Fisheries and Oceans Canada | Pêches et Océans Canada

International Joint Commission – International Watershed Initiative Project

# Red River Telemetry Study

*2016/17 Year-End Report*

by

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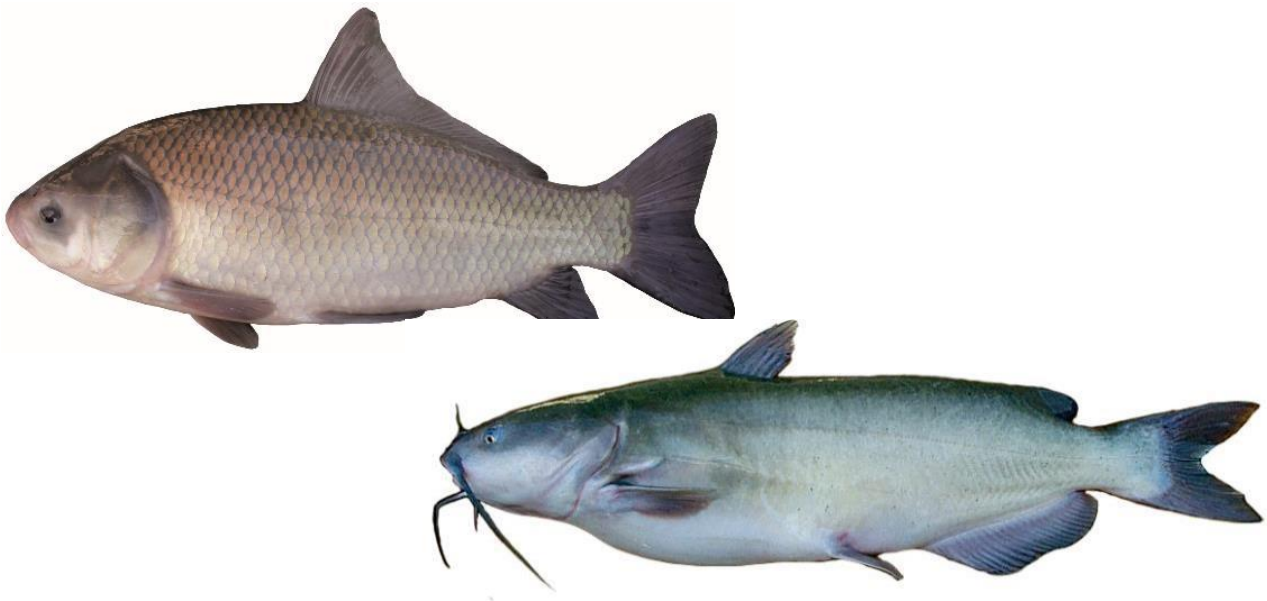
Riverine Ecology Lab



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# Summary

The International Joint Commission (IJC) provided funding to Fisheries and Oceans Canada (DFO) to purchase hydroacoustic receivers and tags for the "Red River Telemetry Study" to be deployed in the 2017 field season in the US portion of the Red River. Eighteen receivers and fifty tags for Channel Catfish (*Ictalurus punctatus*) and Bigmouth Buffalo (*Ictiobus cyprinellus*) were received at the Freshwater Institute.

For 2017, the deployment of the hydroacoustic receivers in the Red River and tagging of Channel Catfish and Bigmouth Buffalo are planned with our US partners Jamison Wendel from the Minnesota Department of Natural Resources and Mark Pegg from University of Nebraska - Lincoln and his lab.

Preliminary study results were presented by Patricia Ramlal at the International Red River Board meeting held in Devils Lake, North Dakota in January 2017 and by Doug Watkinson at the Great Lakes Acoustic Telemetry Observation System (GLATOS) annual meeting held in Ann Arbor, Michigan in February 2017.

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

**Date:** March 31, 2017

# 1 Lake Winnipeg Basin Fish Movement Study

## 1.1 Background

In 2016, Fisheries and Oceans Canada initiated in collaboration with several partner organizations, including Manitoba Sustainable Development, Lake Winnipeg Foundation, University of Nebraska – Lincoln, Minnesota Department of Natural Resources, a large-scale, long-term tagging project in the Lake Winnipeg basin.

The aim of the project was to answer several state, provincial, and federal stakeholder questions by collecting information and gaining knowledge on fish movement. Examples were:

(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 Fisheries Branch of Manitoba Sustainable Development**:

(a) to improve fishery management objectives and provide key information on transboundary fish movements and habitat use. Habitat maps developed in the frame of this project will provide 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 can provide critical information regarding the use of tributaries by these large river species.

(c) to improve restoration efforts of Lake Sturgeon (*Acipenser fulvescens*) in the Red River basin. Currently, the agencies are relying on anecdotal information, such as angler reports, to obtain basic distribution and movement information. This research will advance our knowledge of Lake Sturgeon in the Red River basin and guide 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 program**: to protect and preserve species at risk. In particular, findings on fish movement and habitat use will contribute to the recovery strategy of Mapleleaf mussel (*Quadrula quadrula*) by studying its host, the Channel Catfish (*Ictalurus punctatus*), and management plan for Bigmouth Buffalo (*Ictiobus cyprinellus*). An updated species status report for on Lake Sturgeon for the Committee on the Status of Endangered Wildlife in Canada

(COSEWIC) is currently being reviewed and this research will help inform managers when a listing decision needs to be made. Information on habitat preferences and seasonal migration of these species is currently not available.

(5) **Fisheries and Oceans Canada's Aquatic Invasive Species program**: to manage impacts of invasive species such as Zebra Mussel and Common Carp (*Cyprinus carpio*) on the aquatic ecosystem.

