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# International Year of the Salmon Data Mobilization Recommendations

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Brett Johnson

Hakai Institute

1713 Hyacinthe Bay Road, Heriot Bay, BC, Canada

## *Executive Summary*

An agreement was signed between the Hakai Institute and the North Pacific Anadromous Fish Commission on February 3rd, 2020 for Hakai to scope and review the requirements of data management for high seas salmon ecology and oceanographic observations collected by the International Year of the Salmon collaborative project. Here, we recommended a number of actions and considerations for building and delivering digital infrastructure systems for integrating a keystone data ecosystem—salmon ecology. Foremost we recommend timely, inclusive, and equitable data access. To that end we recommend adopting the Global Ocean Observation System (GOOS) framework. The GOOS is a project of the United Nations’ Educational, Scientific and Cultural Organization and unifies networks of researchers around the world. Adopting the international standards and principles outlined broadly by UNESCO will ensure a multilateral approach inline with the UN Declaration on the Rights of Indigenous Peoples to the standardization, integration, and equitable distribution of salmon ocean ecology data in British Columbia and beyond.

Data collected by the 2019 research cruise is centrally accessible in an International Year of the Salmon Ocean Observation System (IYS-OOS) catalogue at <https://iys.hakai.org>. We provide a complete catalogue of the data sets produced by the IYS in 2019 with ISO 19115 compliant metadata records, making the knowledge that these data exist publicly discoverable—a fundamental first step.

We recommend four components of a Data Management and Communications Model: 1) Data catalogue records compliant with ISO 19115 (<http://iys.hakai.org>)-- COMPLETE; 2) Open-Access licensing and Open Data Access Protocols; 3) Controlled Vocabularies that define the variables, methods, units, platforms and measurement types used in salmon ocean ecology adhering to ‘Ocean Best Practices’ maintained by the Global Ocean Observation System; 4) A dedicated TRUSTed digital repository for hosting data and data-analysis tool-development code securely in perpetuity.

## *Introduction*

The North Pacific Anadromous Fish Commission (NPAFC) is implementing a five-year International Year of the Salmon (IYS) collaborative project through 2022 to set the conditions for the resilience of salmon and people in a rapidly changing world. Members nations of the

NPAFC are collaborating on a multi-vessel Oceanographic Expedition planned for March 2021 covering from California North and West to Kamchatka, Russia and as south as South Korea, including the Sea of Okhotsk and parts of the Bering Sea. Trans-disciplinary researchers spanning Physical, BioGeoChemical, and Biodiversity/Ecosystem domains from at least a dozen institutions and agencies will generate a complex set of data. Success will be measured by timely and equitable access to data and knowledge generated by the International Year of the Salmon. The NPAFC and the Hakai Institute with support from the British Columbia Salmon Restoration and Innovation Fund and the Tula Foundation are conducting a review of current practices and new approaches to mobilizing salmon ocean ecology data, specifically for the data collected during the five-vessel survey planned for 2021.

## *Methods*

### **Data Model**

For every data element, collection method, platform, and variable produced by the IYS High Seas Expeditions in 2021, the following tasks need to be completed:

- Determine whether the data element is already defined within GOOS framework. Such elements will be processed first because the requirements are well-defined. For data elements that do not naturally belong in IYS-OOS, determine whether there is a recognized and compatible repository where they belong and can be federated or linked to the IYS-OOS. Example alternative data repositories: Biodiversity of Life Online Database (BOLD), DataONE, Dryad, Federal Open Data, BC Gov. Data etc.)
- Publish. For all data elements, generate appropriate and valid metadata records to make the existence of the data public knowledge and insert the records into the metadata catalogue on the IYS Data Portal, so that they are discoverable by IYS users.
- Process. Work closely with the data provider to bring fully validated and standardized copies of data elements into the appropriate repositories.
- Communicate. Representatives from each scientific discipline involved with the IYS should connect through a working group that disseminates and advocates for best-practices.

