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International Joint Commission – International Watershed Initiative Project

# **Red River Telemetry Study**

## *2017/18 Year-End Report*

by

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Photo credit: Camille Macnaughton, Fisheries and Oceans Canada.

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## Summary

The acoustic equipment purchased in 2016 through funding provided by the International Joint Commission (IJC) to Fisheries and Oceans Canada (DFO) for the “Red River Telemetry Study” was deployed in the 2017 field season in the US portion of the Red River from the international border to Fargo, North Dakota. Eighteen receivers were installed in the Red River and forty Channel Catfish (*Ictalurus punctatus*) and twenty Bigmouth Buffalo (*Ictiobus cyprinellus*) were tagged by the US partners Mark Pegg from University of Nebraska - Lincoln and his lab, Jamison Wendel from the Minnesota Department of Natural Resources, and Todd Caspers from the North Dakota Game and Fish Department.

Funding received from IJC to DFO in 2017 partially supported a DFO staff member responsible for data management and analysis of the telemetry data. Study results were presented by Eva Enders at the International Red River Basin (IRRB) meeting held in Winnipeg, Manitoba in January 2018, by Doug Watkinson at the Lake Winnipeg Research Consortium Science Workshop in February 2018, and by Doug Watkinson and Colin Charles at the Great Lakes Acoustic Telemetry Observation System (GLATOS) annual meeting held in Ann Arbor, Michigan in February 2018.

The project is on-track to produce proposed deliverables stated in the Memorandum of Understanding (Cost-sharing Other Federal Government Department or Agency) within the projected timelines and the cost-breakdown provided in the document is still accurate.

**Date:** 21 February 2018

# 1 Lake Winnipeg Basin Fish Movement Project

## 1.1 Background

Fisheries and Oceans Canada in collaboration with several partner organizations, including Manitoba Sustainable Development, Lake Winnipeg Foundation, University of Nebraska – Lincoln, University of Manitoba, Lakehead University, Minnesota Department of Natural Resources, and North Dakota Game and Fish Department, is conducting a large-scale, long-term telemetry project in the Lake Winnipeg basin.

The aim of the project is to answer several state, provincial, and federal stakeholder questions by collecting information and gaining knowledge on fish movement. For example, for the:

- (1) **International Red River Board (IRRB) part of the International Joint Commission (IJC):** to make recommendations for water apportionment in the Red River by answering questions on Instream Flow Needs for fish movement and habitat.
- (2) **Department of Natural Resources Minnesota, North Dakota Game and Fish Department, and Manitoba Sustainable Development:**
  - (a) To improve fishery management objectives and provide key information on transboundary fish movements and habitat use. In addition, habitat maps developed in the frame of this project are providing valuable input information for the provincial Zebra Mussel (*Dreissena polymorpha*) assessment.
  - (b) To obtain information on river connectivity in the Red River and the use of tributaries; much effort has been made to restore connectivity to many tributaries but some fish barriers still remain. This research provides critical information regarding the use of tributaries by these large river fish species.
  - (c) To improve restoration efforts of Lake Sturgeon (*Acipenser fulvescens*) in the Red River basin. Until now, the agencies were relying on anecdotal information, such as angler reports, to obtain basic distribution and movement information. This research advances our knowledge of Lake Sturgeon in the Red River basin and guides restoration efforts.
- (3) **US Army Corps of Engineers:** to provide baseline data prior to the construction of the Fargo Floodway.
- (4) **Fisheries and Oceans Canada's Species-at-Risk (SAR) program:** to protect and preserve species at risk. In particular, findings on fish movement and habitat use contribute to the recovery strategy of Mapleleaf mussel (*Quadrula quadrula*) by studying its host, the Channel Catfish and to the management plan for Bigmouth

Buffalo. This research will also help to inform SAR managers when a listing decision needs to be made for Lake Sturgeon.

- (5) **Fisheries and Oceans Canada's Aquatic Invasive Species (AIS) program:** to manage impacts of invasive species such as Zebra Mussel and Common Carp (*Cyprinus carpio*) on the aquatic ecosystem.
  - (a) The project provided a unique short window of opportunity, to sample baseline habitat before the full establishment of Zebra Mussel in Lake Winnipeg.
  - (b) Common Carp is thought to disturb the ability of one of Canada's largest wetlands, the Netley-Libau Marsh, situated on the outflow of the Red River into Lake Winnipeg, to remove nutrients from the watershed. In Delta Marsh, located in the southern end of Lake Manitoba, Common Carp destroy submerged vegetation and, with it, critical marsh habitat. Outcomes of this study are to establish the habitat use of Common Carp in the Netley-Libau Marsh and help determine potential impacts on the ability of this valuable marsh habitat to buffer nutrient inputs in Lake Winnipeg.
- (6) **Fisheries and Oceans Canada's Fisheries Protection program (FPP):** to gain valuable insight on:
  - (a) Fish passage requirements in the Lake Winnipeg basin.
  - (b) The efficiency of existing fish passage structures (e.g., fishway at St. Andrews Lock and Dam on the Red River at Lockport, Manitoba).

## 1.2 Red River Telemetry Study

Through the International Red River Board, the Aquatic Ecosystem Committee submitted a project proposal to the International Watershed Initiative (IWI) for funding from IJC to extend the Lake Winnipeg Basin Fish Movement Project into the United States (US) by installing receivers every 30 river km (rkm) upstream of the international border until Fargo, North Dakota and tag fish in the US portion of the Red River.