(a) The project provides a unique short window of opportunity, to sample habitat baseline 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. Exclusion structures have been installed and a positive effect has been observed. Outcomes of this study will establish the habitat use of Common Carp in the Netley-Libau Marsh and determine potential effects on the ability of this valuable marsh habitat to buffer nutrient inputs in Lake Winnipeg.

(6) **Fisheries and Oceans Canada's Fisheries Protection program**: to gain valuable insight on:

(a) fish passage requirements in the Lake Winnipeg Basin; and

(b) the efficiency of existing fish passage structures (e.g., fishway at St. Andrews Lock and Dam on the Red River at Lockport, MB).

## 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 this study into the American portion of the Red River and tag fish in the United States.

The expected information on habitat use and fish movement gained through this study will be crucial for Instream Flow Needs predictions and will provide previously unknown aspects of the lives of fishes in the Red River such as where certain fish spawn and when fish move to and from spawning grounds or overwintering areas. Additionally, we will better understand the population structure and movement of fish between the United States (US) and Canada in the Red River Basin.

# 2 Achievements of the 2016/17 field season

## 2.1 Receiver deployment

In 2016, 125 Vemco VR2W receivers were deployed in the Lake Winnipeg basin (Figure 1). The hydroacoustic receivers were installed along the Red River until the US border, the Assiniboine River upstream to the Portage Diversion Dam, and the Winnipeg River upstream to the Pine Falls Generating Station (Figure 2a). Distances between receivers varied between 20 and 30 river km (rkm) depending on river transect.

**Figure 1:** Hydroacoustic receiver setup.

The design of the receiver array installed in the south basin of Lake Winnipeg is based on experiences of GLATOS studies in Lake Erie where they used curtains and some individual receivers. After model simulations, Richard Kraus (USGS - Great Lakes Science Center) et al. concluded that a higher probability of fish detection is achieved with a grid design. Consequently, we chose a 7 x 7 km grid design and a 5 x 5 km in the southern end of Lake Winnipeg. Gates are placed around Black Island (Figure 2b).

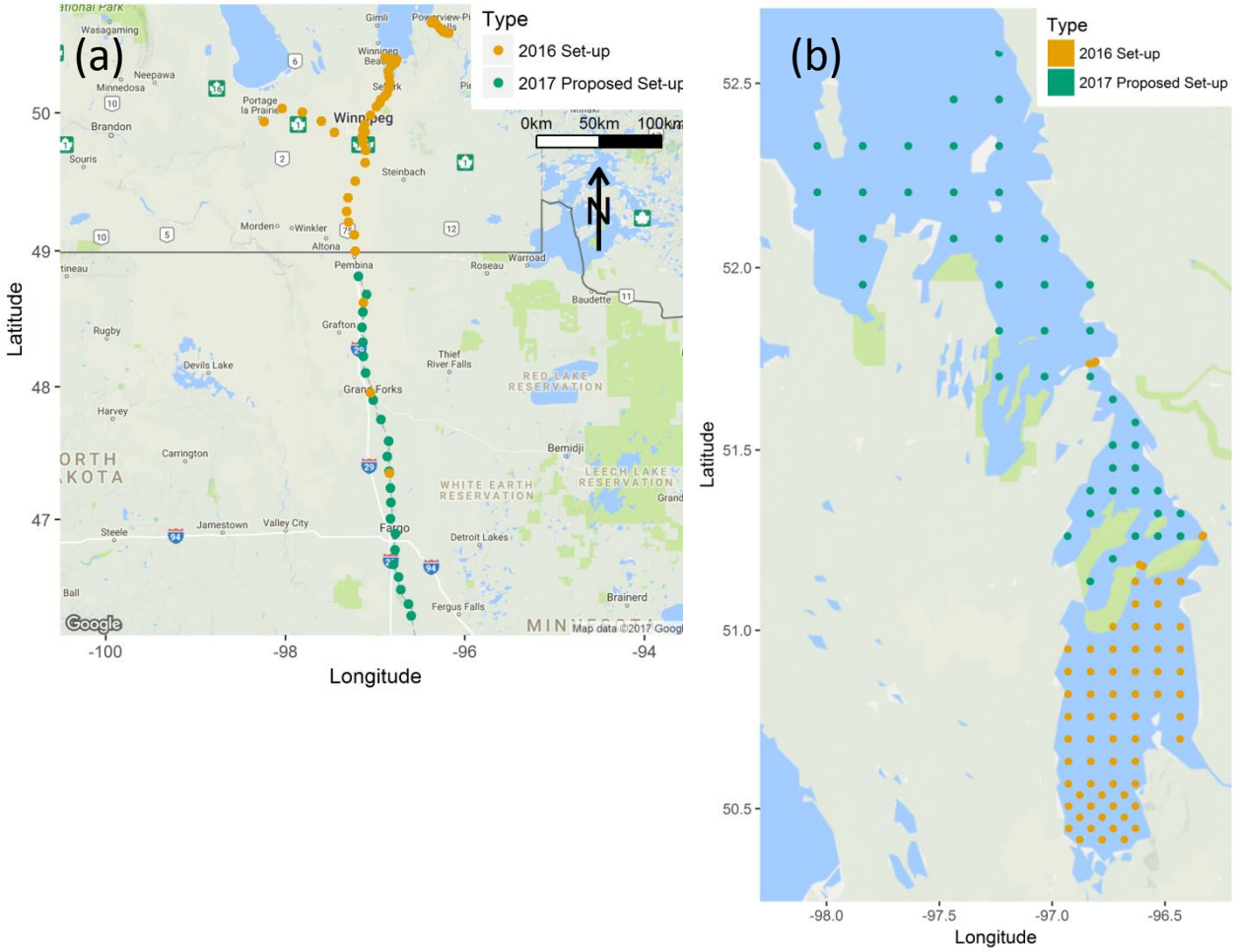


**Figure 2:** Receiver locations (a) in the Red, Assiniboine, Winnipeg rivers and (b) in Lake Winnipeg using a grid design.

