ACCELERATING SYNTHESIS SCIENCE THROUGH REPRODUCIBLE SCIENCE PRACTICES

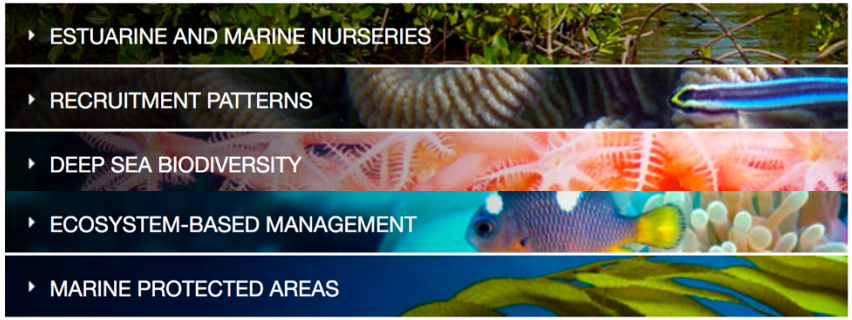
Matthew B. Jones
National Center for Ecological Analysis and Synthesis
University of California Santa Barbara

@metamattj
jones@nceas.ucsb.edu
https://orcid.org/0000-0003-0077-4738

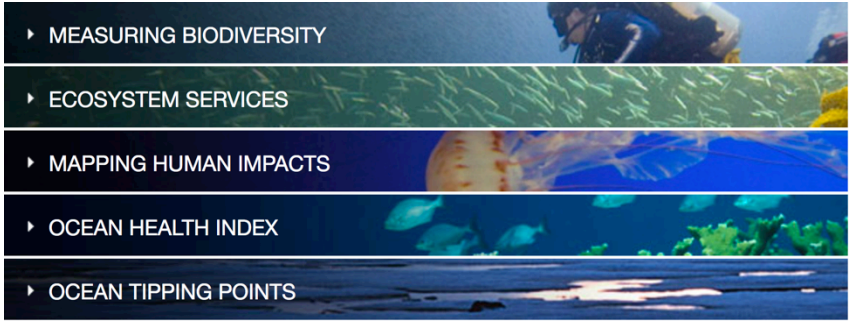
Ecological Synthesis

NCEAS
National Center for Ecological Analysis and Synthesis

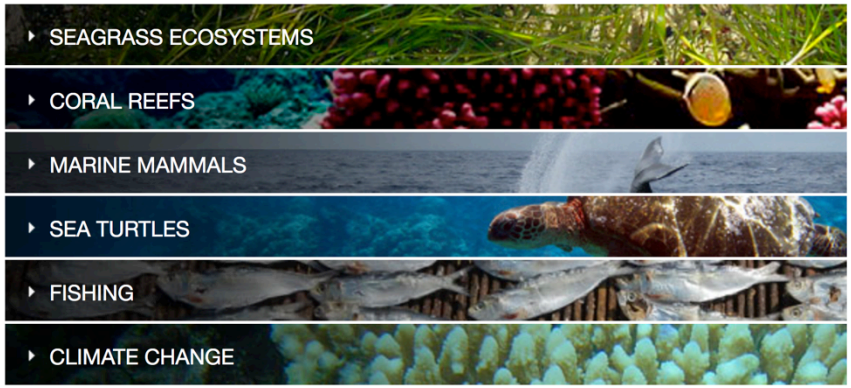
Marine Systems



Understanding Ocean Health



Threats and Population Declines



Climate and Ecosystems


Reproducible
Science


Provenance


Citation

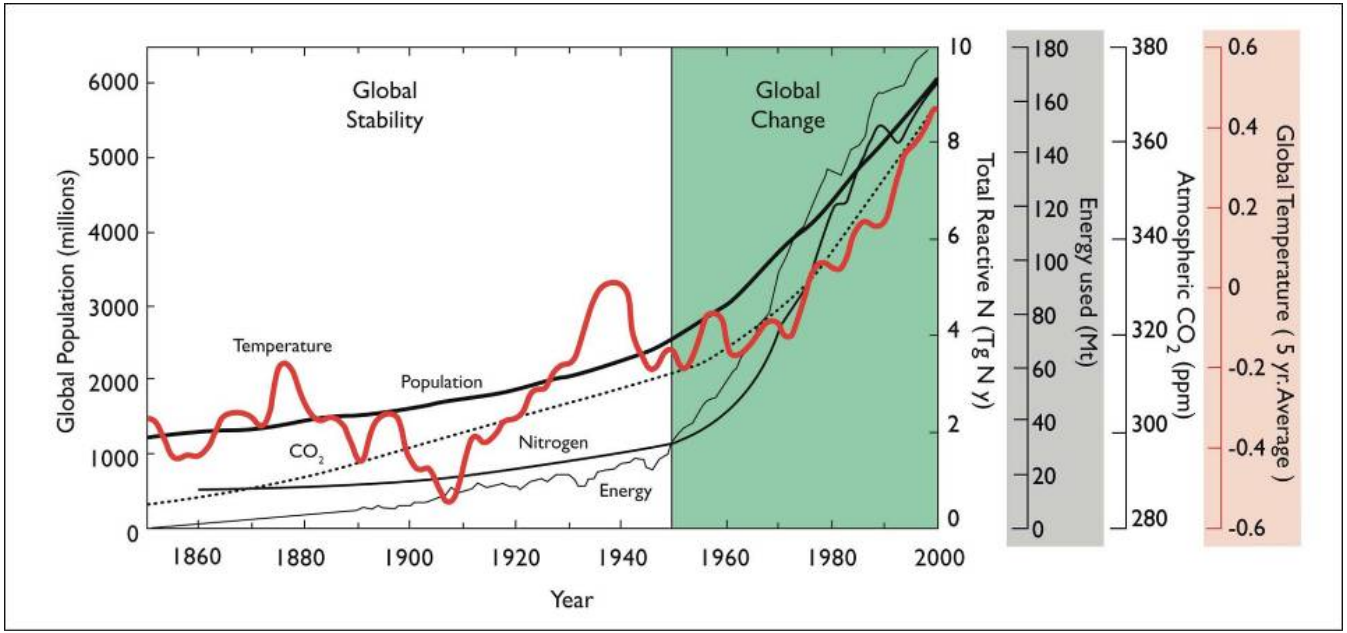

Synthesis

Reproducible Science

Climate Change
Fisheries
Sustainabiity
Subsistence

Science
Governance
Regulation
Policy

Trust in Science



What **data**?
What **methods**?
What **parameter settings**?

Can we **trust** these data and methods?

Smith et al. (2009) Ecology doi:10.1890/08-1815.1

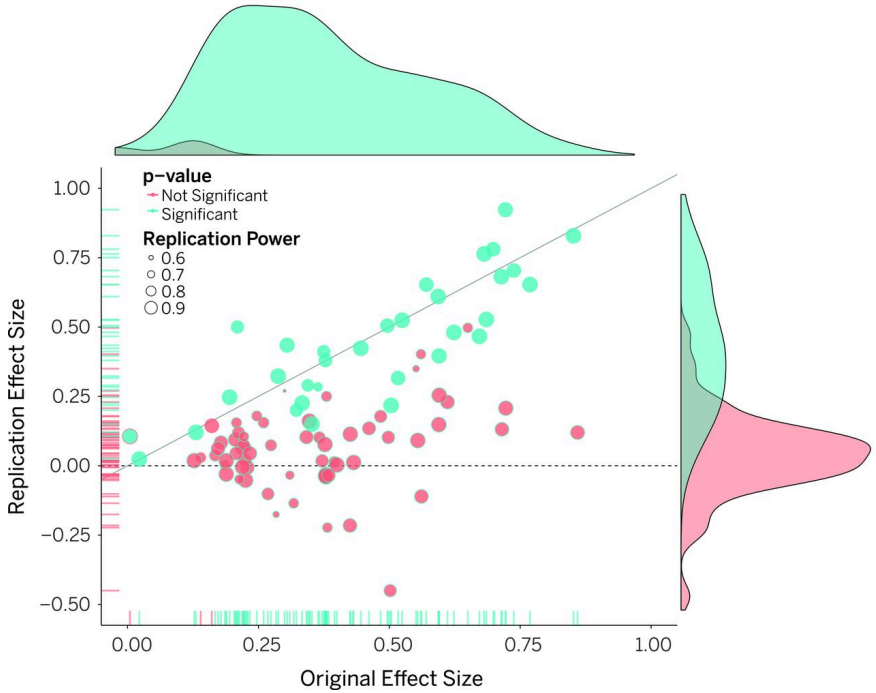
Reproducibility Crisis

"Most research findings are false for most research designs and for most fields"

Ioannidis, 2005

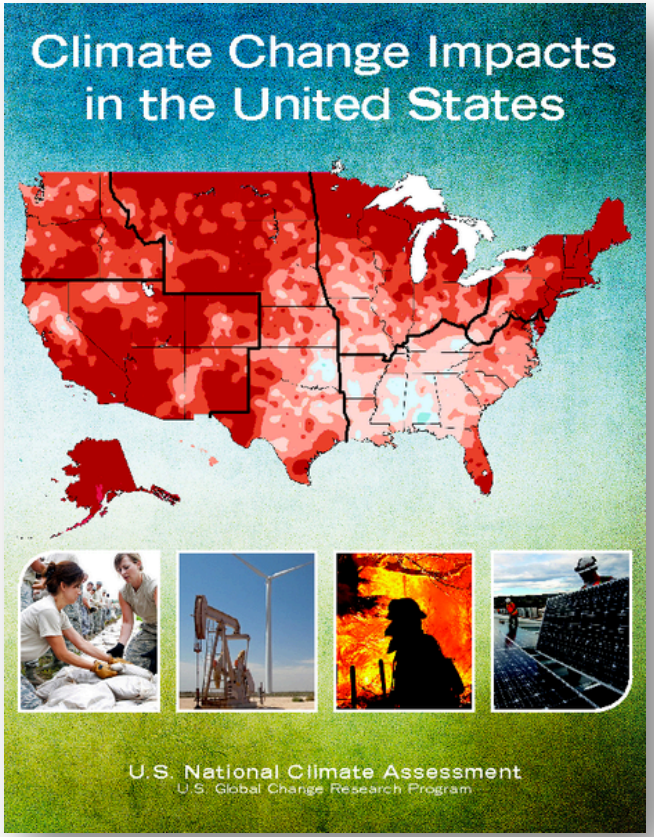
"Most replication effects were smaller than original results"

Open Science Collaboration, 2015



doi:10.1126/science.aac4716

National Climate Assessment



"This report is the result of a **three-year** analytical effort by a team of **over 300 experts**, overseen by a broadly constituted Federal Advisory Committee of **60 members**. It was developed from information and analyses gathered in over 70 workshops and listening sessions held across the country."

