

SEAN environmental contaminants SOP 5: Comprehensive reporting of Environmental Contaminants monitoring results

Version 1.0

Revision History Log:

Previous Version #	Revision Date	Author	Changes Made	New Version #
-	8/1/2018	C. Sergeant	Initial version	1.0

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1 Introduction

This standard operating procedure (SOP) covers all the necessary information for SEAN staff and partners to report the results of monitoring Airborne, Freshwater, and Marine Contaminants. Reporting is divided into two categories:

1. Delivering data to internal and external repositories after lab results are available
2. Compiling one year of monitoring results into a NPS Natural Resource Data Series report for all three ecosystems components (lichen, Dolly Varden, mussels)

The project leader (currently, the SEAN ecologist) is responsible for ensuring this SOP is followed and reporting occurs efficiently.

Since the Environmental Contaminants monitoring program operates as a surveillance program (see protocol narrative for an expanded discussion), it is unlikely that trends in contaminants will be identified in the coming decades. The primary objective of periodic reporting is to determine whether monitored contaminants elevate to levels that signal the potential for park resource impairment. Thus, the reporting envisioned here would occur every five years and rely on simple summaries of collected data and comparisons to existing thresholds of ecological or human concern.

2 Data delivery to internal NPS and external repositories

By following the steps in the remainder of Section 2, all of the necessary basic data for the environmental contaminants protocol are stored in maintained databases and publicly accessible. This SOP assumes that the repositories and processes outlined below will continue over time, but due to the long interval of contaminants data collection (every 5 years), these processes will need to be reviewed and potentially updated before each round of sampling to reflect current practices.

1 Airborne contaminants

The United States Forest Service (USFS) maintains all of its atmospheric monitoring data in the National Lichens and Air Quality Database and Clearinghouse (<http://gis.nacse.org/lichenair/>). Currently, the University of Minnesota Research Analytical Lab conducts the lichen tissue analysis necessary for the SEAN Airborne Contaminants program and is likely to remain the contracted lab into the future.

Three steps comprise the data delivery for Airborne Contaminants:

1. After lichens are collected per SOP 2 instructions, samples are sent to the contracted analytical lab for tissue chemistry analysis. Lichen field collection sheets (deliverable EC_A) are scanned into a single color PDF file, retained in the SEAN server, and disseminated through the NPS Data Store in accordance with SOP 2.
2. The contracted lab provides a spreadsheet file of analytical results (deliverable EC_B) that will be retained in the SEAN server, and disseminated through the NPS Data Store in accordance with SOP 2.

3. The lab results spreadsheet (EC_B) will be sent to the USFS National Air Program Manager (currently, Linda Geiser) for inclusion into the USFS database. The USFS is responsible for translating spreadsheet results into the necessary database format.

2 Freshwater contaminants

At this time, no broadly distributed, maintained, and easily discoverable database has been identified for contributing mercury analyses from Dolly Varden tissue. Thus, deliverables from this component of the environmental contaminants protocol will be retained in the NPS Data Store and linked from the SEAN website.

Three steps comprise the data delivery for freshwater contaminants:

1. After Dolly Varden are collected per SOP 3 instructions, samples are sent to the appropriate analytical lab for tissue mercury analysis. Dolly Varden field collection sheets (deliverable EC_C) are scanned into a single color PDF file, retained in the SEAN server, and disseminated through the NPS Data Store in accordance with SOP 3.
2. The analytical lab provides a technical report detailing lab methods, raw sample data, and accompanying data descriptions of analytical results (deliverable EC_D) allowing future data users with toxicological expertise to assess data quality. This product will be retained in the SEAN server, and disseminated through the NPS Data Store in accordance with SOP 3.
3. A single CSV file distilled from EC_E will contain only tissue mercury analysis results for individual and/or pooled fish. Data columns must provide enough information to be consistent and comparable with the analyses performed and described in Cyr et al. (2017). At a minimum, this spreadsheet must include site code, number of fish (if sample pooled across multiple individuals), field fork length (mm), field mass (g), and total mercury (ng/g wet weight). This product will be retained in the NPS Data Store, and also disseminated through the SEAN web site in accordance with SOP 3.

3 Marine contaminants

The National Oceanographic and Atmospheric Administration (NOAA) maintains all of its marine mussel contaminants data in their National Status and Trends (NS&T) database

(<https://products.coastalscience.noaa.gov/collections/ltnmonitoring/nsandt/default.aspx>). Currently, TDI-Brooks/B&B Laboratories in College Station, Texas is the lab contracted for the NOAA Mussel Watch program and is likely to remain the contracted lab into the future. Owing to an existing single-award Indefinite Delivery/Indefinite Quantity contract through the General Services Administration, other federal agencies can either enter into an interagency agreement with NOAA to procure the analytical lab work, or procure directly through TDI-Brooks/B&B Laboratories, which eliminates NOAA overhead and was done for the 2017 analysis.