## 2.2 Fish tagging

For the hydroacoustic telemetry study, fish were caught using different methodologies: Bigmouth Buffalo and Common Carp 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 (200 mm to 300 mm). Gill net panels were set in deep pools at dusk (~1700 - 2100 CDT) and pulled at dawn (soak time of ~12 h).

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) released. Vemco V16-4H hydroacoustic transmitters (16 mm diameter, 6½ years battery life) were implanted in the body cavity of the fish.

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

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), 40 Common Carp (20 in the Netley Marsh and 20 in the Libau Marsh), 121 Channel Catfish (67 in the Lower Red River, 24 in the Upper Red River, 30 in the Winnipeg River), and 43 Sturgeon (42 in the Winnipeg River and 1 in the Red River).

**Table 1:** Tagged fish per species and number of individual fish detected on a receiver before fall of 2016 in parenthesis.

| Site | Bigmouth Buffalo | Common Carp | Channel Catfish | Lake Sturgeon |
|---|---|---|---|---|
| La Salle River | 20 (20) | | | |
| Seine River | 20 (20) | | | |
| Netley Marsh | | 20 (19) | | |
| Libau Marsh | | 20 (18) | | |
| Lower Red River | | | 67 (64) | 1 (1) |
| Upper Red River | | | 24 (22) | |
| Winnipeg River | | | 30 (30) | 42 (42) |

### 2.3 Sync tags

To determine probability to detect a fish, two trials were conducted using seven sync tags in Lake Winnipeg and four sync tags in the Red River. The original sync tag line in Lake Winnipeg was 1.2 km long, it was extended to 2.1 km (with 300 meter spacing), and further extension to 3 km is planned for 2017.

### 2.4 Receiver download

Of the 125 VR2W receivers that were installed across the system, 114 VR2W receivers were downloaded in the fall of 2016. Two receivers were lost and the other nine were not visited in the fall of 2016.

# 3 Preliminary results

### 3.1 Detection probability

Simulations of the detection probability were conducted using different grid sizes. Common Carp and Catfish were used as examples. With the 7 km grid spacing, we are typically detecting a fish within less than a day before it is detected again on another receiver.

Detection probability is correlated to environmental conditions (wind, likely wave height) as revealed by the sync tag data. In the current model (Zero-inflated Poisson), wind from an Environment Canada and Climate Change (ECCC) weather station in Gimli is used.

The area of Lake Winnipeg's south basin is 2825 km$^2$. The sync tag data provided and estimate of a 1.2 km detection radius 50% of time, which represents a 10% coverage of the south basin (285 km$^2$) (Figure 3).

The theoretical proportion of detection follows the observed data for Common Carp and Channel Catfish. The detection probability was confirmed when subsampling receivers by reducing density of receiver array (i.e., 7 x 7 km, 14 x 14 km, 21 x 21 km etc.).

