

**Invasive Carp eDNA Program Data Management
Standard Operating Procedure**
IC eDNA Monitoring Program



U.S. Fish and Wildlife Service, Region 3

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Document Information:

IC eDNA Monitoring Program

WGL eDNA Program Data Management SOP

SOP Number 5

2023 QAPP

Application/Purpose:

This document describes roles and responsibilities for all data that are collected, documented, reviewed, and stored in the Invasive Carp (IC) eDNA Monitoring Program.

Data Management Roles and Responsibilities:

Each role for the flow of data within the IC eDNA Program is provided in Figure 1. Figure 2 outlines the data flow for WGL generated detection results. Specific details surrounding the data flow, roles and the responsible party are listed in the following sections.

FWCO Staff:

- FWCOs are responsible for entering (automatic with ArcGIS Field Maps APP), proofing, and retaining field data. The ArcGIS Field Maps APP Manual No 1 is a provided as a separate document.
- The eDNA Leads are responsible to properly enter data and facilitate QA/QC of data using the ArcGIS Pro eDNA Editing Manual No 2. If possible, QA/QC and edits of missing or incorrect data should be completed and synced with the database within 10 business days after the last day of collection for a specific event or before the next sampling event to be conducted at the same location if that is to occur in less than 10 days. This removes the possibility of confusing old and new data points and declutters the online web maps used for data collection.
 - a. Once data have been proofed and edited, any changes must be synced back to the database. After this is complete, the station eDNA lead will inform the eDNA Database Coordinator so that completed data can be cleared from the ArcGIS Field Maps APP map. If other field work prevents proofing and QA/QC of data to take place within the required 10 business days, FWCO staff must notify the eDNA Database Coordinator and eDNA Program Coordinator.
- FWCO staff should retain an electronic copy of the completed dataset for each of their eDNA events. A list of data collected, and an explanation of data fields are provided in Table 1 for ArcGIS Field Maps APP.
- Hard copy and electronic data (final QA/QC of field data) should be backed up regularly.
- Survey123 electronic Shipping COC forms will be submitted to WGL when samples are shipped. WGL will receive an email via a web hook when the Survey123 Shipping COC form is submitted. The Survey 123 Chain of Custody SOP No 3 is provided in a separate document. A list of field descriptions for Survey123 Shipping COC forms are included in Tables 2 through Table 4. WGL will use the eDNA Shipping Alerts channel in Teams to let FWCO offices know when samples are received in the lab. The shipping FWCO may request a hard copy of their Survey123 Shipping COC data.

- Survey123 electronic Post-Trip & QA/QC Summary Survey 123 forms will be submitted to WGL when samples are shipped. WGL will receive an email via a web hook when the Post-Trip & QA/QC Summary Survey 123 form is submitted. Post-Trip & QA/QC Summary form instructions are provided in the Survey123 Chain of Custody SOP No 3.

WGL Staff:

- WGL staff are responsible for keeping an internal Case Log for all samples. The Case Log tracks cases and samples through the lab workflow.
- WGL staff will keep a record of location of samples stored on benchtops before processing or within freezers after samples are dried prior to extraction should be maintained (such as a log-in/log-out record book).
- WGL staff will track all sample movement to or from a specified location, and movements will be recorded via signature on the freezer or benchtop shelving log.
- WGL will also keep records of thermalcycler, freezer and sample logs as well.
- WGL will maintain hard copies of laboratory notebooks and the electronic Case Log in an excel file. Raw data files from the real-time instruments will be processed with standardized R-code, QC Report, and all result files will be kept in a folder labeled with the case number. These files will be backed up on the WGL and MFC servers.
- WGL staff are responsible for recording and archiving fridge and freezer temperatures on the WGL and MFC servers.
- WGL will scan data notebooks into PDFs by case and these will be saved on the WGL server and backed up on the MFC server.
- The eDNA Processing Lead will be responsible for reporting results with the eDNA Program Coordinator and eDNA Database Coordinator within 48 hours of results completion.
- The Survey123 Shipping COC and Post-Trip & QA/QC Summary data and all laboratory generated data files will be maintained on the WGL and MFC servers.
- WGL staff will upload data to SQL server after each case is completed.

