REGIONAL MONITORING
PROGRAM FOR WATER QUALITY
IN SAN FRANCISCO BAY
sfei.org/rmp

2018 RMP Bird Egg Monitoring Sampling and Analysis Plan

Contribution #891

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1. Introduction

The Regional Monitoring Program for Water Quality in San Francisco Bay (RMP) monitors concentrations of contaminants in bird egg tissue as an indicator of water quality. In 2018, the RMP will collect bird egg samples from various locations in the Bay as part of routine Status and Trends Monitoring. The target species will be Double-crested Cormorants and Forster's Terns.

The samples will be collected by staff at the USGS Western Ecological Research Center (USGS-WERC) who will procure all necessary egg collection permits.

Bird-egg tissue will be analyzed for mercury, selenium, polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), and per- and polyfluoroalkyl substances (PFAS) by laboratories at the USGS-WERC, the Marine Pollution Studies Laboratory at Moss Landing Marine Labs (MPSL-DFW), and SGS-AXYS.

The purpose of this Sampling and Analysis Plan is to clearly document the sampling design, methods, and responsibilities and to make it easy for project partners to coordinate.

2. Key Personnel and Approvals

Table 1. Key Personnel and Approvals of Sampling and Analysis Plan

Contact	Role	Phone/Email	Plan Approval Date
Jay Davis	RMP Lead Scientist	jay@sfei.org 510-746-7368	2/27/18
Phil Trowbridge	RMP Manager	philt@sfei.org 510-746-7345	PT
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Paul Salop	AMS Project Manager	salop@amarine.com 510-323-6523 Applied Marine Sciences, Inc. 4749 Bennett Dr., Ste L Livermore, CA 94551	PDS
Sean Campbell	SGS-AXYS Project Manager	scampbell@axys.com 250-655-5834 SGS-AXYS Analytical 2045 Mills Road Sidney, BC, Canada V8L 5X2	SBC
Wesley Heim	MPSL-DFW Director	wheim@mlml.calstate.edu 831-771-4459 Marine Pollutions Studies Lab 7544 Sandholdt Road Moss Landing, CA 95039	WH

Autumn Bonnema	MPSL-DFW Project Manager	bonnema@mlml.calstate.edu 831-771-4175 Marine Pollution Studies Lab 7544 Sandholdt Road Moss Landing, CA 95039	AB
Rebecca Pugh	NIST Project Manager	Rebecca.Pugh@noaa.gov 843-460-9864 NIST Hollings Marine Laboratory 331 Ft. Johnson Rd. Charleston, SC 29412	RP

3. Sampling Design

The target species will be Double-crested Cormorants and Forster's Terns (hereafter referred to as "cormorants" and "terns"). Cormorant eggs will be collected from up to 3 locations in 2018. Tern eggs will be collected from up to 4 locations in 2018. The number of stations and the total number of eggs required for the 2018 study are shown in Table 2.

In addition to the 2018 samples, archived tern egg samples from 2016 will be analyzed for PBDEs (see Section 11 for details).

Table 2: 2018 Bird Egg Study Design

	Double Crested Cormorant[1]	Forster's Tern
Number of sites	3	4[2]
Composites per Site	3	3
Total Composites to Collect	9	12
Eggs per Composite	7	7
Total Eggs to Collect	63[3]	84[3]

1. PFAS analyses will be conducted on cormorant samples. Avoid using any Teflon coated equipment when handling these eggs.
2. Note that the number of sites for collection of tern eggs was reduced from 6 sites (the number used in past sampling) to 4 sites in 2016. Sites that were removed are the Napa-Sonoma Marsh and Eden Landing sites.
3. Individual tern eggs will be analyzed for mercury by USGS. Individual cormorant eggs will be analyzed for mercury by MPSL-DFW. All other samples will be analyzed as composites. The 3 composites collected from each site serve as field replicate samples.

4. Sampling Locations

Cormorant eggs will be collected from up to 3 locations in 2018. Wheeler Island and Richmond Bridge are the historical sites for cormorant egg collection. A South Bay target location was most recently sampled at Pond A9/10.

Tern eggs will be collected from up to 4 locations in 2018. The historical collection sites have been: (1) Pond A16; (2) Pond A2W; (3) Pond AB2 in Don Edwards National Wildlife Refuge; (4) Eden Landing Ecological Reserve; (5) Hayward Shoreline Regional Park; and (6) Napa-Sonoma Marsh Wildlife Area. However, terns are known to be nomadic and change colony sites annually in response to local conditions, and, in 2016, eggs were collected at Ponds AB1 and AB2, Hayward Shoreline Regional Park, and New Chicago Marsh. It is plausible that collections will need to occur at other sites in response to local breeding conditions in 2018.

The coordinates of the actual sampling sites will be determined using a hand-held device and reported on field sheets provided by USGS.

Table 3: Potential Stations for 2018 Bird Egg Samples

Station	Site Type	CEDEN Code	Latitude	Longitude
Wheeler Island	Cormorant/Historical	2EEPSWI	38.0849	-121.9375
Richmond Bridge	Cormorant/Historical	2EEPSRB	37.9352	-122.4373
Pond A9/10 in Don Edwards NWR	Cormorant/Target	2EEPSDEP9/10C	37.4511	-122.0117
Pond A16 in Don Edwards NWR	Tern/Historical	2EEPSDEP16	37.4512	-121.9694
Pond A2W in Don Edwards NWR	Tern/Historical	A2W	37.4429	-122.0690
Pond AB2 in Don Edwards NWR	Tern/Historical	AB2	37.4317	-122.0495
Eden Landing Ecological Reserve	Tern/Historical	EL	37.5811	-122.1100
Hayward Shoreline Regional Park	Tern/Historical	2EEPSHRS	37.6322	-122.1459
Napa-Sonoma Marsh Wildlife Area	Tern/Historical	2EEPSNM	38.1485	-122.3155
New Chicago Marsh	Tern/Possible Target	2EEPSNCM	37.4380	-121.9680
Pond A1 in Don Edwards NWR	Tern/Possible Target	2EEPSPA1	37.4376	-122.0960
Pond A7 in Don Edwards NWR	Tern/Possible Target	2EEPSPA7	37.4435	-122.0089
Hayward Pond 3B	Tern/Possible Target	HAY3B	37.6302	-122.1468
Pond AB1 in Don Edwards NWR	Tern/Possible Target	2EEPSDEP_AB1	37.4443	-122.0637

5. Egg Collection

Eggs will be collected by USGS-WERC using approved USGS field collection and handling protocols (Ackerman et al., 2013). USGS-WERC will procure all necessary egg collection permits. USGS-WERC will record relevant field sampling information and any anomalies on a standardized field data sheet.