The collected information on habitat use and fish movement are valuable input information for Instream Flow Needs predictions of the Hydrological Committee of the International Red River Board and provide detailed information on fish movement, spawning sites and timing, and overwintering areas. Additionally, we increase our understanding of the population structure and movement of fish in the Red River between the US and Canada.

## 2 Achievements of the 2017/18 field season

### 2.1 Receiver deployment

In 2016, 125 Vemco VR2W receivers (Figure 1) were deployed in the Lake Winnipeg basin (Figure 2 and 3). The acoustic receivers were installed in the Red River up to the US border, the Assiniboine River upstream to the Portage Diversion Dam, and the Winnipeg River upstream to the Pine Falls Generating Station. Distances between receivers varied between 5 and 30 river rkm depending on river reach.

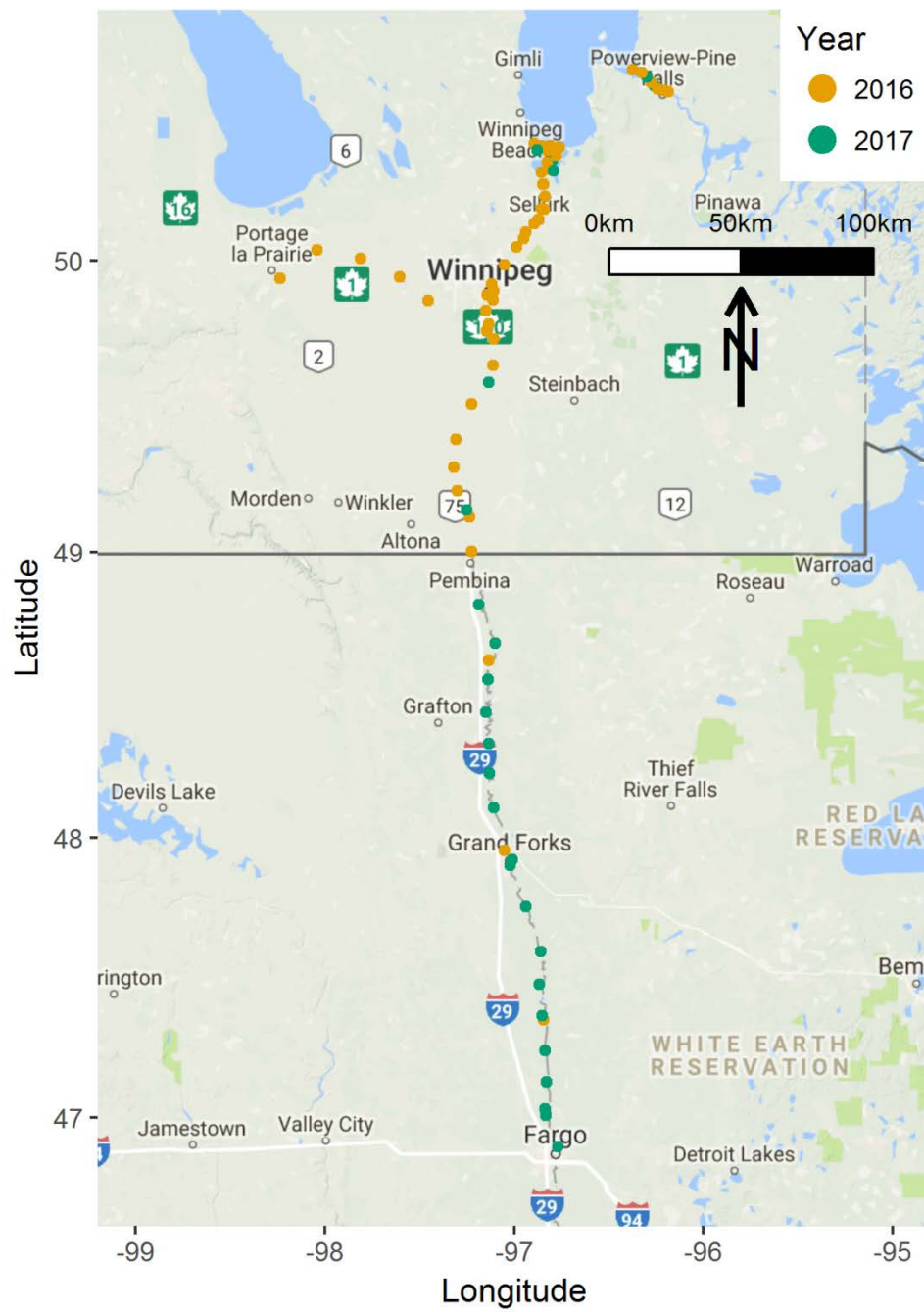


**Figure 1:** Acoustic receiver setup.

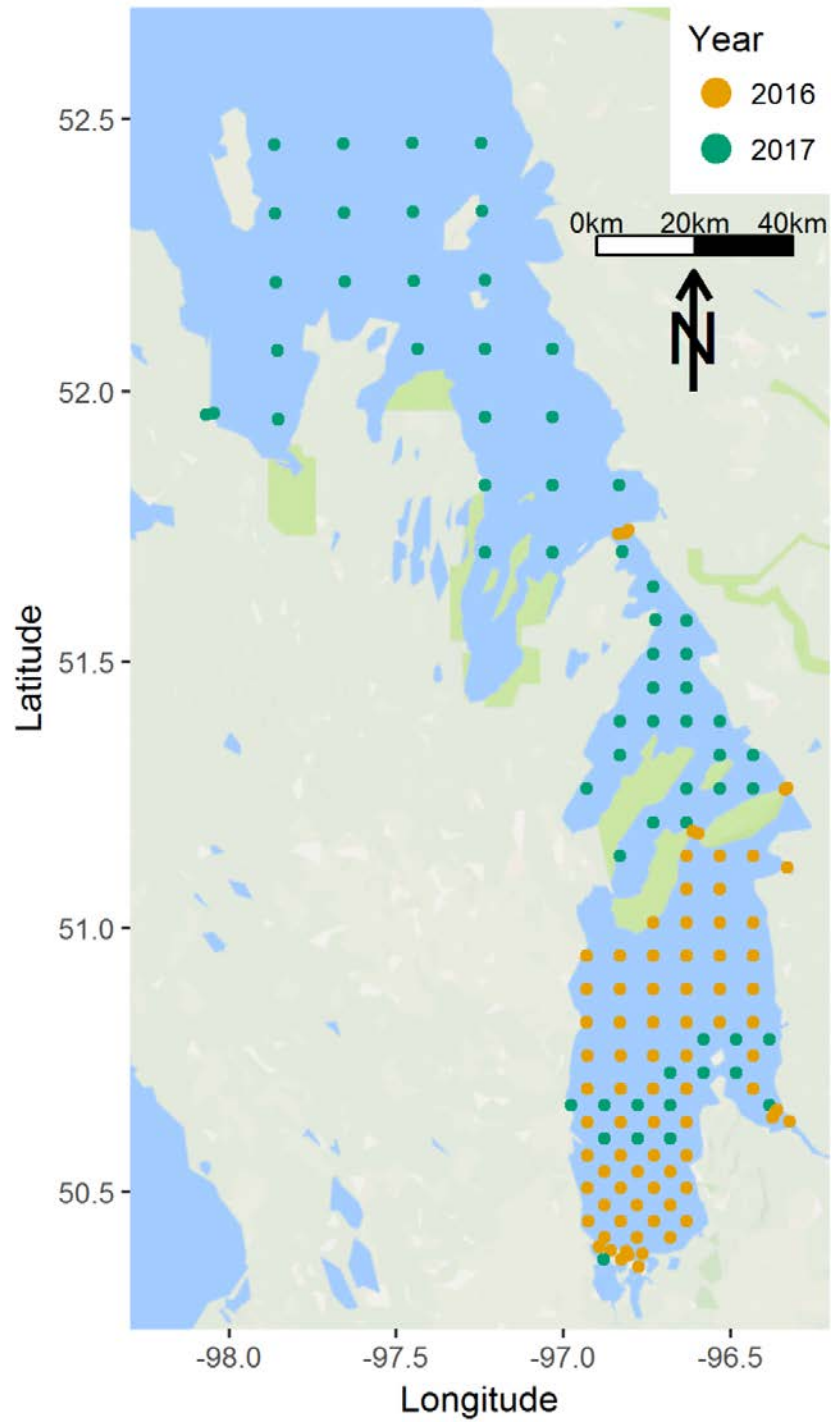
In 2017, an additional 122 receivers were deployed in the Lake Winnipeg basin (Figures 2 and 3). From these, eighteen receivers were installed in the US portion of the Red River (Figure 2) from the international border upstream to Fargo, North Dakota, every 30 rkm. Currently, a total of 860 rkm in Red, Assiniboine, and Winnipeg rivers and an area of ~9,000 km<sup>2</sup> in Lake Winnipeg are now being monitored by receivers (Table 1).

**Table 1:** Numbers of receivers deployed at different locations throughout the Lake Winnipeg basin in 2016 and 2017, respectively.

<b>Location</b>	<b>2016</b>	<b>2017</b>
