Commercial Fisheries Baseline Economic Assessment - U.S. Waters of the Great Lakes, Upper Mississippi River, and Ohio River Basins

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U.S. Army Corps
of Engineers
Product of the GLMRIS Team

The Great Lakes and Mississippi River Interbasin Study (GLMRIS) Team consists of a regional, collaborative effort led by the U.S. Army Corps of Engineers (Corps), including various District and Division offices, as well as Corps Centers of Expertise and Research Laboratories. Products of the GLMRIS Team are also made possible in collaboration with various federal, state, local, and non-governmental stakeholders.

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PURPOSE OF COMMERCIAL FISHERIES BASELINE ECONOMIC ASSESSMENT:

In support of the Great Lakes and Mississippi River Interbasin Study (GLMRIS), this report will establish the current economic value of the *commercial* fisheries in the U.S. waters of the Great Lakes, Upper Mississippi River, and Ohio River Basins based on the most recent annual harvest data available from state agencies (or equivalents) and inter-tribal agencies or organizations. This document is an assessment of the ex-vessel value of commercial fisheries in these basins- this includes both tribal and state-licensed commercial harvests. These values will set the baseline against which future conditions will be compared in GLMRIS.

TERMINOLOGY: DEFINITIONS AND APPLICATIONS

Baseline Condition:

According to the U.S. Army Corps of Engineers' IWR 96-R-21, *Planning Manual*, the base condition- referred to as the baseline condition in this report- is the "conditions that exist at the time of the study." The Planning Manual states that the study may "rely on average conditions in recent years rather than precise data for the year of the study" if "the average reasonably represents the relevant study area conditions."

This report establishes the baseline condition by utilizing the average of the most recent five years of harvest data (harvest levels and ex-vessel prices) for commercial fisheries in the U.S. waters of the Great Lakes Basin, Upper Mississippi River Basin, and Ohio River Basin. The average was determined to be a more accurate representation of commercial fishing harvests due to annual harvest level fluctuations.

Without-Project Condition:

According to the U.S. Army Corps of Engineers' ER 1105-2-100, Planning Guidance Notebook, the without-project condition is "the most likely condition expected to exist in the future in the absence of a proposed water resources project. The future without-project condition constitutes the benchmark against which plans are evaluated. Forecasts of future without-project conditions shall consider all other actions, plans and ER 1105-2-100 programs that would be implemented in the future to address the problems and opportunities in the study area in the absence of a Corps project. Forecasts should extend from the base year (the year when the proposed project is expected to be operational) to the end of the period of analysis."

The commercial fisheries without-project condition will assess the impacts to commercial fisheries assuming that no action is taken to prevent the transfer of aquatic nuisance species between the U.S. waters of the Great Lakes Basin, and Upper Mississippi River and Ohio River Basins[1].

With-Project Condition:

According to the U.S. Army Corps of Engineers' Planning Guidance Notebook, "the with-project condition is the most likely condition expected to exist in the future with the implementation of a particular water resources development project. Comparison of conditions with the project to conditions without the project will be performed to identify the beneficial and adverse effects of the proposed plans." The commercial fisheries with-project condition will assess the impacts to commercial fisheries associated with a plan(s) that may be implemented to

[1] The GLMRIS team recognizes that the transfer of ANS between the Great Lakes, Upper Mississippi River, and Ohio River Basins may potentially impact fisheries in the U.S. and Canadian waters of the Great Lakes. The Team is also aware of ongoing practices to manage the Great Lakes fisheries as a bi-national effort. The GLMRIS team will continue to remain cognizant of potential environmental, economic, and social impacts of ANS transfer to Canadian interests.

prevent the transfer of aquatic nuisance species between the Great Lakes, Upper Mississippi River, and Ohio River Basins. This is not addressed in the *Commercial Fisheries Baseline Economic Assessment - U.S. Waters of the Great Lakes, Upper Mississippi River, and Ohio River Basins*, but will be assessed in a subsequent report.

Ex-Vessel Value:

According to the National Oceanic and Atmospheric Association's (NOAA) National Marine Fisheries Services' (NMFS) report *Our Living Oceans; Report on the Status of U.S. Living Marine Resources, 1999*, the ex-vessel revenue is defined as "the quantity of fish landed by commercial fishermen multiplied by the average price [ex-vessel price] received by them at the first point of sale… The estimate of economic value often takes…commercial catches and multiplies them by an average price to arrive at a baseline measure of economic worth among various user groups." This report establishes a baseline "ex-vessel value" for all commercial fishing harvests in the Great Lakes, Upper Mississippi River, and Ohio River Basins by applying the following equation:

Harvest Level (Pounds) × Ex-Vessel Price (Dollars per Pound) = Ex-Vessel Value (Dollars).

Commercial Fishing:

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) Public Law 94-265, established by the U.S. Department of Commerce, National Oceanic and Atmospheric Association (NOAA) and National Marine Fisheries Service is the "primary law governing marine fisheries management in the United States federal waters." According to the MSA, "the term 'commercial fishing' means fishing in which the fish harvested, either in whole or in part, are intended to enter commerce or enter commerce through sale, barter or trade." Commercial harvests include both native and non-native fish[2].

This definition is utilized to describe commercial fishing activities that take place in the U.S. waters of the Great Lakes, Upper Mississippi River and Ohio River Basins by both native and non-native commercial fishermen. Note that subsistence fishing is not included as part of the definition of "commercial fishing." This is a separate activity which will be addressed in a subsequent complementary report: *Subsistence Fishing in the Great Lakes, Upper Mississippi River, and Ohio River Basins.*

[2] In this report, there will be an asterisk present when indicating a non-native species.

Subsistence Fishing:

In support of the Great Lakes and Mississippi River Interbasin Study, an assessment of subsistence activities in the Great Lakes, Upper Mississippi, and Ohio River Basins was generated. The report *Treaty Rights and Subsistence Fishing in the U.S. Waters of the Great Lakes, Upper Mississippi River, and Ohio River Basin*, establishes a working definition of subsistence fishing which encompasses the following criteria:

> "1. A long-term consistent pattern of use, excluding interruptions beyond the control of the community or area;
> 2. A pattern of use recurring in specific seasons for many years;
> 3. A pattern of use consisting of methods and means of harvest which are characterized by efficiency and economy of effort and cost, conditioned by local characteristics;
> 4. The consistent harvest and use of fish or wildlife as related to past methods and means of taking; near, or reasonably accessible from, the community or area;
> 5. A means of handling, preparing, preserving, and storing fish or wildlife which has been traditionally used by past generations, including consideration of alteration of past practices due to recent technological advances, where appropriate;
> 6. A pattern of use which includes the handing down of knowledge of fishing and hunting skills, values, and lore from generation to generation;
> 7. A pattern of use in which the harvest is shared or distributed within a definable community of persons; and
> 8. A pattern of use which relates to reliance upon a wide diversity of fish and wildlife resources of the area and which provides substantial cultural, economic, social, and nutritional elements to the community or area."

This working definition is used to differentiate commercial fishing activities from subsistence fishing activities. This report solely generates a baseline assessment of commercial fishing activities. All documentation of subsistence fishing practices will be included in a subsequent report: *Treaty Rights and Subsistence Fishing in the U.S. Waters of the Great Lakes, Upper Mississippi River, and Ohio River Basin.*

GLMRIS BACKGROUND INFORMATION:

The United States Army Corps of Engineers (USACE), in consultation with other federal agencies, Native American tribes, state agencies, local governments and non-governmental organizations, is conducting the Great Lakes and Mississippi River Interbasin Study (GLMRIS). In accordance with the study authorization, USACE will evaluate a range of options and technologies (collectively known as "ANS controls") to prevent the spread of aquatic nuisance species between the Great Lakes and Mississippi River basins by aquatic pathways

An aquatic nuisance species (ANS) is a nonindigenous species that threatens the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquacultural or recreational activities dependent on such waters. See 16 U.S.C. § 4702(1) (2010).

As a result of international commerce, travel and local practices, ANS have been introduced throughout the Mississippi River and Great Lakes basins. These two basins are connected by man-made channels that, in the past, exhibited poor water quality, which was an impediment to the transfer of organisms between the basins. Now that water quality has improved, these canals allow the transfer of both indigenous and nonindigenous invasive species.

USACE is conducting a comprehensive analysis of ANS controls and will analyze the effects each ANS control or combination of ANS controls may have on current uses of: i) the Chicago Area Waterway System (CAWS), the only known continuous aquatic pathway between the Great Lakes and Mississippi River basins; and ii) other aquatic pathways between these basins. Following the *Economic and Environmental Principles and Guidelines for Water and Related Land Resource Implementation Studies*, Water Resource Council, March 10, 1983, USACE will:

- Inventory current and forecast future conditions within the study area;
- Identify aquatic pathways that may exist between the Great Lakes and Mississippi River basins;
- Inventory current and future potential aquatic nuisance species;
- Analyze possible ANS controls to prevent ANS transfer, to include hydrologic separation of the basins;
- Analyze the impacts each ANS control may have on significant natural resources and existing and forecasted uses of the lakes and waterways within the study area; and
- Recommend a plan to prevent ANS transfer between the basins. If necessary, the plan will include mitigation measures for impacted waterway uses and significant natural resources.

Significant issues associated with GLMRIS may include, but are not limited to:

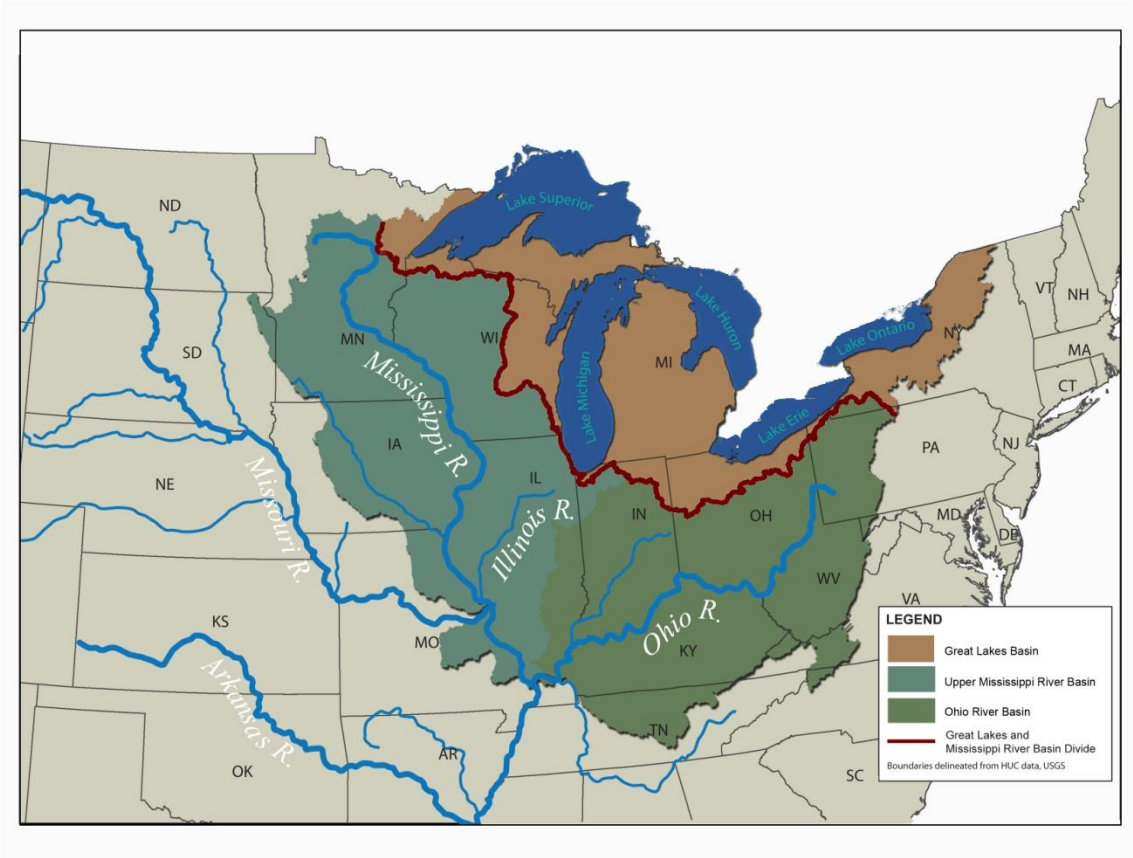
- Significant natural resources such as ecosystems and threatened and endangered species;
- Commercial and recreational fisheries;
- Current recreational uses of the lakes and waterways;
- ANS effects on water users;

- Effects of potential ANS controls on current waterway uses such as flood risk management, commercial and recreational navigation, recreation, water supply, hydropower and conveyance of effluent from wastewater treatment plants and other industries; and
- Statutory and legal responsibilities relative to the lakes and waterways.

GLMRIS STUDY AREA

The GLMRIS study area includes portions of the Great Lakes, Mississippi River, and Ohio River Basins that fall within the United States.

Figure 1: GLMRIS Study Area Map



Potential aquatic pathways between the Great Lakes, Mississippi River, and Ohio River Basins exist along the basins' shared boundary (illustrated in *Figure 1: GLMRIS Study Area Map*). This shared boundary is the primary concentration of the study.

The *Detailed Study Area* is the area where the largest economic, environmental and social impacts from alternative plans are anticipated to occur. The *Detailed Study Area* consists of the Upper Mississippi and Ohio River Basins (green shaded areas) and the Great Lakes Basin (brown shaded area).

NAVIGATION AND ECONOMICS PRODUCT DELIVERY TEAM:

In support of the Great Lakes and Mississippi River Interbasin Study, the Navigation and Economics Product Delivery Team (PDT) was formed. The PDT will assess: 1) the economic impacts from Aquatic Nuisance Species (ANS), and 2) the economic impact from the potential implementation of ANS control measures. The plan of study can be generalized into two large concerns: the Navigation related economics and all other economic concerns. Under each of the two concern areas are study categories.

Navigation Related Economic Impacts
Commercial Cargo
Non-Cargo Related Navigation

Other Related Economic Impacts
Flood Risk Management
Hydropower
Commercial and Recreational Fishery[3]
Water Quality
Water Supply
Regional Economic Development

Fisheries Economics Team:
The Fisheries Economics Team (Team) was formed in order to assess the impacts of aquatic nuisance species (ANS) transfer between the fisheries in the Great Lakes Basin and the Upper Mississippi River and Ohio River Basins. The Team will assess the impacts to the following: commercial fisheries, subsistence fisheries, water-related recreation, pro-fishing tournaments, and the charter fishing industry. A separate report will be produced for each of these five fisheries categories. The *Commercial Fisheries Baseline Economic Assessment – U.S. Waters of the Great Lakes, Upper Mississippi River, and Ohio River Basins* (this study) focuses solely on the commercial fisheries in the U.S. waters of the Great Lakes, Upper Mississippi River, and Ohio River Basins.

Commercial Fisheries Focus:
The Fisheries Economics Team was formed in order to assess the impacts associated with the transfer of ANS to the fisheries in the Great Lakes and the Upper Mississippi River and Ohio

[3] The recreational fishery will be assessed via a survey of recreational anglers' current behavior as well as how their behavior may change if ANS were introduced to their respective basins. The charter fishing industry, subsistence fishing, and pro-fishing tournaments will also be assessed. The charter fishing industry will be assessed via a survey of charter captains' current behavior and likely behavioral changes in the case of ANS transfer. A subsistence fishing assessment will be completed by contacting the tribes in the Great Lakes, Upper Mississippi River, and Ohio River Basins in order to determine their subsistence fishing harvests and the cultural significance of these harvests. Pro-fishing tournaments will be assessed via a literature review focusing on existing pro-fishing tournaments, what they entail, and where they are located.

River Basins. One component of this fisheries analysis is to determine the impacts to the commercial fisheries in the aforementioned basins.

This task will be completed in three steps. First, this baseline assessment will establish the current value of the commercial fisheries in each basin. A follow-up report will document the anticipated impacts to the commercial fisheries in the event that no actions are undertaken to prevent aquatic nuisance species transfer. Finally, the Fisheries Economics Team will assess the impacts to the commercial fishing industry in the case of the various with-project condition alternatives.

COMMERCIAL FISHERIES ASSESSMENT OVERVIEW:

In order for the Fisheries Economics Team to be able to determine the impacts of aquatic nuisance species transfer between the commercial fisheries in the U.S. waters of the Great Lakes basin and the Upper Mississippi River and Ohio River Basins, an assessment of the current state of the commercial fisheries in the each basin was imperative. The difference between the state of the fisheries in the event of aquatic nuisance species transfer and the current state of the fisheries will yield the total impacts associated with ANS transfer between the basins.

Overview of Study Areas:

The Fisheries Economics Team established its study areas in the Great Lakes Basin and the Upper Mississippi River and Ohio River Basins in accordance with the overall GLMRIS study area. The GLMRIS Geographic -Information System (GIS) Team was consulted to establish the specific study areas for the fisheries economics team. The process by which the GIS team established these focus areas is included in Appendix A of this report.

This baseline assessment of fisheries focuses on the major water bodies within the Great Lakes basin and the Upper Mississippi River and Ohio River Basins. The Great Lakes, Upper Mississippi River, Ohio River and their major tributaries are assessed but disjunct water bodies are not included since ANS cannot travel via aquatic pathways to these. The following describes the study areas within the two water basins in more detail:

Great Lakes Basin:

The Great Lakes basin study area includes: Lake Superior, Lake Michigan, Lake Ontario, Lake Huron and Lake Erie. Note that this study will only consider tribal and state-licensed commercial fishing activities that fall within U.S. boundaries of the Great Lakes. Canadian portions of the Great Lakes are outside of the scope of the study. See *Plate 1: Great Lakes Basin Map* for map of the Great Lakes Basin focus areas. The following table outlines the water bodies in the Great Lakes Basin that are included in this baseline assessment. For a complete list of all water bodies that were considered, see *Appendix A: Commercial Fisheries Assessment Methodology.*

Table 1: Great Lakes Basin Water Bodies Included in Baseline Economic Assessment

Water Body
Lake Michigan
Lake Erie
Lake Superior
Lake Ontario
Lake Erie & Tributaries[1]
1. Note that Lake Erie is the only water body whose tributaries support commercial fishing activity. This was determined upon consultation with state's Departments of Natural Resources.

Upper Mississippi River and Ohio River Basins:

The Upper Mississippi River and Ohio River basins include the following rivers: the Upper Mississippi River, Ohio River and their tributaries. Tributaries of the Upper Mississippi River include the: Illinois, Kaskaskia, Rock, and Zumbro Rivers. See *Plate 2: Upper Mississippi River Stream Map* for a map of these streams. Tributaries of the Ohio River include the Wabash, Cumberland, Kentucky, and Salt Rivers. See *Plate 3: Ohio River Stream Map* for a map of these streams. Note that the rivers included in this analysis include only those that supported commercial fishing activities at some point during the analysis period.

Table 2: UMR and Ohio River Basin Water Bodies Included in Baseline Economic Assessment

Basin	Streams Included in Assessment
Upper Mississippi River	Upper Mississippi River Illinois River Kaskaskia River Rock River Zumbro River[1]
Ohio River	Ohio River Wabash River Cumberland River Kentucky River Salt River[2]
1. The Zumbro River will be assessed qualitatively since fish harvests on this river occurred infrequently during the analysis period. 2. The Salt River will be assessed qualitatively since fish harvests on this river occurred infrequently during the analysis period.	

Overview of Methodology:

This baseline assessment of commercial fisheries establishes current baseline value of the commercial fisheries in the U.S. waters of the Great Lakes, Upper Mississippi River and Ohio River Basins based on recent harvest level and ex-vessel price data available from state agencies.

State agencies were requested to provide annual harvest levels and the associated dockside[4] values for the years between 1989 through 2009 in order to generate analyses of harvesting trends over time. Due to lags in data entry, most states were not able to provide harvest data for years 2010 and 2011. The most recent year for which most state agencies were able to provide harvest data was 2009 in the Great Lakes Basin and 2005 in the Upper Mississippi River and Ohio River basins. Most states provided the harvest data for each species in the following format exemplified in Table 3.

Table 3: Harvest Data Provided by State Agencies

Species	Year	Harvest Level (lbs)	Ex-vessel price ($/lb)
(species)	1989	x	y
(species)	1990	x	y
(species)	1991	x	y
…	…	…	…
(species)	2009	x	y

Ex-vessel prices were then converted to 2010 values using the producer price index (PPI) for "other finfish".[5].

Equation 1: Ex-Vessel Price

$$\text{Ex-Vessel Price}_{2010} = (\text{Ex-Vessel Price}_{\text{year x}}) \times (\text{PPI}_{2010} / \text{PPI}_{\text{year x}})$$

[4] Ex-vessel prices indicate the price per pound which the commercial fishermen received for their harvests.

[5] "The Producer Price Index is a family of indexes that measures the average change over time in the selling prices received by domestic producers of goods and services. PPIs measure price change from the perspective of the seller. This contrasts with other measures, such as the Consumer Price Index (CPI), that measure price change from the purchaser's perspective. Sellers' and purchasers' prices may differ due to government subsidies, sales and excise taxes, and distribution costs" (Bureau of Labor Statistics). Producer price index (PPI) number "02230199" for "other finfish" was utilized for converting nominal dollars to 2010 dollars.

The 2010 ex-vessel prices were then multiplied by the harvest level (pounds) to yield the ex-vessel value in 2010 dollars (as shown in Equation 2: Ex-Vessel Value). This process was repeated for each species harvested by each state in each year between 1989 and 2009.

Equation 2: Ex-Vessel Value

$$\text{Ex-vessel value (\$)} = \text{Harvest Level (lbs)} \times \text{Ex-vessel price (\$/lb)}$$

Annual harvest levels and ex-vessel values were then aggregated for each species in all bordering states of each water body. This is exemplified in Equation 3. This same equation was utilized to compute the annual ex-vessel value of each species on each lake or river.

Equation 3: Single Species Harvest Level on a Lake or River

$$\text{Annual Harvest Level for Bigmouth Buffalo on Lake Erie} = \text{Harvest Level}_{MI} + \text{Harvest Level}_{OH}$$

All species harvest levels were then aggregated for each water body. This is exemplified in Equation 4. The same equation was utilized to compute the annual ex-vessel value of all species on each lake or river.

Equation 4: Harvest Level of All Species on a Single Lake or River

$$\text{Annual Harvest Level for All Species on Lake Erie} = \text{Harvest Level}_{Species1} + \text{Harvest Level}_{Species\ 2} + \ldots + \text{Harvest Level}_{Species\ n}$$

Harvest levels for all lakes or rivers were then aggregated at the basin level. This is exemplified in Equation 5. The same equation was utilized to compute the annual ex-vessel value of all species on each lake or river.

Equation 5: Harvest Level of All Species In a Basin

$$\text{Annual Harvest Level for the Great Lakes Basin} = \text{Harvest Level}_{Lake\ Michigan} + \text{Harvest Level}_{Lake\ Superior} + \text{Harvest Level}_{Species\ Huron} + \text{Harvest Level}_{Lake\ Erie\ \&\ Tributaries} + \text{Harvest Level}_{Lake\ Ontario}$$

The average of the most recent five years of harvest level and ex-vessel value data for each basin yielded the current value of the commercial fisheries in each basin. A thorough description of the data collection procedures and analysis methodology that was used to generate the baseline assessment is documented in Appendix A of this report.

Overview of Findings

Values for the commercial fisheries in the U.S. waters of the Great Lakes, Upper Mississippi River, and Ohio River Basins are as follows:

Great Lakes Basin

The average harvest level from the most recent 5 years (2005 through 2009) for the U.S. waters of the Great Lakes Basin was determined to be approximately 19.3 million pounds with an associated ex-vessel value of about $22.5 million in 2010 dollars. This forms the baseline harvest and value against which future conditions will be compared.

Upper Mississippi River Basin

The average harvest level from the most recent 5 years (2001 through 2005) for the Upper Mississippi River Basin was determined to be approximately 10.0 million pounds with an associated ex-vessel value of about $4.0 million in 2010 dollars. This forms the baseline harvest and value against which future conditions will be compared.