6. Egg Handling, Measurement, Labeling, and Shipment to Laboratories

After being collected in the field, each egg (cormorant and tern) will be tagged with a unique ID by USGS-WERC and then transported in egg cartons on wet ice to the USGS-WERC and placed in a refrigerator until shipment or sample processing.

USGS-WERC will measure egg length, egg width, and total egg mass (with eggshell) of all eggs (terns and cormorants) following Steps 1-7 in the Egg Dissection protocols in Attachment 1.

USGS-WERC will record the unique ID and the egg measurements in the spreadsheet in Attachment 5.

USGS-WERC will dissect and process the tern eggs (see Section 8). USGS-WERC will analyze the tern eggs for total mercury and ship appropriate subsamples to labs for analysis.

USGS-WERC will ship the whole cormorant eggs to AXYS Analytical for dissection and processing. Whole eggs will be shipped at room temperature via FedEx or UPS in specially designed egg shippers with high density foam in a double padded cardboard box. Each egg will also be placed in a sealed whirlpak bag. USGS-WERC will make every reasonable effort to package cormorant eggs so that they reach AXYS Analytical fully intact.

AXYS will process the whole cormorant eggs (see Section 8). AXYS will analyze the cormorant eggs for PCBs, PBDEs, and PFASs, and ship all other subsamples to AMS. AMS will then ship or deliver the subsamples for mercury and selenium to MPSL, the long-term archives to NIST, and the short-term archives to Shaeffers in Oakland, CA.

Shipping addresses for laboratories are shown in Table 1. See Attachment 2 for shipping details.

Permits Required

Shipments of bird egg tissue across the US-Canada border require that both the importer and the exporter have a permit from the USFWS Migratory Bird Office. The local contact at the USFWS Migratory Bird Office that processes migratory bird permits is Stephen Fettig (stephen_fettig@fws.gov). Shipments must be declared to USFWS using Form 3-177 up to 3

days prior to the shipment. Therefore, in order to comply with the shipping plan, USGS-WERC, AXYS, and AMS will all need to obtain a USFWS permit. More information is available at http://www.fws.gov/le/ImpExp/faqs.htm.

7. Chain of Custody and Field Collection Documentation

All samples will be accompanied by a chain of custody form (COC) provided by the shipper. The COC form will include the unique sample ID, site name, collection date, sample type, and other remarks.

When USGS-WERC ships subsamples, USGS-WERC will provide SFEI with a chain of custody form and the Attachment 5 spreadsheets for terns and cormorants in an electronic format. For the final report USGS-WERC will provide SFEI with a CEDEN format electronic data deliverable (EDD) spreadsheet for both the tern and cormorant eggs that will include information such as site name, collection date, sample unique ID, whole egg weight, egg length, and egg width. SFEI will provide the EDD spreadsheet template to USGS-WERC.

8. Egg Dissection and Compositing

Tern Eggs: USGS-WERC

For each site, there should be 21 eggs collected. These eggs will be randomly sorted into 3 composite samples per site with 7 eggs each. There will be a total of 12 composite samples across the 4 sites.

USGS-WERC staff will follow the protocols in Attachment 1 to dissect and dry each egg.

The compositing plan for tern eggs is shown in Attachment 3. First, the contents of each egg will be oven dried and homogenized. Second, an appropriate aliquot of each egg will be put into the appropriate container for total mercury analysis. Then, USGS-WERC will combine 2 g dried mass from each of 7 eggs into a composite sample (using equal amounts of mass from each egg). This process will be repeated for each site until all eggs have been composited. In total, this will yield 12 composite samples. USGS-WERC will subsample the large composite for PBDEs and selenium as described in Attachment 3 and will ship the subsamples to the appropriate labs (i.e., AXYS and MPSL).

Cormorant Eggs: AXYS

Upon receipt of eggs, AXYS will inspect for breakage and discard any eggs that are broken. For each site, there should be 21 eggs collected. These eggs will be randomly sorted into 3

composite samples per site with 7 eggs each. There will be a total of 9 composite samples across the 3 sites.

Sort into composites and weigh the eggs

- On the worksheet (Attachment 5), randomly assign the eggs, in groups of 7, to 3 composite groups for each site (Composite Groups 1-9 for the 3 sites in total).
- For each site, weigh each egg individually and record the unique ID and the egg measurements in the spreadsheet in Attachment 5.
- Calculate the total mass of each composite group by summing the mass of the 7 individual eggs in each group.
- Calculate the approximate tissue mass of each composite group by subtracting expected shell mass (assume 15% of total mass is shell mass).

Plan the aliquots and composites

- Attachment 4 shows the compositing plan for cormorant eggs. On paper, work out whether there is enough tissue mass for all of the analyses.
- Contact the RMP Manager to confirm the aliquot and compositing plan before processing the eggs.

Dissect eggs, extract aliquots, create composite

- Obtain authorization to proceed from the RMP Manager.
- Follow the Egg Dissection Protocol in Attachment 1 to dissect each egg.
- The contents from each egg should be homogenized, individually, in a 500 mL glass jar using a wand blender, using trace clean equipment to avoid contamination for analytes of interest (mercury, selenium, PCB, PBDE, PFASs).
- Put the appropriate aliquot of each egg into the appropriate container for mercury analysis. See Attachment 2 for container information.
- Put the remaining portion of each egg (using approximately equal masses from each egg) in a clean stainless steel bowl. Once the tissue from all 7 eggs from the same sample have been combined in the container, thoroughly mix the liquid contents and prepare to fill the subsamples.

Subsample composite and ship subsamples to laboratories

- Subsample the large composite as described in Attachment 4. See Attachment 2 for container information.
- Subsamples will be frozen immediately after processing is complete.
- Ship the subsamples to the appropriate labs. See Attachment 2 for shipping instructions.

