



NOAA Technical Memorandum NMFS-XXX-##

# GAP Production Data Documentation

Bering Sea Survey Team, Gulf of Alaska Survey Team, Aleutian Islands Survey Team

U.S. DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration  
National Marine Fisheries Service  
Northwest Fisheries Science Center



**NOAA  
FISHERIES**

# GAP Production Data Documentation

Bering Sea Survey Team<sup>1,\*</sup>, Gulf of Alaska Survey Team<sup>1,\*</sup> and Aleutian Islands Survey Team<sup>1,\*</sup>

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**Part I.**

# **Welcome**

## *AFSC Bottom Trawl Surveys*

Report run date: Tuesday, October 08, 2024

## **AFSC Bottom Trawl Surveys**

AFSC bottom trawl surveys are conducted by the AFSC's Groundfish Assessment Program and Shellfish Assessment Program and are conducted in the Gulf of Alaska, Aleutian Islands, Eastern Bering Sea Slope, Eastern Bering Sea Shelf, and Northern Bering Sea. Each survey is a multispecies survey that collects data on the distribution, abundance, and biological characteristics of fish, crab, and other resources to inform groundfish stock assessment and management. These fishery-independent surveys are conducted in the summer aboard contracted commercial fishing vessels. Specifics regarding each of the surveys can be found below.

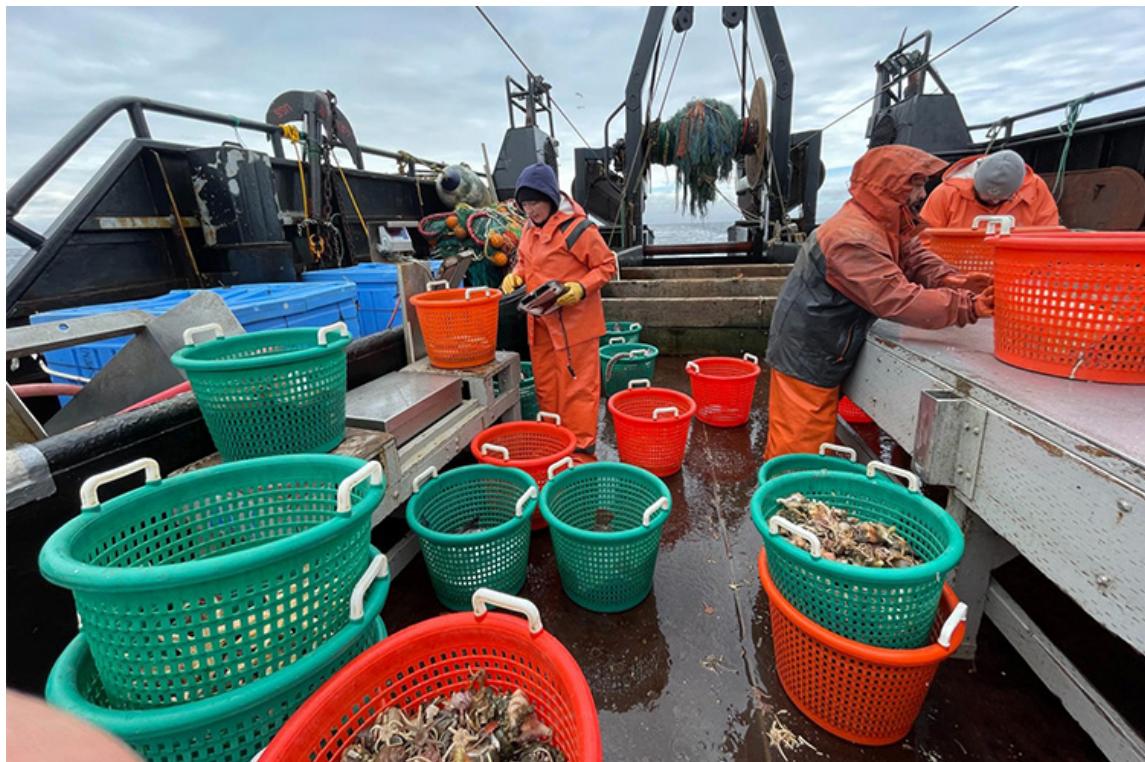


Figure 1.: Sorting and weighing fish on deck on the 2022 Bering Sea groundfish survey aboard the F/V Alaska Knight. Credit: Emily Markowitz/NOAA Fisheries.

## *Documentation Objective*

### **Documentation Objective**

As part of our commitment to open science, reproducibility, and transparency, we provide this metadata guide to compliment our public-domain data.

Please consider this resource to be a **Living Document**. The code in this repository is regularly being updated and improved. Please refer to releases for finalized products and project milestones.

At this time, these master production and AKFIN tables are **provisional and we are welcoming feedback before the 2024 survey season**. We look forward to hearing from you. Do not hesitate to reach out (to us at either nmfs.afsc.gap.metadata@noaa.gov or GitHub issues, especially if you find discrepancies in the data or want to suggest improvements to infrastructure. Thank you in advance for your collaboration and partnership with us as we develop our future data universe.

### **User Resources**

- Groundfish Assessment Program Bottom Trawl Surveys
- AFSC's Resource Assessment and Conservation Engineering Division
- All AFSC Research Surveys
- Survey code books
- Publications and Data Reports
- Research Surveys conducted at AFSC

### **Cite this data**

Use the below bibtext citations, as cited in our group's citation repository for citing the data created and maintained in this repo. Add "note = {Accessed: mm/dd/yyyy}" to append the day this data was accessed. Included here are AFSC RACE Groundfish and Shellfish Assessment Program's:

- Design-Based Production Data (internal) (NOAA Fisheries Alaska Fisheries Science Center, Goundfish Assessment Program, 2024).

### *Access Constraints*

- AFSC RACE Groundfish Data for AKFIN (Alaska Fisheries Information Network (AKFIN), 2024).
- Public Data hosted on the Fisheries One Stop Shop (FOSS) Data Platform (NOAA Fisheries Alaska Fisheries Science Center, 2024).

```
@misc{GAPPproducts,
  author = {{NOAA Fisheries Alaska Fisheries Science Center, Goundfish Assessment Program}},
  year = {2023},
  title = {AFSC Goundfish Assessment Program Design-Based Production Data},
  howpublished = {https://www.fisheries.noaa.gov/alaska/science-data/groundfish-assessment-},
  publisher = {{U.S. Dep. Commer.}},
  copyright = {Public Domain}
}

@misc{FOSSAFSCData,
  author = {{NOAA Fisheries Alaska Fisheries Science Center}},
  year = {2023},
  title = {Fisheries One Stop Shop Public Data: RACE Division Bottom Trawl Survey Data Quer},
  howpublished = {https://www.fisheries.noaa.gov/foss},
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@misc{GAPakfin,
  author = {{Alaska Fisheries Information Network (AKFIN)}},
  institution = {{NOAA Fisheries Alaska Fisheries Science Center, Goundfish Assessment Prog}},
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  howpublished = {https://www.psmfc.org/program/alaska-fisheries-information-network-akfin},
  publisher = {{U.S. Dep. Commer.}},
  copyright = {Public Domain}
}
```

### **Access Constraints**

There are no legal restrictions on access to the data. They reside in public domain and can be freely distributed.

### *Suggestions and comments*

**User Constraints:** Users must read and fully comprehend the metadata and code of conduct prior to use. Data should not be used beyond the limits of the source scale. Acknowledgement of AFSC Groundfish Assessment Program, as the source from which these data were obtained, in any publications and/or other representations of these data, is suggested.

## **Suggestions and comments**

If the data or metadata can be improved, please create a pull request, submit an issue to the GitHub organization or submit an issue to the code's repository.

## **NOAA README**

This repository is a scientific product and is not official communication of the National Oceanic and Atmospheric Administration, or the United States Department of Commerce. All NOAA GitHub project code is provided on an 'as is' basis and the user assumes responsibility for its use. Any claims against the Department of Commerce or Department of Commerce bureaus stemming from the use of this GitHub project will be governed by all applicable Federal law. Any reference to specific commercial products, processes, or services by service mark, trademark, manufacturer, or otherwise, does not constitute or imply their endorsement, recommendation or favoring by the Department of Commerce. The Department of Commerce seal and logo, or the seal and logo of a DOC bureau, shall not be used in any manner to imply endorsement of any commercial product or activity by DOC or the United States Government.

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# **1. Survey Background**

## **1.1. What we do**

## **1.2. Who is conducting the research?**

Scientists from the Alaska Fisheries Science Center's Groundfish Assessment Program (GAP) conduct these bottom trawl surveys with participation from the Alaska Department of Fish & Game (ADF&G), the International Pacific Halibut Commission (IPHC), universities, and other organizations. This research is conducted primarily on chartered fishing vessels.

## **1.3. What is the research objective?**

Learn more about the program. The objectives of these surveys are to:

- monitor the population and environmental trends in the marine ecosystem of the Bering Sea, Aleutian Islands, and Gulf of Alaska,
- produce fishery-independent biomass (weight) and abundance (number) estimates for commercially important fish and crab species, and
- collect other biological and environmental data for use in ecosystem-based fishery management.

## **1.4. Who is conducting the research?**

Scientists from the Alaska Fisheries Science Center conduct these bottom trawl surveys with participation from the Alaska Department of Fish & Game (ADF&G), the International Pacific Halibut Commission (IPHC), and universities. This research is conducted on chartered fishing vessels.

## 1. Survey Background

### 1.5. Bottom trawl surveys and regions

#### Bottom Trawl Survey Regions

AFSC RACE Groundfish and Shellfish Public Data Coverage

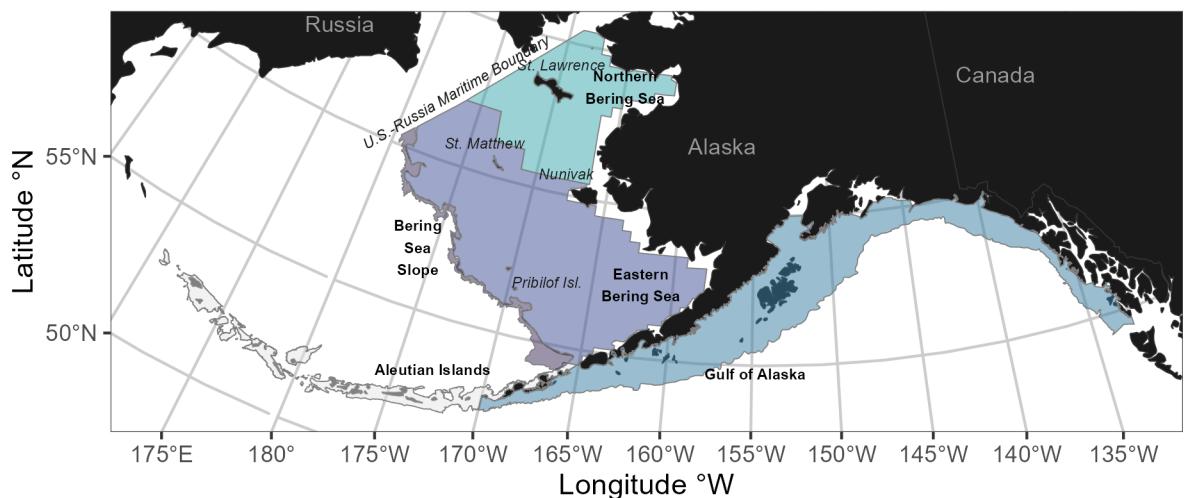


Figure 1.1.: Strata used in the all surveys.

Each survey conducted by the Groundfish Assessment Program are multispecies bottom trawl surveys. We collect environmental and biological data to assess how climate variability and loss of sea ice are affecting bottom-dwelling marine life on the Bering Sea shelf. We monitor trends in the distribution (location and movement patterns) and abundance of groundfish and crab species as well as oceanographic data (e.g., water temperature, depth). We collect biological information such as organism weight, length, stomachs to learn about diets, and otoliths to determine fish ages. We use this information in annual stock assessments and to assess the state of the ecosystem. This research is conducted on fishing industry contract vessels.