Ohio River Basin

The average harvest level from the most recent 5 years (2001 through 2005) for the Ohio River Basin was determined to be approximately 1.4 million pounds with an associated ex-vessel value of about $2.0 million in 2010 dollars. This forms the baseline harvest and value against which future conditions will be compared.

The analyses of these basins were kept separate due to the fact that the overall goal of the Fisheries Economics Team is to determine the impacts to commercial fisheries in the case of aquatic nuisance species transfer between the Great Lakes basin and the Upper Mississippi River and Ohio River Basins. Consequently, this called for the analyst to formulate a separate baseline assessment for each basin as a prerequisite for the forthcoming analysis which seeks to determine the impacts of ANS transfer on each of the three basins' commercial fisheries.

GREAT LAKES BASIN BASELINE ASSESSMENT

The fisheries that lie within U.S. waters of the Great Lakes Basin were assessed. The U.S. portion of the Great Lakes Basin fishery is valued at $22.5 million with a harvest level of 19.3 million pounds.

Baseline figures reflect the average of 2005 through 2009 harvest level and ex-vessel value data. *Table 4: Great Lakes Baseline Harvest and Values* displays the contribution to the total Great Lakes Basin fishery harvest level and ex-vessel value by each of the Great Lakes. Note that Lake Michigan and Lake Erie support the greatest amount of commercial fishing (58.1 percent of the total pounds) and the greatest value (61.9 percent of the total).

Table 4: Great Lakes Baseline Harvest and Values

Lake	Harvest Level[1] (lbs)	Total Harvest Level (%)	Ex-Vessel Value[1] ($)	Total Ex-vessel value (%)
Lake Michigan	6,363,000	32.9	8,920,000	39.6
Lake Erie	4,880,000	25.2	5,013,000	22.3
Lake Huron	3,539,000	18.3	4,553,000	20.2
Lake Superior	4,541,000	23.5	3,990,000	17.7
Lake Ontario	21,000	0.1	32,000	0.1
Total: All Lakes	**19,345,000**	**100.0**	**22,506,000**	**100.0**
1. Harvest levels and values reflect a five-year average from 2005 through 2009. All values are rounded to the nearest thousand. Ex-vessel values are in 2010 dollars.				

Table 4 exhibits that Lake Michigan's baseline harvest level is approximately 6.4 million pounds with an associated value of $8.9 million. The primary contributor to Lake Michigan's harvest levels and values is comprised of lake whitefish, which is harvested by state-licensed commercial fishermen in Michigan and Wisconsin, as well as tribal commercial fishermen (of the CORA member tribes[6]). Lake Whitefish accounted for approximately 88 percent of Lake Michigan's total harvest level and 29 percent of the total Great Lakes harvest level in Year 2009.

Lake Erie's baseline harvest level is 4.9 million pounds with an associated value of $5.0 million. The harvest of species in the Temperate Bass and Perch families (such as white bass, white perch*, yellow perch, and walleye) account for the majority of the harvest level and ex-vessel value on Lake Erie. In 2009, the total harvest of all these species accounted for approximately 3.0 million pounds. This represented 55 percent of the Lake's total harvest level in 2009.

[6] CORA is an acronym for the Chippewa Ottawa Resource Authority. Member tribes include the: Bay Mills Indian Community, Grand Traverse Band of Ottawa and Chippewa Indians in Michigan, Little River Band of Ottawa Indians, Little Traverse Bay Band of Odawa Indians, and Sault Ste. Marie Tribe of Chippewa Indians of Michigan. CORA reports commercial fishing harvests by tribal commercial fishermen to the state for fisheries management purposes.

Lake Huron, Lake Superior and Lake Ontario accounted for a total of 41.9 percent of the Great Lakes' baseline harvest level and 38.1 percent of its value. The harvest of lake whitefish on Lake Huron and Lake Superior, and yellow perch on Lake Ontario are key contributors to these lakes' baseline values.

Table 5: Great Lakes Commercial Fishing Harvest Levels displays the harvest level (pounds) for the years 1989 through 2009 for each of the Great Lakes and the total for the Great Lakes Basin. Lake Erie's share of the commercial harvest has experienced a slight decrease over time in part due to fewer harvests of Carps and Herring. Lake Michigan's harvest levels have declined dramatically from the 1990s due to a decrease in harvest of lake whitefish. Lake Superior's increase in harvest levels can be attributed to the harvest of Smelts and Whitefishes. Lake Huron and Lake Ontario have also experienced slight declines in harvest levels and values over the 20-year period of analysis.

Table 5: Great Lakes Commercial Fishing Harvest Levels (Values Shown in Thousands)

Year	Lake Michigan		Lake Superior		Lake Huron		Lake Erie		Lake Ontario[1]		Total: All Lakes
	Lbs. Harvested	% of Total	Lbs. Harvested	% of Total	Lbs. Harvested	% of Total	Lbs. Harvested	% of Total	Lbs. Harvested	%of Total	
1989	7,129	41.8	1,476	8.7	3,001	17.6	5,443	31.9	N/A	N/A	**17,049**
1990	13,379	52.6	1,456	5.7	4,824	19.0	5,794	22.8	N/A	N/A	**25,453**
1991	15,938	58.5	1,058	3.9	4,814	17.7	5,300	19.4	141	0.5	**27,251**
1992	17,924	61.2	1,282	4.4	4,706	16.1	5,265	18.0	89	0.3	**29,266**
1993	15,530	60.7	1,112	4.3	4,579	17.9	4,315	16.9	67	0.3	**25,603**
1994	15,194	59.0	1,131	4.4	4,735	18.4	4,591	17.8	81	0.3	**25,732**
1995	14,336	57.2	962	3.8	5,313	21.2	4,403	17.6	60	0.2	**25,074**
1996	13,633	53.5	2,561	10.1	5,078	19.9	4,127	16.2	64	0.3	**25,463**
1997	12,695	50.0	2,483	9.8	5,332	21.0	4,817	19.0	53	0.2	**25,380**
1998	12,046	49.4	3,105	12.7	4,864	20.0	4,279	17.6	70	0.3	**24,364**
1999	10,844	49.3	3,045	13.8	4,557	20.7	3,504	15.9	48	0.2	**21,998**
2000	6,958	36.5	3,475	18.3	4,744	24.9	3,791	19.9	70	0.4	**19,038**
2001	6,722	35.2	4,211	22.1	4,627	24.2	3,479	18.2	47	0.2	**19,086**
2002	6,246	36.5	2,488	14.5	4,160	24.3	4,192	24.5	42	0.2	**17,128**
2003	6,009	35.6	3,241	19.2	3,944	23.4	3,664	21.7	12	0.1	**16,870**
2004	6,016	35.0	3,690	21.5	3,580	20.8	3,863	22.5	38	0.2	**17,187**
2005	6,922	36.9	3,738	19.9	3,597	19.2	4,479	23.9	7	0.0	**18,743**
2006	7,120	36.9	4,021	20.9	3,844	19.9	4,280	22.2	5	0.0	**19,270**
2007	5,918	30.5	4,429	22.9	3,709	19.1	5,282	27.3	35	0.2	**19,373**
2008	5,614	27.6	6,507	32.0	3,279	16.1	4,919	24.2	15	0.1	**20,334**
2009	6,245	32.9	4,012	21.1	3,264	17.2	5,445	28.6	41	0.2	**19,007**
5-Year Ave.	**6,364**	**32.9**	**4,541**	**23.5**	**3,539**	**18.3**	**4,881**	**25.2**	**21**	**0.1**	**19,345**
1.Note that Lake Ontario harvest data was not available until 1991.											

Table 6: Great Lakes Commercial Fishing Ex-Vessel Values (Values Shown in Thousands) displays the ex-vessel values (in 2010 dollars) for the years 1991 through 2009 for each of the Great Lakes and the total for the Great Lakes basin.

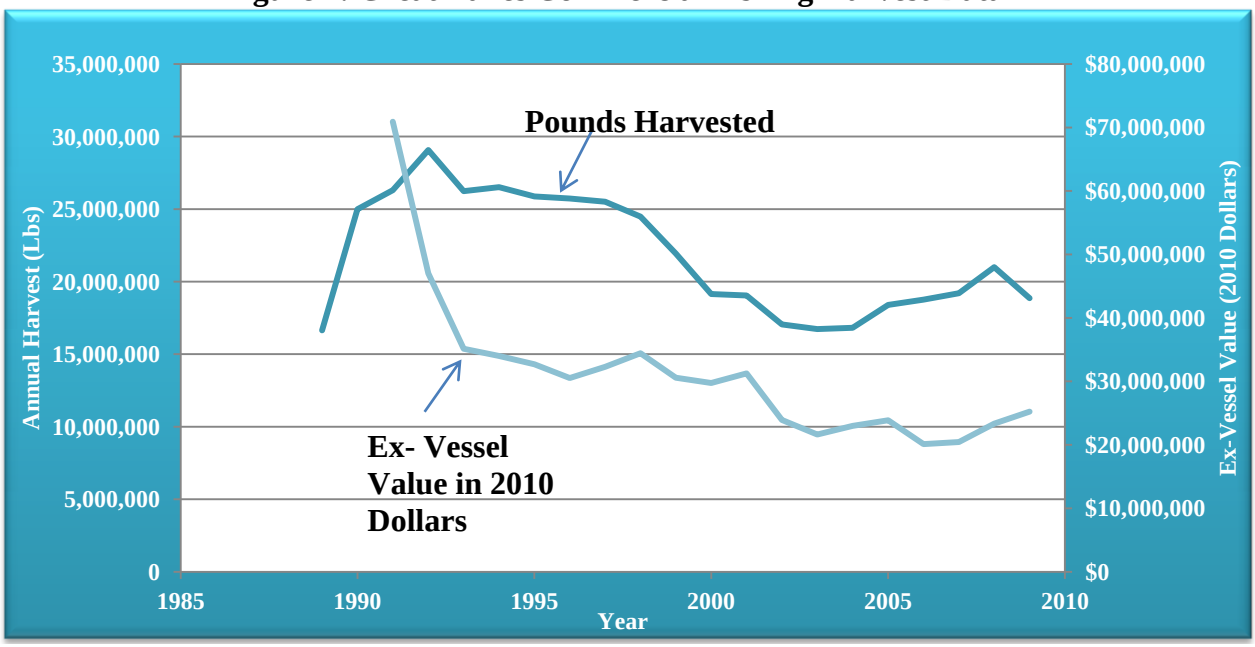
Table 6: Great Lakes Commercial Fishing Ex-Vessel Values (Values Shown in Thousands)

Year[1]	Lake Michigan		Lake Superior		Lake Huron		Lake Erie		Lake Ontario		Total: All Lakes ($)
	Ex-vessel Value ($)	% of Total	Ex-vessel Value ($)	% of Total	Ex-vessel Value ($)	% of Total	Ex-vessel Value ($)	% of Total	Ex-vessel Value ($)	% of Total	
1991	45,779	64.3	2,328	3.3	12,866	18.1	9,925	13.9	312	0.0	**71,210**
1992	31,021	65.7	2,015	4.3	9,195	19.5	4,791	10.1	186	0.0	**47,208**
1993	23,817	67.5	1,330	3.8	6,941	19.7	3,062	8.7	125	0.0	**35,275**
1994	21,588	63.2	1,258	3.7	6,418	18.8	4,752	13.9	155	0.0	**34,171**
1995	19,847	60.5	1,118	3.4	7,855	23.9	3,868	11.8	131	0.0	**32,819**
1996	16,944	55.3	3,140	10.2	6,831	22.3	3,619	11.8	129	0.0	**30,663**
1997	17,042	52.6	3,360	10.4	7,029	21.7	4,865	15.0	122	0.0	**32,418**
1998	18,862	54.5	4,663	13.5	6,885	19.9	4,030	11.6	163	0.0	**34,603**
1999	16,584	54.2	4,066	13.3	6,169	20.2	3,642	11.9	110	0.4	**30,571**
2000	11,960	40.2	4,827	16.2	7,676	25.8	5,123	17.2	167	0.6	**29,753**
2001	11,501	36.8	6,393	20.4	8,636	27.6	4,627	14.8	110	0.4	**31,267**
2002	10,822	45.2	2,631	11.0	5,568	23.3	4,834	20.2	75	0.3	**23,930**
2003	8,647	40.0	3,290	15.2	5,402	25.0	4,284	19.8	21	0.1	**21,644**
2004	9,081	39.5	3,342	14.5	5,156	22.4	5,352	23.3	72	0.3	**23,003**
2005	9,928	41.6	3,148	13.2	4,990	20.9	5,791	24.3	13	0.1	**23,870**
2006	8,835	43.9	2,777	13.8	4,340	21.6	4,151	20.6	8	0.0	**20,111**
2007	7,503	36.7	2,981	14.6	4,136	20.2	5,772	28.2	58	0.3	**20,450**
2008	8,382	36.6	6,138	26.8	4,414	19.3	3,956	17.3	16	0.1	**22,906**
2009	9,948	39.5	4,904	19.5	4,881	19.4	5,396	21.4	66	0.3	**25,195**
5-Year Ave.	**8,919**	**39.6**	**3,990**	**17.7**	**4,552**	**20.2**	**5,013**	**22.3**	**32**	**0.1**	**22,506**

1. Note that the Bureau of Labor Statistics did not start publishing producer price index (PPI) data for the "other finfish" category “02230199” until 1992. Since the PPI was needed in order to generate the ex-vessel values for each of the Great Lakes, these values do not begin until 1991.

Figure 2: Great Lakes Commercial Fishing Harvest Data displays Great Lakes annual commercial fishing harvest data from the years 1989 through 2009.

Figure 2: Great Lakes Commercial Fishing Harvest Data



Harvest levels have dropped by over fifteen percent in recent years (2000-2009) compared to historic levels (1989-2009). Great Lakes fisheries harvest declines will be explored in more detail for each individual Great Lake.

Table 7: Summary Statistics for Great Lakes Basin

Annual Harvest Summary Data: 1989-2009	
Average Harvest (Pounds)	21,841,000
Maximum Harvest Level	29,226,000
Minimum Harvest Level	16,871,000
Annual Ex-vessel value Summary Data: 1991-2009 (adjusted to 2010 dollars)	
Average Ex-vessel value	$31,039,000
Maximum Ex-vessel value	$70,898,000
Minimum Ex-vessel value	$20,111,000
Annual Harvest Summary Data: 1989-1999	
Average Harvest (Pounds)	24,784,000
Maximum Harvest Level	29,226,000
Minimum Harvest Level	17,050,000
Annual Harvest Summary Data: 2000-2009	
Average Harvest (Pounds)	18,603,000
Maximum Harvest Level	20,333,000
Minimum Harvest Level	16,871,000
Recent harvest levels (2000 - 2009) compared to historic (1989-2009)	-14.83%
Correlation coefficient between harvest level and ex-vessel value (1991-2009)	0 .73
BASELINE VALUE: GREAT LAKES BASIN	
5-Year Average Harvest Level (2005-2009)	**19,345,000**
5-Year Average Ex-vessel Value (2005-2009)	**$22,506,000**

Lake Michigan Baseline Assessment

Harvest data for each of the Great Lakes will be explored in the order of commercial fishing ex-vessel value contribution (from greatest to least)[7]. Therefore, Lake Michigan is analyzed first.

Lake Michigan's baseline (5-year average from 2005-2009) harvest level is 6.4 million pounds with an associated ex-vessel value of $8.9 million. It contributes a total of 32.9 percent to the total harvest of fish on the Great Lakes and 39.6 percent to the total ex-vessel value of Great Lakes fisheries[8]. Tribal and state-licensed fishermen participating in commercial fishing activity on Lake Michigan during the analysis period (years 1989 through 2009) include those from: Illinois, Indiana, Michigan and Wisconsin, as well as CORA member tribes. Lake Michigan experienced a rapid decline in harvest levels since 1989. While the maximum harvest level in the 1990s was 17.9 million pounds (1992) and accounted for about 61.2 percent of the total commercial fishing harvests on the Great Lakes; the maximum harvest level since year 2000 was about 7.1 million pounds (2006) and accounted for approximately 36.9 percent of the Great Lakes commercial fishing harvests. See *Table 8: Lake Michigan's Total Commercial Fishing Harvests* for annual harvest levels (in pounds) and ex-vessel values (in 2010 dollars) over the 20-year analysis period.

Table 8: Lake Michigan's Total Commercial Fishing Harvests

Year	Harvest Level (lbs)	Ex-Vessel Value[1] (2010 Dollars)
1989	7,129,484	N/A
1990[2]	13,379,019	N/A
1991	15,937,586	$45,779,492
1992	17,924,127	$31,021,009
1993	15,530,110	$23,816,686
1994	15,193,616	$21,587,975
1995	14,335,548	$19,847,380
1996	13,633,053	$16,943,805
1997	12,694,928	$17,042,141
1998	12,046,434	$18,862,350
1999	10,843,811	$16,583,901
2000	6,958,053	$11,959,552
2001	6,721,785	$11,500,763
2002	6,246,452	$10,822,253
2003	6,009,169	$8,647,388
2004	6,016,457	$9,080,927
2005	6,921,717	$9,927,776
2006	7,121,542	$8,835,733
2007	5,918,276	$7,502,728
2008	5,613,754	$8,382,036
2009	6,244,879	$9,947,692

[7] See *Table 4: Great Lakes Baseline Harvest and Values* for list of harvest levels by lake.
[8] Refer to *Great Lakes Baseline Harvest and Values* in the "Great Lakes" portion of the document.

5-Year Average	**6,364,034**	**$8,919,193**

1. Note that the commercial fishing ex-vessel value data does not begin until 1991. This is the first year that the Bureau of Labor Statistics began publishing producer price index (PPI) data for commercial fishing category "02230199."
2. Note that CORA data begins in 1990.

Table 8 was used to generate the summary statistics for Lake Michigan in *Table 9: Summary Statistics for Lake Michigan*. Harvest levels are down by almost 37 percent in recent years (2000 through 2009) compared to the historical average (1989 through 2009). The baseline harvest level (about 6.4 million pounds) is a decline from the historical average harvest level of 10.1 million pounds.

Michigan and Wisconsin's state-licensed fishermen, as well as CORA member tribes harvest lake whitefish on Lake Michigan, and consequently, the majority of the commercial harvests during the analysis period (1989-2009). In 2009, the total harvest of lake whitefish by these states and tribes totaled approximately 5.5 million pounds, which is the vast majority (about 88%) of the total pounds of fish harvested on the Lake (approximately 6.4 million pounds). Of this total harvest of lake whitefish, Michigan harvested 16 percent, Wisconsin (47 percent) and CORA member tribes (58 percent). The harvest of lake whitefish has declined in more recent years; the average harvest from 1989 through 1999 was about 6.6 million pounds while the average harvest during the 2000s was 4.6 million pounds. This also contributed to the decrease in ex-vessel value for Lake Michigan. The baseline ex-vessel value ($8.9 million) is significantly less than the average ex-vessel value (1992 through 2009) of $16.2 million.

Table 9: Summary Statistics for Lake Michigan

Annual Harvest Summary Data: 1989-2009	
Average Harvest (pounds)	10,115,163
Maximum Harvest Level	17,924,127
Minimum Harvest Level	5,613,754
Annual Ex-Vessel Value Summary Data: 1991-2009 (adjusted to 2010 dollars)	
Average Ex-vessel value:	$16,215,323
Maximum Ex-vessel value	$45,779,492
Minimum Ex-vessel value	$7,502,728
Annual Harvest Summary Data: 1989-1999	
Average Harvest (pounds)	13,513,429
Maximum Harvest Level	17,924,127
Minimum Harvest Level	7,129,484
Annual Harvest Summary Data: 2000-2009	
Average Harvest (pounds)	6,377,071
Maximum Harvest Level	7,120,165
Minimum Harvest Level	5,613,754
Recent harvest levels (2000 - 2009) compared to historic (1989-2009)	-36.96%
BASELINE VALUE: LAKE MICHIGAN	
5-Year Average Harvest Level (2005-2009)	**6,363,758**
5-Year Average Ex-Vessel Value (2005-2009)	**$8,919,103**

Figure 3: Lake Michigan Commercial Fishing Harvests displays Lake Michigan's commercial fishing harvest data from the years 1989 through 2009. Note that the steep increase in harvests between 1989 and 1990 can be attributed to the contribution of CORA member tribes' commercial fishing harvest data. The decrease in harvests between 1990 and 2009 can be attributed to the reduced harvest of lake whitefish.

Figure 3: Lake Michigan Commercial Fishing Harvests

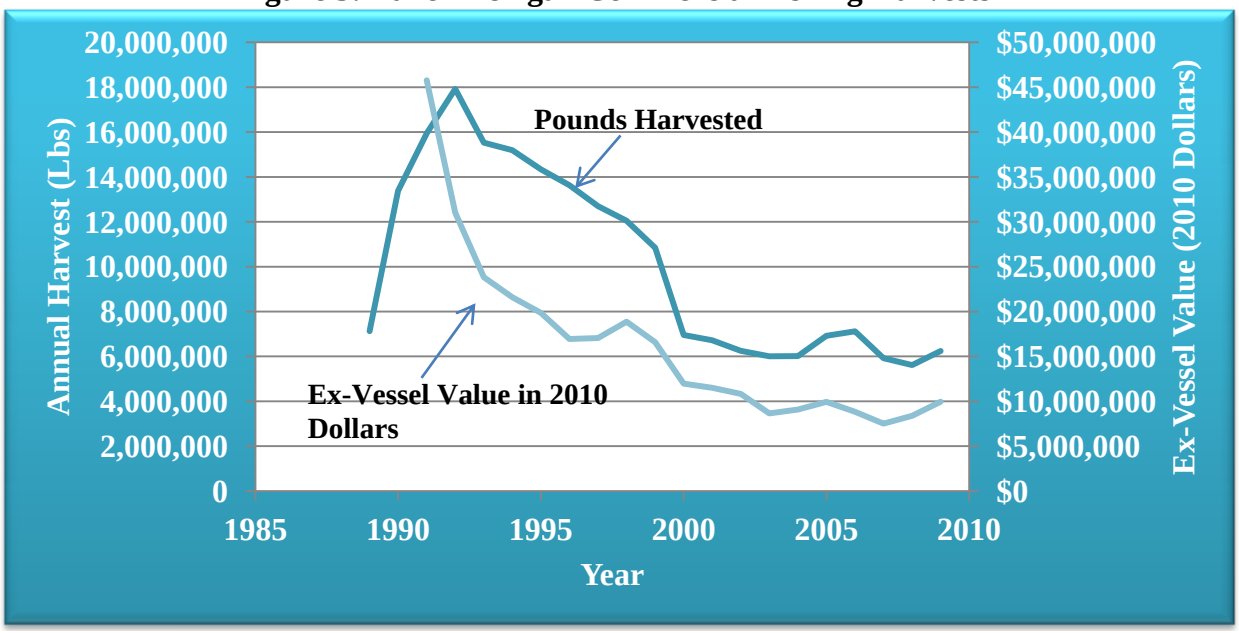


Table 10: Lake Michigan Baseline Harvest Data by Species exemplifies the contribution of species to the total harvest level and ex-vessel value of commercial fishing on Lake Michigan. Note that almost all of the commercial fishing harvests are generated from the harvest of three families: whitefishes, smelt, and shads and herrings.

Lake whitefish (a species in the Whitefishes, Smelts, and Shads and Herrings family) alone account for approximately 4.9 million pounds of this total baseline harvest (6.4 million pounds) and approximately $6.4 million of the baseline ex-vessel value for Lake Michigan ($8.9 million).