9. Analytical Methods

Table 4: Laboratory Analysis Plan for 2018 RMP Bird Samples

Parameter[1]	Method	Lab Agency	Cormorant	Tern	Tern Archive[2]
Total Mercury	EPA 7473	USGS-WERC		X	
% Moisture	Whole Egg Oven Drying	USGS-WERC		X	
Mercury	EPA 7473	MPSL-DFW	X		
% Moisture	EPA 7473 & EPA 200.8	MPSL-DFW	X		
Selenium	EPA 200.8	MPSL-DFW	X	X	
PBDE	AXYS MLA-033	AXYS	X	X	X
PCB (209)	AXYS MLA-010	AXYS	X		
PFASs	AXYS MLA-043 Rev 08	AXYS	X		
% Moisture	Various[3]	AXYS	X		
% Lipid	Various[3]	AXYS	X	X	X

Notes

1. See Attachment 6 for lists of the specific target analytes, fractions, and reporting units for this study.
2. See Section 11 for details.
3. Percent moisture and percent lipid will be analyzed by AXYS three different ways using the methods for PBDEs, PCBs, and PFASs.

10. Quality Assurance Samples

The laboratory and quality assurance methods used will conform to the RMP Quality Assurance Project Plan (SFEI, 2017). No field blanks will be needed because whole eggs will be collected. At each site, the three composite samples will serve as field duplicates. Laboratory QC samples will be run at a frequency of at least 1 per every 20 samples. The total number of QC sample expected for each parameter is shown in Table 5.

Table 5: Total Number of Field Samples and Laboratory Quality Assurance and Quality Control Samples for the 2018 Bird Egg Study.

Species	Laboratory	Parameter	Field Samples	Lab Blank	Lab Dupe	MS[1]	MSD[1]	CRM[1]	CCV[1] (optional)
Cormorant	MPSL-DFW	Mercury	63	4	4	4	4	4	4
Cormorant	MPSL-DFW	Selenium	9	1	1	1	1	1	1
Cormorant	SGS-AXYS	PBDE	9	1	1	1	Note 2	1	1
Cormorant	SGS-AXYS	PCB	9	1	1	1	Note 2	1	1
Cormorant	SGS-AXYS	PFAS	9	1	1	1	Note 2	1	1
Tern	USGS-WERC	Mercury	84	5	5	5	5	5	5
Tern	MPSL-DFW	Selenium	12	1	1	1	1	1	1
Tern	SGS-AXYS	PBDE	12	1	1	1	Note 2	1	1

Notes:

1. MS=Matrix Spike; MSD=Matrix Spike Dupe; CRM=Certified Reference Material; CCV=Continuing Calibration Verification (i.e., Lab Control Sample).
2. Matrix spike duplicates are not required for PCBs, PBDEs, and PFASs due to limits on sample mass. However, if concentrations in lab duplicate samples are close to the method detection limit (1-2xMDL), then SFEI may request that MSDs (at 5-20xMDL) be performed on samples with extra mass to assess repeatability of laboratory methods.

11. Additional Samples for Laboratory Analysis

In 2016, the RMP archived 12 samples of tern eggs for later analysis for PBDEs. These samples have been stored at the Shaeffers facility in Oakland since processing. These samples will be analyzed for PBDEs at the same time as the 12 new tern samples from 2018. The number of archive samples and the number of associated QA/QC samples for these analyses are shown in Table 6. These samples were dried in 2016. Therefore, the analysis will not include %moisture but will include %lipid. For unit conversions to wet-weight, the %moisture values of these samples from 2016 will be used.

Table 6: Total Number of Archived Samples and Laboratory Quality Assurance and Quality Control Samples from the 2016 Bird Egg Study.

Species	Laboratory	Parameter	Field Samples	Lab Blank	Lab Dupe	MS[1]	MSD[1]	CRM[1]	CCV[1] (optional)
2016 Tern Archive	SGS-AXYS	PBDE	12	1	1	1	Note 2	1	1

Notes

1. MS=Matrix Spike; MSD=Matrix Spike Dupe; CRM=Certified Reference Material; CCV=Continuing Calibration Verification (i.e., Lab Control Sample).
2. Matrix spike duplicates are not required for PCBs, PBDEs, and PFASs due to limits on sample mass. However, if concentrations in lab duplicate samples are close to the method detection limit (1-2xMDL), then SFEI may request that MSDs (at 5-20xMDL) be performed on samples with extra mass to assess repeatability of laboratory methods.

12. Samples for RMP Archives

Extra samples of cormorant egg tissue will be collected as outlined in the RMP Archiving Strategy (Appendix 2 of SFEI, 2017). The containers for archives are listed in Attachment 2. The required archives are listed in the compositing plan for cormorants in Attachment 4. Tern egg tissue samples are not archived in the specimen bank.

SGS-AXYS will fill the archive containers per the compositing plan in Attachment 4 then ship the containers to AMS. AMS will be responsible for adding the short-term archives to Shaeffer's in Oakland, and shipping the long-term archives to NIST in Charleston, SC.

13. Reporting

For a final report, USGS-WERC will summarize the 2018 1) tern egg field sampling effort, external egg morphometrics, and total mercury concentrations, and 2) cormorant egg field sampling effort and external egg morphometrics in a final data summary. The USGS-WERC data summary shall include:

- Data tables with the egg length, egg width, egg weight (with eggshell), sample ID, and collection site for each tern and cormorant egg (see Attachment 5),
- Collection information for tern and cormorant eggs in a CEDEN EDD template that will be provided by SFEI and will include information such as site name, collection date, sample unique ID, egg weight, egg length, and egg width etc.,
- Total mercury analysis results for individual tern eggs in a CEDEN EDD template with all associated quality assurance metadata,
- A list of any deviations from this Sampling and Analysis Plan, and
- Recommendations, if any, to improve methods for future bird egg sampling.

Laboratory results from AXYS and MPSL-DFW will be provided to SFEI in a CEDEN EDD template with all associated quality assurance metadata.

The field sampling information for this study (e.g., the number and location of samples collected) will be included in the 2018 Field Sampling Report prepared by SFEI.

The results from this study, in the form of time series graphs, will be reported to the TRC and Steering Committee, and may appear in the 2019 Pulse of the Bay report (September 2019).

14. Reporting Units

USGS-WERC

Total mercury results for individual tern eggs will be reported by USGS-WERC on a fresh wet-weight basis, following methods similar to Ackerman et al. (2013) and may be slightly modified to account for the eggshell (Herzog et al. 2016). Mercury, field collection, and composite data will be provided to SFEI in a CEDEN comparable EDD. The units that USGS will use to report results to SFEI are listed below.

- Egg=µg/g fww
- Egg Moisture=%
- Duplicates=µg/g fww
- Method Detection Limit and Reporting Limit=µg/g fww
- System and Method Blanks=ng
- Matrix Spikes and Matrix Spike Duplicates=ng
- Continuing Calibration Verification=ng
- Certified Reference Materials=µg/g dw

SFEI will convert some QA sample results to CEDEN Reporting Units as described later in this section.

