FISHERIES MANAGEMENT PLAN

PINE RIDGE
INDIAN RESERVATION

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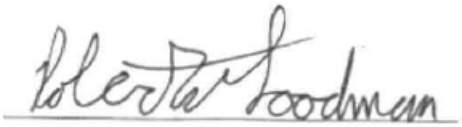

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TABLE OF CONTENTS

Introduction

The Pine Ridge Indian Reservation, in southwest South Dakota, was established in 1889. Originally, the Reservation consisted of 2.8 million acres, but allotment sales and purchase of the Aerial Gunnery Range by the Defense Department reduced its current size to about 1.6 million acres. Most land is within Shannon and Jackson counties with extensive off-reservation trust lands in adjacent Bennett County, and Sheridan County in Nebraska. The 2010 population census was 18,834 residents (U. S. Census Bureau 2010).

The terrain consists of rolling grassland prairie dissected by streams, which form deep canyons. The northern half of the reservation consists of badlands. The area is semi-arid with temperatures that range from 100 °F in the summer to -40 °F in the winter. The growing season averages 130 days and average rainfall is 16 inches. The land is primarily pasture that is grazed by livestock and is also for grain farming.

The Pine Ridge Indian Reservation has three primary drainage systems including the Cheyenne, White, and Little White rivers. The Cheyenne River borders the northwest corner of the reservation and drains badlands. The White River curves diagonally across the reservation from southwest to northeast. It is the largest drainage system on the reservation with numerous braided intermittent streams, which also drains highly erodible badlands. The Little White River originates in the sandhills and flows eastward across the southeast corner of the reservation (Figure 1).

Since 1951, the Oglala Sioux Tribe and the U. S. Fish and Wildlife Service (USFWS) have cooperated in the management of the fishery resources on the Pine Ridge Indian Reservation. The USFWS provided technical assistance and fish stocking as needed for management. The Tribe provided man-power and program direction. Oglala Sioux Parks and

Recreation Authority (OSPRA) has adopted fishing regulations (Appendix A), including bag limits and license fees, and maintains a staff of conservation officers to enforce the regulations (OSPRA 2007).

Stunting, overpopulation of rough fish (e.g., common carp *Cyprinus carpio*, white suckers *Catostomus commersonii*), and winter-kill have been the most frequent fish management challenges in the impoundments. Heavy rains have periodically "flushed" the creeks and reestablishment of the trout fishery has been required. Stunting and overpopulation of rough fish in impoundments have been treated by chemical eradication and restocking with game and forage fish. Winter kills have been addressed by restocking with fish resistant to winter kill (e.g., yellow perch *Perca flavescens* and northern pike *Esox lucius*) or stocking largemouth bass *Micropterus salmoides* and bluegill *Lepomis macrochirus* (Appendix B) in good water years, hoping that these conditions hold long enough to establish a recreational fishery (USFWS 1997). Additionally, over 30 species of fish have been reported on the Reservation (Appendix C; Haines and Sherman 1984; Green et al. 1990; Hoagstrom 2006).

Currently, most game fish populations are found in six reservoirs across the reservation that range in size from 27 to 700 acres including: Oglala, White Clay, Wolf Creek, Denby, Kyle, and Yellow Bear reservoirs (Figure 1). A small, catchable rainbow trout *Oncorhynchus mykiss* program was carried out between 1951 and 1992 and was popular with local residents. However, this program was discontinued because of poor return to the creel. Rainbow trout have continued to be stocked sporadically in Oglala and Yellow Bear Reservoirs through 2014, however they have rarely been found in fisheries surveys.

Sedimentation has contributed to declining stream habitat conditions (W. Stancill, USFWS, personal communication) and the impoundments are poorly suited for trout due to

thermal stresses. Most streams are low gradient, silt laden, and generally unsuitable for game fish. However, these streams contain numerous native cyprinids and catostomids (Hoagstrom 2006). A few streams that originate in the sandhills (e.g. Denby creek) or in pine covered canyon areas (e.g. No Flesh Creek and Corn Creek) are relatively clear and cool and have held non-native trout populations prior to the 1990's.

The continued spread of aquatic invasive species throughout North America has led to the need for awareness and prevention in all aspects of fisheries work. The discovery of Asian clam shells in rearing ponds at Gavins Point National Fish Hatchery (GPNFH) in 2009 highlighted the importance of this awareness at reservation waters in the Great Plains region. In 2010, reservation waters in South Dakota, including Denby, Kyle, Oglala, White Clay, and Yellow Bear Reservoirs on the Pine Ridge Reservation, were sampled for Asian clams due to the possibility they had been transferred, via stocking, from GPNFH. None were found, possibly due to a lack of suitable habitat (USFWS 2010). Nevertheless, the threat of invasion by zebra mussels (*Dreissena polymorpha*), Eurasian watermilfoil (*Myriophyllum spicatum*), and other exotic species persists, especially on waters with boating access.

This Plan outlines the goals, strategies, and tactics for the fisheries management program on the Pine Ridge Indian Reservation. It is the result of a cooperative effort involving the Oglala Sioux Tribe and the USFWS. The Plan recognizes that: (1) through proper planning and management, the fish resources on the Reservation can make valuable contributions to the Tribal members; (2) the Oglala Sioux Tribe has the inherent right and responsibility to make decisions concerning the management of the fish resources on their lands; (3) Native American culture and customs are compatible with the management of fishery resources; (4) the primary responsibility for execution of the fish management lies with the Tribe and the Bureau of Indian Affairs; (5) the

USFWS's role is to assist the Tribe and the Bureau in such management by providing technical advice, assistance, and support.