Table 10: Lake Michigan Baseline Harvest Data by Species

Family[1]	Harvested Species	Harvest Level[2] (lbs)	% of Total	Ex-Vessel Value[3] ($)	% of Total
Whitefishes, Smelts, and Shads & Herrings	chubs, lake whitefish, menominee, rainbow smelt*, gizzard shad, alewife*, cisco	5,983,930	94.0	8,527,618	96
Salmon, Trout, Chars, and Cods	coho salmon, chinook salmon, rainbow trout, lake char*, burbot	298,622	4.7	226,988	3
Perches	yellow perch, walleye	76,677	1.2	163,858	2
Suckers	sucker	4,530	0.1	640	0
Drums	freshwater drum	0	0.0	0	0
Catfishes	channel catfish	0	0.0	0	0
Carp	common carp*	0	0.0	0	0
	Total: All Species	**6,363,758**	**100.0**	**8,919,103**	**100**

1. Refer to Appendix A for description as to why the GLMRIS Natural Resources Team grouped some families together.
2. This is a five-year average (2005-2009) of the annual harvest levels.
3. This is a five-year average (2005-2009) of the annual ex-vessel values displayed in 2010 dollars.

Lake Erie Baseline Assessment

Lake Erie's baseline (5-year average from 2005-2009) harvest level is 4.9 million pounds with an associated value of $5.0 million. It contributes a total of 25.2 percent to the total harvest of fish on the Great Lakes and 22.3 percent to the total ex-vessel value of Great Lakes fisheries[9]. Harvests are attributed to four states: Michigan, Ohio, New York and Pennsylvania[10]. See *Table 11: Harvest Data for Lake Erie* for annual harvest levels (in pounds) and values (in 2010 dollars) over the analysis period.

Table 11: Harvest Data for Lake Erie

Year	Harvest Level (lbs)	Ex-Vessel Value[1] (2010 Dollars)
1989	5,443,095	N/A
1990	5,793,573	N/A
1991	5,300,191	$9,924,529
1992	5,264,942	$4,791,169
1993	4,315,103	$3,062,079
1994	4,591,098	$4,752,099
1995	4,402,596	$3,867,750
1996	4,127,291	$3,619,094
1997	4,816,504	$4,865,215
1998	4,279,219	$4,029,726
1999	3,504,164	$3,641,656
2000	3,790,824	$5,123,306
2001	3,478,582	$4,627,447
2002	4,192,434	$4,833,632
2003	3,663,928	$4,283,930
2004	3,863,429	$5,351,558
2005	4,478,536	$5,791,368
2006	4,279,581	$4,150,801
2007	5,282,094	$5,771,670
2008	4,918,672	$3,955,770
2009	5,445,450	$5,396,398
5-Year Average	**4,880,867**	**$5,013,201**

1. Note that the commercial fishing ex-vessel value data does not begin until 1991. This is the first year that the Bureau of Labor Statistics began publishing producer price index (PPI) data for commercial fishing category "02230199." Harvest levels and values for Lake Erie reflect the Lake's harvest data as well as tributary harvest data. According to the Ohio DNR, the majority of commercial fishing on Lake Erie tributaries take place on those that lie between Lorain and Toledo, Ohio.

[9] Refer to Table 4 in the *Great Lakes Basin Baseline Assessment* portion of the document.
[10] Note that no tribal harvests were reported for Lake Erie.

Table 11: Harvest Data for Lake Erie was used to generate the summary statistics for Lake Erie displayed in *Table 12: Summary Statistics for Lake Erie.* Lake Erie experienced little fluctuation in harvest levels and values over the 21-year analysis period.

Harvest levels are only down 4 percent in recent years compared to the historical average. The baseline harvest level (about 4.9 million pounds) is greater than the average harvest level of 4.5 million pounds. Further, the baseline ex-vessel value ($5.0 million) is also higher than the average ex-vessel value of about $4.8 million.

The majority of the harvest on Lake Erie is attributed to the harvest of species in the Temperate Bass and Perch families. Their contribution to Lake Erie's baseline harvest level was approximately 2.7 million pounds. The total harvest of Temperate Bass and Perches increased by over 30 percent in recent years compared to the historical average (1989 through 2009).

The total harvest of white bass, white perch*, yellow perch and walleye in 2009 was approximately 3.0 million pounds. Ohio harvested the majority of these pounds (2.8 million) in 2009, while Michigan harvested 131 thousand pounds, Pennsylvania (42 thousand) and New York (13 thousand).

Other families of species witnessed similar increases in harvest levels or have maintained constant harvest levels. For instance, the Catfish and Bullhead family (which includes species such as channel catfish and brown bullhead), which accounted for roughly 12 percent of the baseline harvest level, experienced a 12 percent increase in harvest levels.

The increase in harvest levels experienced by the Temperate Bass, Perch, Catfish and Bullhead families are offset by the decrease in harvest levels of other species. The harvest of Carp* and Herring is down by 48 percent in recent years (2000s) compared to the historical average. The harvest of common carp* dropped from 1.2 million pounds in year 2000 to 556,000 pounds in 2004.

Other species, such as freshwater drum (which accounts for approximately 494,000 pounds of the baseline harvest level) experienced similar decreases in harvest levels over the analysis period. The harvest of freshwater drum decreased by 36 percent in the 2000s compared to the historical average.

Table 12: Summary Statistics for Lake Erie

Annual Harvest Summary Data: 1989-2009	
Average Harvest (Pounds)	4,534,824
Maximum Harvest Level	5,793,573
Minimum Harvest Level	3,478,582
Annual Ex-vessel value Summary Data: 1991-2009 (adjusted to 2010 dollars)	
Average Ex-vessel value	$4,833,642
Maximum Ex-vessel value	$9,924,529
Minimum Ex-vessel value	$3,062,079
Annual Harvest Summary Data: 1989-1999	
Average Harvest (Pounds)	4,712,525
Maximum Harvest Level	5,793,573
Minimum Harvest Level	3,504,164
Annual Harvest Summary Data: 2000-2009	
Average Harvest (Pounds)	4,339,353
Maximum Harvest Level	5,445,450
Minimum Harvest Level	3,478,582
Recent harvest levels (2000 - 2009) compared to historic (1989-2009)	-4.31%
BASELINE VALUE: LAKE ERIE	
5-Year Average Harvest Level (2005-2009)	**4,880,867**
5-Year Average Ex-Vessel Value (2005-2009)	**$5,013,201**

Figure 4: Lake Erie Commercial Fishing Harvests displays Lake Erie's annual commercial fishing harvest data for the years 1989 through 2009.

Figure 4: Lake Erie Commercial Fishing Harvests

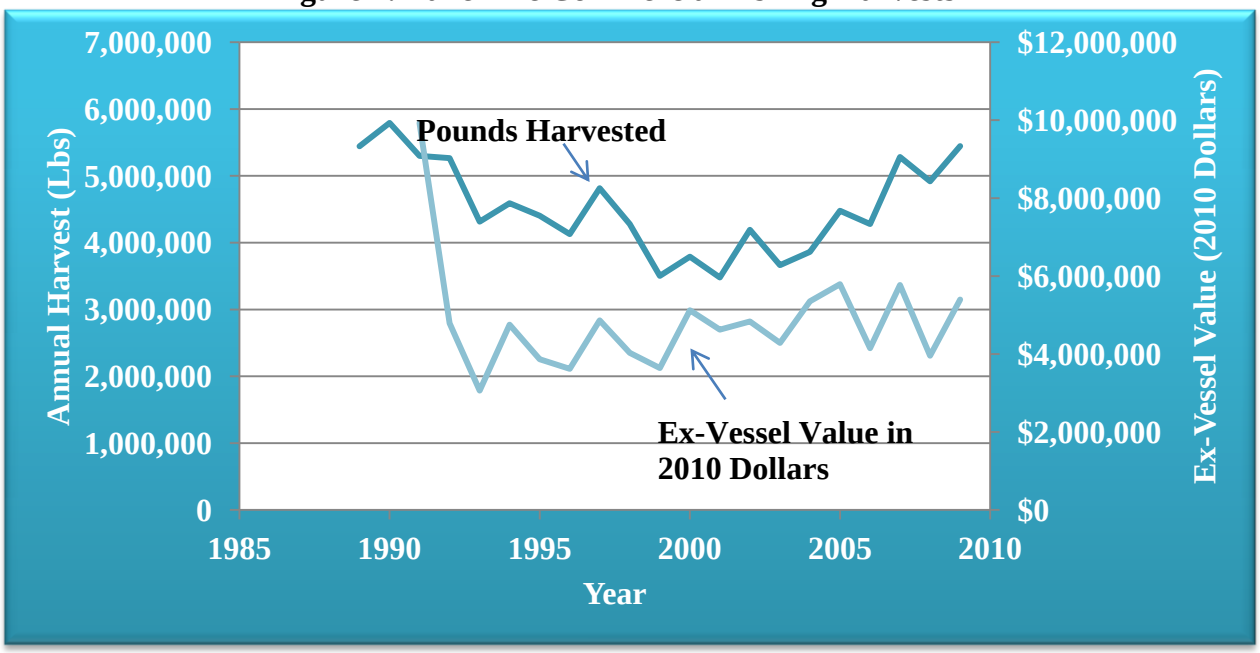


Table 13 exemplifies the contribution of species to the total harvest level and ex-vessel value of commercial fishing on Lake Erie.

Table 13: Lake Erie Baseline Harvest Data by Species

Family[1]	Harvested Species	Harvest Level[2]	% of Total	Ex-Vessel Value[3] ($)	% of Total
Temperate Bass & Perches	white bass, white perch*, yellow perch, walleye	2,656,950	54.4	4,041,752	80.6
Suckers	bigmouth buffalo, quillback, suckers, redhorse	207,995	4.3	311,411	6.2
Shads & Whitefishes	lake whitefish, gizzard shad, chubs	273,878	5.6	144,685	2.9
Minnows & Carps	common carp*, goldfish*	660,619	13.5	199,735	4.0
Catfishes & Bullhead	channel catfish, bullhead	583,538	12.0	224,701	4.5
Drums	freshwater drum	493,805	10.1	90,244	1.8
Cods	burbot	4,082	0.1	673	0.0
Gars	gars	0	0.0	0	0.0
Total: All Species		**4,880,867**	**100.0**	**5,013,201**	**100.0**

1.Refer to Appendix A of this report for a description as to why the Natural Resources Team grouped some families together.
2. This is a five-year average (2005-2009) of the annual harvest levels.
3. This is a five-year average (2005-2009) of the annual ex-vessel values displayed in 2010 dollars.

Lake Huron Baseline Assessment

Lake Huron's baseline harvest level is 3.5 million pounds with an associated value of $4.6 million[11]. It contributes a total of 18.3 percent to the total harvest of fish on the Great Lakes and 20.2 percent to the total value of Great Lakes fisheries[12].

Lake Huron experienced a decline in harvest levels since 1989. The maximum harvest level in the 1990s was 5.3 million pounds (1997) and accounted for about 20.9 percent of the total commercial fishing harvests on the Great Lakes; the maximum harvest level since year 2000 has been about 4.7 million pounds (2000) and accounted for 24.8 percent of the Great Lakes commercial fishing harvests. See *Table 14: Harvest Data for Lake Huron* for annual harvest levels and values over the analysis period (1989 through 2009).

Table 14: Harvest Data for Lake Huron

Year	Harvest Level (lbs)	Ex-vessel Value[1] (2010 Dollars)
1989	3,001,332	N/A
1990[2]	4,823,925	N/A
1991	4,813,993	$12,866,188
1992	4,705,911	$9,194,523
1993	4,578,638	$6,941,272
1994	4,735,131	$6,418,245
1995	5,312,593	$7,855,333
1996	5,077,522	$6,830,801
1997	5,331,884	$7,029,022
1998	4,864,169	$6,885,485
1999	4,556,979	$6,168,993
2000	4,744,019	$7,675,731
2001	4,626,977	$8,636,323
2002	4,159,798	$5,567,671
2003	3,944,492	$5,401,610
2004	3,580,255	$5,155,527
2005	3,596,746	$4,989,914
2006	3,843,912	$4,339,905
2007	3,708,789	$4,135,733
2008	3,278,541	$4,414,027
2009	3,263,788	$4,880,630
5-Year Average	**3,538,355**	**$4,552,042**

1. Note that the commercial fishing ex-vessel value data does not begin until 1991. This is the first year that the Bureau of Labor Statistics began publishing producer price index (PPI) data for commercial fishing category "02230199."
2. Note that CORA tribal commercial harvest data was not available until year 1990.

[11] Recall, the baseline figures represent the average values of commercial harvest levels and commercial ex-vessel values over the five-year time period (2005-2009).

[12] Refer to *Table 4: Great Lakes Baseline Harvest and Values* in the "Great Lakes" portion of the document.

Table 14: Harvest Data for Lake Huron was used to generate the summary statistics displayed in *Table 15: Summary Statistics for Lake Huron*. Harvest levels are down by approximately 10 percent in recent years compared to the historical average. The baseline harvest level (about 3.5 million pounds) is slightly less than the average harvest level of 4.3 million pounds. Further, the baseline ex-vessel value (approximately $4.6 million) is also less than the average ex-vessel value of $6.6 million.

CORA member tribes and Michigan state-licensed commercial fishermen harvest fish on Lake Huron. The primary harvested species is lake whitefish; in 2009, it accounted for 2.8 million pounds with an associated value of $4.3. million. CORA tribes' commercial fishermen harvested about 42 percent of the total lake whitefish from Lake Huron in 2009 while Michigan state-licensed commercial fishermen harvested about 58 percent of this total. This ratio fluctuates throughout the analysis period, sometimes with CORA tribes harvesting more and sometime the state-licensed commercial fishermen harvesting more of the total catch of lake whitefish. The harvest of lake whitefish has remained constant over the analysis period (1989 through 2000).

The average harvest level in the 1990s was 4.7 million pounds while the average in the 2000s was 3.9 million pounds. Declines in harvest levels on Lake Huron can be attributed to the decrease in the harvest of species such as menominee, rainbow smelt*, sucker, white perch*, yellow perch, white bass, channel catfish and common carp*.

Table 15: Summary Statistics for Lake Huron

Annual Harvest Summary Data: 1989-2009	
Average Harvest	4,311,876
Maximum Harvest Level	5,331,884
Minimum Harvest Level	3,001,332
Annual Ex-vessel value Summary Data: 1992-2009 (adjusted to 2010 dollars)	
Average Ex-vessel value:	$6,599,312
Maximum Ex-vessel value	$12,866,188
Minimum Ex-vessel value	$4,135,733
Annual Harvest Summary Data: 1989-1999	
Average Harvest	4,709,280
Maximum Harvest Level	5,331,884
Minimum Harvest Level	3,001,332
Annual Harvest Summary Data: 2000-2009	
Average Harvest	3,874,732
Maximum Harvest Level	4,744,019
Minimum Harvest Level	3,263,788
Recent harvest levels (2000 - 2009) compared to historic (1989-2009)	**-10.14%**
BASELINE VALUE: LAKE HURON	
5-Year Average Harvest Level (2005-2009)	**3,538,355**
5-Year Average Ex-Vessel Value (2005-2009)	**$4,552,042**

Figure 5: Lake Huron Commercial Fishing Harvests displays Lake Huron's commercial fishing harvest data for the years 1989 through 2009.

Figure 5: Lake Huron Commercial Fishing Harvests

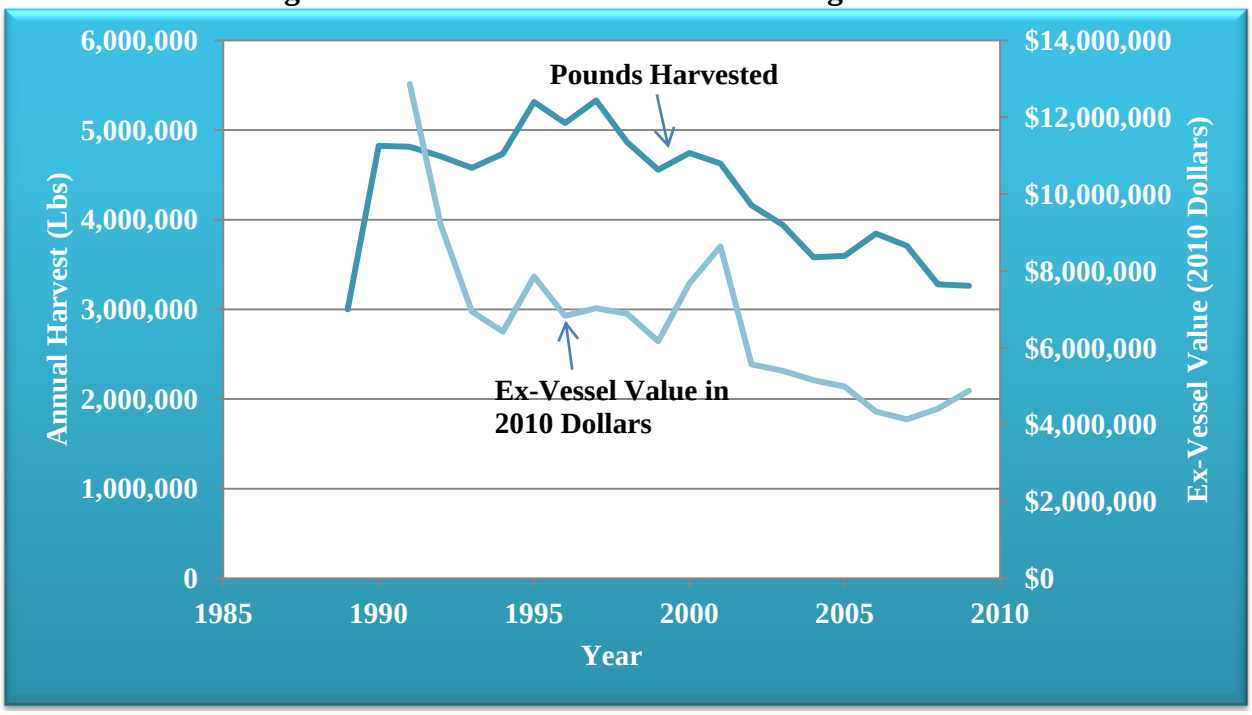


Table 16: Lake Huron Baseline Harvest Data by Species exemplifies the contribution of species to the total harvest level and ex-vessel value of commercial fishing on Lake Huron.

Table 16: Lake Huron Baseline Harvest Data by Species

Family[1]	Harvested Species	Harvest Level[2]	% of Total	Ex-Vessel Value[3] ($)	% of Total
Whitefishes, Smelts, Shads, Herrings	chub, menominee, lake whitefish, smelt*, gizzard shad, alewife*, cisco	2,841,386	80.3	4,058,189	89.2
Cods, Chars, Salmon and Trouts	burbot, lake trout, coho salmon*, chinook salmon*, rainbow trout*	343,844	9.7	330,074	7.3
Sunfishes, Temperate Bass, Perches	rock bass, crappie, white bass, white perch*, yellow perch , walleye	64,959	1.8	83,753	1.8
Bullhead Catfishes	bullhead, channel catfish	135,951	3.8	49,646	1.1
Suckers	buffalo, quillback, sucker	65,542	1.9	16,892	0.4
Drums	freshwater drum	61,362	1.7	7,169	0.2
Carp	common carp*	25,311	0.7	6,319	0.1
Gars, Bowfins	gar, bowfin	0	0.0	0	0.0
Total: All Species		**3,538,355**	**100.0**	**4,552,042**	**100.0**

1. Refer to Appendix A of this report for description as to why the Natural Resources Team grouped some families together.
2. This is a five-year average (2005-2009) of the annual harvest levels.
3. This is a five-year average (2005-2009) of the annual ex-vessel values displayed in 2010 dollars.

Lake Superior Baseline Assessment

Lake Superior's baseline harvest level is 4.5 million pounds with an associated value of $4.0 million[13]. It contributes a total of 23.5 percent to the total harvest of fish on the Great Lakes and 17.7 percent to the total value of Great Lakes fisheries[14]. Lake Superior experienced an increase in harvest levels since 1989. The maximum harvest level from 1989 through 1999 was approximately 3.1 million pounds (1998) and accounted for about 12.7 percent of the total commercial fishing harvests on the Great Lakes; the maximum harvest level since year 2000 was about 6.5 million pounds (2008) and accounted for 32.0 percent of the Great Lakes commercial fishing harvests. See *Table 17: Harvest Data for Lake Superior* for annual harvest levels (in pounds) and values (in 2010 dollars) over the analysis period.

Table 17: Harvest Data for Lake Superior

Year	Harvest Level (lbs)	Ex-Vessel Value[1] (2010 Dollars)
1989	1,475,940	NA
1990	1,455,548	NA
1991	1,057,637	$2,328,038
1992	1,282,315	$2,014,802
1993	1,111,526	$1,330,100
1994	1,130,853	$1,257,517
1995	961,973	$1,118,478
1996[2]	2,561,445	$3,140,349
1997	2,482,987	$3,359,515
1998	3,104,517	$4,662,677
1999	3,045,285	$4,066,441
2000[3]	3,474,988	$4,826,574
2001	4,211,110	$6,393,349
2002	2,487,625	$2,630,599
2003	3,241,341	$3,289,883
2004	3,689,844	$3,342,304
2005	3,738,084	$3,148,161
2006	4,020,658	$2,777,296
2007	4,428,527	$2,980,519
2008	6,506,751	$6,137,591
2009	4,011,536	$4,904,422
5-Year Average	**4,541,111**	**$3,989,598**

1.Note that the commercial fishing ex-vessel value data does not begin until 1991. This is the first year that the Bureau of Labor Statistics began publishing producer price index (PPI) data for commercial fishing category "02230199."
2. Great Lakes Indian Fish and Wildlife Commission (GLIFWC) data was not available until 1996.
3. Minnesota's harvest data begins in year 2000. Data prior to that point was

[13] Recall, the baseline figures represent the average values of commercial harvest levels and commercial ex-vessel values over the five-year time period (2005-2009).

[14] Refer to *Table 4* in the "Great Lakes" portion of the document.

unavailable.

Table 17: Harvest Data for Lake Superior was used to generate the summary statistics for Lake Superior displayed in *Table 18: Summary Statistics for Lake Superior*. Harvest levels are up about 41 percent in recent years compared to the historical average.

The baseline harvest level (about 4.5 million pounds) is greater than the historical average harvest level of 2.8 million pounds. Further, the baseline ex-vessel value ($4.0 million) is greater the average ex-vessel value of $3.4 million.

Harvest levels and ex-vessel values in the 1990s reflect the totals of two states' tribe and state-licensed commercial fishing harvests: Michigan and Wisconsin. However, the Great Lakes Indian Fish and Wildlife Commission data contribution does not begin until 1996; therefore, some increase in the harvest since then can be attributed to this data contribution.

The Great Lakes Indian Fish and Wildlife Commission (GLIFWC) represents the following tribes: Bay Mills Indian Community, Lac Vieux Desert Band of Lake Superior Chippewa Indians, Bad River Band of Lake Superior Chippewa Indians of Wisconsin, Red Cliff Band of Lake Superior Chippewa Indians of Wisconsin, Lac du Flambeau Band of Lake Superior Chippewa Indians of Wisconsin, Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin, St. Croix Chippewa Indians of Wisconsin, Mille Lacs Band of Ojibwe, and Fond du Lac Band of Lake Superior Chippewa Indians of Minnesota[15].

Minnesota's data contribution begins in year 2000. Therefore, increases in harvest levels during the 2000s are partially attributed to Minnesota's data contribution.

The majority of the harvests on Lake Superior are comprised of lake whitefish. In 2009, the total harvest of this species was approximately 2.5 million pounds. This is less than the average harvest level of species in the 2000s (about 4.0 million pounds). The remainder of the total harvest in 2009 is attributed to the harvest of species such as lake herring (approximately 618,000 pounds).

[15] Note that the 1854 Treaty Authority member tribes (which border Lake Superior) did not provide harvest data for any year during the Great Lakes analysis period (1989 through 2009). These tribes include the Grand Portage Band of Lake Superior Chippewa Indians, and the Bois Forte Band of Lake Superior Chippewa Indians.