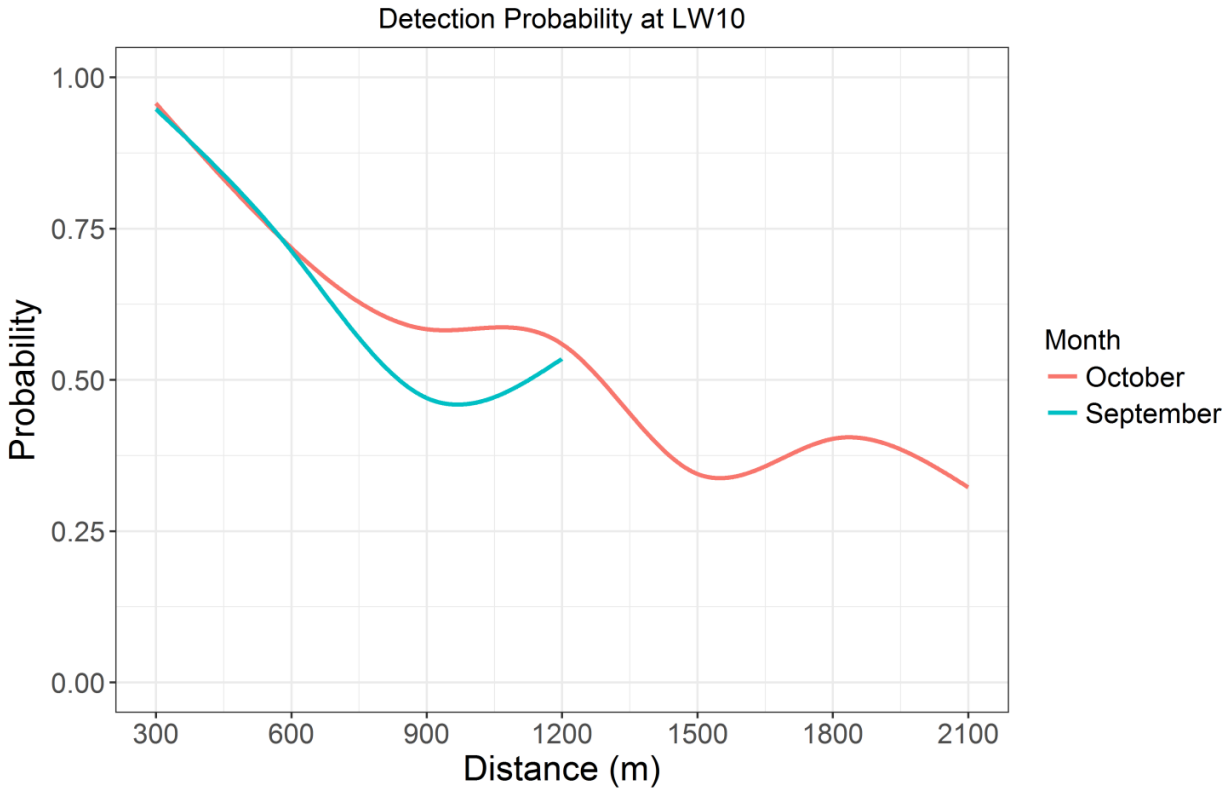


**Figure 3:** Detection probability estimates from the sync tag data obtained from Lake Winnipeg in the fall of 2016.

## *3.2* Fish movement per species

### *3.2.1 Bigmouth Buffalo*

Bigmouth Buffalo in the Red River moved extensively (Figure 4). Tools were developed to calculate total distance moved by individual fish and river movement was summarized (Figure 5).

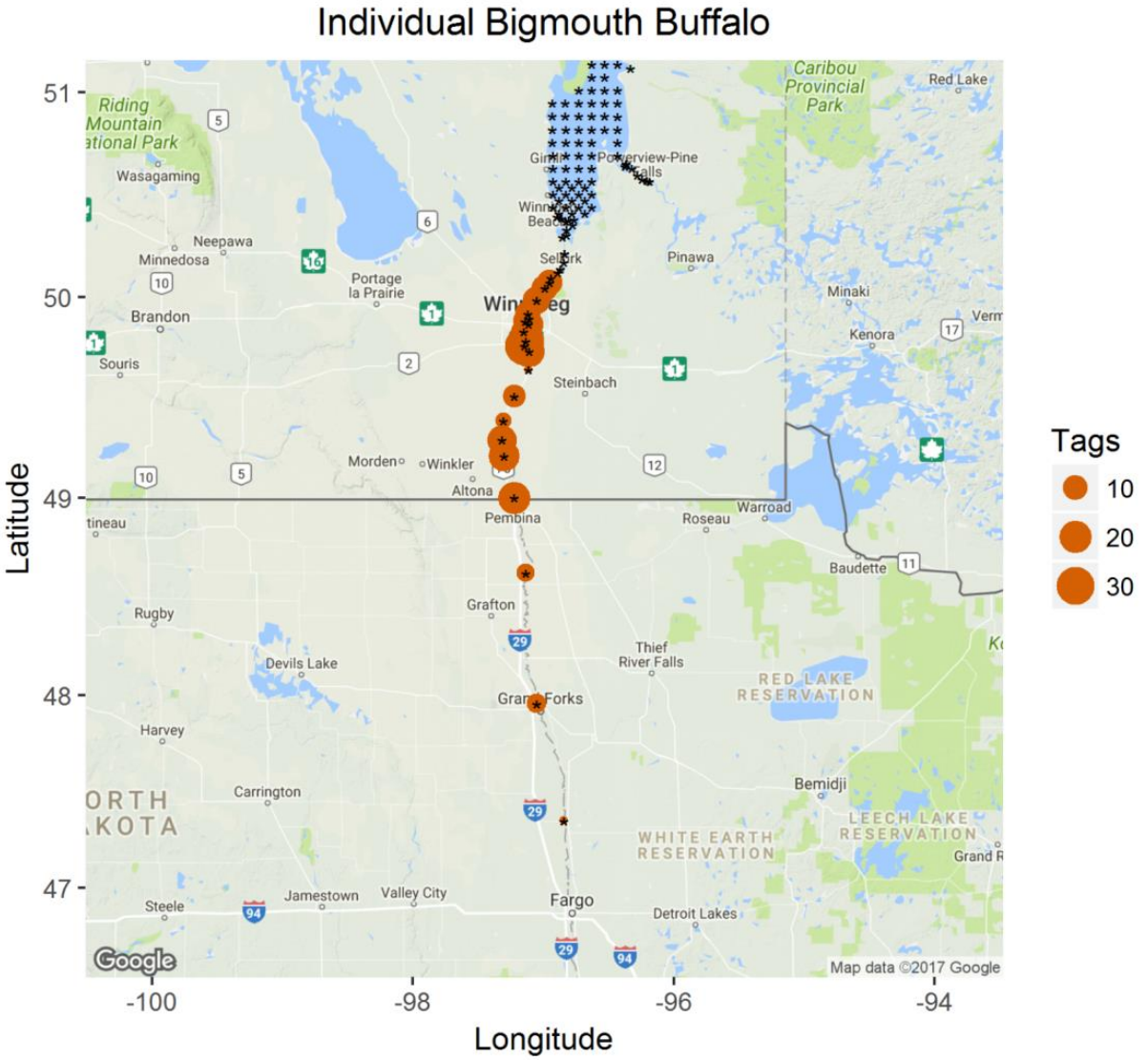


**Figure 4:** Unique tag detections of Bigmouth Buffalo in the Red River. * indicate receiver positions and + tagging locations.

