GREAT LAKES FISHERY COMMISSION

Project Completion Report[1]

Biological Impacts of Low-Head Barrier Dams Historical Database

by:

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May 1997

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[1]Project completion reports of Commission-sponsored research are made available to the Commission's Cooperators in the interest of rapid dissemination of information that may be useful in Great Lakes fishery management, research, or administration. The reader should be aware that project completion reports have not been through a peer review process and that sponsorship of the project by the Commission does not necessarily imply that the findings or conclusions are endorsed by the Commission.

Biological Impacts Of Low- Head Barrier Dams

Historical Database

Prepared For : Great Lakes Fisheries Commission
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Biological Impacts of Low-Head Barrier Dams - Progress Report

Background

The primary purpose of this database is to provide a tool to assist researchers involved with the Barrier Impact Study in selecting streams for study. By combining existing Great Lakes datasets into a single integrated database comparisons of potential study streams with regard to community structure and physical stream parameters may be accomplished. It is hoped that this database may also serve as a useful management tool for researchers and managers in other agencies.

During the planning stages three types were identified as necessary for the historical database:

Fish community information:
(Biomass estimates, presence/absence & fish attribute data)
Physical stream parameters:
(location, flow regimes, surficial geology)
Barrier dam information:
(location, type, features, age)

Data Collection

In January various agencies were contacted to inquire about the availability of data. In Ontario the primary sources were considered to be the Ontario Ministry of Natural Resources, (district offices, Great Lakes Management Units, Natural Resources Information Branch, and Ontario Fisheries Information System). In Michigan and Wisconsin their respective Department of Natural Resource offices and the US Sea Lamprey Control Center were contacted as primary data sources.

The following datasets were subsequently obtained largely due to the assistance of the people noted here:

1. United States Fish and Wildlife Service (Sea Lamprey Control Center, Luddington)

Electric weir data
Lamprey trap data
(Thanks to Elly Koon)

2. Ontario Ministry of Natural Resources (Ontario Fisheries Information System)

Electrofishing catches from southern Ontario streams
(Thanks to Marion Daniels and Mike Jones)

3. Ontario Ministry of Natural Resources (Natural Resource Information Branch)

Leslie, Zippin, and Carle and Strub population estimates of closed stream fish populations using depletion/removal method.
(Thanks to George Gale)

4. Ontario Ministry of Natural Resources (Natural Resources Information Branch)

Province wide fish species distribution data. Presence data from various sources including Royal Ontario Museum surveys, OMNR Aquatic habitat inventory surveys, and Canadian Museum of Nature surveys (electronic)
(Thanks to George Gale)

5. Wisconsin Fish Distribution Survey Database

Comprehensive inventory of fishes found in Wisconsin streams
(Thanks to Don Fago)

6. Michigan Department of Natural Resources:

Field forms from various Michigan streams. (on paper)
(Thanks to Dan Hayes)

Database structure:

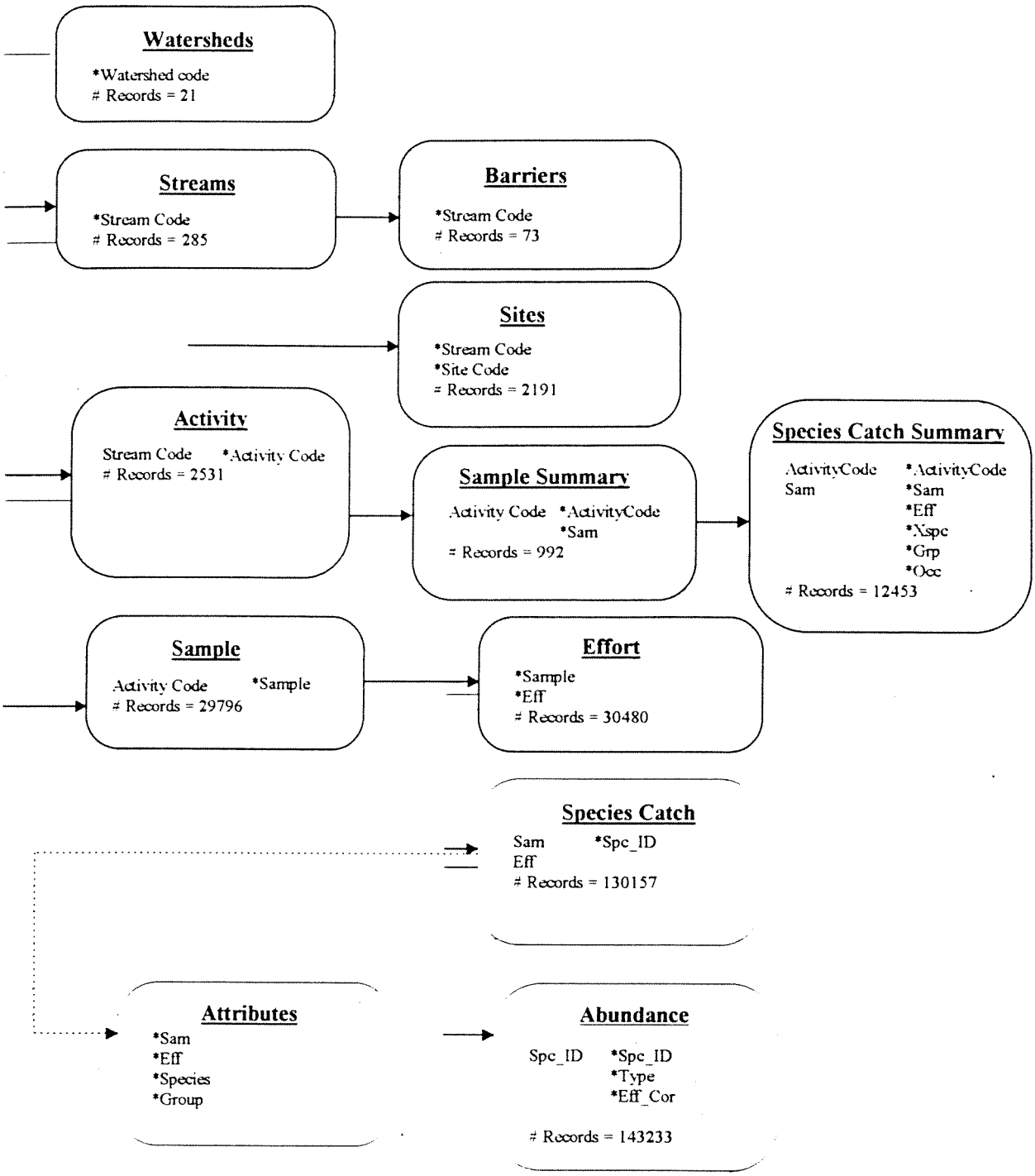

Fig. 1 Graphical representation of main relationships in database. *'s indicate primary keys in table, broken lines indicate relationships not yet developed

Primary Table Descriptions:

1. Streams

Each stream is uniquely identified by a stream code assigned during the database development process, e.g. OON100 (1st character is lake abbreviation, 2nd & 3rd char are province or state abbreviation, last 3 characters are an arbitrarily assigned number which is unique within the particular lake and province.)

The Streams table is where general information about each stream is stored, ie mouth lat,long, and UTM coordinates, location etc.

2. Barriers

The Barriers table is related to the Streams table on the stream code field in a one to many relationship (Each stream can have one or more barrier records associated with it) . The barriers table contains information about each particular barrier on a stream, natural or otherwise.

3. Sites

The Sites table is related to the Streams table on the stream code field in a one to many relationship. The Sites table contains information about individual sites on each stream. For USFWS-SLC data sites are made up of unique zone and station numbers, the township, range and section data is contained in the sample table. The site code for USFWS-SLC data is a concatenation of zone and station numbers. One of the fields in the site table may be used to flag the location of the site relative to the barrier location if one exists on the stream. This field needs to be filled in still for all streams on the Ontario side.

4. Activity

The Activity table is related to the Streams on the stream code field in a one to many relationship. Each record in the activity table represents a one or more sampling activities. A unique activity is represented by the combination of the stream code, year, season, gear, and data source fields.

5. Sample

The Sample table is related to the Activity table on the stream code, year, season, gear, data source fields. Each record in the Sample table represents a unique sampling occasion occurring at a particular site and day. A unique sample ID was given to each record in this table. Records from the USFWS databases were given a sample id consisting of an L, T or W plus their original ID depending upon which database the record came from (larval, trap or weir). The sample table contains information specific to that particular sampling occasion, (ie water temperature, current velocity, weather conditions etc.). The Sample table is also related to the Site table on the site code field in a many to one relationship so that site descriptions can be extracted along with sample data.

6. Effort

The Effort table is related to the Sample table on the sample ID field in a many to one relationship. Each record in this table contains information on distinct efforts units used within each sample, (ie multiple electrofishing runs at the same location, or multiple mesh sizes used in gang of gillnets). In most instances there is only one record in the effort table per record in the sample table.

7. Species Catch

The Species Catch table is related to the Effort table on the sample ID, and EFF fields in a one to many relationship. Each record in this table contains information on distinct species and groups, including numbers caught and in some cases biomass.

8. Species Abundance

The Species Abundance table is related to the Species Catch table on the field Spc_ID. The Species Abundance table contains population estimates for species when available. Three types of population estimates are given.

9. Sample Summary

The Sample Summary table is a summary of the sample table. It contains Trap and Weir sample data summarized by year. It includes information such as opening date, closing date, and site sampled. It is related to the Activity table on the field ActivityCode.

10. Species Catch Summary

The Species Catch Summary is a summary of the Species Catch table for trap and weir data by year. It contains the total number of fish caught by species at each trap or weir. It is related to the Sample Summary table on the fields ActivityCode and Sam.