Table 18: Summary Statistics for Lake Superior

Annual Harvest Summary Data: 1989-2009	
Average Harvest (Pounds)	2,832,404
Maximum Harvest Level	6,506,751
Minimum Harvest Level	961,973
Annual Ex-Vessel Value Summary Data: 1991-2009 (adjusted to 2010 dollars)	
Average Ex-vessel value (Pounds)	$3,353,085
Maximum Ex-vessel value	$6,393,349
Minimum Ex-vessel value	$1,118,478
Annual Harvest Summary Data: 1989-1999	
Average Harvest	1,788,184
Maximum Harvest Level	3,104,517
Minimum Harvest Level	961,973
Annual Harvest Summary Data: 2000-2009	
Average Harvest (Pounds)	3,981,046
Maximum Harvest Level	6,506,751
Minimum Harvest Level	2,487,625
Recent harvest levels (2000 - 2009) compared to historic (1989-2009)	40.55%
BASELINE VALUE: LAKE SUPERIOR	
5-Year Average Harvest Level (2005-2009)	**4,541,111**
5-Year Average Ex-Vessel Value (2005-2009)	**$3,989,598**

Figure 6: Lake Superior Commercial Fishing Harvests displays Lake Superior's commercial fishing harvest data for the years 1989 through 2009. Increases in harvest levels in 1996 through 1999 can be partially attributed to the contribution of GLIFWC's data set. Increased harvest levels since 2000 are attributed to both GLIFWC's data set and state-licensed commercial fishing data provided by Minnesota (which wasn't available until year 2000). Therefore, increases in harvest levels and ex-vessel values over the study period (1989 through 2009) are not necessarily indicative of increased harvest, but rather, an increase in reported harvests.

Figure 6: Lake Superior Commercial Fishing Harvests

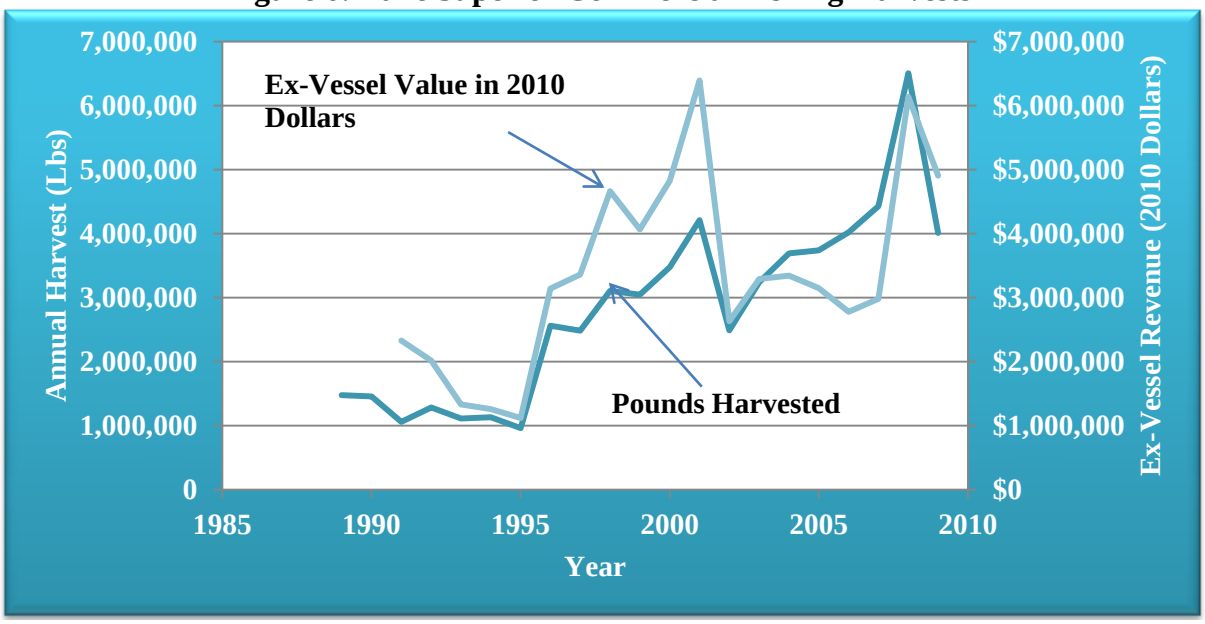


Table 19 exemplifies the contribution of species to the total harvest level and ex-vessel value of commercial fishing on Lake Superior.

Table 19: Lake Superior Baseline Harvest Data by Species

Family[1]	Harvested Species	Harvest Level[2] (lbs)	% of Total	Ex-Vessel Value [3] ($)	% of Total
Whitefishes, Smelts	lake herring, chubs, lake whitefish, cisco (flesh and roe), menominee, rainbow smelt*, alewife*	3,485,278	76.7	2,854,338	71.5
Whitefishes, Cods	lake char, burbot, splake, chinook salmon*, coho salmon*, European brown trout*, rainbow trout*	1,045,971	23.0	1,130,635	28.3
Perches, Cods	perch, walleye, northern pike	6,592	0.1	4,098	0.1
Suckers	sucker	3,269	0.1	527	0.0
Carp	common carp*	0	0.0	0	0.0
	Total: All Species	**4,541,111**	**100.0**	**3,989,598**	**100.0**

1. Refer to Appendix A of this report for description of why the Natural Resources Team grouped families together.
2. This is a five-year average (2005-2009) of the annual harvest levels.
3. This is a five-year average (2005-2009) of the annual ex-vessel value.

Lake Ontario Baseline Assessment

Lake Ontario's baseline (5-year average from 2005-2009) harvest level is 20,720 pounds with an associated value of $31,915[16]. It contributes a total of 0.1 percent to the total harvest of fish on the Great Lakes and 0.1 percent to the total ex-vessel value of Great Lakes fisheries[17].

Lake Ontario experienced a decrease in harvest levels since 1989. The maximum harvest level in the 1990s was approximately 141 thousand pounds (1991) and accounted for 0.5 percent of the total commercial fishing harvests on the Great Lakes; the maximum harvest level since year 2000 has been about 70 thousand pounds (2000) and accounted for 0.4 percent of the Great Lakes commercial fishing harvests. See *Table 20: Lake Ontario Harvest Data* for annual harvest levels (in pounds) and values (in 2010 dollars) over the analysis period.

Table 20: Lake Ontario Harvest Data

Year	Harvest Level1 (lbs)	Ex-Vessel Value[1] (2010 Dollars)
1989	N/A	N/A
1990	N/A	N/A
1991	140,643	$312,055
1992	88,865	$185,682
1993	67,234	$124,897
1994	80,645	$154,763
1995	59,615	$131,112
1996	63,796	$129,437
1997	52,788	$122,338
1998	69,970	$163,407
1999	48,164	$110,355
2000	70,179	$166,901
2001	46,655	$110,351
2002	41,658	$75,279
2003	12,118	$21,008
2004	38,266	$72,422
2005	7,394	$12,822
2006	4,774	$7,953
2007	34,878	$57,536
2008	15,163	$15,591
2009	41,389	$65,671
5-Year Average	**20,720**	**$31,915**

1. Note that the commercial fishing ex-vessel value data does not begin until 1991. This is the first year that commercial harvest data for Lake Ontario was available.

[16] Recall, the baseline figures represent the average values of commercial harvest levels and commercial ex-vessel values over the five-year time period (2005-2009).

[17] Refer to *Table 4: Great Lakes Baseline Harvest and Values* in the "Great Lakes" portion of the document.

Table 20: Lake Ontario Harvest Data was used to generate the following summary statistics for Lake Ontario (displayed in *Table 21: Summary Statistics for Lake Ontario*). Harvest levels and values decreased during the analysis period. Harvest levels are down by almost 40 percent in recent years compared to the historical average. The baseline harvest level (about 21,000 pounds) is less than half of the average harvest level of approximately 52,000 pounds. Further, the baseline ex-vessel value ($31,900) is also less than half of the average ex-vessel value of $107,300.

Lake Ontario's harvest decreased (by almost 40%) in the 2000-2009 harvest levels, the 10-year average, compared to the 1991-2009 harvest levels. This can be attributed to the decrease in the harvest of numerous fisheries such as: white bass, rock bass, black crappie, sunfish and freshwater drum, which were harvested in the 1990s by New York but were not harvested in the 2000s.

Note that all harvests on Lake Ontario are from state-licensed fishermen. No tribal commercial fishing harvests were reported during the analysis period (1991 through 2009).

Table 21: Summary Statistics for Lake Ontario

Annual Harvest Summary Data: 1991-2009	
Average Harvest (pounds)	51,800
Maximum Harvest Level	140,643
Minimum Harvest Level	4,774
Annual Ex-vessel value Summary Data: 1991-2009 (adjusted to 2010 dollars)	
Average Ex-vessel value	$107,346
Maximum Ex-vessel value	$312,055
Minimum Ex-vessel value	$7,953
Annual Harvest Summary Data: 1991-1999	
Average Harvest (pounds)	74,636
Maximum Harvest Level	140,643
Minimum Harvest Level	48,164
Annual Harvest Summary Data: 2000-2009	
Average Harvest (pounds)	31,247
Maximum Harvest Level	70,179
Minimum Harvest Level	4,774
Recent harvest levels (2000 - 2009) compared to historic (1991-2009)	-39.68%
BASELINE VALUE: LAKE ONTARIO	
5-Year Average Harvest Level (2005-2009)	**20,720**
5-Year Average Harvest Value (2005-2009)	**$31,915**

Figure 7: Lake Ontario Commercial Fishing Harvests displays Lake Ontario's commercial fishing harvest data for the years 1991 through 2009. Note that the number of state-licensed commercial fishermen decreased in year 2000. This is correlated with a decline in commercial fishing harvests and associated ex-vessel values. This is exemplified in Figure 7.

Figure 7: Lake Ontario Commercial Fishing Harvests

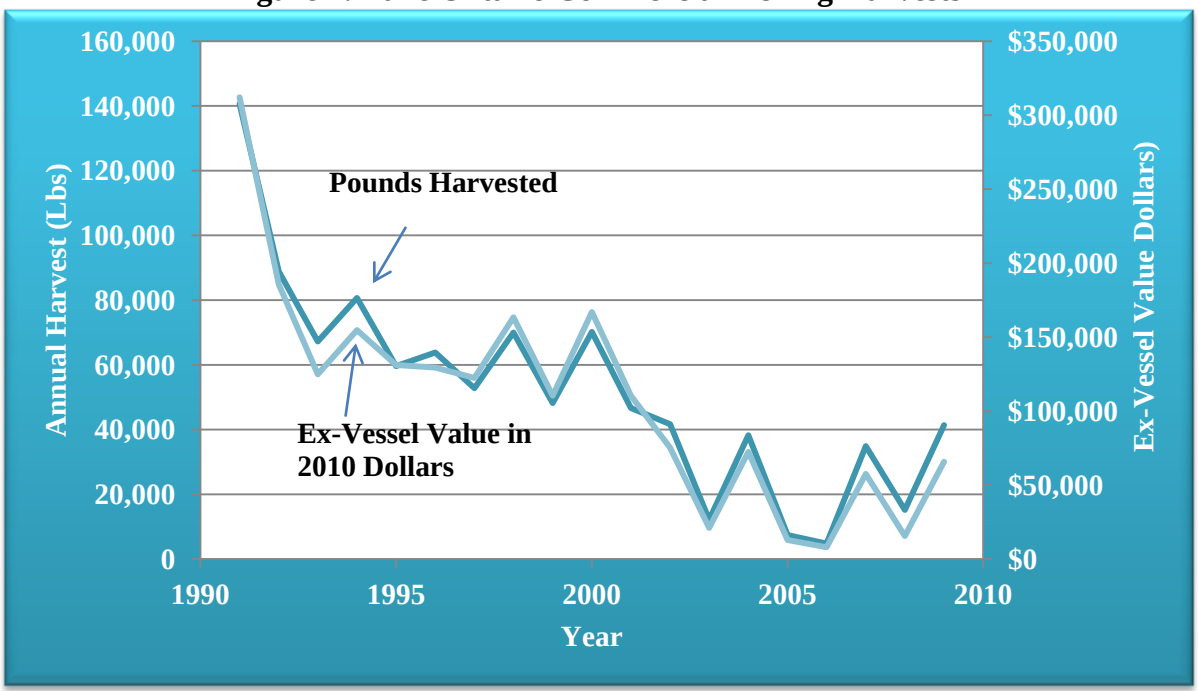


Table 22: Lake Ontario Baseline Harvest Data by Species exemplifies the contribution of species to the total harvest level and ex-vessel value of commercial fishing on Lake Ontario. Note that families Perches, Temperate Bass and Sunfishes are comprised of lake yellow perch, white perch, rock bass, black crappie and sunfish. Of these, yellow perch is the only species that was harvested between 2005 and 2009 (the period from which the baseline was derived). Therefore, yellow perch alone account for about 97 percent of Lake Ontario's total commercial fishing harvest and approximately 98 percent of its value.

Table 22: Lake Ontario Baseline Harvest Data by Species

Family[1]	Harvested Species	Harvest Level[2] (lbs)	% of Total	Ex-vessel value[3] ($)	% of Total
Perches, Temperate Bass, Sunfishes	yellow perch, white perch*, rock bass, black crappie, sunfish	20,151	97.3	31,355	98
Bullhead	brown bullhead	568	2.7	560	2
Drums	freshwater drum	0	0.0	0	0
Total: All Species		**20,720**	**100.0**	**31,915**	**100**

1. Refer to Appendix A of this report for description as to why the GLMRIS Natural Resources Team grouped some families together.
2. This is a five-year average (2005-2009) of the annual harvest levels.
3. This is a five-year average (2005-2009) of the annual ex-vessel values in 2010 dollars

UPPER MISSISSIPPI RIVER BASIN BASELINE ASSESSMENT

The analysis period for the Upper Mississippi River Basin includes years 1989 through 2005. These are the years for which the majority of states in the basin were able to provide commercial harvest data. The baseline harvest levels and values were derived from the average of the most recent five years of data available, years 2001 through 2005.

The Upper Mississippi River Basin fishery is valued at $4.0 million with a harvest level of almost 10.0 million pounds. Baseline figures reflect the average of 2001 through 2005 harvest level and ex-vessel value data. *Table 23: Upper Mississippi River Basin Baseline Harvest and* Values displays the total Upper Mississippi River Basin fishery harvest level and value.

This total is comprised of the following water bodies: Upper Mississippi River, Illinois River, Kaskaskia River and the Rock River[18]. These are the only rivers in the Upper Mississippi River Basin for which states identified commercial fishing harvests during the analysis period (years 1989 through 2005).

Table 23: Upper Mississippi River Basin Baseline Harvest and Values

Basin	Water Bodies Included in Basin Total	Harvest Level[1] (lbs)	Ex-Vessel Value[1] ($)
Upper Mississippi River	Upper Mississippi River Illinois River Kaskaskia River Rock River Zumbro River[2]	9,999,000	3,969,000
1. Harvest levels and values reflect a five-year average from 2001 through 2005. All values are rounded to the nearest thousand. Ex-vessel values are displayed in 2010 dollars. 2. The Zumbro River will be addressed in a qualitative manner due to the fact that harvests on these rivers only occurred in a few years during the analysis period.			

The primary contributor to the Upper Mississippi River Basin's harvest levels and values (in the Upper Mississippi, Illinois, Kaskaskia and Rock Rivers) is comprised of species such as: bigmouth, smallmouth and black buffalo (which contribute 27 percent to the total harvest in 2005), silver and bighead carp* (21 percent), common carp* (17 percent), and blue catfish, channel catfish and flathead catfish (15 percent).

The Zumbro River in Minnesota also supported commercial harvests during 1998 and 1999. The harvest of common carp, sucker, and quillback during these years totaled to approximately 49,000 pounds.

[18] See *Plate 2: Upper Mississippi River Basin Map* for map of the rivers included in the Upper Mississippi River Basin baseline economic assessment.

Table 24 displays the harvest level (pounds) and the associated harvest level for the years 1989 through 2005 for the Upper Mississippi River Basin.

Table 24: Upper Mississippi River Basin Harvest Levels and Values

Year	Harvest Level (lbs)	Ex-Vessel Value[1] (2010 Dollars)
1989	11,190,479	N/A
1990[2]	16,070,981	N/A
1991	10,574,524	$7,787,526
1992	12,492,360	$5,904,489
1993	12,369,442	$4,609,197
1994	12,194,779	$4,114,320
1995	12,606,357	$4,661,670
1996	12,588,122	$4,116,747
1997	11,462,408	$4,383,578
1998	11,407,486	$4,302,589
1999[3]	11,132,226	$3,460,319
2000	9,097,356	$3,432,144
2001	10,077,421	$3,498,193
2002	10,450,292	$3,850,934
2003	9,914,227	$3,812,858
2004	9,499,023	$4,128,483
2005	10,051,589	$4,555,282
5-Year Average	**9,998,510**	**$3,969,150**

1. Note that the commercial fishing ex-vessel value data does not begin until 1991. This is the first year that the Bureau of Labor Statistics began publishing producer price index (PPI) data for commercial fishing category “02230199."
2. Harvest levels for the Rock River in Illinois begin in 1990.
3. Harvest level and ex-vessel value data for paddlefish and shovelnose sturgeon roe begin in year 1999.

The Upper Mississippi Basin has experienced a fluctuation in harvest levels over the analysis period. Harvest levels are down by 13 percent in recent years (2000 through 2005) compared to the historical average (1989 through 2005).

This can be attributed to the decrease in harvest levels of various species. For instance, harvest levels of common carp* are down by 35 percent in recent years (2000 through 2005) compared to the historical average (1989 through 2005), while the harvest of buffalo (down 7 percent) and total harvests of catfishes and bullheads (down 9 percent) have also experienced declines in harvest levels.

Decreases in the harvest of some families of species are partially offset by increases in harvests of other species. For example, the harvest of shovelnose sturgeon and shovelnose sturgeon roe are up by 60 percent in recent years (2000 through 2005) compared to historic (1989 through 2005) levels. Further, the harvest of species such as silver* and bighead carp* (up 200 percent) and grass carp* (up 78 percent) have experienced increases in harvest levels in recent years (up 156 percent) compared to historic levels.

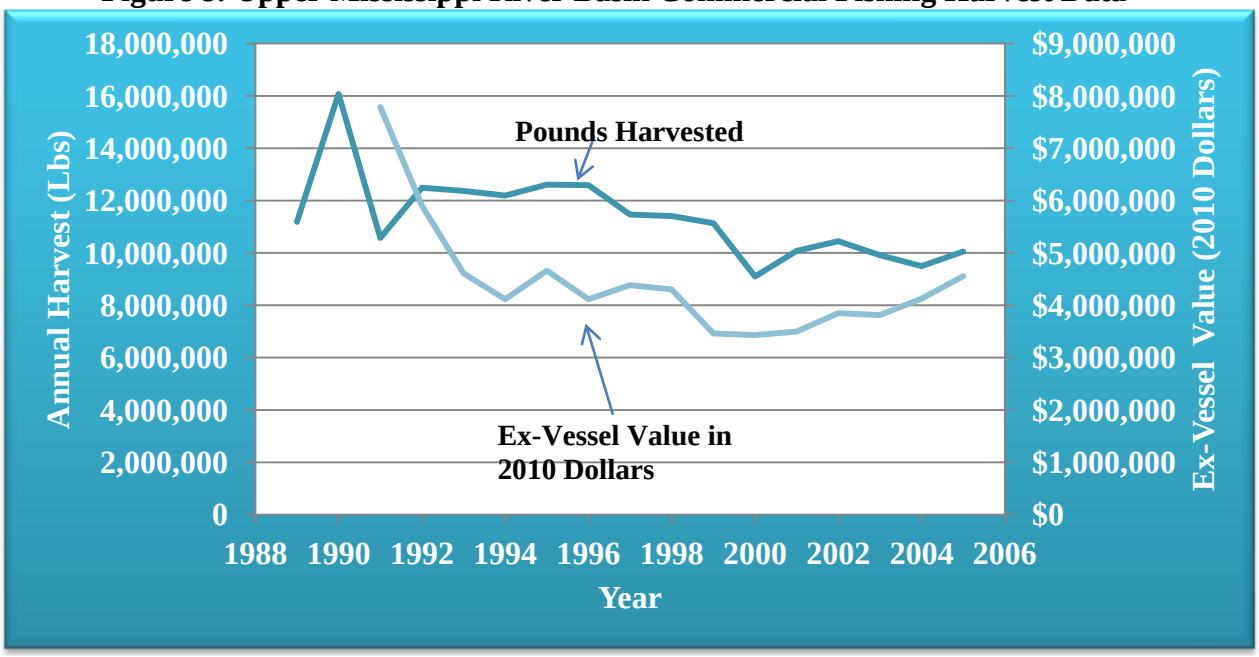
Table 25 exhibits summary statistics for total fish and roe harvests in the Upper Mississippi River Basin.

Table 25: Summary Statistics for the Upper Mississippi River Basin

Annual Harvest Summary Data: 1989-2005	
Average Harvest	11,363,475
Maximum Harvest Level	16,070,981
Minimum Harvest Level	9,097,356
Annual Ex-Vessel Value Summary Data: 1992-2005 (adjusted to 2010 dollars)	
Average Ex-vessel value:	$4,441,222
Maximum Ex-vessel value	$7,787,526
Minimum Ex-vessel value	$3,432,144
Annual Harvest Summary Data: 1989-1999	
Average Harvest	12,189,924
Maximum Harvest Level	16,070,981
Minimum Harvest Level	10,574,524
Annual Harvest Summary Data: 2000-2005	
Average Harvest	9,848,318
Maximum Harvest Level	10,450,292
Minimum Harvest Level	9,097,356
Recent harvest levels (2000 - 2005) compared to historic (1989-2005)	-13.33%
Correlation coefficient between harvest level and ex-vessel value (1991-2005)	0 .23
BASELINE VALUES: UPPER MISSISSIPPI RIVER BASIN	
5-Year Average Harvest Level (2001-2005)	**9,998,510**
5-Year Average Ex-Vessel Value (2001-2005)	**$3,969,150**

Figure 8: Upper Mississippi River Basin Commercial Fishing Harvest Data displays the aggregated commercial fishing harvest levels and ex-vessel values for the years 1991 through 2009 for the following rivers: Upper Mississippi River, Illinois River, Kaskaskia River and Rock River.

Figure 8: Upper Mississippi River Basin Commercial Fishing Harvest Data



Suckers represent the majority of the baseline commercial fishing harvest (35 percent) and baseline ex-vessel value (29 percent) for the Upper Mississippi River Basin. This family includes species such as, buffalo, redhorse, carpsuckers, and other Sucker family species. These species are harvested in the following rivers: Upper Mississippi River (by Iowa, Wisconsin, Minnesota, Missouri and Illinois), the Illinois River (by Illinois), the Kaskaskia River (by Illinois) and the Rock River (by Illinois).

Bullhead and other Catfish species also make up a large majority of the commercial fishing ex-vessel value in the Upper Mississippi River Basin. Channel catfish make up the majority of harvest in this family. The baseline harvest level for channel catfish was 1.2 million pounds with an associated value of $756,000. This species accounted for approximately 24 percent of the baseline harvest level in the Upper Mississippi River Basin.

Table 26: Upper Mississippi River Basin Baseline Harvest Data by Species exemplifies the contribution of species to the baseline harvest level and value of commercial fishing in the Upper Mississippi River Basin. Note that all harvests are from state-licensed fishermen. No tribal harvests were reported during the analysis period (1989 through 2005).

