

Lake Mattamuskeet Technical Working Group
March 5, 2014
Mattamuskeet National Wildlife Refuge

Purpose for the meeting:

- 1) Frame the issues, formulate and prioritize appropriate questions to meet objectives.**
- 2) Discuss currently available data describing current and optimal ecological condition of Lake Mattamuskeet necessary to support its biota; emergent vegetation and SAV, migratory birds, anadromous/catadromous species, blue crabs and recreational fishery. Identify critical information/data gaps.**
- 3) Identify next steps and timeline that will lead to the development of a lake management plan. This plan will address short and long term priority wildlife and fishery objectives and appropriate management actions.**

Pete Campbell	USFWS Mattamuskeet NWR	Refuge Manager/Biologist
John Faustini	USFWS Regional Office	Regional Hydrologist
John Stanton	USFWS Migratory Bird Program	Migratory Bird Program Coordinator
Dennis Stewart	USFWS ARNWR	Wildlife Biologist
Wilson Laney	USFWS Fisheries/Ecological Services	Senior Biologist
Joe Fuller*	NCWRC	Waterfowl Biologist
Doug Howell	NCWRC	Waterfowl Biologist
Chad Thomas	NCWRC	Regional Fisheries Supervisor
Jeremy McCargo	NCWRC	District Fisheries Biologist
Roger Rulifson	East Carolina University Inst. for Coastal Science and Policy	Senior Scientist
Dan Rittschof	Duke University Marine Lab	L.H. Snowdon Prof. of Ecology
Michelle Moorman	USGS NC Water Science Center	Biologist/Water Quality Specialist

* absent for first meeting

A. Welcome and Meeting Expectations

The purpose of the Lake Mattamuskeet Technical Working Group (WG) is to provide the refuge with assistance in identifying current and needed information and data necessary to address lake management issues and to suggest short, medium and long term management and monitoring strategies and actions targeting these issues. This WG will meet periodically to share information and discuss proposed management priorities that will contribute to the development of a holistic management plan for the lake.

The results of this first meeting will be shared with the public during the refuge's second citizen informational meeting, which will be held in an Open House venue on March 20th at the Mattamuskeet High School.

The first topic discussed by the WG was what type of plan is needed for the lake, a “Lake Management Plan” or a “Comprehensive Water Management Plan”. It was decided that the goal should be to develop a broader umbrella **Lake Management Plan**, which also includes the canal system that will encompass the following:

- *Identifying the Biological requirements of the Lake’s Resources of Concern*
- *Biological management priorities and strategies*
- *Water management (Quality and Quantity) to meet these biological requirements*
 - *Lake level issues*
 - *Water quality issues*
 - *Water flow issues*
 - *Water circulation issues*
- *Public use*
- *Management Implementation and Timelines*
- *Monitoring the results of management actions*
 - What are our biotic and abiotic indicators?
 - Measuring response by species and by habitat/community type

All derived management strategies will be based on sound science and support the Resources of Concern. The refuge will apply the principles of Adaptive Management as the plan is developed. This means that the plan will be revisited on a set schedule and management strategies will be evaluated based on monitoring results and adjusted as appropriate. The Lake Management Plan will be included as an Appendix in the refuges’ overall Habitat Management Plan, which is a Step-Down Plan under the refuge Comprehensive Conservation Plan (CCP).

All proposed lake management strategies must be compatible with the primary purpose of the refuge, be in compliance with the Goals, Objectives and Strategies in the CCP and with the refuge’s legal mandate to protect landowner drainage rights per the NC Court ruling.

B. Framing the Issues/Questions; Defining Important Terminology

The WG agreed that it is important to create a common understanding of certain key terminology. Specifically, how do we define the lake’s “fishery”? How do we define “Low vs High water levels” in Lake Mattamuskeet? The later can be viewed from both a biological and a public use aspect.

In order to establish a common definition for **high vs. low lake levels**, we need to consider the history of lake water levels. To do so it is important for us to have a common reference for historic water level data and for data being collected currently. This will require relating existing water level gages to some fixed vertical datum – NAVD 88 was recommended. We also need to understand better the range or variability of lake levels, based on seasonality and other factors, and the effect on Resources of Concern. Using this information we can derive an agreed upon range of water levels to define high vs. low. No specific definitions were assigned during the meeting; however, attempts were made to qualify the use of the terms “high” and “low” pertaining to lake levels throughout the rest of the discussion.

