# FOCUSED STUDY ACTIVITY WORK PLAN

## General Information

| | | |
|---|---|---|
| ***Decision Pool C: Activity paused.**<br>* Activity paused pending outcomes of new project 13: Development of an integrated report on mercury in the oil sands region<br>* Funding in 2018/19 and beyond is dependent upon the findings of the integrated report on mercury in the oil sands region and the outcomes of the Biological Monitoring Integration Workshop | | |
| **Work Plan Unique Identifier:** | *B-IC-8-1718* | |
| **Focused Study Activity Title:** | **Colonial Waterbirds Monitoring: Temporal and Spatial Patterns in Mercury Levels in Gull and Tern Eggs and Possible Underlying Factors** | |
| **Focused Study Category:** | Investigation of Cause or Potential Ecological Impact | |
| **Geographic Location (***choose from drop-down menu. If Project Location is in more than one area choose from second drop-down***)** | Lower Athabasca River | More than 2 Locations (Described in Detailed Monitoring Plan) |
| **Monitoring Site(s) Coordinates** *(latitude and longitude)* | See appended list below | |
| **Project Leader:** | Bruce Pauli | |
| **Organization and contact information:** | **Environment and Climate Change Canada (ECCC)**<br>Ecotoxicology and Wildlife Health Division<br>Science and Technology Branch<br>Environment and Climate Change Canada<br>National Wildlife Research Centre<br>1125 Colonel By Drive, Ottawa, ON N1H 0H3<br>Tel: 613 998-6690; email: bruce.pauli@canada.ca | |
| **Date Study initiated:** | 2009 | |
| **Monitoring Category:**<br>*(From OSM long-term plan; choose from drop-down menu)* | Biotic Response Monitoring | |
| **Strategic Objective of Focused Study:** *(From OSM long-term plan; choose from drop-down menu)* | Objective B2: Investigate the causal mechanisms of a known important biotic relationship in relation to Oil Sands Developments<br>Monitoring of contaminant burdens in the eggs of colonial waterbirds in the Lower Athabasca Region, i.e. the Peace-Athabasca Delta and Lake Athabasca has revealed that mercury levels in these eggs are elevated compared to eggs from the same species collected from areas removed from the Athabasca River. This focused study/investigation of cause will | |

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|---|---|
| | integrate with other components of the oil sands monitoring program to assess mercury burdens in eggs of colonial waterbirds in the region. Factors contributing to egg mercury levels will be investigated including possible spatial differences in mercury bioavailability and possible differences in mercury sources. A major component of this focused study/investigation of cause project is to conduct integrated evaluations of contamination in the birds' food web in order to determine the origin of mercury in eggs. The potential effects of mercury on these bird species will also be assessed. The overall strategic objective of this focused study/investigation of cause is to establish the monitoring of contaminant burdens in eggs of colonial waterbirds as a validated long-term monitoring strategy for the evaluation of potential environmental impacts of oil sands industrial activities. |
| **Hypotheses:**<br>*(Briefly outline the specific hypotheses that your focused study is aiming to address)* | The work will test the hypotheses that 1) mercury burdens in the eggs of colonial waterbirds downstream of oil sands industrial operations are no different than burdens measured in the eggs of these birds collected from other areas, 2) there is no evidence of spatial differences in mercury bioavailability, 3) oil sands industrial operations are not contributing to an increase in mercury burdens in the eggs of colonial waterbirds collected downstream of oil sands industrial operations, and 4) methylmercury burdens in eggs of colonial waterbirds are below levels associated with toxicological effects. |
| **Deliverables:**<br>*What tangible goal (s) and/or product(s) will the monitoring produce and when?* | Tangible goals and products from this focused study/investigation of cause and the associated monitoring include the following:<br>1. Monitoring information on the burdens of contaminants, i.e. mercury, in wildlife and in their food web in the oil sands region. These data will be used to evaluate spatial differences and temporal trends in mercury levels in wildlife.<br>2. Assessment of spatial differences in mercury bioavailability that may be contributing to spatial patterns in egg mercury levels.<br>3. Information on potential sources of mercury in colonial waterbird eggs and whether egg mercury levels may be traced to oil sands industrial operations.<br>4. Assessment of possible ecological impacts of mercury in colonial waterbirds.<br>5. The validation of monitoring contaminant burdens in colonial waterbird eggs as a long-term monitoring strategy for the assessment of potential environmental impacts of oil sands industrial operations.<br><br>These tangible goals and products will be produced throughout the 3-year duration of the study, with product 4) being delivered by the end of the three year period. |