Data Steward:

- Data Steward Reports will be generated as each case is completed. Each report will be sent to the eDNA Program Coordinator and saved electronically in the WGL and MFC servers.
- The eDNA Database Coordinator will backup and maintain the eDNA sample data in at least three backup locations. The eDNA Database Coordinator will also routinely back up eDNA sample data from the ArcGIS Online eDNA Fisheries Group once a

week. Field offices should still download and maintain the data collected by their office (per 2. Above). A list of field descriptions that contain data descriptions for reported results is listed in Table 5.

- The Data Steward will update metadata annual through ArcGIS and ServCat records.
- USFWS Denver Enterprise Team (FWS Geospatial Warehouse) will maintain an electronic folder that contains the file geodatabase complete with field and lab data.

Quality Assurance/Quality Control Specialist:

- Survey123 Shipping COC data will be stored in an ArcGIS database and will be maintained by the eDNA Processing QA/QC Specialist.
- All Post-Trip & QA/QC Summary data will be stored in an ArcGIS database and will be maintained by the eDNA Processing QA/QC Specialist. A list of field descriptions that contain data descriptions for the Post-Trip & QA/QC Summary data is listed in Table 6.
- Review, validate and certify eDNA detection data before eDNA Processing Lead reports results.

Data Tables:

Table 1. Data dictionary for the invasive carp eDNA field sample point feature class.

Field Name	Alias	Type	Length	Description
RUID	Regional Unique ID	Long Integer	8	Composite number that has 2-digits representing the year (YY), a 3-digit case (CCC) number; a series of unique numbers assigned by the Whitney Genetics Lab (WGL) to each Fish and Wildlife Conservation Office (FWCO) at the start of the sampling year and provided for each individual planned sampling event, followed by a 3 digit sample ID number (SSS) assigned by the FWCO numerically as they take samples in the field (no punctuation, YYCCCCSSS). Used as the primary key to join to the eDNA Data Steward Report table.
FWCO_ID	Sampling Station ID Code	Text	3	Alpena FWCO – ALP; Ashland FWCO – ASH; Carterville FWCO – CAR; Columbia FWCO – COL; Green Bay FWCO – GRB; La Crosse FWCO - LAX; Lower Great Lakes FWCO – LGL The office who lead the collection of samples and collected the eDNA sample field data.
STATE	State	Text	2	Two letter U.S. state code in which samples were collected.
BASIN	Basin	Text	4	LH = Lake Huron; LM = Lake Michigan; LE = Lake Erie; LS = Lake Superior; LO = Lake Ontario; CAWS = Chicago Area Waterway System; UMR=Upper Mississippi River; OHR=Ohio River; MOR=Missouri River; OTHR=Other (applicable to older eDNA field data) -Other designations to be added as needed by Fisheries Data Steward; River basin where samples were collected.
WATERBODY	Waterbody	Text	100	Waterbody name of where sample was collected. A set domain list is used to standardize waterbody name for each sampling site.
DATE_COLL	Date Collected	Date	255	Date of collection (MM/DD/YYYY)
WIND_DIR	Wind Direction	Text	20	Abbreviated wind direction at time of sampling, “Calm”, “Variable”, or shorthand (NE, NW, SE, SW, N, S, E, W)

