

# **Nebraska Sport Fisheries**

## Table of Contents

Background and Indicators .....	1
Littoral Habitat .....	1
Open Water Habitat .....	2
Walleye .....	2
White Bass .....	3
Smallmouth Bass.....	3
Channel Catfish .....	3
Gizzard Shad .....	3
Lake Ogallala Trout .....	4
Lower Platte River Catfish and Shovelnose Sturgeon.....	6
Methods of Analyses .....	6
Resources Bound to Reservoir Elevations.....	6
Resources Bound to Area of Habitat .....	6
Resources Bound to Reservoir Inflows .....	7
Resources Bound to Lower Platte river flows .....	7
Results .....	7

**Technical Appendix:  
Nebraska Sport Fisheries  
Lake McConaughy and the Lower Platte River**

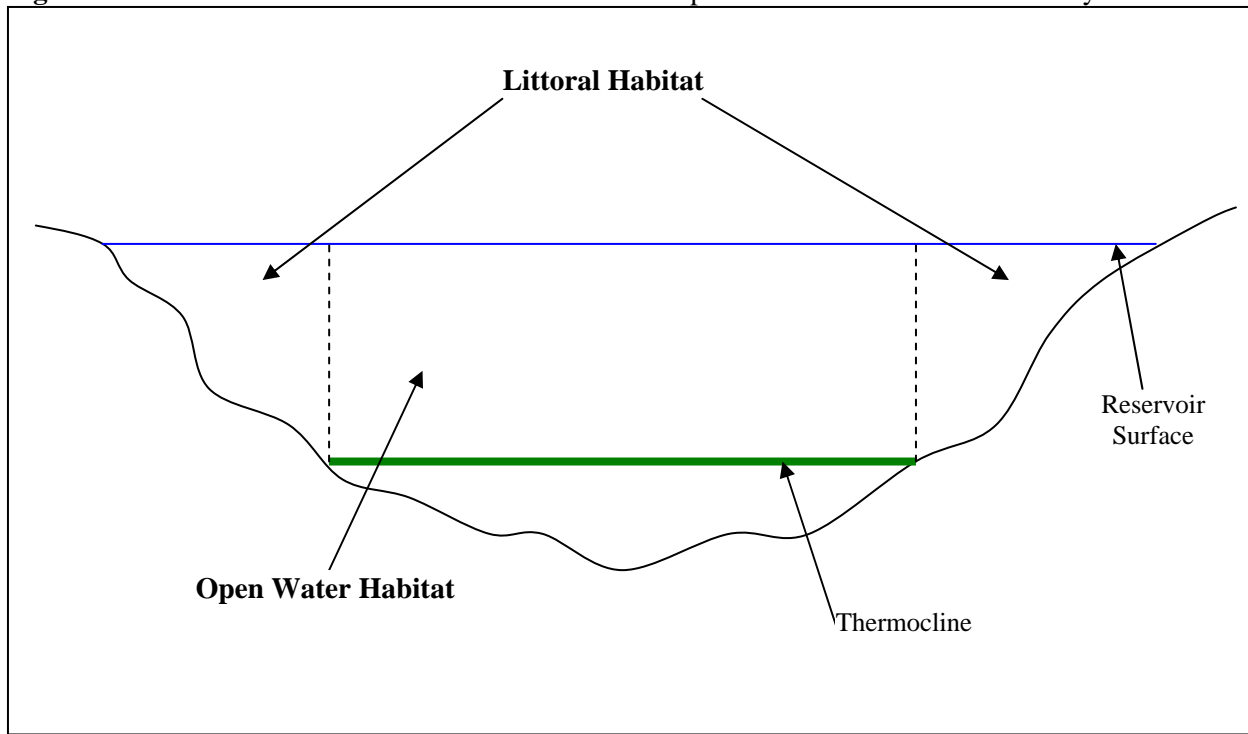
Several specific fisheries and recreation resources were examined in relation to Lake McConaughy and Lake Ogallala. These were overall littoral habitat, open water habitat, walleye, white bass, smallmouth bass, channel catfish, gizzard shad, and Lake Ogallala trout. Some of these resources are quite well understood in terms of what lake levels or conditions have on the resource, while understanding of others is less well developed. This state of knowledge is discussed within each indicator description. The lower Platte River resources examined include the catfish and shovelnose sturgeon fisheries.