# Detailed Study Plan

(Please provide detailed information on the specifics of your focused study including – (**keywords, hypothesis and the assumptions and constraints behind your hypothesis**)

## Provide a maximum of 10 key words that describe this project. Use commas to separate them:

**Athabasca River, wildlife, colonial waterbirds, mercury, toxicity, monitoring, oil sands, cumulative effects, ecosystem health**

## Describe how you will test your hypotheses:

**Overview:** A key aspect of how we will test our hypotheses is through enhanced cooperation with other researchers in the oil sands community, i.e. other groups in ECCC (e.g. scientists from WSTD and ASTD), Parks Canada Agency, Alberta Environment and Parks, the Alberta Biodiversity Monitoring Institute, the Canadian Wildlife Service, Health Canada, Alberta Health and Wellness, and academia. We also note that during 2018/19, a crucial aspect of this workplan is ongoing communication with proposed study partners to further develop and refine the longer term work plan and strategy. Our plan is to accomplish this through regular teleconferences (e.g. quarterly) with principal investigators and ECCC partners, and via workshops with project scientists; these communications will also occur through the activities of the new project being proposed this year for the Oil Sands Monitoring Program that has as its goal the development of a design for an integrated study on mercury in the oil sands. This is crucial for the development of recommendations for the most appropriate techniques and ecosystem components to include in a long-term monitoring program for the oil sands. To test the hypotheses of this particular focus study we will:

- Validate the use of bird eggs as local indicators by assessing the degree to which resources from overwintering locations are used for egg formation,
- Continue egg collection (gulls and terns) at selected colonial waterbird colonies to determine spatial and temporal trends in egg mercury levels,
- Develop methods to remove the influence of dietary differences on egg mercury levels to facilitate assessments of spatial/temporal patterns in mercury levels,
- Establish necessary geographic coverage of collection locations and required frequency of collection at identified collection locations,
- Further link egg contaminants with food web contamination in association with other projects in the Wildlife Health Component and with projects in other components of the oil sands monitoring program,
- Assess mercury uptake at the base of wildlife food chains in key monitoring areas,
- Integrate new and existing data to assess factors regulating mercury bioavailability, e.g. methylmercury concentrations in water and sediment, methylmercury transport, water chemistry,
- Integrate existing data to assess linkages between organic contaminants and mercury,
- Test non-traditional metal isotopes (e.g., lead, vanadium) to track the dispersion of oil sands metals and bioaccumulation in food webs
- Help develop a long-term monitoring program for metals and organic contaminants in northern Alberta food webs

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The most recent assessment of temporal trends in mercury concentrations in colonial waterbird eggs (2009-2016) indicates little recent change in egg mercury levels. However, annual variation in egg levels is significant and assessing temporal trends in egg contaminant levels will require data collection over a longer period.

Assessment of 2014-2015 FY JOSM data revealed that colonial waterbird eggs collected at sites in receiving waters of the Athabasca River (Mamawi Lake and Lake Athabasca) had higher levels of mercury than eggs collected from other sites removed from the influence of the river (Dolgova et al. 2018). These other sites were located in more southerly (Langdon Reservoir, Miquelon Lake, Lac La Biche, Preston Lake, Namur Lake) and northerly regions (Rocky Island Lake, Bistcho Lake, Great Slave Lake, and Daring Lake) indicating that neither proximity to urban areas nor latitude could explain elevated mercury levels in eggs collected from sites in receiving waters of the Athabasca River. Inter-site differences in egg mercury levels may indicate the presence of local contaminant sources. When interpreting waterbird egg mercury levels in a spatial context, possible differences in the diets of birds were considered since levels of biomagnifying contaminants, e.g. mercury, in eggs will increase with trophic position. Trophic position was evaluated by measuring stable nitrogen isotopes ($^{15}N/^{14}N$, expressed as $\delta^{15}N$ values) in eggs. However, comparing $\delta^{15}N$ values across sites is not appropriate without considering possible inter-site differences in baseline $\delta^{15}N$ values. Stable nitrogen isotope analysis of bulk tissue does not address this issue. To resolve this, we used a new approach: amino acid compound-specific nitrogen isotope analysis (AA-CSIA) to generate both baseline $\delta^{15}N$ and trophic $\delta^{15}N$ values from the same sample. The resulting isotope data were corrected for baseline differences providing the means to compare nitrogen isotope values across sites. These baseline-corrected isotope data were used to remove the influence of trophic position on egg mercury levels so that spatial differences in egg mercury levels could be discerned (Dolgova et al. 2018).