<b>Assiniboine River</b>	6	4
<b>Cooks Creek</b>	1	1
<b>Dauphin River</b>	0	1
<b>Devils Creek</b>	1	1
<b>La Salle River</b>	1	1
<b>Lake Winnipeg</b>	69	130
<b>Manigotagan River</b>	1	1
<b>Red River</b>	30	32
<b>Red River - USA</b>	3	18
<b>Rivière Aux Rats</b>	0	1
<b>Roseau River</b>	0	1
<b>Saskatchewan River</b>	0	1
<b>Seine River</b>	1	1



**Figure 2:** Receiver locations in the Red, Assiniboine, and Winnipeg rivers. Receivers installed in 2016 in yellow, 2017 in green.



**Figure 3:** Receiver locations in Lake Winnipeg using a grid design. Receivers installed in 2016 in yellow, 2017 in green.

## 2.2 Fish tagging

For the acoustic telemetry study, fish were caught using different methodologies: Bigmouth Buffalo, Common Carp, and Walleye (*Sander vitreus*) were captured by boat electrofishing. Channel Catfish were angled and tagged by the research team from the University of Nebraska. Lake Sturgeon were caught using multi-panel multifilament gill nets with large mesh size.

Upon capture, fish were placed in holding tanks filled with ambient water. Captured fish were measured and weighed immediately and undersized individuals ( $>2\%$  tag:body weight ratio;  $>1.2$  kg) released. Vemco V16-4H acoustic transmitters (16 mm diameter, 6½ years battery life) were implanted in the body cavity of the fish (Figure 4).



**Figure 4:** Vemco V16-4H acoustic transmitter used in telemetry study.

A small fin clip was taken for genetic testing of all fish before they were released to be used in a population genetics study.