MPSL-DFW

Total mercury results for cormorant egg samples (and all associated lab QA samples) will be reported by MPSL-DFW on a wet-weight basis (ug/g ww).

Total selenium results for cormorant and tern egg samples (and all associated lab QA samples) will be reported by MPSL-DFW on a dry-weight basis (ug/g dw).

AXYS

All analytical results for cormorant and tern egg samples (and all associated lab QA samples) will be reported by AXYS on a wet-weight basis (ng/g ww).

Conversions Between Units by SFEI

UGSG-WERC reports some lab QA results for total mercury in terns in units of ng. The QA samples with these reporting units are: System & Method Blanks, Matrix Spikes and Matrix Spike Duplicates, and Continuing Calibration Verification Samples. For the RMP's QA Program and coherent reporting in CEDEN, it is necessary to convert these results into similar units as the egg samples. Therefore, the following assumptions will be made to convert these results into wet-weight concentrations for typical tern egg samples.

1. The average mass of tern egg tissue in a sample will be assumed to be 0.03 g dw, which will be converted to g ww using the the average ratio of wet and dry mass for all the samples in the current year (it is expected to be around 75%). The assumed sample mass will be adjusted if the laboratory changes the sample size of the actual samples.
2. The QA results in ng will be converted to an approximate "concentration" by dividing the QA result in ng by the "typical" sample mass in g ww from Step 1 (or actually used subsample mass and moisture % in the case of MS & MSDs or other QC samples derived from field samples). This allows more direct evaluation of the relative signal in QC samples (e.g. blank contamination) compared to a typical environmental sample signal.
3. For MS/MSD samples, the spiked mass will first be converted to an approximate concentration equivalent (as described above, with actual spiked subsample ww mass equivalent) and then added to the measured concentration in the unspiked sample to derive the "ExpectedValue" for CEDEN reporting. The analytical result on MS/MSD samples will also be reported in the same basis as unspiked samples (again, following CEDEN protocols). Percent recovery can be calculated either before or after conversion to concentration equivalent basis (but note, calculated recoveries should be identical regardless of reporting basis, as all ng basis values (spike amount, expected value, analytical result) in a given MS would be transformed to concentration by its given sample ww mass equivalent).
4. The Method Detection Limit for the lab QA samples for total mercury in terns will be assumed to be 0.015 ug/g dw for all samples and converted to wet-weight using the the average ratio of wet and dry mass for all the samples in the current year (it is expected to be around 75%).
5. Certified Reference Material results should be reported in the basis for which the material is certified, if the CRM is actual tissue. However, if spiked solution CRMs (e.g. with an expected ng/ml concentration) are used, results should be converted to approximate tissue ww concentration equivalents to allow comparison to field sample concentration ranges.

Any tern egg sample results reported in dry-weight units may be converted to wet weight units using the mass of the tissue before and after drying recorded by USGS-WERC. Egg sample results reported in wet-weight units may be converted to a fresh weight weight basis using

individual egg length and breadth (width) measurements and two species-specific constants derived from the literature: Kv (egg volume coefficient) and typical fresh wet weight density (Ackerman et al., 2013; Hoyt, 1979). Specifically wet weight results can be converted to fresh wet weight results using the following equations,

(1) $Xfww = (WW / FWW) * Xww$
(2) $FWW = V * Dfww$
(3) $V = Kv * L * B^2$

Where:
FWW = fresh wet weight
WW = wet weight
Xfww = chemical concentration on a fresh wet weight basis
Xww = chemical concentration on a wet weight basis
V = volume
Dfww = density of a typical freshly laid egg (g/mL)
Kv = species-specific egg volume coefficient
L = individual egg length
B = individual egg breadth (ie. width)
Kv and wet weight density for terns are provided in Ackerman et al., (2013).

Cormorant egg results will be reported by the laboratories on a wet weight basis. These results may be converted to a fresh weight weight basis using the formula described above for terns. Kv and wet weight density for cormorants will be determined from the literature. These results may be converted to a dry-weight basis or a lipid-weight basis using the %moisture or %lipid measurements for each sample.

References

Ackerman, JT, MP Herzog, and SE Schwarzbach. 2013. Methylmercury is the predominant form of mercury in bird eggs: a synthesis. Environmental Science and Technology 47:2052-2060.

Herzog, MP, JT Ackerman, CA Eagles-Smith, and CA Hartman. 2016. It's what's inside that counts: egg contaminant concentrations are influenced by estimates of egg density, egg volume, and fresh egg mass. Ecotoxicology 25:770-776.

SFEI. 2017. Quality Assurance Program Plan for the Regional Monitoring Program for Water Quality in San Francisco Bay. San Francisco Estuary Institute Richmond CA. Report No.: 828. Available online: http://www.sfei.org/documents/2017-quality-assurance-program-plan-regional-monitoring-program-water-quality-san-francisco-bay.

Attachments

Attachment 1. Standard Operating Procedure for Bird Egg Dissection and Processing (see below)

Attachment 2. Containers and Handling Instructions for RMP Bird Egg Samples
https://docs.google.com/spreadsheets/d/1slQ7R_DYpL1AOmh4Ty4v8trG3kUp6KW-yeEa_GbSxd0/edit#gid=0

Attachment 3. Compositing Plan for Tern Eggs
https://docs.google.com/spreadsheets/d/1AxdsgLO4CmKZOX4E_yr7_dBXvQqKztO6mjCbF5VXOzo/edit#gid=1979867832

Attachment 4. Compositing Plan for Cormorant Eggs
https://docs.google.com/spreadsheets/d/1AxdsgLO4CmKZOX4E_yr7_dBXvQqKztO6mjCbF5VXOzo/edit#gid=1326138554

Attachment 5. Worksheet for Sample IDs and Bird Egg Masses
https://docs.google.com/spreadsheets/d/1QuvPepeQ0YII3FwrNlV63_PDjWpdKZ2ldH47Xgb4s_Q/edit#gid=373575469

Attachment 6. 2018 Bird Eggs Target Analytes Tables
https://docs.google.com/spreadsheets/d/1MCqt5ryk-X2JnuuAxGHMKGyxTaF054vc9Mp74QB8MHE/edit?ts=5a74c42d#gid=0

Attachment 1

STANDARD OPERATING PROCEDURE
Bird Egg Dissection and Processing

The following describes the process of dissecting and processing eggs in the laboratory. Field collection protocols are considered separately and vary with species and study objectives.