Accessory Table Descriptions

Codes - Cloud Cover

Cloud cover at sampling time. Coded as an integer from 0 - 10 corresponding to 0 % to 100% cloud cover respectively , in the USFWS datasets there were two different codings for cloud cover, one for the trap database and one for the weir database. The trap database was coded as an integer ranging from 0 - 3 corresponding to clear, partly cloudy, mostly cloudy, total cover respectively. The weir database was coded as an integer ranging from 1 - 10 corresponding to 0% - 100% respectively. The trap data was recoded (0 becoming 0, 1 becoming 3, 2 becoming 60, 3 becoming 100).

Codes - Collection Conditions

Applies to records from USFWS-SLC only and describes conditions at collection time

Codes - Collection Methods

Applies to records from USFWS-SLC larval database only. Codes for specific equipment or chemicals used to collect samples

Codes - Collection Problems

Codes describing problems encountered during sample collection, present in USFWS-SLC records only. This code consists of a letter (L, T, or W, corresponding to Larval, Trap or Weir) and original numeric code from USFWS-SLC data

Codes - Data Source

Arbitrary codes indicating source of the data

Codes - Flow Description

From USFWS-SLC database codes. Larval database codes were used and trap and weir data was recoded to correspond

Codes - Group

Species subgroup codes ie. 01 = young of the year, 02 = 0+. The code SC was used to designate any species broken down into size groups, it was impossible to designate a code for each size group as size intervals used for grouping were not consistent.

Codes - Responsible Organization

Arbitrary code designating organization responsible for data collection

Codes - Season

Year was broken down into four seasons, may be dissected further if necessary using date field in sample table

Codes - Species

None of the datasets had a comprehensive species code list for Michigan, Wisconsin, and Ontario. This code list was made up in an attempt to code any species which occurred in the databases used. There are undoubtedly species not yet coded, something to be aware of when entering new data. This list is based upon the OMNR species code list but not all of the codes are identical to OMNR codes, some juggling had to be done to make room for species (especially around the cyprinid section). This table includes the equivalent OMNR, USFWS and Wisconsin DNR codes in separate fields if conversion back to these needs to be done. Remember some species in this database may not have equivalent area specific codes.

Codes - Survey Gear

A general gear code used to make the activity table less lengthy than if every possible type of equipment had its own code.

Codes - Survey Type

This field only filled in for USFWS-SLC records and indicates the survey purpose

Codes - Water Level

USFWS-SLC larval database codes

Codes - Weather

Data from USFWS-SLC was recoded to match the values found in this table

Codes - Wind Direction

USFWS-SLC codes were used

Codes - Wind Intensity

USFWS-SLC codes from trap and weir databases were recoded to correspond to values in this table.

Interface

The custom interface is designed to allow a user who may not have much experience with Access to extract data from the database. The interface is essentially a form from which the user can select tables and fields which they would like data from.

The only knowledge required to use the interface is the structure of the database (i.e. how the various tables relate to one another). The interface will build the relationships between tables but the user must select the appropriate tables to begin with. The data model (how the various tables are related can be found in the help file (press F1 or click on Help) and in this manual (Fig. 1).

The following section will describe the different parts of the query interface and will conclude by describing the exact steps in running a simple query.

To get into the query design screen the user can click on the Run Queries button from the opening screen, the query design screen will then pop up. Moving from left to right and top to bottom the components of the design screen are described below.

Cancel

This button will close the design screen and bring the user back to the main menu

View

This button will only become active once some tables and fields have been selected. When clicked this button will run the query. The data extracted will then pop up in a table on the screen.

Load

This button will bring up the Load Query screen. The interface enables the user to save a query and run it at a later date. Clicking on this button allows the user to recall saved queries.

Save

When clicked this button will bring up the Save Query form. Here the user can save a designed query to be run at a later date.

Export

When clicked this button will open the Export Query Form. Here the user can export a designed query into one of several formats; Lotus (WK1 and WKS), Excel (XLS), Text (TXT) or an Access table.

SQL

When clicked this button will open the View SQL form. Here a user can examine the Structured Query Language (SQL) of the designed query. The user cannot modify the SQL in this window however, only view it.

Tables
This is a pull down list of the tables a user can select to be included in the query. A table is selected by clicking on the appropriate table name in the list.

Unique Values
This check box may cause a bit of confusion to some users. When checked a query will only return unique occurrences of the fields the user has selected, when it is unchecked all records will be returned.

Available
Once a table has been selected from the Tables pull down box the Available box will be filled with a list of fields from that table. The fields within this box can then be selected by double clicking on the field name or by clicking on the right pointing arrow next to the box. All the fields from the available box can be selected by clicking on the double right pointing arrow next to the box.