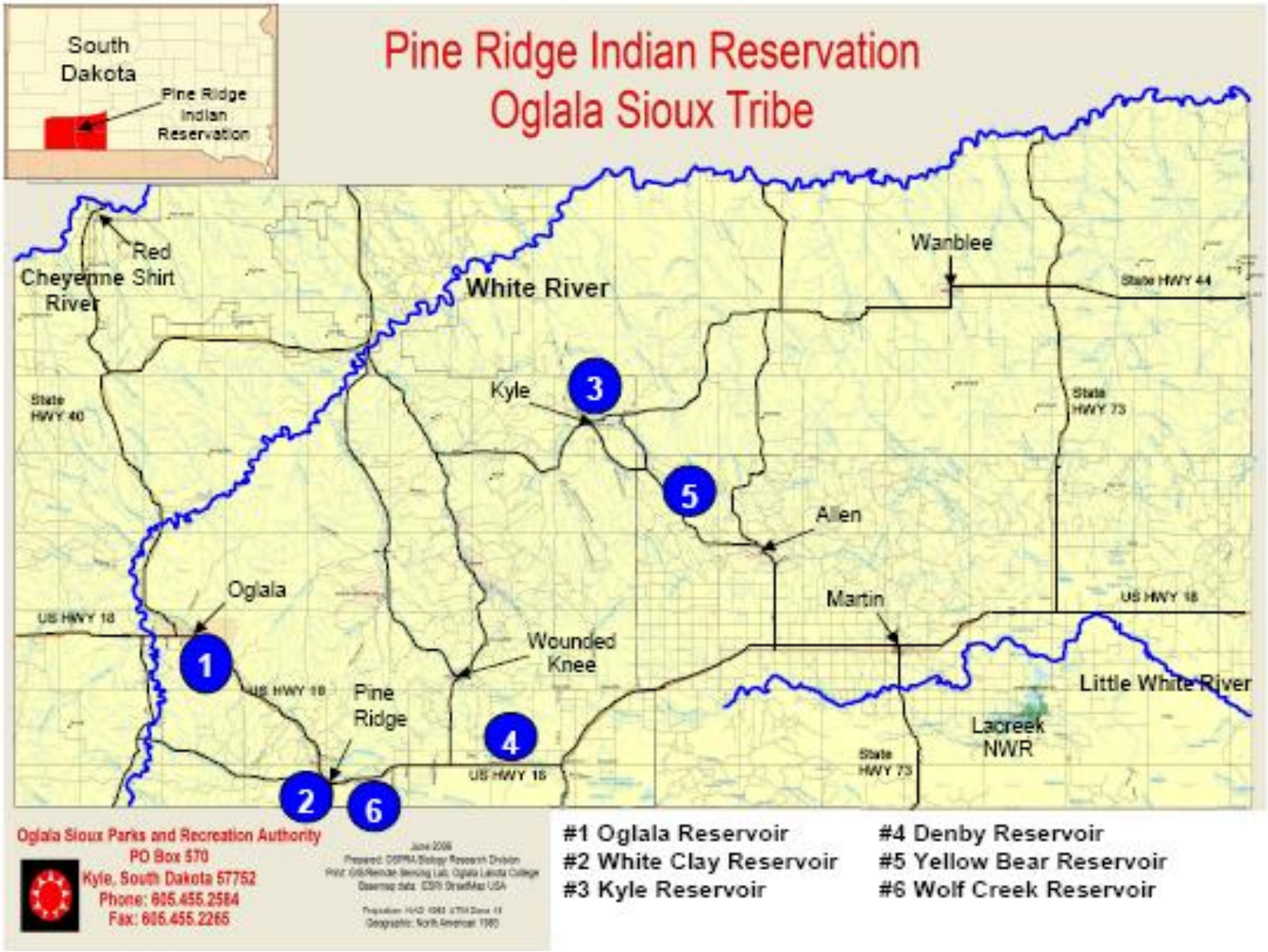

Figure 1. Map of the Pine Ridge Indian Reservation

Goals of the Fisheries Management Plan

1. To maintain fish in sufficient numbers and variety to meet the present and future economic, recreational, and aesthetic needs of the Tribal members.

2. To generate income from fishing license sales. This goal recognizes that with proper management, the fishery resource can support increased angling without reducing fishing quality. Furthermore, it recognizes the need for supplementing the operating funds of the Tribal fish and wildlife program.

3. To conserve and enhance all fish and wildlife resources on the Pine Ridge Indian Reservation. This goal recognizes that the Reservation's aquatic habitat is a valuable resource.

Management Objectives and Strategies

1. Protect, preserve, and enhance the fishery resources for the benefit of the Tribal members.

- Update and enforce fishing regulations.
- Fence out livestock to protect shoreline habitat along reservoirs and critical riparian areas along streams.
- Encourage agricultural practices that eliminate or limit sediment and pesticide runoff into Reservation waters.
- Identify new lakes, streams, creeks, reservoirs, and stock dams to introduce fish.
- Construct new impoundments (stock dams).
- Construct new access to reservoirs and rivers.

- Construct boat ramps.
- Provide access for the disabled or handicapped anglers with fishing docks.
- Control overabundant vegetation with approved herbicides in selected areas.
- Plan reservoir clean-up days. Have school field trips to clean litter around reservoirs.

2. Establish regulations that are in the best interest of the fishery resource.
   - Evaluate and establish daily and possession limits.
   - Establish minimum, maximum, or slot length limits only where needed.
3. Monitor managed waters at a minimum of every two years.
   - Conduct fishery surveys to measure fish population characteristics using electrofishing, experimental gill nets, and/or trap nets to evaluate the following:
     a) Relative abundance.
     b) Relative weight.
     c) Proportional and relative stock densities.
     d) Survival, growth, and recruitment.
   - Monitor water qualities (dissolved oxygen, pH, alkalinity, temperature, conductivity, and salinity)
   - Conduct creel surveys at a minimum of once every five years (Appendix D), which will measure the following:
     a) Angling catch, harvest, and release rates by fish species.
     b) Angling pressure, party size, and mean trip length.
     c) Size structures of fish harvested.
     d) Angler demographics and residency.
     e) Angler preferences and satisfaction.

4. Based on monitoring program, manage reservoirs and rivers with a basic yield, put and take, or put, grow, and take concept.

- Basic yield: The fishery is managed to provide anglers with the opportunity to harvest fish. The majority of the fish captured are fish that were hatched and grew to catchable size in the wild. In many instances, the fishery will be managed for "balanced" populations of predator and prey fish (Anderson and Weithman 1978). These fisheries do not rely upon, but may be supported with a supplemental stocking program.
- Put and take: The fishery is managed to provide anglers the opportunity to harvest fish that were stocked after being raised to catchable size in a reserve pond or fish hatchery.
- Put, grow, and take: The fishery is managed to provide anglers the opportunity to harvest large fish. These fisheries generally lack the capability of natural fish production; therefore, fish are raised to sub-catchable size, stocked, and allowed to grow to a catchable size.

5. Provide annual fish stocking to designated waters (Appendix E; USFWS 1994).

- Submit stocking requests through the USFWS (i.e., Great Plains FWCO and Gavins Point National Fish Hatchery).
- Transplant fish from over populated waters to less populated waters.

6. Control rough fish populations (e.g., common carp and white sucker).

- Use predatory game fish (e.g., northern pike, walleye, largemouth bass) to control the recruitment of rough fish.
- Control access of rough fish by prohibiting use of live minnows.
- Educate anglers to not dump minnow buckets in Reservation waters.

- Consider chemical renovation when rough fish populations exceed 70% of the total biomass.

7. Protect endangered and threatened fish species.
    - Identify waters containing endangered or threatened species.
    - Educate public about endangered and threatened species.
8. Prevent, reduce, and control invasive aquatic nuisance species on the Reservation.
    - Educate public on preventing the spread and introduction of aquatic nuisance species.
    - Encourage boat and trailer washing.
    - Discourage live bait use.
    - Wash and disinfect with bleach all boats, trailers, and equipment used for fish population monitoring surveys.
9. Monitor for the presence of aquatic nuisance species.
    - Complete surveys of recreational waters for zebra mussels, Asian clams, and other aquatic nuisance species on a regular basis.
10. Public outreach to inform and educate Tribal members of angling opportunities.
    - Provide fishing regulations at all fishing license vendors.
    - Provide fishery assessment reports to public.
    - Encourage school field trips to lakes, reservoirs, and streams.
    - Oglala Sioux Park and Recreation Authority biologists, managers, and conservation officers should introduce children to fish and aquatic invertebrate sampling and water chemistry education.
    - Have a free fishing weekend annually.
    - Kid fishing tournaments.

- Plan reservoir clean-up day. Have school field trips to clean litter around reservoirs.

11. Generate income.

- Continue current fishing license fees.
- Establish numerous vendors to sell fishing licenses.
- Provide camping areas near fishing access points and collect camping fees.

Specific Reservoir Objectives and Strategies

Each reservoir is unique with different types and sizes of watersheds, differences in the size of the reservoir itself, and with various fish species. Inter- and intraspecific interactions among fish species are usually complicated. Management of the reservoirs will be adaptive and driven by this Fish Management Plan.

Definitions of fishery terms are presented in Appendix F and fishery data collection, with example data sheets, and analysis protocols are presented in Appendix G.