We will further investigate potential factors contributing to these temporal and spatial differences in egg mercury levels by continuing this Focus/Investigation of Cause study in the Oil Sands (OS) region. We will continue our work investigating temporal and spatial patterns in egg mercury levels, assessing possible spatial differences in mercury sources, assessing possible spatial differences in mercury bioavailability, and assessing possible effects of mercury on colonial waterbirds.

Colonial waterbirds, such as gulls and terns, have been used as indicators of environmental conditions since the 1960s across a variety of Canadian ecosystems, e.g. inland waterbodies, Laurentian Great Lakes, St. Lawrence River, and along the coasts of the Pacific, Arctic and Atlantic oceans. This research and associated monitoring has been conducted under a variety of programs including the Chemicals Management Plan, Clean Air Regulatory Agenda, Great Lakes Action Plan (Hebert et al. 1999), and other ecosystem initiatives including the Northern Contaminants Program. It has also occurred in the oil sands region (Hebert et al. 2011, 2013). The utility of waterbirds in a monitoring context stems, in part, from the degree to which the chemical composition of their eggs reflects local environmental conditions. Eggs are a good local indicator because these species are “income” breeders, i.e. they are thought to use local resources for egg formation as opposed to resources carried-over from their overwintering grounds. While the above research programs illustrate the acceptance of waterbird eggs as indicators of local environmental conditions there is a need to validate this approach in the context of oil sands monitoring. Our proposed work consists of five parts:

Part 1: Validation of eggs as indicators of local environmental conditions.

- assessment of the use of overwinter resources in colonial waterbird eggs.
- colonial waterbirds breeding in the oil sands region likely overwinter in marine areas, e.g. Pacific coast of North America.
- we will measure stable sulphur isotopes ($\delta^{34}S$ values) in eggs to evaluate the degree to which resources obtained on the overwintering grounds are transferred to eggs.

Part 2: Assessment of temporal change in egg mercury levels

- continued sampling and analysis of eggs from sites where sampling began in 2009.

Part 3: Assessment of spatial patterns in egg mercury levels and possible mercury sources

- continued assessment of spatial patterns in egg mercury levels including use of compound-specific stable isotope analysis to adjust egg mercury levels for diet.

- assessment of spatial patterns in prey fish consumed by colonial waterbirds
- two species of cyprinids: Spottail Shiner (*Notropis hudsonius*) and Emerald Shiner (*Notropis atherinoides*), were collected from 9 locations in 2013. Four locations were on the mainstem of the Athabasca River, both upstream and downstream of oil sands activities. A further five locations were located in the Peace-Athabasca Delta, Lake Athabasca, and Peace River. Prey fish from the PAD, Lake Athabasca and Peace River are also available from subsequent years (2014-2017). Measurement of mercury levels in prey fish and waterbird eggs will allow us to look for congruent spatial patterns in mercury levels across taxa.
- investigate relationships between egg mercury levels and levels of organic contaminants previously linked to oil sands activities, i.e. PAHs.

Part 4: At selected sites, assess possible differences in factors that influence the bioavailability of methylmercury.

- Information will be collected on factors that affect the bioavailability of methylmercury (e.g., methylmercury concentrations in water, water chemistry) in different habitats where the birds feed.
- Levels of methylmercury near the base of the food chain (zooplankton, benthic invertebrates) will be measured to identify spatial variation in uptake of mercury.

Part 5: Assess possible impacts of egg mercury levels on colonial waterbirds.

- This will be done by comparing well-defined literature toxicity thresholds for mercury in bird eggs to levels measured in eggs from the study region.

**Links to depositional rationalization**

Hebert et al. (2011) previously suggested that the Athabasca River may be serving as a potential source of environmental contaminants to colonial waterbirds nesting at downstream locations; the highest egg mercury levels were observed in samples collected downstream of the Athabasca River (Dolgova et al. 2018). However, other factors may also be contributing to these spatial trends.