Computational Reproducibility

Facilitate transparency by **capturing** and **communicating** scientific workflows

Increase **trust in science**

Stand on the shoulders of giants (build on work that came before)

Give credit for that **secondary** usage enabling **easy attribution**

Practical Reproducibility

Preserve the data

Preserve the software workflow

Document what you did

Describe how to interpret it all

✖ Clear all filters

Search

Search phrase

My Search

sasap ✖

Filter by:

- Data attribute
- Data files
- Creator
- Year
- Identifier
- Taxon
- Location

DATASETS 1 TO 25 OF 44

1 2 Next

Sort by Most recent

knb Jeanette Clark and Rich Brenner. 2017. **Sockeye salmon brood tables, northeastern Pacific, 1922-2016.** Knowledge Network for Biocomplexity. urn:uuid:c11dff42-b988-437a-afee-58fc62dcd1dc.

5

knb Commercial Fisheries Entry Commision. 2018. **Commercial Fisheries Entry Commission Basic Information Table, 1975-2016.** Knowledge Network for Biocomplexity. urn:uuid:8f351735-baf9-451a-b821-c1117ebf5a5e

12

knb Andrew Munro and Eric Volk. 2018. **Summary of Pacific Salmon Escapement Goals in Alaska with a Review of Escapements from 2001 to 2009.** Knowledge Network for Biocomplexity. urn:uuid:d62539fd-3025-48d0-a1c3-5a903de1f269.

10

knb Alaska Department of Labor and Workforce Development, Research and Analysis Section. 2018. **Alaskan fishing industry employee counts by month, grouped by region and fish species from 2000-2016.** Knowledge Network for Biocomplexity. urn:uuid:32958097-0ad3-428a-aba9-c37e804be0ef.

9

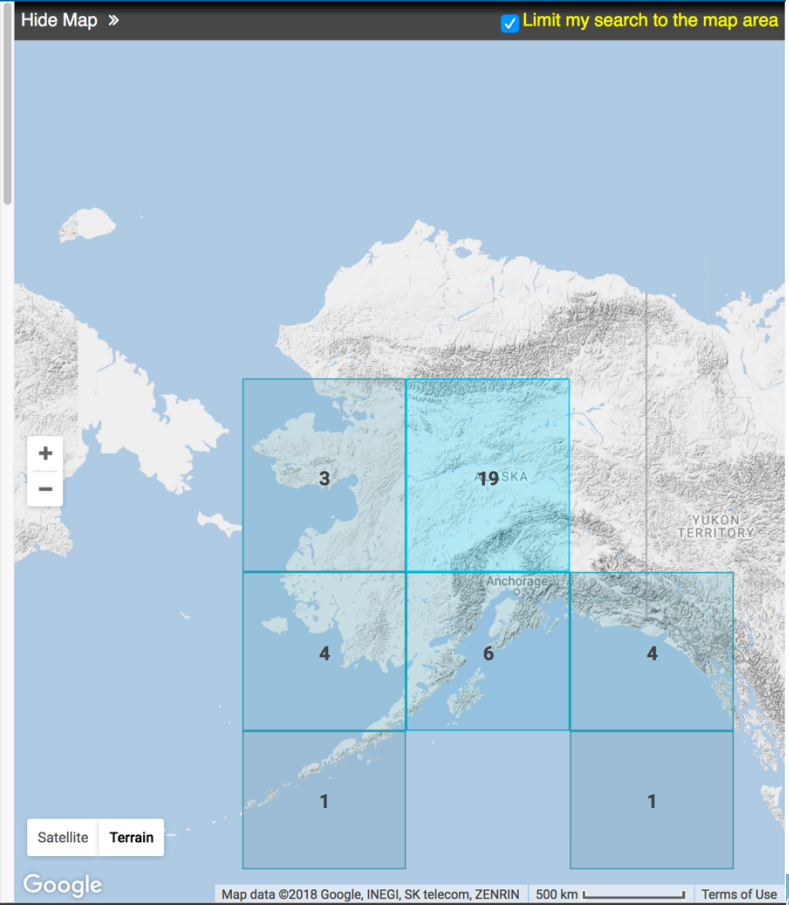
knb Alaska Department of Labor and Workforce Development Research & Analysis Section. 2018. **Alaskan fishing industry employee counts by month, subsetted by region and fish species.** Knowledge Network for Biocomplexity. urn:uuid:4bbc9577-e81f-40f4-b4ca-9c740092baba.

5

knb Commercial Fisheries Entry Commission. 2018. **Commercial Fisheries Entry Commission Permit Earnings, 1975-2016.** Knowledge Network for Biocomplexity.

Hide Map »

Limit my search to the map area



DataONE

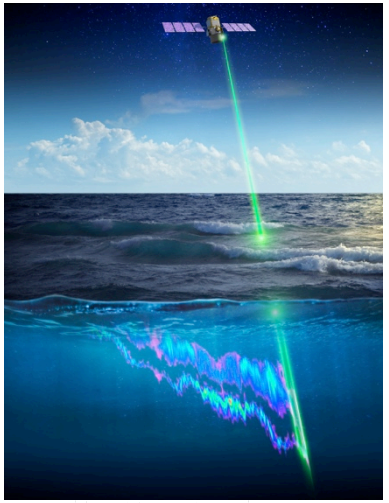
https://search.dataone.org

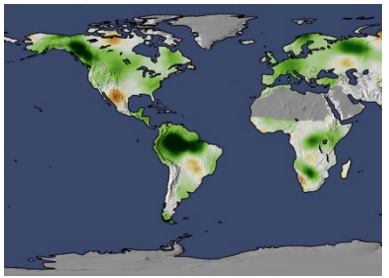
Global
Data Coverage

800K
Data Packages

40
Repositories

143K
Contributors





Reproducible Science

Provenance

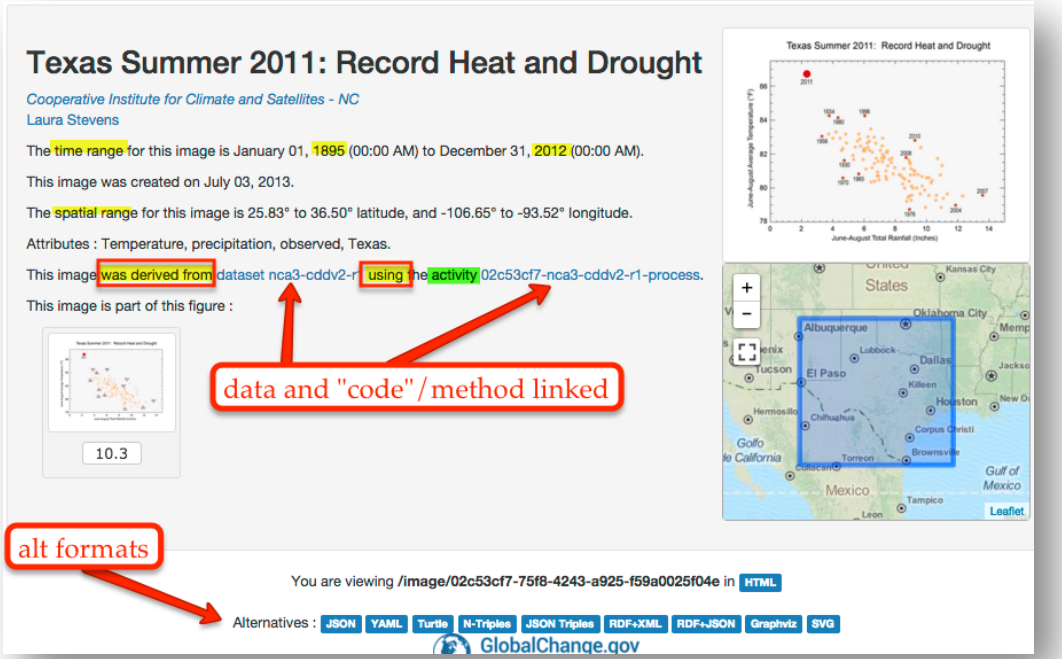
Citation

Synthesis

Computational Provenance

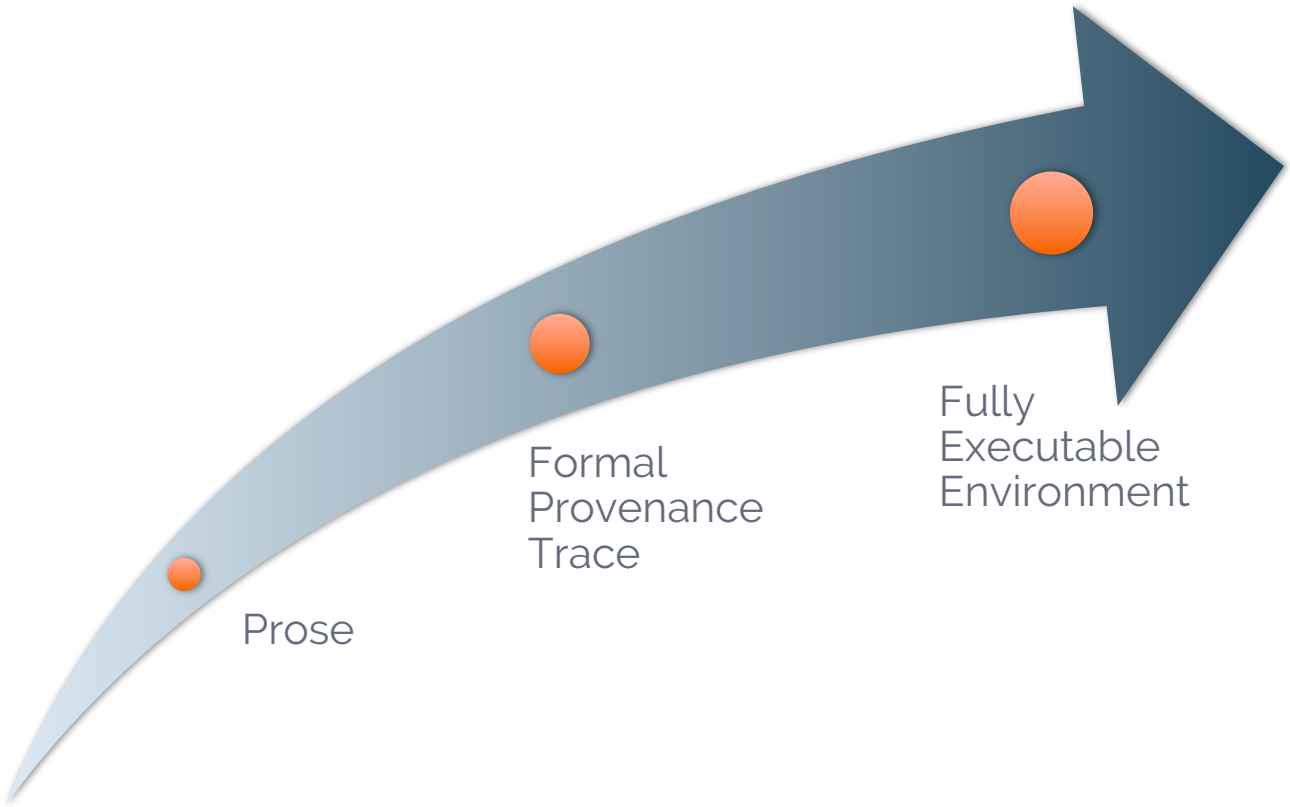
Origin, processing history of data

- Input data
- Workflow/scripts
- Output data
- Figures
- Understand methods, dataflow, and dependencies



Provenance

Origin and processing history of artifacts



Provenance in DataONE

Phase II Goal: Facilitate reproducible science

- Track **data derivation** history
- Track data **inputs** and **outputs** of analyses
- Track analysis and model **executions**
- Preserve and document software **workflows**
- Link all of these to **publications**

ProvONE

Extended PROV model for workflow provenance.