**Background and Indicators**

Littoral Habitat: Area of water within specific depth constraints June through August

Strictly speaking, the term littoral refers to that area of a water body where aquatic vegetation supporting light reaches the bottom. For the purposes of this document, the term is used in a near context fashion. For the purposes of this document, littoral habitat is defined to be that habitat where light reaches the bottom, and where the bottom lies above the thermocline. That reservoir habitat that does not meet these criteria is defined by this document as open water habitat (Figure 1).

**Figure 1:** Illustration of distinction between littoral and open water habitat used in the analyses.



The amount of littoral habitat present in the reservoir is a general indicator of the total carrying capacity of the reservoir. Many fish species in the reservoir use both the littoral and open water

habitat at different times and for different life processes. Others use primarily one habitat or the other. Of the species investigated in this report, channel catfish and smallmouth bass are considered to be littoral habitat dependent, gizzard shad are considered to be open water dependent, and walleye and white bass use both habitat types. Using a detailed digital-elevation model of the reservoir recently developed by USGS, the area of littoral habitat (quantitatively defined as area where the reservoir is <65 feet deep in June, <55ft. deep in July, and <45ft. deep in August) was calculated on one foot contours. This was then analyzed with outputs from the Platte River Hydrology Model to determine the amount of littoral habitat that would be present under the different alternatives.

#### Open Water Habitat: Area of water within specific depth constraints June through August

The amount of open water habitat present in the reservoir is a general indicator of the amount of habitat available to support the open water dependent gizzard shad, and the open water use of walleye and white bass. As gizzard shad make up a large component of the prey-base of the reservoir, the amount of open water habitat available is also a general indicator of the carrying capacity of the reservoir for those fisheries dependent on the gizzard shad. Using a detailed digital-elevation model of the reservoir recently developed by USGS, the area of open water habitat (quantitatively defined as area where the reservoir is >65 feet deep in June, >55ft. deep in July, and >45ft. deep in August) was calculated on one foot contours. This was then analyzed with outputs from the Platte River Hydrology Model to determine the amount of open water habitat that would be present under the different alternatives.

#### Walleye: water level in April and May.

The walleye fishery is one of the better understood resources in Lake McConaughy in terms of the effects of lake levels on the resource. Walleye spawn in shallow water along the shoreline of the lake between mid-April and mid-May, with timing depending largely on temperature conditions in the lake, and by extension, spring weather patterns. Because they spawn in shallow water, the conditions most favorable to successful reproduction are stable or rising water levels during this time frame. Declining water levels can lead to stranding and subsequent desiccation of eggs above the water line. As a result, the indicator used is the trend in water level in April and May.

Natural reproduction of walleye in Lake McConaughy currently accounts for approximately 25% of the total annual walleye recruitment to age-1 in the reservoir. The remaining 75% of recruitment is through hatchery production. As a result, when attempting to translate the data presented in the analyses on the total walleye population in the reservoir, differences from Present Conditions should be viewed to be of secondary significance to hatchery augmentation.

Beyond reproduction, retention of larval walleye plays an important role in recruitment to the year-1 walleye population. Nebraska Game and Parks Commission (NGPC) biologists believe significant numbers of larval walleye can be flushed from the reservoir with large May and June releases, particularly in those years when the reservoir is operating at lower levels. As the pulse flow objectives for the Program involve substantial releases from the reservoir during these months, total May and June reservoir outflows were also analyzed.