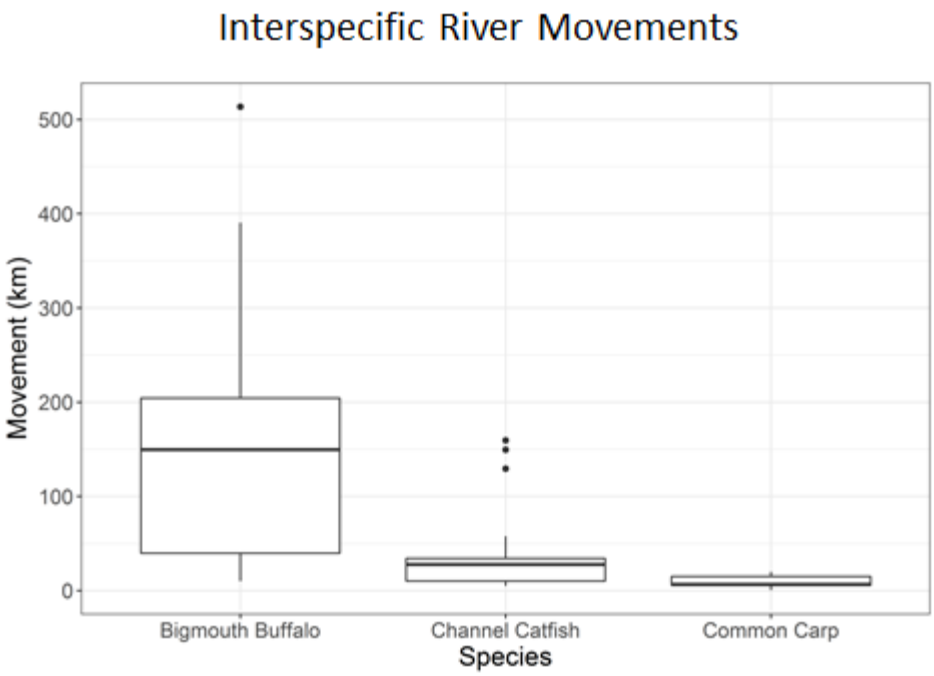


**Figure 5:** Box-Whisker plots on the interspecific river movement (in km) comparing movements of Bigmouth Buffalo, Channel Catfish, and Common Carp in river habitat.

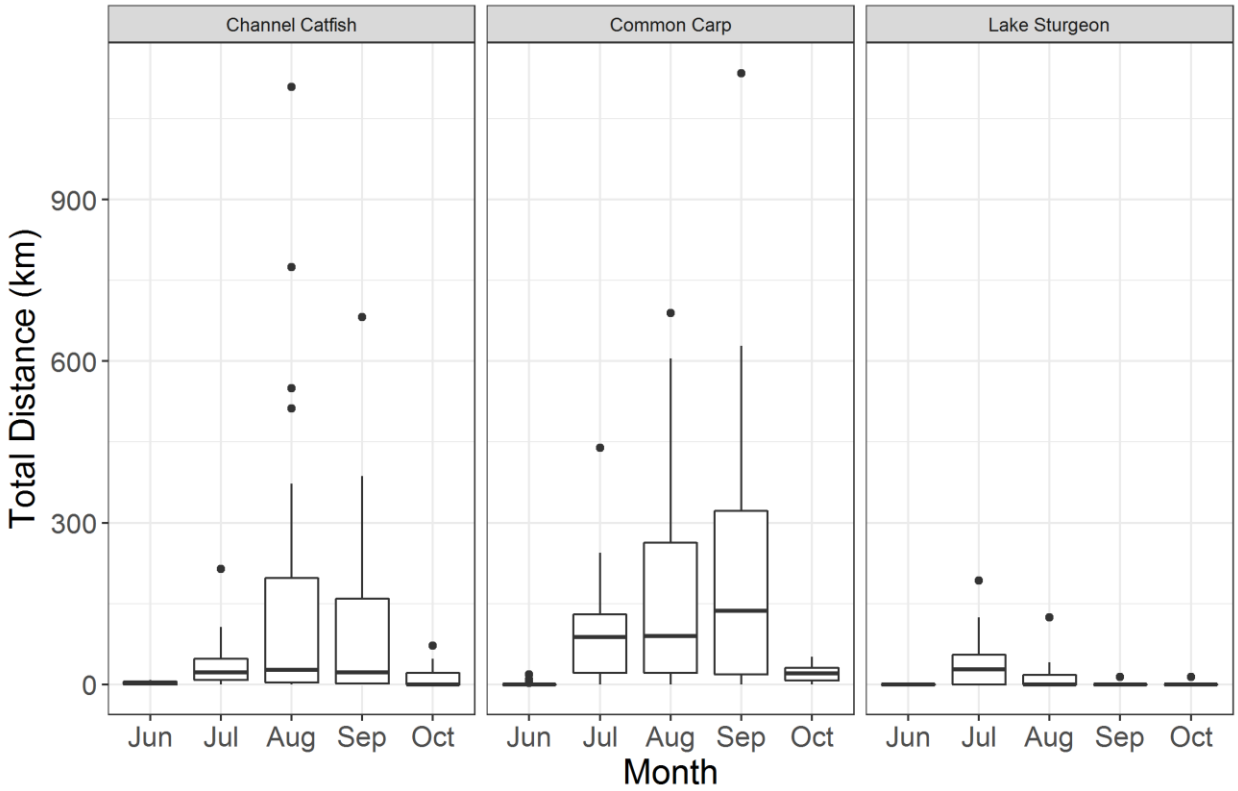


**Figure 6:** Box-Whisker plots on the interspecific lake movement per month (in km) between Channel Catfish, Common Carp, and Lake Sturgeon in the lake habitat.