Prov Index

DataONE support for indexing, searching, and displaying provenance.

R and Matlab

Libraries in R, MATLAB, Java for generating and manipulating provenance records.

Web Provenance

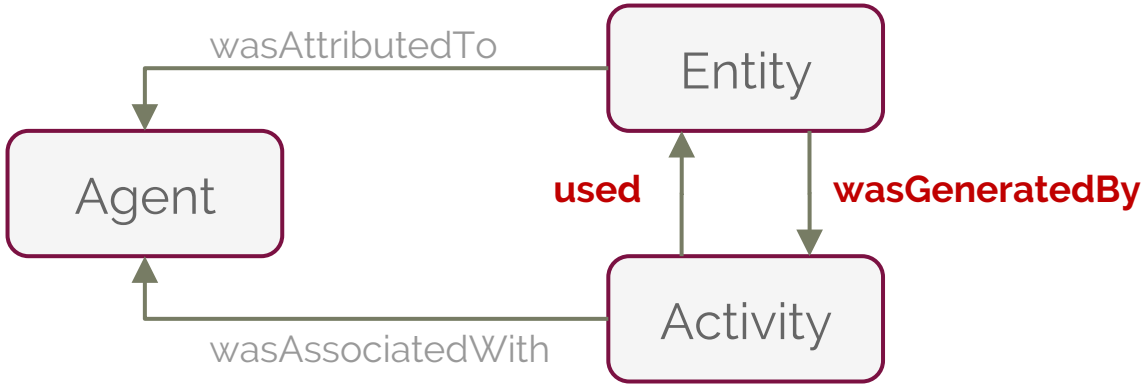
Web-based user interface for displaying and editing provenance.