Denby Reservoir

Introduction

Denby reservoir is about 1.0 km north of U.S. Highway 18 and 20 km east of Pine Ridge. A 33 m earthen dam across Denby Creek maintains water levels in the impoundment. Denby Creek is the primary water supply, but one small intermittent unnamed creek on the southwest corner contributes during the rainy season. The earthen structure has one box-type fixed crest spillway with a screw gate that allows for complete draw downs. Access to the dam is limited to one dirt road on the northwest side of the lake. The lake is used primarily for recreation. The surrounding watershed is used for livestock grazing and a small residence lies on the southeast corner of the reservoir.

The reservoir is about 8 ha (20 acres) with a maximum depth of 5 m and an average depth of 3 m. Last reported conductivity is 273 µS/cm at 28 °C and alkalinity averages 114 mg/L (USFWS 2013). Secchi disk averages 3 m with and average pH of 9.9.

The bottom is primarily fine silt and organic matter with an area of gravel on the southeast corner. Emergent vegetation is primarily cattail *Typha sp.* and softstem bulrush *Scirpus validus* on the southeast corner, submergent vegetation is abundant throughout the dam and consists primarily of coontail *Ceratophyllum demersum*. Inundated trees are abundant on the west side. The lake is surrounded by dense vegetation and trees and shows little sign of trampling by livestock.

Denby Reservoir fishery management history

The reservoir was chemically renovated and restocked in 1955, 1958, 1964, and 1971 in an attempt to control green sunfish and white sucker. Previous attempts to stock catchable size trout have failed because of competition, predation, and lethal summer water temperatures. The initial fishery survey was conducted during June 1996 (USFWS 1997), consisting of night electrofishing, trap nets, and gill nets.

Surveys of Denby Reservoir were conducted in 2008, 2010, and 2012 consisting only of electrofishing. Bluegill size structure has remained desirable and within the objectives of the 2007 Management Plan, with a PSD > 40 and a slowly increasing RSD-P. Recruitment appears to be successful with the 2012 survey showing markedly increased overall relative abundance. Condition has remained very good throughout the surveys, indicating that competition is not a problem. At this time, the population should be providing good numbers of harvestable fish.

Largemouth bass relative abundance has remained low. The most recent stock index (2012) indicated there was a large proportion of preferred length fish, however this should be interpreted with caution due to the small sample. This does, however, indicate that good growth is possible for largemouth bass in Denby. Largemouth bass fingerlings were stocked in 2008 and 2013 to supplement the population, however, due to the timing of the stocking and sampling

events, it is difficult to determine if they were successful. Sampling in 2010 yielded very few fish and none were of a size range to indicate they had been stocked two years prior. Largemouth bass condition in Denby has consistently been higher than values observed in any other reservoir on the Pine Ridge Reservation, indicating that prey availability is ample and the reservoir should support a healthy largemouth bass population.

Yellow perch relative abundance and size structure has improved relative to initial sampling events. However, stock indices and condition are still below desired values. This indicates that yellow perch may be overpopulated and could benefit from increased largemouth bass density to limit their recruitment.

Due to the inefficiency of electrofishing in indexing northern pike abundance, it is difficult to make conclusions about the state of their population in Denby Reservoir based on the low sample sizes provided by fishery surveys. The consistent observation of pike presence indicates they are likely persisting in the reservoir in low numbers.

Denby Reservoir objectives and strategies

Largemouth bass – objective 1. Increase largemouth bass relative abundance to a stock length electrofishing mean catch per unit effort (*C/f*) of 40 fish/hr and a balanced population size structure with a PSD range of 40 to 70 and RSD-P greater than 10.

Strategy 1a. Evaluate the largemouth bass population by conducting electrofishing.

Strategy 1b. Stock largemouth bass at a rate of 1 lb/surface acre (2 to 3 adults/surface acre or 100 fingerlings/surface acre) to supplement the existing population when possible.

Bluegill – objective 2. Maintain densities of stock length bluegill to an electrofishing mean *C/f* of 50 fish/hr and maintain a balanced population size structure of bluegills with a PSD range of 20 to 60 and RSD-P between 5 to 20.

Strategy 2a. Evaluate the bluegill population by conducting electrofishing.

Strategy 2b. Maintain adequate density of largemouth bass to limit panfish recruitment.

Strategy 2c. Encourage harvest of small bluegill (< 8 in.)

Yellow perch – objective 3. Maintain densities of stock length yellow perch to a gill net mean *C/f* of 10 to 40 fish/net and maintain a balanced population size structure of yellow perch with a PSD range of 30 to 60 and RSD-P between 5 to 20.

Strategy 3a. Evaluate the yellow perch population by gill netting.

Strategy 3b. Maintain adequate density of largemouth bass to limit panfish recruitment.

Strategy 3c. Encourage harvest of small yellow perch (< 8 in.).

Northern pike – objective 4. Maintain densities of stock length northern pike to a gill net mean *C/f* of 5 fish/net, a PSD range of 40 to 80 and RSD-P between 5 to 20.

Strategy 4a. Evaluate the northern pike population by conducting gill net surveys.

Strategy 4b. Maintain adequate density of northern pike to limit rough fish recruitment.

Kyle Reservoir

Introduction

Kyle Reservoir is located in the center of the reservation near the city of Kyle. Historically, this reservoir is known for an excellent cool and warm water fishery. Kyle Reservoir has a surface area of 26 ha (65 acres). The dam structure was recently renovated in the 1990's. However, the reservoir is quickly being silted in on the upstream end and choked off with submergent vegetation, mostly coontail. Maximum depth is 7 m (Haines and Sherman

1984). Emergent vegetation is primarily cattail *Typha sp.* and softstem bulrush *Scirpus validus*. Inundated trees are abundant on the north and south sides.

Kyle Reservoir fishery management history

Information regarding the management in Kyle Reservoir is limited. An initial electrofishing survey was conducted during June 2007 (USFWS 2007), consisting of night electrofishing.

Further surveys of Kyle Reservoir occurred in 2009 and 2015. Black crappie relative abundance decreased substantially from 2009 to 2015 survey, which produced only five fish. It is unclear if poor recruitment or overharvest may be contributing to this decline. Bluegill relative abundance has declined to a more desirable level over time, bringing it close to the goal of the 2007 Management Plan. Stock indices remain low resulting in few harvestable fish being found. Bluegill condition is high, indicating that prey availability is not a problem, suggesting that high harvest of fish over stock length may be occurring.

Largemouth bass relative abundance, stock indices, and condition were all at desired levels (USFWS 2007) in both the 2009 and 2015 surveys, indicating this population is stable and well-maintained. There should be an abundance of large fish providing excellent angling opportunities. Largemouth bass have not been stocked in Kyle Reservoir since 2008 indicating that the population is maintaining its structure without supplementation. The PSD and RSD-P are higher than the goal levels provided in the 2007 Management Plan, the primary goal of which was to maintain a good size structure of bluegill. Thus, increasing density of small bass (<300 mm) could still contribute towards that goal, though the relative abundance of bluegill has decreased dramatically in recent years.

Kyle Reservoir objectives and strategies

Largemouth bass – objective 1. Maintain largemouth bass relative abundance at a stock length electrofishing mean *C/f* of 40 fish/hr. A lower density and higher growth rate bluegill population will likely be maintained with an abundant population of small bass (< 12 in.). Maintain the bass size structure at a PSD range of 20 to 40 and RSD-P around 10.