Selected
When a field has been selected from the available box it will be moved into the selected box. The field name will appear in the selected box as well as the table name from which it was selected. A field can be removed from the selected box by double clicking on it or highlighting it and clicking on the left pointing arrow next to the selected box. Clicking on the double left pointing arrow will remove all of the fields from the selected box which belong to the currently selected table. Clicking on the red double left pointing arrow will remove all of the fields from the selected box regardless of the table to which they belong.

Sort
The sort check boxes below the Available and Selected boxes will sort the fields alphabetically in each of these boxes.

Where
When clicked this button allows users to set a filter on the data that the query will return. To use this feature highlight a field in the selected box which you would like to filter on and then click on the Where button. The field name will appear in the Where box at the bottom of the screen in the following format [*TableName*].[*FieldName*] =. It is then left to the user to fill in the criteria they would like to filter on. If the field you would like to filter on is a text field (indicated in the Field Type box at the bottom of the screen), the user must put quotes around the filter criteria. To set filters on multiple fields simply repeat the above procedure for the next field to be filtered on. To remove the filter criteria simply click on the red 'X' next to the Where box.

Order By
When clicked this button allows the user to specify how the resulting data will be sorted. At present time the data can only be sorted in ascending order. To use this feature the user should highlight the field they would like to sort on in the Selected box and then click on the Order By button. The field to be sorted on will appear in the Order By box at the bottom of the screen. The data can be sorted on multiple fields by repeating the above procedure for each of the fields the user would like to sort on. The sort criteria can be cleared by clicking on the red 'X' next to the Order By box.

Field Definition & Field Type

When a field is highlighted in either the Available or Selected boxes a field definition and field type will appear at the bottom of the screen. These are provided to let the user know what data is contained in each of the fields without having to refer to the data dictionary. The field type is provided to assist the user in setting filters as described above in the Where section.

Sample Query

Here is a step by step example of how to design a simple query using the query design form.

Query: Extract dates of sampling on all streams in Michigan contained within the database.

1. The first step is to decide which tables are necessary. It is easiest to begin from the lowest table in the structure and work up the tree. Information on sampling sites is contained within the Sample table. We also want data contained in the Streams table (Stream name, location etc.). Between these two tables in the data structure is the Activity Table so we will need to select that one as well. Finally as mentioned we will need the Streams Table.

2. Once at the design screen the next step is to select the first table you will need fields from. In this example that will be the Streams table. Select it from the Tables pull down box. Looking through the fields in the Available box we will select a few fields, Stm_Cod, Lake, Stm_Name, and Locale. Select these four fields so that they appear in the Selected box. Now select the next table Activity. For now we will pretend that we do not need any fields from this table. Because the table must be included in the query as it is the link from Streams to Sample we will select what I have called a place holder field, F0, this field does not contain any information but is used just to include the table in the query. Select F0 so that it appears in the Selected box. Now select the last table in our query the Sample Table. Select these fields from the Sample table so that they appear in the Selected box, Date, Sam_Lat, Sam_Long, Sam. Once this has been done all of the fields and table have been selected. You can see how if you wanted to extract species data as well you could just select the Species Catch table and pick out the fields you would like to see.

3. We only want the streams located in Michigan so we need to set a filter on the query. The State or Province in which the stream is located is contained within the Locale field. By looking at the definition of the field we can see that MI denotes Michigan. TO set the filter highlight Locale and click on the where button. The following text will appear in the Where box at the bottom of the screen: "[Streams].[Locale] =" and the cursor will move to behind the "=" sign. Now it is left to the user to specify what the filter criteria are, in this case MI. Because the field is a text field, as indicated by the Field Type at the bottom of the form we need to put quotes around MI for the query to accept it. The text in the where box should look like this in order for the filter to work: [Streams].[Locale] = "MI", double or single quotes are acceptable. If the field you are filtering on is a numeric field quotes should not be used.

4. To close the query, double click on the control box in the upper left corner of the data table, you will be returned to the query design form.

5. The query you have just made can now be saved and run again later using the Save and Load buttons or can be exported using the export button.

Appendix A - Data Dictionary

Data Dictionary of HSD

Field Name	Field Type and Length	Definition

Activity_Comm Text 255
- Any comments pertaining to the sampling activity in general

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ActivityCode Number (Long) 4
- Arbitrary activity code unique within the database

Air_Temp Number (Single) 4
- (C)

Ann_Disc Number (Single) 4
- Annual discharge, from IMSL database, (Gavin Christie & Miro Kuc)

Area_Sam Number (Single) 4
- Area sampled in square meters

B_Dis_Ft Number (Single) 4
- Discharge in ft^3/s at barrier

B_Dis_M Number (Single) 4
- Discharge in M^3/s at barrier

Barr_Cod Number (Integer) 2
- Unique number identifying multiple barriers on a stream

Barr_Lat Number (Long) 4
- Barrier Latitude

Barr_Long Number (Long) 4
- Barrier Longitude

Barr_Typ Text 1
- N=Natural, F=fabricated

Barr_Typ Text 5
- Type of barrier present N=Natural falls, L = Lamprey barrier, O = Non-lamprey specific fabricated barrier