Table 26: Upper Mississippi River Basin Baseline Harvest Data by Species

Family[1]	Harvested Species	Harvest Level[2] (lbs)	% of Total	Ex-Vessel Value[3] ($)	% of Total
Suckers	bigmouth buffalo, smallmouth buffalo, black buffalo, sucker, redhorse, carpsucker	3,455,452	34.6	1,168,362	29.4
Bullhead Catfishes	bullhead, channel catfish, flathead catfish, blue catfish	1,730,585	17.3	1,104,723	27.8
Carps & Minnows	common carp*, grass carp*, minnows	2,128,550	21.3	287,338	7.2
Paddlefish, Mooneyes, Shads, Herrings & Carps	paddlefish, paddlefish roe, mooneye, goldeye, gizzard shad, skipjack herring, bighead carp*, silver carp*	1,146,414	11.5	538,653	13.6
Drums	freshwater drum	1,291,021	12.9	212,515	5.4
Sturgeons	shovelnose sturgeon, shovelnose sturgeon roe	130,448	1.3	638,910	16.1
Other	other	91,621	0.9	13,601	0.3
Gars & Bowfins	gars, bowfins	24,196	0.2	4,922	0.1
Freshwater Eels	American eel	223	0.0	126	0.0
	Total: All Species	**9,998,510**	**100.0**	**3,969,150**	**100.0**

1. Refer to Appendix B of this report for description as to why the Natural Resources Team grouped some families together.
2. This is a five-year average (2001-2005) of the annual harvest levels.
3. This is a five-year average (2001-2005) of the annual ex-vessel values displayed in 2010 dollars.

OHIO RIVER BASIN BASELINE ASSESSMENT

The analysis period for the Ohio River Basin includes years 1999 through 2005. These are the years for which the majority of states in the basin were able to provide commercial harvest data. The baseline harvest levels and values were derived from the average of the most recent five years of data, years 2001 through 2005.

The Ohio River Basin fishery is valued at $2.0 million with a harvest level of 1.4 million pounds. Baseline figures reflect the average of 2001 through 2005 harvest level and ex-vessel value data. Table 27 displays the total Ohio River Basin fishery harvest level and value.

This total is comprised of the following water bodies: Ohio River, Wabash River, Cumberland River and the Kentucky River[19]. These are the only rivers in the Ohio River Basin for which states identified commercial fishing harvests during the analysis period (years 1999 through 2005).

Table 27: Ohio River Basin Baseline Harvest and Ex-Vessel Value

Basin	Water Bodies Included in Basin Total	Harvest Level[1] (lbs)	Ex-Vessel Value[1] ($)
Ohio River	Ohio River Wabash River Cumberland River Kentucky River Salt River[2]	1,381,000	2,046,000

1. Harvest levels and values reflect a five-year average from 2001 through 2005. All values are rounded to the nearest thousand. Ex-vessel values are displayed in 2010 dollars.
2. The Salt River will be assessed qualitatively since harvest levels were only available for two years during the analysis period.

Table 27: Ohio River Basin Baseline Harvest and Ex-Vessel Value exhibits that the Ohio River Basin's baseline harvest level is approximately 1.4 million pounds with an associated value of $2.0 million. The primary contributors to the Ohio River Basin's harvest levels and ex-vessel values are species such as: catfish (contribute 38 percent to the baseline harvest level; contribute 17 percent to the baseline ex-vessel value) paddlefish roe (contribute 61 percent to the baseline ex-vessel value), and others. Species in the Paddlefish, Mooneyes, Shads, and Carps* family accounted for 41 percent of the Ohio River Basin's baseline harvest level and 72 percent of the baseline ex-vessel value.

[19] See *Plate 3: Ohio River Basin Map* for rivers included in the Ohio River Basin baseline economic assessment.

The Salt River yielded 205 pounds of commercial fish harvest in 1999 and 179 pounds in 2000. These levels can be attributed to the harvest of channel catfish, flathead catfish, buffalo, common carp* and freshwater drum.

Table 28: Ohio River Basin Harvest Levels and Values displays the harvest level (pounds) and the associated harvest level for the years 1999 through 2005 for the Ohio River Basin.

Table 28: Ohio River Basin Harvest Levels and Values

Year	Harvest Level (lbs)	Ex-Vessel Value (2010 Dollars)
1999	1,008,082	$812,698
2000	1,524,141	$1,811,622
2001	1,650,068	$1,837,689
2002	1,527,303	$1,830,855
2003	919,525	$1,379,796
2004	1,313,894	$1,949,763
2005	1,494,115	$3,232,229
5-Year Average	**1,380,981**	**$2,046,066**

The Ohio River Basin has experienced some fluctuation in harvest levels over the 7-year analysis period. Harvest levels are down by about 3 percent in recent years (2002 through 2005) compared to the historical average (1999 through 2005).

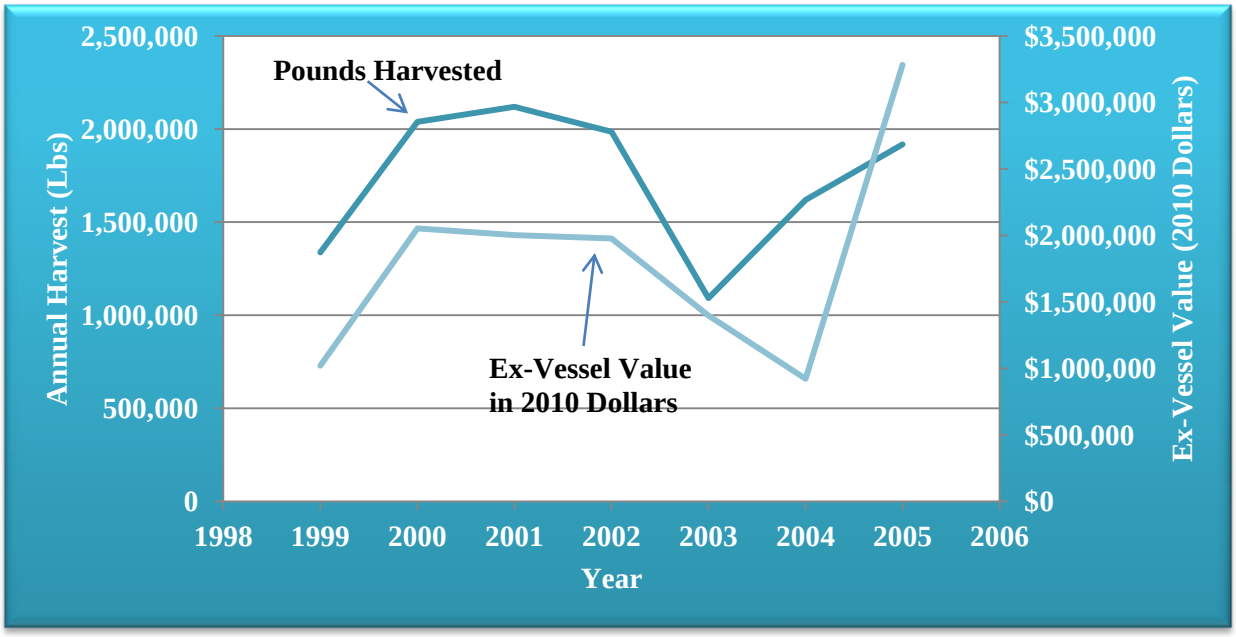
Table 29: Summary Statistics for the Ohio River Basin

Annual Harvest Summary Data: 1999-2005	
Average Harvest	1,348,161
Maximum Harvest Level	1,650,068
Minimum Harvest Level	919,525
Annual Ex-vessel value Summary Data: 1999-2005 (adjusted to 2010 dollars)	
Average Ex-vessel value:	$1,836,379
Maximum Ex-vessel value	$3,232,229
Minimum Ex-vessel value	$812,698
Annual Harvest Summary Data: 1999-2001	
Average Harvest	1,394,097
Maximum Harvest Level	1,650,068
Minimum Harvest Level	1,008,082
Annual Harvest Summary Data: 2002-2005	
Average Harvest	1,313,709
Maximum Harvest Level	1,527,303
Minimum Harvest Level	919,525
Recent harvest levels (1999 - 2001) compared to historic (1999-2005)	-2.56%
Correlation coefficient between harvest level and ex-vessel value (1999-2005)	0 .60
BASELINE VALUE: OHIO RIVER BASIN	
5-Year Average Harvest Level (2001-2005)	**1,380,981**
5-Year Average Ex-Vessel Value (2001-2005)	**$2,046,066**

Figure 9: Ohio River Basin Commercial Fishing Harvest Data displays Lake Ontario's commercial fishing harvest data for the years 1991 through 2009.

Note that the reduced harvest levels and values in 2003 can be partially attributed to the decrease in harvests of species in Kentucky's waters (in the Kentucky and Ohio Rivers). This was likely due to the fact that 2003 yielded the fewest number of fishing days due to lengthy periods of high water and high flow.

Figure 9: Ohio River Basin Commercial Fishing Harvest Data



Paddlefish and paddlefish roe accounted for the majority of the Ohio River Basin's commercial ex-vessel value in 2005. The total ex-vessel value associated with these species in 2005 was approximately $2.6 million, comprising 88 percent of the total ex-vessel value ($3.2 million) in the Ohio River Basin in 2005. Paddlefish and paddlefish roe were harvested on the Ohio River, Wabash River, Cumberland River and the Kentucky River.

Channel, flathead and blue catfish accounted for the majority of the remaining harvest levels and ex-vessel values in 2005. The total harvest level of these three species in 2005 was approximately 585,000 pounds, with an associated ex-vessel value of $365,000. These species were harvested from the Ohio River (by Illinois, Indiana and Kentucky), the Wabash River (by Illinois and Indiana), the Cumberland River (by Kentucky), and the Kentucky River (by Kentucky).

Note that all harvests are by state-licensed fishermen. There were no tribal harvests in the Ohio River Basin during the analysis period (1999-2005).

Table 30: Ohio River Basin Baseline Harvest Data by Species exemplifies the contribution of species to the baseline harvest level and value of commercial fishing in the Ohio River Basin.

Table 30: Ohio River Basin Baseline Harvest Data by Species

Family[1]	Harvested Species	Harvest Level[2] (lbs)	% of Total	Ex-Vessel Value[3] ($)	% of Total
Paddlefish, Mooneyes, Shads, & Carps	paddlefish, paddlefish roe, mooneye, goldeye, gizzard shad, silver carp*, bighead carp*	569,456	41.2	1,464,230	71.6
Bullhead Catfishes	bullhead, channel catfish, flathead catfish, blue catfish	525,590	38.1	354,520	17.3
Suckers	buffalo, carpsuckers, suckers	210,514	15.2	67,593	3.3
Sturgeons	shovelnose sturgeon, shovelnose sturgeon roe	21,819	1.6	146,381	7.2
Other	Other	16,568	1.2	6,740	0.3
Minnows & Carps	minnows, common carp*, grass carp*	29,597	2.1	5,347	0.3
Drums	freshwater drum	5,007	0.4	780	0.0
Gars	gars	2,415	0.2	466	0.0
Freshwater Eels	American eel	14	0.0	9	0.0
	Total: All Species	**1,380,981**	**100.0**	**2,046,066**	**100.0**

1. Refer to Appendix B of this report for description as to why the GLMRIS Natural Resources Team grouped some families together.
2. This is a five-year average (2001-2005) of the annual harvest levels.
3. This is a five-year average (2001-2005) of the annual ex-vessel values displayed in 2010 dollars.

CONCLUSION

The commercial fishing industry on the U.S. waters of the Great Lakes, Upper Mississippi River, and Ohio River basins are an economic engine for the region. While many fishery harvests have declined in the last twenty years, some have enjoyed increased harvests and values. Changes in harvests and values are driven by multiple factors, some biological, some concerning tastes and preferences of the consumer. This evaluation does not attempt to determine why the fisheries experienced changes in the past. The purpose of this evaluation is to establish the current conditions for the commercial fisheries in the region for use in GLMRIS. The current condition will be utilized as a starting point to predict what might happen to the fisheries over the perid of analysis with or without implementation of controls for aquatic nuisance species. From there, we will establish what might happen to the fisheries with controls in place.

This evaluation summarizes the available commercial harvests and values for the U.S. waters of each of the Great Lakes, the Upper Mississippi River and its tributaries, and the Ohio River and its tributaries. The team worked closely with the reporting agencies and the Tribes to acquire the most current data set. Since there are yearly fluctuations in catch and value, the team determined that using the most recent five years of data would be an appropriate estimation of the current conditions of commercial fisheries, and will serve as the baseline from which future forecasts will be projected. Findings from this evaluation include:

- The U.S. waters of the Great Lakes are harvesting an average of 19.3 million pounds of fish product for resale. The ex-vessel value of this harvest is $22.5 million (in 2010 dollars).
- The Upper Mississippi River basin harvest on average is about 10 million pounds of fish product for resale with an associated ex-vessel value of $4.0 million (in 2010 dollars).
- The Ohio River basin harvest on average is 1.4 million pounds with an associated ex-vessel of $2.0 million (in 2010 dollars).

The baseline economic assessment of commercial fisheries is summarized further in *Table 31: Summary Data.*

Table 31: Summary Data

Basin	Baseline Harvest Level[1]	Baseline Harvest Value[2]
Great Lakes[3]	19,345,000	22,506,000
Upper Mississippi River	9,999,000	3,969,000
Ohio River	1,381,000	2,046,000

1. This is a five-year average of the annual harvest levels (rounded to the nearest thousand). Harvest levels for the Great Lakes Basin are reflective of 2005 through 2009 harvest data; harvest levels for the Upper Mississippi River and Ohio River Basins are reflective of 2001 through 2005 harvest data.
2. This is a five-year average of the annual harvest values displayed in 2010 dollars (rounded to the nearest thousand). Harvest values for the Great Lakes Basin are reflective of 2005 through 2009 harvest data; values for the Upper Mississippi River and Ohio River Basins are reflective of 2001 through 2005 harvest data.
3. This baseline reflects harvest levels and values of the fisheries in the U.S. waters of the Great Lakes.

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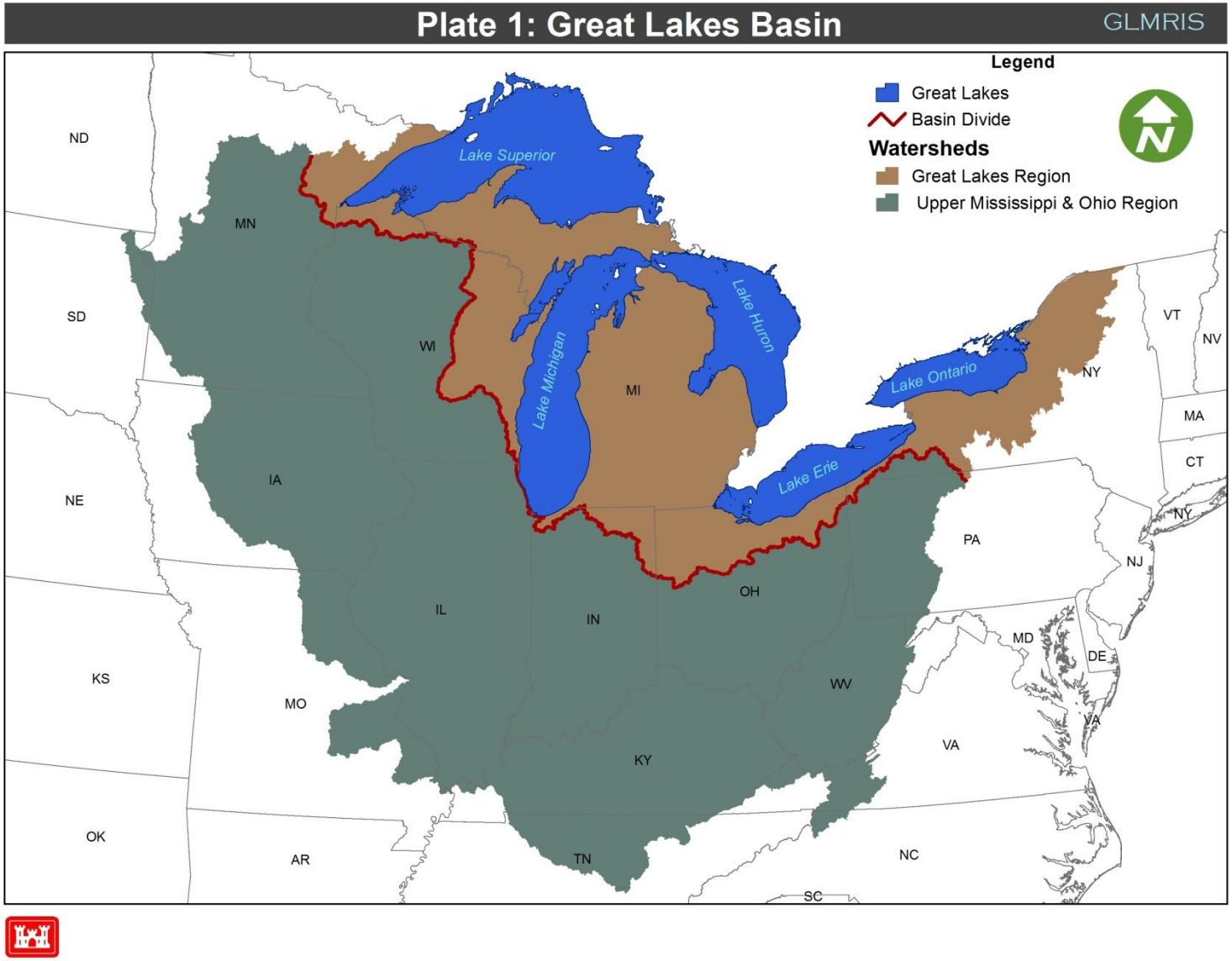
Plate 1: Great Lakes Basin
GLMRIS
Legend
Great Lakes
Basin Divide
Watersheds
Great Lakes Region
Upper Mississippi & Ohio Region
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Lake Ontario
ND
MN
SD
WI
MI
NY
VT
NV
MA
CT
NJ
PA
NE
IA
IL
IN
OH
WV
MD
DE
VA
KS
MO
KY
OK
AR
TN
NC
SC

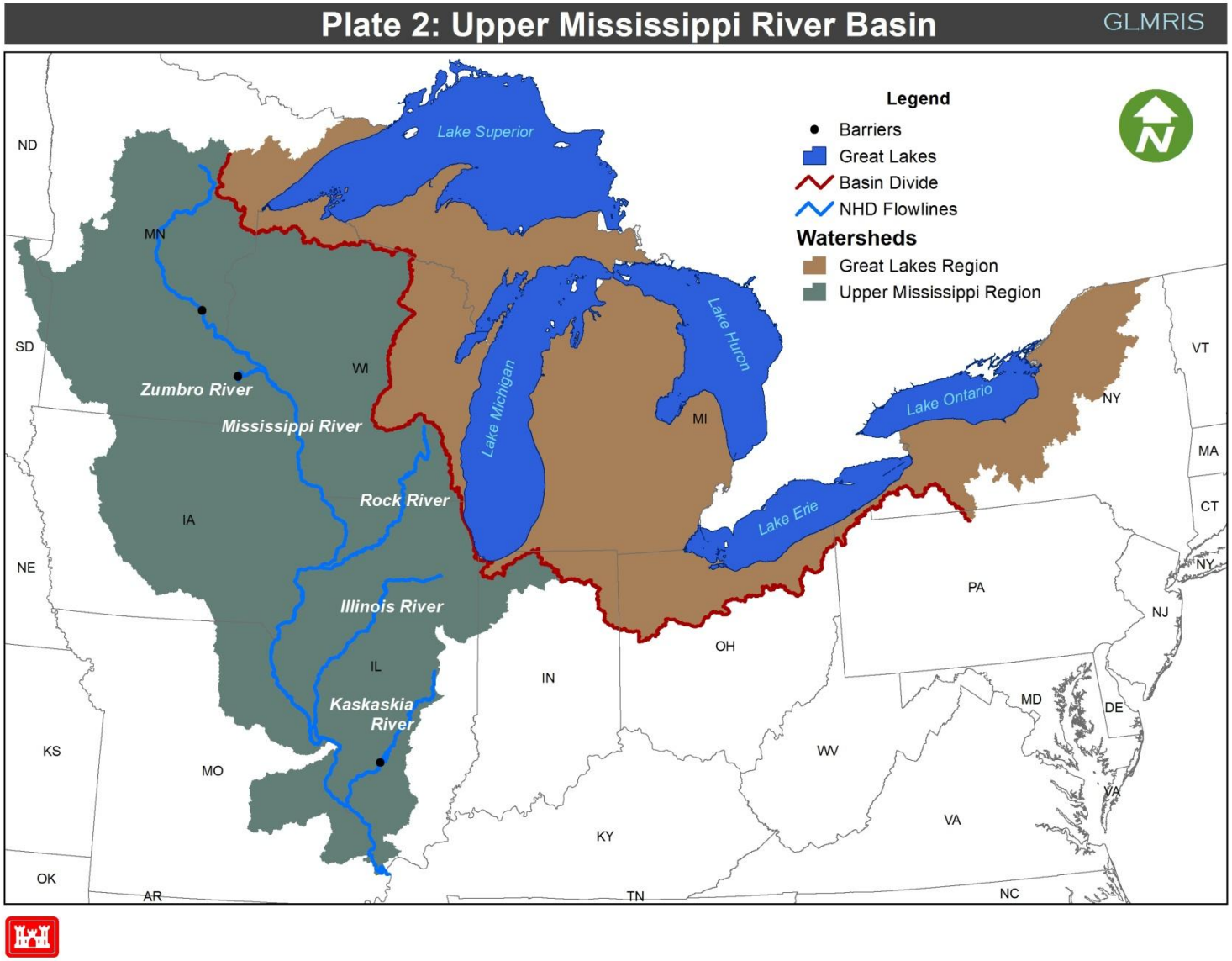
Plate 2: Upper Mississippi River Basin
GLMRIS
Legend
Barriers
Great Lakes
Basin Divide
NHD Flowlines
Watersheds
Great Lakes Region
Upper Mississippi Region
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Lake Ontario
Zumbro River
Mississippi River
Rock River
Illinois River
Kaskaskia River
ND
MN
SD
WI
MI
IA
NE
IL
IN
OH
PA
NY
VT
MA
CT
NJ
MD
DE
WV
VA
KY
TN
NC
KS
MO
OK
AR

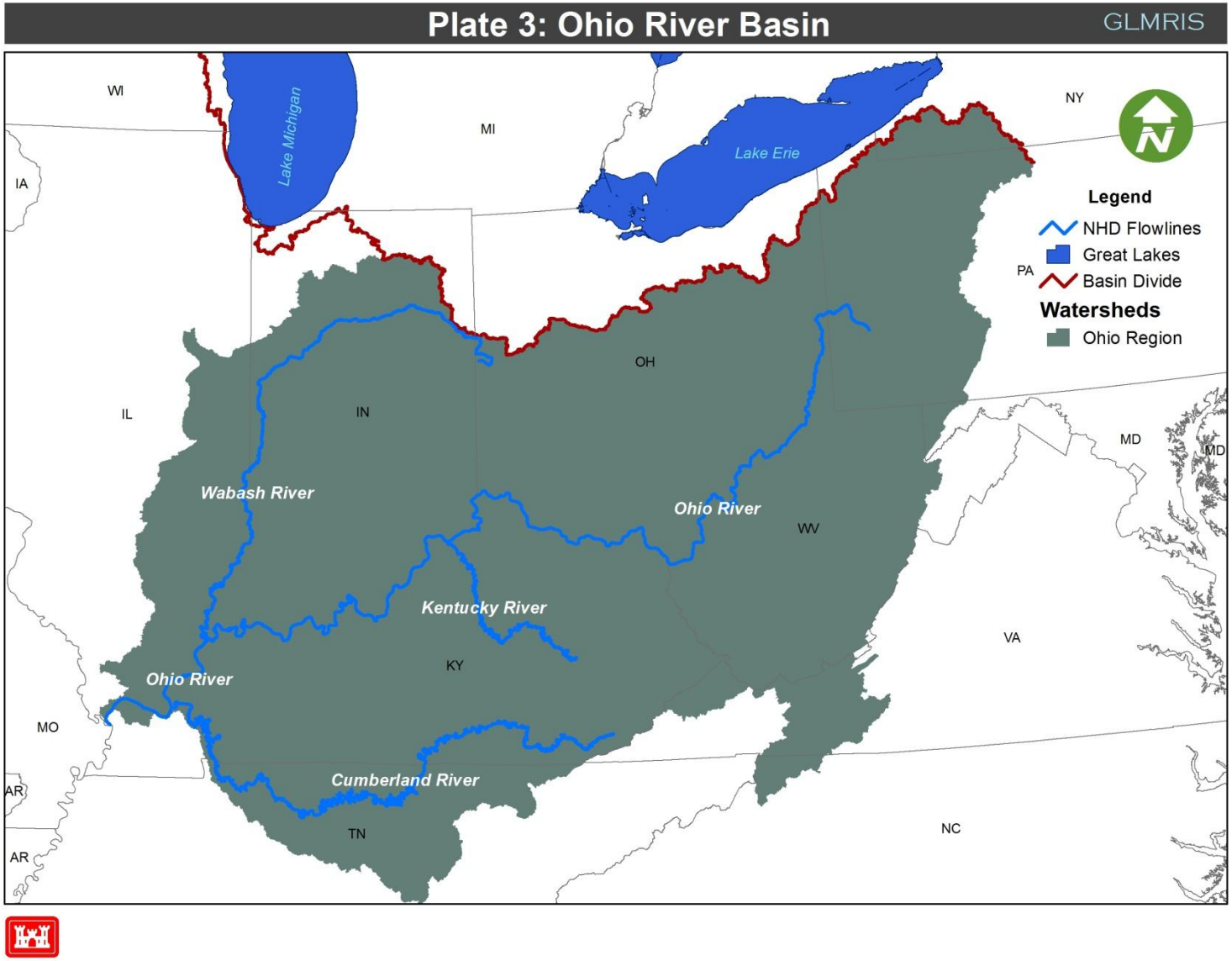
Plate 3: Ohio River Basin
GLMRIS
WI
MI
NY
IA
IL
IN
OH
PA
MD
MD
WV
VA
KY
MO
AR
AR
TN
NC
Lake Michigan
Lake Erie
Wabash River
Ohio River
Kentucky River
Ohio River
Cumberland River
Legend
NHD Flowlines
Great Lakes
Basin Divide
Watersheds
Ohio Region