#### White Bass: North Platte flow threshold in May

White bass spawn in tributary streams, in this case the North Platte River. The Nebraska Game and Parks Commission (NGPC) has found that North Platte River flow levels of 2000 cfs or above in May are most conducive to successful white bass spawning. Therefore, the indicator used is the 2000 cfs North Platte flow threshold in May.

#### Smallmouth Bass: elevation of 3255 feet

Smallmouth bass spawn in the shallow rocky margins of the reservoir, particularly in Lemoyne Bay, on the reservoir's north side. As a result they are subject to the same types of effects as walleye. While optimum availability of rocky habitat exists at reservoir elevations above 3,255 ft above msl, considerable rocky habitat exists below this elevation. Additional information has been recently produced by the NGPC on rocky habitat availability. This information, when combined with typical smallmouth bass spawning depth (<15 feet), allows a more accurate interpretation of how spawning habitat availability is likely to be affected by the Program.

#### Channel Catfish

Like white bass, channel catfish spawn in the North Platte River above Lake McConaughy, and the success of reproduction and strength of year class are linked to North Platte River flows, albeit in June rather than May. Channel catfish spawning may be triggered not only by total river flow into the reservoir in the spring, but also by the relative change in river flow (i.e., rising river conditions). Therefore, average river flow for the months of April, May and June are analyzed, as well as trends in river conditions from March to April, and from April to May.

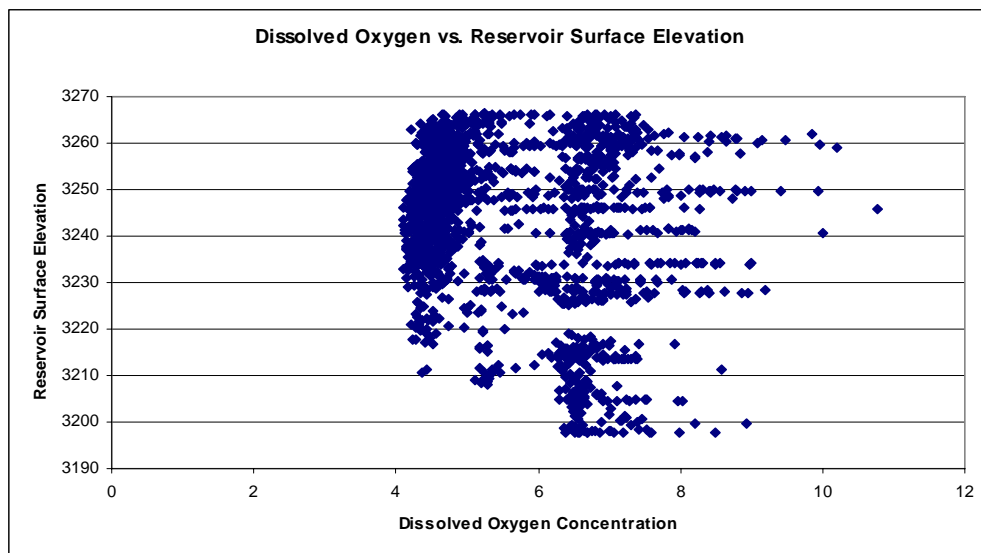
#### Gizzard Shad: 3250 and 3240 feet elevations.