Field Name	Alias	Type	Length	Description
LATITUDE	LATITUDE	Double	n/a	WGS 84 Decimal Degrees, 5 decimals
LONGITUDE	LONGITUDE	Double	n/a	WGS 84 Decimal Degrees, 5 decimals
TEMP_F	TEMP_F	Double	n/a	Temperature of the water in degrees Fahrenheit (1 decimal). Temperature could be in Fahrenheit or Celsius. Fahrenheit became standard measure in 2016. A -999999 means no data.
DEPTH	DEPTH	Double	n/a	Depth where sample was taken in Feet (1 decimal). Depth for all cases for all years could be reported either in meters or feet. Feet became standard measurement in 2016. A -999999 means no data.
BLANK	BLANK	Text	5	Yes/No (Field Control: Tube filled with distilled water)
HABITAT	HABITAT	Text	30	Habitat type where sample was collected, i.e. LDB (Left Descending Bank), RDB (Right Descending Bank), MC (Main Channel), SC (Side Channel), RAB (Right Ascending Bank), LAB (Left Ascending Bank), LAB-SC (Left Ascending Bank-Side Channel), RAB-SC (Right Ascending Bank-Side Channel), MC-SC (Main Channel-Side Channel), OW-B/BW/M (Open Water-Bay/Backwater/Marina), SH-B/BW/M (Shoreline-Bay/Backwater/Marina), DAM-TW (Dam Tailwaters), OTHER (Other), IMP (Impoundment)
COLLECT_TIME	Collection Time	Long Integer	4	Time stamp in military time, no punctuation when sample was collected
PROCESS_TIME	Processing Time	Long Integer	4	Time stamp in military time, no punctuation when sample was processed in the eDNA trailer either by filtering or centrifuge. Please see the Quality Assurance Plan for more information (QAPP).
PROCESSOR	PROCESSOR	Text	3	Initials of person who filtered/processed the sample

Field Name	Alias	Type	Length	Description
COMMENTS	COMMENTS	Text	500	General notes, issues, or observations while sampling or processing
QC_Comments	QC Comments	Text	500	Notes or comments on changes made to the data as part of the quality control review
DISPLAY_ORDER	Display Order	Integer	1	The number sets the display order for the individual point in the feature layer within the online hosted web map. 1 denotes a positive eDNA detection status, 2 denotes No detection data, and 3 denotes No eDNA detected.

Table 2. Data dictionary for the eDNA result data steward report table generated by the Whitney Genetics Lab.

Field Name	Alias	Type	Length	Description
Case_Number	Case Number	Long Integer	5	Composite number that has 2-digits representing a year (YY) and a 3-digit case number (CCC); a series of unique numbers assigned by the Whitney Genetics Lab (WGL) to each Fish and Wildlife Conservation Office (FWCO) at the start of the sampling year and provided for each individual planned sampling event.
Sample_Number	Sample Number	Integer	3	A 3-digit sample ID number assigned by the FWCO numerically as they take samples in the field (no punctuation, #####)
Unique_ID	Unique ID	Long Integer	8	Composite number that has 2-digits representing the year (YY), a 3-digit case (CCC) number; a series of unique numbers assigned by the Whitney Genetics Lab (WGL) to each Fish and Wildlife Conservation Office (FWCO) at the start of the sampling year and provided for each individual planned sampling event, followed by a 3 digit sample ID number (SSS) assigned by the FWCO numerically as they take samples in the field (no punctuation, YYCCSSS). Used as the foreign key to join the field data to eDNA sample field data (Primary key: RUID)

Field Name	Alias	Type	Length	Description
Any_Detection	Any Detection	Integer	1	1= detection of at least 1 of the 3 assays (Bighead, Silver, or Invasive Carp), 0= no detection of any assay, null= no detection data
ACTM_Assay	ACTM Assay	Integer	1	1= detection of at least 1 Invasive Carp qPCR replicate, 0= no detection, corresponds to one of three assays running in multiplex, null= no detection data
BHTM_Assay	BHTM Assay	Integer	1	1= detection of at least 1 Bighead carp qPCR replicate, 0= no detection, corresponds to one of three assays running in multiplex, null= no detection data
SCTM_Assay	SCTM Assay	Integer	1	1= detection of at least 1 Silver carp qPCR replicate, 0= no detection, corresponds to one of three assays running in multiplex, null=no detection data
eDNA_Detection_Summary	eDNA Detection Summary	Integer	1	Summary results from the ACTM_Assay, BHTM_Assay, and SCTM_Assay. 0= no detections, 1= detection ACTM only, 2= Bighead or BHTM and ACTM only, 3= Silver or SCTM and ACTM only, 4= Both Bighead (BHTM) and Silver (SCTM) with or without ACTM detection. null= no detection data
eDNA_Detection_Status	eDNA Detection Status	Text	255	Summary results from the ACTM Assay, BHTM Assay, and SCTM Assay in text for symbolizing on detection maps. No eDNA detected= no detections, IC carp eDNA only detected= detection of ACTM only, Bighead carp eDNA only detected= Bighead (BHTM) and ACTM only, Silver carp eDNA only detected= Silver (SCTM) and ACTM only, No eDNA detected= no detections, Bighead carp and Silver carp eDNA detected= Both Bighead (BHTM) and Silver (SCTM) with or without ACTM detection. No detection data= detection data not available

Field Name	Alias	Type	Length	Description
Reportable_Data	Reportable Data	Text	255	Yes/No, Yes = data is reported to the public, No = data is not reported to the public.
Notes	Notes	Text	255	Any relevant lab notes pertaining to the eDNA detection data.