Appendix A: Commercial Fisheries Baseline Economic Assessment Methodology

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INTRODUCTION

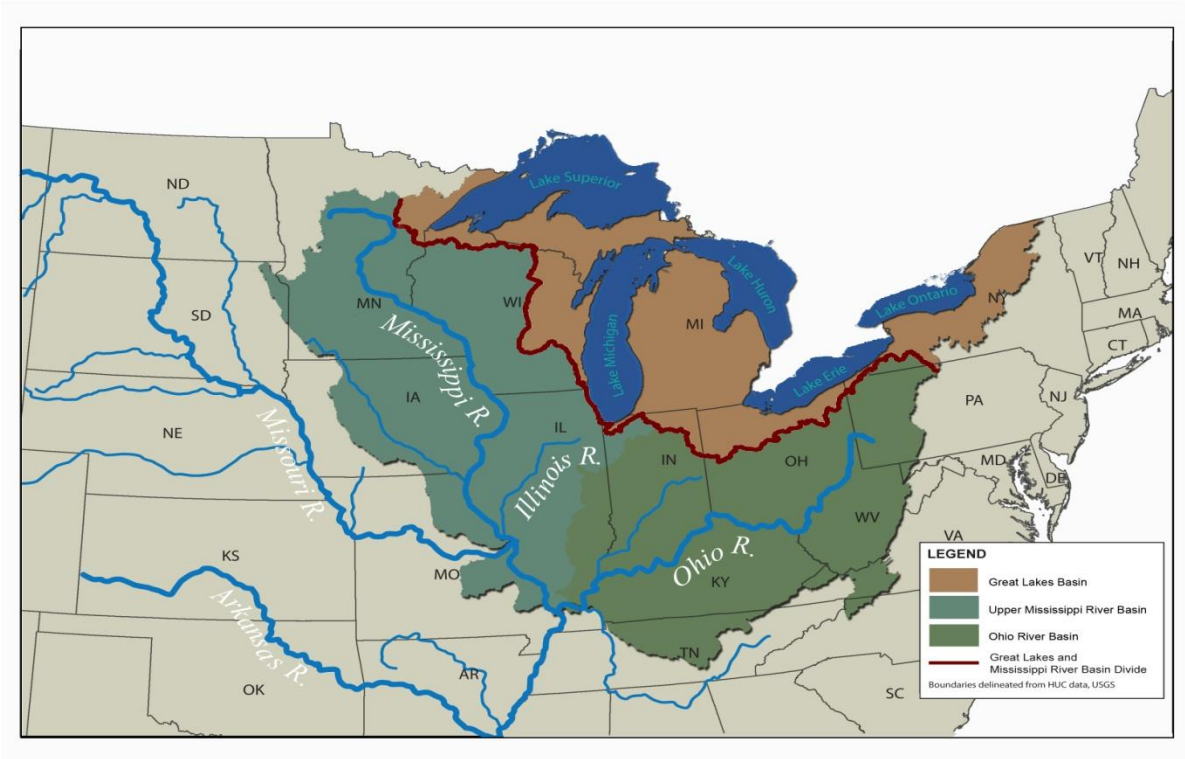
The following document outlines the methodology that was utilized to generate the baseline assessment of the commercial fisheries in the Great Lakes, Upper Mississippi River (UMR), and Ohio River Basins. The derivation of the focus areas, data collection procedures and data analysis methodologies are explained in this appendix to the *Commercial Fisheries Assessment- U.S. Waters of the Great Lakes, Upper Mississippi River, and Ohio River Basins*.

FOCUS AREAS

The Fisheries Economics Team identified the study area for the *Commercial Fisheries Assessment- U.S. Waters of the Great Lakes, Upper Mississippi River, and Ohio River Basins* in compliance with the overall Great Lakes and Mississippi River Interbasin Study (GLMRIS) study area. The GLMRIS study area includes portions of the Great Lakes, Mississippi River, and Ohio River basins that fall within the United States. Potential aquatic pathways between the Great Lakes and Mississippi River and Ohio River Basins exist along the basins' shared boundary. This shared boundary is the primary concentration of the study.

The Detailed Study Area is the area where the largest economic, environmental and social impacts from alternative plans are anticipated to occur. The Detailed Study Area consists of the Upper Mississippi and Ohio River Basins (green) and the Great Lakes Basin (orange/brown). This study area is depicted in *Figure 1: GLMRIS Study Area Map.*

FIGURE 1: GLMRIS STUDY AREA MAP



GREAT LAKES BASIN

The Fisheries Economics Team examined the fisheries within the Great Lakes Basin in the following water bodies: Lake Michigan, Lake Superior, Lake Huron, Lake Erie and Lake Ontario[1]. Great Lakes tributaries were also considered for the analysis. Disjunct water bodies within the Great Lakes Basin were not assessed due to the fact that Aquatic Nuisance Species (ANS) cannot transfer via aquatic pathways to separate water bodies.

The Fisheries Economics Team contacted agencies (such as Departments of Natural Resources) in order to determine whether the Great Lakes tributaries that fell within their state boundaries supported commercial fishing activity during the analysis period (years 1989 through 2009). If this criterion was met, then the tributary was included in this economic assessment.

The final Great Lakes Basin study area includes the following water bodies: Lake Michigan, Lake Erie (and its tributaries that lie between Lorain, Ohio and Toledo, Ohio), Lake Superior, Lake Huron, and Lake Ontario[2].

UPPER MISSISSIPPI & OHIO RIVER BASINS

The Fisheries Economics Team examined the fisheries within the Upper Mississippi River Basin and the Ohio River Basin. In order to determine which streams to include in the baseline economic assessment, tribal commissions and state agencies (such as Departments of Natural Resources) were contacted in order to identify which streams supported commercial fishing activity at some point during the analysis period (years 1989 through 2009)[3].

In order to limit the fisheries analysis to the portions of these rivers that are at risk of being invaded by ANS via aquatic pathways, the GLMRIS Geographic Information System (GIS) Team located dams along the rivers. Working outward from Cairo, Illinois towards the rivers in the Upper Mississippi River Basin and Ohio River Basin, if an impassible dam was located, then the remaining portion of the river was excluded from the analysis.

For instance, since there were neither physical or technological barriers along the Illinois and Ohio Rivers that would prevent an ANS from transferring from the Great Lakes Basin into these rivers, the entire Illinois River and Ohio River were included in this analysis. However, the Coon Rapids Dam was located along the Upper Mississippi River in southern Minnesota and was determined to be a barrier to ANS transfer. Therefore, it is between Cairo, Illinois and the

[1] Note that the *Commercial Fisheries Assessment- U.S. Waters of the Great Lakes, Upper Mississippi River, and Ohio River Basins* will focus only on the commercial fisheries in U.S. waters. Canadian portions of the Great Lakes and their tributaries will not be included in the analysis due to the fact that they are outside the scope of the GLMRIS study.

[2] According to the Michigan Department of Natural Resources, no commercial fishing activity takes place on Lake St. Clair so it has been omitted from this analysis.

[3] Disjunct water bodies within the UMR and Ohio River Basins were not assessed due to the fact that Aquatic Nuisance Species (ANS) have limited ability to transfer via aquatic pathways to separate water bodies.

aforementioned dam in Coon Rapids, Minnesota that will be the focus of the UMR. This dam identification process was applied to all rivers in both basins.

The final Upper Mississippi River Basin study area includes the following rivers: the Upper Mississippi River, Illinois River, Kaskaskia River, Rock River, and Zumbro River. The final Ohio River Basin study area includes the: Ohio River, Wabash River, Cumberland River, Kentucky River, and Salt River.

DATA COLLECTION

The following discussion focuses on the data collection procedures that were employed in order to obtain harvest level and ex-vessel price[4] data for the fisheries in the Great Lakes, Upper Mississippi River, and Ohio River Basins.

AGENCY ASSISTANCE FOR THE GREAT LAKES BASIN

The *Commercial Fisheries Assessment - U.S. Waters of the Great Lakes, Upper Mississippi River, and Ohio River Basins* seeks to identify the current value of the fisheries in the Great Lakes, Upper Mississippi River, and Ohio River Basins.

In order to accomplish this task, the Fisheries Economics Team collaborated with fisheries specialists at state and inter-tribal agencies such as Departments of Natural Resources and the Great Lakes Indian Fish and Wildlife Commission, to obtain data regarding states' commercial fishing harvests and their associated ex-vessel values.

These agencies each collect commercial fishing harvest data from commercial fishermen on a monthly basis[5] for fisheries management purposes[6]. Note that all harvest levels and associated ex-vessel prices utilized to generate the *Commercial Fisheries Assessment - U.S. Waters of the Great Lakes, Upper Mississippi River, and Ohio River Basins* reflect those that are reported by the fishermen to state or inter-tribal agencies[7]. Irregularities or outliers in the data sets were

[4] Ex-vessel prices indicate the price per pound which the commercial fishermen received for their harvests.

[5] Note that some states collect commercial fishing harvest data (harvest level and ex-vessel price data) on a daily basis (such as Ohio's trap net fishermen harvesting from Lake Erie) while the Michigan Department of Natural Resources requires that state-licensed commercial fishermen report their harvests on an annual basis. However, the remaining state agencies require reporting on a monthly basis.

[6] Tribal commercial fishermen report their harvests to the tribes, which then report them to the inter-tribal agencies, who then provide the data to the state's Department of Natural Resources for fisheries management purposes.

[7] The use of this data has certain implications, the first being that the data that was utilized for the formation of the *Commercial Fisheries Assessment - U.S. Waters of the Great Lakes, Upper Mississippi River, and Ohio River Basins* is secondary data. Therefore, USACE did not have the ability to ensure that all data was reported in a consistent manner. It is assumed that there may be some misrepresentation of actual harvests, as well as some errors regarding data entry. USACE

responded to by: (1) contacting the state or inter-tribal agency to ascertain whether the irregularity in the data could be attributed to an event (ex: fewer fishing days due to flooding in a given year) or whether the irregularity in the data set resulted from an error in data entry (which resulted in an alteration of the data), or (2) finding that there was no identifiable reasoning as to why harvest data presented an outlier, in which case the data was left unaltered. These steps to ensure an accurate secondary data set are presented in Table 1.

TABLE 1: DATA LIMITATIONS

Category	Basin[1]	Limitation	Resolution
Data Collection	GL, UMR, OHR	Harvest data reflects the reporting completed by commercial fishermen.	The report outlines in the "Purpose of Commercial Fisheries Baseline Economic Assessment" section that the current value of the commercial fisheries is based upon "the most recent annual harvest data available from state agencies (or equivalents) and inter-tribal agencies or organizations." The report does not claim to have collected primary data.
Data Entry	GL, UMR, OHR	Since commercial fishermen report their harvest data to the state or tribe (which then reports it to their inter-tribal agency which reports it to the state), there are assumed to be at least some data entry errors.	For years during which there seem to be anomalies or outliers in the data, state/inter-tribal agencies were contacted in order to determine whether the oddity was a data entry error or whether a specific event caused a change in harvest levels or ex-vessel values. Changes that were or were not explained are identified in the report.
Data Availability	GL	The most recent annual harvest data (harvest levels and associated ex-vessel prices) were not available for all states for the most recent years (2010	Harvest data (harvest levels per species and associated ex-vessel prices) were requested for all years between 1989 and 2009 in order to provide the analyst with approximately 20 years of harvest data to analyze trends in harvest levels and ex-vessel values.

attempted to account for irregularities in the data by contacting state and inter-tribal agencies to make determinations as to why values in certain years appeared to be outliers. In some cases, harvest data fluctuations were attributed to data entry errors (which resulted in amendments to the data sets), while others were attributed to actual changes in the harvest due to fewer numbers of fishing days in a given year (which yielded no changes to the data sets). Other data irregularities that were not explained by these aforementioned reasons remained unaltered in order to preserve the integrity of the data.

		and 2011) due to lags in data entry.	
	UMR, OHR	The most recent annual harvest data (harvest levels and associated ex-vessel prices) were not available for all states for the most recent years (2006 through 2011) due to lags in data entry.	Harvest data (harvest levels per species and associated ex-vessel prices) were requested for all years between 1989 and 2005 in order to provide the analyst with approximately 16 years of harvest data to analyze trends in harvest levels and ex-vessel values.
Tribal Data Availability	GL	Several tribes bordering the Great Lakes participate in commercial fishing activities. Data provided by the states did not identify whether harvests, as reported to USACE, were solely state-licensed commercial fishing harvests or whether they included tribal harvests.	State agencies were contacted in order to distinguish whether commercial fishing harvest data, as reported by the state DNRs, included or excluded tribal commercial fishing harvests in order to avoid double-counting. It was found that all states keep separate records of tribal commercial fishing harvests.
	GL	The following tribes engage in commercial fishing activities, but did not provide harvest data for any year during the GL analysis period (1989 through 2009): 1854 Treaty Authority member tribes (Grand Portage Band of Lake Superior Chippewa Indians, Bois Forte Band of Lake Superior Chippewa Indians).	This report does not include any data from the 1854 Treaty Authority member tribes. These tribes border Lake Superior. This is noted in the Lake Superior portion of this report.

Missing Ex-Vessel Prices	GL, UMR, OHR	For certain years, ex-vessel price data was not available for specific species.	In order to allow for a quantitative analysis of all reported harvests, one of four methods was applied to generate proxies for missing ex-vessel prices.
Missing Harvest Levels	GL, UMR, OHR	For a few states, one year during the analysis period was reported to have a harvest level of zero despite harvest levels in previous and subsequent years.	State and inter-tribal agencies were contacted in order to obtain this missing data. If there was a reason that a harvest did not occur in this year, the harvest level remained a zero and the irregularity in the data was noted in the text. In the case where it was found that there was no identifiable reasoning as to why harvest data presented an outlier, the data was left unaltered and the irregularity was noted in the text.
1. GL refers to the Great Lakes Basin. UMR refers to the Upper Mississippi River Basin. OHR refers to the Ohio River Basin.			

All states bordering the following water bodies in the Great Lakes Basin were contacted: Lake Michigan, Lake Superior, Lake Huron, Lake Erie, and Lake Ontario. Further, inter-tribal agencies which are comprised of tribes that engage in fishing on the Great Lakes were contacted. These agencies include[8] the:

- Great Lakes Indian Fish and Wildlife Commission (GLIFWC), which is comprised of the following tribes that fish on Lake Superior:
    - Bay Mills Indian Community
    - Keweenaw Bay Indian Community
    - Lac Vieux Desert Band of Lake Superior Chippewa Indians
    - Bad River Band of Lake Superior Chippewa Indians of Wisconsin
    - Red Cliff Band of Lake Superior Chippewa Indians of Wisconsin
    - Lac du Flambeau Band of Lake Superior Chippewa Indians of Wisconsin
    - Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin
    - Sokaogon Chippewa Community of Wisconsin
    - St. Croix Chippewa Indians of Wisconsin
    - Mille Lacs Band of Ojibwe
    - Fond du Lac Band of Lake Superior Chippewa Indians of Minnesota

[8] Note that in addition to the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) and the Chippewa Ottawa Resource Authority (CORA), the 1854 Treaty Authority was also contacted. However, this inter-tribal organization did not contribute commercial fishing harvest data to this study effort.

The following map exemplifies the locations of the GLIFWC member tribes.

FIGURE 2: GLIFWC MEMBER TRIBES

- ❖ Chippewa Ottawa Resource Authority (CORA), which represents the following tribes that reside in Michigan and fish on Lake Michigan, Lake Superior, and Lake Huron:
    - Bay Mills Indian Community[9]
    - Grand Traverse Band of Ottawa Indians
    - Little River Band of Ottawa Indians
    - Little Traverse Bay Band of Odawa Indians
    - Sault Ste. Marie Tribe of Chippewa Indians of Michigan

[9] Note that the Bay Mills Indian Community is included as part of GLIFWC and CORA. GLIFWC reports on all harvests on Lake Superior, therefore CORA data for Lake Superior was not utilized since it was already encompassed in the GLIFWC data set. Note that the GLIFWC and CORA data did not distinguish harvests by each tribe, but rather, a total annual harvest for each species. Therefore, the assumption that all member tribes commercially harvest fish on the Great Lakes should not be made.

The following tables exhibit the agencies that were contacted in order to obtain commercial fishing harvest data.

TABLE 2: LAKE SUPERIOR AGENCY ASSISTANCE

Bordering States	Contributing Agencies
Minnesota	Minnesota Department of Natural Resources/ Great Lakes Indian Fish and Wildlife Commission (GLIFWC)
Wisconsin	Wisconsin Department of Natural Resources/ Great Lakes Indian Fish and Wildlife Commission (GLIFWC)
Michigan	Michigan Department of Natural Resources/ Great Lakes Indian Fish and Wildlife Commission (GLIFWC)

TABLE 3: LAKE MICHIGAN AGENCY ASSISTANCE

Bordering States	Contributing Agencies
Wisconsin	Wisconsin Department of Natural Resources
Illinois	Illinois Department of Natural Resources
Indiana	Indiana Department of Natural Resources
Michigan	Michigan Department of Natural Resources/ Chippewa Ottawa Resource Authority (CORA)

TABLE 4: LAKE HURON AGENCY ASSISTANCE

Bordering States	Contributing Agencies
Michigan	Michigan Department of Natural Resources/ Chippewa Ottawa Resource Authority (CORA)

TABLE 5: LAKE ERIE AGENCY ASSISTANCE

Bordering States	Contributing Agencies
Michigan	Michigan Department of Natural Resources
Ohio[1]	Ohio Department of Natural Resources
Pennsylvania	Pennsylvania Fish and Boat Commission
New York	New York State Department of Environmental Conservation
1. Ohio was the only state to report commercial fishing activity on Lake Erie's tributaries (between Lorain and Toledo, Ohio).	

TABLE 6: LAKE ONTARIO AGENCY ASSISTANCE

Bordering States	Contributing Agencies
New York	New York State Department of Environmental Conservation

TABLE 7: LAKE ST. CLAIR AGENCY ASSISTANCE

Bordering States	Contributing Agencies
Michigan	Michigan Department of Natural Resources[1]
1. According to the Michigan Department of Natural Resources, there is no commercial fishing activity on Lake St. Clair. Therefore, it is excluded from the commercial fisheries analysis.	

DATA CONTRIBUTION FOR THE GREAT LAKES BASIN

Each agency was requested to provide commercial harvest data for the period, 1989-2009. This data set of 21 years was determined by the Fisheries Economics Team and Natural Resources Team to be an appropriate duration over which the harvest data could be summarized and analyzed. Table 8 exemplifies the states/ inter-tribal agencies that were found to have commercial fishing activity at some point during the analysis period. Table 9 displays the years for which the harvest data was provided.

TABLE 8: GREAT LAKES COMMERCIAL FISHING ACTIVITY

State	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario
Minnesota	×				
Wisconsin	×	×			
Illinois					
Indiana					
Michigan	×	×	×	×	
Ohio				×	
Pennsylvania				×	
New York				×	×
GLIFWC	×				
CORA	×	×	×		
Note: There is no commercial fishing activity on Lake St. Clair according to the Michigan Department of Natural Resources.					

TABLE 9: DATA PROVIDED FOR THE GREAT LAKES

Great Lake	State/Agency	Data Provided[1]
Lake Superior	Minnesota	2000-2009
	Wisconsin	1989-2009
	Michigan	1989-2009
	GLIFWC	1996-2009
Lake Michigan	Wisconsin	1989-2009
	Illinois	1989-2009

	Michigan	1989-2009
	Indiana	1989-2009
	CORA	1990-2009
Lake Huron	Michigan	1989-2009
	CORA	1990-2009
Lake Erie	Michigan	1989-2009
	Ohio	1989-2009
	Pennsylvania	1989-2009
	New York	1999-2009
Lake Ontario	New York	1999-2009
1. Note that some states provided data in excess of the requested 20-year period. This is not reflected in the table. This table is included to provide the reader with an understanding of what data was available for the given time period.		

AGENCY ASSISTANCE FOR THE UMR AND OHIO RIVER BASINS:

State agencies were contacted in order to obtain commercial fishing harvest data for the water bodies in the Upper Mississippi River and Ohio River Basins. The following tables display which agencies were contacted in order to provide commercial fishing harvest data on the Upper Mississippi River, Illinois River, Kaskaskia River, Rock River, Zumbro River, Ohio River, Wabash River, Cumberland River, Kentucky River, and Salt River.

TABLE 10: UMR AGENCY ASSISTANCE

Bordering States	Contributing Agencies
Minnesota	Upper Mississippi River Conservation Committee
Iowa	Upper Mississippi River Conservation Committee
Missouri	Upper Mississippi River Conservation Committee
Wisconsin	Upper Mississippi River Conservation Committee
Illinois	Illinois Department of Natural Resources, Upper Mississippi Conservation Committee

TABLE 11: UMR TRIBUTARY AGENCY ASSISTANCE

River	Bordering State	Contributing Agency
Illinois	Illinois	Illinois Department of Natural Resources
Kaskaskia	Illinois	Illinois Department of Natural Resources
Rock	Illinois	Illinois Department of Natural Resources
Zumbro	Minnesota	Minnesota Department of Natural Resources

TABLE 12: OHIO RIVER AGENCY ASSISTANCE

Bordering States	Contributing Agencies
Illinois	Illinois Department of Natural Resources
Indiana	Indiana Department of Natural Resources

Kentucky	Kentucky Department of Fish and Wildlife
Ohio	Ohio Department of Natural Resources
West Virginia	Ohio Department of Natural Resources
Pennsylvania	Ohio Department of Natural Resources

TABLE 13: OHIO RIVER TRIBUTARY AGENCY ASSISTANCE

River	Bordering State	Contributing Agencies
Wabash	Illinois	Illinois Department of Natural Resources
	Indiana	Indiana Department of Natural Resources
Cumberland	Kentucky	Kentucky Department of Fish and Wildlife
Kentucky	Kentucky	Kentucky Department of Fish and Wildlife
Salt	Kentucky	Kentucky Department of Fish and Wildlife

DATA CONTRIBUTIONS FOR THE UMR & OHIO RIVER BASIN

Each agency for states bordering the rivers in the UMR and Ohio River Basins was requested to provide commercial fishing harvest data for the period 1989-2009. Table 14 exemplifies the Upper Mississippi River Basin states that were found to have commercial fishing activity at some point during this period. Table 15 exhibits the years for which the harvest data was provided.