## *Planning*

For the 2021 cruise to be successful, the establishment of a data standards study team made up of relevant representation of stakeholders needs to be established as soon as possible to begin to prioritize every data element, method, platform, and variable they plan to collect. The NPAFC is a natural platform for this study group, so is the adoption of data standards put forward by the Global Ocean Observation System (GOOS). GOOS is a program that is coordinated by the Intergovernmental Oceanographic Commission of UNESCO (United Nations Educational, Scientific and Cultural Organization). GOOS is governed by a multinational Steering Committee, three scientific domain Expert Panels, and many Observation Coordina-

tion Groups of people and organizations worldwide. GOOS is partnered with expert agencies in biological data—namely the Ocean Biogeographic Information System (OBIS), Biodiversity of Life Online Database (BOLD) and the Marine Biodiversity Observation Network (MBON), International Ocean Observation System, and the Canadian Integrated Ocean Observation System. We recommend using established international standards connected to GOOS where available, and extending or developing standards where needed. The product of this strategic alignment and development we can call the International Year of the Salmon Ocean Observation System (IYS-OOS) for now.

## *Steering Committee*

An executive-level steering committee will provide technical and strategic advice on the project while Hakai and NPAFC will retain administrative oversight of the project. Steering Committee participants will include:

- Eric Peterson/Brett Johnson – Hakai Institute
- Mark Saunders/Stephanie Taylor– NPAFC
- Dick Beamish and Brian Riddell – 2019 and 2020 Expeditions/Pacific Salmon Foundation
- Bruce Patten – DFO Pacific Biological Station and OBIS Canada Node Manager
- Erin Satterthwaite – GOOS BioEco Expert Panel Member
- Brian Hunt – University of British Columbia Institute of Oceans and Fisheries, Expedition Scientist
- Expedition Chief Scientists

## *Science Groups by Domain and EOVS*

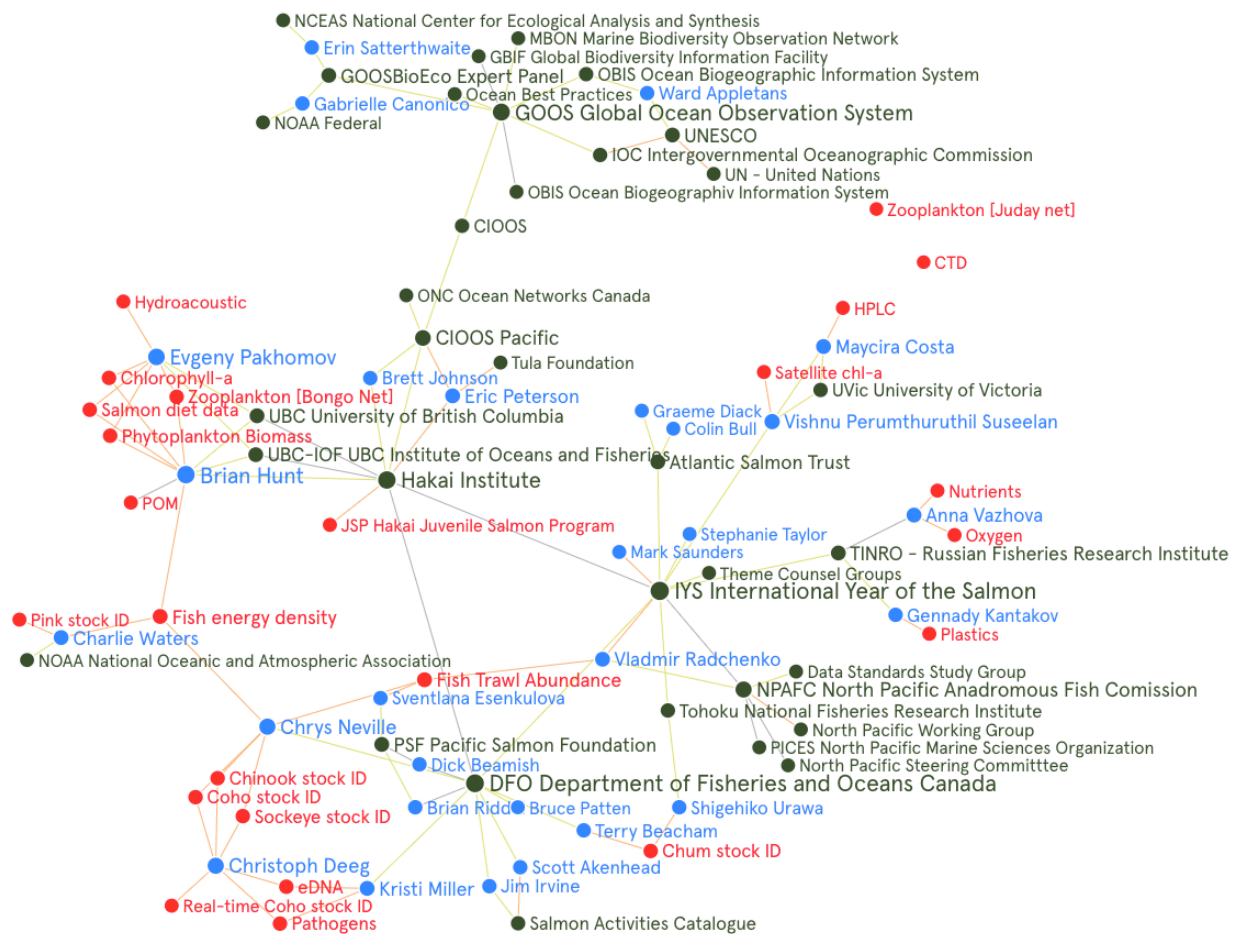
Key research networks should be identified under the following non-arbitrary science domains that reflect the GOOS Essential Ocean Variable schema.