Strategy 1a. Evaluate the largemouth bass population by conducting electrofishing.

Strategy 1b. Stock bass fingerlings at a rate of 0.5 lb/surface acre (100 fingerlings / surface acre) to supplement the existing population when possible.

Bluegill – objective 2. Manage densities of stock length bluegill to an electrofishing mean *C/f* of 50 fish/hr and maintain a balanced population size structure of bluegills with a PSD range of 20 to 60 and RSD-P between 5 to 20.

Strategy 2a. Evaluate the bluegill population by conducting electrofishing.

Strategy 2b. Maintain adequate density of largemouth bass to limit panfish recruitment.

Crappie – objective 3. Maintain densities of stock length crappie to an electrofishing mean *C/f* of 20 fish/hr and maintain a balanced population size structure with a PSD range of 30 to 60 and RSD-P $\geq$ 10.

Strategy 3a. Evaluate the crappie population by conducting electrofishing.

Strategy 3b. Maintain adequate density of largemouth bass to limit panfish recruitment.

Strategy 3c. Temporarily promote catch-and-release of all crappie to help increase spawning and recruitment success and allow more fish to reach harvestable size.

Northern pike – objective 4. Maintain densities of stock length northern pike to a gill net mean *C/f* of 5 fish/net, a PSD range of 40 to 80 and RSD-P between 5 to 20.

Strategy 4a. Evaluate the northern pike population by conducting gill net surveys.

Strategy 4b. Maintain adequate density of northern pike to control panfish abundances.

Oglala Reservoir

Introduction

Oglala reservoir is located on White Clay Creek near the city of Oglala, is 283 ha (700 surface acres) and has a maximum depth 6.7 m (22 ft). The bottom is silt laden, with very little aquatic vegetation. The water is generally quite turbid. Fish biomass is dominated by carp, although coolwater and warmwater game fish are surprisingly abundant given the turbidity (Haines and Sherman 1984).

Oglala Reservoir fishery management history

Information regarding the management history in Oglala Reservoir is limited. The dam structure was renovated/repaired in summer 2007 and the reservoir began to fill in fall 2007 and spring 2008. Following the renovation walleye fry were stocked from 2008-2010, yellow perch fry were stocked in 2008 and 2009, largemouth bass fingerlings were stocked from 2012 to 2015, and smallmouth bass were stocked in 2014 and 2015. In 2015, walleye were stocked as fingerlings rather than fry.

Fishery surveys were conducted in 2009 and 2012, consisting of nighttime (2009) and daytime (2012) electrofishing. Walleye were sampled in low numbers, though during the time of year that surveys took place, electrofishing is a poor method of indexing walleye abundance. Stock indices and population size structure indicate that stocked fish have survived and grown to produce some quality length fish, however sample sizes were low and thus it is difficult to make conclusions about the state of the fishery.

The initial yellow perch stockings were successful and there is a high abundance of stock length yellow perch, however PSD remains low. As perch abundance increased, condition decreased to below a desirable level indicating that they may be overpopulated and competing for prey. The length structure indicates there may not be any natural reproduction because all perch appear to be from the original two stockings. As yellow perch continue to grow, some will likely be harvested, decreasing competition. Continued stocking may be necessary if future surveys do not show recruitment.

Northern pike were present prior to the dam renovation but have not been restocked. Black bullhead numbers have increased dramatically, indicating that it could help to have northern pike present to control their recruitment. No survey has been conducted since the stocking of largemouth bass, however multiple year classes of bass were found in the 2012 survey indicating that some resident fish were present in the creek when the reservoir refilled or were transferred into the reservoir via other means. Future surveys will be necessary to assess largemouth bass stocking success.

Oglala Reservoir objectives and strategies

Walleye – objective 1. Maintain a minimum relative abundance with a gill net mean *C/f* of 10 stock length fish/net, a PSD range of 30 to 60, and RSD-P greater than 10.

Strategy 1a. Evaluate the walleye population by conducting gill net surveys.

Strategy 1b. If available, continue stocking walleye as fry or fingerlings and reassess stocking success in future surveys.

Northern pike – objective 2. Introduce northern pike and maintain population at a gill net mean *C/f* of 5 fish/net, a PSD range of 40 to 80 and RSD-P between 5 to 20 in order to limit rough fish recruitment.

Strategy 2a. Stock northern pike fingerlings at a rate of 75 / acre.

Strategy 2b. Evaluate the northern pike population by conducting gill net surveys.

Yellow perch – objective 3. Maintain densities of stock length yellow perch to a gill net mean *C/f* of 10 to 40 fish/net and maintain a balanced population size structure of yellow perch with a PSD range of 30 to 60 and RSD-P between 5 to 20.

Strategy 3a. Evaluate the yellow perch population by conducting gill net surveys.

Strategy 3b. If future surveys fail to find evidence of natural recruitment, stock regularly with yellow perch at a rate of 500 fry / acre.

Largemouth bass – objective 4. Maintain largemouth bass relative abundance at a stock length electrofishing mean *C/f* of 40 fish/hr and a balanced population size structure with a PSD range of 40 to 70 and RSD-P greater than 10.

Strategy 4a. Evaluate the largemouth bass population by conducting electrofishing.

Strategy 4b. If future surveys show recruitment to be absent, stock largemouth bass at a rate of 1 lb/surface acre (2 to 3 adults/surface acre or 100 fingerlings/surface acre) to supplement the existing population when possible.

White Clay Reservoir

Introduction

White Clay Reservoir is located in a ponderosa pine area south of Pine Ridge, South Dakota and north of White Clay, Nebraska. White Clay Creek is the primary water supply, but an unnamed creek on the south west corner of the impoundment provides intermittent run-off during spring and heavy rains. The surrounding land is steep and sandy so runoff is minimal.

The dam and emergency spill way are earthen and there is also one screw-gate for drawdown capabilities. The watershed is steep and rocky with scattered grasslands and ponderosa pine draws. The surrounding area is used primarily for livestock grazing and is severely overgrazed in many parts of the watershed. Access is limited to one road in South Dakota enter from the east end and one from the south in Nebraska. The impoundment is relatively close to the cities of Pine Ridge and White Clay and receives the greatest fish pressure of any of the reservation impoundments.

White Clay Reservoir is about 36 ha (90 acres) with a maximum depth of 7 m and an average depth of 3 m. The banks and shoreline are moderately sloped, which produces a large littoral area. The substrate is sand and clay with scattered outcrops of rock. Submergent vegetation is abundant and includes coontail, milfoil *Myriophyllum sp.*, and pondweeds. During summer, submergent vegetation on the south east area and the two small bays on the west become too dense to navigate a boat through. Emergent vegetation includes cattail, sedges, and bulrush which form a narrow band around most of the impoundment. The most recent measurement of conductivity is 406 µS/cm at 25 °C and alkalinity averages 171 mg/L (USFWS 2013). Secchi disk depth averages 3 m with an average pH of 8 during the summer.

White Clay Reservoir fishery management history

The dam has been periodically managed for catchable trout, but competition and warm temperatures make it a poor site. The impoundment was drained and held in a draw down state for four years to facilitate repairs on the dam during the late 1980's and early 1990's. Surveys, conducted during the first year after being refilled, indicated that bluegill, yellow perch, northern pike, largemouth bass, and white sucker had either survived or colonized the impoundment.

During spring 1993, 60 adult largemouth bass were transplanted from Yellow Bear Reservoir to White Clay Reservoir and fingerling largemouth bass were stocked during summer of 1994.