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Barr_UTM_E Number (Long) 4
- Easting of barrier location

Barr_UTM_N Number (Long) 4
- Northing of barrier location

Barrier Yes/No 1
- Presence/absence of barrier

Bio_Den Number (Single) 4
- Biomass density in sampled area

CATCNT Text 10
- Number of fish caught

CatCnt_Total Number (Double) 8
- sum of catch by species + grp over duration of sampling

CATWT Text 10
- Weight of fish caught

CatWt_Total Number (Double) 8
- sum of catch weight by species + grp over duration of sampling

---

Clouds Number (Byte) 1
- Cloud Cover (see lookup table Cloud Cover Codes)

Col_Meth Number (Byte) 1
- Collection Method (See lookup table collection methods codes)

Coll_Prob Text 2
- Collection Problems (see lookup table Collection Problem Codes)

Cond_Cod Number (Integer) 2
- Condition code

Const_yr1 Number (Integer) 2
- Year that construction began

Const_yr2 Number (Integer) 2
- Year that construction was completed or barrier was last modified

---

County Number (Long) 4
- County sample site located in

County_Nm Text 50
- County or nearest town name

CountyCd Number (Long) 4
- US County code

Data_Avl Text 5
- Type of data available; Char. 1 = Presence data, Char. 2 = Catch data, Char. 3 = Abundance data, Char. 4 = Fish attribute data

---

Data_Src Text 2
- Source of data

Date Date/Time 8
- Sample date

Day_Open Date/Time 8
- Day which sampling began for the season (usu. the day trap or weir operation began)

Day_Shut Date/Time 8
- day which sampling ended for the season (usu. day trap or weir operation ended)

Days_Fished Text 3
- number of days fished if known (# of days operated - # of days of down time)

Days_Operated Text 3
- number of days from beginning of operation to end

Dead_Mrk Number (Integer) 2
- Number caught dead and marked

Dead_Un Number (Integer) 2
- Number caught dead and unmarked

Desc Text 255
- Site description

Distance Number (Single) 4
- Distance to confluence or mouth

District Number (Integer) 2
- Old OMNR district code (Pre reorganization)

EFF Text 3
- Used when more than one independent sampling occasion at same site on same day (ie. more than one pass electrofishing)

Eff_Cor Text 2
- Y if effort correction was used

F0 Text 1
- Place holder field, used when constructing queries with the interface. Allows a user to include a table without taking any data from it. Does not contain any information.

F6 Text 1
- Flagging field

Features Memo -
- Specific feature of the barrier

Flow_Des Number (Byte) 1
- 1 = Nonexistent, 2 = Dead, 3 = Sluggish, 4 = Pools & Riffles, 5 = Moderate, 6 = Rapid, 7 = Torrential

---

FOF_NM Text 35
- Fisheries office name from where data originated (OMNR Data only)

Gear Text 4
- Gear used for sampling, coded

GRP Text 2
- Species subgroup

Grp_Desc Text 255
- Description of species subgroup

Inst_Res Text 1
- M = MICHIGAN STATE, W = U OF WISCONSIN, G = U OF GUELPH

Jmp_Pool Yes/No 1
- Presence absence of jumping pool

Lake Text 1
- Indicates which great lake the stream is a tributary of S=Superior M= Michigan H=Huron E=Erie O=Ontario

---

Lamp_Trp Yes/No 1
- Presence absence of lamprey trap

Live_Mrk Number (Integer) 2
- Number caught live and marked

Live_Un Number (Integer) 2
- Number caught live and unmarked

Locale Text 50
- State or province in ~~which the mouth~~ of the tributary is located, MI = MIchigan, WI = Wisconsin, NY = New York, ON = Ontario

---

Map OLE Object -
- if availabe this field contains a bitmap showing stream location on a small scale

---

Map Cod Text 50
- Map Code pertaining to map type

Map_Typ Text 50
- Type of map code pertains to, ie NTS = national topographic series map of map code Map Cod

---

Max_H20 Number (Single) 4
- Maximum water temp (C)

Max_Len Number (Integer) 2
- Maximum length of fish caught

Min_H20 Number (Single) 4
- Minimum water temp (C)

Min_Len Number (Integer) 2
- Minimum length of fish caught

Mn_Bio Number (Long) 4
- Mean biomass of fish caught

Num_Traps Text 2
- number of traps operated if known

OCC Number (Long) 4
- Identifies duplicate SPC + GRP occurrences (ie. two unique unknown species)

Org_Cod Text 2
- Organization responsible for collection of data

Pop_den Number (Single) 4
- Population density in sampled area

Pop_Est Number (Single) 4
- Estimated population size for area sampled

PRJ_CD Text 12
- Code relating data back to fishnet project (OMNR data only)

PRJ_NM Text 56
- Fishnet project name (OMNR data only)