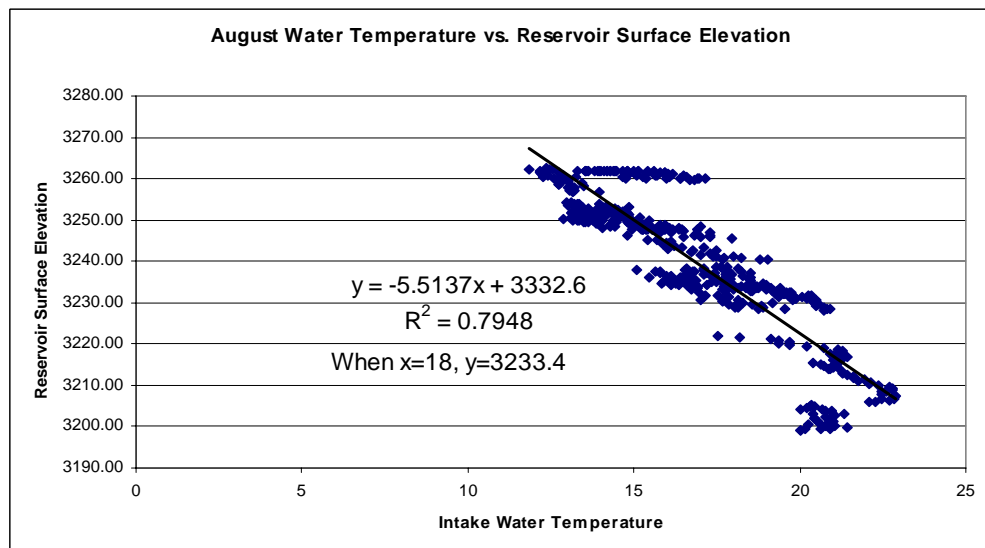
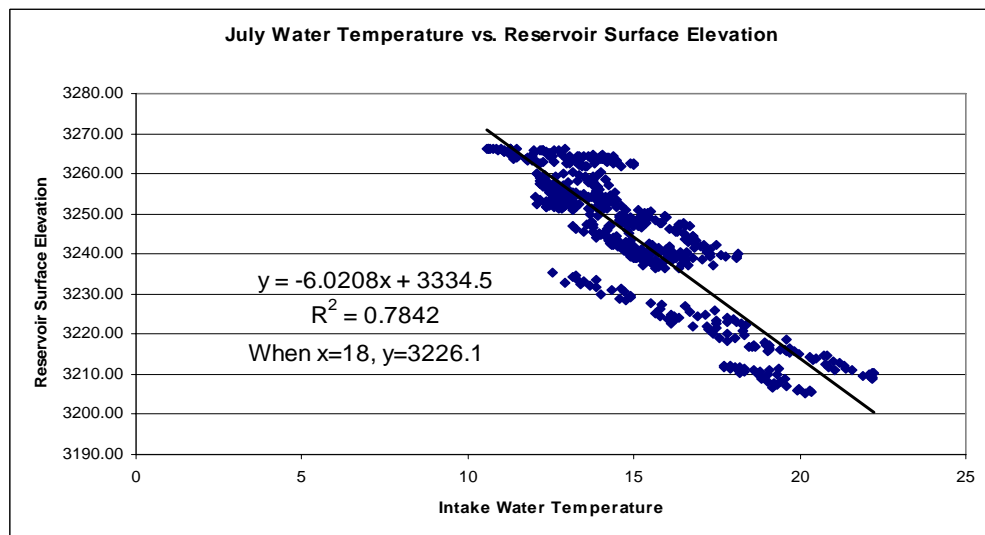
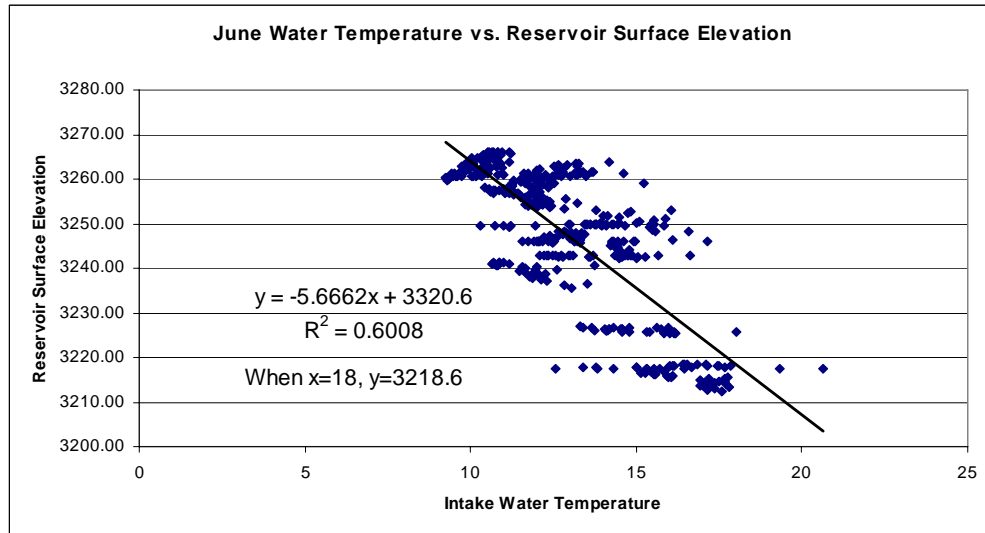
Gizzard shad make up a large component of the forage base for the gamefish in the lake, and as such are an important resource. Gizzard shad spawn in open water in the protected bays around the shoreline of the lake, and therefore the indicator used is a general figure for the elevation that provides substantial area of inundated bays. At this time, 3250 feet above msl is the NGPC's best estimate of that elevation.

