Alberta Conservation Association (ACA)

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Project Name: Owl River Walleye and Aquatic Habitat Assessment

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Partnerships

- Alberta Environment and Sustainable Resource Development
- Syncrude Canada Ltd.

Key Findings

- Nearly all 998 walleye (88%) captured migrating from Lac La Biche into the Owl River were in a spawning stage (i.e., ripe or spent).
- Size of walleye in the spawning run ranged from 435 to 677 mm total length.
- Reliable abundance estimates of the spawning run could not be derived due to zero recaptures.
- Dissolved oxygen levels were high (6.8 to 10.1 mg/L) throughout the system from May to August.
- Total phosphorus levels were high (summer average: 84 to 290 µg/L) throughout the system; levels were higher at downstream sites than at upstream sites.
- Total coliform counts exceeded established limits for agricultural use (>1,000 mpn/100 mL) at all sites.

Introduction

The walleye population of Lac La Biche has been exploited by humans since the early 1900s. Heavy harvest (legal and illegal) in the lake, including spawning tributaries, led to a collapse of the walleye fishery in the 1960s. Between 1985 and 1987, the Alberta government stocked more than one million fingerlings in the lake (Mitchell and Prepas 1990). However, the success of this stocking was limited, and by 1995, the lake was still considered as recovering and managed with a zero bag limit regulation (Berry 1995). Since 2006, the government has stocked nearly 200 million walleye fry and fingerlings in the lake to restore the population. Many of the stocked fish reached sexual maturity by 2013 and resulted in larger spawning runs and greater natural recruitment of walleye in the lake. However, potential reductions in water quality and spawning habitat in the Owl River from riparian habitat degradation could limit success of the restoration

program. Alberta Environment and Sustainable Resource Development (ESRD) considers the Owl River to be a primary spawning system for Lac La Biche walleye. The historical walleye spawning habitat is located approximately 30 km upstream from Lac La Biche (Chris Davis, pers. comm.). In 2011/12, we began a long-term project to protect and restore riparian habitat along the Owl River to aid the walleye restoration. We collected baseline data on riparian health, water quality, aquatic habitat and the distribution of walleye spawning habitat. In 2014, we reassessed these characteristics as part of a three-year interval monitoring protocol; results of the riparian component of the study are presented under the Land Management section (Riparian Conservation Program).

Methods

We conducted a mark-recapture survey during spring 2014 to estimate abundance of the walleye spawning run. We deployed two pound trap nets in the Owl River to capture spawning walleye migrating upstream from Lac La Biche. Traps were set immediately after ice out on May 6, 2014, and checked daily until May 19, 2014. Traps were located 1 km apart, with the downstream trap located 2.5 km upstream of the confluence with the lake. Fish caught in the downstream trap constituted the initial capture, and the catch in the upstream trap constituted the recapture event. We removed all walleye from traps and sexed, measured, fin clipped and released them upstream of the traps; we used different fin clips to differentiate between fish marked in the downstream and upstream traps. We installed a data logger in the Owl River to record water temperature during the spawning run. We identified and enumerated all other fish caught in the traps.

We conducted nighttime visual observations during peak walleye spawning season to determine habitat use and spawning activity within a 40 km section of the Owl River. We actively searched for walleye using hand-held spotlights from a boat and from shore, and recorded locations with a GPS unit. We conducted monthly water quality analyses from May to August at five locations. Where applicable, we interpreted water quality data using the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines (CCME 2007) for a) Protection of Aquatic Life and b) Protection of Agricultural Water Uses, as well as the ESRD environmental quality guidelines for Alberta surface waters (ESRD 2014). In August, we conducted macroinvertebrate analyses at five locations following the United States Environmental Protection Agency's multihabitat protocol. Also in August, we assessed aquatic habitat along cross-sectional transects at 1 km intervals in the upper section (upper 10 km) and at 5 km intervals in the lower section (lower 30 km) of the river. Data collected included wetted and bankfull widths, bank erosion and angle, riparian width, vegetation cover and composition, soil exposure, littoral substrate composition and human-related disturbance along banks.