The initial fishery survey was conducted in 1996, consisting of electrofishing, trapnets, and gillnets. More recent surveys were completed in 2008, 2010, and 2012. No stocking has occurred since 2008 when largemouth bass fry and walleye fry were stocked.

The most recent survey (2012) indicates that bluegill relative abundance and size structure have reached desirable levels in White Clay Reservoir. An increasing largemouth bass population has likely limited excessive bluegill recruitment and increased the population size structure, meaning there are plenty of "quality and preferred" length bluegills available for harvest. However, this reservoir fish community may now be out of balance as there is no evidence of younger age classes of bluegill and an overabundance of small largemouth bass. A shift in approach towards encouraging some harvest of smaller bass may help keep this balance. Yellow perch show a similar trend to bluegill with an ideal size structure but low numbers of younger age classes causing concern.

White Clay Reservoir objectives and strategies

Largemouth bass – objective 1. Maintain largemouth bass relative abundance to a stock length electrofishing mean *C/f* of 30 fish/hr and a balanced population size structure with a PSD range of 40 to 70 and RSD-P greater than 10.

Strategy 1a. Evaluate the largemouth bass population by conducting electrofishing.

Strategy 1b. Maintain size structure by encouraging some harvest of smaller bass, which will allow bluegill and yellow perch recruitment to recover.

Bluegill – objective 2. Maintain densities of stock length bluegill to an electrofishing mean *C/f* of 50 fish/hr and maintain a balanced population size structure of bluegills with a PSD range of 20 to 60 and RSD-P between 5 to 20.

Strategy 2a. Evaluate the bluegill population by conducting night electrofishing.

Strategy 2b. Consider stocking bluegill to aid recruitment.

Yellow perch – objective 3. Maintain densities of stock length yellow perch to a gill net mean *C/f* of 10 to 40 fish/net and maintain a balanced population size structure of yellow perch with a PSD range of 30 to 60 and RSD-P between 5 to 20.

Strategy 3a. Evaluate the yellow perch population by conducting gill netting.

Strategy 3b. Consider stocking yellow perch to aid recruitment.

Yellow Bear Reservoir

Introduction

Yellow Bear Reservoir is located in a ponderosa pine forested area between the communities of Kyle and Allen. Historically, this reservoir was managed as a put-and-take trout fishery, but the water temperature was likely too warm and is best suited for a warm water fishery. The reservoir has a surface area of 6 ha (15 acres) with a maximum depth of 5 m, alkalinity is 200 mg/L (Haines and Sherman 1984). The dam structure was renovated in 2006.

Yellow Bear Reservoir fishery management history

Fishery surveys were conducted in Yellow Bear Reservoir in 2008, 2010, and 2015. In initial surveys, the reservoir was heavily overpopulated with small green sunfish. Yellow perch

and largemouth bass fry were stocked in 2008 in order to supplement populations and increase predation on green sunfish. Low numbers of green sunfish in later surveys (2010 and 2015) indicated that increasing predator populations had successfully controlled the green sunfish population. Bass also appear to have controlled black bullhead reproduction as that population only consists of a few older fish and is showing no signs of recruitment. The most recent survey showed the largemouth bass relative abundance and stock indices to be in line with the goals of the 2007 Management Plan. Bluegill are still overpopulated in Yellow Bear Reservoir. Increasing numbers of small largemouth bass could help limit bluegill recruitment.

Rainbow trout were stocked for several years, though only a few have been sampled during fishery surveys. It is unknown what the return to creel has been like, but it is suspected that warm temperatures have caused poor survival for stocked trout across the Pine Ridge Reservation. In 2015 brown trout were stocked with the hope that their higher thermal tolerance would lead to better survival.

Yellow Bear Reservoir objectives and strategies

Largemouth bass – objective 1. Maintain largemouth bass relative abundance at a stock length electrofishing mean *C/f* around 40 fish/hr and a balanced population size structure with a PSD range of 40 to 70 and RSP-P greater than 10.

Strategy 1a. Evaluate the largemouth bass population by conducting night electrofishing.

Strategy 1b. Stock fingerling largemouth bass at a rate of 0.5 lb/surface acre (100 fingerlings / surface acre) to supplement the existing population when possible and help control panfish recruitment.

Bluegill – objective 2. Maintain densities of stock length bluegill to an electrofishing mean *C/f* of 50 fish/hr and maintain a balanced population size structure of bluegills with a PSD range of 20 to 60 and RSP-P between 5 to 20.

Strategy 2a. Evaluate the bluegill population by conducting night electrofishing.

Strategy 2b. Maintain adequate density of largemouth bass to limit panfish recruitment.

Yellow perch – objective 3. Maintain densities of stock length yellow perch to a gill net mean *C/f* of 10 to 40 fish/net and maintain a balanced population size structure of yellow perch with a PSD range of 30 to 60 and RSP-P between 5 to 20.

Strategy 3a. Evaluate the yellow perch population by conducting gill netting.

Strategy 3b. Maintain adequate density of largemouth bass to limit panfish recruitment.

Strategy 3c. Supplement population by stocking fingerling yellow perch.

Brown trout – objective 4. Provide a successful put-and-grow brown trout fishery with a high return-to-creel.

Strategy 4a. Stock catchable sized brown trout on a regular basis when available.

Strategy 4b. Evaluate the brown trout population by conducting electrofishing or gill netting surveys.

Strategy 4c. Conduct creel survey to understand fate of stocked brown trout and whether or not they are providing a successful fishery.

Black bullhead – objective 5. Maintain a black bullhead relative abundance at an electrofishing mean *C/f* of less than 10 fish/hr.

Strategy 5a. Evaluate the black bullhead population by conducting electrofishing.

Strategy 5b. Maintain adequate density of largemouth bass to limit bullhead recruitment.

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Appendix A. Summary of license fees, harvest limits, and fishing regulations, for Pine Ridge Indian Reservation reservoirs (OSPRA 2007).

License fees

License type	Tribal member	Non-tribal resident	Non-tribal member
Annual	$5.00	$25.00	$35.00
Annual family	$7.00	$35.00	$40.00
24-hour	N/A	N/A	$15.00
5-day	N/A	N/A	$20.00

Harvest limits

Species	Daily limit	Possession
Largemouth bass	2	4
Northern pike	No limit	No limit
Walleye	1	2
Catfish	2	4
Bullhead	5	10
Sunfish*	5	10
Perch	5	10
Non-game	No limit	No limit

*Sunfish includes: bluegill, green sunfish, orange-spotted sunfish, and pumpkinseed.

Definitions

Possession: Physical possession or control of any fish or parts thereof, on ones person premises, motor vehicle, or public or private place of processing or storage.

Daily limit: The number of fish that may be taken from midnight to midnight.

Game fish: All species belonging to the pike, catfish, sunfish, and perch families of fish species.

Non-game fish: Any and all fish species not included in the game fish families.

Categories

Tribal member: Enrolled member of the Oglala Sioux Tribe.

Non-tribal member resident: Person who has resided on the Pine Ridge Reservation for a minimum of one year.

Non-tribal member: Person who is not an enrolled member of the Oglala Sioux Tribe.

License Information

Fishing licenses are valid until December 31st of the year of issuance. Licenses must be in the licensee's possession while engaged in any fishin activity including the fishing of rivers and streams. License not required for children under the age of 15 years when accompanied by an licensed adult. Any fish caught by them will be included in the daily and possession limit of the license holder. Active duty veterans and person 55 years of age and older are also exempt from the license requirements.