In order to discuss management of the lake's fishery, it is important to agree on what we mean by the term "fishery". There are many species of fish, both freshwater and estuarine species, which provide forage for game fish and migratory birds and support both a recreational and subsistence fishery. Blue crabs are also an important component of the overall lake fishery that provides an important component to both the recreational and subsistence fishing communities. Defining priority components of a fishery dictates the type of management strategies we may employ. After much discussion, the WG agreed that for purposes of developing a lake management plan, **we define "fishery" to include the following elements; the species of greatest interest, both sport fish and shellfish and species that provide the lake's forage base, the habitat on which they depend, and members of the public who harvest both finfish and shellfish from the lake and canals for recreational or subsistence purposes.**

The NC Wildlife Resources Commission (WRC), which has a long history of assisting the refuge with the lake's fishery, prioritizes management for sport fish such as largemouth bass, black crappie, bluegill, but acknowledges that estuarine species provide a food source for these game species. The USFWS is charged with managing for anadromous species such as alewife and the American Eel. These species are also part of the management responsibility for the WRC. Although no recreational fishery for alewife (commonly referred to as herring) exists due to a statewide harvest moratorium (in place since 2006), management efforts should consider passage of alewife into the lake through the water control structures. Annual WRC fish surveys focus on collecting data primarily sportfish and use largemouth bass, bluegill, crappie and other sport fish as indicators of the overall health of a fishery. Similar surveys are needed to assess the status of the anadromous fish spawning runs and lake use by American Eels. The blue crab fishery in the lake was also recognized as a popular public use. The WG considered that the term "fishery" involves an overlap of fish species, fish habitats, and recreational anglers.

FRAMING THE FISHERY QUESTIONS

1. Should/can we actively manage/manipulate water levels for target fish species?
2. What habitats are being used for spawning purposes?
 - a. Spawning is generally in spring
 - b. Sunfish species spawn in spring and summer
 - c. Catfish spawn in summer
 - d. Alewife and white perch in the spring
 - e. At what time of year do blue crab young recruit through WCSs to the Lake?
3. Is there habitat for rearing and recruitment?
 - a. More complex habitat promotes recruitment
 - b. Need to create table for main species – ideal water depth, habitats, DO, salinity, temps, all the optimums
 - c. Screen water quality data with life requisites
 - d. How does it compare historically to now?
 - e. This information will be useful internally and to share with the public
4. What role does the fishery play in providing food resources for fish-eating birds based on information collected in the past and in current time?

5. Impacts of rough fish, e.g. common carp, on the health of the SAV community?
 - a. SAV is needed for spawning and rearing habitat as well as food resources for migratory birds
6. How do existing lake closures for waterfowl affect the fishery?
 - a. Do closures improve the fishery? Impede it? Have no effect?
7. What is the public's expectation?
 - a. Quality vs. Quantity of fish?
 - b. Greater or lesser variety of fish species?
 - c. Quantity of blue crab
8. What is the overall quality of fish populations in the lake and canals?
9. Do low lake levels have a significant impact on largemouth bass?
10. What role do the canal and culverts play in sustaining various fish populations of interest?
11. What is the role of fish stocking for sustaining the fishery?
 - a. How much if any is needed?
12. What difference in temperature exists at given depths?
 - a. Comment was made that WRC electrofishing is most efficient when main lake stations can be accessed at water temperatures (>55 F)
13. How do dissolved oxygen, pH, contaminants, nutrients, impaired circulation, turbidity, flow, etc. affect fish populations?

MIGRATORY BIRD AND SAV QUESTIONS

1. Human dimensions are very important – how do you address that issue?
 - a. Attach a Go Pro camera on the airplane during aerial waterfowl surveys to share footage with the public?
 - b. Install live-feed cameras on the east side of the refuge during waterfowl closure period and stream to internet so public can view waterfowl during closure period?
2. What is the influence of food sources in the lake vs duck movement between the lake and private land?
3. Given current water quality in lake, what water level is the high threshold beyond which SAV growth is negatively affected?
 - a. Fresh water systems = favorable secchi depths vary depending on the species of SAV.
 - i. SAV growth is highly correlated with light attenuation through the water column and at the leaf surface. Light attenuation is affected by turbidity, total suspended solids and chlorophyll *a*. In addition, dissolved inorganic nitrogen and phosphorus directly affect the potential for leaf surface light attenuation through epiphytic growth.

4. How does boat access/use on the lake impact SAV production? Should the seasonal boating restrictions continue, given the importance and positive results pertaining to minimizing waterfowl disturbance?
5. What are the effects of physical forces (i.e. wind, waves, fetch and depth) on SAV growth?
 - a. Deeper water = more resuspension of sediments but less physical damage.
6. Why are numbers of nesting osprey decreasing (local or regional phenomenon)?
 - a. Determine prey types and possible contaminants affecting reproduction
7. How is dissolved oxygen, pH, contaminants, nutrients, impaired circulation, turbidity, flow, etc. currently affecting SAV?