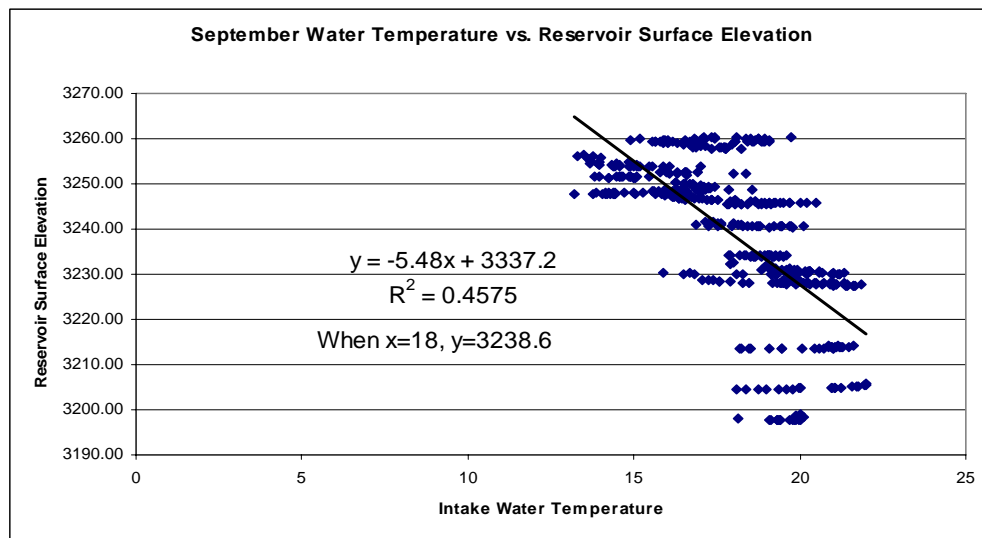
Gizzard shad overwinter survival is also strongly influenced by reservoir water surface elevations. Lake McConaughy lies at the extreme northern end of the species range. As such, they are particularly susceptible to freezing conditions, and thermal refugia, such as sheltered stream mouths, offer protection. When reservoir elevations drop below a certain threshold (generally below about 3,240 feet above msl), these stream mouths are not able to provide the sheltered thermal refugia used by a large part of the population for winter survival. It is unclear to what extent these refugia sustain the population, and to what degree the ability of them to provide refugia may remain below this threshold. As a result, the results of this analysis provide a fairly strong indicator of the effects of the Program on winter survival of gizzard shad, but cannot be considered a prediction.