In 2016, a total of 244 fish were tagged (Table 1), of these 40 were Bigmouth Buffalo (20 in the La Salle River and 20 in the Seine River), 121 Channel Catfish (67 in the Lower Red River, 24 in the Upper Red River, 30 in the Winnipeg River), 40 Common Carp (20 in the Netley Marsh and 20 in the Libau Marsh), 43 Lake Sturgeon (42 in the Winnipeg River and 1 in the Red River). In 2017, an additional 40 Bigmouth Buffalo (40 in the Lower Red River and 40 in the US portion of the Red River), 40 Channel Catfish (tagged in the US portion of the Red River), 2 Lake Sturgeon (Lower Red River), and 204 Walleye in Lake Winnipeg were tagged. Further, three Lake Sturgeon joined the study site from an ongoing telemetry study of hatchery reared and released Lake Sturgeon in the upstream portion of the Assiniboine River.

**Table 2:** Number of tagged fish per species and location in 2016 and 2017, respectively.

Species	Year	Site	Number	Total
<b>Bigmouth Buffalo</b>	2016	La Salle River	20	<b>80</b>
	2016	Seine River	20	
	2017	Red River	20	
	2017	Red River - USA	20	
<b>Channel Catfish</b>	2016	Red River	91	<b>161</b>
	2016	Winnipeg River	30	
	2017	Red River - USA	40	
<b>Common Carp</b>	2016	Libau Marsh	20	<b>40</b>
	2016	Netley Marsh	20	
<b>Lake Sturgeon</b>	2016	Red River	1	<b>45</b>
	2016	Winnipeg River	42	
	2017	Red River	2	
<b>Walleye</b>	2017	Red River	110	<b>204</b>
	2017	Sandy Bar	60	
	2017	Dauphin River	18	
	2017	Matheson	10	
	2017	Winnipeg River	6	

### 2.3 Reference tags

To determine probability of detecting a fish, seven reference tags are deployed in Lake Winnipeg and four reference tags are deployed in the Red River. The reference tag line in Lake Winnipeg has a spacing of 300 m and extends to 2.1 km.

### 2.4 Receiver download

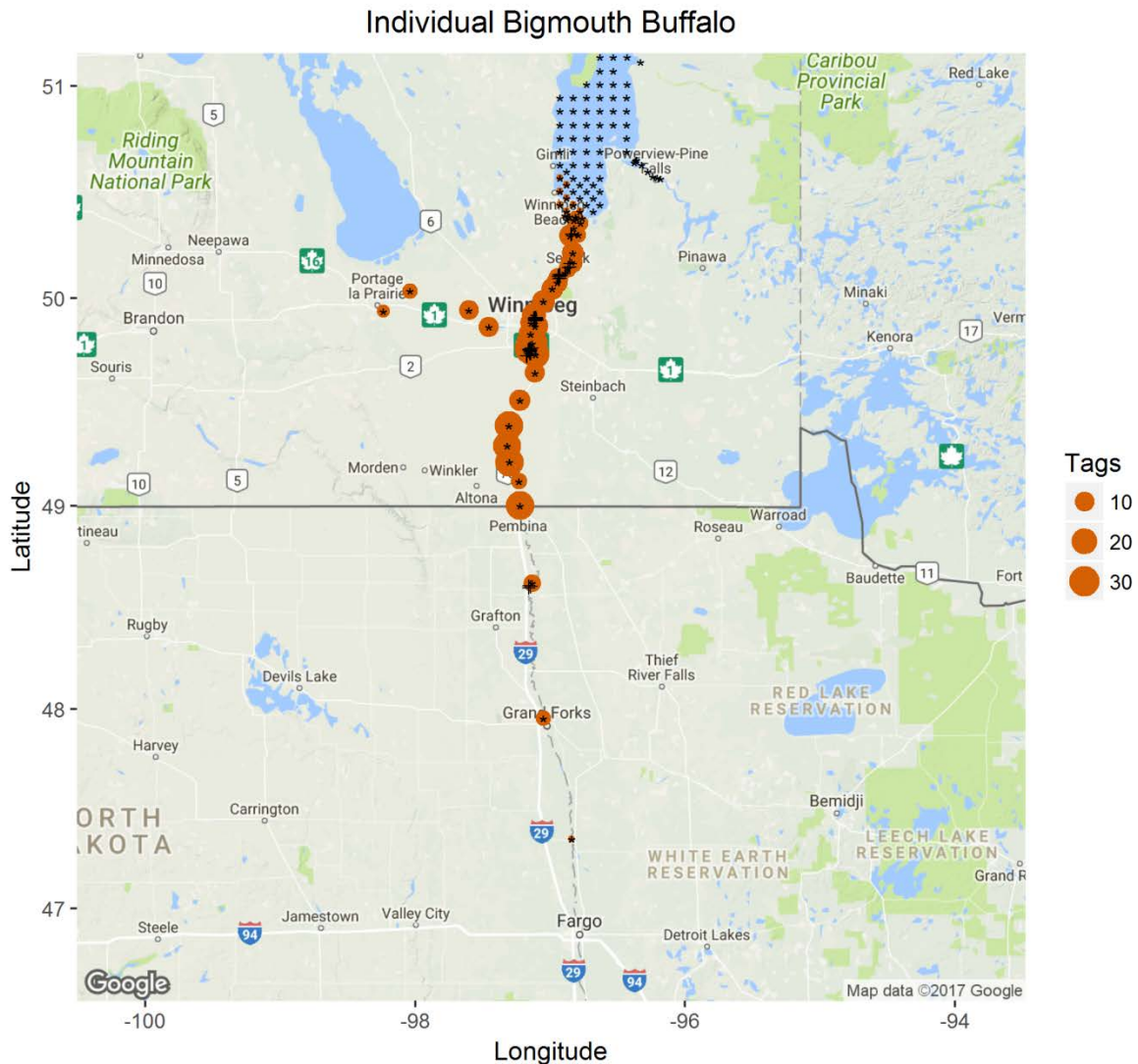
Receivers installed in 2016 were downloaded during the 2017 field season. The receivers installed in 2017 will be downloaded for the first time in the 2018 field season.