Table 1.1.: Survey summary stats

Survey	Survey Definition	Years ID	Depth (m)	Area (km <sup>2</sup> )	# Statistical Areas	# Possible Stations
Aleutian Islands Bottom Trawl Survey	52	2024 - 1991 (14)	1 - 500	64,415.0	80	1,312

## 1. Survey Background

<b>Survey</b>	<b>Survey Definition ID</b>	<b>Years</b>	<b>Depth (m)</b>	<b>Area (km2)</b>	<b>Statistical Areas</b>	<b>#</b>	<b># Possible Stations</b>
Eastern Bering Sea Slope Bottom Trawl Survey	78	2016 - 2002 (6)	201 - 1,200	32,861.3		37	
Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey	98	2024 - 1982 (42)	1 - 200	492,989.9		28	515
Gulf of Alaska Bottom Trawl Survey	47	2023 - 1990 (16)	1 - 1,000	313,784.9		37	6,939
Northern Bering Sea Crab/Groundfish Survey - Eastern Bering Sea Shelf Survey Extension	143	2023 - 2010 (6)	1 - 100	198,866.8		4	144

### 1.5.1. Aleutian Islands

Most recent data report: (Von Szalay et al., 2023)

- Upper Continental Slope of the Aleutian Islands from Unimak Pass to Stalemate Bank
- Triennial (1990s)/Biennial since 2000 in even years, since 1992
- Modified Index-Stratified Random of Successful Stations Survey Design
- Important commercial fish species include Atka mackerel, Pacific ocean perch, walleye pollock, Pacific cod, sablefish, and other rockfish species.

## 1. Survey Background

### AI Bottom Trawl Survey Region AFSC RACE Groundfish and Shellfish Public Data Coverage

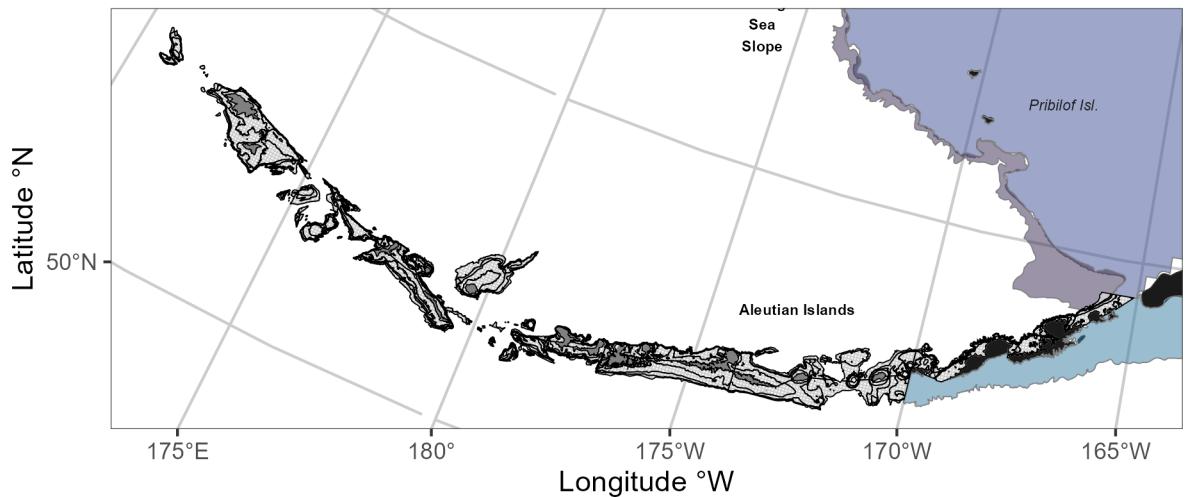


Figure 1.2.: Strata used in the Aleutian Islands bottom trawl survey.

#### 1.5.2. Gulf of Alaska

Most recent data report: (Siple et al., 2024)

- Continental Shelf and Upper Slope of the Gulf of Alaska extending from the Islands of Four Mountains 2,300 km east to Dixon Entrance
- Triennial (1990s)/Biennial since 2001 in odd years, since 1991
- Stratified Random Survey Design
- Important commercial species in the Gulf of Alaska include Pacific ocean perch, walleye pollock, Pacific cod, flatfish, and other rockfish species.

## 1. Survey Background

### GOA Bottom Trawl Survey Region

AFSC RACE Groundfish and Shellfish Public Data Coverage

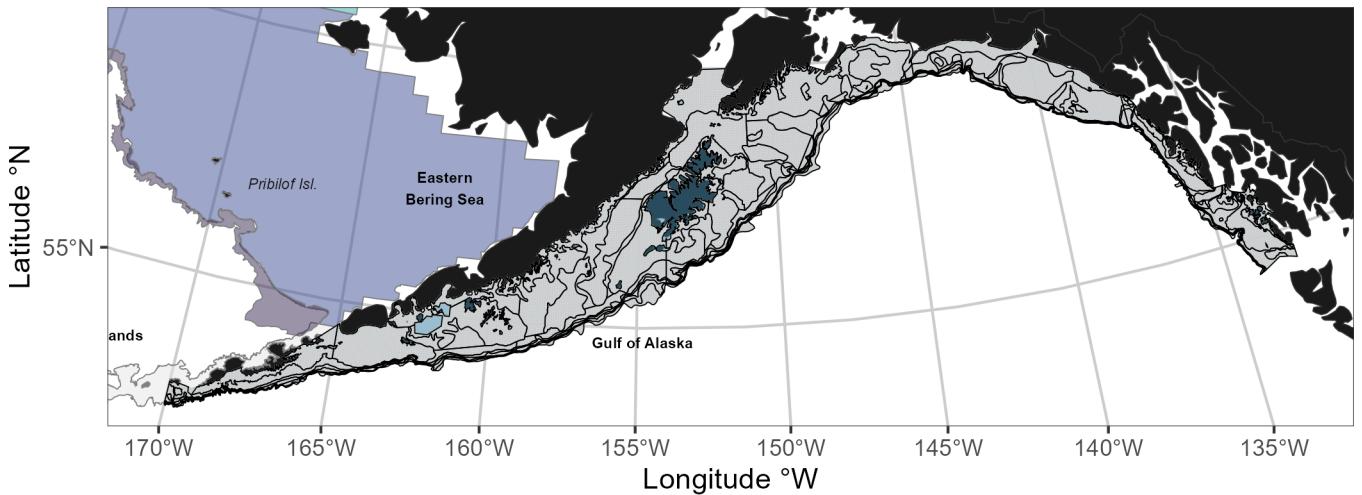


Figure 1.3.: Strata used in the Gulf of Alaska bottom trawl survey.

#### 1.5.3. Eastern Bering Sea Shelf

Most recent data report: (Markowitz et al., 2024)

- The continental shelf of the eastern Bering Sea from the Aleutian Islands to the Bering Strait
- Conducted annually since 1982.
- Uses a stratified systematic sampling survey design with fixed stations at center of 20 x 20 nm grid.
- Similar in design to the northern Bering Sea shelf bottom trawl survey.
- Focus species for the Bering Sea include walleye pollock, Pacific cod, Greenland turbot, yellowfin sole, northern rock sole, red king crab, and snow and Tanner crabs.

## 1. Survey Background

### EBS Bottom Trawl Survey Region

AFSC RACE Groundfish and Shellfish Public Data Coverage

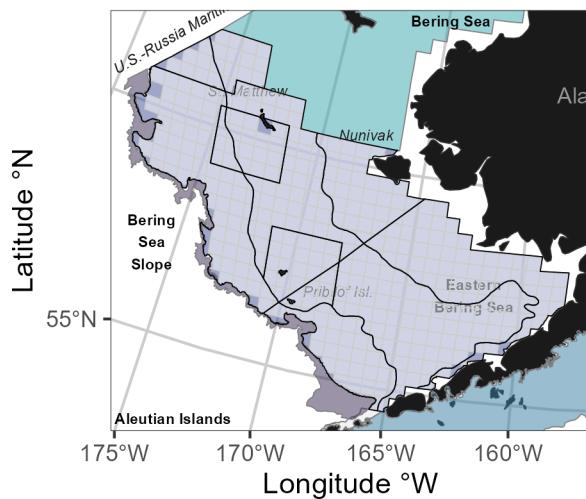


Figure 1.4.: Strata used in the Eastern Bering Sea bottom trawl survey.

#### 1.5.4. Northern Bering Sea

Most recent data report: (Markowitz et al., 2024)

- The continental shelf of the northern Bering Sea, including the area north of St. Lawrence Island and Norton Sound
- Biennial/Annual; conducted intermittently since 2010
- Uses a stratified systematic sampling survey design with fixed stations at center of 20 x 20 nm grid.
- Similar in design to the eastern Bering Sea shelf bottom trawl survey.

## 1. Survey Background

### NBS Bottom Trawl Survey Region

AFSC RACE Groundfish and Shellfish Public Data Coverage

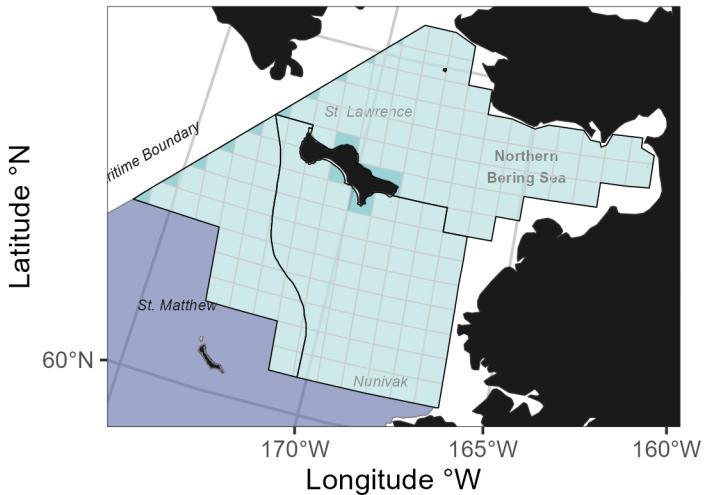


Figure 1.5.: Strata used in the Northern Bering Sea bottom trawl survey.

#### 1.5.5. Eastern Bering Sea Upper Continental Slope

Most recent data report: (Hoff, 2016)

- The eastern Bering Sea upper continental slope survey area extends from Unalaska and Akutan Islands to the U.S.-Russian Maritime Boundary at 61° N near the International Date Line (166° E to 180° W) at depths from 200 to 1,200 m
- Conducted intermittently since 2002 (funding dependent)
- Modified Index-Stratified Random of Successful Stations Survey Design
- Focus species for the Bering Sea slope include giant grenadier, Pacific ocean perch, popeye grenadier, walleye pollock, and arrowtooth flounder.

## 1. Survey Background



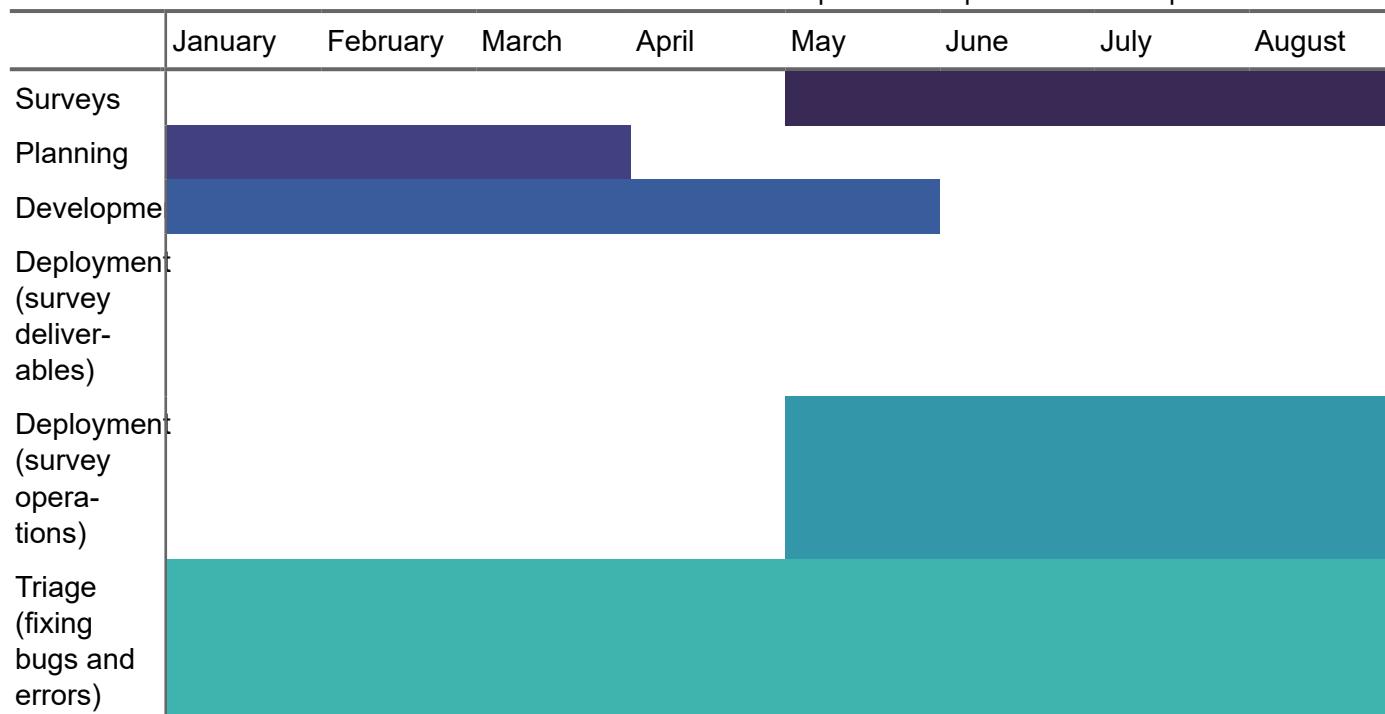
Figure 1.6.: Strata used in the Bering Sea Slope bottom trawl survey.