Table 3. Field descriptions for the Shipping eDNA Chain of Custody Form

Field Name	Alias	Type	Length	Description
Unique_Username	Username	String	255	The ArcGIS username of the individual logged in to the Survey123 application.
Case_Number	Case Number	Integer	5	Composite number that has a 5-digit “case” number, a series of unique numbers assigned by the Whitney Genetics Lab (WGL) to each Fish and Wildlife Conservation Office (FWCO) at the start of the sampling year and provided for each individual planned sampling event.
Sample_Range	Sample Numbers	String	50	Sample number range being shipped.
Date_of_Collection_Start	Date of Collection Start	Date	255	Start date of collection of samples (M/DD/YYYY)
Date_of_Collection_End	Date of Collection End	Date	255	End date of collection of samples (M/DD/YYYY)
Shipped_by	Shipped by (first and last names)	String	255	Individuals who shipped the samples.
Collection_Office	Collection Office	String	255	FWCO office who shipped the samples.
Notes	Notes	String	255	General notes, issues, or observations about samples.
Shipping_Notes	Shipping Notes	String	255	Note of how many boxes are being shipped and which boxes contain which samples.
Sample_Numbers	Sample Numbers	String	255	Sample number range being shipped.
Released_by	Released by: (Name, Agency)	String	255	Name and Agency of who is releasing samples
Release_Signature	Release Signature	Text	255	Digital signature of who is releasing samples.

Field Name	Alias	Type	Length	Description
Release_Signature_Certified	I certify the digital release signature above represents my signature for Chain of Custody purposes.	String	255	A yes check box to certify the digital signature represents the individual signature for the chain of custody purposes.
Release_Date	Release Date	Date	255	The release date of the samples (M/DD/YYYY).
Delivered_by	Delivered via	String	255	How were samples transferred: options include FedEx, In Person, and Other
Delivered_by_Other	Delivered via Other	String	255	How were samples transferred by other.
Received_by	Received by	String	255	Name of WGL staff who is receiving the samples.
Receipt_Signature	Receipt Signature	String	255	Digital signature of who is receiving the samples.
Receipt_Signature_Certified	Select1	String	255	A yes check box to certify the digital signature represents the individual signature for the chain of custody purposes.
Receipt_Date	Receipt Date	Date	255	The receipt date of the samples (M/DD/YYYY).
Editing_Notes	Editing Notes	String	255	Any changes to the form denoted with the initials of the individual making the change and the date when the change was made

Table 4. Field descriptions for the individual FWCO eDNA Chain of Custody Form

Field Name	Alias	Type	Length	Description
Unique_Username	Unique_Username	String	255	The ArcGIS username of the individual logged in to the Survey123 application.
Case_Number	Case Number	Integer	5	Composite number that has a 5-digit “case” number, a series of unique numbers assigned by the Whitney Genetics Lab (WGL) to each Fish and Wildlife Conservation Office (FWCO) at the start of the sampling year and provided for each individual planned sampling event.
Sample_Range	Sample Numbers	String	50	Sample number range being transferred.
Date_of_Collection	Date of Collection	Date	255	Date of collection of samples (M/DD/YYYY)
Collected_by	Collected by (first and last names)	String	255	Individuals who assisted in collecting the samples.
Collection_Office	Collection Office	String	255	FWCO office who lead the collection of samples.
Notes	Notes	String	255	General notes, issues, or observations about samples being transferred.
Editing_Notes	Editing Notes	String	255	Any changes to the form denoted with the initials of the individual making the change and the date when the change was made.
Reviewed_by	Reviewed by	String	255	Individual checking the record for missing or incorrect information.
Date_Reviewed	Date of Review	Date	255	Date the record was checked for missing or incorrect information.
Review_status	Review Status	String	255	Status of the record being checked for missing or incorrect information.