Previous work found that mercury methylation rates were more important than inorganic mercury loading when determining fish methylmercury (MeHg) exposure (Eagles-Smith et al. 2016). Under organic-rich, anaerobic conditions, sulfur-reducing bacteria mediate the transformation of inorganic mercury to MeHg. Enhanced bacterial activity and subsequent methylation rates have been observed under low pH, low salinity and high levels of dissolved organic matter (Ullrich et al. 2001). Wetlands are a particularly important site for MeHg production in aquatic systems, with high methylation rates observed in various wetland ecosystems, including boreal forests (St. Louis et al. 1994) and tropical floodplains (Lazaro et al. 2016).

Thus, environmental conditions in the Peace-Athabasca Delta may produce more favorable conditions for mercury methylation compared to ‘northern’ or ‘southern’ sites. Further research is required to investigate this possibility. Ongoing efforts to integrate data from biotic and abiotic monitoring programs, including regional data on Hg deposition and Hg transport via the Athabasca River, are critical to conclusively elucidate the factors underlying the spatial differences in egg mercury levels in the region.

**Legend:** CATE = Caspian Tern, COTE = Common Tern, HERG = Herring Gull, CAGU = California Gull, RBGU = Ring-billed Gull, SPOT = Spottail Shiner, EMER = Emerald Shiner

| Site Location | Species Sampled | Samples Collected | Years Collected |
|---|---|---|---|
| Egg Island, Western Lake Athabasca | CATE, COTE, HERG, CAGU, RBGU | Eggs, Contaminants | 1977, 2009-2017 |
| Mamawi Lake | COTE, RBGU | Eggs, Contaminants | 2009-2017 |
| Great Slave Lake | HERG | Eggs, Contaminants | 2008-2016 |
| Langdon Reservoir | CAGU | Eggs, Contaminants | 2008-2017 |
| Daring Lake | HERG | Eggs, Contaminants | 2014-2015 |
| Bistcho Lake | CAGU, HERG | Eggs, Contaminants | 2014-2016 |
| Rocky Island Lake | HERG | Eggs, Contaminants | 2014-2015 |
| Eastern Lake Athabasca | HERG, CAGU | Eggs, Contaminants | 2014-2015 |
| Namur Lake | HERG, CAGU | Eggs, Contaminants | 2014-2015 |
| Preston Lake | HERG, RBGU | Eggs, Contaminants | 2014-2017 |
| Lac La Biche | HERG, CAGU | Eggs, Contaminants | 2014-2016 |
| Miquelon Lake | HERG, CAGU | Eggs, Contaminants | 2014-2015 |
| Athabasca River 1 | SPOT, EMER | Whole fish, Contaminants | 2013 |
| Athabasca River 2 | SPOT, EMER | Whole fish, Contaminants | 2013 |
| Athabasca River 3 | SPOT, EMER | Whole fish, Contaminants | 2013 |
| Athabasca River 4 | SPOT, EMER | Whole fish, Contaminants | 2013 |
| Mamawi Lake | SPOT, EMER | Whole fish, Contaminants | 2013-2017 |
| Lake Claire | SPOT, EMER | Whole fish, Contaminants | 2013-2017 |
| Lake Athabasca 1 | SPOT, EMER | Whole fish, Contaminants | 2013-2017 |
| Peace River | SPOT, EMER | Whole fish, Contaminants | 2013-2017 |

## Assumptions and Constraints behind the hypotheses and the testing methods:

- Egg chemical composition reflects the environment where the eggs are laid,
- Variation in mercury levels in colonial waterbird eggs may confound elucidation of spatial and temporal patterns in contaminant availability. If so, this could prevent an oil sands "signal" from being detected,
- Mercury inputs to the region originate from various sources and are complex, preventing source attribution of mercury in eggs,
- Environmental change in the region, e.g. climate change, may complicate the evaluation of a potential link between oil sands emissions and mercury bioaccumulation in bird eggs.

# References:

Dolgova, S.; Popp, B.N.; Courtoreille,K.; Espie, R.H.M.; Maclean, B.; McMaster, M.; Straka, J.R.; Tetreault, G.R.; Wilkie, S.; Hebert, C.E. 2018. Spatial trends in a biomagnifying contaminant: application of amino acid compound specific stable nitrogen isotope analysis to the interpretation of bird mercury levels. Submitted to Environmental Toxicology and Chemistry.