### 3 Preliminary results

#### 3.1 Fish movement per species

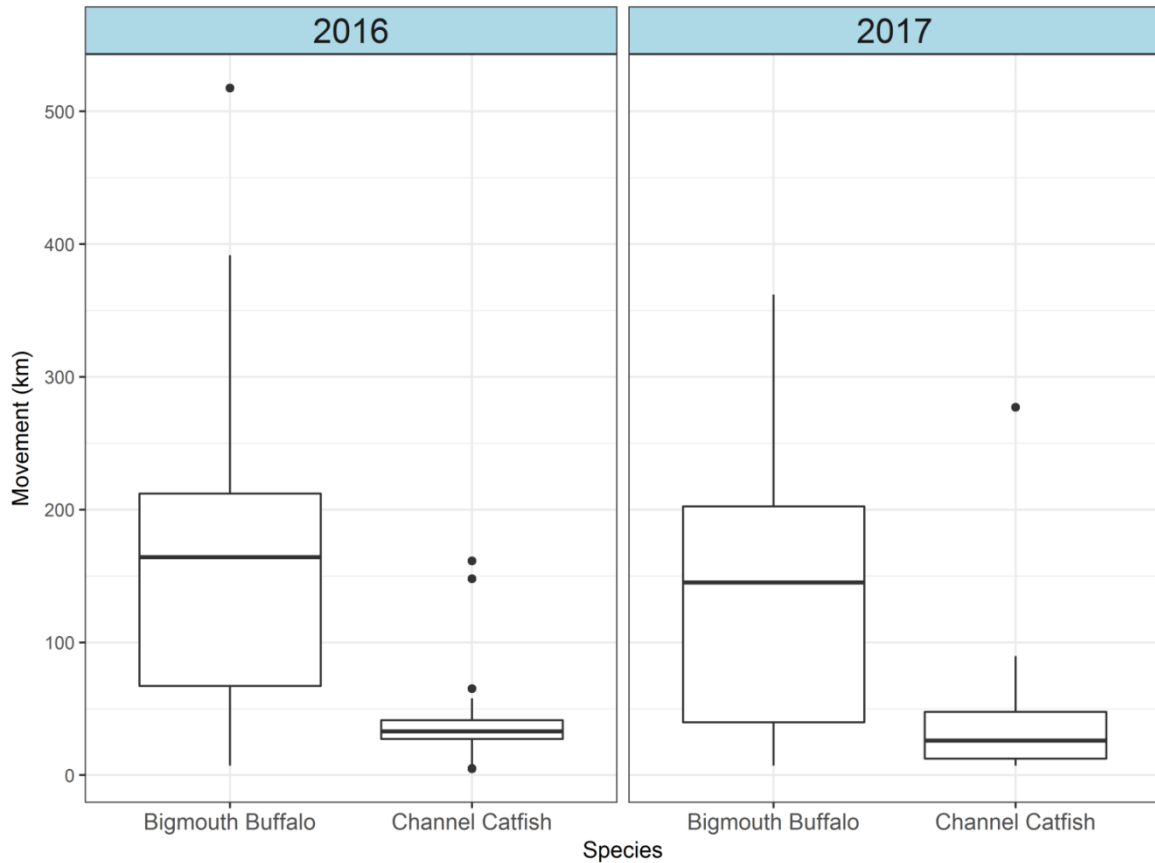
##### 3.1.1 Bigmouth Buffalo

Bigmouth Buffalo in the Red River moved extensively (Figure 5). The maximum movement for a single fish was 517.5 km and the minimum movement 7.0 km. The average movement observed in 2016 for Bigmouth Buffalo was 176.2 km and 131.5 km in 2017 (Figure 6).