Restrictions

No person shall:

- Take fish by any other means than by rods, lines, and baited fish hooks.
- Fish on reservation waters without proper licensing by tribal authority.
- Empty the contents of any minnow bucket or otherwise introduce bait minnows or fish of any species into the waters of the Pine Ridge Indian Reservation.
- Discharge firearms containing bulleted cartridges or shotgun slugs into or in the vicinity of the Pine Ridge Indian Reservation lakes and reservoirs.
- Place in or upon any waters within the boundaries of the Pine Ridge Indian Reservation any harmful substances or explosive of any kind or character with the intent to take or kill, stun, or wound fish.

- Have in possession any net, gig, spear, fish trap, or other device, contrivance, or material for the purpose of taking fish except as otherwise provided for in the Oglala Sioux Tribe fishing regulations.
- Cut or drill through the ice a hole greater diameter than 8 inches, nor shall the length of any side of ice hole exceed 8 inches which is used for ice fishing.
- Deposit refuse in the reservation waters.
- Loan his/her license to another or aid another in obtaining a license fraudulently.
- Fish through the ice with more than four lines (with a maximum of three hooks per line) or four tip-ups.

Appendix B. Fish stocking history in Pine Ridge Indian Reservation reservoirs. Stocking size abbreviations are fry (FY; Hatch to 1.49 in), fingerling (FG; 1.5 to 5.49 in), sub-adult (SA; ≥ 5.5 in, not sexually mature), adult (AD; sexually mature, regardless of size), and mixed (MX; transplanted from natural sources).

	Reservoir	Denby			Kyle			Oglala		
Species	Year	Month	N	Size	Month	N	Size	Month	N	Size
Largemouth	2015							6	45,000 (S)	FG
Bass	2014							7	5,500 (S)	FG
	2013	7	5,148	FY				7	12,078	FG
	2012								17,000	FG
	2008	7	2,000	FY	7	6,500	FY			
	1996							7	80,000	FG
	1995							7	70,000	FG
	1994									
	1992									
	1989									
	1988				7	5,000	FG			
Bluegill	2013							7	6,500	FY
	1988	9	2,500	FY						
Northern	1996							4	60,000	FG
Pike	1995							4	70,000	FG
Yellow	2009							6	170,900	FY
Perch	2008							6	190,000	FY
	1995								9 quarts	Eggs
Rainbow	2015									
Trout	2014							5	1,785	AD
	2012									
	2010									
	2009									
	2008									
	1992									
	1991	4	1,500	AD						
	1989									
	1988									
Channel	1991	9	5,000	FG						
Catfish	1989	9	5,000	FG						
	1988	9	5,000	FG						
Walleye	2015							6	75,900	FG
	2010							6	70,000	FY
	2009							6	71,400	FY
	2008							6	35,000	FY

	Reservoir	White Clay			Wolf Creek			Yellow Bear		
Species	Year	Month	N	Size	Month	N	Size	Month	N	Size
Largemouth	2015									
Bass	2014									
	2013									
	2012									
	2008	7	9,000	FY				7	1,500	FY
	1996									
	1995									
	1994		60	AD						
	1992	9	30,000	FG						
	1989	9	5,000	FG						
	1988									
	2013									
	1988							9	2,500	FY
Northern	1996									
Pike	1995									
Yellow	2009									
Perch	2008							6	1,800	FY
	1995									
Rainbow	2015							4	2,100 (B)	AD
Trout	2014									
	2013							5	1,500	AD
	2012							5	1,440	AD
	2010							5	1,500	AD
	2009							4	503	AD
	2008							5	1,500	AD
	1992				4	1,500	AD	4	1,000	AD
	1991				4	1,500	AD	4	1,000	AD
	1989				4	1,000	AD	4	1,000	AD
	1988				4	1,000	AD			
Channel	1991									
Catfish	1989	7	5,000	FG						
	1988									
Walleye	2015									
	2010									
	2009									
	2008	6	35,000	FY						

Appendix C. Check list of fishes on the Pine Ridge Indian Reservation (Haines and Sherman 1984). Species abundance: 1 = dominant, 2 = frequent, 3 = common, 4 = rare, 5 = present but unknown abundance. Abundances based on Haines and Sherman (1984), Green et al. (1990), and Hoagstrom (2006).

Family and species	Abundance	Location
Hiodontidae		
Goldeye *Hiodon alosoides*	3	Cheyenne and White rivers
Clupeidae		
Gizzard shad *Dorosoma cepedianum*	5	Cheyenne River
Cyprinidae		
Common carp *Cyprinus carpio*	3	Throughout the Reservation
Western silvery minnow *Hybognathus argyritis*	4	White River
Plains minnow *Hybognathus placitus*	3	White River
Sturgeon chub *Macrhybopsis gelida*	4	White River
Golden shiner *Notemigonus crysoleucas*	2	Denby, Oglala, White Clay, and Wolf Creek reservoirs
Red Shiner *Notropis lutrensis*	2	Cheyenne and White rivers
Sand shiner *Notropis stramineus*	2	Cheyenne and White rivers
Fathead minnow *Pimephales promelas*	2	Throughout the Reservation
Flathead chub *Platygobio gracilis*	3	Cheyenne and White rivers
Longnose dace *Rhinichthys cataractae*	3	Cheyenne and White rivers and most creeks
Creek chub *Semotilus atromaculatus*	2	Cheyenne River and most creeks
Catostomidae		
River carpsucker *Carpiodes carpio*	3	Cheyenne and White rivers
Quillback *Carpiodes cyprinus*	3	Cheyenne River and Oglala Reservoir
White sucker *Catostomus comersonii*	3	Cheyenne and White rivers and most reservoirs
Mountain sucker *Catostomus phatyrhynchus*	3	Cheyenne River
Buffalo sp. *Ictiobus sp.*	5	White River and Oglala Reservoir
Shorthead redhorse *Moxostoma macrolepidotum*	2	Cheyenne and White rivers and Oglala reservoir
Ictaluridae		
Channel catfish *Ictalurus punctatus*	2	Cheyenne and White rivers, Oglala and White Clay reservoirs
Stonecat *Noturus flavus*	3	Cheyenne and White rivers
Black bullhead *Ameiurus melas*	1	White River and most reservoirs
Salmonidae		
Brook trout *Salvelinus fontinalis*	5	
Brown trout *Salmo trutta*	4	Cheyenne River
Rainbow trout *Oncorhynchus mykiss*	5	
Cyprinodontidae		
Plains topminnow *Fundulus sciadicus*	3	Cheyenne R., Wolf Creek
Esocidae		
Northern pike *Esox lucius*	1	Denby, Kyle, Oglala, White Clay reservoirs

Appendix C continued.

Family and species	Abundance	Location
Centrarchidae		
Rock bass *Ambloplites rupestris*	4	Cheyenne River
Green sunfish *Lepomis cyanellus*	3	Cheyenne and White rivers and most reservoirs
Pumpkinseed *Lepomis gibbosus*	3	Denby and White Clay reservoirs
Orangespotted sunfish *Lepomis humilis*	5	
Bluegill *Lepomis macrochirus*	1	Denby, Kyle, Oglala, White Clay, and Yellow Bear Reservoirs
Smallmouth bass *Micropterus dolomieu*	4	Cheyenne River
Largemouth bass *Micropterus salmoides*	1	Denby, Kyle, Oglala, White Clay, and Yellow Bear Reservoirs
Black crappie Pomoxis nigromaculatus	1	Kyle, Oglala, and White Clay reservoirs
Percidae		
Yellow perch *Perca flavescens*	1	Oglala and White Clay reservoirs
Sauger *Sander canadense*	3	Cheyenne and White rivers
Walleye *Sander vitreum*	1	Denby, Oglala, and White Clay reservoirs

Appendix D. Creel surveys.