Results

We captured a total of 998 walleye during spring 2014, nearly 88% of which were in a spawning stage (i.e., ripe or spent), confirming use of the Owl River as a walleye spawning system. Walleye ranged in size from 435 to 677 mm total length (TL), with a mean TL (± SE) of 564.2 ± 2.3 mm (n = 583) (Figure 1). Males ranged in size from 435 to 677 mm TL, with a mean TL of 542.8 ± 2.7 mm (n = 379); females ranged in size from 490 to 669 mm TL, with a mean TL of 609.3 ± 2.9 mm (n = 130). In general, females were larger than males. Other fish caught included 1,566 northern pike and 8 white suckers. We were unable to derive reliable abundance estimates

for walleye due to zero recaptures. Unusually high water levels and flows influenced trap efficiency.

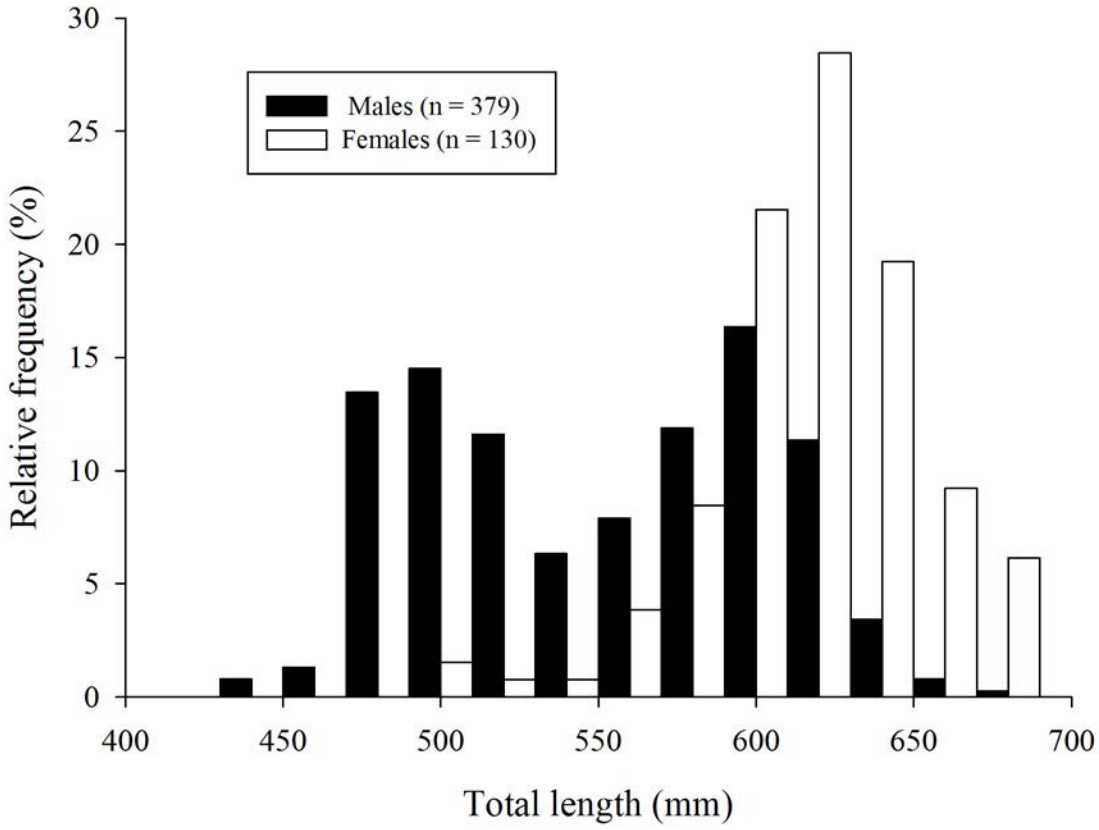

Figure 1. Length frequency distribution of walleye captured during the 2014 Owl River walleye spawning-run assessment.