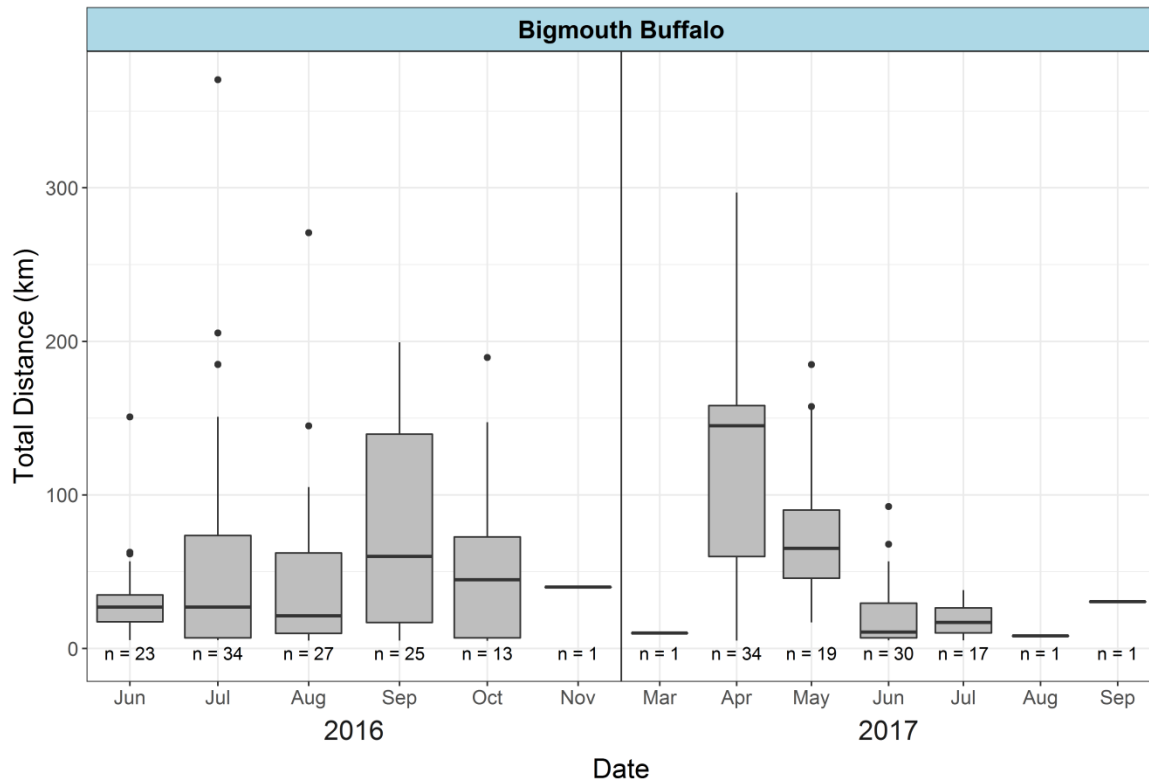


**Figure 5:** Number of unique tag detections of Bigmouth Buffalo on a given receiver location in the Red River. \* indicate receiver positions and + tagging locations.

As of yet, we have not seen any Channel Catfish that was tagged in the Red River moving into the US, but we have seen one Channel Catfish that was tagged in the US in 2017 move into Canadian waters, through the St. Andrews Lock and Dam and into Lake Winnipeg. Movement patterns varied between seasons (Figure 7).



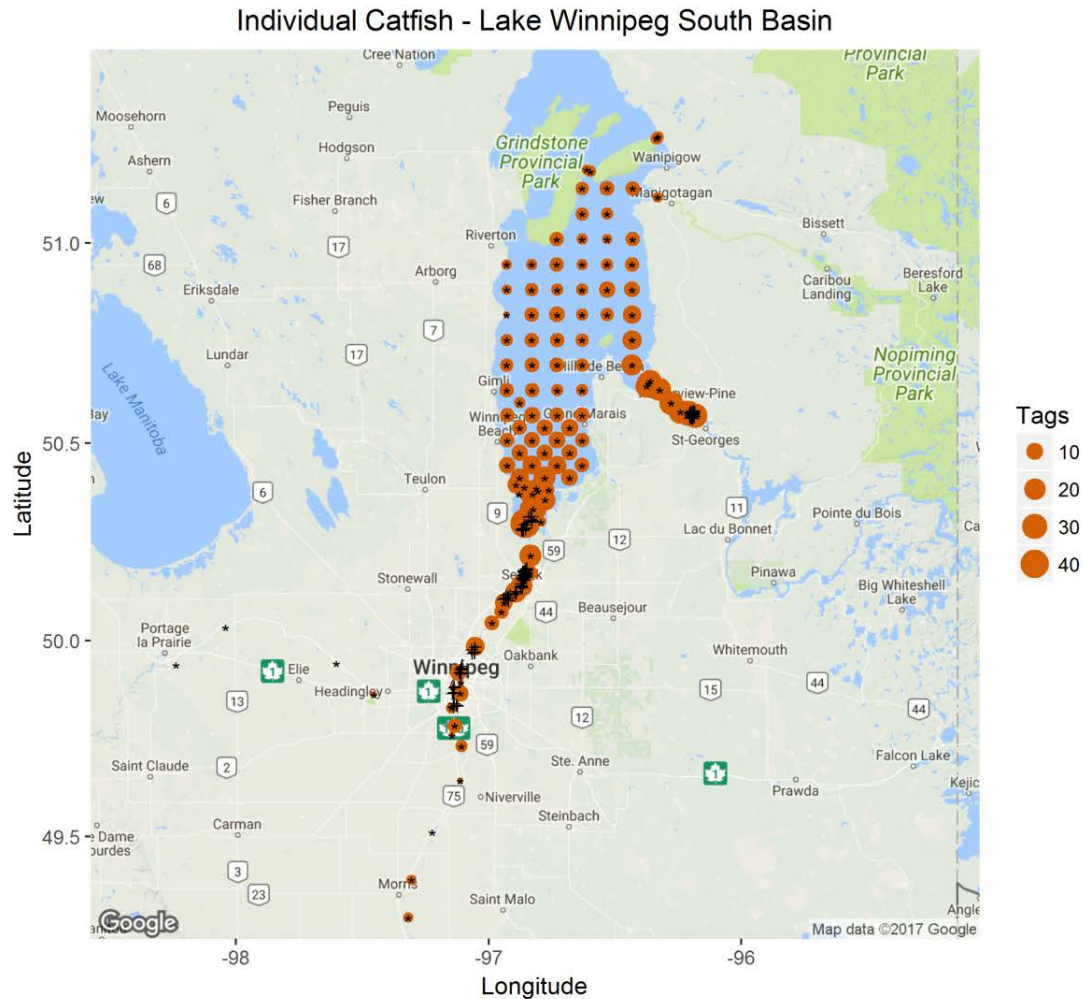
**Figure 6:** Box-Whisker plots on the interspecific river movement (in km) comparing movements of Bigmouth Buffalo and Channel Catfish in river habitat for 2016 and 2017, respectively.