## 2. Workflow

### 2.1. Operational Product Development Timeline

Over the course of the year, the survey team is developing a variety of different data products. Planning and preparation for surveys happens in the late winter and spring, surveys occur in the summer, data validation takes place over the course of the survey and after the survey, and data products are produced through fall and late winter.

Table 2.1.: Operational product development timeline.



## 2. Workflow

	January	February	March	April	May	June	July	August
User feedback and brain-storming								

## 2.2. Data workflow from boat to production

Organisms first need to be collected aboard the vessel before data can be entered into tablets.

The objective of this process is to take raw data, QA/QC and clean these data, curate standard data products for these survey. Please note, through this process we are not providing "data" (what we consider lower level data material; see the data levels section below) but "data products", which is intended to facilitate the most fool-proof standard interpretation of the data. These data products only use data from standard and validated hauls, and has undergone careful review.

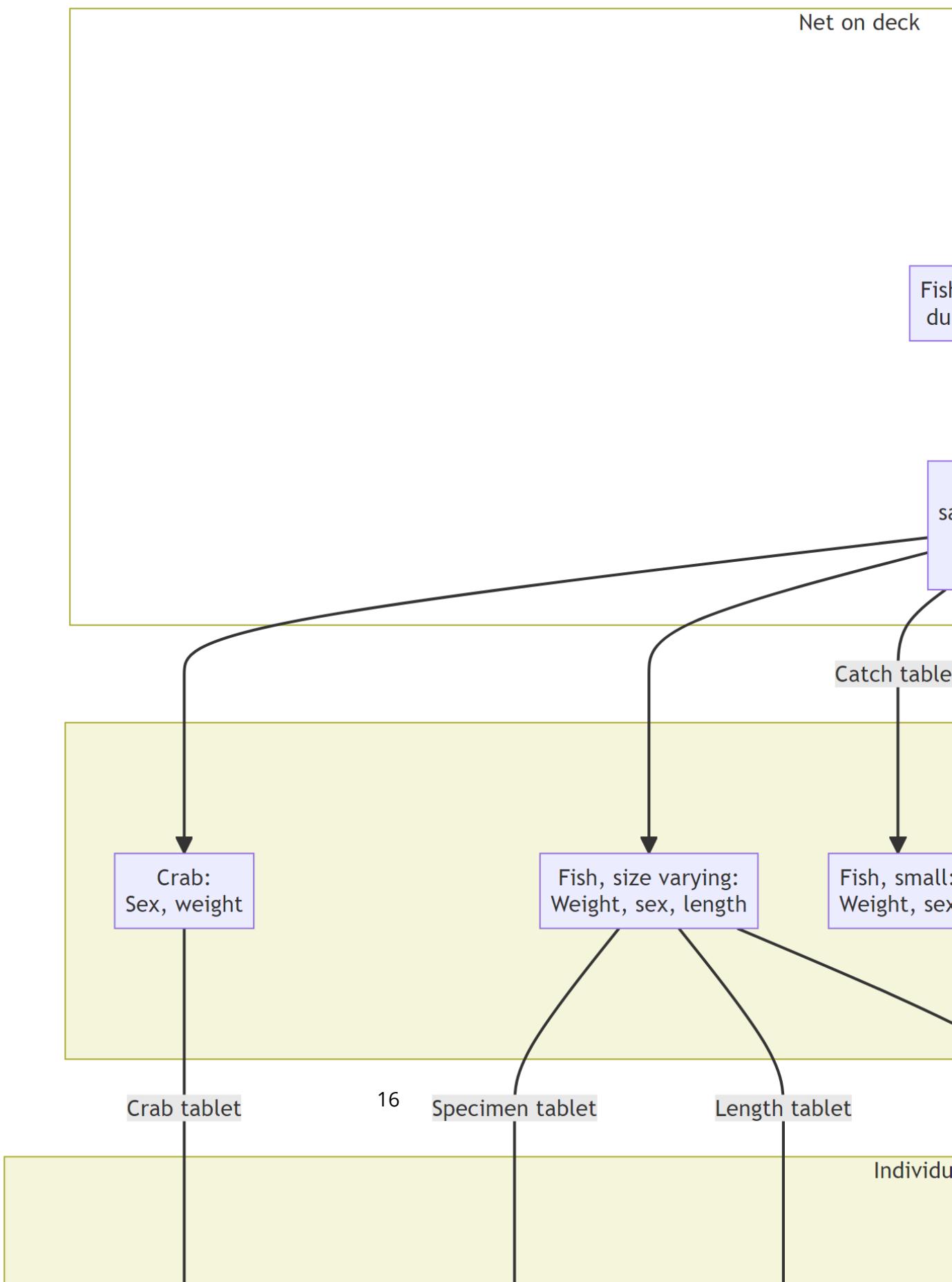
**Once survey data collected on the vessel has been checked and validated**, the gap\_products/code/run.R script is used to orchestrate a sequence of programs that calculate the standard data products resulting from the NOAA AFSC GAP bottom trawl surveys. Standard data products are the CPUE, BIOMASS, SIZECOMP, and AGECOMP tables in the GAP\_PRODUCTS Oracle schema. The tables are slated to be updated twice a year: once after the survey season following finalization of that summer's bottom trawl survey data to incorporate the new catch, size, and effort data and once prior to an upcoming survey to incorporate new age data that were processed after the prior summer's survey season ended. This second pre-survey production run will also incorporate changes in the data due to the specimen voucher process as well as other post-hoc changes in the survey data.

The data from these surveys constitute a **living data set** so we can continue to **provide the best available data to all partners, stakeholders, and fellow scientists**.

During each data product run cycle:

1. Versions of the tables in GAP\_PRODUCTS are locally imported within the gap\_products repository to compare with the updated production tables. Any

## 2. Workflow



## 2. Workflow

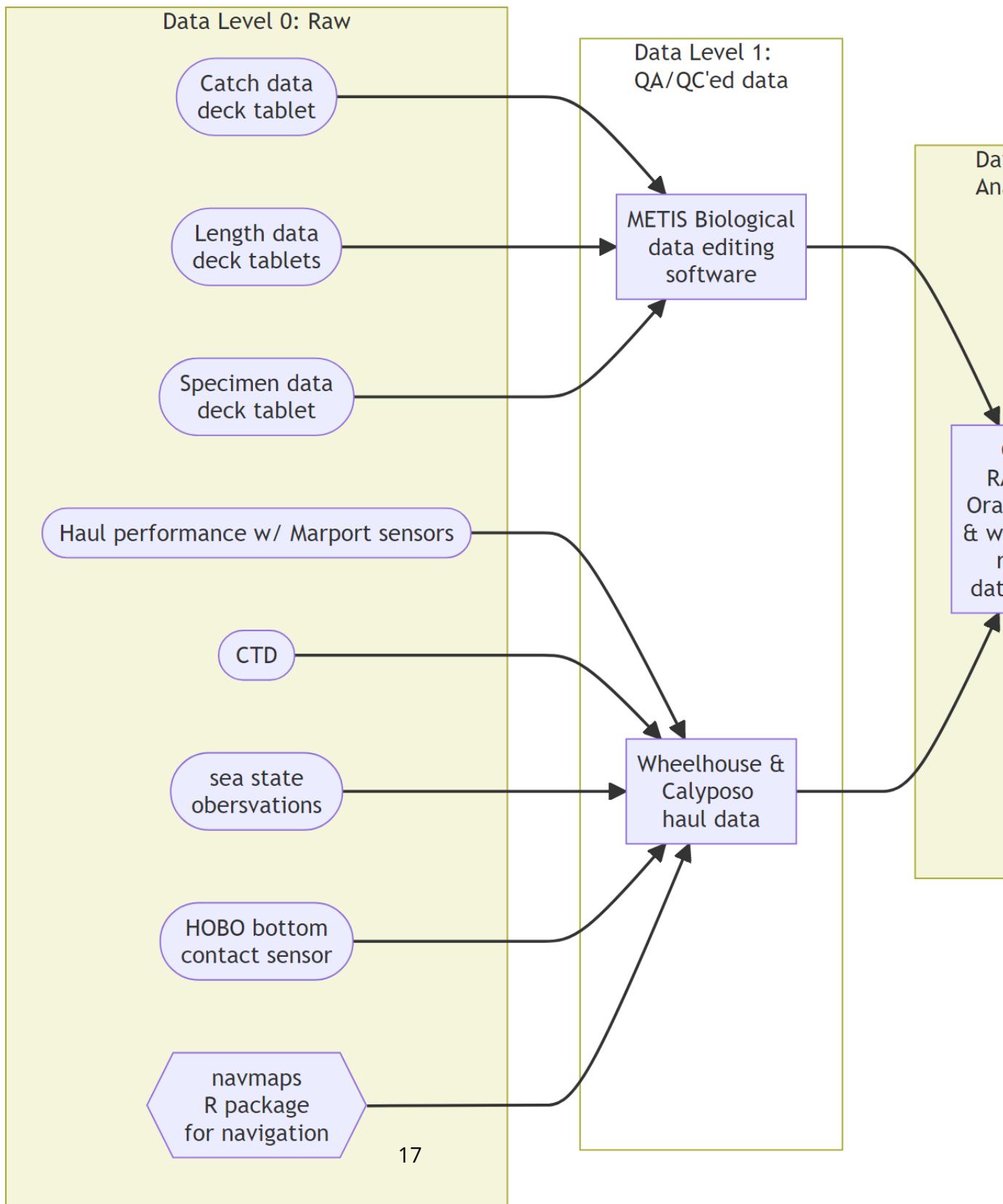


Figure 2.2.: Simplified data workflow from boat to production.

## 2. Workflow

changes to a production table will be compared and checked to make sure those changes are intentional and documented.

2. Use the gapindex R package to calculate the four major standard data products: CPUE, BIOMASS, SIZECOMP, AGECOMP. These tables are compared and checked to their respective locally saved copies and any changes to the tables are vetted and documented. These tables are then uploaded to the GAP\_PRODUCTS Oracle schema.
3. Calculate the various materialized views for AKFIN and FOSS purposes. Since these are derivative of the tables in GAP\_PRODUCTS as well as other base tables in RACEBASE and RACE\_DATA, it is not necessary to check these views in addition to the data checks done in the previous steps.