Three steps comprise the data delivery for marine contaminants:

1. After mussels are collected per SOP 4 instructions, samples are sent to the contracted analytical lab for tissue chemistry analysis (see Table 6.1 in the protocol narrative for specific groups of analytes).

Mussel field collection sheets (deliverable EC_F) are scanned into a single color PDF file, retained in the NPS Data Store, and also disseminated through the SEAN web site in accordance with SOP 4.

2. The analytical lab provides a technical report detailing lab methods, raw sample data, and accompanying data descriptions of analytical results (deliverable EC_G) allowing future data users with toxicological expertise to independently assess data quality. This product will be retained in the NPS Data Store, and also disseminated through the SEAN web site in accordance with SOP 4.
3. The lab results spreadsheet will be sent to the NOAA Mussel Watch Program Coordinator (currently, Dennis Apeti) for inclusion into the NOAA database. NOAA will be responsible for translating spreadsheet results into the necessary NS&T database format. Navigating the NOAA NS&T website to find data from the SEAN is not intuitive, so directions are provided here (current as of September 2017):
 1. In your web browser, navigate to:
<https://products.coastalscience.noaa.gov/collections/ltmonitoring/nsandt/default.aspx>
 2. Click on “NS&T Data Page” in the middle of the webpage
 3. Navigate about two-thirds of the way down the Data Page to the “Special Studies” section heading and find the second table titled, “Alaska – NPS Mussel Watch Special Study”
 4. Each link within that table leads to a simple .CSV file for downloading data

3 Integrated NRDS report content and format

Basic data sets will be publicly available through the repositories listed in Section 2, but there will still be a need to provide simple, integrated summary tables of environmental contaminants data in one location that can be provided to NPS staff, the public, and interested researchers.

The SEAN envisions these reports to be produced in the NPS Natural Resource Data Series (NRDS) and designated as deliverable EC_H. According to the NPS Natural Resource Publications Management website, NRDS reports, “are limited to those collected, processed (undergone quality assurance and quality control procedures), and analyzed following methods prescribed in peer-reviewed and published NPS Inventory & Monitoring protocols. In most cases, data reported in the NRDS are a subset of larger-scale or longer-term periods of record and have not undergone complete trend or spatial analyses.” Analysis of in-depth or novel results that includes interpretation of data should be drafted separately in an NPS Natural Resources Report or peer-reviewed manuscript. These products are not described here and are up to the discretion of SEAN staff as novel data arise and warrant additional publication.

The integrated environmental contaminants NRDS should have the following elements:

1. **Executive Summary:** Intended for park superintendents and managers; briefly review program purpose and design; summarize Results in the context of ecological and human health thresholds of concern or changes from previous monitoring results

2. **Acknowledgements:** Field crew, logistical supporters, document reviewers, etc. should be thanked here
3. **Introduction:** Briefly present the monitoring program context, goals, and objectives; cite the narrative or SOPs for those interested in more details
4. **Methods:** List and map study areas; briefly describe field and analytical techniques; note annual deviations from sampling prescribed in protocols; cite the narrative or SOPs for those interested in more details
- 1 **Results:** Present tables and figures of annual and historical results; summarize long- and short-term trends and anomalous or system-specific observations
Contents of the Results Section

The results for each NRDS should be linked directly to the program objectives listed in the protocol narrative. The Project Leader's priority is to promptly publish the annual technical report with the main components below:

- Objective 1: *Monitor lichen tissue concentrations for nitrogen, sulfur, and 25 additional elements in conformance with protocols developed for the Tongass National Forest*

Two summary tables should be provided as the minimum amount of data reporting:

- 1) Existing USFS environmental thresholds (ppm) for individual elements present in *Hypogymnia spp.* above which may trigger potential concern for park resource impairment. These are copied directly from Dillman et al. (2007). For more information on the development of these thresholds and their interpretation, see Dillman et al. (2007) and Pirhalla and Bower (2016).

S	N	Al	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li
0.09	0.88	1126.44	9.47	76.62	0.04	24671.17	0.61	1.25	2.38	31.31	1990.78	3284.34	0.71
Mg	Mn	Mo	Na	Ni	P	Pb	Rb	Si	Sr	Ti	V	Zn	
2127.70	860.85	0.54	929.13	4.26	1597.23	10.13	53.00	563.82	61.26	62.42	2.99	70.20	

- 2) Results of elemental analysis for latest lichen samples. At a minimum, the table should report at least the following columns by site and lichen species:

Site code	Collection date	Species	Substrate	S (%)	N (%)	Al (ppm)	Ba (ppm)	... additional elements (ppm)
KLGO_DY	09/08/2017	P. glauca	Pico boles and branches	0.051	0.378	391.33	1.050	...