EGG DISSECTION PROCEDURE

1. Eggs should be in whirlpaks upon collection and stored in whirlpaks (within egg crates) until dissection. Ensure that the end of the whirlpak is kept open to prevent molding.
2. After field collection and prior to dissection, eggs should be stored with the **small end down** in the whirlpak in the egg crate and egg crates should be stored in the refrigerator.
3. Wear nitrile gloves and a face mask throughout processing, replacing gloves when they become soiled.
4. Use clean tools with each egg. To clean tools, wash first with a diluted alconox and deionized water solution, wipe clean with a Kimwipe, then wash with 50/50 isopropyl alcohol and deionized water, rinse with deionized water, and then dry again with a Kimwipe.
5. Clean outside of egg with isopropyl alcohol. Soak isopropyl alcohol on a cotton swab (or you can also just spray alcohol onto egg from a wash bottle), and gently wipe off the dirt from the egg. Rinse egg with deionized water and dry with a Kimwipe.
6. Measure Egg Morphometrics:
    a. Using digital calipers, measure and record the widest part of the egg for the width, and the small point to the cap for the length of the egg.
    b. Measure and record the weight of the whole egg (with eggshell) on a digital balance. Make sure egg is at room temperature when recording weight.
7. If the egg is damaged or leaking, make notes of it on the datasheet. Any egg that is cracked or otherwise leaking albumen will have an unusable contaminant concentration, so make sure to record this.
8. The containers to be used for this study are listed in Attachment 2.
    a. USGS: For RMP study, use this type of jar for each tern egg: Chemically cleaned and certified 60-mL jar (Thermo Scientific™ Wide-Mouth Short-Profile Amber Glass Jars, with PTFE-lined polypropylene lid: https://www.fishersci.com/shop/products/wide-mouth-short-profile-amber-glass-jars-closure/p-4521644#tab2).
    b. AXYS: Use this type of jar for each cormorant egg: Chemically cleaned and certified 500-mL glass jar.
9. Label both the lid and the jar with the egg sample ID.
10. Measure the weight of the jar **with lid** and record on data sheet.
11. Place the jar (**with lid**) on the digital scale (0.01 g) and tare to zero.

12. Work the tip of a clean pair of scissors into the round cap of the egg, then cut a hole about the size of a nickel or dime, staying within the air cell.
13. Empty the egg into the jar, by first piercing the membrane if needed, then turning the hole over the open container and tipping the egg until the contents slide out.
14. Determine the development stage of the embryo.
15. Discard eggshell.
16. **Place the lid on the jar**, and weigh the egg contents (without eggshell).
17. Screw the lid tightly on the egg jar and then place into a sealed plastic bag, in batches, to reduce potential for desiccation.
18. Freeze the jarred eggs at 0 degrees C until egg processing.

TERN EGG DRYING AND HOMOGENIZING PROCEDURE

1. Turn on drying oven and set to the drying temperature of 50 degrees C.
2. Remove eggs from freezer and allow to warm to room temperature.
3. Print out a weight loss sheet for each batch, and fill it out as samples are processed. Once finished with it, it can be stored in the processing data binder. You will need to organize the batches with floating labels with the year, location gathered, species, type, batch #, and total number of samples in the batch.
4. Place samples in drying oven and record the start date and time on the sample processing data sheet.
5. Egg contents are dried in their processing jars with their lids next to the jars. Large eggs will generally dry between 72-168 hrs, while smaller eggs will generally dry between 24-72 hrs. When weighing them, make sure the lid is on.
6. Fill out the drying log over time as the samples dry. Evaporative loss must be <1.5% within a 24 hr period before eggs can be removed. Once a sample hits 1.5% or lower, it can be removed from the drying oven and immediately be stored in a desiccator.
7. Measure sample dry weight
    a. After sample has dried, remove from oven and place into a desiccator to cool for approximately 20 minutes.
    b. Record total dry time in appropriate cell on the processing data sheet.
    c. Remove only 3-4 samples from desiccator at a time (NOT the whole tray as the samples will rapidly rehydrate if left exposed to the air), place a dried sample with the weigh boat onto the calibrated balance and record the weight in the appropriate column on the processing data sheet.
8. Store dried egg in desiccator until egg homogenization.
9. Homogenize dried egg contents in a spice grinder with stainless steel blades.
10. Return homogenized egg sample to same sample jar.
11. Place homogenized egg back in drying oven at 50 degC for 2-3 hours to account for any moisture which may have accumulated during homogenization.
12. Store dried and homogenized egg in a desiccator until total mercury determination.
13. Clean spice grinder and allow to dry completely between each egg, rinsing first with a diluted alconox and deionized water solution, wiping with Kimwipes, followed by a final rinse with deionized water, and then drying the spice grinder using a Kimwipe.