Eagles-Smith, C.A.; Acherkam, J.T.; Willacker, J.J.; Tate, M.T.; Lutz, M.A.; Fleck, J.A.; Stewart, A.R.; Wiener, J.G.; Evers, D.C.; Lepak, J.M.; David, J.A.; Pritz, C.F. 2016. Spatial and temporal patterns of mercury concentrations in freshwater fish across the Western United States and Canada. *Sci. Total Environ.* 568: 1171-1184.

Hebert, C.E.; Campbell, D.; Kindopp, R.; MacMillan, S.; Martin, P.; Neugebauer, E.; Patterson, L.; Shatford, J. 2013. Mercury trends in colonial waterbird eggs downstream of the Oil Sands Region of Alberta, Canada *Environ. Sci. Technol.* 47: 11785-11792.

Hebert, C.E., Norstrom, R.J.; Weseloh, D.V. 1999. A quarter century of environmental surveillance: The Canadian Wildlife Service's Great Lakes Herring Gull Monitoring Program. *Environ. Rev.* 7: 147–166

Hebert, C.E., Weseloh, D.V.; Macmillan, S.; Campbell, D.; Nordstrom, W. 2011. Metals and polycyclic aromatic hydrocarbons on colonial waterbird eggs from Lake Athabasca and the Peace-Athabasca Delta, Canada. *Environ. Toxicol. Chem.* 30: 1178–1183.

Lazaro, W.L.; Diez, S.; da Silva, C.J.; Ignacio, A.R.A.; Guimaraes, J.R.D. 2016. Waterscape determinants of net mercury methylation in tropical wetland. *Environ. Res*. 150: 438-445.

St Louis, V.L.; Rudd, J.W.M.; Kelly, C.A.; Beaty, K.G.; Bloom, N.S.; Flett, R.J. 1994. Importance of wetlands as sources of methy mercury to boreal forest ecosystems. *Can. J. Fish. Aquat. Sci*. 51: 1065-1076.

Ullrich, S.M.; Tanton, T.W.; Abdrashitova, S.A. Mercury in the aquatic environment: A review of factors affecting methylation. 2001. *Critical Reviews in Environ. Sci. Tech*. 31: 241-293.

# Data Management

*If this work generates data please summarize your project-level data management plan.*

| Deliverables | Timeframe |
|---|---|
| Data Collection Period:<br><br>*Field work* | Start : 2018-05-15 End: 2018-12-01 |
| Data Analysis Period:<br><br>*Laboratory analysis and QA/QC of data* | Start : 2019-01-01 End: 2019-03-31 |
| Data Release Date:<br><br>*Metadata and data consistent, complete and meet basic standard format for publication in Open Data; on or linked to JOSM portal* | 2020-03-31 |
| Project-level Data Management Plan | This project is linked to the Wildlife Contaminants and Toxicology Biotic Response Synthesis Project and to the new project that will design a mercury study for the oil sands. This means that data collected during this focused study/investigation of cause will be submitted to and incorporated into the on-going Oil Sands Wildlife Contaminants and Toxicology Program database being established by that project and made available to both projects. From there the data can be assessed by the Synthesis Project activities, by the mercury study project, and can also be made available to the ECCC Open data Catalogue, the ECCC Oil Sands Portal and the GoC Open Data Catalogue. |

# Reporting and Publications

*Provide information on the anticipated reports / publications. (Insert additional rows if needed)*

| Expected Subject/Titles of Publications or Reports | Short Description of Publication or Report | Expected Year of Publication |
|---|---|---|
| Interpreting spatial trends in biomagnifying contaminants: Insights from the application of amino acid compound-specific stable nitrogen isotope analysis | Compound-specific stable nitrogen isotope analysis is used to interpret spatial patterns in egg mercury levels. | 2018 |
| Temporal changes in egg mercury levels over one decade | Temporal changes in levels of mercury in colonial waterbird eggs are assessed. | 2020 |

# Technical / Professional Roles and Responsibilities

*Identify members of the monitoring team/organization, their roles and responsibilities. Identify monitoring organization leads if different from overall monitoring activity lead. (Insert additional rows if needed)*

| Role | Responsibilities | Resource Name/Organization |
|---|---|---|
| Co-Project Lead/PI | Design of focus study, field work, analysis of data, writing and interpretation of focus study | ECCC |
| Co-Project Lead/PI | Design of focus study, analysis of data, writing and interpretation of focus study | ECCC |
| Metals chemist | Laboratory analyses and metals analytical support | ECCC |
| Laboratory Technologist<br>Science Team Support | Field work, processing of samples and laboratory analyses | ECCC |