Field Name	Alias	Type	Length	Description
Review_Notes	Review Notes	String	255	Notes on any missing or incorrect information.
Case_Number_Sender	Case_Number_Sender	Integer	5	Case number of the samples being sent. Part of the related table containing sample transfer contacts, transfer dates, delivery method, and signatures.
Collection_Office_Sender	Collection_Office_Sender	String	255	Collection office sending the samples. Part of the related table containing sample transfer contacts, transfer dates, delivery method, and signatures.
Sample_Numbers	Sample Numbers	String	255	Sample number range being transferred. Part of the related table containing sample transfer contacts, transfer dates, delivery method, and signatures.
Release_Signature	Release Signature	String	255	Digital signature of who is releasing samples. Part of the related table containing sample transfer contacts, transfer dates, delivery method, and signatures.
Release_Signature_Certified	I certify the digital release signature above represents my signature for Chain of Custody purposes.	String	255	A yes check box to certify the digital signature represents the individual signature for the chain of custody purposes. Part of the related table containing sample transfer contacts, transfer dates, delivery method, and signatures.
Release_Agency	Release Agency	String	100	The agency who is releasing the samples. Part of the related table containing sample transfer contacts, transfer dates, delivery method, and signatures.
Release_Date	Release Date	Date	255	The release date of the samples (M/DD/YYYY). Part of the related table containing sample transfer contacts, transfer dates, delivery method, and signatures.

Field Name	Alias	Type	Length	Description
Receipt_Signature	Receipt Signature	String	255	Digital signature of who is receiving the samples. Part of the related table containing sample transfer contacts, transfer dates, delivery method, and signatures.
Receipt_Signature_Certified	I certify the digital receipt signature above represents my signature for Chain of Custody purposes.	String	255	A yes check box to certify the digital signature represents the individual signature for the chain of custody purposes. Part of the related table containing sample transfer contacts, transfer dates, delivery method, and signatures.
Receipt_Agency	Receipt Agency	String	100	The agency who is receiving the samples. Part of the related table containing sample transfer contacts, transfer dates, delivery method, and signatures.
Receipt_Date	Receipt Date	Date	255	The receipt date of the samples (M/DD/YYYY). Part of the related table containing sample transfer contacts, transfer dates, delivery method, and signatures.
Delivered_by	Delivered via	String	255	How were samples transferred: options included FedEx, In Person, and Other. Part of the related table containing sample transfer contacts, transfer dates, delivery method, and signatures.
Delivered_by_Other	Delivered via Other	String	255	How were samples transferred by other. Only filled in if the user selects the other option for the Delivered_by field. Part of the related table containing sample transfer contacts, transfer dates, delivery method, and signatures.

Table 5. Field descriptions for eDNA results table.

Field Name	Alias	Type	Length	Description
Case_Number	Case_Number	Integer	5	Composite number that has a 5- digit “case” number, a series of unique numbers assigned by the Whitney Genetics Lab (WGL) to each Fish and Wildlife Conservation Office (FWCO) at the start of the sampling year and provided for each individual planned sampling event.
Sample_Number	Sample_Number	Integer	3	A 3-digit sample ID number assigned by the FWCO numerically as they take samples in the field (no punctuation, #####)
Unique_ID	Unique_ID	Integer	8	Composite number that has a 5- digit “case” number, a series of unique numbers assigned by the Whitney Genetics Lab (WGL) to each Fish and Wildlife Conservation Office (FWCO) at the start of the sampling year and provided for each individual planned sampling event, followed by a 3 digit sample ID number assigned by the FWCO numerically as they take samples in the field (no punctuation, #####). Used as the join field to link the field data to eDNA sample result data.
Any_Detection	Any_Detection	Integer	1	1= detection of at least 1 of the 3 assays (Bighead, Silver, or Invasive Carp), 0= no detection of any assay