Attachment 2 - Containers and Handling Instructions

				Egg Collection Details						Whole Egg Shipping			Container Details							Total Number of Samples and Shipping Instructions				
Sample Type	**Target Analyte or Purpose**	**Analyzing Lab**	**Labeling Acronym**	**Sites**	**Eggs Per Site**	**# of Eggs**	**Collected By**	**Handling**	**Shipped For Compositing**	**Whole Eggs Shipped By**	**Whole Eggs Shipped To**	**Handling**	**Container Type**	**Ordered By**	**Ordered From**	**Shipped to**	**Cleaned By**	**After Cleaning, Ship to**	**After Processing, Ship to**	**Samples per Site**	**Total Samples**	**Shipped By**	**Shipped To**	**Handling**
1. Tern Individual	Mercury	USGS-WERC	USGS-Hg	4	21 (3 composites of 7 eggs)	84	USGS-WERC	Wet Ice	No	NA	NA	Refrigeration	Chemically cleaned and certified 60-mL amber glass jars with PTFE-lined polypropylene lid	USGS-WERC	Thermo Scientific Part No. 05-719-14	USGS-WERC	NA	NA	NA	21	84	NA	NA	NA
2. Tern Composite	Selenium	MPSL-DFW	Se										15mL HDPE w/ HDPE Unlined lids	SFEI	Fisher Scientific. Part Number 03-337-7B	MPSL-DFW	MPSL-DFW	USGS-WERC	MPSL-DFW	3	12	USGS	MPSL-DFW	Dried Masses Shipped at Room Temperature. USGS recommends that the outside receiving labs perform a re-desiccation step and then store samples in desiccators before further chemical analysis to ensure tissue samples have not obtained moisture during transport and storage after leaving USGS.
	PBDE	AXYS	PBDE										20 mL Glass	SFEI	ESS Vial. Part Number 0020-0310-PC	USGS-WERC	NA	NA	AXYS	3	12	USGS	AXYS	Dried Masses Shipped at Room Temperature. USGS recommends that the outside receiving labs perform a re-desiccation step and then store samples in desiccators before further chemical analysis to ensure tissue samples have not obtained moisture during transport and storage after leaving USGS.
3. Cormorant Individual	Individual Egg Homogenate	NA (container for homogenizing individual eggs)											Chemically cleaned and certified 500-mL glass jar	AXYS	NA	AYXS	NA	NA	NA	21	63	NA	NA	NA
	Mercury	MPSL-DFW	MPSL-Hg										15 mL HDPE	SFEI	MPSL-DFW	MPSL-DFW	MPSL-DFW	AXYS	AMS	21	63	AXYS	AMS then MPSL	Samples shipped frozen on dry ice. Once samples are received, AMS will ship these samples to MPSL.
4. Cormorant Composite	Super Composite	NA (container for compositing)											pre-cleaned amber glass (120mL) with tinfoil lined lid	AXYS	NA	NA	AXYS	NA	Analyze or Distribute subsamples	3	9	NA	NA	NA
	Selenium	MPSL-DFW	Se										15 mL HDPE	SFEI	MPSL-DFW	MPSL-DFW	MPSL-DFW	AXYS	AMS	3	9	AXYS	AMS then MPSL	Samples shipped frozen on dry ice. Once samples are received, AMS will ship these samples to MPSL.
	PCB and PBDE	AXYS	PCB and PBDE	3	21 (3 composites of 7 eggs per site)	63	USGS-WERC	Wet Ice	to AXYS	USGS-WERC	AXYS	High density foam, each egg in individual whirl-pak bag, at room temperature	60 mL glass with Teflon liner	AXYS	NA	NA	AXYS	NA	NA	3	9	NA	NA	NA
	PFASs	AXYS	PFC										60mL HDPE	AXYS	NA	NA	AXYS	NA	NA	3	9	NA	NA	NA
	Long term archive	NA	Archive_Nist22										22 mL Teflon vial	SFEI	Savillex. Part number 200-022-20, 600-033-71 and 730-0100	NIST	NIST	AXYS	AMS	9 (3 per composite)	27	AXYS	AMS then NIST	Samples shipped frozen on dry ice. Once samples are received, AMS will ship these samples to NIST.
	Long term archive	NA	Archive_Nist10										10 mL polypropylene cryovial	SFEI	USA Scientific. Part number 1410-9100.	NIST	NIST	AXYS	AMS	15 (5 per composite)	45	AXYS	AMS then NIST	Samples shipped frozen on dry ice. Once samples are received, AMS will ship these samples to NIST.
	Short term archive for Trends/CEC/QA	NA	Archive_AMS60										60 mL amber glass jar	SFEI	Fisher Scientific Vial. Part number 05-719-14.	AXYS	AXYS	NA	AMS	12 (4 per comosite)	36	AXYS	AMS then Schaeffers	Samples shipped frozen on dry ice. Once samples are received, AMS will put these samples in the RMP archive in Oakland.
	Short term archive for Trends/CEC/QA	NA	Archive_AMS30										30 mL polypropylene jar	SFEI	Fisher Scientific. Part Number 02-891A	AXYS	NA	NA	AMS	8 (2 per composite)	18	AXYS	AMS then Schaeffers	Samples shipped frozen on dry ice. Once samples are received, AMS will put these samples in the RMP archive in Oakland.
5. Archived Tern Composites from 2016	PBDE	AXYS	PBDE	4	21 (3 composites of 7 eggs)	84	USGS-WERC	Wet Ice	No	NA	NA	NA	20 mL Glass	-	-	-	-	Currently at Schaefers	AXYS	3	12	AMS	AXYS	Samples shipped frozen on dry ice.

Attachment 3: Compositing Plan for Tern Eggs

Sample Type	Total samples	Number and		Size (g-dw)	Subsampling	Number and		Size (g-dw)	Laboratory	Notes
Individual Egg for Mercury	84	84	@	2	None	NA			USGS	
Composite for Other Analyses	12	10	@	8	Selenium, %moisture	1	@	1.5	MPSL-DFW	
					PBDEs, %moisture, %lipid	1	@	6.25	AXYS	
		2	@	14	Selenium, %moisture	1		2.5	MPSL-DFW	Note 1
					PBDEs, %moisture, %lipid	1		11.25	AXYS	Note 1

Total Mass Required	276	g-dw
Expected Total Sample Mass	286	g-dw (assumes 4 g-dw per egg, 7 eggs per composite, 3 composites per site, 4 sites, 15% breakage)

Notes

1. Extra mass in these samples for QA analyses.
2. If there is extra mass, create an archive sample using a clean glass jar.

Attachment 4: Compositing Plan for Cormorant Eggs

Sample Type	Total samples	Number and		Size (g-ww)	Subsampling	Number and		Size (g-ww)	Laboratory	Notes
Individual Egg for Mercury & % Moisture	63	55	@	5	None	NA			MPSL-DFW	
		8	@	7	None	NA			MPSL-DFW	Note 1
Composite	9	7	@	185	Selenium, %moisture	1	@	6	MPSL-DFW	
					PCBs (209), PBDEs, %moisture, %lipid	1	@	20	AXYS	
					PFASs, %moisture, %lipid	1	@	9	AXYS	
					"NIST22" Archive-teflon vials	3	@	15	Archive	
					"NIST10" Archive-PP cryovials	5	@	3	Archive	
					"AMS60" Archive-glass	4	@	15	Archive	
					"AMS30" Archive-PP	2	@	15	Archive	
					Total			185		
		2	@	215	Se, %moisture	1	@	10	MPSL-DFW	Note 1
					PCBs (209), PBDEs, %moisture, %lipid	1	@	40	AXYS	
					PFASs, %moisture, %lipid	1	@	15	AXYS	
					"NIST22" Archive-teflon vials	3	@	15	Archive	
					"NIST10" Archive-PP cryovials	5	@	3	Archive	
					"AMS60" Archive-glass	4	@	15	Archive	
					"AMS30" Archive-PP	2	@	15	Archive	
					Total			215		

Total Mass Required	2056	g-ww
Expected Total Sample Mass	2035	g-ww (assumes 38 g-ww per egg, 7 eggs per composite, 3 composites per site, 3 sites, 15% breakage)

Notes

1. Extra mass in these samples for QA analyses.

2. If there is insufficient mass for all the samples, skip one of the "AMS60" archives. If there is extra mass, add it to one of the "AMS60" archives.