Water temperature ranged from 8.8°C to 21.9°C, and dissolved oxygen ranged from 6.8 to 10.1 mg/L from May to August. Total phosphorus concentrations were high throughout the system. Summer average total phosphorus ranged between 84 to 290 µg/L, with higher concentrations at downstream sites than at upstream sites (Table 1). Average total nitrogen concentrations in summer ranged from 0.8 to 0.9 mg/L, slightly lower than the ESRD (2014) limit (1.0 mg/L) in most cases. Turbidity ranged from a high of 29 NTU in May to a low of 2.1 NTU in August, with summer averages ranging from 5.7 to 14.7 NTU. As expected, turbidity was higher in spring (May) than summer, and summer averages were higher at downstream sites than at upstream sites. Total coliform counts were high, and summer averages exceeded the CCME (2007) limit for agricultural use (>1,000 mpn/100 mL) at all sites (Table 1). We collected a total of 4,856 macroinvertebrates belonging to 35 families. Species diversity ranged from 1.2 to 1.7, and species richness ranged from 13 to 21; there were no clear spatial distribution patterns. The most common family was Baetidae (Order: Ephemeroptera).

Table 1. Summer averages (June and August 2014) for key water quality variables at five water quality sites in the Owl River system.

Site	Temp (°C)	DO (mg/L)	TP (µg/L)	TN (mg/L)	Chl*a* (µg/L)	Turbidity (NTU)	Total coliform (mpn/100)
1-W	15.7	7.6	115.5	0.8	4.0	8.1	1,550
9-W	17.0	8.9	112.8	0.9	4.6	7.8	1,510
12-W	15.9	8.0	128.0	0.9	4.7	9.6	1,830
16-W	16.6	8.2	170.0	0.9	5.3	14.7	1,945
2-W[1]	16.9	8.6	61.0	0.9	3.8	5.7	1,580

[1]Site located on Piche River, approximately 200 m upstream of confluence with Owl River.
Temp = temperature; DO = dissolved oxygen; TP = total phosphorus; TN = total nitrogen, Chl*a* = chlorophyll-*a*

Dominant substrate in the upper sites consisted of boulders, cobble and gravel suitable for walleye spawning, whereas sites in the lower section consisted mainly of fine sediments and sands unsuitable for walleye spawning. Overall, bank disturbance (erosion, exposed soil and human disturbance) along the river was low, with grasses/sedges and woody shrubs dominating the vegetation.

Conclusions

In 2014, we monitored the walleye population and aquatic habitat along the Owl River as part of a long-term initiative to protect and restore riparian habitat along the Owl River. Atypically high water levels and associated current speed during the peak spawning season in May prevented us from deriving reliable abundance estimates of the walleye spawning run. Nonetheless, most walleye caught were in a spawning stage and congregated in the upper reaches of our study site, reaffirming the use of this reach within our conservation zone as the primary spawning site in the Owl River system. Total coliform counts remained high and exceeded the CCME limit for agricultural use at all sites. Dissolved oxygen concentrations were high throughout the river system and above CCME limits for supporting aquatic life. Total phosphorus concentrations were high throughout the system indicating the Owl River is a nutrient-rich system, with a trend of increasing concentrations farther downstream.

Communications

- Submitted progress report to Syncrude Canada Ltd.

Literature Cited

Alberta Environment and Sustainable Resource Development (ESRD). 2014. Environmental quality guidelines for Alberta surface waters. Water Policy Branch, Policy Division, Edmonton, Alberta, Canada. 48 pp.

Berry, D.K. 1995. Alberta's walleye management and recovery plan. Alberta Environment Protection, Natural Resources Service, Number T/310, Edmonton, Alberta, Canada. 32 pp.

Canadian Council of Ministers of the Environment (CCME). 2007. Canadian environmental quality guidelines, v.10. Produced by Canadian Council of Ministers of the Environment, Winnipeg, Manitoba, Canada.

Mitchell, P., and E. Prepas. 1990. Atlas of Alberta lakes. University of Alberta Press, Edmonton, Alberta, Canada. 675 pp.

Photos

Alberta Conservation Association staff member Chad Judd holding a large walleye captured during the spring trapping survey. Photo: Jason Blackburn

Aerial view of the Owl River. Photo: Tyler Johns