Field Name	Alias	Type	Length	Description
AC_Assay	AC_Assay	Integer	1	1= detection of at least 1 Invasive Carp qPCR replicate, 0= no detection, corresponds to one of three assays running in multiplex
BH_Assay	BH_Assay	Integer	1	1= detection of at least 1 Bighead carp qPCR replicate, 0= no detection, corresponds to one of three assays running in multiplex
SC_Assay	SC_Assay	Integer	1	1= detection of at least 1 Silver carp qPCR replicate, 0= no detection, corresponds to one of three assays running in multiplex
eDNA_Detection_Summary	eDNA_Detection_Summary	Integer	1	Summary results from the AC_Assay, BH_Assay, and SC_Assay. 0= no detections, 1= detection AC only, 2= Bighead or Bighead and AC only, 3= Silver or Silver and AC only, 4= Both Bighead and Silver with or without AC detection.
Notes	Notes	Text	255	Any relevant lab notes pertaining to the eDNA detection data.

Table 6. Field descriptions for Post-Trip & QA/QC Summary Survey123 Form.

Field Name	Alias	Type	Length	Description
Case	Case Number	Integer	5	Composite number that has a 5-digit “case” number, a series of unique numbers assigned by the Whitney Genetics Lab (WGL) to each Fish and Wildlife Conservation Office (FWCO) at the start of the sampling year and provided for each individual planned sampling event.
Basin	Sample Basin	String	255	The watershed the sample was collected from.
Begin_Date	Date of Collection Start	Date	255	Start date of collection of samples (M/DD/YYYY)
End_Date	Date of Collection End	Date	255	End date of collection of samples (M/DD/YYYY)
Post_Trip_Summary	Post Trip Summary	String	255	Sampling plan was completed as described in Exhibit 1 OR Sampling plan was NOT completed as described in Exhibit 1 (Describe below)
Description_of_deviations	Description of deviations from Exhibit 1	String	1000	List and description of any deviations from Exhibit 1, only available if “Sampling plan was NOT completed as described in Exhibit 1 (Describe below)” was selected in Post Trip Summary
Field_Operations_Manager	Field Operations Manager (first and last name)	Text	255	Individual who was the Field Operations Manager

Field Name	Alias	Type	Length	Description
Sampling_Quality	Sampling Quality	String	255	The Sampling QA/QC Specialist observed and witnessed adherence to the QAPP in the following criteria. A “Yes” or “No” check box is selected for each criteria “Boat decontaminated in the field”, “Sample collection procedure”, “Navigation to sample sites”
Explanation_of_Deviation	Explanation of Deviation	String	1000	List and describe any deviations from the QAPP, include reasoning. Only available if any “No” answer is selected in Sampling Quality
Sampling_QAQC_Specialist	Sampling QA/QC Specialist (first and last name)	Text	255	Individual who was the Sampling QA/QC Specialist
Processing_Quality	Processing Quality	String	255	The Processing QA/QC Specialist observed and witnessed adherence to the QAPP in the following criteria. A “Yes” or “No” check box is selected for each criteria “Decontamination of processing equipment”, “Sample processing procedure”
Explanation_of_Deviation	Explanation of Deviation	String	1000	List and describe any deviations from the QAPP, include reasoning. Only available if any “No” answer is selected in Processing Quality
Processing_QAQC_Specialist	Processing QA/QC Specialist (first and last name)	Text	255	Individual who was the Processing QA/QC Specialist
Data_Quality_for_case_number	Data Quality Specialist certifies case number	Integer	255	The Data QA/QC Specialist completed the QA/QC of sample date for case number:

Field Name	Alias	Type	Length	Description
Data_quality_confirm	Data Quality Confirmation	String	255	The Data QA/QC Specialist confirms that data are accurate and represent the locations and conditions in which samples were collected. A “Yes” or “No” check box is selected
Explanation_of_Deviation	Explanation of Deviation	String	1000	List and describe any deviations, include reasoning. Only available if “No” is selected in Data Quality Confirmation
Data_QAQC_Specialist	Data QA/QC Specialist (first and last name)	Text	255	Individual who was the Data QA/QC Specialist
Notes	Notes	String	1000	General notes, issues, or observations about sample collection and processing
eDNA_Lead_Signature	eDNA Lead Signature (first and last name)	Text	255	Individual who was the eDNA Lead, certifying that the information input is correct and accurate and that they communicated with the field staff for the information that is entered.
eDNA_Lead_Signature_Certified	Select1	String	255	A yes check box to certify the digital signature represents the individual signature for Exhibit 2 purposes.
Date	Date of eDNA Lead Signing	Date	255	Date the eDNA Lead submits Exhibit 2 (M/DD/YYYY).