TABLE 14: STATES WITH COMMERCIAL FISHING IN THE UMR BASIN

State	UMR	Illinois River	Kaskaskia River	Rock River	Zumbro River
Minnesota	×				×
Iowa	×				
Missouri	×				
Wisconsin	×				
Illinois	×	×	×	×	

TABLE 15: DATA PROVIDED FOR THE UMR BASIN

River	Bordering State	Data Provided[1]
Upper Mississippi River	Minnesota	1989-2005
	Iowa	1989-2005
	Missouri	1989-2005
	Illinois	1989-2005
	Wisconsin	1989-2005
Illinois River	Illinois	1989-2005
Kaskaskia River	Illinois	1989-2005

Rock River	Illinois	1989-2005
Zumbro River	Minnesota	1998-1999
Ohio River	Illinois	1989-2005
	Indiana	1999-2005
	Kentucky	1999-2005
	Ohio	N/A[2]
	West Virginia	N/A
	Pennsylvania	N/A
1. Note that some states provided data in excess of the requested 20-year period. This is not reflected in the table. This table is included to provide the reader with an understanding of what data was available for the given time period. 2. "N/A" indicates that these states do not commercially harvest fish on the given water body.		

Note that year 2005 is the most recent year for which all states were able to provide harvest data. Therefore, the analysis period of the Upper Mississippi River Basin is 1989 through 2005.

Table 16 exemplifies the Ohio River Basin states that were found to have commercial fishing activity at some point during this period. Table 17 exhibits the years for which the harvest data was provided.

TABLE 16: STATES WITH COMMERCIAL FISHING IN THE OHIO RIVER BASIN

State	Ohio River	Wabash River	Cumberland River	Kentucky River	Salt River
Illinois	×	×			
Indiana	×	×			
Kentucky	×		×	×	×
Ohio					
Pennsylvania					
West Virginia					

TABLE 17: DATA PROVIDED FOR THE OHIO RIVER BASIN

River	Bordering State	Data Provided[1]
Ohio River	Illinois	1995-2005
	Indiana	2006-2005
	Kentucky	1999-2005
Wabash River	Illinois	1989-2005
Cumberland River	Kentucky	1999-2005
Kentucky River	Kentucky	1999-2005
Salt River	Kentucky	1999-2001

1. Note that some states provided data in excess of the requested 20-year period. This is not reflected in the table. This table is included to provide the reader with an understanding of what data was available for the given time period.

Note that years 1999 through 2005 are the years that almost all were able to provide harvest data. Therefore, the analysis period for the Ohio River Basin is 1999 through 2005.

DATA ANALYSIS

The following discussion outlines the processes for generating harvest levels and values for commercially harvested species on each water body in the Great Lakes, Upper Mississippi River, and Ohio River Basins.

DATA ORGANIZATION

Each of the aforementioned state agencies in the Great Lakes, UMR, and Ohio River Basins was requested to provide commercial fishing harvest data for the years between 1989 and 2009[10]. The following data was requested of each state for each water body over the given time period: year, species, pounds harvested, and ex-vessel value[11]. The data, if not already done so, was organized in the following format. For example, Figure 3 exhibits the organizational structure of a given harvested species (Lake Whitefish) by the state of Michigan from Lake Michigan.

FIGURE 3: INITIAL ORGANIZATION OF COMMERCIAL HARVEST DATA

Year	Species Name	Total Catch (lbs)	Nominal Dockside Value ($/lb)
• 1989	• lake whitefish	• 2,023,896 lbs	• $0.97
• 1990	• lake whitefish	• 2,326,067 lbs	• $1.08
• ...	• lake whitefish	• ...	• ...
• 2009	• lake whitefish	• 855,780 lbs	• $1.28

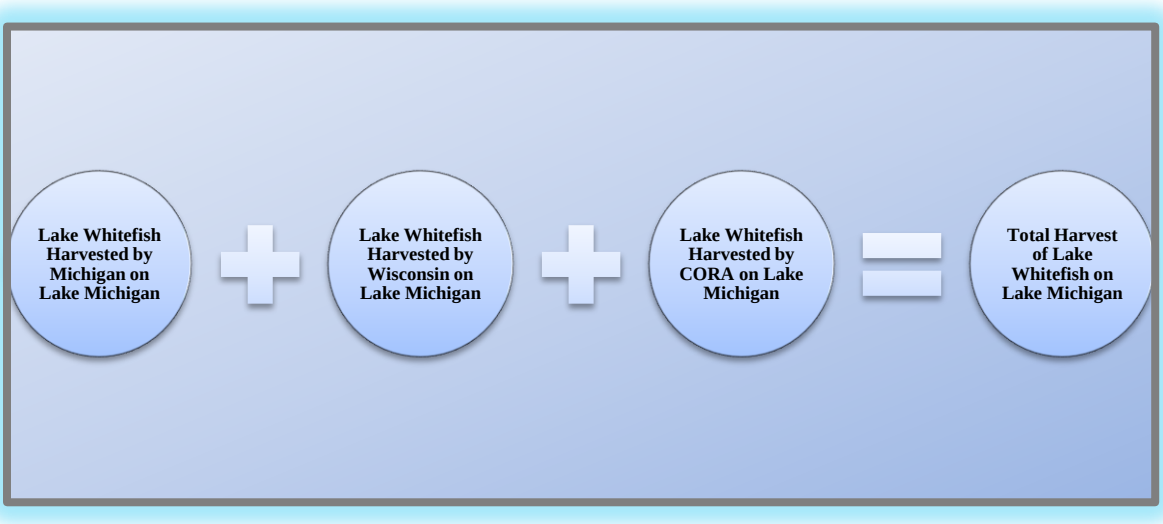
[10] Recall, this is not the analysis period for all basins. The analysis period for each basin is reflective of the available commercial harvest data from state agencies. The analysis period for the Great Lakes Basin is 1989 through 2009; the analysis period for the UMR Basin is 1989 through 2005; the analysis period for the Ohio River Basin is 1999 through 2005.

[11] This is the ex-vessel value of the species. For the purposes of this analysis, all ex-vessel values are presented as price per pound. These values were reported by the state in nominal values. At a later point in the analysis process, these nominal values were converted to current (2010) dollar values.

This same process was repeated for each species harvested by each state on each water body[12]. Therefore, a complete set of historical data was generated for all harvested species in the Great Lakes, Upper Mississippi River, and Ohio River Basins.

demonstrates how each data set for each state contributed to the analysis of the individual species harvested on each water body.

FIGURE 4: DATA COLLECTION CONCEPT



CONVERTING NOMINAL DOLLARS TO REAL DOLLARS

The total ex-vessel value of a given species in a given year is derived by the following equation:

EQUATION 1: EX-VESSEL VALUE

Ex-Vessel Value ($) = Total Catch (lbs) × Ex-Vessel Value ($/lb)

In order for the ex-vessel values to be input into this equation, they must be converted into a common year's value. This allows for ex-vessel values from $Year_1$ to be directly compared to $Year_2$,…,$Year_n$. The Producer Price Index was utilized to accomplish this task. The Producer Price Index (PPI) "is a family of indexes that measures the average change over time in the selling prices received by domestic producers of goods and services. PPIs measure price change from the perspective of the seller…PPIs are used to adjust other economic times series for price changes and to translate those series into inflation-free dollars" (Bureau, 2011).

[12] This methodology was applied to all water bodies in the Great Lakes, UMR, and Ohio River Basins.

State agencies provided ex-vessel value data in nominal dollars. The process for converting nominal ex-vessel values to ex-vessel values in 2010[13] dollars is as exemplified in *Equation 2: Ex-Vessel Value*.

EQUATION 2: EX-VESSEL VALUE

$$\textbf{Ex-Vessel Value}_{2010} = (\textbf{Ex-vessel Value}_{\text{year x}}) \times (\textbf{PPI}_{2010} / \textbf{PPI}_{\text{year x}})$$

For example, when converting the ex-vessel value of lake whitefish harvested by Michigan from Lake Michigan from 2002 into 2010 dollars (demonstrate in *Table 18: Example of Derivation of Current* Ex-Vessel Value), the aforementioned equation was applied.

TABLE 18: EXAMPLE OF DERIVATION OF CURRENT EX-VESSEL VALUE

Equation	$\text{Ex-vessel Value}_{2010\text{Dollars}} = (\text{Ex-vessel Value}_{2002}) \times (\text{PPI}_{2010} / \text{PPI}_{2002})$
Input Values	$\text{Ex-vessel Value}_{2010\ \text{Dollars}} = (\$0.89) \times (325.20/220.40)$
Final Value	$\text{Ex-vessel Value}_{2010\ \text{Dollars}} = \$1.31$
1. Note that the PPI values were generated by the Bureau of Labor Statistics for the category "other finfish."	

Upon converting the nominal dollars to 2010 dollars, the analyst was then able to apply the ex-vessel value formula. Table 19: Lake Whitefish Ex-Vessel Value Derivation exemplifies the complete process of calculating the ex-vessel values for the years 1989 to 2009 for the commercial harvest of Lake Whitefish by the State of Michigan on Lake Michigan. This procedure was applied to each harvested species in each water body[14] by each bordering state.

[13] "The Producer Price Index is a family of indexes that measures the average change over time in the selling prices received by domestic producers of goods and services. PPIs measure price change from the perspective of the seller. This contrasts with other measures, such as the Consumer Price Index (CPI), that measure price change from the purchaser's perspective. Sellers' and purchasers' prices may differ due to government subsidies, sales and excise taxes, and distribution costs" (Bureau, 2011). Producer price index (PPI) number "02230199" for "other finfish" was utilized for converting nominal dollars to 2010 dollars. Note that this PPI was utilized instead of the average PPI for all goods and services in order to ascertain a change in price that more accurately reflects that of fish. The National Oceanic and Atmospheric Association was contacted in order to determine the specific water bodies that the fish in PPI category "other finfish" was comprised of. It was found that this PPI reflects changes in prices of saltwater fish rather than freshwater fish. However, this PPI was utilized due to the fact that it is assumed that it more accurately reflects the changes in prices of freshwater fish than does the average PPI (for all goods and services). During the analysis process, year 2010 was the most recent year for which the Bureau of Labor Statistics published an annual PPI for the "other finfish" category.

[14] "Each water body" refers to each analyzed water body in the Great Lakes, UMR, and Ohio River Basins.

TABLE 19: LAKE WHITEFISH EX-VESSEL VALUE DERIVATION

Year	Total Catch (lbs) (a)	Ex-vessel Value ($/lb) (b)	PPI: Current Year (c)	PPI: 2010 (d)	Ex-vessel Value (2010 $) e = b × (d/c)	Total Ex-vessel value (2010 $) f = a × e
2005	823,696	$0.58	253.3	325.20	$0.75	$617,251
2006	1,263,025	$0.56	297.8	325.20	$0.61	$773,554
2007	1,044,310	$0.55	328.0	325.20	$0.55	$573,118
2008	953,686	$0.54	322.0	325.20	$0.55	$522,156
2009	855,780	$1.28	278.6	325.20	$1.49	$1,274,370
1. Year 1992 was the first year for which the BLS generated a Producer Price Index for the "other finfish" category, PPI series ID "WPU02230199."						

MISSING HARVEST LEVELS:

Some states reported annual harvest levels with zeroes for one or more of the years during the analysis period. In order to preserve the integrity of the report's purpose, which is to establish the current economic value of the commercial fisheries in the U.S. waters of the Great Lakes, Upper Mississippi River, and Ohio River Basins based on the most recent annual harvest data *available* from state agencies (or equivalents), these zeroes were assumed to be an accurate representation of the total harvest for each state (or inter-tribal agency) in the given year.

However, for some data sets, zeroes appeared in a year with relatively high harvest levels in previous and subsequent years. In this case, the appropriate agency was contacted in order to ensure that the zero was an accurate representation of the harvest. If the zero was accurate, the data was not altered. However, if the data was found to be a data entry error, the zero was replaced with the appropriate value.

MISSING EX-VESSEL VALUES:

Several states were able to provide harvest level data for the full analysis period. However, some ex-vessel values were unavailable for various years, especially during the late 1980s and 1990s. In order to capture the total ex-vessel value during these years, four techniques were employed to generate surrogates for these missing ex-vessel values. Table 20 exemplifies when each of the methods was utilized. These methods were selected in order to reflect the assumption that ex-vessel prices (dollars per pound) are similar across states harvesting in the same basin.

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TABLE 20: CHOOSING A METHOD TO GENERATE EX-VESSEL VALUE PROXIES

State's data set identifies a specific species harvested on a given water body	State's data set identifies an ex-vessel value for the specific species on a given water body in a given year	Another state bordering the same water body, harvesting the same species in the same year has an ex-vessel value available	Other states bordering the other water bodies in the same basin and harvest the same species have ex-vessel value data available for the given year	Same state has a ex-vessel value available for the given species on the given water body in a subsequent year	Method Employed
Yes	No	Yes	→		**Method 1**
Yes	No	No	Yes	→	**Method 2**
Yes	No	No	No	Yes	**Method 3**
No/Yes	No	No	No	No	**Method 4**

The following discussion will pertain to the four methods that were employed in order to generate ex-vessel values for harvested species without associated ex-vessel values readily available by the states. A proxy for the ex-vessel value was only used when the harvest data for a given year was missing the associated ex-vessel value.

METHOD 1

Method 1 was utilized when:

- State's data set identified a specific species harvested on a given water body
- State's data set did not identify a ex-vessel value for the specific species on a given water body in a given year
- Another state, bordering the same water body, harvesting the same species in the same year has a ex-vessel value available

The first effort to generate a value to be used as a proxy for the missing ex-vessel value involved producing the average ex-vessel value of other states that also harvested the given species in the given year on the given water body. This allows for prices to reflect fluctuations in the market over time. Table 21 demonstrates an example of where this procedure was applied.

TABLE 21: MISSING EX-VESSEL VALUE: CASE 1

Water Body	Bordering States/ Tribes	Species	Year	Harvest Level Data Provided (Y/N)	Ex-vessel Value Provided (Y/N)
Lake Superior	Minnesota	Lake Trout	2000	Y	Y
Lake Superior	Wisconsin	Lake Trout	2000	Y	**N**
Lake Superior	Michigan	Lake Trout	2000	Y	Y
Lake Superior	GLIFWC/CORA	Lake Trout	2000	Y	N

As is shown in Table 21, Michigan and Minnesota were able to provide complete harvest data for year 2000. Wisconsin was able to provide harvest level data but not ex-vessel value data. In this case, the average nominal ex-vessel value of Michigan and Minnesota's harvest of Lake Trout in year 2000 on Lake Superior was used as a proxy for the ex-vessel value of lake char harvested by Wisconsin. This analysis process is shown in Table 22. This process was repeated for GLIFWC and CORA ex-vessel prices for lake trout.

TABLE 22: EVALUATION METHOD FOR MISSING EX-VESSEL VALUE- CASE 1

Current Year	Total Catch (lbs) (a)	Nominal Ex-vessel Value (b)	PPI: Year of harvest (c)	PPI: 2010 (d)	Ex-vessel Value (2010 $) e = b × (d/c)	Total Ex-vessel value (2010 $) f = a × e
2000	15,549	=average (MI, MN) =$1.12	218.2	325.2	$1.66	$25,855

METHOD 2

Method 2 was utilized when:

- State's data set identified a specific species harvested on a given water body
- State's data set did not identify a ex-vessel value for the specific species on a given water body in a given year
- Another state, bordering the same water body, harvesting the same species in the same year doesn't have ex-vessel value available
- Other states bordering other water bodies in the same basin and harvest the given species have ex-vessel value data available for the given year

In the case where there was no state on the same waterbody from which to borrow a nominal ex-vessel value to use as a proxy for the missing ex-vessel value, a second method was employed. This involved using the average ex-vessel value of all other states in the basin which harvested the given species.

An example of where this method was utilized is Kentucky's harvest of suckers on the Ohio River. The Kentucky Department of Natural Resources was unable to provide ex-vessel values so the average value of suckers in the basin was utilized as a surrogate for this missing ex-vessel value.

TABLE 23: MISSING EX-VESSEL VALUES- CASE 3

Water Body	Bordering State	Species	Year	Ex-vessel Value Provided (Y/N)
Ohio River	Kentucky	Suckers	2004	**N**
Illinois River	Illinois	Suckers	2004	Y
UMR	Illinois	Suckers	2004	Y
UMR	Iowa	Suckers	2004	Y
UMR	Minnesota	Suckers	2004	Y
UMR	Missouri	Suckers	2004	Y
UMR	Wisconsin	Suckers	2004	Y

Therefore, the surrogate ex-vessel value is an average of all other states' ex-vessel values for suckers in the basin in year 2004. This is exemplified in the following table.

TABLE 24: EVALUATION METHOD FOR MISSING EX-VESSEL VALUE- CASE 3

Current Year	**Total Catch (lbs)** **(a)**	**Nominal Ex-vessel Value** **(b)**	**PPI: Current Year** **(c)**	**PPI: 2010** **(d)**	**Ex-Vessel Value (2010 $)** **e = b × (d/c)**	**Total Ex-vessel value (2010 $)** **f = a × e**
2004	1,170	=average ($IL_{IL\ River}$, IL_{UMR}, IA_{UMR}, MN_{UMR}, MO_{UMR}, WI_{UMR})	207.6	325.2	$0.24	$278

METHOD 3

Method 3 was utilized when:

- State's data set identified a specific species harvested on a given water body
- State's data set did not identify a ex-vessel value for the specific species on a given water body in a given year
- Another state, bordering the same water body, harvesting the same species in the same year doesn't have ex-vessel value available
- Other states bordering the other water bodies in the same basin and harvest the given species do not have ex-vessel value data available for the given year
- The same state has an ex-vessel value available for the given species on the given water body in a subsequent year

In the case where there was no state from which to borrow a nominal ex-vessel value to use as a proxy for the missing ex-vessel value, then a third method for generating a ex-vessel value was

utilized. This method involved utilizing a subsequent year's value and price-adjusting the value to the missing year.

For instance, this was the case for Iowa's harvest of shovelnose sturgeon roe. Ex-vessel value data was available for recent years but not earlier years. Table 25 demonstrates an example of where this procedure was applied.

TABLE 25: MISSING EX-VESSEL VALUE: CASE 2

Water Body	Bordering State	Species	Year	Ex-Vessel Value Provided (Y/N)
Upper Mississippi River	Iowa	Shovelnose Sturgeon Roe	2000	**N**
Upper Mississippi River	Iowa	Shovelnose Sturgeon Roe	2001	Y

In this case, the year 2001 nominal value was adjusted to year 2000 price levels, and then re-adjusted to 2010 price levels. This is exemplified in the table below.

TABLE 26: EVALUATION METHOD FOR MISSING EX-VESSEL VALUE- CASE 2

Current Year	Ex-vessel Value (2001$) (a)	PPI: 2001 (b)	PPI: 2000 (c)	Ex-Vessel Value (2000$) d = a × (c/b)	PPI: 2010 (e)	Ex-Vessel Value (2010$) f = d × (e/c)
2000	= year 2001 value =$25.00	236.6	218.2	=$23.06	325.2	=$34.36

METHOD 4

Method 4 was utilized when:

- State's data set did or did not identify a specific species harvested on a given water body
- State's data set did not identify an ex-vessel value for the group of species on a given water body in a given year
- Another state, bordering the same water body, harvesting the same group of species in the same year doesn't have ex-vessel value available
- Other states bordering the other water bodies in the same basin do not have ex-vessel value data available for the given year
- The same state does not have a ex-vessel value available for the given group of species on the given water body in a subsequent year

In this case, the average ex-vessel value of all other species harvested by the state in that given year was used as a proxy for the missing ex-vessel value of the "other species" category. Since the list of "other species" did not include roe in any of the data sets, the ex-vessel value of roe was excluded from this average[15].

This was the case for Kentucky's harvest of "other" species on the Ohio River. The derivation of Kentucky's ex-vessel value for "other" species in the year 2004 is exemplified in the table below.

TABLE 27: EVALUATION METHOD FOR MISSING EX-VESSEL VALUE- CASE 4

Current Year	Total Catch (lbs) (a)	Nominal Ex-Vessel Value (b)	PPI: Year of harvest (c)	PPI: 2010 (d)	Ex-Vessel Value (2010 $) e = b × (d/c)	Total Ex-Vessel Value (2010 $) f = a × e
2004	83	=average (all other species harvested by KY on the Ohio River)	207.6	325.2	$0.44	$12,336

The following tables exhibit the number of times that methods 1 through 4 were employed for each state bordering each water body in each basin for the baseline period (2005-2009 for the Great Lakes Basin; 2001-2005 for the Upper Mississippi River and Ohio River Basins).

TABLE 28: EX-VESSEL VALUE APPROXIMATTIONS- GL BASIN

Basin	State	Water Body	Years Analyzed	# of Years Analyzed	# of Species Analyzed	# of Ex-Vessel Values Calculated	Method 1	Method 2	Method 3	Method 4
GL	IL	Lake Mich.	2005-2009	5	2	10	0	0	0	0
GL	IN	Lake Mich.	2005-2009	5	5	25	0	0	0	0
GL	MI	Lake Erie	2005-2009	5	14	70	0	0	0	0
GL	MI	Lake	2005-	5	22	110	0	0	0	0

[15] Roe have significantly higher ex-vessel values that fish; therefore the analyst excluded this from the average ex-vessel value calculation. This preserved the integrity of the approximated value.

		Huron	2009							
GL	MI	Lake Mich.	2005-2009	5	11	55	0	0	0	0
GL	MI	Lake Sup.	2005-2009	5	10	50	0	0	0	0
GL	MN	Lake Sup.	2005-2009	5	10	50	0	0	0	0
GL	NY	Lake Erie	2005-2009	5	1	5	0	0	0	0
GL	NY	Lake Ont.	2005-2009	5	6	30	0	6	0	0
GL	OH	Lake Erie	2005-2009	5	10	50	0	34	0	0
GL	PA	Lake Erie	2005-2009	5	13	65	40	0	0	15
GL	WI	Lake Sup.	2005-2009	5	6	30	0	0	0	0
GL	WI	Lake Mich.	2005-2009	5	5	25	0	1	0	0
					Total	**575**	**40**	**41**	**0**	**15**
						Percent of Total	**7%**	**7%**	**0%**	**3%**
									Percent Estimated	**17%**

TABLE 29: EX-VESSEL VALUE APPROXIMATIONS- UMR BASIN

Basin	State	Water Body	Years Analyzed	# of Years Analyzed	# of Species Analyzed	# of Ex-Vessel Values Calculated	Method 1	Method 2	Method 3	Method 4
UMR	IL	Illinois River	2001-2005	5	2	19	95	0	0	0
UMR	IL	Kaskaskia River	2001-2005	5	5	18	90	0	0	0
UMR	IL	Rock River	2001-2005	5	14	10	50	0	0	0
UMR	IL	UMR	2001-2005	5	22	19	95	0	0	0
UMR	IL	Illinois River (Roe[1])	2001-2005	5	11	1	5	0	0	0
UMR	IL	UMR (Roe[1])	2001-2005	5	10	2	10	4	0	0
UMR	IA	UMR	2001-	5	10	14	70	3	0	0

			2005							
UMR	MN	UMR	2001-2005	5	1	17	85	5	0	0
UMR	MO	UMR	2001-2005	5	6	18	90	2	0	0
UMR	WI	UMR	2001-2005	5	10	18	90	14	0	0
					Total	**680**	**28**	**0**	**0**	**0**
						Percent of Total	**4%**	**0%**	**0%**	**0%**
									Percent Estimated	**4%**
1. Illinois' roe harvests were included in separate data sets.										