Attachment 5 Worksheet for Sample IDs and Tern Egg Masses

StationCode	Collection Date	USGS Egg ID	USGS Composite ID	AXYS Egg ID	AXYS Composite Egg ID	Whole Egg Mass with Shell (g)	Whole Egg Length (mm)	Whole Egg Breadth (mm)	Wet Mass of Egg Contents (g)	Dried Mass of Egg Contents (g)
fill in CEDEN stn code		XX-1								
fill in CEDEN stn code		XX-2								
fill in CEDEN stn code		XX-3								
fill in CEDEN stn code		XX-4								
fill in CEDEN stn code		XX-5								
fill in CEDEN stn code		XX-6								
fill in CEDEN stn code		XX-7								
fill in CEDEN stn code		XX-8								
fill in CEDEN stn code		XX-9								
fill in CEDEN stn code		XX-10								
fill in CEDEN stn code		XX-11								
fill in CEDEN stn code		XX-12								
fill in CEDEN stn code		XX-13								
fill in CEDEN stn code		XX-14								
fill in CEDEN stn code		XX-15								
fill in CEDEN stn code		XX-16								
fill in CEDEN stn code		XX-17								
fill in CEDEN stn code		XX-18								
fill in CEDEN stn code		XX-19								
fill in CEDEN stn code		XX-20								
fill in CEDEN stn code		XX-21								

		Composite	Mass	Estimated Shell-Less Mass
		1	0	0
		2	0	0
		3	0	0
		4	0	0
		5	0	0
		6	0	0
		7	0	0
		8	0	0
		9	0	0

Attachment 5 Worksheet for Sample IDs and Cormorant Egg Masses

Location	StationCode	Collection Date	USGS Egg ID	USGS Composite ID	AXYS Egg ID	AXYS Composite Egg ID	Whole Egg Mass Measured by USGS (g)	Whole Egg Length (mm)	Whole Egg Breadth (mm)	Whole Egg Mass Measured by AXYS (g)
Wheeler Island	fill in CEDEN stn code		WI-1	NA						
Wheeler Island	fill in CEDEN stn code		WI-2	NA						
Wheeler Island	fill in CEDEN stn code		WI-3	NA						
Wheeler Island	fill in CEDEN stn code		WI-4	NA						
Wheeler Island	fill in CEDEN stn code		WI-5	NA						
Wheeler Island	fill in CEDEN stn code		WI-6	NA						
Wheeler Island	fill in CEDEN stn code		WI-7	NA						
Wheeler Island	fill in CEDEN stn code		WI-8	NA						
Wheeler Island	fill in CEDEN stn code		WI-9	NA						
Wheeler Island	fill in CEDEN stn code		WI-10	NA						
Wheeler Island	fill in CEDEN stn code		WI-11	NA						
Wheeler Island	fill in CEDEN stn code		WI-12	NA						
Wheeler Island	fill in CEDEN stn code		WI-13	NA						
Wheeler Island	fill in CEDEN stn code		WI-14	NA						
Wheeler Island	fill in CEDEN stn code		WI-15	NA						
Wheeler Island	fill in CEDEN stn code		WI-16	NA						
Wheeler Island	fill in CEDEN stn code		WI-17	NA						
Wheeler Island	fill in CEDEN stn code		WI-18	NA						
Wheeler Island	fill in CEDEN stn code		WI-19	NA						
Wheeler Island	fill in CEDEN stn code		WI-20	NA						
Wheeler Island	fill in CEDEN stn code		WI-21	NA						
Richmond Bridge	fill in CEDEN stn code		RB-1	NA						
Richmond Bridge	fill in CEDEN stn code		RB-2	NA						
Richmond Bridge	fill in CEDEN stn code		RB-3	NA						
Richmond Bridge	fill in CEDEN stn code		RB-4	NA						
Richmond Bridge	fill in CEDEN stn code		RB-5	NA						
Richmond Bridge	fill in CEDEN stn code		RB-6	NA						
Richmond Bridge	fill in CEDEN stn code		RB-7	NA						
Richmond Bridge	fill in CEDEN stn code		RB-8	NA						
Richmond Bridge	fill in CEDEN stn code		RB-9	NA						
Richmond Bridge	fill in CEDEN stn code		RB-10	NA						
Richmond Bridge	fill in CEDEN stn code		RB-11	NA						
Richmond Bridge	fill in CEDEN stn code		RB-12	NA						
Richmond Bridge	fill in CEDEN stn code		RB-13	NA						
Richmond Bridge	fill in CEDEN stn code		RB-14	NA						
Richmond Bridge	fill in CEDEN stn code		RB-15	NA						
Richmond Bridge	fill in CEDEN stn code		RB-16	NA						
Richmond Bridge	fill in CEDEN stn code		RB-17	NA						
Richmond Bridge	fill in CEDEN stn code		RB-18	NA						

Richmond Bridge	fill in CEDEN stn code		RB-19	NA						
Richmond Bridge	fill in CEDEN stn code		RB-20	NA						
Richmond Bridge	fill in CEDEN stn code		RB-21	NA						
South Bay	fill in CEDEN stn code		SB-1	NA						
South Bay	fill in CEDEN stn code		SB-2	NA						
South Bay	fill in CEDEN stn code		SB-3	NA						
South Bay	fill in CEDEN stn code		SB-4	NA						
South Bay	fill in CEDEN stn code		SB-5	NA						
South Bay	fill in CEDEN stn code		SB-6	NA						
South Bay	fill in CEDEN stn code		SB-7	NA						
South Bay	fill in CEDEN stn code		SB-8	NA						
South Bay	fill in CEDEN stn code		SB-9	NA						
South Bay	fill in CEDEN stn code		SB-10	NA						
South Bay	fill in CEDEN stn code		SB-11	NA						
South Bay	fill in CEDEN stn code		SB-12	NA						
South Bay	fill in CEDEN stn code		SB-13	NA						
South Bay	fill in CEDEN stn code		SB-14	NA						
South Bay	fill in CEDEN stn code		SB-15	NA						
South Bay	fill in CEDEN stn code		SB-16	NA						
South Bay	fill in CEDEN stn code		SB-17	NA						
South Bay	fill in CEDEN stn code		SB-18	NA						
South Bay	fill in CEDEN stn code		SB-19	NA						
South Bay	fill in CEDEN stn code		SB-20	NA						
South Bay	fill in CEDEN stn code		SB-21	NA						