Q Text 2
- Quarter section

QQ Text 2
- Quarter Quarter section

Quality Number (Byte) 1
- Quality of population estimate

Range Text 3
- Range number (USFWS data only)

Rel_Barr Text 2
- A = above barrier, B = Below barrier, NA = either stream has no barrier or relative barrier location unavailable

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Rel_Yr Number (Integer) 2
- +n -n or 0 depending on the year the sample was taken relative to the year of barrier construction

---

SAM Text 12
- Sample code unique within database (for weir and trap data from USFWS is 'W' or 'T' followed by USFWS record code), otherwise is an

---

Sam_Lat Number (Single) 4
- Site Latitude

Sam_Long Number (Single) 4
- Site Longitude

Sam_UTM_E Number (Double) 8
- UTM Easting of sampling site

Sam_UTM_N Number (Double) 8
- UTM Northing of sampling site

SD Number (Long) 4
- Original source of data

Season Text 3
- 1 = Jan. - Mar, 2 = April - June, 3 = July - Sept., 4 = Oct. -Dec.

Section Number (Long) 4
- Section number (USFWS data only)

Sel Yes/No 1
- Selection Field (for internal database use)

Site_Cod Text 7
- Zone & Station

Site_Cod Text 50
- Site code which was used in original dataset,

SITE_LST Text 10
- Fishnet

Siz_Rnge Text 10
- Size range

SPACE Text 2
- Fishnet

SPC Text 4
- original species code

Spc_comm Memo -
- any comments pertaining to species caught

SPC_ID Number (Long) 4
- Arbitrary species ID used to make relationship to abundance simpler

---

Spr_Disc Number (Single) 4
- Spring discharge, from IMSL database, (Gavin Christie & Miro Kuc)

St_Mile Number (Double) 8
- # of miles upstream station is from the stream's mouth

St_Mile_A Text 1
- Code describing sampling area relative to station mileage (See Station Mileage Codes)

Staff Number (Single) 4
- Staff gauge reading

Stat_Prov Text 2
- State or province abbreviation

Std_Err Number (Single) 4
- Standard error of population estimate

Stm_Cod Text 6
- Unique code for each stream (Barrier streams end in multiples of 50)

Stm_Lat Number (Long) 4
- Stream mouth latitude

Stm_Long Number (Long) 4
- Stream mouth longitude

Stm_Name Text 50
- Stream name

Stm_UTM_E Number (Long) 4
- Universal transverse mercator (UTM) easting of mouth of tributary

---

Stm_UTM_N Number (Long) 4
- Universal transverse mercator (UTM) northing of mouth of tributary

---

Strm_Cod Text 8
- Stream code unique to database (Char 1 = Lake, Char 2 & 3 = province or state, last 3 char. are arbitrary numeric values

---

Temp_Units Text 1
- Units of Wtr_Temp

TIME_ Number (Single) 4
- Time weir or trap serviced

Tot_Bio_E Number (Single) 4
- Estimated total biomass in area sampled

Tot_Clip Number (Integer) 2
- Total number caught clipped

Tot_Dead Number (Integer) 2
- Total number caught dead

Tot_Live Number (Integer) 2
- Total number caught live

Tot_Scar Number (Integer) 2
- Total number caught scarred

Township Number (Long) 4
- Township number (USFWS data only)

Trap_Comm Text 255
- any comments pertaining to operation of trap(s)/weir

Trap_Type Text 50
- type of trap operated if known

Type Text 2
- Type of population estimate

USFWS_Stm_Cod Number (Integer) 2
- Stream codes supplied by US Fish and Wildlife Service

Watshed Text 50
- OMNR Watershed code

Weather Number (Byte) 1
- Weather conditions (see lookup table Weather Conditions Codes)

Wind_Dir Number (Byte) 1
- Wind direction (see lookup table Wind Direction Codes)

Wind_Int Number (Byte) 1
- Wind intensity (see lookup table Wind Intensity Codes)

WSHEDCD Text 15
- Watershed code (either OMNR or US EPA HUC code)

WSHEDMAP OLE Object -
- Paintbrush map of watershed (if available)

WSHEDNM Text 50
- Watershed name

Wtr_Temp Number (Long) 4
- Water Temperature at sampling site

XEFFSECS Text 5
- Shocking time (units indicated in XEFFUNITS)

XEFFUNITS Text 50
- Units of XEFFSECS

XSPC Text 4
- HSD code for species; similar to OMNR codes but some minor modifications, particularly in the cyprinids

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XSPC Text 4
- HSD species code

Year	Text	4

- Year of sampling

Appendix B - OMNR Fish Species Distribution Database Documentation

Source Code Documentation For Fish Species Distribution Data (OMNR)

Excerpt from correspondence with George Gale.

"The 'source code' is included in all data records and is outlined on an enclosed reference sheet. This data tracking number can often be used to pursue original data, thus enabling confirmation of taxonomic identifications and associated habitat/community data. It can also be used on occasion to access the original specimen(s) if needed, primarily where one of the two museums have catalogued the specimens. Incidentally, please be sure you give appropriate credit, especielly if the museum data is used in any publication or wide spread report."