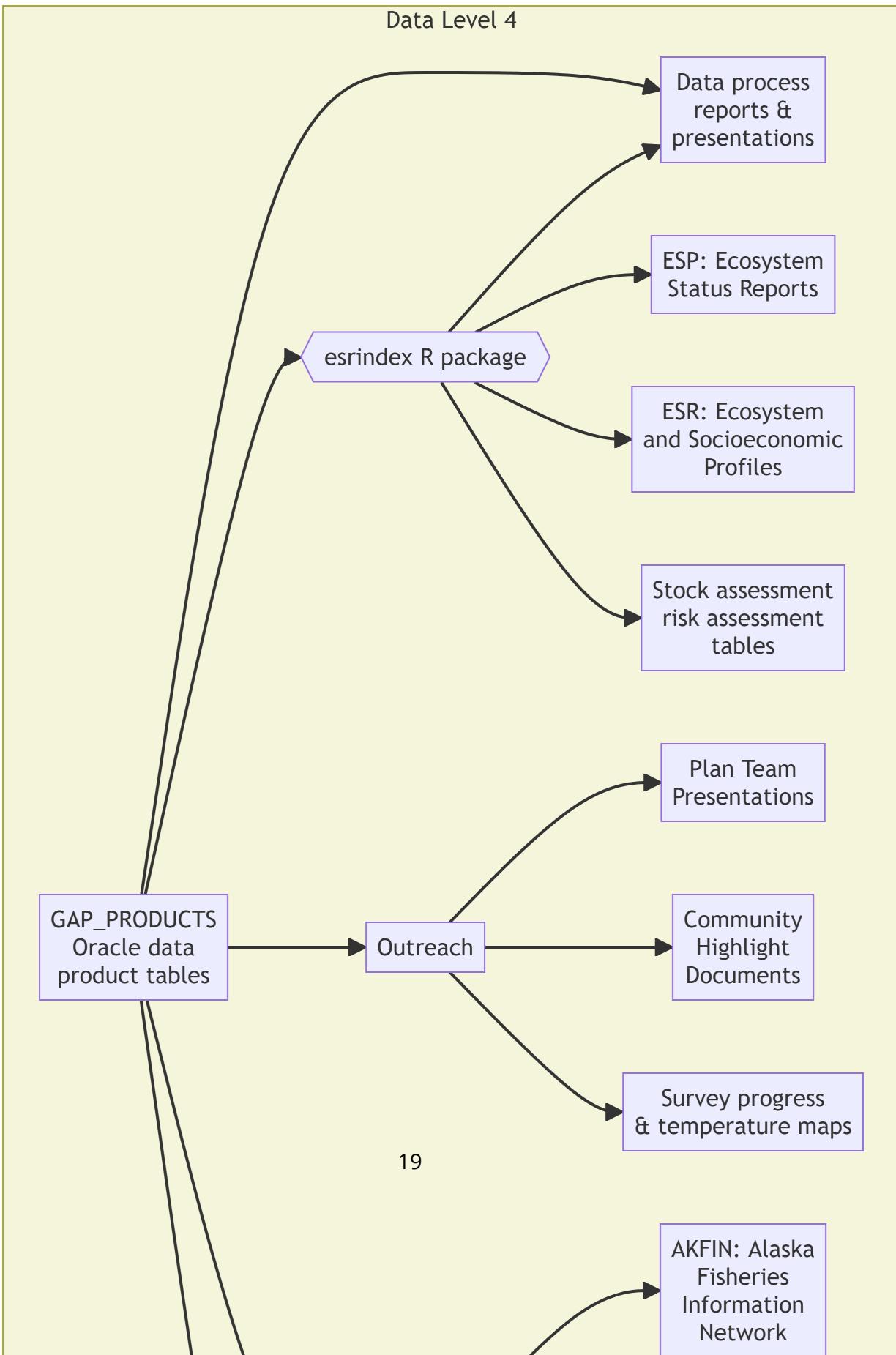
### 2.3. Data levels

GAP produces numerous data products that are subjected to different levels of processing, ranging from raw to highly-derived. The suitability of these data products for analysis varies and there is ambiguity about which data products can be used for which purpose. This ambiguity can create challenges in communicating about data products and potentially lead to misunderstanding and misuse of data. One approach to communicating about the level of processing applied to data products and their suitability for analysis is to describe data products using a Data Processing Level system. Data Processing Level systems are widely used in earth system sciences to characterize the extent of processing that has been applied to data products. For example, the NOAA National Centers for Environmental Information (NCEI) Satellite Program uses a Data Processing Level system to describe data on a scale of 0-4, where Level 0 is raw data and Level 4 is model output or results from analysis. Example of how NASA remote sensing data products are shared through a public data portal with levels of data processing and documentation.

For more information, see Sean Rohan's October 2022 SCRUGS presentation on the topic.

- **Level 0:** Raw and unprocessed data. Ex: Data on the G drive, some tables in RACE\_DATA
- **Level 1:** Data products with QA/QC applied that may or may not be expanded to analysis units, but either not georeferenced or does not include full metadata. Ex: Some tables in RACE\_DATA and RACEBASE

## 2. Workflow



## *2. Workflow*

- **Level 2:** Analysis-ready data products that are derived for a standardized extent and account for zeros and missing/bad data. Ex: CPUE tables, some data products in public-facing archives and repositories
- **Level 3:** Data products that are synthesized across a standardized extent, often inputs in a higher-level analytical product. Ex: Abundance indices, some data products in public-facing archives and repositories
- **Level 4:** Analytically generated data products that are derived from lower-level data, often to inform management. Ex: Biological reference points from stock assessments, Essential Fish Habitat layers, indicators in Ecosystem Status Reports and Ecosystem and Socioeconomic Profiles

## 3. News

### 3.1. News/change logs

- GAP\_PRODUCTS ChangeLog (last produced on 2024-09-05) using gapindex v2.2.0:  
Run completed by: Ned Laman, Zack Oyafuso
- GAP\_PRODUCTS ChangeLog (last produced on 2024-09-03) using gapindex v2.2.0:  
Run completed by: Ned Laman, Zack Oyafuso
- GAP\_PRODUCTS ChangeLog (last produced on 2024-08-29) using gapindex v2.2.0:  
The additions of previous years' age data and 2024 EBS catch, effort, and size data
- GAP\_PRODUCTS ChangeLog (last produced on 2024-08-20) using gapindex v2.2.0:  
Initial 2024 post-survey run with new ages since last run and all of EBS Shelf 2024 survey data but none of AI 2024 survey data. While trying to update the records in the GAP\_PRODUCTS table, the connection was terminated, partially uploading records in the agecomp tables and outputting NA to the N\_HAUL and N\_LENGTH fields in the biomass tables. At this point, the GAP\_PRODUCTS tables are incomplete. The AKFIN and FOSS tables were NOT updated in this run.
- GAP\_PRODUCTS ChangeLog (last produced on 2024-05-04) using gapindex v2.2.0: A development branch version of gapindex called using\_datatable uses the data.table package for many dataframe manipulations, which greatly decreased the computation time of many of the functions. There were no major changes in the calculations in this version of the gapindex package and thus the major changes listed below are not related to the gapindex package. The only major change from this run was the addition of GOA 2023 Pacific Ocean perch read otolith data.
- GAP\_PRODUCTS ChangeLog (last produced on 2024-04-09) using gapindex v2.2.0: A development branch version of gapindex called using\_datatable uses the data.table package for many dataframe manipulations, which greatly decreased the computation time of many of the functions. There were no major changes in the calculations in this version of the gapindex package and thus the major changes listed below are not related to the gapindex package.

### 3. News

- GAP\_PRODUCTS ChangeLog (last produced on 2024-02-29) using gapindex v2.2.0: A new version of gapindex 2.2.0 was used for this production run and now accesses taxonomic information from RACEBASE.SPECIES instead of GAP\_PRODUCTS.TAXONOMIC-CLASSIFICATION. As a result, there will be some SPECIES\_CODE values that are supported due to slight differences between the two tables. Discussion in this github issue #54. As a result there are new cpue records for SPECIES\_CODE values 22290 and 22292 and removed cpue records for SPECIES\_CODE values 21345, 22200 and 69326.
- GAP\_PRODUCTS ChangeLog (last produced on 2024-01-09) using gapindex v2.1.3: A new version of gapindex (v2.1.3) was used to produced these data. Data for SPECIES\_CODE 68590 (Chionoecetes hybrids) are now removed, per this issue ([https://github.com/afsc-gap-products/gap\\_products/issues/3](https://github.com/afsc-gap-products/gap_products/issues/3)). New read otolith data were incorporated into the age compositions. GOA depth subareas are now included in the size comps, and there were some modifications with EBS skate length data that are now incorporated into the length compositions.
- GAP\_PRODUCTS ChangeLog (last produced on 2023-11-17) using gapindex v2.1.2: A new version of gapindex (v2.1.2) was used to produced these data. There was a slight change to how subarea biomass totals are calculated that was not fully addressed in v2.1.1. The modified biomass records reflect this change.
- GAP\_PRODUCTS ChangeLog (last produced on 2023-11-14) using gapindex v2.1.1: A new version of gapindex (v2.1.1) was used to produced these data. There was a slight change to how subarea biomass totals are calculated. The modified biomass records reflect this change. New 2022 otolith data were available since the last iteration of the GAP\_PRODUCTS for Aleutian Island Pacific ocean perch and northern rockifsh and Eastern Bering Sea northern rock sole. Zero-filled CPUE records for four GOA species codes (SPECIES\_CODE: 21210, 30010, 30360, 77102, 98101) were added due to how the 1990 data were integrated in the last production run of GAP\_PRODUCTS. Two Arctic cod (SPECIES\_CODE: 21725) and one plain sculpin (SPECIES\_CODE: 21371) count records were modified in the NBS data, which changes the numerical CPUE estimates for those hauls which changes the estimated population abundance and size composition for those species.
- Groundfish Assessment Program Survey Data Serving and Data Improvements: Initial data changes brief distributed to SSMA and other partners by Ned Laman, Zack Oyafuso, and Emily Markowitz
- Run 2023-06-01 gapindex v2.1.0: Initial compiling and planning notes

## **4. Code of Conduct**

### **4.1. What are Codes of Conduct?**

Codes of Conduct are voluntary sets of rules that assist creators, developers, and users of code and data with data protection compliance and accountability in specific sectors or relating to particular processing operations.

Codes can help organizations to ensure all participants follow best practices and rules designed specifically for their sector or processing operations, thus enhancing compliance and collaboration. They are developed and managed by an association or other body (the 'Code Owner') which is representative of a sector (or category of data controllers or processors), with the expert and sectoral knowledge of how to enhance data protection in their area.

#### **4.1.1. Code of Conduct from the nmfs-opensci GitHub.**

## **5. NOAA Fisheries Open Science Code of Conduct**

This code of conduct was developed and adapted from the Atom code of conduct in October 2021.

### **5.1. Our Pledge**

In the interest of fostering an open and welcoming environment, we as contributors and maintainers pledge to making participation in our project and our community a harassment-free experience for everyone, regardless of age, body size, disability, ethnicity, gender identity and expression, level of experience, nationality, personal appearance, race, religion, or sexual identity and orientation.

### **5.2. Our Standards**

Examples of behavior that contributes to creating a positive environment include:

- Using welcoming and inclusive language
- Being respectful of differing viewpoints and experiences
- Gracefully accepting constructive criticism
- Focusing on what is best for the community
- Showing empathy towards other community members

Examples of unacceptable behavior by participants include:

- The use of sexualized language or imagery and unwelcome sexual attention or advances
- Trolling, insulting/derogatory comments, and personal or political attacks
- Public or private harassment

## *5. NOAA Fisheries Open Science Code of Conduct*

- Publishing others' private information, such as a physical or electronic address, without explicit permission
- Other conduct which could reasonably be considered inappropriate in a professional setting

### **5.3. Our Responsibilities**

Project maintainers are responsible for clarifying the standards of acceptable behavior and are expected to take appropriate and fair corrective action in response to any instances of unacceptable behavior.

Project maintainers have the right and responsibility to remove, edit, or reject comments, commits, code, wiki edits, issues, and other contributions that are not aligned to this Code of Conduct, or to ban temporarily or permanently any contributor for other behaviors that they deem inappropriate, threatening, offensive, or harmful.

### **5.4. Scope**

This Code of Conduct applies both within project spaces and in public spaces when an individual is representing the project or its community. Examples of representing a project or community include using an official project e-mail address, posting via an official social media account, or acting as an appointed representative at an online or offline event. Representation of a project may be further defined and clarified by project maintainers.

### **5.5. Enforcement**

Instances of abusive, harassing, or otherwise unacceptable behavior may be reported by contacting the project team. All complaints will be reviewed and investigated and will result in a response that is deemed necessary and appropriate to the circumstances. Further details of specific enforcement policies may be posted separately.

*5. NOAA Fisheries Open Science Code of Conduct*

## **5.6. Attribution**

This Code of Conduct is adapted from the Contributor Covenant, version 1.4, available at <https://contributor-covenant.org/version/1/4>

**Part II.**

**GAP Production Data**

## **Data Description**

The Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC) conducts fisheries-independent bottom trawl surveys to monitor the condition of the demersal fish and crab stocks of Alaska. These data are developed to describe the temporal distribution and abundance of commercially and ecologically important groundfish species, examine the changes in the species composition of the fauna over time and space, and describe the physical environment of the groundfish habitat. These data are created using the gapindex R package v2.1.0.