Objectives

The objective of a creel survey is to provide accurately describe angler data that will be used in determining and implementing a fisheries management plan. Specifically, a creel survey will provide information on the following: 1) angling catch, harvest, and release rates by fish species, 2) angling pressure, party size and mean trip length, 3) size structures of harvested fish, 4) angler demographics and residency, and 5) angler preferences and satisfaction.

Methods

Fishing pressure estimates and angler interview surveys should be stratified between weekend/holidays and weekdays. Since fishing pressure typically increases during the weekend days and holidays, surveys should occur on all weekends and holidays. A second stratification should be between AM (7 AM to 2 PM) and PM (2 PM to 9 PM). The time period will be randomly selected for each randomly selected day. Pressure count times should be randomly selected on the hour for two counts within each time period (i.e., for AM periods: one randomly selected hour between 7 AM and 10 AM and one hour between 11 AM and 1 PM). The number of surveys per week during the sample period should be at a minimum of one weekday and one weekend day per week. Typical summer angler survey sample periods are from April 1 to September 30 and winter from December 1 to February 28 during the winter. Data should be recorded on pressure count (Appendix Figure 1) and angler interview (Appendix Figure 2) forms. Fish kept by anglers will be identified by species and measured to the nearest centimeter.

Fishing pressure will be estimated including total angling hours, angling pressure during each day, and determine boat and shore angling pressure. The fish species targeted will be estimated for each month. The number and size of each fish species harvested will be measured for each month. Additionally, angler demographics will be measured including: party size, distance traveled, trip duration, residency, age, and gender. Finally, angler satisfaction will be estimated.

Further information found on sampling the recreational creel in Malvestuto (1996).

Appendix E. Stocking guidelines and management strategies for ponds and small impoundments (USFWS 1994).

Stocking Guidelines and Management Strategies for Ponds and Small impoundments

Prepared by the U. S. Fish and Wildlife Service
Office of Fisheries and Wildlife Management
Pierre, SD
March 1994

Pond Management Strategies

Ponds will be stocked with a predator (e.g., largemouth bass, northern pike) and a prey species (e.g., bluegill, yellow perch, golden shiners, or fathead minnows). When predators such as largemouth bass are stocked alone they prey upon their young causing poor recruitment. If a pond has abundant aquatic vegetation and the predators are over harvested, then the prey species escape predation usually resulting in an over abundant slow growing prey population. This does not occur with fathead minnows, but the predators such as largemouth bass generally eat them faster than they can reproduce and they will be absent several years after being stocked.

When largemouth bass are stocked with out forage species such as bluegill, about 35% of the largemouth bass survive the first two years. If the largemouth bass are stocked with a forage fish then the survival increases to about 55%.

Largemouth bass do not spawn in the northern plains (North Dakota, South Dakota, Nebraska, and Kansas) until the third or fourth growing season. Bass fishing in newly established ponds will be managed as "catch-and-release" until the bass have had at least one spawning season. Research indicates that "catch-and-release" during the first 5 years after initial stocking is important in maintaining the optimum number of adult largemouth bass. After two growing seasons the largemouth bass will reach about 10 to 13 inches and prey such as bluegill will reach 5 to 6 inches. A 15 inch minimum size limit will protect the bass long enough for them to spawn once.

After 5 years of protecting the largemouth bass population, a 12 inch minimum largemouth bass size limit will be used if the pond is to be managed for producing large panfish such as bluegill. This keeps enough predation on the bluegill to provide good growth rates on surviving individuals. Only ponds that exhibit consistently good largemouth bass recruitment will be managed as panfish lakes.

After 5 years of protecting the largemouth bass, if the pond is to be managed as a trophy largemouth bass fishery, then a slot limit protecting 12 to 15 inch fish will be used.

Black crappie or yellow perch can be substituted for bluegills in ponds where a pan-fishery is the management goal, but again a 12 inch minimum size limit on largemouth bass will be used to control panfish recruitment and maintain acceptable growth rates.

Maintenance and supplemental stocking will be used only in rare instances and only with species such ast trout, channel catfish, or saugeye (sauger X walleye hybrids) that cannot spawn in pond environments but have been documented to contribute to recreational fisheries. Trout stockings will be avoided in impoundments that have established centrarchid populations or large numbers of predators. Supplemental stocking of species such as largemouth bass and bluegill have been shown to be ineffective. We will attempt to correct poor recruitment or overharvest of largemouth bass by transferring adults from other lakes.

The overall pond management strategy will be to:
1) Initially stock and establish a fishery.
2) Survey every 3 to 4 years or after a suspected winter-kill.
3) If a survey indicates problems such as an over abundance of slow growing panfish or a predominance of rough fish, then the impoundment will be chemically renovated and restocked. In the event of winter-kills, the impoundment will be restocked if rough fish did not survive.

Stocking Guidelines

Stocking is divided into four main types:
1) Initial stocking: stocking fish in newly created or renovated waters.
2) Supplemental stocking: stocking to increases populations of fish that spawn naturally in a lake. This type of stocking is rarely effective or necessary.
3) Maintenance stocking: annual stocking of fish less than catchable size into waters where natural spawning does not occur or with hybrids of low reproductively. Stocking channel catfish or saugeye are examples. This type of stocking is effective in certain situations.
4) Put and take stocking: stocking catchable size fish during the main fishing season. Stocking rainbow trout into waters where they will survive but not reproduce is an example.

Table E-1. Recommended stocking rates.

Year	Size	Rate/acre
	Largemouth bass	
1	2 inch	100
2	2 inch	100
	Bluegill	
1	1 inch	500
	Black or white crappie[a]	
	Stocking rates will be the same as for bluegill	
	Yellow perch[b]	
1	2 inch	500
2	fertilized eggs	Vegetated areas only
3	fertilized eggs	Vegetated areas only
	Northern pike – initial	
1		0
2	Fry	1500 (Vegetated areas only)
	or 2 inch	75 when water temp < 75 °F
3	Fry	1500 (Vegetated areas only)
	or 2 inch	75 when water temp < 75 °F
	Northern pike – supplemental[c]	
N/A	8 inches	
	Walleye – initial	
1		0
2	Fry	500- 3000 (vegetated areas only)
	or 2 inch	50-100 (from boat in open waters)
3	Fry	500- 3000 (vegetated areas only)
	or 2 inch	50-100 (from boat in open waters)
	Walleye – maintenance	
N/A	2 inch	50-100 (from boat in open waters)
	Saugeye	
	Stocking rates will be the same as for walleye	
	Channel catfish – initial	
1	2 inch	100
2		0
3	6 – 8 inch	25
	Channel catfish – maintenance[d]	
N/A	6 – 8 inch	10 - 50
	Flathead catfish[e]	
N/A	8 inch	1 – 5

Table E-1 Continued.