OMNR Fish Species Distribution Data System
Data Sources

Data Source	Source Code
Canadian Museum of Nature	'N' + 6 digit catalogue number
Royal Ontario Museum - Accession Data	'RMA' + 5 digit accession number
Royal Ontario Museum - Catalogue Data	'RMC' + 5 digit catalogue number
Ontario Ministry of Natural Resources - Stream Survey Program	'OMNRS' + 2 digit District Code (pre 1992 version)
Ontario Ministry of Natural Resources - Large River Survey Program	'OMNRR' + 2 digit District Code (pre 1992 version)
Ontario Ministry of Natural Resources - Stream Assessment: Closed Population Analysis Program	'OMNRPD' + 2 digit District Code (pre 1992 version)

OMNR Administrative Code System (pre 1992 District Codes)

Northwestern Region	**10**
Dryden	11
Fort Frances	12
Ignace	13
Kenora	14
Red Lake	15
Sioux Lookout	16
North Central Region	**20**
Atikokan	21
Geraldton	22
Nipigon	23
Terrace Bay	24
Thunder Bay	25
Northern Region	**30**
Chapleau	31
Cochrane	32
Gogama	33
Hearst	34
Kapuskasing	35
Kirkland Lake	36
Moosonee	37
Timmins	38
Northeastern Region	**40**
Blind River	41
Espanola	42
North Bay	43
Sault Ste. Marie	44
Sudbury	45
Temagami	46
Wawa	47
Algonquin Region	**50**
Algonquin Park (inside park)	51
Bancroft	52
Bracebridge	53
Minden	54
Parry Sound	55
Pembroke	56
Leslie M. Frost Centre	57
Algonquin Park (outside park)	58
Eastern Region	**60**
Brockville	61
Cornwall	62
Carleton Place	63
Napanee	64
Tweed	66
Central Region	**70**
Huronia	71
Cambridge	72
Lindsay	73
Maple	74
Niagra	75
Southwestern Region	**80**
Aylmer	81
Chatham	82
Owen Sound	83
Simcoe	84
Wingham	85

Appendix C - OMNR Population Analysis Database Documentation

Fish Population Analysis - Quality Index

An index of quality is generated during the execution of the Leslie, Zippin and Carle and Strub fish population analysis methodologies. It is not displayed along with the detailed statistical information, however, it is added to the provincial fish population analysis summary database. It is used to quickly determine how well the statistical procedures worked given the specific data being analyzed.

In general, the higher the number the better the statistical results. To date only 0 and 1 are used.

'1' is the highest index of quality indicating that 2X standard error is less than 66.6% of the estimated population (for Zippen and Carle & Strub methods only). For the Leslie method the F-test must have been significant to achieve a '1'.

Zero will be the only other index present. This will be present where 2X standard error is greater than 66.6% of the estimated population OR Where the estimated population was less than the actual catch. The latter situation may occur, for example, where effort corrected catches produced 'irregular trends'. Furthermore, '0' may also occur where the Carle and Strub "M-statistic" is low.

It should be noted that all analyzed population data species groupings do not contribute records to the provincial summary database. Occasionally data will produce such poor statistical trends or perhaps not even be appropriate for the methodology in question. These data records would never then be summarized in the provincial summary database.

	Leslie (& Davis) - 1939 (linear regression model)	Zippin - 1958 (maximum likelihood model)	Carle & Strub - 1978 (maximum likelihood model)
Calculations:	- simple regression concept but mathematically involved and tedious to calculate.	- Simple to calculate or to determine graphically with reference to Zippin's graphs	- Conceptually simple but may be mathematically tedious if large numbers of iterations are required.
Evaluation of statistics:	- Roots of quadratic method of calculating confidence limits is questionable; use R-squared and F-test to evaluate.	- Standard confidence limits are straight forward to calculate and usually reliable	- Standard confidence limits are straight forward to calculate and usually reliable
Advantages:	- Theoretically can handle unequal efforts (as per Ricker 1975 modifications). - Theoretically good for large open populations or large numbers of runs.	- Quick, effective and flexible for most commonly encountered numbered of runs (3,4,5,& 7). - Reasonably good for small, not too dense closed populations typically seen in many areas. - Estimates are not too conservative.	- Effective for all numbers of runs although best with 4 or more - Handles irregular data trends easily. - Does not require capture of a large proportion of the closed population, although greater than 30% is recommended.
Disadvantages:	- Confidence limits are statistically questionable due to dependence of variables. (Note, Delury methods avoid this but captures are limited to 2% of the population if good results are expected.) - Tedious to calculate and prone to calculation error -Does not handle irregular catch results well.	- Capture of a high proportion of the closed population is recommended (eg. 60%) with up to 90% preferred. (N.B. this should be spread over all runs evenly with a diminishing trend.) - Zippin's graphs available for a limited number of runs only (i.e. 3,4,5, & 7) - Must use equal effort during all runs. (A poor second best allows modification of the data prior to actual analysis.) - Cannot handle irregular or non-diminishing trends well	- Results can be conservative especially with only 3 runs. - Mathematical iterations are awkward, tedious and prone to error except if processed by computer (e.g. the system at Fisheries Branch permits 10,000 iterations with at least 9 calculations each for data extremes.) - Must use equal effort during all runs. (a poor second best allows modification of the data to reflect equal effort prior to actual analysis.)
General Recommended Rating	(3)	(1)	(2)