Modeling Provenance

ProvONE

W3C PROV

See **w3.org/TR/prov-o/**

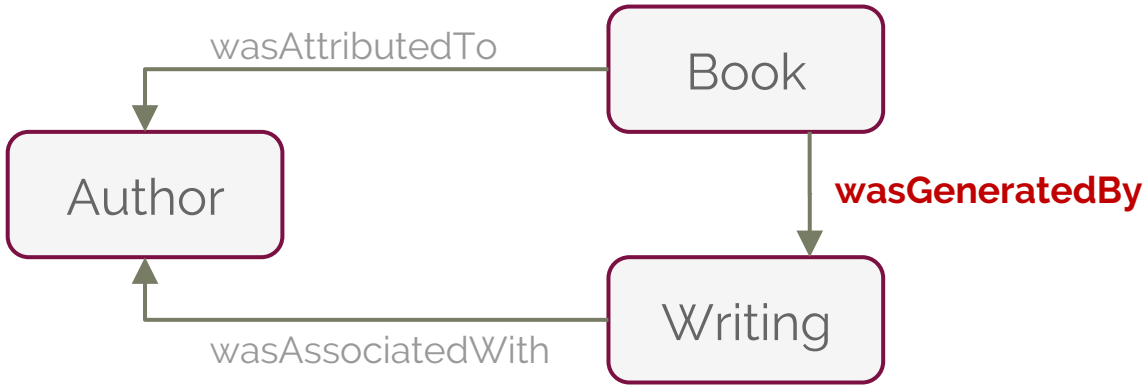


Modeling Provenance

ProvONE

W3C PROV

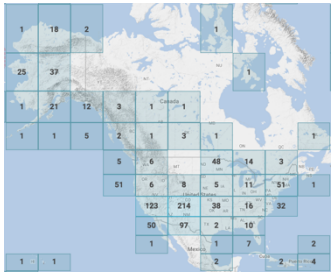
See **w3.org/TR/prov-o/**



Provenance for Science Workflows

ProvONE – an extension of W3C PROV

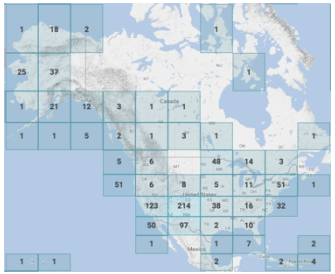
See **purl.dataone.org/provone-v1-dev**

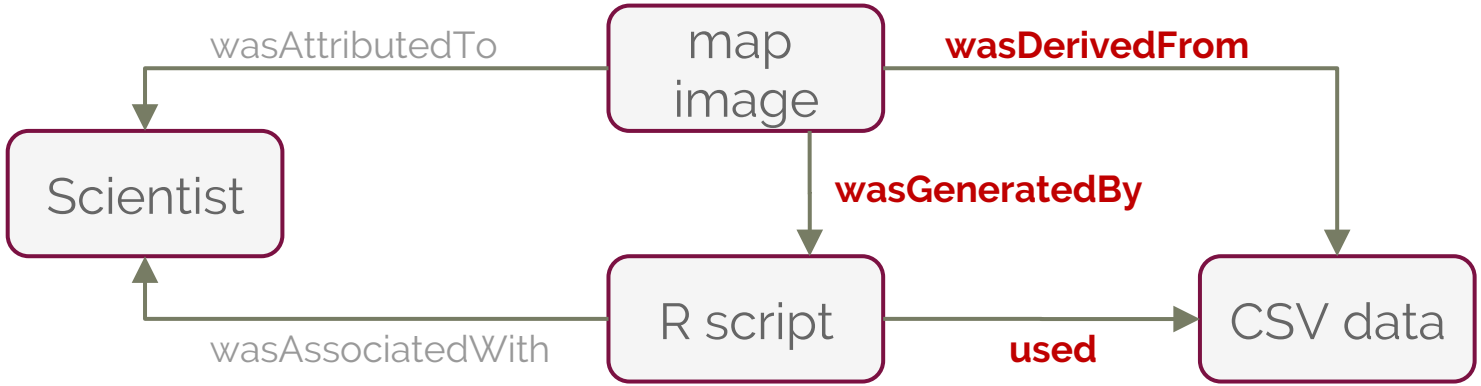


Provenance for Science Workflows

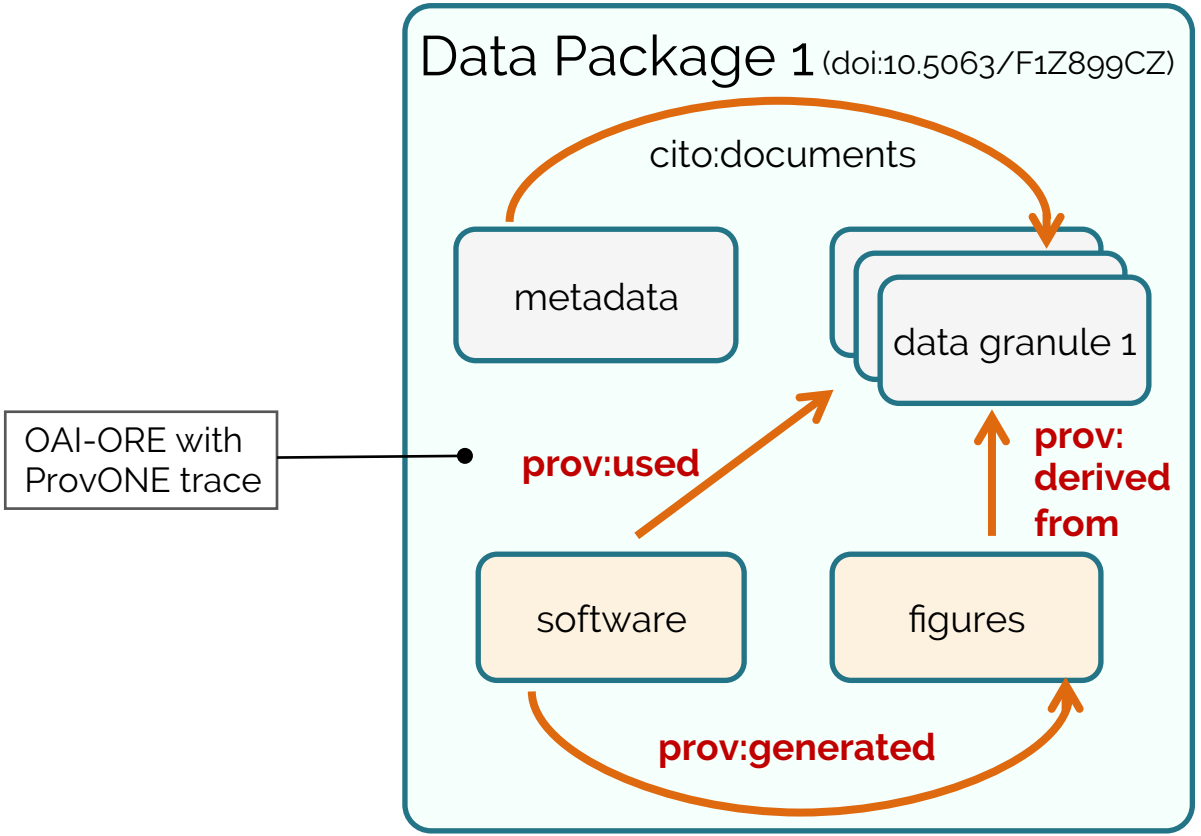
ProvONE – an extension of W3C PROV

See **purl.dataone.org/provone-v1-dev**



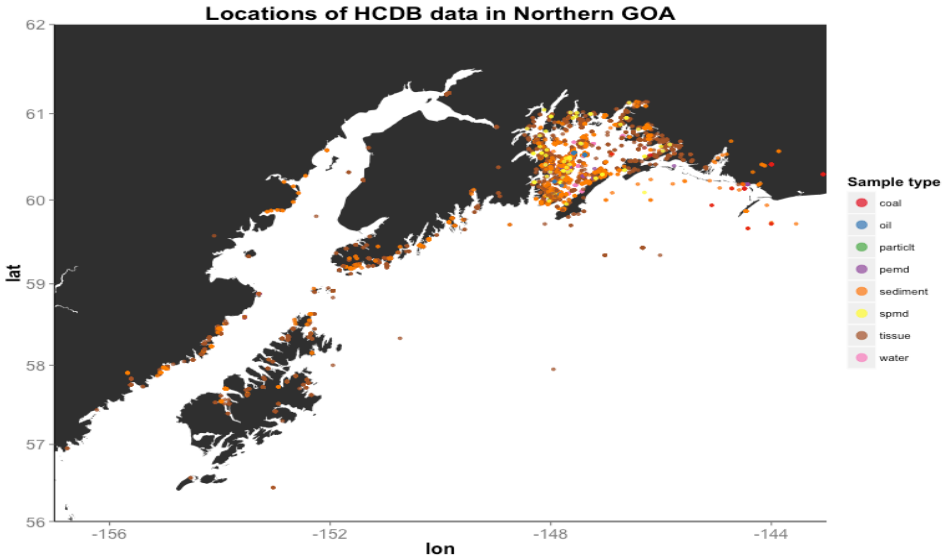


Data Package with Provenance

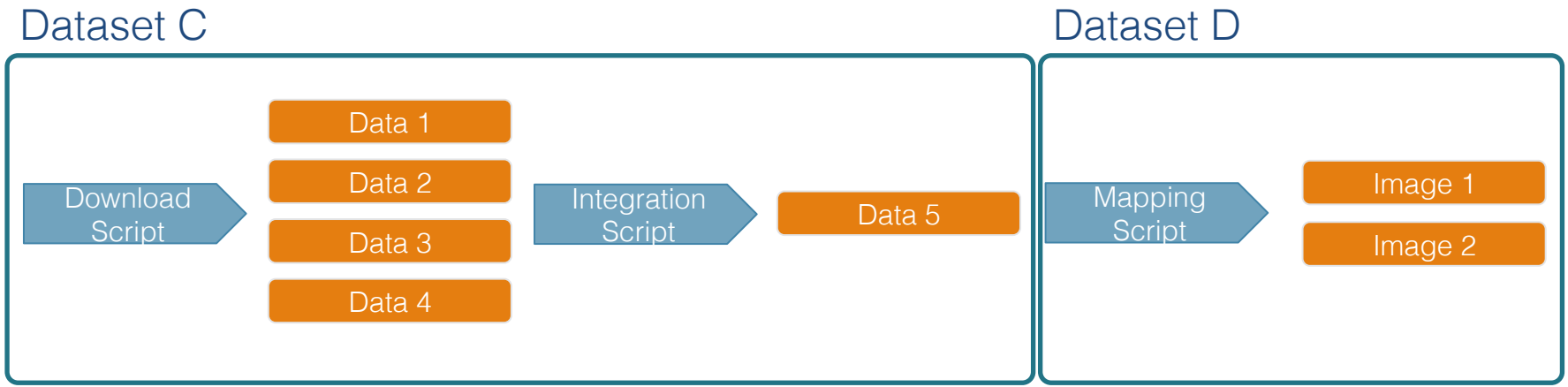


Hydrocarbon Data Example

Mark Carls. 2017. Analysis of hydrocarbons following the Exxon Valdez oil spill, Gulf of Alaska, 1989 - 2014. Arctic Data Center.