Year	Size	Rate/acre
	Trout – catchable[f]	
N/A		150 – 200

[a] Crappie should be introduced only after a predator population has been established and not where bluegill or yellow perch are established. Lake should be > 50 acres. Water clarity will determine crappie species for stocking. Black crappie depend more heavily upon zooplankton and therefore require clearer water.
[b] Yellow perch can be substituted for bluegill or crappie, but will not be stocked together in small impoundments.
[c] Survival of supplemental stockings have been extremely poor due to predation by largemouth bass or other large predators. When supplemental stocking is deemed necessary, the northern pike should be greater than 8 inches to reduce predation related losses.
[d] Use lower rate when competition results in reduced bluegill growth rates.
[e] Flathead catfish have been used in small lakes to control bullheads.
[f] Stock each month that the lake is open to fishing and water temperatures are within the ranges acceptable to trout survival.

Guidelines for Identifying Lakes Suitable for Fish Stockings

1) The pond/impoundment should be > ½ acre in size.
2) There should be no fish already in the pond.
3) Minimum water clarity of 8 inches.
4) At least ¼ of the pond should be > 10 feet deep. About 80% of the ponds less than 15 feet deep will periodically winter-kill and require restocking. Spring fed impoundments maybe exceptions to this rule and will be evaluated on a case-by-cases basis.
5) Ponds less 4 acres should be fences to exclude livestock. Access points could be developed for livestock watering.
6) Water receiving trout should maintain temperatures less than 70 °F and oxygen levels greater than 5 ppm. For put-and-take fisheries, these guidelines are only applicable during the times trout are stocked.

Appendix F. Glossary of fishery terms.

Alkalinity: Alkalinity is a measure of a waters ability to resist a change in pH expressed in mg/l or ppm. Because alkalinity is dependent on minerals such as calcium (Ca), and this relates to aquatic vegetation production, alkalinity is a good indicator of a water bodies potential to produce fish. Less than 40 mg/l is considered soft water; greater than 40 mg/l is hard water.

Catch per Unit Effort (CPUE): CPUE is the catch per unit of sampling effort that is used as an index of abundance or to document population changes over time. The formula is:

$$\text{CPUE} = \frac{\text{number of fish in a length class, length category, or sample}}{\text{Hour for electrofishing or net night}}$$

Conductivity: Conductivity is a measure of a water bodies ability to conduct electricity, which is dependent on the amount of ions in the water. Total dissolved solids (TDS) is equal to 0.5 X Conductivity. Conductivity is a good measure of a water bodies productivity because of the relation between minerals and productivity.

Effort: The effort is the total amount of time expended in collecting a sample. The time may be in hours, minutes, or net days. The effort is used to calculate CPUE.

Habitat Suitability Index (HSI): a numerical index (0 = poor, 1 = excellent) which is used to identify how well a fish species should perform in a lake or pond. The HSI value is computed using water quality and habitat conditions and evaluated how well a species can spawn, survive, and grown in a body of water.

Morphoedaphic Index (MEI): This index is used as a fish yield estimator based on average depth (X) and total dissolved solids (TDS). The formula is: MEI = X/TDS.

Memorable length: The memorable length is a standard category unique for each species. The memorable length is the length that most anglers remember catching and is 59 to 64% of the world record length.

Net days: A unit of time used to describe the effort required to collect a sample using Gill nets or Trap nets. For example, if 5 Gill nets were left for a 24 hour period, then 5 Gill nets days worth of effort were expended.

pH: a measure of how basic or acidic a body of water is. This information is important as many species of game fish have narrow pH tolerances.

Preferred length: The preferred length is a standard category unique for each species. The preferred length is the length that most anglers prefer to catch and is usually within a range of 45 to 55% of the world record length.

Proportional Stock Density (PSD): PSD is the number of fish greater than or equal to a minimum quality length in a sample divided by the number of fish greater than or equal to a minimum stock length. The formula is:

$$PSD = \frac{\text{number of fish} \geq \text{"quality" length}}{\text{number of fish} \geq \text{"stock" length}}$$

Quality length: The quality length is a standard length category unique for each species of fish. The Quality length is usually within a range of 36 to 41% of the world record length and generally the minimum size that most anglers will keep.

Relative Stock Density (RSD): The RSD is the number of fish greater than a minimum preferred length in a stock divided by the number of fish greater than or equal to a minimum stock size. The formula is:

$$RSD = \frac{\text{number of fish} \geq \text{"preferred" length}}{\text{number of fish} \geq \text{"stock" length}}$$

Relative weight (*Wr*): The relative weight of a fish or group of fish is referred to as a "Wr" value. The relative weight is a comparison of the condition of the fish in a sample and the condition of a theoretical optimum sample. The formula is:

$$Wr = \frac{W}{Ws} \times 100$$

where "W" is the weight of an individual and "Ws" is a length specific standard weight.

Stock length: The stock length is the smallest of the standard length category unique for each species of fish. The stock length is usually within a range of 20 to 26% of the world record length and at or near which a species reaches sexual maturity.

Trophy length: Trophy length is a standard length category unique for each species of fish. The Trophy length is size worthy of acknowledgment and is greater than 74% of the world record length.

Appendix G. Data collection and analysis protocol.

For each species, five fish per 10 mm (0.4 inch) larger than 80 mm (3.2 inches) were weighed to the nearest gram (g) and measured to the nearest millimeter (mm). Fish smaller than 80 mm were tallied for length frequency analysis only. Once five fish were recorded for a 10 mm group, additional fish in that group were tallied for length frequency analysis only. Panfish, bass, and walleye should use the 10-mm data sheet. Northern pike and common carp should use the 20-mm data sheet (Figures in this Appendix).

Catch per unit effort (CPUE) was recorded separately for each net and each electrofishing transect to enable calculating CPUE confidence intervals (CI) at the 80% CI level. CPUE and confidence intervals were analyzed using the one or two gears that are appropriate for each species of fish. Catch per unit effort data sheet example is in this Appendix.

Analysis of Data Collected

1) Trends in relative abundance were assessed as catch-per-unit-effort (CPUE) as fish/trap net night, fish/gill net night, and for electrofishing fish/hr.

2) Calculating relative weight (*Wr*) assessed condition of fish by size groups.

Relative Weight (*Wr*): The relative weight of a fish or group of fish is referred to as a "Wr" value. The relative weight is a comparison of the condition of the fish in a sample and the condition of a theoretical optimum sample (Wege and Anderson 1978, Blackwell et al. 2000). The formula is: $Wr = (W/Ws) \times 100$, where "W" is the weight of an individual and "*Ws*" is a length specific standard weight.

3) Proportional stock density (PSD) and incremental relative stock density (RSD) for substock, stock, quality, preferred, memorable, and trophy size categories (Anderson 1978; Gabelhouse 1984) were calculated for each species in each gear.

The PSD is the number of fish greater than or equal to a minimum quality length in a sample divided by the number of fish greater than or equal to a minimum stock length. The formula is:

$$PSD = \frac{\text{number of fish} \geq \text{"quality" length}}{\text{number of fish} \geq \text{"stock" length}}$$

Relative Stock Density (RSD): The RSD is the number of fish greater than a minimum preferred length in a stock divided by the number of fish greater than or equal to a minimum stock size. The formula is:

$$RSD = \frac{\text{number of fish} \geq \text{"preferred" length}}{\text{number of fish} \geq \text{"stock" length}}$$

Date _____ Lake _____ Page _____ of _____

Management Area _____ Gear _____

Fish No.	Gear (#)	Species	Length (mm)	Weight (g)
01				
02				
03				
04				
05				
06				
07				
08				
09				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
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Fish No.	Gear (#)	Species	Length (mm)	Weight (g)
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