Appendix D - Wisconsin DNR Wisconsin Statewide Fish Distribution Survey Documentation

Data Source Codes for Wisconsin Statewide Fish Distribution Survey

Historic (1900-50) SD 01-10
- 01 Early Wisconsin fish collection (1900-31) (reported by Greene, 1935)
- 02 Greenbank et al. (1940s) (from the UW-Madison Zoology Museum)
- 04 UW - Madison's Catalog of Wis. Conserv. Dep. collection

Research SD 11-19
- 11 Fish Distribution Study personnel
- 12 Fish Distribution Study's stocking.
- 13 Research personnel - identified by trained ichthyologist.
- 14 Fish Research - collecting done for fish distribution study; identification of specimens handled as in SD 33; however, their identification of sunfishes is also accepted
- 15 Fish Research - similar to SD 14, except it is a *partial sample
- 16 Fish Research - sample identified by Fish Distribution Survey personnel, except for same species as SD 14
- 17 Fish Research - similar to SD 16 except it is a partial sample
- 18 Other research personnel - sample identified by Fish Distribution Study (FDS) personnel
- 19 Other research Personnel - not identified by FDS personnel

Fisheries Management SD 20-39, 94-96
- 23 Youth Camp - identified by FDS personnel
- 25 Rock River Chemical Treatment and Lake Koshkonong Power Plant site - identified by FDS personnel or Dr. G Becker
- 32 All specimens were identified by FDS personnel, excpet for some specimens of 35 species (depending on each species distribution in the state) that are assumed to be easily identifiable by Fisheries Management personnel
- 33 In addition to accepting Fishereis Management's identification of up to 35 species (mentioned above), their identification of other species is also accepted if at least 1 fish of that species was identified by FDS personnel. Therefore, while species should be accurate, numbers of specimens caught may not be accurate due to fish returned to water.
- 36 Similar to 33 except that FDS personnel did not receive specimens of 1 or more species (excluding the 35 accepted species). Therefore, the specimens had to be generalized to family or genus
- 94 Fishereis Management Survey - based on reports only
- 95 Literature not based on any particular survey - e.g. surface water resource publications
- 96 Restocking of fish after chemical treatment

University of Wisconsin System SD 40-74
- 40 UW - Madison students
- 45 UW - Stevens Point students
- 46 Dr. George Becker
- 47 UW - Stevens Point, Dr. Coble and students
- 50 UW - Milwaukee, Dr. Norden and students
- 55 Dr. George Seeburger
- 56 UW - Whitewater students
- 60 UW - Waukesha students
- 61 Prof. Marlin Johnson and UW - Madison students
- 65 UW - Parkside students
- 66 UW - Eau Claire, Dr. Crowe
- 70 Beloit College students
- 71 Dr. J. Lutz
- 72 Prof. Held and UW - La Crosse students

Miscellaneous SD 75-93, 97-99
- 73 Wisconsin DNR, Bureau of Water Resources Management district personnel
- 75 Milwaukee Public Museum
- 76 ENCAP, Inc., Dr. Greenfield, Dekalb Univ., Dekalb, Ill.
- 77 Dairyland Power Cooperative, La Crosse
- 78 Northern States Power Co.
- 79 N.U.S. Corp., Pittsburgh, PA.
- 80 Bio Test, Inc., Chicago, Ill.
- 81 Dames and Moore, Park Ridge, Ill.
- 82 Wis. Electric Power Co., Milwaukee
- 83 Upper Mississippi River Conservation Comm.
- 84 Illinois Natural History Survey, Urbana, Ill.
- 86 Commercial fishermen identified by Fish Distribution Study or Dr. G. Becker
- 87 Dr. Underhill and Univ. Minnesota students
- 88 Iowa Coop. Fish Research Unit, Ames Ia.
- 89 Minnesota DNR
- 90 U.S. Fish and Wildlife Service
- 91 Michigan DNR
- 92 Michigan DNR - identified by Univ. Michigan, Ann Arbor, Mich
- 93 Miscellaneous Collectors
- 97 U.S. Army Corps of Engineers
- 98 Commercial fisherman
- 99 Unknown collector - e.g., sport fisherman

* Partial = those in which sampling effort and/or species identification were incomplete and therefore did not yield adequate assessment of total species composition