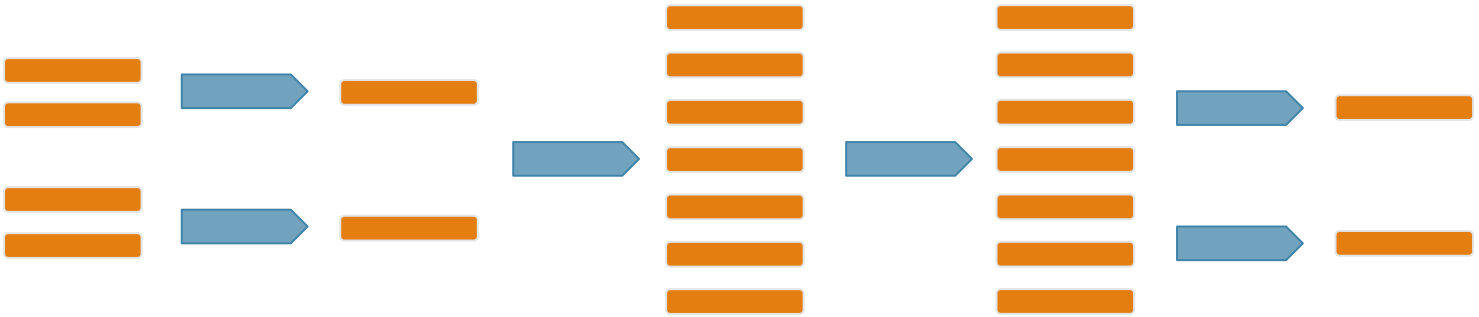
Publishing Data Workflows



Hydrocarbon Data Example

Complex Workflows

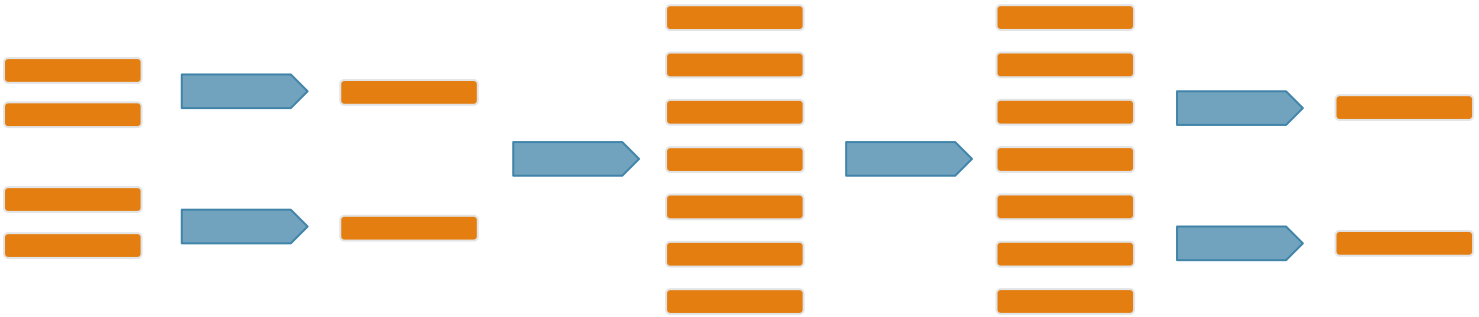
Simplified view of complex workflows



Hydrocarbon Data Example

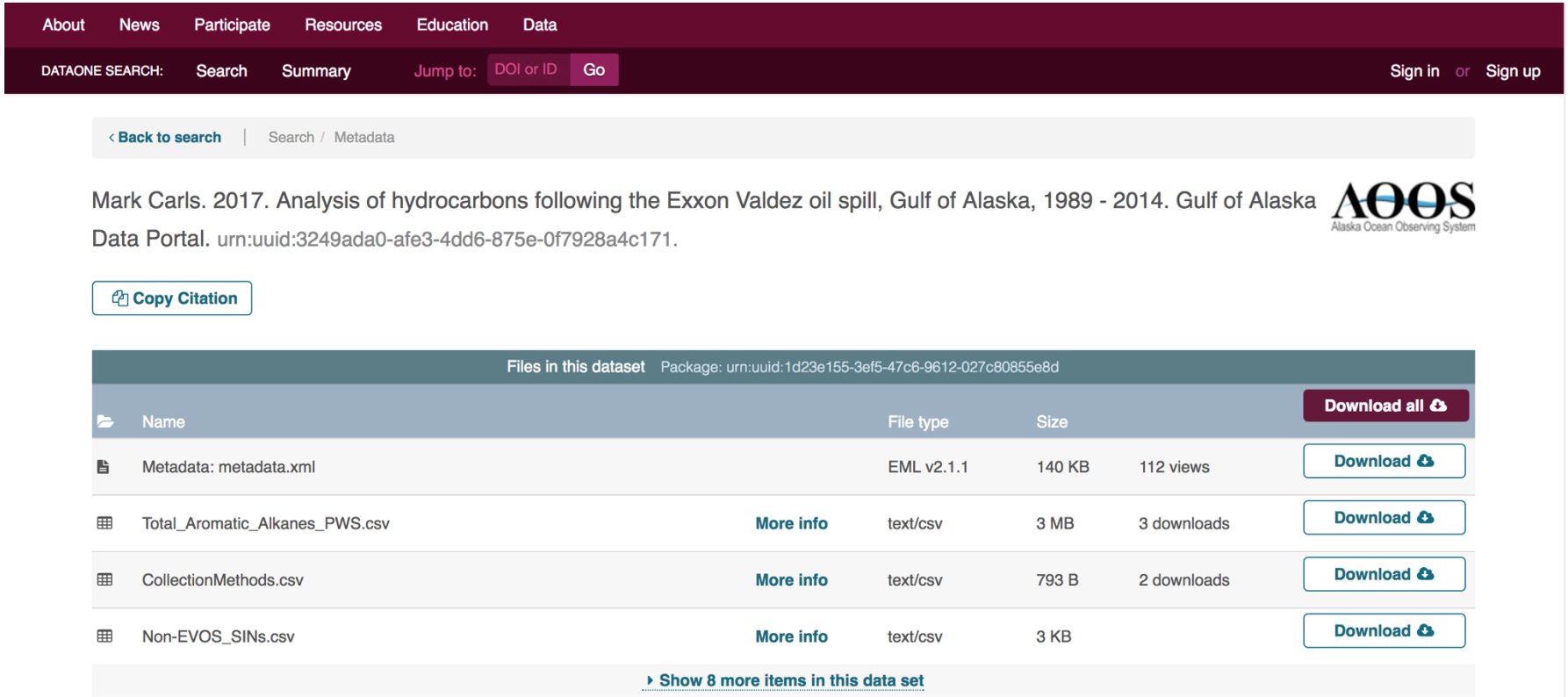
Complex Workflows

Simplified view of complex workflows



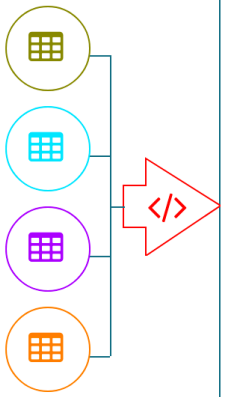
Provenance Display

DataONE Search

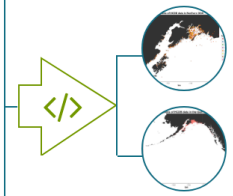


Data Table, Image, and Other Data Details

4 sources



2 derivations



Data Table

Entity Name	**Total_Aromatic_Alkanes_PWS.csv**
	Download
Description	Combined dataset from PAH, Alkane and Sample tables documenting samples collected after the Exxon Valdez oil spill in Prince William Sound, AK
Object Name	Total_Aromatic_Alkanes_PWS.csv
Online Distribution Info	**https://cn.dataone.org/cn/v2/resolve/urn:uuid:44108e76-405d-4d58-b1b3-fb4b55e3fff9**
Size	2801033 byte
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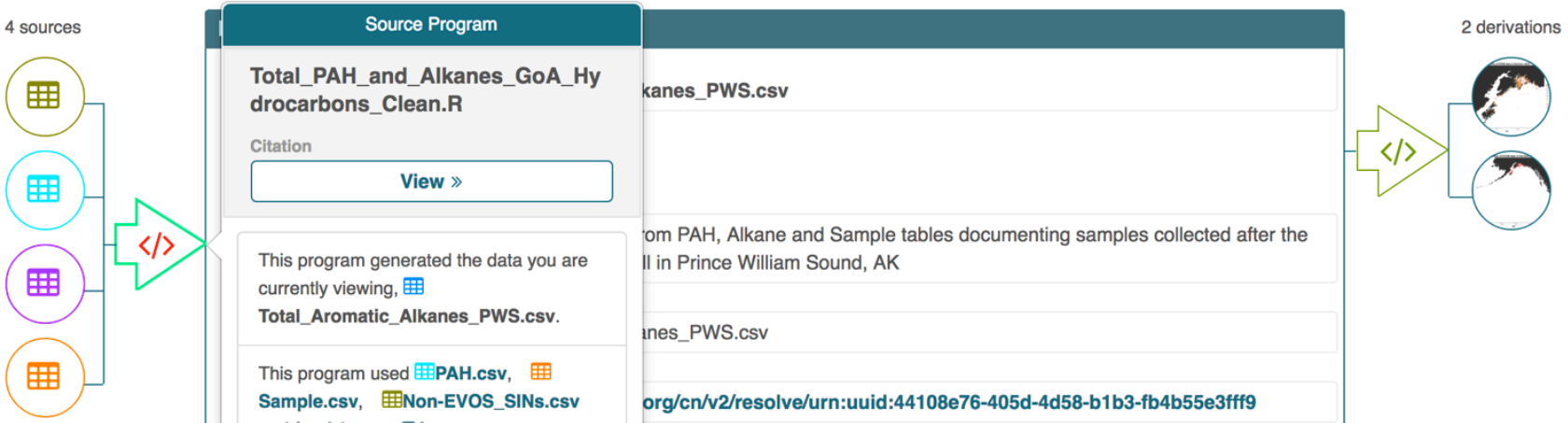
Attribute Orientation	column
Simple Text	
Field Delimeter	,

Number Of Records	12142

Data Table, Image, and Other Data Details



Text Format	Number of Header Lines	1
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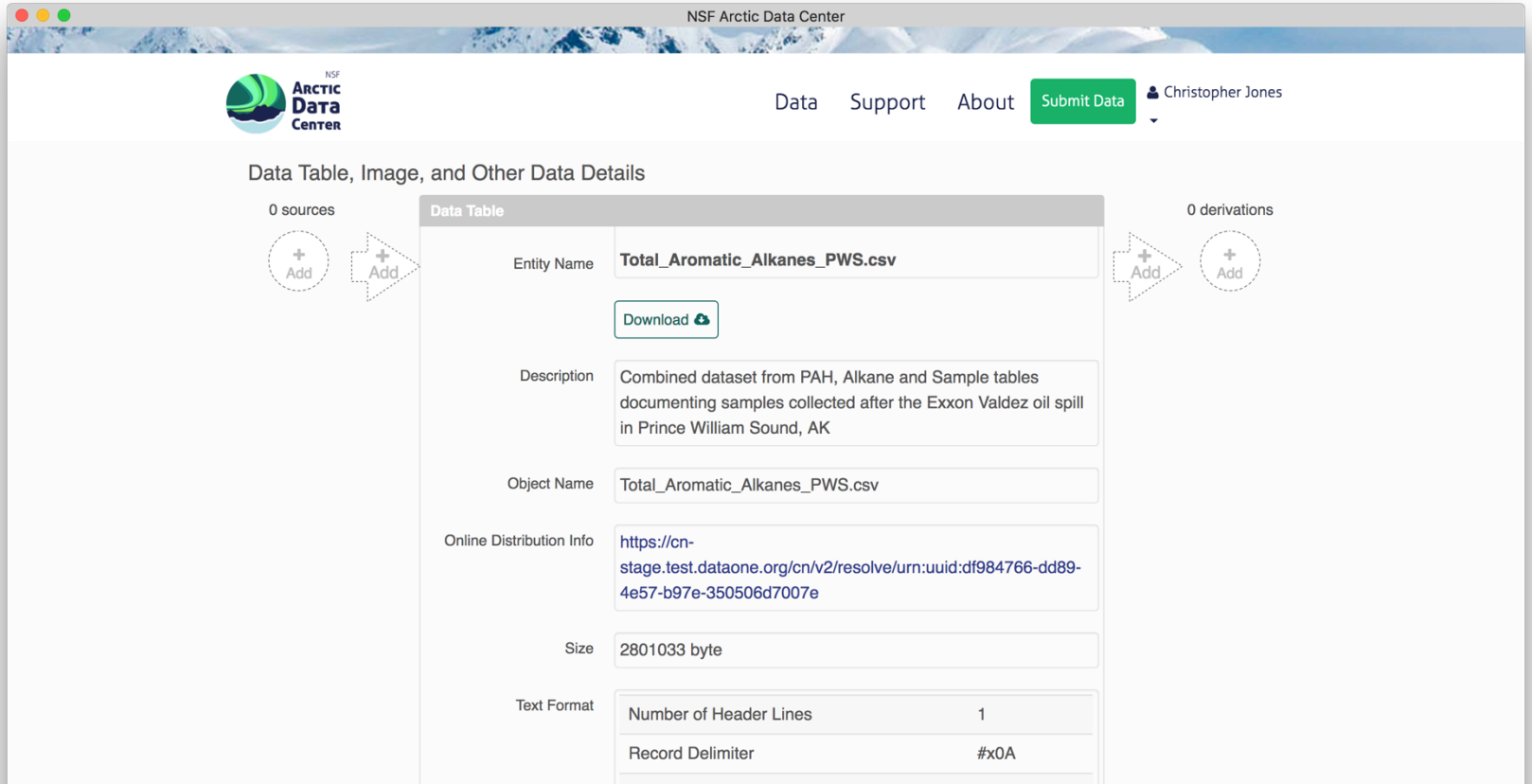
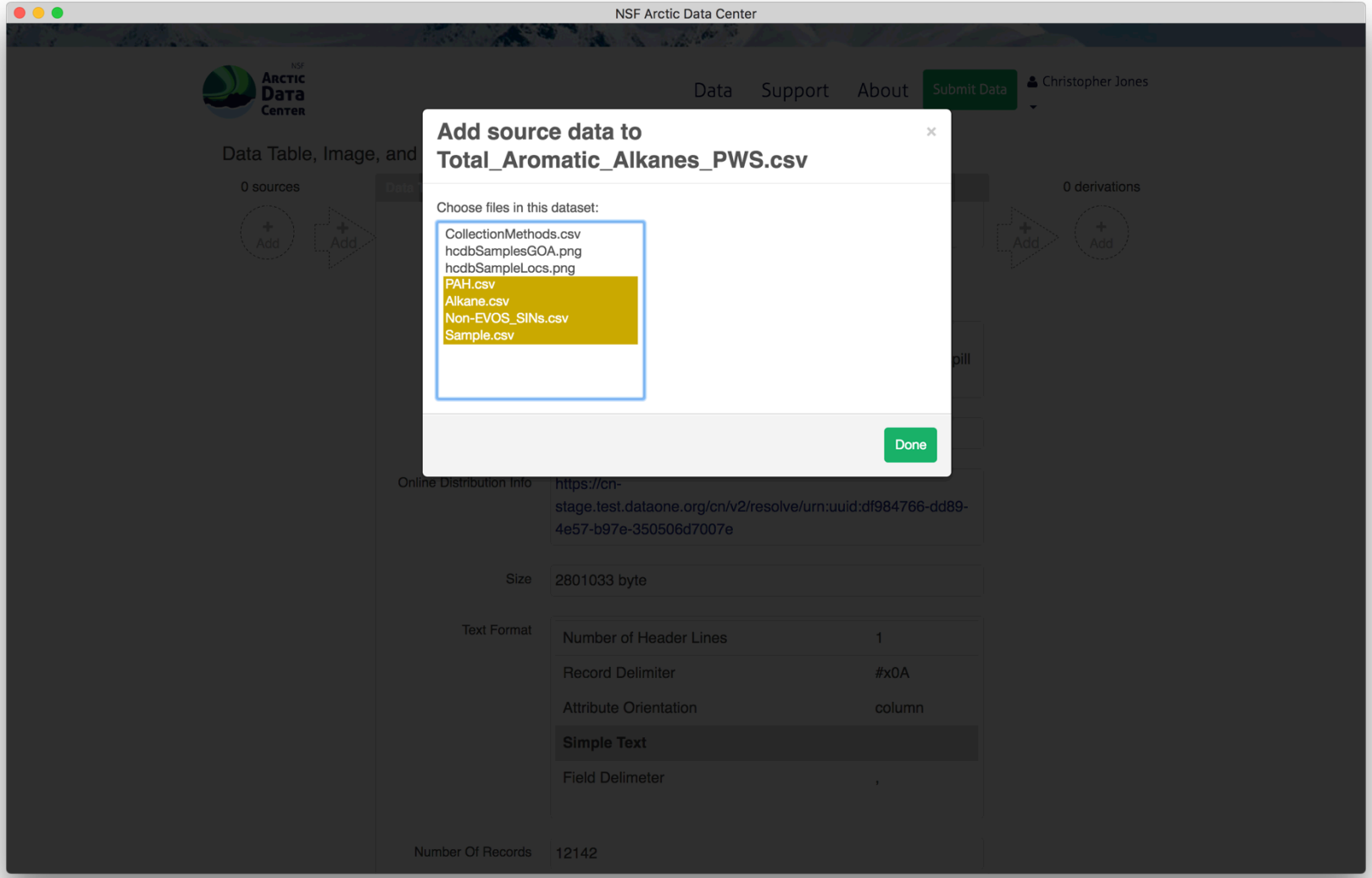
	Attribute Orientation	column
	Simple Text	
	Field Delimeter	,
Number Of Records	12142	