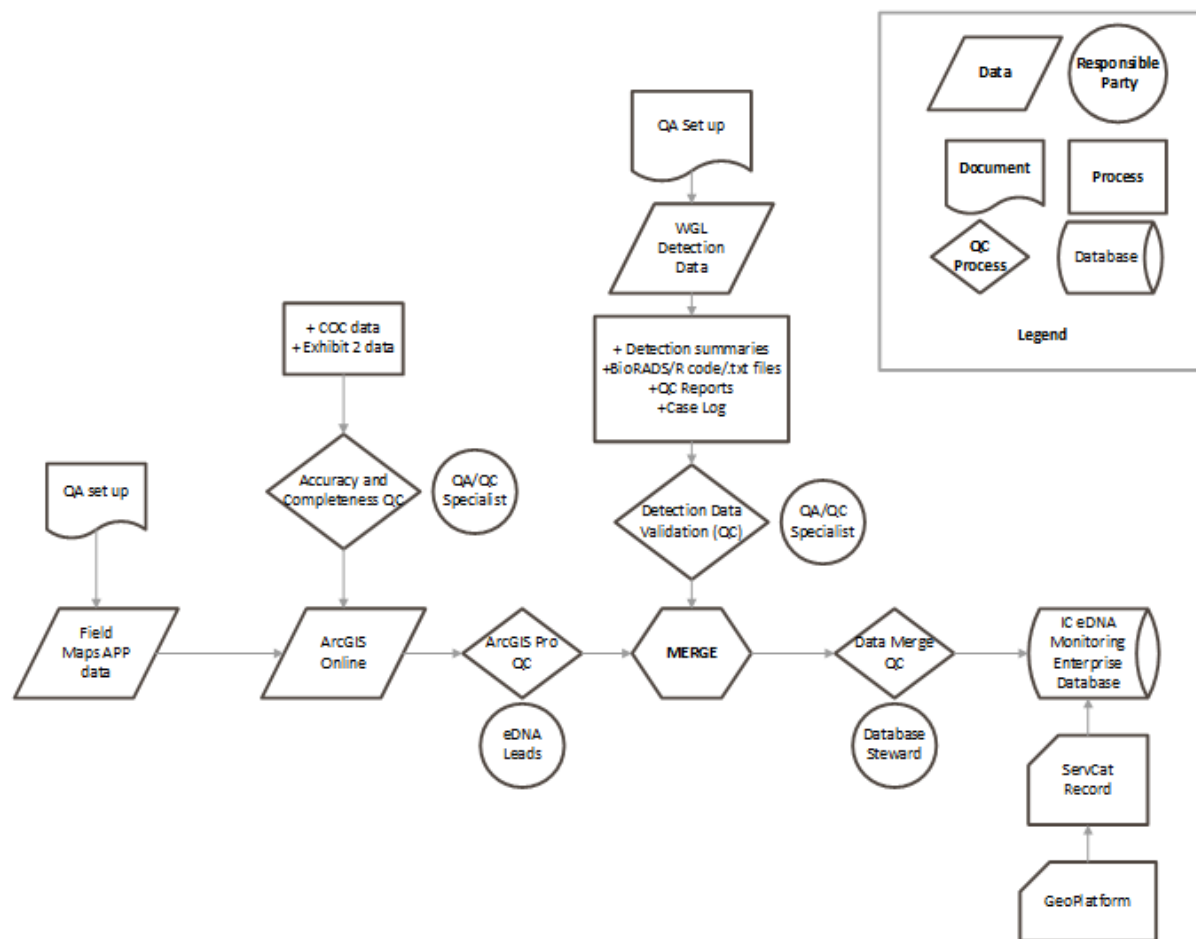


Figure 1. Invasive Carp eDNA Monitoring Program overall data flow from FWCO field collection, incorporating WGL sample processing and the resulting Invasive Carp eDNA Monitoring Enterprise Database.