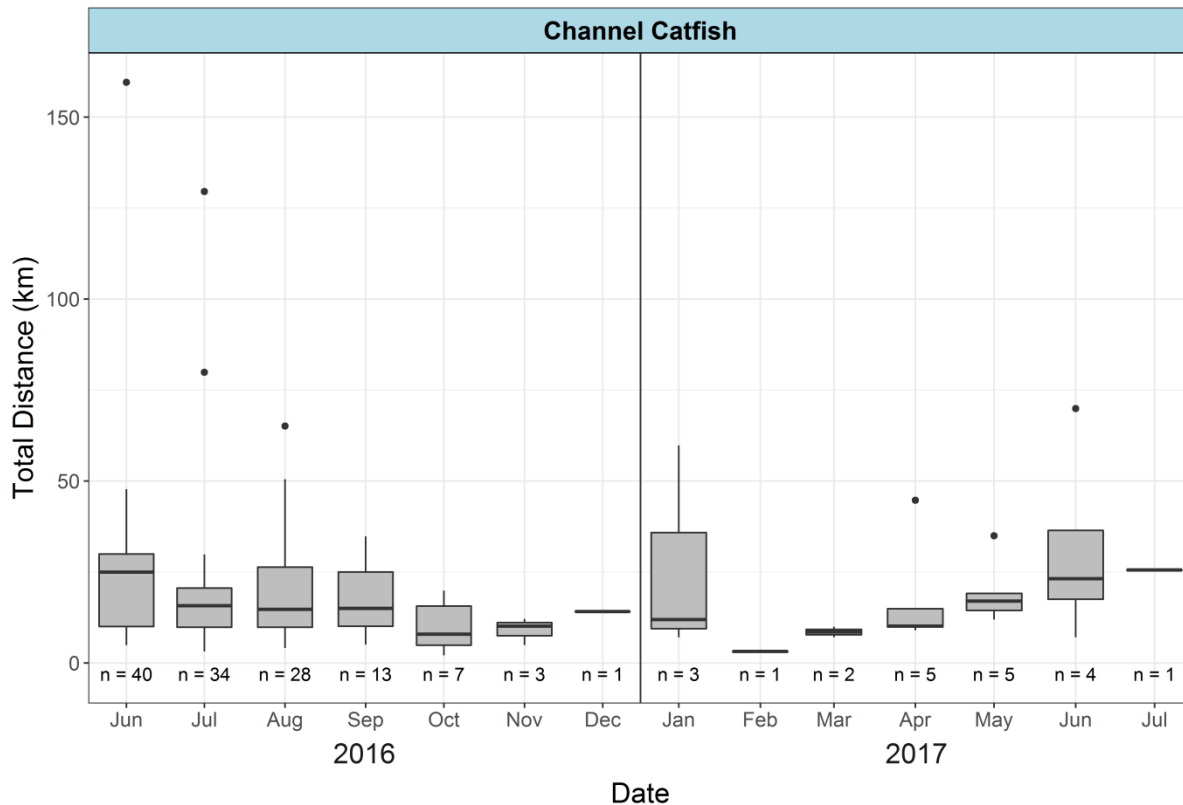
**Figure 7:** Seasonal variation in fish movements for Bigmouth Buffalo in river habitat for 2016 and 2017, respectively.

### 3.1.2 Channel Catfish

In comparison to Bigmouth Buffalo, Channel Catfish moved less in the river (Figure 6). The maximum movement for a single fish was 277.0 km and the minimum movement 4.9 km. The average movement for Channel Catfish was 37.1 km in 2016 and 48.5 km in 2017 (Figure 6). As of yet we have seen no Channel Catfish tagged in the Red River moved into the US, but we have seen one Channel Catfish that was tagged in 2017 in the US move into Canadian waters, through the St. Andrews Lock and Dam and into Lake Winnipeg. Also some fish tagged in the Red River moved throughout the south basin as well as to the Winnipeg River (Figure 8). The seasonal movement patterns in Channel Catfish were less pronounced but with an increase in activity observed in January (Figure 9).



**Figure 8:** Number of unique tag detections of Channel Catfish per receiver location (\*) in lake and river habitat combined for 2016 and 2017 downloaded data. Tagging locations are indicated by +.



**Figure 9:** Seasonal variation in fish movement for Channel Catfish in river habitat for 2016 and 2017, respectively.

## 4 Plan for the 2018/19 field season

### 4.1 Fish tagging

A large tagging effort is again foreseen for the spring 2018. To capitalize on the existing receiver network, an additional 230 fish will be tagged – these will likely include 80 Freshwater Drum (*Aplodinotus grunniens*) and 150 Walleye (*Sander vitreus*) at locations still to be determined in the Lake Winnipeg basin. The tagging effort in the US portion of the Red River will be led by the University of Nebraska – Lincoln and in the Canadian portion by Fisheries and Oceans Canada. Fish will be caught using angling and boat electrofishing. Fish will then be tagged with the acoustic transmitter.

### 4.2 Receiver download

The acoustic receivers have a battery life of 15 months. Consequently, the data will be downloaded annually and the batteries on the receivers exchanged.