Web Provenance Editor

Deployed by Arctic Data Center




NSF Arctic Data Center
Arctic Data Center
Data
Support
About
Submit Data
Christopher Jones
Data Table, Image, and
0 sources
Add
Add
0 derivations
Add
Add
Add source data to Total_Aromatic_Alkanes_PWS.csv
Choose files in this dataset:
CollectionMethods.csv
hcdbSamplesGOA.png
hcdbSampleLocs.png
PAH.csv
Alkane.csv
Non-EVOS_SINs.csv
Sample.csv
Done
Online Distribution Info
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Number Of Records
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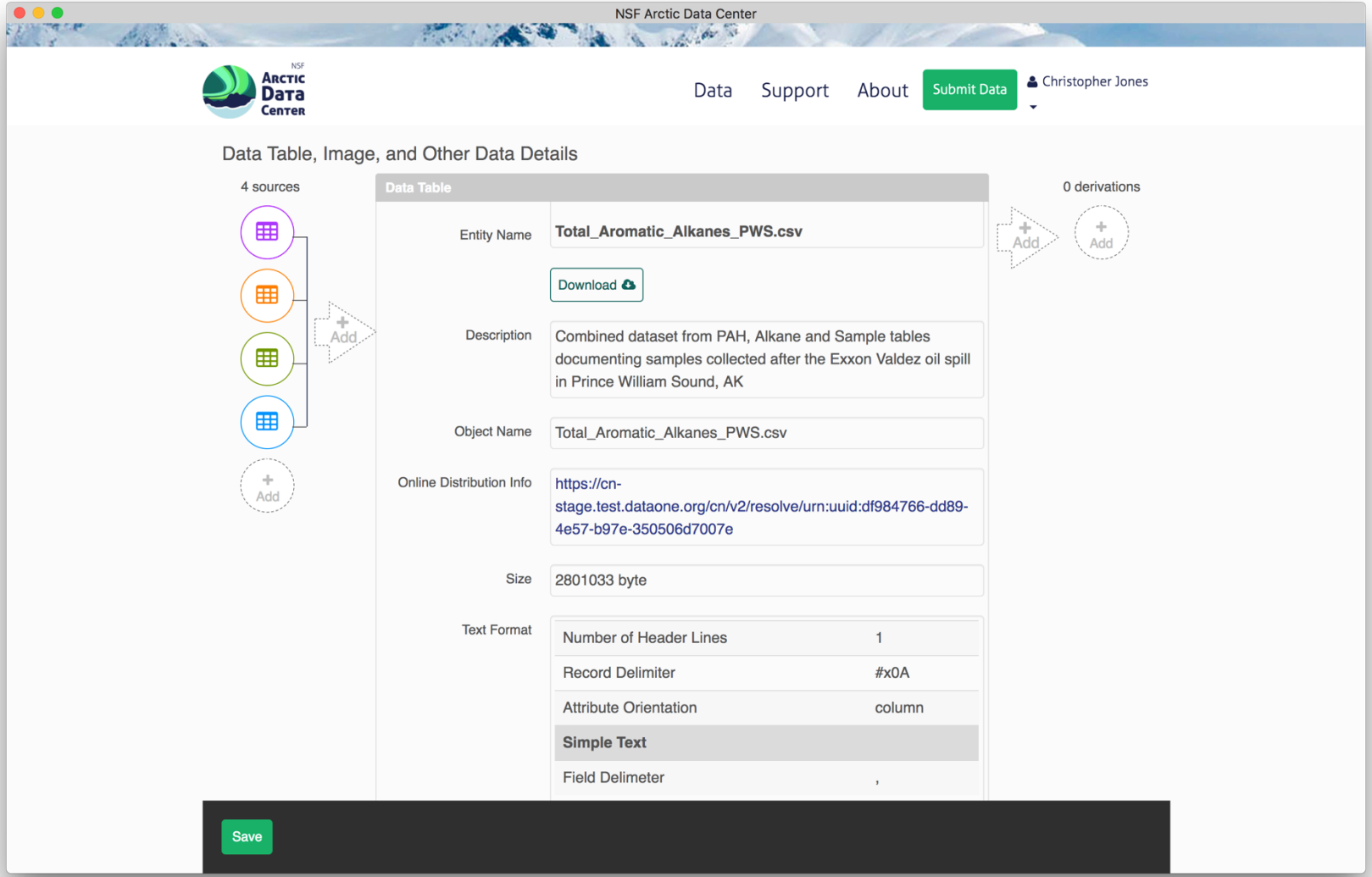
NSF Arctic Data Center
NSF Arctic Data Center
Data
Support
About
Submit Data
Christopher Jones
Data Table, Image, and Other Data Details
4 sources
Add
Add
Data Table
Entity Name
Total_Aromatic_Alkanes_PWS.csv
Download
Description
Combined dataset from PAH, Alkane and Sample tables documenting samples collected after the Exxon Valdez oil spill in Prince William Sound, AK
Object Name
Total_Aromatic_Alkanes_PWS.csv
Online Distribution Info
https://cn-stage.test.dataone.org/cn/v2/resolve/urn:uuid:df984766-dd89-4e57-b97e-350506d7007e
Size
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Text Format
Number of Header Lines 1
Record Delimiter #x0A
Attribute Orientation column
Simple Text
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Add
Add
Save

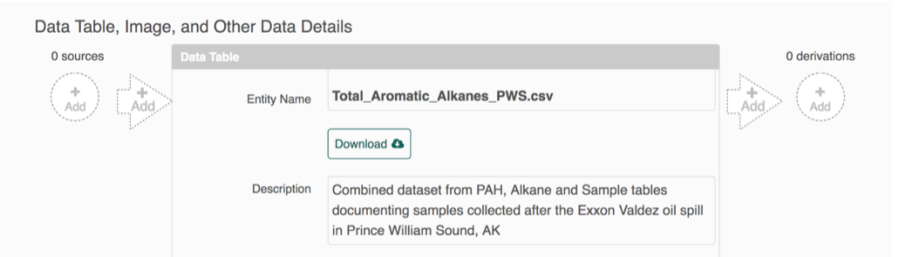
Provenance Editing

Matlab DataONE Toolbox

Recordr R Library

YesWorkflow Tool

MetacatUI
Web Provenance Editor



Reproducible Science

Provenance

Citation

Synthesis

Credit where credit is due

Indexing and exposing data citations in international data repository networks

Alfred P. Sloan Foundation

University of California CDL California Digital Library

DataCite FIND, ACCESS, AND R

DataONE

Force11 Data Citation Principles

1. Importance of data citation
2. **Credit and Attribution**
3. **Evidence**
4. Unique Identification
5. Access
6. **Persistence**
7. **Specificity** and Verifiability
8. Interoperability and Flexibility

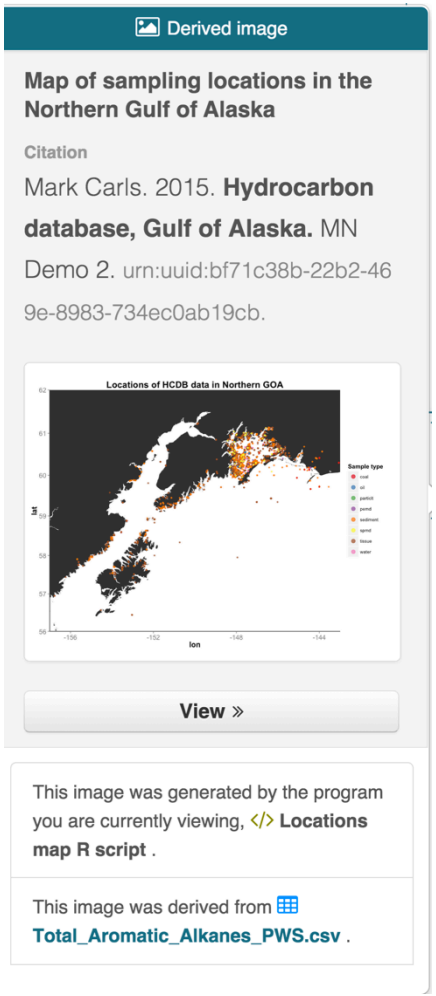
Joint Declaration of Data Citation Principles, https://doi.org/10.25490/a97f-egyk

Transitive Credit

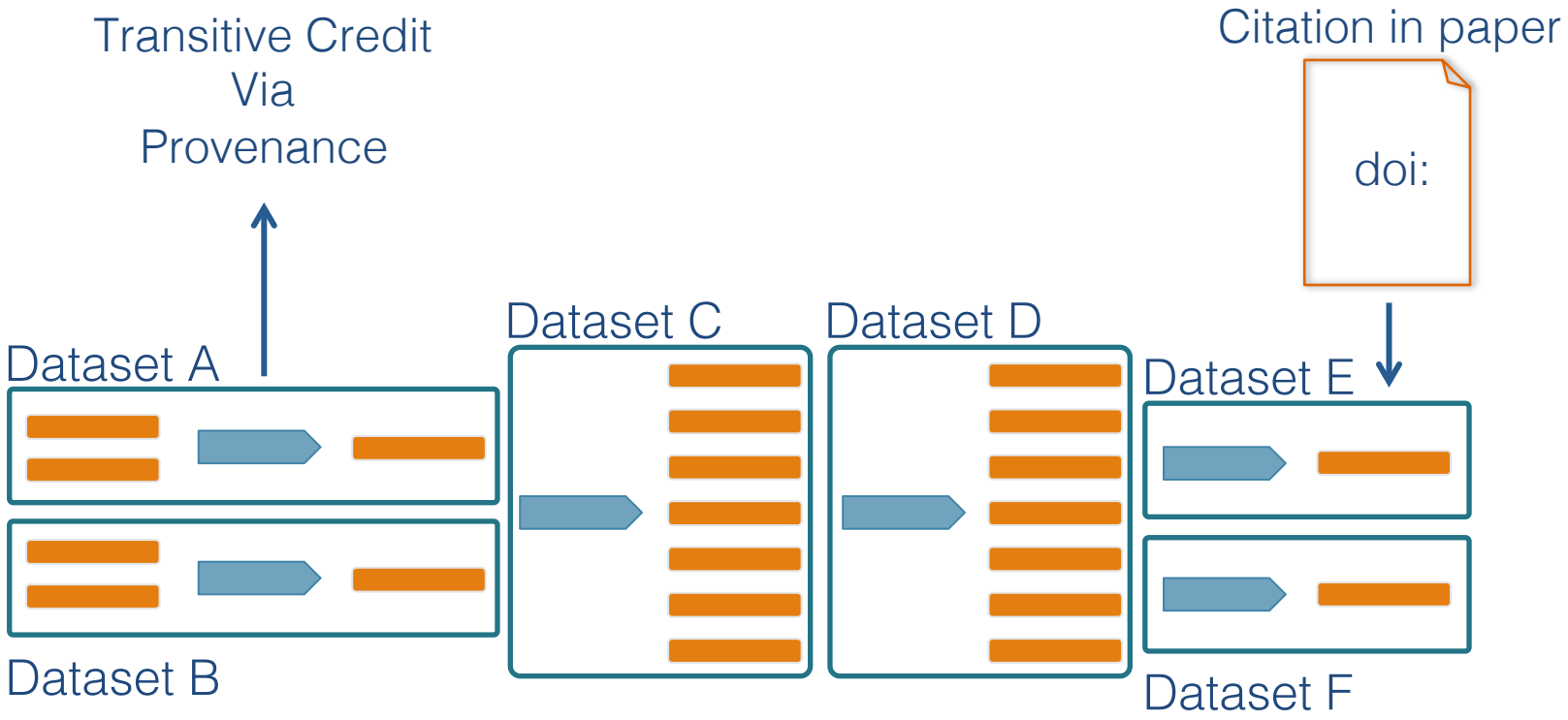
When a user cites a pub, we know:

- **Which data** produced it
- **What software** produced it
- What was **derived** from it
- **Who to credit** down the attribution stack

See: Katz & Smith. 2014. **Implementing Transitive Credit with JSON-LD**. arXiv:1407.51



Citing multi-generational workflows



Evolution of the Living Paper

Scholarly Publications

1st Gen	**Prose**		
2nd Gen	**Prose**	**+ Data**	
3rd Gen	**Prose**	**+ Data**	**+ Code**

DataONE

Prose + Data + Code + **Provenance**

WHOLETALE

Prose + Data + Code + **Provenance + Execution Environment**

Reproducible Science

Provenance

Citation

Synthesis

State of Alaska's Salmon and People

NCEAS
National Center for Ecological Analysis and Synthesis

8 SASAP working groups

1: **Bio-physical State of Knowledge of Salmon Distribution & Habitat**
Leads: Peter Westley and Dan Rinella

2: **Sociocultural and Economic Dimensions of Salmon Systems**
Leads: Courtney Carothers, Jessica Black, Tobias Schworer

3: **Governance and Subsistence**
Leads: Steve Langdon, Taylor Brelsford, James Fall

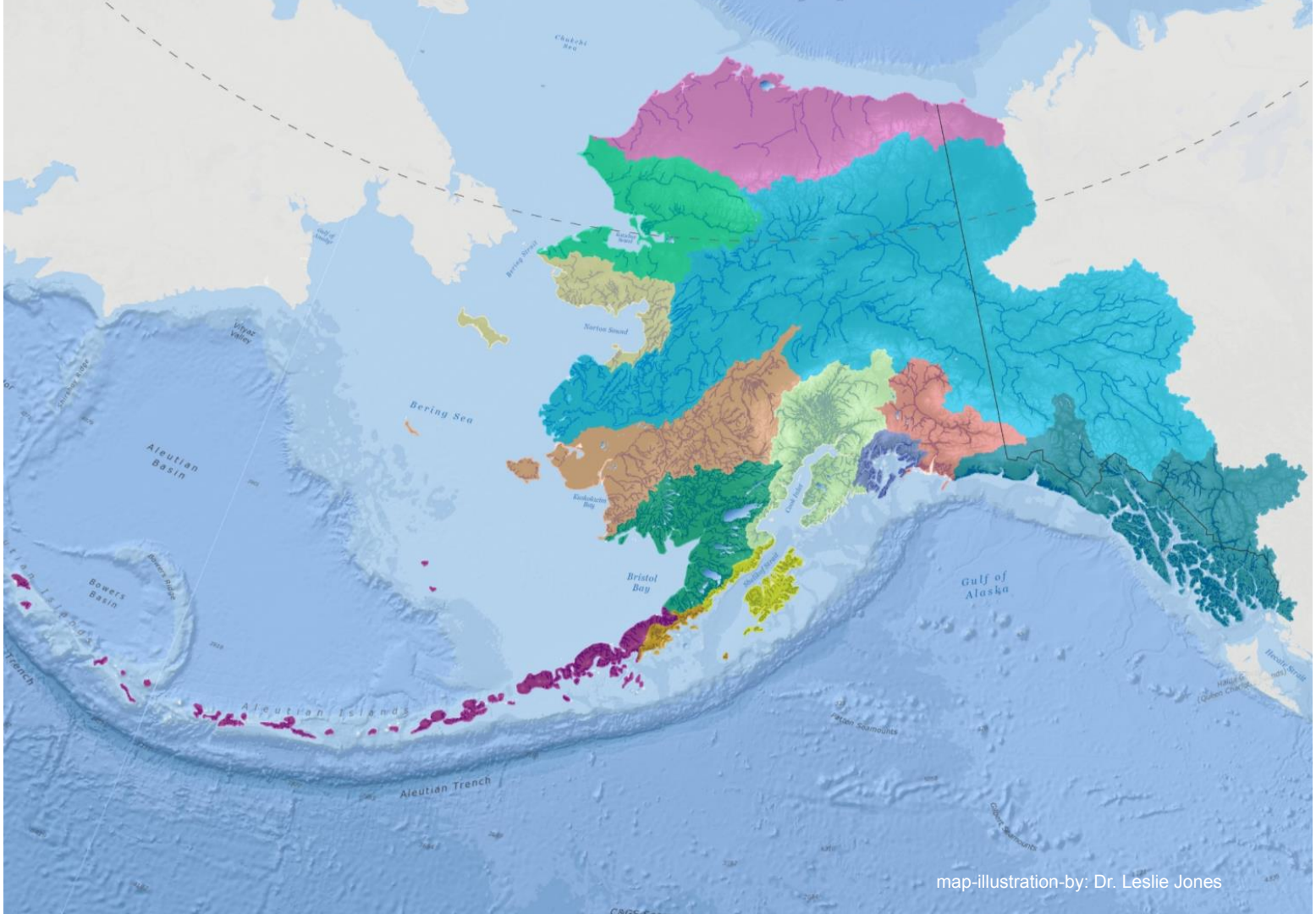
4: **Consistency, Causes, and Consequences of Declining Size and Age of Alaskan Salmon**
Leads: Eric P. Palkovacs, Peter Westley, Bert Lewis

5: **Well-Being and Alaska Salmon Systems**
Leads: Rachel Donkersloot, Jessica C. Black, Courtney Carothers

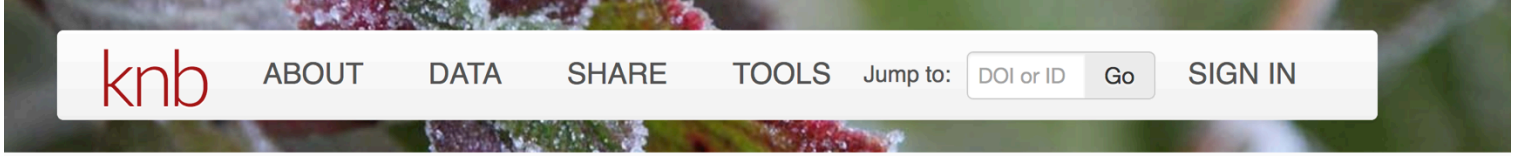
6: **Interacting Effects of Ocean Climate and At-Sea Competition on Alaskan Salmon**
Leads: Peter S. Rand, Robert W. Campbell, Kristen B. Gorman

7: **Using Participatory Modeling to Empower Community Engagement in Salmon Science**
Leads: Michael L. Jones

8: **Kenai Lowlands Salmon Research Synthesis and Design Tools for Integrated Watershed Management**
Leads: Coowe Walker, Mark Rains, Ryan King, Charles Simenstad, Dennis Whigham



map-illustration-by: Dr. Leslie Jones



h | Home / Search / Metadata

Jeanette Clark and Rich Brenner. 2017. Sockeye salmon brood tables, northeastern Pacific, 1922-2016. Knowledge Network for Biocomplexity. urn:uuid:c11dff42-b988-437a-afee-58fc62dcd1dc.

Copy Citation | Quality report

Files in this dataset Package: resource_map_urn:uuid:c11dff42-b988-437a-afee-58fc62dcd1dc

Name		File type	Size	Downloads	Download All
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broodTableProcessing.Rmd	More info	application/R	19 KB	3 downloads	Download
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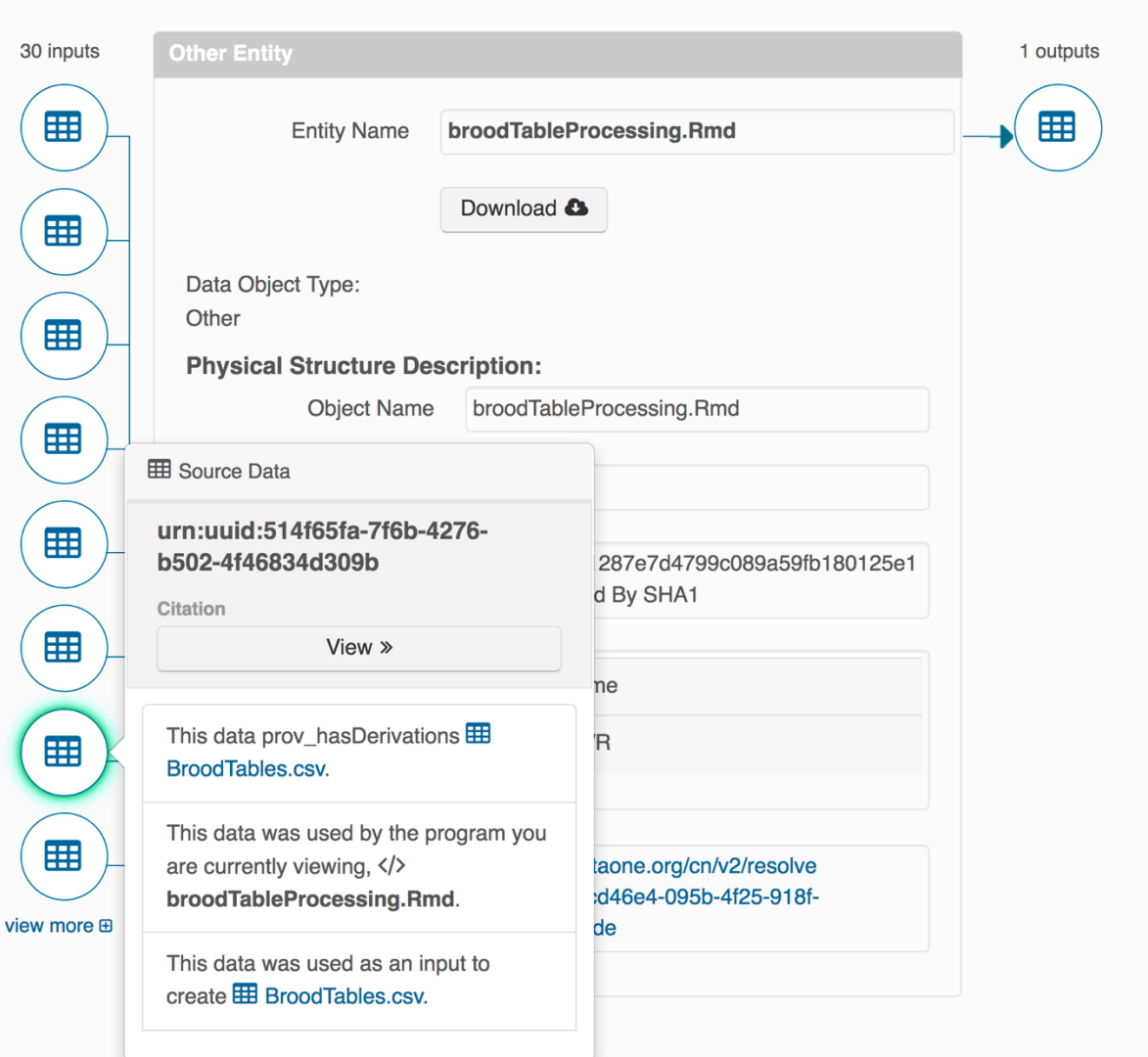
30 inputs
Other Entity
1 outputs
Entity Name
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Physical Structure Description:
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broodTableProcessing.Rmd
Source Data
urn:uuid:514f65fa-7f6b-4276-b502-4f46834d309b
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This data prov_hasDerivations BroodTables.csv.
This data was used by the program you are currently viewing, </> broodTableProcessing.Rmd.
This data was used as an input to create BroodTables.csv.
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Rmarkdown as Provenance

01-brood-table-integration.Rmd

Knit | Insert | Run

```
## Datasets

As part of the SASAP project, brood tables for 48 Sockeye salmon stocks were collected.
Table 2.1 shows a list of these stocks, along with other regional and location
information.