Users must read and fully comprehend the metadata prior to use. Data should not be used beyond the limits of the source scale. Acknowledgement of NOAA, as the source from which these data were obtained, in any publications and/or other representations of these data, is suggested. These data are compiled and approved annually after each summer survey season. The data from previous years are unlikely to change substantially once published. Some survey data are excluded, such as non-standard stations, surveys completed in earlier years using different/non-standard gear, and special tows and non-standard data collections.

### **gapindex**

Code to generate design-based catch-per-unit-effort (CPUE), indices of abundance, biomass, and size and age compositions from survey data is available from gapindex. See the gapindex documentation for more information. Make sure you have installed R packages devtools, RODBC, and getPass and are connected to the AFSC network or VPN while using this package.

## **Cite this data**

Use the below bibtext citations, as cited in our group's citation repository for citing the data created and maintained in this repo (NOAA Fisheries Alaska Fisheries Science Center, Groundfish Assessment Program, 2024). Add "note = {Accessed: mm/dd/yyyy}" to append the day this data was accessed.

# 6. Data description

## 6.1. Data tables

### 6.1.1. AGECOMP

Stratum- and region-level age compositions by sex. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 665,247

Number of columns: 10

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

SURVEY\_DEFINITION\_ID

Survey ID

ID key code

NUMBER(38,0)

The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey\_definition\_id is associated with the srvy and survey columns. Full list of survey definition IDs are in RACE\_DATA.SURVEY\_DEFINITIONS and in the code books.

## *6. Data description*

YEAR

Survey year

year

NUMBER(10,0)

Year the observation (survey) was collected.

AREA\_ID

Area ID

ID key code

NUMBER(38,0)

Area ID key code for each statistical area used to produce production estimates (e.g., biomass, population, age comps, length comps). Each area ID is unique within each survey.

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

SEX

Sex of a specimen

ID key code

NUMBER(38,0)

Sex of a specimen where "1" = "Male", "2" = "Female", "3" = Unsexed.

AGE

Taxon age bin (yrs)

integer

NUMBER(38,0)

Age bin of taxon. Age bin of a taxon in years estimated by the age comp estimate. Age -9 indicates unaged lengths for a particular sex because no otoliths were collected for

## *6. Data description*

that sex/length combination. Age -99 indicates a case where no lengths were collected within a stratum for a species/year even though catch numbers were recorded.

POPULATION\_COUNT

Estimated population

numeric

NUMBER(38,0)

The estimated population caught in the survey for a species, group, or total for a given survey.

LENGTH\_MM\_MEAN

Mean length at age weighted by numbers at length

numeric

NUMBER(38,3)

Mean length (millimeters)

LENGTH\_MM\_SD

Standard deviation of length at age weighted by numbers at length

numeric

NUMBER(38,3)

Variance of mean length.

AREA\_ID\_FOOTPRINT

Survey Footprint

text

VARCHAR2(4000 BYTE)

Survey footprint, usually equivalent to the SURVEY\_DEFINITION\_ID with the exception of the Standard and Standard +NW survey footprints in the Eastern Bering Sea shelf bottom trawl survey

## *6. Data description*

### **6.1.2. AREA**

Information related to the various strata, subareas, INPFC and NMFS management areas, and regions for the Aleutian Islands, Gulf of Alaska, and Bering Sea shelf and slope bottom trawl surveys. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 395

Number of columns: 9

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

DESIGN\_YEAR

Design year

year

NUMBER(10,0)

Year ID associated with a given value AREA\_ID. This field describes the changes in the survey design over time.

SURVEY\_DEFINITION\_ID

Survey ID

ID key code

NUMBER(38,0)

The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey\_definition\_id is associated with the srvy and survey columns. Full list of survey definition IDs are in RACE\_DATA.SURVEY\_DEFINITIONS and in the code books.

## *6. Data description*

AREA\_ID

Area ID

ID key code

NUMBER(38,0)

Area ID key code for each statistical area used to produce production estimates (e.g., biomass, population, age comps, length comps). Each area ID is unique within each survey.

AREA\_TYPE

Area ID type description

category

VARCHAR2(255 BYTE)

The type of stratum that AREA\_ID represents. Types include: STRATUM (the smallest building-block unit of area in these surveys), REGION, DEPTH, SUBAREA, INPFC BY DEPTH, INPFC, SUBAREA BY DEPTH, REGULATORY AREA, NMFS STATISTICAL AREA.

AREA\_NAME

Area ID name

text

VARCHAR2(4000 BYTE)

Descriptive name of each AREA\_ID. These names often identify the region, depth ranges, or other regional information for the area ID.

DESCRIPTION

Description

text

VARCHAR2(4000 BYTE)

Description of row observation.

AREA\_KM2

Area (km2)

kilometers squared

NUMBER(38,3)

## *6. Data description*

Area in square kilometers.

DEPTH\_MIN\_M

Area ID minimum depth (m)

meters

NUMBER(38,3)

Minimum depth (meters).

DEPTH\_MAX\_M

Area ID maximum depth (m)

meters

NUMBER(38,3)

Maximum depth (meters).

### **6.1.3. BIOMASS**

Stratum/subarea/region-level mean CPUE (weight and numbers), total biomass, and total abundance with associated variances. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 2,656,482

Number of columns: 16

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

SURVEY\_DEFINITION\_ID

Survey ID

## *6. Data description*

ID key code

NUMBER(38,0)

The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey\_definition\_id is associated with the srvy and survey columns. Full list of survey definition IDs are in RACE\_DATA.SURVEY\_DEFINITIONS and in the code books.

YEAR

Survey year

year

NUMBER(10,0)

Year the observation (survey) was collected.

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific-name columns. For a complete species list, review the code books.

AREA\_ID

Area ID

ID key code

NUMBER(38,0)

Area ID key code for each statistical area used to produce production estimates (e.g., biomass, population, age comps, length comps). Each area ID is unique within each survey.

CPUE\_KGKM2\_MEAN

Mean weight CPUE

kilograms per kilometers squared

NUMBER(38,6)

The mean catch weight (kilograms) per unit effort (area swept by the net, units squared kilometers).

## *6. Data description*

CPUE\_NOKM2\_MEAN

Mean numeric CPUE

count per kilometers squared

NUMBER(38,6)

The mean of numerical catch per unit effort (area swept by the net, units square kilometers).

N\_HAUL

Valid hauls

count

NUMBER(38,0)

Total number of hauls.

N\_WEIGHT

Hauls with catch

count

NUMBER(38,0)

Total number of hauls with positive catch biomass.

N\_COUNT

Hauls with taxon counts

numeric

NUMBER(38,0)

Total number of hauls with positive count data.

N\_LENGTH

Hauls with taxon lengths

count

NUMBER(38,0)

Total number of hauls with length data.

BIOMASS\_MT

Estimated biomass

## *6. Data description*

numeric

NUMBER(38,6)

The estimated total biomass.

BIOMASS\_VAR

Estimated biomass variance

numeric

NUMBER(38,6)

The estimated variance associated with the total biomass.

POPULATION\_COUNT

Estimated population

numeric

NUMBER(38,0)

The estimated population caught in the survey for a species, group, or total for a given survey.

POPULATION\_VAR

Estimated population variance

numeric

NUMBER(38,6)

The estimated population variance caught in the survey for a species, group, or total for a given survey.

CPUE\_KGKM2\_VAR

Variance of the mean weight CPUE

kilograms per kilometers squared

NUMBER(38,6)

The variance of mean catch weight (kilograms) per unit effort (area swept by the net, units squared kilometers).

CPUE\_NOKM2\_VAR

Variance of the mean numeric CPUE

## *6. Data description*

count per kilometers squared

NUMBER(38,6)

The variance of mean numerical catch per unit effort (area swept by the net, units square kilometers).

### **6.1.4. CPUE**

Haul-level zero-filled weight and numerical catch-per-unit-effort. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 21,360,338

Number of columns: 7

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

HAULJOIN

Haul ID

ID key code

NUMBER(38,0)

This is a unique numeric identifier assigned to each (vessel, cruise, and haul) combination.

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

## *6. Data description*

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

WEIGHT\_KG

Sample or taxon weight (kg)

kilograms

NUMBER(38,3)

Weight (thousandths of a kilogram) of individuals in a haul by taxon.

COUNT

Taxon count

count, whole number resolution

NUMBER(38,0)

Total whole number of individuals caught in haul or samples collected.

AREA\_SWEPT\_KM2

Area swept (km)

kilometers

NUMBER(38,6)

The area the net covered while the net was fishing (kilometers squared), defined as the distance fished times the net width.

CPUE\_KGKM2

Weight CPUE (kg/km<sup>2</sup>)

kilograms per kilometers squared

NUMBER(38,6)

Catch weight (kilograms) per unit effort (area swept by the net, units square kilometers).

CPUE\_NOKM2

Number CPUE (no/km<sup>2</sup>)

count per kilometers squared

NUMBER(38,6)

## *6. Data description*

Numerical catch per unit effort (area swept by the net, units square kilometers).

### **6.1.5. SIZECOMP**

Stratum/subarea/region-level size compositions by sex. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Ground-fish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 3,239,488

Number of columns: 7

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

SURVEY\_DEFINITION\_ID

Survey ID

ID key code

NUMBER(38,0)

The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey\_definition\_id is associated with the srvy and survey columns. Full list of survey definition IDs are in RACE\_DATA.SURVEY\_DEFINITIONS and in the code books.

YEAR

Survey year

year

NUMBER(10,0)

Year the observation (survey) was collected.

AREA\_ID

## *6. Data description*

Area ID

ID key code

NUMBER(38,0)

Area ID key code for each statistical area used to produce production estimates (e.g., biomass, population, age comps, length comps). Each area ID is unique within each survey.

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

LENGTH\_MM

Length of a specimen

millimeters

NUMBER(10,0)

Length bin in millimeters. A length of -9 indicates cases where no lengths were collected within a stratum for a species/year, even though catch numbers were recorded.

SEX

Sex of a specimen

ID key code

NUMBER(38,0)

Sex of a specimen where "1" = "Male", "2" = "Female", "3" = Unsexed.

POPULATION\_COUNT

Estimated population

numeric

NUMBER(38,0)

## *6. Data description*

The estimated population caught in the survey for a species, group, or total for a given survey.

### **6.1.6. SPECIES\_YEAR**

This is a table

Number of rows: 18

Number of columns: 2

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific-name columns. For a complete species list, review the code books.

### **6.1.7. STRATUM\_GROUPS**

Lookup table for which strata are contained within a given subarea, INPFC or NMFS management area, or region for the Aleutian Islands, Gulf of Alaska, and Bering Sea shelf and slope bottom trawl surveys. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 768

## *6. Data description*

Number of columns: 4

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

AREA\_ID

Area ID

ID key code

NUMBER(38,0)

Area ID key code for each statistical area used to produce production estimates (e.g., biomass, population, age comps, length comps). Each area ID is unique within each survey.

SURVEY\_DEFINITION\_ID

Survey ID

ID key code

NUMBER(38,0)

The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey\_definition\_id is associated with the srvy and survey columns. Full list of survey definition IDs are in RACE\_DATA.SURVEY\_DEFINITIONS and in the code books.

DESIGN\_YEAR

Design year

year

NUMBER(10,0)

Year ID associated with a given value AREA\_ID. This field describes the changes in the survey design over time.

STRATUM

Stratum ID

## *6. Data description*

ID key code

NUMBER(10,0)

RACE database statistical area for analyzing data. Strata were designed using bathymetry and other geographic and habitat-related elements. The strata are unique to each survey region. Stratum of value 0 indicates experimental tows.

### **6.1.8. SURVEY DESIGN**

This table contains for a given survey (via SURVEY\_DEFINITION\_ID) and survey year (YEAR), which version (DESIGN\_YEAR) of the AREA\_IDs that were used to calculate the various standard data products. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 87

Number of columns: 3

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

SURVEY\_DEFINITION\_ID

Survey ID

ID key code

NUMBER(38,0)

The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey\_definition\_id is associated with the srvy and survey columns. Full list of survey definition IDs are in RACE\_DATA.SURVEY\_DEFINITIONS and in the code books.

YEAR

## *6. Data description*

Survey year

year

NUMBER(10,0)

Year the observation (survey) was collected.

DESIGN\_YEAR

Design year

year

NUMBER(10,0)

Year ID associated with a given value AREA\_ID. This field describes the changes in the survey design over time.