TABLE 30: EX-VESSEL VALUE APPROXIMATION: OHIO RIVER BASIN

Basin	State	Water Body	Years Analyzed	# of Years Analyzed	# of Species Analyzed	# of Ex-Vessel Values Calculated	Method 1	Method 2	Method 3	Method 4
Ohio River	IL	Ohio River	2001-2005	5	17	85	0	0	0	0
Ohio River	IL	Wabash River	2001-2005	5	19	95	0	0	0	0
Ohio River	IL	Ohio River (Roe[1])	2001-2005	5	2	10	0	0	2	0
Ohio River	IL	Wabash River (Roe[1])	2001-2005	5	1	5	0	0	2	0
Ohio River	IN	Wabash River	2001-2005	5	9	45	35	0	0	5
Ohio River	IN	Ohio River	2001-2005	5	7	35	28	0	0	5
Ohio River	KY	Cumberland River	2001-2005	5	13	65	53	0	2	6
Ohio River	KY	Kentucky River	2001-2005	5	12	60	0	55	0	5
Ohio River	KY	Ohio River	2001-2005	5	16	80	71	0	4	5
					Total	**480**	**187**	**55**	**10**	**26**
						Percent of Total	**39%**	**11%**	**2%**	**5%**
									Percent Estimated	**58%**
1. Illinois' roe harvests were included in separate data sets.										

CATEGORIZING SPECIES IN EACH WATER BODY:

Recall that this *Commercial Fisheries Economic Baseline Assessment* is intended to serve as part one of a three-part process.

The first is to establish the current value of the commercial fisheries in the Great Lakes and Upper Mississippi River basins. This is accomplished via the *Commercial Fisheries Baseline Economic Assessment*.

The second part is to ascertain how the value of the fisheries would change in the event of aquatic nuisance species (ANS) transfer between the basins. In order for the baseline assessment to prepare the framework for the without-project condition, the GLMRIS Natural Resources Team (NRT) was consulted in order to determine a method of aggregating the data.

It was determined that the harvest data for the species in each water body should be categorized by Family and ecological similarities. Habitat utilization, feeding regimes, and other life history characteristics were used to group species together using letter categories. By categorizing species in this manner, the potential effects of aquatic nuisance species can be easily identified based on ecological overlap. For example, the introduction of an invasive filter feeder could have significant impacts on any of the commercial fish species that are also filter feeders. The groupings are explained in the following:

A- This group consists of members from the families gars (Lepisosteidae) and bowfins (Amiidae). These groups of fish are found in back water habitat and primarily feed on other fish.

B- Paddlefish (*Polyodon spatula*), mooneyes (*Hiodon* spp.), shads and herrings (Clupeidae), and two species from the minnows and carps family (bighead carp and silver carp) are grouped together. These fish are filter feeding species that inhabit the upper portions of the water column.

C- Minnows and Carps (Cyprinidae) make up this category. These fish are omnivores that consume everything from macrophytes to insects as they scavenge a diverse array of habitats.

D- These fish are primarily benthic feeders where they forage on macroinvertebrates. Most species of suckers (Catostomidae) are categorized in this group.

E- Two species of sucker (river redhorse *Moxostoma carinatum* and greater redhorse *Moxostoma valenciennesi*) as well as the only freshwatermember of the drum family (Sciaenidae: *Aplodinotus grunniens*) are grouped together because they primarily feed on mollusks.

F- This group consists of the catfishes. Catfish (Ictaluridae) are predatory; however they tend to be more general in their consumption of food. They will eat everything from macroinvertebrates to fish.

G- One species of smelt (Osmeridae: *Osmerus mordax*) and the whitefishes (Salmonidae: Coregoninae) are classified here. This group of fish spends much of their time in deeper waters and filter feed zooplankton and possum shrimp *Mysis relicta*. The rainbow smelt does make migrations and deviate to feeding on fish at larger sizes, but primarily spend much of their time in deep water feeding on plankton.

H- One members of the true cod family, burbot (Gadidae: *Lota lota*) and the salmons, trouts and chars Salmonidae: Salmoninae are predators of the Great Lakes. Their early life stages are dependent on possum shrimp as well.

I- Temperate bass (Moronidae), sunfishes (Centrarchidae), and perches (Percidae) are different groups of fish that share similar traits and therefore are combined for the purpose of this study. These families are often found in riverine systems and the littoral zone of lakes in which they feed on variety of organisms at different stages of their life. As juveniles, all three groups prey on zooplankton and as adults feed on insects and fish.

J- This group consists of the sturgeon family (Acipenseridae). These fish are benthic fish that consume everything from mollusks to fish.

K- Freshwater eels are represented by one species, the American eel (*Anguilla rostrata*), which is catadromous, meaning they migrate from freshwater to saltwater to spawn. Their diet includes fish, insects, frogs, and they scavenge for decaying organisms.

Table 31: Harvestable Species in the Great Lakes Basin, which categorizes all harvestable species on the Great Lakes, was provided by the Natural Resources Team.

TABLE 31: HARVESTABLE SPECIES IN THE GREAT LAKES BASIN

Family	Species	Common Name	Native/ Non-Native	Categorization Letter
Bowfin	*Amia calva*	bowfin	Native	A
Shads & Herrings	*Alosa psuedoharengus*	alewife	Non-Native	B
	Dorosoma cepedianum	gizzard shad	Native	B
Minnows & Carps	*Cyprinus carpio*	common carp	Non-Native	C
	Carassius auratus	goldfish	Non-Native	C
Suckers	*Ictiobus niger*	black buffalo	Native	D
	Ictiobus cyprinellus	bigmouth buffalo	Native	D
	Ictiobus bubalus	smallmouth buffalo	Native	D
	Moxostoma carinatum	river redhorse	Native	E
	Moxostoma valenciennesi	greater redhorse	Native	E
	Moxostoma duquesnei	black redhorse	Native	D
	Moxostoma erythrurum	golden redhorse	Native	D
	Moxostoma macrolepidotum	shorthead redhorse	Native	D
	Moxostoma anisurum	silver redhorse	Native	D
	Carpiodes cyprinus	quillback	Native	D
Bullhead Catfishes	*Ictalurus punctatus*	channel catfish	Native	F
	Ameiurus melas	black bullhead	Native	F
	Ameiurus natalis	yellow bullhead	Native	F
	Ameiurus nebulosus	brown bullhead	Native	F
Smelts	*Osmerus mordax*	rainbow smelt	Non-Native	G
Whitefishes[1]	*Coregonus alpenae*	longjaw cisco	Native	G
	Coregonus artedi	lake herring	Native	G

	Coregonus clupeaformis	lake whitefish	Native	G
	Coregonus hoyi	bloater	Native	G
	Coregonus johannae	deepwater cisco	Native	G
	Coregonus kiyi	kiyi	Native	G
	Coregonus nigripinnis	blackfin cisco	Native	G
	Coregonus reighardi	shortnose cisco	Native	G
	Coregonus zenithicus	shortjaw cisco	Native	G
	Prosopium cylandraceum	menominee	Native	G
Salmons, Trouts & Chars	*Salvelinus namaycush*	lake char[2]	Native	H
	Salvelinus namaycush x fontinalis	splake[3]	Native	H
	Oncorhynchus tshawytscha	Chinook salmon	Non-Native	H
	Oncorhynchus kisutch	coho salmon	Non-Native	H
	Oncorhynchus mykiss	rainbow trout	Non-Native	H
	Salmo trutta	European brown trout	Non-Native	H
True Cods	*Lota lota*	burbot	Native	H
Temperate Bass	*Morone chrysops*	white bass	Native	I
	Morone americana	white perch	Non-Native	I
Sunfishes	*Ambloplites rupestris*	rock bass	Native	I
	Pomoxis nigromaculatus	black crappie	Native	I
	Pomoxis annularis	white crappie	Native	I
Perches	*Sander vitreus*	walleye	Native	I
	Perca flavescens	yellow perch	Native	I
Drums	*Aplodinotus grunniens*	freshwater drum[4]	Native	D

1. Chub, chubs, herring, whitefish, ciscos are all one species or another of the whitefish family.
2. Lean lake trout, fat lake trout and siscowet are all morphs of lake char.
3. Hybrid between lake char and brook char.
4. Also called sheepshead.

This same methodology was applied when aggregating the states' harvest data for the water bodies within the Upper Mississippi River basin. All harvestable fish are listed in *Table 32: Harvestable Fish Species in the UMR and Ohio River Basins.*

TABLE 32: HARVESTABLE FISH SPECIES IN THE UMR AND OHIO RIVER BASINS

Family	Species	Common Name	Native/ Non-Native	Categorization Letter
Sturgeons	*Scaphirhynchus platorynchus*	shovelnose sturgeon	Native	J
Paddlefish	*Polyodon spatula*	paddlefish	Native	B
Gars	*Lepisosteus osseus*	longnose gar	Native	A
	Lepisosteus platostomus	shortnose gar	Native	A
	Lepisosteus oculatus	spotted gar	Native	A
Bowfins	*Amia calva*	bowfin	Native	A
Mooneyes	*Hiodon tergisus*	mooneye	Native	B
	Hiodon alosoides	goldeye	Native	B
Freshwater Eels	*Anguilla rostrata*	American eel	Native	K
Shads & Herrings	*Alosa chrysochloris*	skipjack herring	Native	B
	Dorosoma cepedianum	gizzard shad	Native	B
Minnows & Carps	*Cyprinus carpio*	common carp	Non-native	C
	Ctenopharyngodon idella	grass carp	Non-native	C
	Hypophthalmichthys nobilis	bighead carp	Non-native	B
	Hypophthalmichthys molitrix	silver carp	Non-native	B
Suckers	*Ictiobus niger*	black buffalo	Native	D
	Ictiobus cyprinellus	bigmouth buffalo	Native	D
	Ictiobus bubalus	smallmouth buffalo	Native	D

	Moxostoma carinatum	river redhorse	Native	E
	Moxostoma valenciennesi	greater redhorse	Native	E
	Moxostoma duquesnei	black redhorse	Native	D
	Moxostoma erythrurum	golden redhorse	Native	D
	Moxostoma macrolepidotum	shorthead redhorse	Native	D
	Moxostoma anisurum	silver redhorse	Native	D
	Carpiodes cyprinus	quillback	Native	D
	Carpiodes carpio	river carpsucker	Native	D
	Carpiodes velifer	highfin carpsucker	Native	D
Bullhead Catfishes	*Ictalurus punctatus*	channel catfish	Native	F
	Ictalurus furcatus	blue catfish	Native	F
	Ameiurus melas	black bullhead	Native	F
	Ameiurus natalis	yellow bullhead	Native	F
	Ameiurus nebulosus	brown bullhead	Native	F
	Pylodictis olivaris	flathead catfish	Native	F
Drums	*Aplodinotus grunniens*	freshwater drum	Native	E

AGGREGATING HARVEST DATA

These groupings were used to aggregate the commercial harvest data provided by each state for each water body. For example, four states (Michigan, New York, Ohio, and Pennsylvania) were found to have engaged in commercial fishing activities on Lake Erie between the years of 1989 and 2009.

Each state harvested one or multiple species during 1989 through 2009 timeframe. All harvests were categorized into families, as displayed in the tables below.

TABLE 33: LAKE ERIE HARVEST DATA BY FISHERY FAMILY

State	Suckers				Minnows & Carps		Bullhead & Catfishes	
	bigmouth buffalo	quillback	sucker	redhorse	common carp	goldfish	channel catfish	bullhead
MI	×	×	×		×	×	×	×
NY								
OH	×	×	×		×	×	×	×
PA			×	×			×	×

State	Shads, Herrings & Whitefishes		Temperate Bass & Perches				Drums	Cods
	gizzard shad	lake whitefish	white bass	white perch	yellow perch	walleye	freshwater drum	burbot
MI	×	×	×	×			×	
NY					×			

OH	×	×	×	×	×		×	×
PA		×	×	×	×	×	×	×

Each species' annual harvest levels and ex-vessel values (for all years between 1989 and 2009) were then aggregated individually. For instance, two states (Michigan and Ohio) harvested bigmouth buffalo at some point during the 21-year period. The following tables display the harvest data for these two states for the most recent five years worth of data.

TABLE 34: MICHIGAN'S HARVEST OF BIGMOUTH BUFFALO ON LAKE ERIE

Species	Year[1]	Harvest Level (lbs)	Ex-Vessel Value ($/lb)	Ex-Vessel value ($)
bigmouth buffalo	2005	96,621	$0.75	$72,407
bigmouth buffalo	2006	85,269	$0.72	$61,421
bigmouth buffalo	2007	215,282	$0.42	$91,176
bigmouth buffalo	2008	142,726	$0.44	$63,333
bigmouth buffalo	2009	130,301	$0.59	$76,520
1. This analysis process was applied to all years between 1989 through 2009 for the Great Lakes Basin, all years between 1989 and 2005 for the Upper Mississippi River Basin, and 1999 through 2005 for the Ohio River Basin.				

TABLE 35: OHIO'S HARVEST OF BIGMOUTH BUFFALO ON LAKE ERIE

Species	Year[1]	Harvest Level (lbs)	Ex-Vessel Value ($/lb)	Ex-Vessel Value[2] ($)
bigmouth buffalo	2005	230,426	$0.75	$172,680
bigmouth buffalo	2006	263,396	$0.72	$189,729
bigmouth buffalo	2007	268,884	$0.42	$113,878
bigmouth buffalo	2008	226,574	$0.44	$100,539
bigmouth buffalo	2009	371,632	$0.59	$218,242
1. This analysis process was applied to all years between 1989 through 2009 for the Great Lakes Basin, all years between 1989 and 2005 for the Upper Mississippi River Basin, and 1999 through 2005 for the Ohio River Basin. 2. Ex-vessel values are in 2010 dollars.				

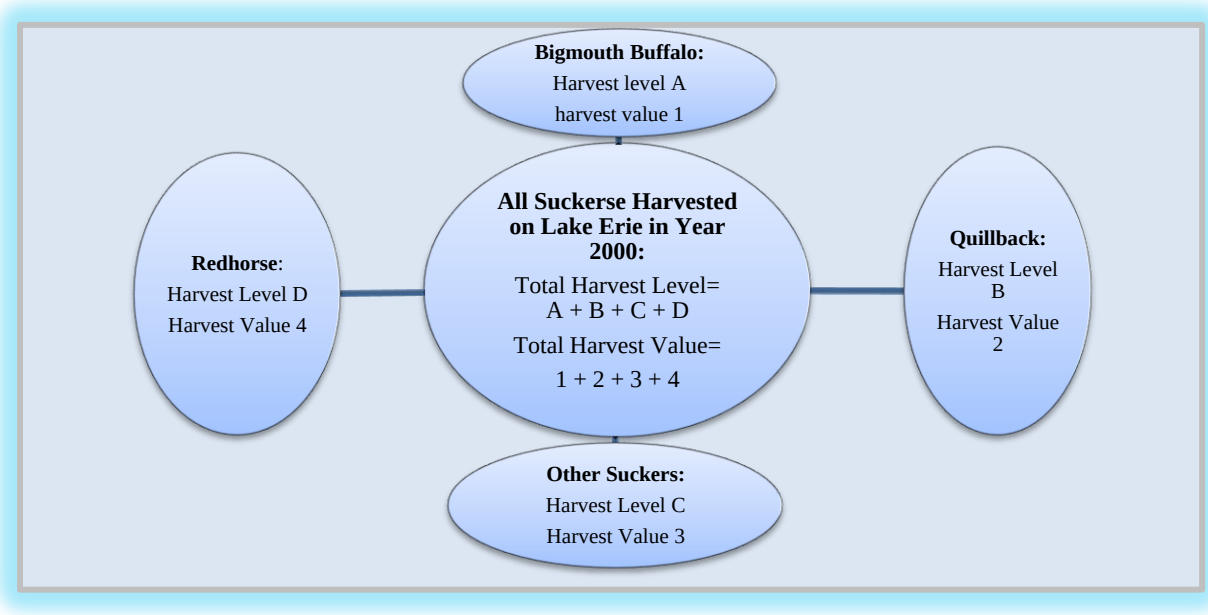
These annual harvest levels and ex-vessel values were aggregated in order to yield the total annual harvest levels and values for bigmouth buffalo between the years of 1989 and 2009. The output is exemplified in the table below.

TABLE 36: LAKE ERIE COMBINED HARVEST

Species	Year[1]	Harvest Level (lbs)	Ex-vessel value ($)
bigmouth buffalo	2005	327,047	$245,087
bigmouth buffalo	2006	348,665	$251,150
bigmouth buffalo	2007	484,166	$205,054
bigmouth buffalo	2008	369,300	$163,872
bigmouth buffalo	2009	501,933	$294,762
1. This analysis process was applied to all years between 1989 through 2009 for the Great Lakes Basin, all years between 1989 and 2005 for the Upper Mississippi River Basin, and 1999 through 2005 for the Ohio River Basin.			

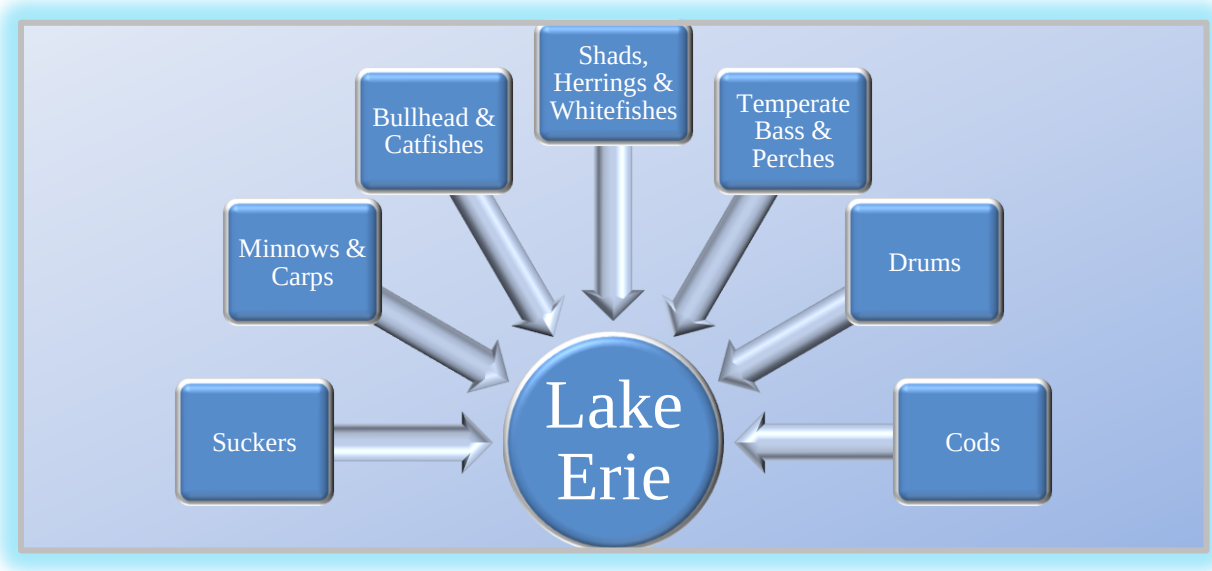
This process was repeated for all species in the "suckers" family. The harvest levels and values for species in a given family were then aggregated. Figure 5 demonstrates how the data was aggregated for year 2000. This was repeated for each year during the analysis period.

FIGURE 5: EXAMPLE OF AGGREGATION OF SPECIES



In order to determine the baseline value for each water body, the annual harvest levels and ex-vessel values for each family were aggregated. This yielded the total harvest level of all species for all years during the 21-year period. The following figure displays how the final data set for Lake Erie was aggregated.

FIGURE 6: FINAL AGGREGATION OF ALL SPECIES FOR LAKE ERIE



This aggregation of data by species, family and lake was repeated for the Great Lakes, Upper Mississippi River, Illinois River, and Ohio River.

BASELINE VALUES

In order to determine the baseline value of the each of the water bodies in the Great Lakes and Upper Mississippi River basins, the average harvest level and ex-vessel value were derived using the most recent five years of harvest data. Note that the averages of harvest levels and ex-vessel values for each water body were derived in order to present a more complete picture of recent trends in commercial fishing harvests and values. Annual fluctuation in harvest levels and associated ex-vessel values are apparent in the data. In order to ensure that the baselines best reflect typical harvest levels, an average of the most recent five years of data was generated to serve as baselines (current values) of the commercial fisheries in the Great Lakes, Upper Mississippi River, and Ohio River Basins.

LAKE OR RIVER BASELINE VALUES

For instance, the baseline harvest level for Lake Erie (and each of the other water bodies in the Great Lakes and Upper Mississippi River basins[16]) was computed by taking the average of the most recent five years of harvest level data. A five-year average was chosen in order to more closely approximate current conditions and to account for any annual fluctuations. This equation is shown below.

EQUATION 3: BASELINE HARVEST LEVEL

$$\textbf{Lake Erie Baseline Harvest Level} = \left(\sum_{Y=2005}^{2009} \text{Harvest Level}_Y\right) / 5$$

The baseline ex-vessel value for Lake Erie was computed by taking the average of the most recent five years of ex-vessel value data[17]. This equation is shown below.

EQUATION 4: BASELINE EX-VESSEL VALUE

$$\textbf{Lake Erie Baseline Ex-Vessel Value} = \left(\sum_{Y=2005}^{2009} \text{Ex-Vessel Value}_Y\right) / 5$$

BASIN BASELINE VALUES

In order to generate the baseline value of the entire Great Lakes basin, the annual harvest level and ex-vessel value data for each water body were aggregated for each year during the analysis period. The aggregation of the harvest data for each great lake yielded the total harvest levels and ex-vessel values of the commercial fisheries in the Great Lakes basin. This is exemplified in

[16] The water bodies analyzed in the Great Lakes basin include: Lake Erie, Lake Michigan, Lake Superior, Lake Huron and Lake Ontario. The water bodies analyzed in the Upper Mississippi River basin include: the Upper Mississippi River, the Illinois River and the Ohio River.

[17] These values were normalized to 2010 values.

Figure 7: Aggregation of data for the Great Lakes Basin.

FIGURE 7: AGGREGATION OF DATA FOR THE GREAT LAKES BASIN

The following table exemplifies the final data set for the Great Lakes Basin.

TABLE 37: GREAT LAKES BASIN COMBINED HARVEST

Year	Harvest Level (lbs)	Ex-Vessel Value[1] ($)
1989	17,049,851	N/A
1990	25,452,065	N/A
1991	27,250,050	$70,898,247
1992	29,266,160	$47,021,504
1993	25,602,611	$35,150,138
1994	25,731,343	$34,015,836
1995	25,072,325	$32,688,941
1996	25,463,107	$30,534,049
1997	25,379,091	$32,295,894
1998	24,364,309	$34,440,238
1999	21,998,403	$30,571,347
2000	19,038,064	$29,752,063
2001	19,085,109	$31,268,233
2002	17,127,967	$23,929,433
2003	16,871,047	$21,643,819
2004	17,188,250	$23,002,738
2005	18,742,477	$23,870,042
2006	19,269,090	$20,111,237
2007	19,372,565	$20,448,186
2008	20,332,880	$22,905,015
2009	19,007,042	$25,194,813

1. Note that the Bureau of Labor Statistics did not start publishing producer price index (PPI) data for the "other finfish" category "02230199" until 1992. Since the PPI was needed in order to generate the ex-vessel values for each of the Great Lakes, these values do not begin until 1991. All ex-vessel values are in 2010 dollars.

Equation 3: Baseline Harvest Level and *Equation 4: Baseline Ex-Vessel Value* were utilized to generate the baseline harvest levels and values for the Great Lakes basin. Note that these equations utilize the most recent five years of harvest data (highlighted in orange in *Table 37: Great Lakes Basin Combined Harvest*).

Similarly, the aggregation of the harvest data from each river in the Upper Mississippi and Ohio River Basins yielded the total harvest levels and ex-vessel values of the commercial fisheries in the Upper Mississippi River basin.