**Physical**

**BioGeoChemical**

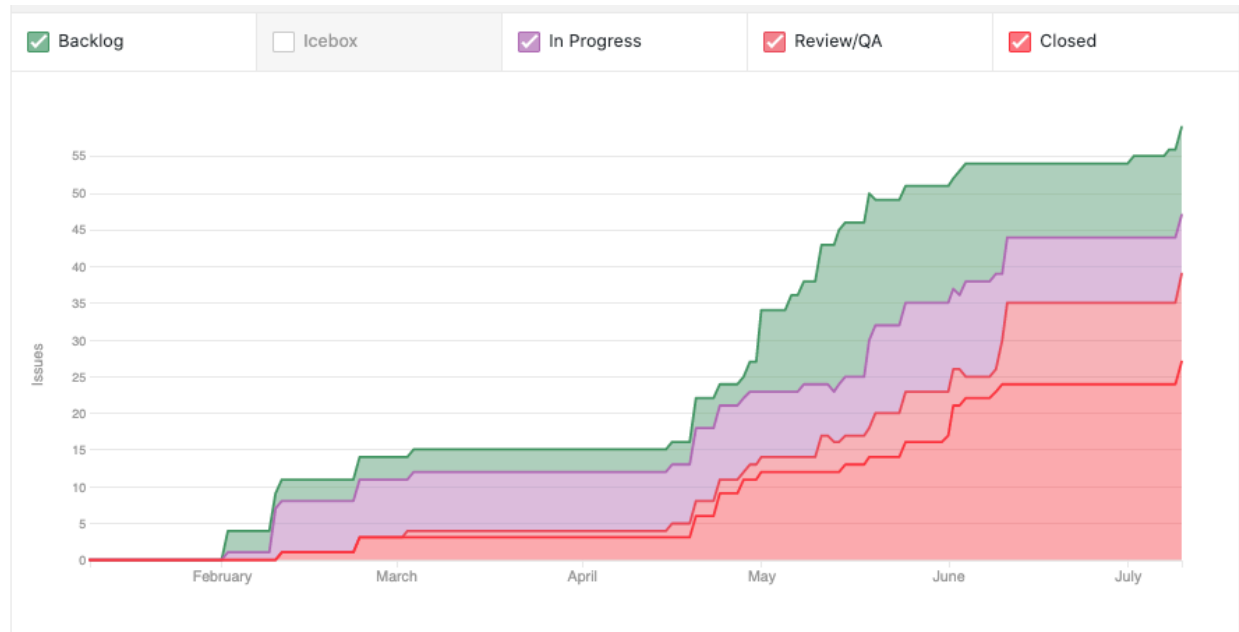
**BioEco**

TODO: update this figure with the 2021 network when it is better identified



## Timeline

### Phase 1



Issues in Pipeline	July 7th	July 8th	July 9th	July 10th
Backlog	11	12	12	12
Icebox	3	3	3	0
In Progress	9	9	9	8
Review/QA	11	11	11	12
Closed	24	24	24	27

Figure X. Cumulative task flow for 2020 Q1 and Q2

Three themes determine the timeline:

- 1) Deepening Engagement and Impact; 2) System Integration and Delivery; and 3) Building for the Future.