### **6.1.9. TAXON\_GROUPS**

GAP\_PRODUCTS.TAXONOMIC\_CLASSIFICATION subsetted for taxonomic classifications accepted by the GAP bottom trawl survey and added GROUP\_CODE to denote taxonomic aggregations. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at (<https://github.com/afsc-gap-products/gap-products>). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 2,777

Number of columns: 22

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

SPECIES\_CODE

Taxon code

ID key code

## *6. Data description*

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

SPECIES\_NAME

Scientific name of species

text

VARCHAR2(255 BYTE)

Scientific name of species.

COMMON\_NAME

Taxon common name

text

VARCHAR2(255 BYTE)

The common name of the marine organism associated with the scientific\_name and species\_code columns. For a complete species list, review the code books.

ID\_RANK

Lowest taxonomic rank

text

VARCHAR2(255 BYTE)

Lowest taxonomic rank of a given species entry.

DATABASE

Database source

category

VARCHAR2(255 BYTE)

Taxonomic database source, either ITIS or WoRMS.

DATABASE\_ID

Species ID in database

ID key code

VARCHAR2(255 BYTE)

## *6. Data description*

Species ID key code of a species in the taxonomic “DATABASE” source.

GENUS\_TAXON

Genus phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of genus of a given species.

SUBFAMILY\_TAXON

Subfamily phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of subfamily of a given species.

FAMILY\_TAXON

Family phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of family of a given species.

SUPERFAMILY\_TAXON

Superfamily phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of superfamily of a given species.

INFRAORDER\_TAXON

Infraorder phylogenetic rank

category

VARCHAR2(255 BYTE)

Infraorder phylogenetic rank. Phylogenetic latin rank of infraorder of a given species.

SUBORDER\_TAXON

## *6. Data description*

Suborder phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of suborder of a given species.

ORDER\_TAXON

Order phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of order of a given species.

SUPERORDER\_TAXON

Superorder phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of superorder of a given species.

INFRACLASS\_TAXON

Infraclass phylogenetic rank

category

VARCHAR2(255 BYTE)

Infraclass phylogenetic rank. Phylogenetic latin rank of infraclass of a given speices.

SUBCLASS\_TAXON

Subclass phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of subclass of a given species.

CLASS\_TAXON

Class phylogenetic rank

category

## *6. Data description*

VARCHAR2(255 BYTE)

Phylogenetic latin rank of class of a given species.

SUPERCLASS\_TAXON

Superclass phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of superclass of a given species.

SUBPHYLUM\_TAXON

Subphylum phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of subphylum of a given species.

PHYLUM\_TAXON

Phylum phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of phylum of a given species.

KINGDOM\_TAXON

Kingdom phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of kingdom of a given species.

GROUP\_CODE

Species or Complex ID

ID key code

NUMBER(38,0)

## *6. Data description*

Equivalent to the SPECIES\_CODE if the taxon is reported as a single taxon in GAP\_PRODUCTS, otherwise denotes a SPECIES\_CODE of a higher taxonomic group to which the taxon is aggregated in the GAP\_PRODUCTS CPUE and BIOMASS tables.

## 7. Universal Column Metadata

This table is used to string together the various field comments for the tables in GAP\_PRODUCTS. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Table 7.1.: Universal stock metadata that users can use to document their table columns.

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
ABUNDANCE HAUL	Design-based index approved haul	logical	VARCHAR(2 BYTE)	Logical, describing if this haul was conducted in a standard manner and thus used for design-based index estimates (TRUE) or not (FALSE).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
ACCESSORIES	Type of gear accessories used on the net	ID key code	NUMBER(38,0)	Type of accessories used on net. For a complete list of accessories ID key codes, [code books]( <a href="https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual">https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual</a> ).
ACTION	Database action	text	VARCHAR2(2 BYTE)	Standard action taken to alter current database record
ACTIVE	Vessel active/inactive	logical	VARCHAR2(255 BYTE)	Logical, describing if a vessel is active (TRUE) or not (FALSE).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
AGE	Taxon age bin (yrs)	integer	NUMBER(3)	Age bin of taxon. Age bin of a taxon in years estimated by the age comp estimate. Age -9 indicates unaged lengths for a particular sex because no otoliths were collected for that sex/length combination. Age -99 indicates a case where no lengths were collected within a stratum for a species/year even though catch numbers were recorded.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
AGENCY_-ACRONYM	Acronym of listed Agency	text abbreviated	VARCHAR2(255) BYTE)	Abbreviated agencies that are affiliated with the Alaska bottom trawl survey.
AGENCY_-JOIN	Agency ID	ID key code	NUMBER(3)	Affiliated agency ID key code.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
AGENCY_LONG	Official name of agency	text	VARCHAR2(255 BYTE)	<p>Full official name of affiliated agencies to the Alaska bottom trawl survey.</p> <p>The VARCHAR2(255 BYTE) column agency_long is associated with the agency_acronym and agency_short columns.</p>

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
AGENCY_SHORT	Agency shorthand name	text	VARCHAR2(BYTE)	A sort version of the full official name of affiliated agencies to the Alaska bottom trawl survey. The column agency_short is associated with the agency_acronym and agency_long columns.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
AGE_DE-TERMINA-TION_-METHOD	Aging method	ID key code	NUMBER(10,0)	Numeric code corresponding to the method of age determination. For a complete list of age determination codes, review the [code books]( <a href="https://www.fisheries.noaa.gov/resource/survey-species-code-manual-and-data-codes-manual">https://www.fisheries.noaa.gov/resource/survey-species-code-manual-and-data-codes-manual</a> ).
AGE_DE-TERMINA-TION_-METH-ODS	Age determination method	ID key code	NUMBER(3)	A unique ID used to identify this age determination method.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
AGE_YEAR	Age bin of taxon	year	NUMBER(38,0)	Age bin of a taxon in years Estimated by the age comp estimate.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
AREAJOIN	Area polygon ID	ID key code	NUMBER(3)	A call sign is a designated sequence of letters and numbers that are assigned when a vessel, whether it be a sailing yacht, motor yacht, rib or commercial vessel, receives its Ship Radio Licence. The vessel also receives its MMSI number, so that each vessel is uniquely identified.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
AREA_ID	Area ID	ID key code	NUMBER(38,0)	Area ID key code for each statistical area used to produce production estimates (e.g., biomass, population, age comps, length comps). Each area ID is unique within each survey.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
AREA_ID_FOOTPRINT	Survey Footprint	text	VARCHAR2(255 BYTE)	Survey footprint, usually equivalent to the SURVEY_DEFINITION_-ID with the exception of the AREA_ID_FOOTPRINT survey footprints in the Eastern Bering Sea shelf bottom trawl survey
AREA_KM2	Area (km2)	kilometers squared	NUMBER(38,3)	Area in square kilometers.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
AREA_NAME	Area ID name	text	VARCHAR(255)	Descriptive name of each AREA_ID. These names often identify the region, depth ranges, or other regional information for the area ID.
AREA_SWEPT_KM2	Area swept (km)	kilometers	NUMBER(38,6)	The area the net covered while the net was fishing (kilometers squared), defined as the distance fished times the net width.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
AREA_TYPE	Area ID type	category description	VARCHAR2(BYTE)	The type of stratum that AREA_ID represents. Types include: STRATUM (the smallest building-block unit of area in these surveys), REGION, DEPTH, SUB-AREA, INPFC BY DEPTH, INPFC, SUBAREA BY DEPTH, REGULAR-TORY AREA, NMFS STATISTICAL AREA.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
BIOMASS_MT	Estimated biomass	numeric	NUMBER(38,6)	The estimated total biomass.
BIOMASS_VAR	Estimated biomass variance	numeric	NUMBER(38,6)	The estimated variance associated with the total biomass.
BOTTOM_TEMPERATURE_C	Bottom temperature (degrees Celsius)	degrees Celsius	NUMBER(38,6); NA	Bottom temperature (tenths of a degree Celsius); NA indicates removed or missing values.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
BOTTOM_TYPE	Seafloor bottom type code	ID key code	NUMBER(3)	Bottom type on sea floor at haul location. For a complete list of bottom type ID key codes, review the [code books]( <a href="https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual">https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual</a> ).
CATALOG_NUM	Catalog number	text	VARCHAR2(255 BYTE)	Museum catalog number associated with record

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
CATCHJOI	Catch observation ID	ID key code	NUMBER(3)	Unique integer ID assigned to each survey, vessel, year, and catch observation combination.
CLASSIFICATION	Taxonomic classification rank group	category	VARCHAR2(255 BYTE)	Phylogenetic classification rank for a given species.
CLASS_-TAXON	Class phylogenetic rank	category	VARCHAR2(255 BYTE)	Phylogenetic latin rank of class of a given species.
COLLECTED BY	Person who collected specimen	text	VARCHAR2(255 BYTE)	Initials of person collected specimen in the field
COMMENT	Comments	text	VARCHAR2	Comments regarding row observation.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
COMMON_NAME	Taxon common name	text	VARCHAR2(255 BYTE)	The common name of the marine organism associated with the scientific_name and species_code columns. For a complete species list, review the [code books]( <a href="https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual">https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual</a> ).
COUNT	Taxon count	count, whole number resolution	NUMBER(3)	Total whole number of individuals caught in haul or samples collected.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
COUNTRY_ID	Country code	ID key code	NUMBER(38,0)	Country ID key code of where a vessel, for example, may be from. For a complete list of country ID [code books]( <a href="https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual">https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual</a> ).
CPUE_KGHA	Weight CPUE (kg/ha)	kilograms per hectare	NUMBER(3	Catch weight (kilograms) per unit effort (area swept by the net, units hectares).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
CPUE_-KGKM2	Weight CPUE (kg/km2)	kilograms per kilometers squared	NUMBER(38,6)	Catch weight (kilograms) per unit effort (area swept by the net, units square kilometers).
CPUE_-KGKM2_-MEAN	Mean weight CPUE	kilograms per kilometers squared	NUMBER(3)	The mean catch weight (kilograms) per unit effort (area swept by the net, units squared kilometers).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
CPUE_-KGKM2_-VAR	Variance of the mean weight CPUE	kilograms per kilometers squared	NUMBER(38,6)	The variance of mean catch weight (kilograms) per effort (area swept by the net, units squared kilometers).
CPUE_-NOHA	Number CPUE (no/ha)	count per hectare	NUMBER(38,6)	Numerical catch per unit effort (area swept by the net, units hectares).
CPUE_-NOKM2	Number CPUE (no/km2)	count per kilometers squared	NUMBER(38,6)	Numerical catch per unit effort (area swept by the net, units square kilometers).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
CPUE_- NOKM2_- MEAN	Mean numeric CPUE	count per kilometers squared	NUMBER(3 8,0,2)	The mean of numerical catch per unit effort (area swept by the net, units square kilometers).
CPUE_- NOKM2_- VAR	Variance of the mean numeric CPUE	count per kilometers squared	NUMBER(3 8,0,2)	The variance of mean numerical catch per unit effort (area swept by the net, units square kilometers).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
CRS	Coordinate reference system	ID key code	VARCHAR2 (BYTE)	The coordinate reference system (CRS) that shapefiles were created in or areas (like AREA_KM2) are calculated in, as defined by <a href="https://spatialreference.org/">https://spatialreference.org/</a> (e.g., "+proj=longlat", "EPSG:3338").

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
CRUISE	Cruise Name	ID key code	NUMBER(3,0)	This is a six-digit integer identifying the cruise number of the form: YYYY99 (where YYYY = year of the cruise; 99 is sequential; 01 denotes the first cruise that vessel made in this year, 02 is the second, etc.).
CRUISEJO	Cruise ID	ID key code	NUMBER(3)	Unique integer ID assigned to each survey, vessel, and year combination.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
DATABASE	Database source	category	VARCHAR2(255 BYTE)	Taxonomic database either ITIS or WoRMS.
DATABASE_ID	Species ID in database	ID key code	VARCHAR2(255 BYTE)	Species ID key code of a species in the taxonomic "DATABASE" source.
DATE	Date	YYYY-MM-DD	DATE	The date (YYYY-MM-DD) of the event (e.g., cruise).
DATE-END	End date	YYYY-MM-DD	DATE	The date (YYYY-MM-DD) of the end of the event (e.g., cruise).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
DATE_START	Start date	YYYY-MM-DD	DATE	The date (YYYY-MM-DD) of the beginning of the event (e.g., cruise).
DATE_TIME	Date and time	MM/DD/YY HH:MM	DATE	The date (MM/DD/YYYY) and time (HH:MM) of the haul. All dates and times are in Alaska time (AKDT) of Anchorage, AK, USA (UTC/GMT -8 hours).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
DATE_- TIME_- END	End date and time	MM/DD/YYYY HH::MM	TIMESTAMP	The date (MM/DD/YYYY) and time (HH:MM) of the end of the haul. All dates and times are in Alaska time (AKDT) of Anchorage, AK, USA (UTC/GMT -8 hours).
DATE_- TIME_- START	Start date and time	MM/DD/YY HH::MM	TIMESTAMP	The date (MM/DD/YYYY) and time (HH:MM) of the beginning of the haul. All dates and times are in Alaska time (AKDT) of Anchorage, AK, USA (UTC/GMT -8 hours).

