan to mean protection, restoration and enhancement

Conservation Pool Volume of reservoir designated for industrial, municipal, agricultural, recreational and other authorized uses, distinct from volume set aside for flood risk reduction

Executive Committee Governing body of the RFHP

Factor Analysis Statistical clustering of variables into one or more factors

FHP Fish Habitat Partnership – basic partnership unit and implementation arm of the NFHAP

Fish Includes sport and non-sport fish species

Fish Habitat Conservation Any action that protects, restores, and/or enhances habitat for fish or other aquatic species

Friends of Reservoirs Volunteer support organization for the RFHP

Hypolimnion Lower layer in a thermally-stratified body of water which is marked by low temperatures and is often deficient in dissolved oxygen

Hypoxic Waters Oxygen deficient waters

Littoral Zone Zone of high photosynthetic activity and concentrated aquatic life extending from reservoir shoreline to areas up to 15 feet in depth

NFHP National Fish Habitat Partnership

Regional Workgroups Regional governing bodies of the RFHP established under the auspices of each of the four regional AWFA associations

Reservoir Body of water formed by the impoundment of free-flowing rivers and streams and that (1) are accessible to the public and (2) support, or could support, a sport fishery

Reservoir System A reservoir and its associated watershed, including downstream flows

Reservoir Tailwaters Waters downstream of a reservoir measurably affected by dam releases

RFHP Reservoir Fisheries Habitat Partnership

Trophic Decline Deterioration in reservoir habitat structure and productivity as reservoir ages, 5 – 20 years after impoundment

Trophic Upsurge Progression in reservoir habitat structure and productivity immediately following impoundment of a stream or river