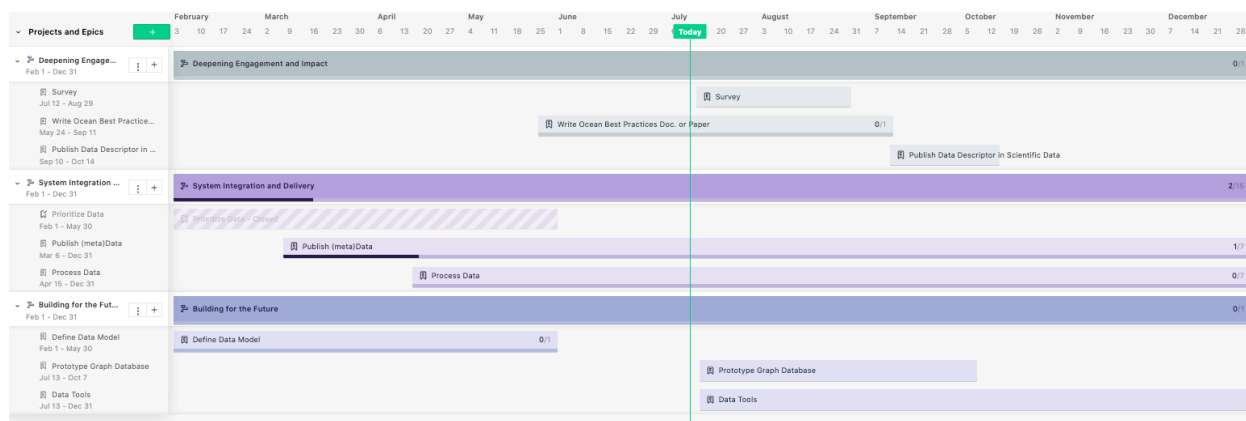


Figure X. Data Strategy roadmap through 2020

## Phase 2

Continue building Data Model

- A web-based IYS Data Portal. We propose to follow the lead of DFO/CIOOS and implement a cloud-based solution with Amazon Web Services, utilizing the Montreal data centre to host a data catalogue/portal. COMPLETE
- A metadata catalogue (we propose to follow DFO/CIOOS and employ CKAN), which allows for data discovery across the federated system. COMPLETE
- A GOOS-compatible repository for physical and biogeochemical data acquired on the expeditions. IN PROGRESS
- Solutions for other data types: either as natural extensions of the GOOS model, as contemplated under the GOOS Bio Eco, or in other repositories, as mandated by our modelling decisions. IN PROGRESS
- Concentrate first on the data types acquired during the 2019 cruise. COMPLETE

## Time Sensitive Challenges

Almost across the board, *documentation* of sensor calibration, collection protocols, sample processing protocols, sampling shipping and tracking protocols are inadequate. sample collect used in the field need better documentation in the metadata associated with each dataset produced on the expedition. This includes equipment and platform descriptions, calibration files, instructions for how data were summarized or aggregated, and any caveats for data interpretation etc... This will help in ensuring the scientific integrity of the consolidated data sets. Dataset 'Quality' levels will eventually be assigned based on completeness of metadata collection and integrity of provenance. Development of these guidelines among research domains is pressing.

## *Links and Resources*

- IYS-OOS GitHub Repository
- Please comment on this document issues in github
- Temporary 'AirTable' IYS-OOS Database
- Template CKAN Catalogue
- Global Ocean Observation System
- OBIS ENV-DATA Darwin Core Archive Data Structure
- Good enough practices in scientific computing