## Deliverables (Year 2) If your Focus Study is longer than 1 year then complete **Appendix C** for multi-year deliverables breakdown

Provide a summary of tangible quarterly deliverables. Identify major project areas (deliverables) and results that can be identified as a tangible goal. This could include: field work, lab work/ analysis, evaluation, data, reports, publications, SOPs etc. Do not define process as your Deliverable e.g. 'fly to Ft. McMurray to conduct fieldwork' or 'seek Director approval for report'.

| |
|---|
| **Deliverable(s)** (please provide enough information to support status reporting) |
| **Q1 – April to June 2018** |
| Field and lab logistics: Permitting, field collections, equipment maintenance, contract preparation, materials acquisition, planning |
| |
| |
| **Q2 – July to September 2018** |
| Lab logistics: Equipment maintenance, sample processing and analysis, contract preparation, materials acquisition, planning |
| |
| |
| **Q3 – October to December 2018** |
| Lab logistics: Equipment maintenance, sample processing and analysis, data acquisition, planning<br>**Data Product: Progress reporting** |
| |
| |
| **Q4 – January to March 2019** |
| Lab logistics: Permit reporting, data analysis and interpretation, planning |
| **Data Product: Progress reporting** |
| |
| |

# Detailed Financial Breakdown – Year 2 of 3 (2017-2020)

Also complete **Appendix B** for the multi-year financial breakdown

| Budget requirements – List areas that require budget expenditures: (ADD OR DELETE BUDGET CATEGORIES AS REQUIRED) | OS Funding | External Funding (*outside JOSM*) |
|---|---|---|
| **O&M - Operations and Maintenance:** | | |
| Field Costs (including aircraft charter) | **$23,500** | **$** |
| Data Management (*captured elsewhere*) | **$** | **$** |
| Internal Lab Analysis | **$0** | **$** |
| Consumable Materials & Supplies | **$0** | **$** |
| **Sub-Total** | **$23,500** | **$** |
| **O&M - Travel** | | |
| Field Work | **$** | **$** |
| Conferences (*identify conference*) | **$** | **$** |
| Meeting (*identify meeting*)<br>*To attend the Oil Sands Science Symposium and the Oil Sands Integrated Workplanning meeting* | **$** | **$** |
| **Sub-Total** | **$** | **$** |
| **O&M - External Contracts :** | | |
| External Lab Analyses (*stable isotopes and compound specific isotopes*) | **$27,984** | **$** |
| External Lab Analysis (*measurement of PAHs in individual egg samples*) | **$24,148** | **$** |
| External Lab Analysis (*metal stable isotopes in wildlife and wildlife food*) | **$37,000** | |
| External Lab Analysis (*factors regulating Hg bioavailability*) | **$21,600** | |
| Contractor (*egg processing and analyses*) | **$25,025** | |
| **Sub-Total** | **$135,757** | **$** |
| **Salaries:** | | |
| Principal Investigators | **$0** | **$** |
| Technical / Professional Assistants<br>(Metals chemist and technologist with central charges) | **$177,559**[1] | **$** |
| Field Staff | **$** | **$** |

| Budget requirements – List areas that require budget expenditures: (ADD OR DELETE BUDGET CATEGORIES AS REQUIRED) | OS Funding | External Funding (*outside JOSM*) |
|---|---|---|
| **Sub-Total** | **$175,743** | **$** |
| | | |
| **Total Salaries[1]** | **$177,559** | **$** |
| **Total O&M** | **$159,257** | **$** |
| **2017-2018 GRAND TOTAL*** | **$336,816** | **$** |

[1]Includes associated EBP, Accommodations, PWGSC Accommodations, and SCC costs

*Grand Total including EBP, Accommodations, PWGSC Accommodations, and SCC costs

# Appendix A - Approvals

| Project Submitted by: | | |
|---|---|---|
| Name: Bruce Pauli | | |
| Organization: Environment and Climate Change Canada | Signature: | Date: |

| Project Approved by: | | |
|---|---|---|
| | | |
| Signature | | Signature |
| Date | | Date |