## 7. Universal Column Metadata

<b>Column name from data</b>	<b>Descriptive column Name</b>	<b>Units</b>	<b>Oracle data type</b>	<b>Column description</b>
DEPTH_GEAR_M	Depth of gear (m)	degrees Celsius	NUMBER(3,2)	Depth of gear (meters).
DEPTH_M	Depth (m)	degrees Celsius	NUMBER(3,2)	Bottom depth (meters).
DEPTH_MAX_M	Area ID maximum depth (m)	meters	NUMBER(3,2)	Maximum depth (meters).
DEPTH_MIN_M	Area ID minimum depth (m)	meters	NUMBER(3,2)	Minimum depth (meters).
DESCRIPTION	Description text		VARCHAR2(4000 BYTE)	Description of row observation.
DESIGN_YEAR	Design year	year	NUMBER(1)	Year ID associated with a given value AREA_ID. This field describes the changes in the survey design over time.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
DISTANCE_FISHED_KM	Distance fished (km)	degrees Celsius	NUMBER(38,9)	Distance the net fished (km) in degrees Celsius. (8.999999999999999e-004). Hundreds of thousands of kilometers.
DUMMY	dummy	dummy	VARCHAR2(1 BYTE)	dummy
DURATION_HR	Tow duration (decimal hr)	hours	NUMBER(38,9)	This is the elapsed time between start and end of a haul (decimal hours).
FAMILY_TAXON	Family phylogenetic rank	category	VARCHAR2(1 BYTE)	Phylogenetic latin rank of family of a given species.
FIELD_ID	Field specimen identification	text	VARCHAR2(255)	Field identification for the vouchered specimen
FREQUENCY	Count of observation	count	NUMBER(3)	Frequency, or count, of an observation.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
GEAR	Type of gear used on the net	ID key code	NUMBER(3,0)	Type of gear used on net. For a complete list of gear ID key codes, review the <a href="https://www.fisheries.noaa.gov/resource-species-code-manual-and-data-codes-manual">code books](https://www.fisheries.noaa.gov/resource-species-code-manual-and-data-codes-manual)</a> .
GEAR_DEPTH_M	Gear depth	meters	NUMBER(3,0)	Depth gear was deployed at (tenths of a meter). Gear depth plus net height equals bottom depth.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
GEAR_ID	Gear ID	ID key code	NUMBER(38,0)	Type of trawl or gear deployed. For a complete list of vessel gear type ID key review the [code books]( <a href="https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual">https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual</a> ).
GEAR_TEMPERATURE_C	Gear temperature (degrees Celsius)	degrees Celsius	NUMBER(3)	Temperature recorded by net gear (tenths of a degree Celsius); NA indicates removed or missing values.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
GENUS_-TAXON	Genus phylogenetic rank	category	VARCHAR2(255 BYTE)	Phylogenetic latin rank of genus of a given species.
GONAD_-G	Weight of gonads (g)	grams	NUMBER(3)	Weight of specimen gonads (grams).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
GROUP_CODE	Species or Complex ID	ID key code	NUMBER(38,0)	Equivalent to the SPECIES_CODE if the taxon is reported as a single taxon in GAP_-PROD-UCTS, otherwise denotes a SPECIES_CODE of a higher taxonomic group to which the taxon is aggregated in the GAP_-PROD-UCTS CPUE and BIOMASS tables.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
HAUL	Haul number	ID key code	NUMBER(3)	This number uniquely identifies a sampling event (haul) within a cruise. It is a sequential number, in chronological order of occurrence.
HAULJOIN	Haul ID	ID key code	NUMBER(38,0)	This is a unique numeric identifier assigned to each (vessel, cruise, and haul) combination.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
HAUL_TYPE	Haul sampling type	ID key code	NUMBER(3)	Type of haul sampling method. For a complete list of haul type ID key codes, review the [code books]( <a href="https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual">https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual</a> ).
ID_RANK	Lowest taxonomic rank	text	VARCHAR2(255 BYTE)	Lowest taxonomic rank of a given species entry.
INFRACLASS_TAXON	Infraclass phylogenetic rank	category	VARCHAR2(255 BYTE)	Infraclass phylogenetic rank. Phylogenetic latin rank of infraclass of a given speices.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
INFRAORDER TAXON	Infraorder phylogenetic rank	category	VARCHAR2(255 BYTE)	Infraorder phylogenetic rank. Phylogenetic latin rank of infraorder of a given species.
ITIS	Integrated taxonomic information system (ITIS) serial number	ID key code	NUMBER(3)	Species code as identified in the Integrated Taxonomic Information System ( <a href="https://itis.gov/">https://itis.gov/</a> ).
KINGDOM TAXON	Kingdom phylogenetic rank	category	VARCHAR2(255 BYTE)	Phylogenetic latin rank of kingdom of a given species.
LATITUDE DD	Latitude (decimal degrees)	decimal degrees	NUMBER(3)	Latitude (one hundred thousandth of a decimal degree).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
LATITUDE_DD_END	End latitude (decimal degrees)	decimal degrees	NUMBER(3,0)	Latitude (one hundred thousandths of a decimal degree) of the end of the haul.
LATITUDE_DD_START	Start latitude (decimal degrees)	decimal degrees	NUMBER(3,0)	Latitude (one hundred thousandths of a decimal degree) of the start of the haul.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
LENGTH_MM	Length of a specimen	millimeters	NUMBER(10,0)	Length bin in millimeters. A length of -9 indicates cases where no lengths were selected within a stratum for a species/year, even though catch numbers were recorded.
LENGTH_MM_MEAN	Mean length at age weighted by numbers at length	numeric	NUMBER(3,0)	Mean length (millimeters)
LENGTH_MM_SD	Standard deviation of length at age weighted by numbers at length	numeric	NUMBER(3,0)	Variance of mean length.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
LENGTH_TYPE	Length type	ID key code	NUMBER(3)	How the taxon was measured (e.g., fork length, carapace width). For a complete list of length_type ID key codes, review the [code books]( <a href="https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual">https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual</a> ).
LONGITUDE_DD	Longitude (decimal degrees)	decimal degrees	NUMBER(3,6)	Longitude (one hundred sandth of a decimal degree).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
LONGITUDE_DD_END	longitude (decimal degrees)	decimal degrees	NUMBER(3,3)	Longitude (one hundred thousandths of a decimal degree) of the end of the haul.
LONGITUDE_DD_START	Start longitude (decimal degrees)	decimal degrees	NUMBER(3,3)	Longitude (one hundred thousandths of a decimal degree) of the start of the haul.
MATURITY_CODE	Specimen maturity code	ID key code	NUMBER(3)	The maturity code or the condition identified by the maturity code.
METADATA_COL_NAME	Column name	text	VARCHAR2(4000 BYTE)	Name of the column in a table.
METADATA_COL_NAME_DESC	Column description	text	VARCHAR2(4000 BYTE)	Description of the column.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
METADATA_COL_NAME_LONG	Column name spelled out	text	VARCHAR2(4000 BYTE)	Long VARCHAR2(4000 for the column.
METADATA_DATATYPE	Oracle datatype code	text	VARCHAR2(4000 BYTE)	Oracle data type of data column.
METADATA_SENTENCE	Sentence	text	VARCHAR2(4000 BYTE)	Table metadata sentence.
METADATA_SENTENCE_NAME	Metadata sentence name	text	VARCHAR2(4000 BYTE)	Name of table metadata sentence.
METADATA_SENTENCE_TYPE	Sentence type	text	VARCHAR2(4000 BYTE)	Type of sentence to have in table metadata.
METADATA_UNITS	Units	category	VARCHAR2(4000 BYTE)	Units of the column.
NET_HEIGHT_M	Net height (m)	meters	NUMBER(38,1)	Measured or estimated distance (meters) Between footrope and headrope of the trawl.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
NET_MEASURED	Net measured during haul	logical	BINARY_DOUBLE	Logical, describing if the net was measured (TRUE) or not (FALSE) by wheelhouse and marport programs during the haul.
NET_WIDTH_M	Net width (m)	meters	NUMBER(38)	Measured or estimated distance (meters) between wingtips of the trawl.
NEW_ID	New specimen identification	text	VARCHAR2(BYTE)	Confirmed taxonomist identification of the vouchered specimen
NEW_SPECIES_CODE	New species code	ID key code	NUMBER(10,0)	Species code associated with new species name

## 7. Universal Column Metadata

<b>Column name from data</b>	<b>Descriptive column Name</b>	<b>Units</b>	<b>Oracle data type</b>	<b>Column description</b>
NEW_SPECIES_NAME	New species name	text	VARCHAR2(255 BYTE)	Updated taxonomic name
N_COUNT	Hauls with taxon counts	numeric	NUMBER(38,0)	Total number of hauls with positive count data.
N_HAUL	Valid hauls	count	NUMBER(38,0)	Total number of hauls.
N_LENGTH	Hauls with taxon lengths	count	NUMBER(38,0)	Total number of hauls with length data.
N_SAMPLE	Hauls with sample	count	NUMBER(38,0)	Total number of hauls with positive sample collection.
N_SPECIMENS	Number of specimens in the lot	count	NUMBER(38,0)	Number of specimens in the voucher lot
N_WEIGHT	Hauls with catch	count	NUMBER(38,0)	Total number of hauls with positive catch biomass.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
OLD_-SPECIES_-CODE	Old species code	ID key code	NUMBER(10,0)	Species code associated with old species name
OLD_-SPECIES_-NAME	Old species name	text	VARCHAR2(255 BYTE)	Taxonomic name previously used in the database
ORDER_-TAXON	Order phylogenetic rank	category	VARCHAR2(255 BYTE)	Phylogenetic latin rank of order of a given species.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
PERFORM	Haul performance code	category	NUMBER(3)	This denotes what, if any, issues arose during the haul. For more information, review the [code books]( <a href="https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual">https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual</a> ).
PHYLUM_-TAXON	Phylum phylogenetic rank	category	VARCHAR2(255 BYTE)	Phylogenetic latin rank of phylum of a given species.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
POLYGON_WKB	Polygon binary string	code string	VARCHAR2(BYTE)	Well-known binary (WKB) representation of geometry for a AREA_JOIN polygon. WKB is used to transfer and store the same information in a more compact form convenient for computer processing but that is not human-readable.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
POLYGON_WKT	Polygon well known text	code string	VARCHAR2(255 BYTE)	Well-known text (WKT) representation of geometry for a AREA_JOIN polygon. WKT is a text markup language for representing vector geometry objects.
POPULATION_COUNT	Estimated population	numeric	NUMBER(3)	The estimated population caught in the survey for a species, group, or total for a given survey.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
POPULATION_VAR	Estimated population variance	numeric	NUMBER(38,6)	The estimated population variance caught in the survey for a species, group, or total for a given survey.
PRESERVATION	Chemical specimen stored in	text	VARCHAR2(255 BYTE)	Chemical specimen currently stored in
PRINCIPAL_INVESTIGATOR	Principle investigator	text	VARCHAR2(255 BYTE)	First and last name of principal investigator for a project.
PROJECT_TITLE	Title of special project	text	VARCHAR2(255 BYTE)	Special project title.
PROJECT_TITLE_SHORT	Short title of special project	text	VARCHAR2(255 BYTE)	Special project short title (short version of PROJECT_TITLE).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
RANK_ID	Taxonomic rank	category	VARCHAR2(255 BYTE)	The taxonomic rank of a taxon identification.
REASON	Reason for taxonomic change	text	VARCHAR2(255 BYTE)	Reason for taxonomic change; pulled directly from online database (i.e. WoRMS or ITIS)