OTHER QUESTIONS

1. Do lower water levels accelerate the establishment and spread of phragmites along the lake's shoreline and into what is now the lake's emergent zone resulting in the displacement of native emergent vegetation?
2. Is herbicide use/application appropriate for lake associated vegetation?
3. Are nutria an issue?

C. Review and Discussion of Existing Information/Data

FISHERY DATA

1. NCWRC data from surveys by year/season/species
 - a. 1997 report describes LMB and Black Crappie sampling in canals during 1996
 - b. 2010 report details LMB sampling or attempts to sample from 2003 to 2011
 - c. Spring 2007 30 LMB caught per hour on the lake – but had been stocked 5 years prior
 - d. Collected limited data in 2012 from canals only
 - e. Fall 2013 collected data from lake and canals on LMB, Bluegill and Black Crappie: report will be available soon
2. Roger Rulifson/East Carolina University: water control structure data pertaining to fisheries
 - a. Brian Wall study for ES in Raleigh in 1997, 1998, and 1999
 - b. Charlton Godwin work 1999-2001
Yearly data from 2000-2010 includes seine surveys from the culverts
 - c. Jen Cudney work 2002-2003 on eel distribution and abundance in the lake
 - d. NCSU Cooperative Research Unit historic reports available on lake studies from the 1960s/1970s
3. Blue Crab data
 - a. May to mid-August 2012 (sex and size at culverts and control structures)

- b. July to August 2012 with weather station pit tag data and oceanography data
- c. 2013: end of May to October pit tag data from mid-June through October 1, correlated with weather station data and oceanography data from central canal
- d. Data coming out this summer 2014

Comment: Blue crab numbers in the lake are a function of Atlantic Ocean population dynamics. Similarly, alewife migrations to the water control structures each spring are strongly dependent on restoration of Atlantic stocks that are severely depressed. Atlantic needlefish are recruited from pelagic ocean as well (Mary Elizabeth Egbert).

MIGRATORY BIRD DATA

- 1. Boat restriction/closure important and has served as a positive action and reduced disturbance to the birds
- 2. Osprey: 1988-2003 productivity surveys, Augspurger's contaminant data, Heidi Alderman's mercury data from MS thesis at ECU, and random checks since 2003
- 3. Shorebird surveys- opportunistic for lakeshore Marsh bird surveys- 2001-2003 on the lake shore and in eastern impoundments
- 4. Waterfowl:
 - a. Mid-winter aerial surveys 1961-2014 – ducks, geese, swan, coots(migratory game birds) compiled into a report by NC WRC
 - i. Include surrounding impoundments and private land
 - ii. Broken down by species
 - b. Refuge aerial surveys of lake and refuge impoundments 1986-current
 - i. October to March - multiple surveys per year

OTHER DATA

- 1. Lakewide SAV surveys
 - a. Completed every two years from 1989 until 2003, then decade gap until August 2013
 - i. Species composition, % cover, specific conductance, depth, dissolved oxygen, soil type, and last year added Secchi depth
 - ii. Verify that existing SAV survey protocols represent the distribution of SAV's in the lake
- 2. 1997 refuge wide phragmites survey
 - a. Needs repeating
 - b. 700 acres of phragmites in 1997 – lake and impoundments (?)
 - c. Need to produce a current benchmark for acres and distribution of phragmites on the lake through re-establishment of the existing survey or other improved methods.
- 3. Salinity and staff plate readings on the four major canals
 - a. Weekly from 1977-2001, then sporadic until 2013.
 - b. Weekly readings resumed in 2013.
 - c. Need to reference gages to one common benchmark
- 4. Water quality station monitoring on both sides of the lake

- a. Data collected from September 2012 to present
 - b. Recording turbidity, dissolved oxygen, specific conductivity, temperature, depth, salinity, and wind speed and direction
 - c. Also taking light attenuation data
5. NCDWQ
- a. Transects back to 1980
 - b. Basic limnological parameters
 - c. **Anyone can get access to DWQ site – takes a few days action item**

PUBLIC USE DATA

- 1. No historic data on angler effort
- 2. Refuge narratives describing fisheries, angler days etc. from 1934 to at least 1991
- 3. Current NC WRC funded study with NCSU on economic impact from tundra swans
- 4. Visitor wildlife viewing numbers?
- 5. Waterfowl hunt data
- 6. Current NCWRC angler creel survey March 1-October 31, 2014.
 - a. Need to add additional weeks for the last crab run
- 7. Canoe/kayak/boat use?