## Activity Planning Review and Evaluation

*To be completed by OSM Administration*

| **Date Completed** | **Review type** | **Validated by** (insert name and title) |
|---|---|---|
| | Program Management review completed | |
| | | |

**APPENDIX B – Detailed Multi-year Financial Breakdown** (Complete the following detailed financial breakdown; add or delete categories as required)

| Budget requirements | Year 1 (2017- 2018) | | Year 2 (2018- 2019) | | Year 3 (2019- 2020) | |
|---|---|---|---|---|---|---|
| | Cash | In-kind | Cash | In-kind | Cash | In-kind |
| 1) Salaries and benefits | | | | | | |
| a) Investigators | | | | | | |
| b) Technical/professional assistants | | | | | | |
| c) Field Staff | | | | | | |
| d) Laboratory Services Unit (ECCC) | | | $177,559 | | $177,559 | |
| 2) Operations and maintenance | | | | | | |
| a) Facilities | | | | | | |
| b) Equipment | | | | | | |
| c) Lab analysis | | | | | | |
| d) Data management | | | | | | |
| e) Field work | | | | | | |
| f) Helicopter Cost | | | | | | |
| g) Shipping | | | | | | |
| h) Fleet Use | | | | | | |
| 3) Consumable Materials and supplies | | | | | | |
| a) | | | | | | |
| b) | | | | | | |
| 4) Travel | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| a) Conferences and meetings | | | | | | |
| b) Field work | | | $23,500 | | $23,500 | |
| c) Project-related travel | | | | | | |
| 5) Dissemination & Engagement | | | | | | |
| a) Publications/Reports | | | | | | |
| b) Translation (if required) | | | | | | |
| c) Communications | | | | | | |
| d) Stakeholder Engagement | | | | | | |
| e) Indigenous Peoples Engagement | | | | | | |
| 6) External Contracts | | | | | | |
| a) External Lab Analyses *(stable isotopes and compound specific isotopes)* | | | $27,984 | | $27,984 | |
| b) External Lab Analysis *(measurement of PAHs in individual egg samples)* | | | $24,148 | | $24,148 | |
| c) External Lab Analysis *(metal stable isotopes in wildlife and wildlife food)* | | | $37,000 | | $37,000 | |
| d) External Lab Analysis *(factors regulating Hg bioavailability)* | | | $21,600 | | $21,600 | |
| e) Contract *(egg processing and egg content analyses)* | | | $25,025 | | $25,025 | |
| **Grand Total[1]** | | | $336,816 | | $336,816 | |

[1]Grand Total including EBP, Accommodations, PWGSC Accommodations, and SCC costs determined from Budget Calculations spreadsheet

**APPENDIX C –Years 2 and 3 Deliverables** (Complete the following detailed breakdown. Provide a summary of tangible quarterly deliverables and your anticipated expenditures. Identify major project areas (deliverables) and results that can be identified as a tangible goal.)

| **Year 2 (2018- 2019)** |
|---|
| **Deliverable(s)** (please provide enough information to support status reporting) |
| **Q1 – April to June 2018** |
| Permitting, field collections, equipment maintenance, contract preparation, materials acquisition, planning |
| |
| |
| **Q2 – July to September 2018** |
| Equipment maintenance, sample processing and analysis, contract preparation, materials acquisition, planning |
| |
| |
| **Q3 – October to December 2018** |
| Equipment maintenance, sample processing and analysis, data acquisition, planning |
| **Data Product: Progress Reporting** |
| |
| |
| **Q4 – January to March 2019** |
| Permit reporting, data analysis and interpretation, planning |
| **Data Product: Progress Reporting** |
| |
| |

| **Year 3 (2019- 2020)** |
|---|
| **Deliverable(s)** (please provide enough information to support status reporting) |

| |
|---|
| **Q1 – April to June 2019** |
| Permitting, field collections, equipment maintenance, contract preparation, materials acquisition, planning |
| |
| |
| **Q2 – July to September 2019** |
| Equipment maintenance, sample processing and analysis, contract preparation, materials acquisition, planning |
| |
| |
| |
| **Q3 – October to December 2019** |
| Equipment maintenance, sample processing and analysis, data acquisition, planning |
| |
| **Data Product: Temporal trend manuscript** |
| |
| **Q4 – January to March 2020** |
| Permit reporting, data analysis and interpretation, planning Eq |
| **Data Product: Progress Reporting for year 2 and 3** |
| |
| |