Values higher than the identified thresholds should be bolded to draw the reader's attention. Depending on the results of future data analyses, the Project Leader may find it valuable to additionally report the range of all lichen samples collected over time for direct comparison with the current year's collection. Note that the columns of data included with the USFS database will be much more extensive. Additionally, when one site has elevated levels for a particular element

relative to other sites, the report author(s) may find it useful to graph concentrations by site. Figure SOP-5.1 shows an example using mock data.

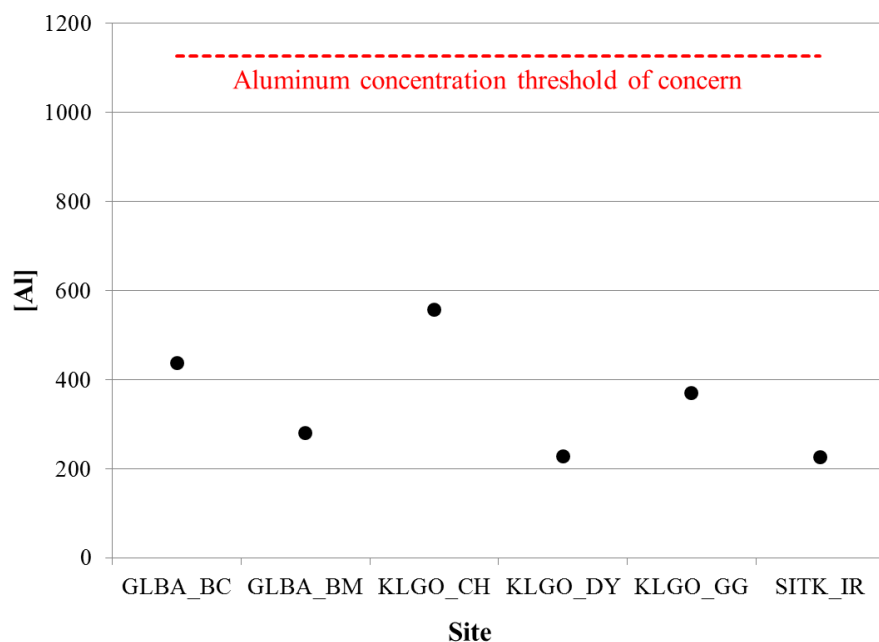


Figure SOP-5.1. Analyte concentration by site.

- Objective 2: *Monitor total mercury in riverine Dolly Varden tissue using existing Environmental Protection Agency (EPA) protocols*

One summary table should be provided as the minimum amount of data reporting. This table would provide the basic total mercury data for each fish and should cross-reference with the individual trap and fish data recorded on the freshwater contaminants field sheet (SOP 3). At a minimum, the table should report the following columns:

Site code	Collection date	Trap #	Serial fish ID	FL (mm)	Mass (g)	[THg] (ng/g wet weight)
GLBA_SA	09/08/2017	2017_1	2017_1	...	...	...

- Objective 3: *Monitor a broad suite of metals, polycyclic aromatic hydrocarbons (PAHs), and persistent organic pollutants (POPs) in bay mussels, in conformance with national protocols developed by the National Oceanic and Atmospheric Administration (NOAA) Mussel Watch Program.*

One summary table should be provided as the minimum amount of data reporting. This table would provide the basic data for each site and should cross-reference with the reports provided by the Mussel Watch analytical lab (SOP 4). At a minimum, the table should report the following columns. To save space, concentration units are not listed for analytes. Metal (As, Cd, Hg, and TBT) concentrations are µg/g wet weight, while all other group concentrations are ng/g wet weight:

Site code	Collection date	As	Cd	Hg	TBT	TPAH	ΣCHLD	ΣDDT	ΣHCH	ΣPCB	ΣPBDE
GBBC	09/08/2017										

The submission, review, technical validation, and acceptance of this report shall be done according to the current process required by the NRSS/IMD publications section. Since this deliverable is scheduled to be produced only once every five years and processes are frequently revised, publication rules and methods are likely to be somewhat different between issues. The author should follow the latest guidance, currently posted at <https://nature.nps.gov/publications/nrpm/procedure.cfm>.

Literature cited

- Cyr, A., C. J. Sergeant, J. A. Lopez, and T. M. O'Hara. 2017. Assessing the influence of migration barriers and feeding ecology on total mercury concentrations in Dolly Varden (*Salvelinus malma*) from a glaciated and non-glaciated stream. *Science of the Total Environment* 580: 710-718.
- Dillman, K., L. Geiser, and G. Brenner. 2007. Air quality bio-monitoring with lichens. The Tongass National Forest. USDA Forest Service. 14 pp.
- Pirhalla, M. A., and M. R. Bower. 2016. Considerations for long term monitoring of airborne contaminants and ecological effects in the Southeast Alaska Network. Natural Resource Report. NPS/SEAN/NRR—2016/1238. National Park Service. Fort Collins, Colorado.