```{r, echo = FALSE}
stocks <- read.csv('data/original/StockInfo.csv', stringsAsFactors = F)
```

```{r, echo = FALSE}
datatable(stocks[, c('Stock.ID','Stock' ,'Region', 'Sub.Region')], rownames = FALSE,
caption = "Stock information")
```

These stocks range geographically from Washington to Alaska. Although temporal coverage
varies by stock, many of the brood tables were updated in 2016, and some have
reconstructions dating back to 1922.

Figure 2.1 indicates the approximate location of the salmon stocks in Table 2.1.

```{r, echo = FALSE}
salmon = makeIcon('images/salmon_tiny.png',
                  'images/salmon_big.png',
                  26, 14)

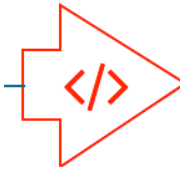
m <- leaflet(stocks)  %>%
  setView(~median(stocks$Lon), median(stocks$Lat), zoom = 4) %>%
  addTiles() %>%
  addMarkers(~~Lon, ~Lat, icon = salmon)

m

```

Figure 2.1: Location of stocks used in this data integration. Salmonid icon by Servien
(vectorized by T. Michael Keesey)
[CC-BY-SA](https://creativecommons.org/licenses/by-sa/3.0/), available at
[Phylopic](http://phylopic.org/)
```

37:72 | Chunk 2 | R Markdown



2.2 Datasets

As part of the SASAP project, brood tables for 48 Sockeye salmon stocks were collected. Table 2.1 shows a list of these stocks, along with other regional and location information.

Show 10 entries Search:

Stock information

Stock.ID	Stock	Region	Sub.Region
101	Washington	WA	WA
102	E.Stuart	Fraser River	Fraser Early Stuart
103	Bowron	Fraser River	Fraser Early Summer
104	Fennell	Fraser River	Fraser Early Summer
105	Gates	Fraser River	Fraser Early Summer
106	Nadina	Fraser River	Fraser Early Summer
107	Pitt	Fraser River	Fraser Early Summer
108	Raft	Fraser River	Fraser Early Summer
109	Scotch	Fraser River	Fraser Early Summer
110	Seymour	Fraser River	Fraser Early Summer

Showing 1 to 10 of 54 entries Previous 1 2 3 4 5 6 Next

These stocks range geographically from Washington to Alaska. Although temporal coverage varies by stock, many of the brood tables were updated in 2016, and some have reconstructions dating back to 1922.

Figure 2.1 indicates the approximate location of the salmon stocks in Table 2.1.

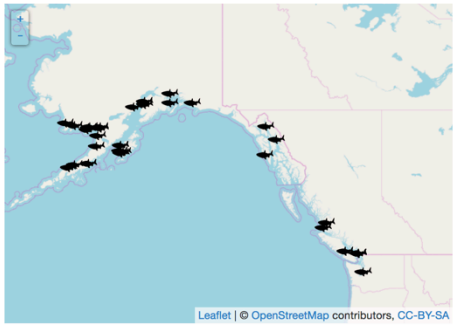
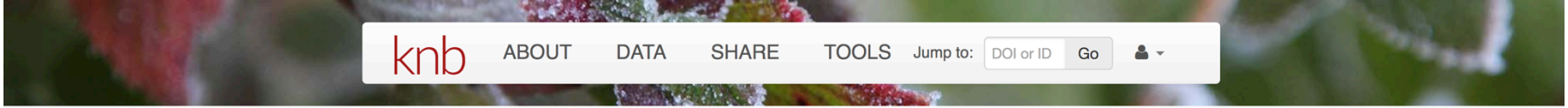


Figure 2.1: Location of stocks used in this data integration. Salmonid icon by Servien (vectorized by T.



SASAP

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2 contributions

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First 1 2 3 4 5 6 Last

DATASETS 1 TO 5 OF 60

1 2 3 ... 12 Next

Sort by Most recent

knb Alaska Department of Fish and Game, Division of Commercial Fisheries, Central Region. 2018. **Chinook age, sex, and length data from East Side Cook Inlet, Alaska, 1970-2012.** Knowledge Network for Biocomplexity. urn:uuid:16763faf-9ad6-4a95-bcfc-97d60957e499.

6

knb Jeanette Clark and Rich Brenner. 2017. **Sockeye salmon brood tables, northeastern Pacific, 1922-2016.** Knowledge Network for Biocomplexity. urn:uuid:c11dff42-b988-437a-afee-58fc62dcd1dc.

6

knb Alaska Department of Fish and Game. 2018. **Salmon age, sex, and length data from Lower Cook Inlet, Alaska, 1961-2014.** Knowledge Network for Biocomplexity. urn:uuid:99e94ab7-b822-458e-88b3-df0ed1964378.

7

knb Jared Kibele and Leslie Jones. 2018. **Glaciers in Alaska with subsetting by watershed and SASAP region.** Knowledge Network for Biocomplexity. urn:uuid:874e1ba2-48d2-4d31-b3fb-682aaf7e984b.

7

knb Jeanette Clark, Rich Brenner, and Bert Lewis. 2018. **Compiled age, sex, and length data for Alaskan salmon.** Knowledge Network for Biocomplexity. urn:uuid:63a9c8df-3543-44fe-a5d0-746469318f18.

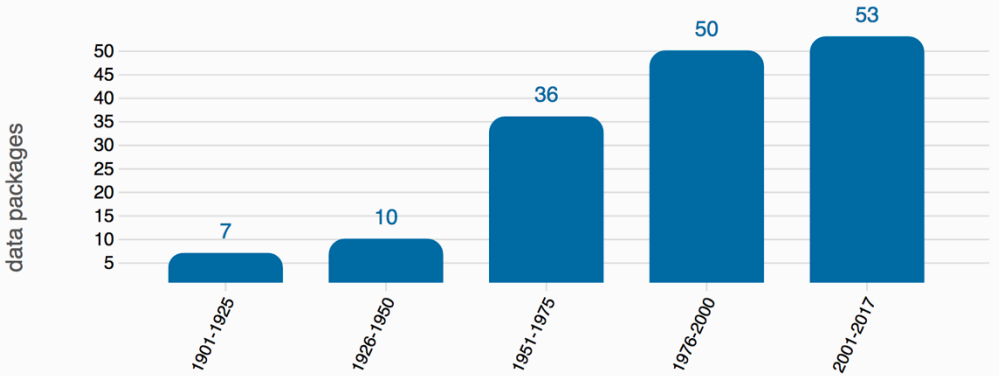
10

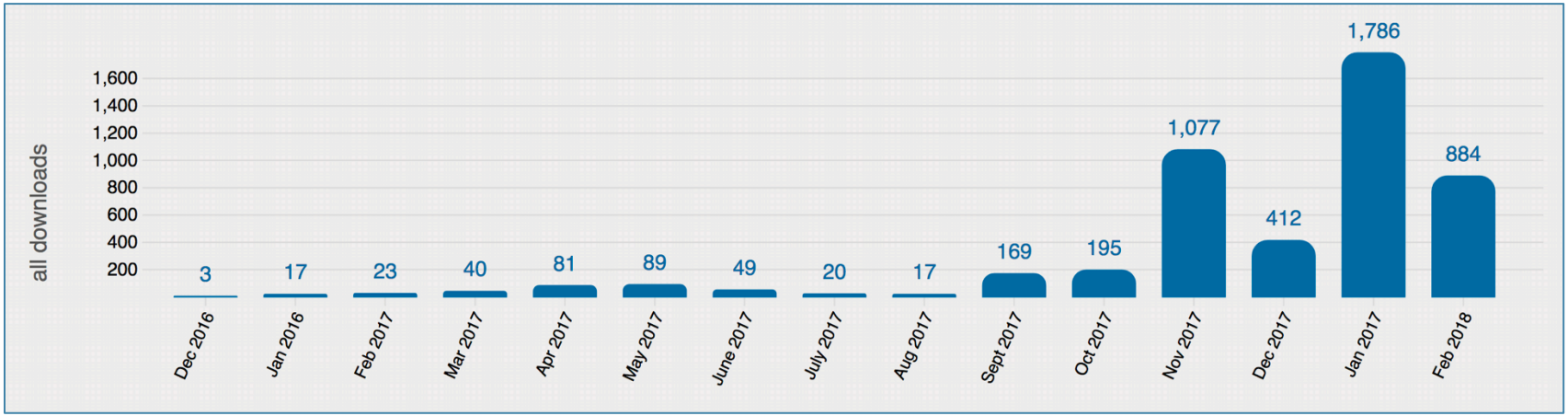
knb ABOUT DATA SHARE TOOLS Jump to: DOI or ID Go

Time period of data

1901 - 2017

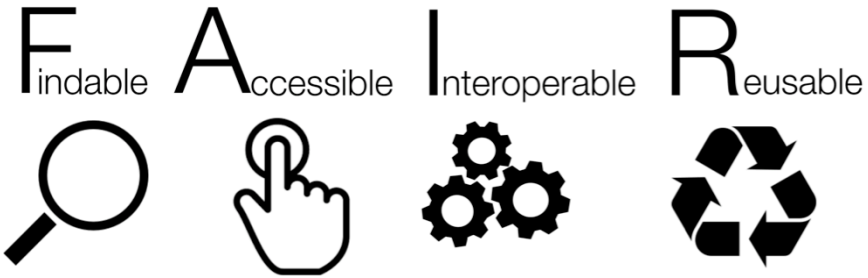
The years in which data was collected, regardless of upload date. Only the most recent version of the data package is counted.





Foundational Infrastructure

Providing ***findable***, ***accessible*** data with ***interoperable*** infrastructure enabling long term data ***reuse*** for synthesis



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