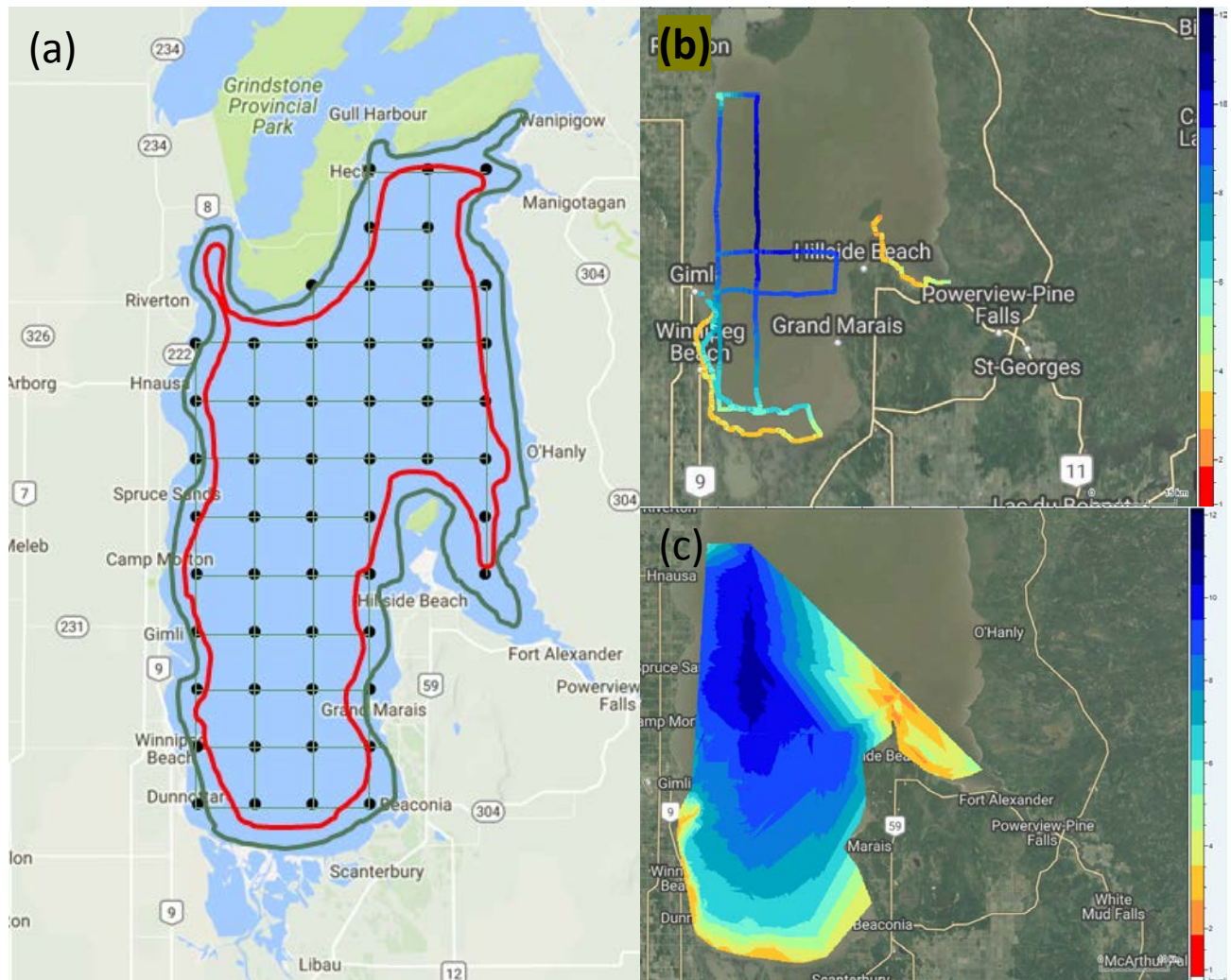
### **4.3 Data management, data quality assurance, and data analysis**

For 2018/19, the Red River Telemetry Study received \$25K for a biologist salary needed to coordinate fish tagging, receiver deployments and downloads, and the data management, quality assurance of the data, and data analysis. Staffing for this position has been accomplished.

### **4.4 Habitat mapping**

A bathymetry and substrate project funded by Environment and Climate Change Canada (ECCC)'s Lake Winnipeg Basin Program, began in 2017 in the south basin of Lake Winnipeg using a BioSonics MX Aquatic Habitat Echosounder. The collected data comprises bathymetry, substrate composition, and submersed plants along a predetermined transect plan (~7 km grid) and at 3 and 6 m contour lines (Figure 10a). The BioSonics MX automatically geo-references the data collected (Figure 10b). Substrate classes (rock, sand, mud, etc.) are identified and plant canopy height and percent coverage assessed. Habitat maps are created in Bionic Visual Habitat software and the substrate types identified by the software are ground-truthed using Ponar grabs (Figure 10c).

The Aquatic Ecosystem Committee of the International Red River Board is planning to submit a proposal to IJC aiming to extend this habitat mapping project into the Red River in 2019/20.



**Figure 10:** (a) Proposed bathymetry and substrate survey grid and 3 m contour in green and 6 m contour line in red for the south basin of Lake Winnipeg. (b) Surveyed grid in 2017. (c) Preliminary bathymetry results for the south basin.

## **Annex I - Project partners**

Fisheries and Oceans Canada

Doug Watkinson, Colin Charles, Doug Leroux, Colin Kovachik, Tyana Rudolfsen,  
Amanda Caskenette, Paul Blanchfield, Eva Enders

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North Dakota Game and Fish Department

Todd Caspers

University of Manitoba

Jason Treberg, Kenneth Jeffries, Darren Gillis

## **Annex II – Publications**

Kraus, Richard; Holbrook, Christopher; Vandergoot, Christopher; Stewart, Taylor; Faust, Matthew; Watkinson, Douglas; Charles, Colin; Pegg, Mark; Enders, Eva; Krueger, Charles (accepted) Evaluation of Acoustic Telemetry Grids for Determining Aquatic Animal Movement and Survival. *Methods in Ecology and Evolution*.