### *3.2.2 Common Carp*

Common Carp moved quickly out of the Netley-Libau Marsh after being tagged and distributed throughout the south basin of Lake Winnipeg but was rarely seen in river habitat (Figure 6, 7). Larger movements occurred in August and September. The array was not deployed at the time when Common Carp were tagged, so it is possible that initial movements were missed as fish moved northwards.

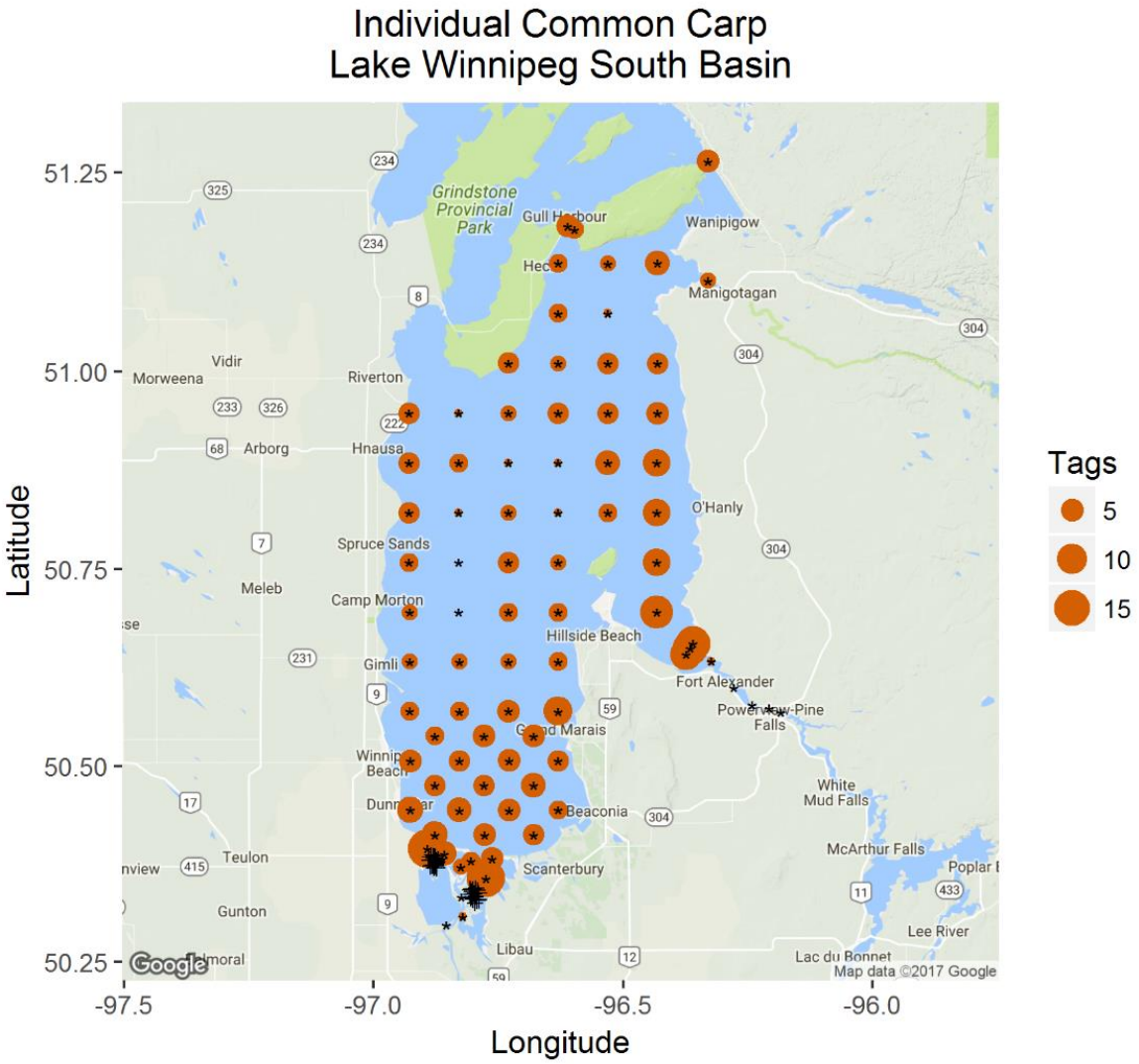


**Figure 7:** Unique tag detections of Common Carp in lake and river habitat. * indicate receiver positions and + tagging locations.

### *3.2.3 Channel Catfish*

Channel Catfish were also widely distributed throughout Lake Winnipeg. Fish that were tagged at the east side of Lake Winnipeg stayed on the east side throughout the observation period (June to October 2016).

Some Channel Catfish tagged in the Red River moved into the US. Also some fish tagged in the Red River moved throughout the south basin as well as to the Winnipeg River (Figure 8).