D. Identify Information Gaps

- 1. Diadromous fish surveys – what is current status?
 - a. Based on timing of the runs – water temperatures
 - b. How many fish are passing through the various water control structures?
- 2. Commitment to continue SAV survey
 - a. Preferably annually - redesign as necessary
 - i. Stratified based on depth, since water depth is a driver
- 3. What water quality thresholds inhibit SAV growth?
- 4. Velocities through tide gates with wind events need to be monitored
 - a. Evaluate side gates for passage of crabs and diadromous fish
 - b. Evaluate how long gates need to be open for sufficient sediment flushing
- 5. Fish health; black crappie in this system are fast growing and short lived – why?
- 6. Other angler questions not answered by creel survey need to be addressed – satisfaction, economics, preferences
- 7. What is carp biomass and how can it be reduced?
- 8. Circulation model for the lake is needed

9. Can we even impact the lake level if we wanted to?
Given the size of the lake and that high vs. low water levels are dictated more so by natural processes instead of active water management. Active water management may be capable of "smoothing" day-to-day variation but is not likely to have a profound effect on extreme events such as floods or droughts.

Need to determine:

- a. Historic and more current precipitation data
 - b. Quantify inputs and outputs to the lake
 - i. Point and non-point inputs
 - ii. Evapotranspiration rates
 - iii. Capacity of canals to move water
 - iv. Vertical gate flow rates
10. Need ground water monitoring for salt intrusion
 - a. Volume of inputs to the lake
 11. Adjacent land use impact on lake turbidity
 12. Waterfowl contribution to nutrient input
 13. Evaluate latest research proposals from water quality group for lake studies and monitoring
 - a. Screening for nitrogen isotopes is common and could potentially be used to determine the sources of nitrogen in the lake (fertilizer, wildlife, septic, atmospheric). A pilot study to see if it works would probably be prudent and could be done in conjunction with the state's sampling and continuous water quality monitors.
 14. Look at Brian Wall's data for historical canal depth

The group then held a discussion of potential short-term management/monitoring/sampling actions to begin to utilize existing information, begin to fill data gaps, address certain fishery concerns and improve public access.

E. Fishery Management Options And Timelines

Immediate term: 2014

1. Three of the four refuge canal gate systems are being repaired to minimize saltwater intrusion into the lakeside canal system. Repairs and retrofitting will be completed by mid-summer 2014. The Rose Bay structure will be replaced with a new four bay structure. That project will begin in July, 2014. The NCWRC recommended repairing these structures to reduce impacts to the largemouth bass fishery.

2. Maintenance dredging of selected canals within the refuge boundary will begin in July 2014. This will improve water management capabilities to allow the gates to operate more efficiently and create refugia habitat for fish. If funding is found, the project can be extended to remove silt “plugs” at the mouth of each canal to access deeper waters. This would enhance the connection between the lake fishery and the canal fishery as well as potentially provide an extended period of boat access on the lake.
3. Procure further funding for the continuous water quality monitoring stations to continue operation through 2016 at a minimum. The Service and USGS cooperated in 2012 to install two continuous water quality monitoring stations, one on each side of the lake. This data is available for public access through a website. This data is important to characterize changes in water quality across seasons and can be used to assess potential impacts to both the vegetation and fishery communities.
4. Continue to collect salinity and water level data in the lake and in the canal system. Lake salinity levels are low (averaging 1.5 ppt or less) and are expected to remain near this level in the lake due to the improvements made to the water control structures.
5. NCWRC will provide a table of life stage requirements for priority fish species. We will then use existing and newly collected water quality data to quickly determine if the condition of the lake is suitable to support these species at acceptable population levels.
6. NCWRC initiated a creel survey for finfish and blue crab that will provide important data to further characterize the lake’s fishery as well as the type of fishing that is occurring. The creel survey will run from March 1 to October 31, 2014.
7. In 2014, the NCWRC will conduct a pit tagging project to document movements of largemouth bass between the lake and the canal system.
8. NCWRC will electroshock the lake and canals this spring when water levels are higher to improve access to all sample locations. NCWRC will also sample canals in fall to evaluate LMB movement. NCWRC will trap net in fall to further characterize Black Crappie population.
9. The refuge will begin to expand its Phragmites control program to include sections of the lake shoreline along the Highway 94 causeway.

Short term: 2015-16

1. Survey for diadromous fish and conduct study of canal side gates to document benefits to diadromous fish, eels, and blue crab movements between the lake and Pamlico Sound.
2. Stock largemouth bass in the lake if surveys conclude poor recruitment is occurring in the lake proper.
3. Replace Rose Bay boat launch and improve Rose Bay parking

4. Improve access at Jarvis Canal or other appropriate location
5. Study the pesticides and solids in the lake
6. Use isotope work to potentially determine the sources of nitrogen in the lake (fertilizer, wildlife, septic, atmospheric) where nutrients are coming from