	Composite	Mass	Estimated Shell-Less Mass
	1	0	0
	2	0	0
	3	0	0
	4	0	0
	5	0	0
	6	0	0
	7	0	0
	8	0	0
	9	0	0

Attachment 6 - 2018 Bird Eggs Target Analytes Tables					
LabAgencyCode	AnalyteName	UnitName	MethodName	MatrixName	FractionName
AXYS	Lipid	% ww	SLA-028 Rev 08	tissue	Total
AXYS	Moisture	% ww	SLA-015 Rev 11	tissue	Total
AXYS	Perfluorobutanesulfonate	ng/g ww	AXYS MLA-043 Rev 08	tissue	Total
AXYS	Perfluorobutanoate	ng/g ww	AXYS MLA-043 Rev 08	tissue	Total
AXYS	Perfluorodecanoate	ng/g ww	AXYS MLA-043 Rev 08	tissue	Total
AXYS	Perfluorododecanoate	ng/g ww	AXYS MLA-043 Rev 08	tissue	Total
AXYS	Perfluoroheptanoate	ng/g ww	AXYS MLA-043 Rev 08	tissue	Total
AXYS	Perfluorohexanesulfonate	ng/g ww	AXYS MLA-043 Rev 08	tissue	Total
AXYS	Perfluorohexanoate	ng/g ww	AXYS MLA-043 Rev 08	tissue	Total
AXYS	Perfluorononanoate	ng/g ww	AXYS MLA-043 Rev 08	tissue	Total
AXYS	Perfluorooctanesulfonamide	ng/g ww	AXYS MLA-043 Rev 08	tissue	Total
AXYS	Perfluorooctanesulfonate	ng/g ww	AXYS MLA-043 Rev 08	tissue	Total
AXYS	Perfluorooctanoate	ng/g ww	AXYS MLA-043 Rev 08	tissue	Total
AXYS	Perfluoropentanoate	ng/g ww	AXYS MLA-043 Rev 08	tissue	Total
AXYS	Perfluoroundecanoate	ng/g ww	AXYS MLA-043 Rev 08	tissue	Total

Attachment 6 - 2018 Bird Eggs Target Analytes Tables					
LabAgencyCode	AnalyteName	UnitName	MethodName	MatrixName	FractionName
AXYS	Lipid	% ww	SLA-020 Rev 04	tissue	Total
AXYS	Moisture	% ww	SLA-015 Rev 11	tissue	Total
AXYS	PBDE 017	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 025	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 028	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 030	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 033	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 047	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 049	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 066	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 085	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 099	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 100	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 138	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 153	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 154	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 179	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 183	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 184	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 188	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 190	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 200	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 201	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 202	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 203	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 206	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 207	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 208	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total
AXYS	PBDE 209	ng/g ww	AXYS MLA-033 Rev 06	tissue	Total

Attachment 6 - 2018 Bird Eggs Target Analytes Tables					
LabAgencyCode	AnalyteName	UnitName	MethodName	MatrixName	FractionName
AXYS	Lipid	% ww	SLA-020 Rev 04	tissue	Total
AXYS	Moisture	% ww	SLA-015 Rev 11	tissue	Total
AXYS	PCB 001	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 002	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 003	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 004	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 005	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 006	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 007	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 008	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 009	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 010	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 011	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 012	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 013	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 014	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 015	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 016	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 017	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 018	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 019	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 020	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 021	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 022	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 023	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 024	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 025	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 026	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 027	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 028	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 029	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 030	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 031	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 032	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 033	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 034	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 035	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 036	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 037	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 038	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 039	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total

AXYS	PCB 040	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 041	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 042	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 043	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 044	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 045	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 046	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 047	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 048	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 049	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 050	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 051	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 052	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 053	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 054	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 055	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 056	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 057	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 058	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 059	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 060	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 061	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 062	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 063	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 064	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 065	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 066	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 067	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 068	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 069	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 070	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 071	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 072	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 073	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 074	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 075	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 076	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 077	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 078	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 079	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 080	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 081	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 082	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total

AXYS	PCB 083	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 084	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 085	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 086	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 087	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 088	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 089	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 090	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 091	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 092	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 093	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 094	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 095	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 096	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 097	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 098	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 099	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
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AXYS	PCB 101	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 102	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 103	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 104	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 105	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 106	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 107	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 108	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 109	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 110	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 111	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 112	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 113	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 114	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 115	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 116	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 117	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 118	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 119	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 120	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 121	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 122	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 123	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 124	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 125	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total

AXYS	PCB 126	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 127	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 128	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 129	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 130	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 131	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 132	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 133	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 134	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 135	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 136	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 137	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 138	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 139	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 140	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 141	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 142	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 143	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 144	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
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AXYS	PCB 146	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 147	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
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AXYS	PCB 154	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 155	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 156	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
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AXYS	PCB 158	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 159	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
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AXYS	PCB 161	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 162	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 163	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 164	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 165	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 166	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 167	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 168	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total

AXYS	PCB 169	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 170	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 171	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 172	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 173	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 174	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
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AXYS	PCB 176	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 177	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 178	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 179	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 180	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 181	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 182	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 183	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
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AXYS	PCB 185	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 186	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 187	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
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AXYS	PCB 194	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 195	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 196	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 197	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 198	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 199	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
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AXYS	PCB 201	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 202	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 203	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 204	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 205	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 206	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 207	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 208	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total
AXYS	PCB 209	ng/g ww	AXYS MLA-010 Rev 12	tissue	Total

Attachment 6 - 2018 Bird Eggs Target Analytes Tables					
LabAgencyCode	AnalyteName	UnitName	MethodName	MatrixName	FractionName
MPSL-DFW	Mercury	ug/g ww	EPA 7473	tissue	Total
MPSL-DFW	Moisture	% ww	EPA 7473	tissue	Total
MPSL-DFW	Selenium	ug/g dw	EPA 200.8	tissue	Total
MPSL-DFW	Moisture	% ww	EPA 200.8	tissue	Total

Attachment 6 - 2018 Bird Eggs Target Analytes Tables					
LabAgencyCode	AnalyteName	UnitName	MethodName	MatrixName	FractionName
USGS-WERC	Total Mercury	ug/g fww	EPA 7473	tissue	Total
USGS-WERC	Moisture	% ww	EPA 7473	tissue	Total