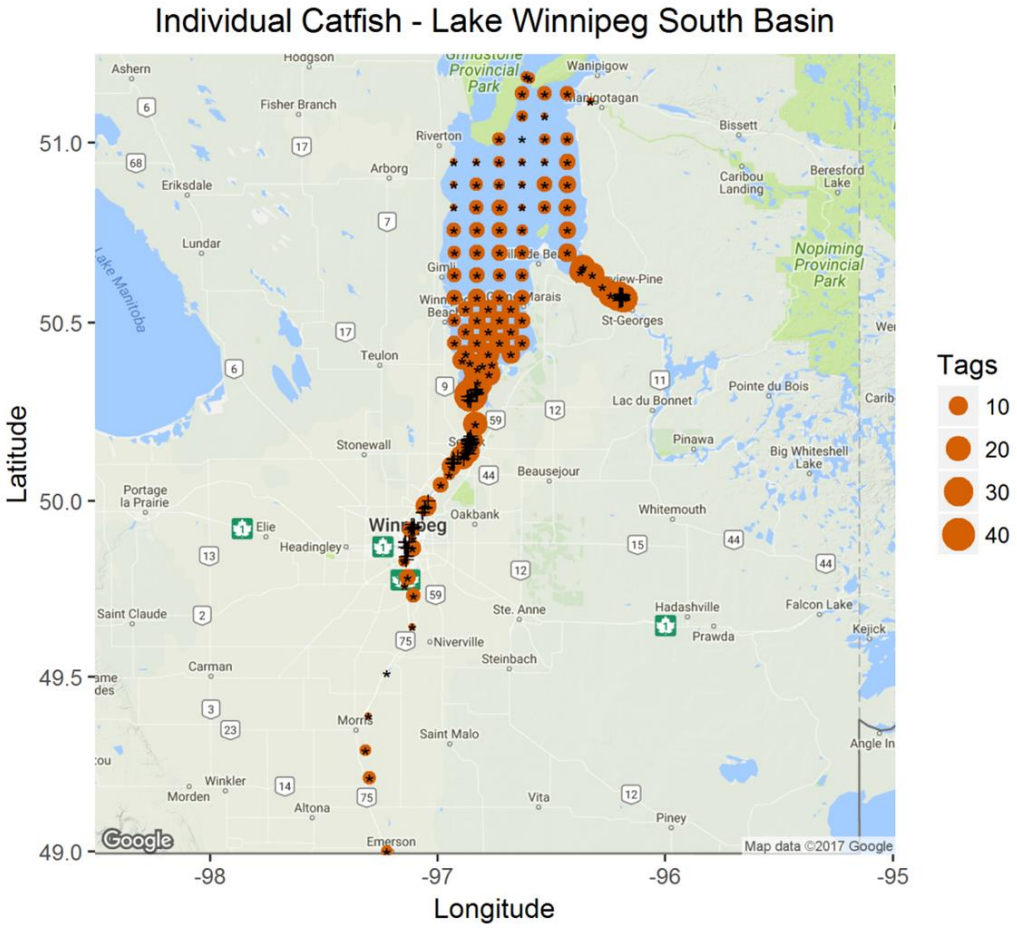


**Figure 8:** Unique tag detections of Channel Catfish in lake and river habitat. * indicate receiver positions and + tagging locations.

### *3.2.4 Lake Sturgeon*

Lake Sturgeon only moved as far as Traverse Bay into Lake Winnipeg, with most fish either moving from and back to the Winnipeg River or never moved out of the Winnipeg River (Figure 9).