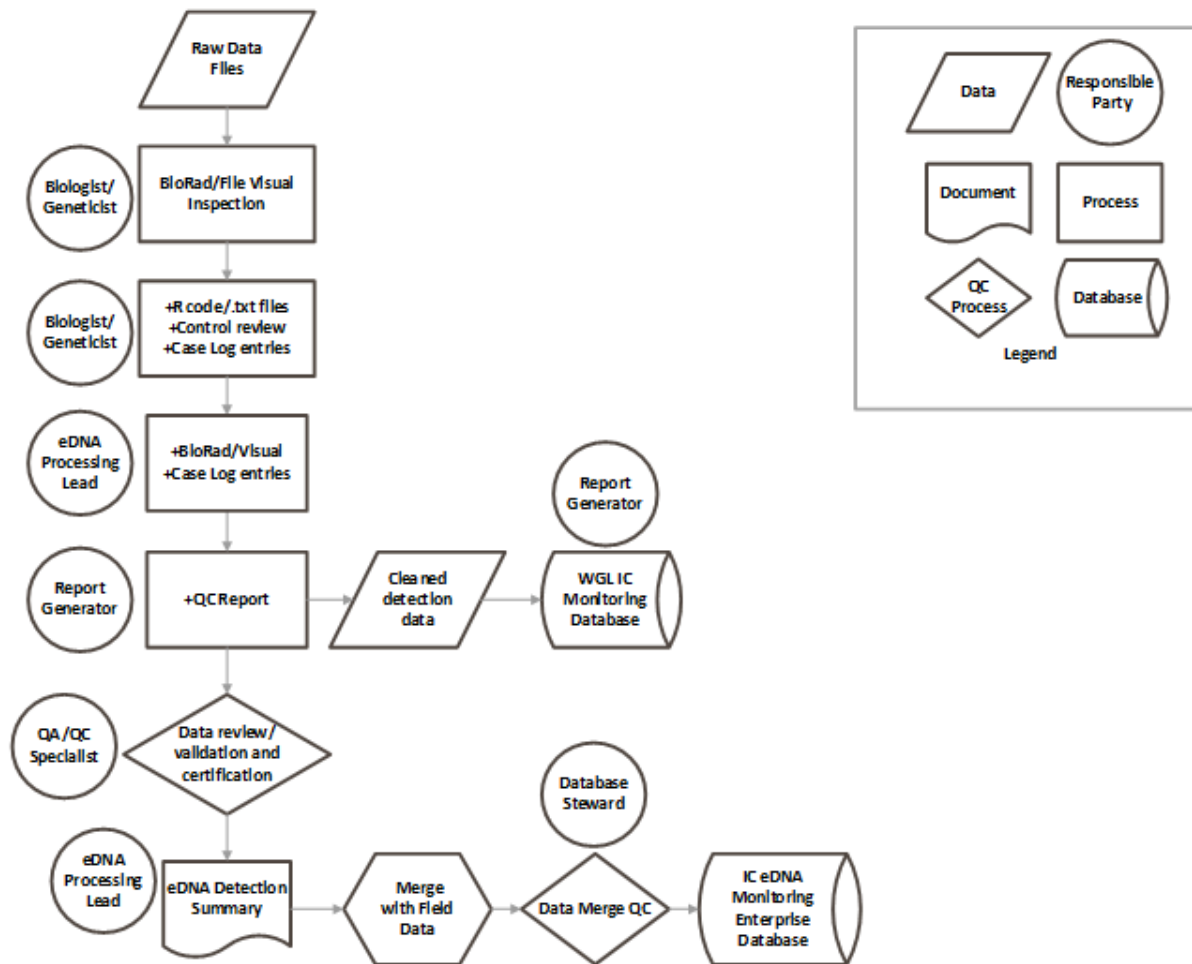


Figure 2. Data flow for detection results generated in WGL for the Invasive Carp eDNA Monitoring Program.