## Lake Ogallala Trout: temperature and oxygen levels

Trout can only survive in cool, well oxygenated water, and as such, can thrive in Lake Ogallala under certain conditions. The hydro intake through which the majority of water released through Kingsley Dam is drawn, is located very low on the dam face. As a result, the water drawn into that intake is deep water under most reservoir conditions, and is generally cold, and low in oxygen. As the reservoir surface elevation declines over the course of the summer, the water being drawn into the intake gets incrementally warmer. Under low reservoir conditions, the temperature of this water can reach levels that cause stress in the trout fishery resident in Lake Ogallala. Similarly, at particularly high reservoir elevations, the water taken into the hydro tends to be very low in oxygen. Analyses were performed on information collected by Central Public Power and Irrigation District (CNPPID) on dissolved oxygen, recorded at the buoy line near the upper end of Lake Ogallala, and temperature, recorded within the intake. These analyses show that no clear correlation between reservoir level in McConaughy and dissolved oxygen at the buoy line exists. This is almost certainly due to the controlling influence of CNPPID's operations relative to their regulatory requirements. A very clear correlation does exist between temperature and reservoir elevation on a monthly basis. As a result, it was possible to predict the reservoir elevation that would result in water temperature reaching levels at which the trout fishery in Lake Ogallala would experience stress (defined as 18C) on a monthly basis. Given these relationships, it is possible to estimate the change in frequency of occurrence of stressful conditions for the trout fishery in Lake Ogallala resulting from low water surface elevations in Lake McConaughy.







### Lower Platte River Catfish and Shovelnose Sturgeon

High water in the lower Platte River in the spring (February through June) provides for habitat creation and maintenance for these fisheries, as well as spawning cues. Specific flow thresholds have not been identified that would best facilitate these processes, therefore a comparison of all flow conditions is made.

### Methods of Analyses

All analyses rely on the outputs of the Opstudy model for Present Conditions and the different alternatives. Different model outputs are used for different resources as applicable. This is described below.

#### Resources bound to reservoir elevations

For these resources with known reservoir elevation requirements (Lake McConaughy walleye, smallmouth bass, gizzard shad (spawning and overwintering), Lake Ogallala trout, Lake McConaughy boat ramps), a comparison of end of month Lake McConaughy water surface elevations is made between Present Conditions and each alternative, as provided by the FEIS Hydrology model (Opstudy). This is then examined in reference to the particular reservoir elevation or elevation condition relevant to the particular resource to determine the percentage of time the requirement is met under Present Conditions and each alternative. If no reference elevation is available for the resource, a general comparison is made over all conditions.

#### Resources bound to area of habitat linked to reservoir elevations

For those resources with known habitat requirements (lake McConaughy littoral habitat, lake McConaughy open water habitat, smallmouth bass habitat), a comparison of end of month Lake McConaughy water surface elevations is again made between the Present Condition and each alternative. This is then combined with spatial models of the reservoir developed by USGS and NGPC to determine the area of the specific habitat type at those water surface elevations. This is



than compared to the areas of these habitat types that would be available under Present Conditions. In the case of littoral and open water habitat, the depth of the thermocline (which varies seasonally) is also a consideration. This can best be illustrated in the following diagram:

#### Resources bound to reservoir inflows

For those resources with requirements relating to reservoir inflows (Lake McConaughy white bass and channel catfish), a similar set of comparisons is made using average monthly flows at the Lewellen, Nebraska gage, located on the North Platte River just above Lake McConaughy. This is then again examined in reference to the particular flow rate relevant to the particular resource to determine the percentage of time the requirement is met under Present Conditions and each alternative. If no reference flow rate is available for the resource, a general comparison is made over all conditions.

#### Resources bound to lower Platte River flows

For lower Platte River resources (catfish, shovelnose sturgeon, airboat operation), comparisons are made in the same fashion as those examining North Platte River flows, above. The only difference being that none of these resources have particular reference flows available. Therefore general comparisons are made across all flow conditions. The gage data used is that from the Louisville, Nebraska gage, located approximately midway between the Platte River confluence with the Missouri River and the Elkhorn River confluence with the Platte River.

### **Results**

note: A summary of the results of the analyses appears in the FEIS Chapter 5 text. To view the complete spreadsheets, with calculations, please see the associated files:

Nebraska Sport Fisheries FEIS Analysis.xls  
Og-Mac daily temps, do's and levels.xls