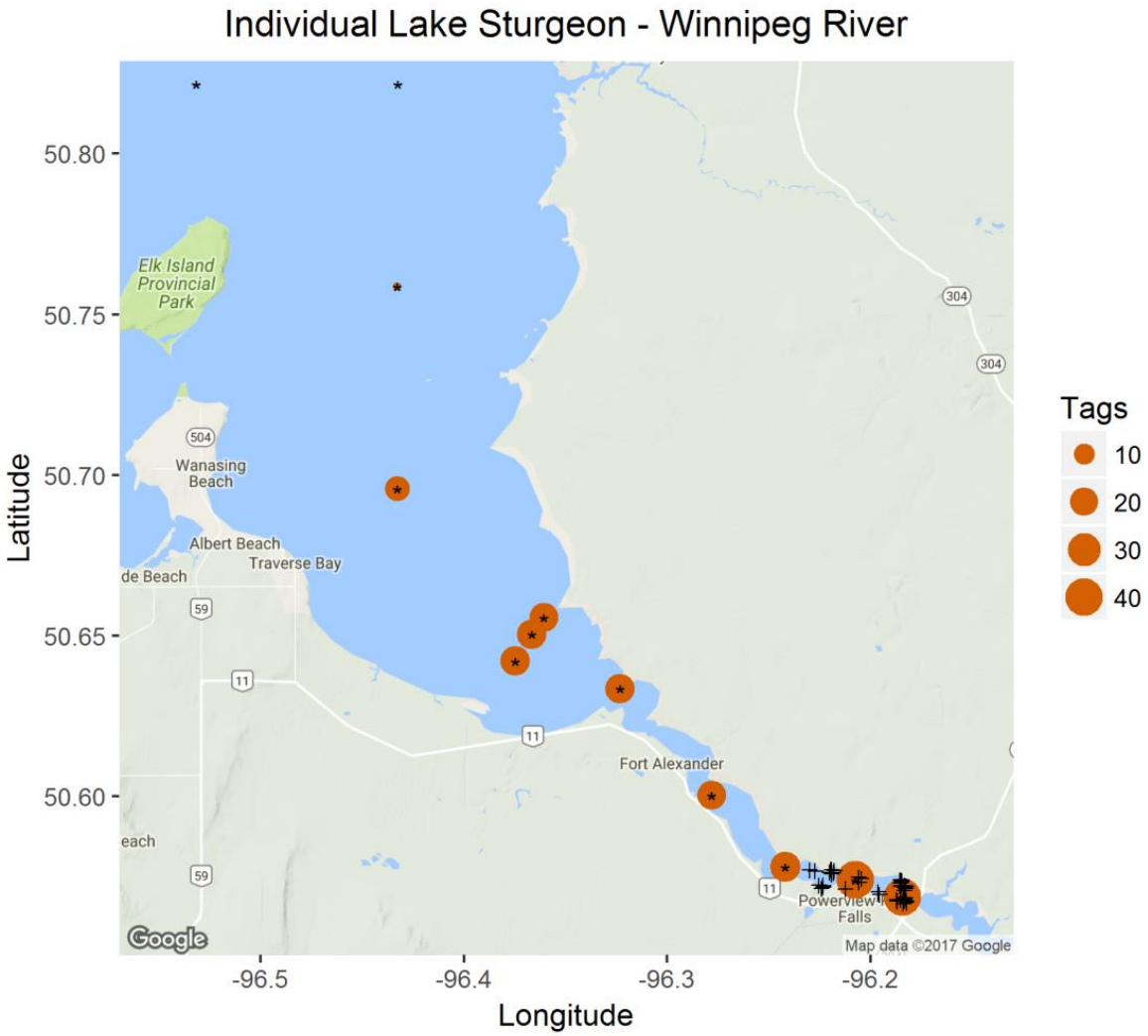


**Figure 9:** Unique tag detections of Lake Sturgeon in Travers Bay and Winnipeg River. * indicate receiver positions and + tagging locations.

### 3.3 Zebra Mussel invasion in Lake Winnipeg

Photos of the receiver equipment were taken when receivers were downloaded in the fall (Figure 10). Settlement of Zebra Mussel mainly occurred on the floats and to lesser extend on the other equipment such as anchors, ropes, and receivers. Zebra Mussel on the images are being counted and individuals measured.

**Figure 10:** Zebra Mussel settlement on a float that was attached to the hydroacoustic receiver equipment located in Lake Winnipeg.

# 4 Plan for the 2017/18 field season

## 4.1 Receiver deployment

In 2017, 89 additional receivers will be deployed soon after fish tagging occurred (Table 2, Figure 2). An array extension into the US portion of the Red River (Figure 1a) and a 7 x 7 km grid extension into the Narrows and a 14 x 14 km grid extension into the north basin are planned (Figure 1b).

**Table 2:** Locations for the 89 additional receivers to be installed in the Lake Winnipeg basin in 2017.

| Additional receiver deployment locations | # |
|---|---|
| Winnipeg River | 2 |
| Lake Winnipeg - south basin, likely Travis Bay | 11 |
| Lake Winnipeg - Narrows and north basin | 46 |
| Lake Winnipeg tributaries. (Dauphin, Saskatchewan, Bloodvein, Berens, and Poplar rivers) | 5 |
| Netley-Libau Marsh | 4 |
| Red River US portion | 16 |
| Red River tributaries (Roseau, Rat, Pembina, Red Lake, and Sheyenne rivers) | 5 |
| **TOTAL** | **89** |

## 4.2 Fish tagging

A large tagging effort is foreseen for the spring 2017. 450 fish will be tagged - 40 Bigmouth Buffalo, 40 Channel Catfish, 20 Lake Sturgeon, and 350 Walleye (*Sander vitreus*).

In the US portion of the Red River, the tagging effort will be led by the Minnesota Department of Natural Resources and the University of Nebraska – Lincoln. The tagging effort will be involve tags for 20 Bigmouth Buffalo that will be caught in slow water velocity areas of backwatered tributaries in the pre-spawning season and 40 Channel Catfish (10 fish below the Dryden dam, 10 at Grand Forks, 10 between Grand Forks and Fargo, and 10 at Fargo).

Fish will be caught using gill nets, angling, and boat electrofishing. Fish will then be tagged with the hydroacoustic transmitter. A small fin clip will also be taken for genetic testing from all fish before they are released and used in a population genetics study.

In the Canadian portion of the Red River, the tagging effort will be led by Fisheries and Oceans Canada. 20 Bigmouth Buffalo will be caught in the lower Red River by electro-fishing in Cooks Creek and/or Devils Creek during the spawning or fish may caught at the same time than the Walleye tagging effort occurs. 20 Lake Sturgeon will be caught likely by gillnetting or also during Walleye tagging.

Five tagging sites are foreseen for the 350 Walleye (110 fish in the Red River, 60 in the Winnipeg River, 60 at Riverton (Hecla Bar), 60 at the Narrows (off Matheson), and 60 I the north basin (Grand Rapids/Dauphin River).

## 4.3 Receiver download

The hydroacoustic receivers have a battery life of 15 months. The first receivers were deployed in May 2016. Consequently, receiver downloads and battery exchanges will be conducted starting in July 2017.

## 4.4 Data management, data quality assurance, and data analysis

For 2017/18, the proposal of the Red River Telemetry Study requested $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.

## 4.5 Habitat mapping

Depending on the availability of Environment Canada and Climate Change's Lake Winnipeg Basin funding for a habitat survey, a BioSonics MX Aquatic Habitat Echosounder will be used to collect data on bathymetry, substrate composition, and submersed plants along a predetermined transect plan (~7 km grid). The BioSonics MX automatically geo-reference the data collected. Substrate classes (rock, sand, mud, etc.) can be identified and plant canopy height and percent coverage assessed. Habitat maps will be created and ground-truthed by benthic grabs or divers. Work will be conducted in the near shore from the Lake Winnipeg Foundation's *Fylgia* with the echo-sounders being attached to a tow body.

# Annex I - Project partners

Fisheries and Oceans Canada
Doug Watkinson, Colin Charles, Doug Leroux, Colin Kovachik, Amanda Caskenette, Paul Blanchfield, Eva Enders

Manitoba Sustainable Development
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