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
SAMPLE_TYPE	- Sample type	ID key code	NUMBER(3)	Sampling information on how the taxon was sampled. For a complete list of length_type ID key codes, review the [code books]( <a href="https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual">https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual</a> ).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
SCIENTIFIC_NAME	Taxon scientific name	text	VARCHAR2(255 BYTE)	The scientific name of the organism associated with the common_name and species_code columns. For a complete taxon list, review the [code books]( <a href="https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual">https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual</a> ).
SEX	Sex of a specimen	ID key code	NUMBER(3)	Sex of a specimen where "1" = "Male", "2" = "Female", "3" = Unsexed.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
SPECIES_CODE	Taxon code	ID key code	NUMBER(38,0)	The species code of the organism associated with the common_name and scientific_name columns.
SPECIES_NAME	Scientific name of species	text	VARCHAR2(255 BYTE)	Scientific name of species.
SPECIES_NAME_ACCEPTED	Scientific name used in taxonomic database	text	VARCHAR2(255 BYTE)	Scientific name of species used in taxonomic "DATABASE" column.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
SPECIES_NAME_SURVEY	Scientific name used in survey data	text	VARCHAR(255 BYTE)	Scientific name of species historically or currently used in the survey.
SPECIMEN_ID	Specimen unique ID	ID key code	NUMBER(38,0)	Each individual examined must have a number assigned to it that is unique within haul (0001 to 9999), though specimen numbers may be repeated between hauls

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
SPECIMEN_SAM-PLE-TYPE	Specimen sample type	ID key code	NUMBER(3)	The specimen sample type ID key code as defined in the RACE_-DATA.SPECIMEN_-SAM-PLE_-TYPES table. For a complete list of Specimen sample type ID key codes, review the [code books]( <a href="https://www.fisheries.noaa.gov/resource-species-code-manual-and-data-codes-manual">https://www.fisheries.noaa.gov/resource-species-code-manual-and-data-codes-manual</a> ).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
SPECIMEN_SUBSAM-PLE_-METHOD	Specimen subsample method	ID key code	NUMBER(38,0)	For a complete list of specimen subsample method ID key codes, review the [specie books](https://www.fisheries.noaa.gov/resource-survey-species-code-manual-and-data-codes-manual).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
SRVY	Survey abbreviation	text abbreviated	VARCHAR2(2 BYTE)	Abbreviated survey names. The column srvy is associated with the survey and survey_definition_id columns. Northern Bering Sea (NBS), Southeastern Bering Sea (EBS), Bering Sea Slope (BSS), Gulf of Alaska (GOA), Aleutian Islands (AI).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
STANDARD_LENGTH_MM	Standard length of specimens (mm)	numeric	VARCHAR2(255 BYTE)	Standard length of specimen or range of lengths if multiple specimens in lot; measured by taxonomists in lab
STATION	Station ID	ID key code	VARCHAR2(255 BYTE)	Alpha-numeric designation for the station established in the design of a survey.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
STRATUM	Stratum ID	ID key code	NUMBER(10,0)	RACE database statistical area for analyzing data. Strata were designed using bathymetry and other geo-graphic habitat-related elements. The strata are unique to each survey region. Stratum of value 0 indicates experimental tows.
SUBCLASS TAXON	Subclass phylogenetic rank	category	VARCHAR2( BYTE)	Phylogenetic latin rank of subclass of a given species.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
SUBFAMILY TAXON	Subfamily phylogenetic rank	category	VARCHAR2(255 BYTE)	Phylogenetic latin rank subfamily of a given species.
SUBMISSION DATE	Date	YYYY-MM-DD	DATE	Date special projects were due to be submitted for the upcoming survey season.
SUBORDER TAXON	Suborder phylogenetic rank	category	VARCHAR2(255 BYTE)	Phylogenetic latin rank suborder of a given species.
SUBPHYLUM TAXON	Subphylum phylogenetic rank	category	VARCHAR2(255 BYTE)	Phylogenetic latin rank subphylum of a given species.
SUPERCLASS TAXON	Superclass phylogenetic rank	category	VARCHAR2(255 BYTE)	Phylogenetic latin rank superclass of a given species.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
SUPERFAMILY_TAXON	Superfamily phylogenetic rank	category	VARCHAR2(255 BYTE)	Phylogenetic latin rank of superfamily of a given species.
SUPERORDER_TAXON	Superorder phylogenetic rank	category	VARCHAR2(255 BYTE)	Phylogenetic latin rank superorder of a given species.
SURFACE_TEMPERATURE_C	Surface temperature (degrees Celsius)	degrees Celsius	NUMBER(3) Celsius); NA	Surface temperature (tenths of a degree Celsius); NA indicates removed or missing values.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
SURVEY	Survey name	text	VARCHAR2(255 BYTE)	Name and description of survey. The column survey is associated with the srvy and survey_definition_id columns.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
SURVEY_DEFINITION_ID	Survey ID	ID key code	NUMBER(3)	The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey_definition_id is associated with the survey and survey columns. Full list of survey definition IDs are in RACE_DATA.SURVEY_DEFINITIONS and in the [code books]( <a href="https://www.fisheries.noaa.gov/resource/survey-species-code-manual-and-data-codes-manual">https://www.fisheries.noaa.gov/resource/survey-species-code-manual-and-data-codes-manual</a> ).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
SURVEY_ID	- Survey ID raw	ID key code	NUMBER(38,0)	The survey ID uniquely identifies a survey instance.
SURVEY_NAME	- Survey name official	text	VARCHAR2(BYTE)	Long name of the survey conducted
SURVEY_SPECIES	- Species used in survey	logical	BINARY_DOUBLE	Designates whether or not species name is accepted/actively used in the RACE surveys
TAXONOMY	Taxonomist text		VARCHAR2(BYTE)	Taxonomist(s) who re-identified specimen(s)

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
				<p>Confidence in the ability of the survey team to correctly identify the taxon to the specified level, based solely on identification skill (e.g., not likelihood of a taxon being caught at that station on a location-by-location basis).</p> <p>Quality codes follow:</p> <p>**High**: High confidence and consistency. Taxonomy is stable and reliable at this level, and field identification characteristics are well known and reliable.</p> <p>**Moderate**: </p>

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
				<p>Confidence in the ability of the survey team to correctly identify the taxon to the specified level, based solely on identification skill (e.g., not likelihood of a taxon being caught at that station on a location-by-location basis). Quality codes follow:</p> <p>**High**: High confidence and consistency. Taxonomy is stable and reliable at this level, and field identification characteristics are well known and reliable.</p> <p>**Moderate**: </p>

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
TRAWLABLE	Trawlable stations	logical	BINARY_DOUBLE	Logical, describing if stations are trawlable (TRUE) or not (FALSE).

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
VESSEL_CALLSIGN	Vessel call sign	ID key code	NUMBER(3)	A call sign is a designated sequence of letters and numbers that are assigned when a vessel, whether it be a sailing yacht, motor yacht, rib or commercial vessel, receives its Ship Radio Licence. The vessel also receives its MMSI number, so that each vessel is uniquely identified.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
VESSEL_- COAST_- GUARD_- NUMBER	Vessel coast guard number	ID key code	NUMBER(38,0)	Official Identification number as defined by <a href="http://www.dco.uscg.mil">www.dco.uscg.mil</a> . The Official Number (O/N) is the 6 or 7 digit number awarded to the vessel at the time it is first documented with the US Coast Guard. This number remains with the vessel indefinitely and should be marked in accordance with 46 CFR 67.121.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
VESSEL_ID	Vessel ID	ID key code	NUMBER(3)	<p>ID number of the vessel used to collect data for that haul. The column <code>vessel_id</code> is associated with the <code>vessel_name</code> column. Note that it is possible for a vessel to have a new name but the same vessel id number. For a complete list of vessel ID key codes, review the [code books](<a href="https://www.fisheries.noaa.gov/resource/survey-species-code-manual-and-data-codes-manual">https://www.fisheries.noaa.gov/resource/survey-species-code-manual-and-data-codes-manual</a>).</p>

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
VESSEL_IMO	Vessel international maritime organization number	ID key code	NUMBER(38,0)	The International Maritime Organization (IMO) number consists of the letters "IMO" followed by a seven-digit number: the pattern is "NNNNNNN", where N is a single-digit number, e.g., "1234567"
VESSEL_LENGTH_M	Vessel length (m)	meters	NUMBER(3,0)	The length of vessel in meters.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
VESSEL_-MMSI	Vessel maritime mobile service identities	ID key code	NUMBER(30,0)	Maritime Mobile Service Identities (MMSIs) are nine-digit numbers used by maritime digital selective calling systems (AIS) and certain other equipment to uniquely identify a ship or a coast radio station.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
VESSEL_NAME	Vessel name	text	VARCHAR2(2 BYTE)	<p>Name of the vessel used to collect data for that haul. The column vessel_name is associated with the vessel_id column. Note that it is possible for a vessel to have a new name but the same vessel id number. For a complete list of vessel ID key codes, review the [code books](<a href="https://www.fisheries.noaa.gov/resource/survey-species-code-manual-and-data-codes-manual">https://www.fisheries.noaa.gov/resource/survey-species-code-manual-and-data-codes-manual</a>).</p>

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
VESSEL_- OWNER	Vessel owner	text	VARCHAR2(255 BYTE)	Name of owner or company.
VESSEL_- TONNAGE	Vessel tonnage	metric tons	NUMBER(3)	The tonnage of vessel in metric tons.
VOUCHER	Voucher number	numeric	NUMBER(3,0)	The voucher number of specimen within a single haul
WEIGHT_- G	Specimen weight (g)	grams	NUMBER(3)	Weight of specimen (grams).
WEIGHT_- KG	Sample or taxon weight (kg)	kilograms	NUMBER(3,3)	Weight (thousands of a kilogram) of individuals in a haul by taxon.
WIRE_- LENGTH_- M	Trawl wire length	meters	NUMBER(3)	Length of wire deployed during a given haul in meters.

## 7. Universal Column Metadata

Column name from data	Descriptive column Name	Units	Oracle data type	Column description
WORMS	World register of marine species (WoRMS)	ID key (WoRMS) taxonomic serial number	NUMBER(38,0)	Species code as identified in the World Register of Marine Species (WoRMS) ( <a href="https://www.marinespecies.org/">https://www.marinespecies.org/</a> ).
YEAR	Survey year	year	NUMBER(1)	Year the observation (survey) was collected.
YEAR_CHANGED	Year changed	numeric	DATE	Year change implemented in database

**Part III.**

**AKFIN**

## *The Alaska Fisheries Information Network*

These data are used directly by stock assessors and are provided to The Alaska Fisheries Information Network (AKFIN).

## **The Alaska Fisheries Information Network**

The Alaska Fisheries Information Network (AKFIN) is a regional program that consolidates and supports the processing, analysis, and reporting of fisheries data for Alaskan fisheries. AKFIN integrates this information into a single data management system using consistent methods and standardized formats. The resulting data enables fishery managers, scientists, and associated agencies to supervise fisheries resources more effectively and efficiently. The AKFIN database contains much of the data needed to complete stock assessments, including GAP trawl survey data. .

## **Data Access Options**

Direct database connection If you are an AFSC employee you may access the AKFIN oracle database directly while on the NOAA network or VPN. Note that this is a separate database from the AFSC oracle database referenced above, and requires separate credentials. If you do not already have an AKFIN account you can request one here. NOAA IT will need to add AKFIN access to your tnsnames.ora file (They do this frequently). Once your connection is established data may be accessed through SQL queries using SQL developer, R, or python.

## **AKFIN Answers**

(AKFIN Answers)[<https://akfin.psmfc.org/akfin-answers/>] is an Oracle BI tool used for distributing data to stock assessors and other users. Usernames and passwords are distinct from AKFIN direct database credentials. The distribution of GAP\_PRODUCTS on AKFIN Answers is planned but not yet implemented. The RACE Survey tab on the stock assessment dashboard contains reports generated from now depreciated tables that predated the GAP\_PRODUCTS tables. AKFIN will keep these reports for reference but they will not be updated 2024 onward.

## Web Service

The screenshot shows the AKFIN Business Intelligence web platform. The top navigation bar includes links for Home, Catalog, Favorites, Dashboards, New, Open, and Signed In As Matt Callahan. The main content area is titled "RACE Survey Reports" and contains several sections of data tables:

- Shared RACE Data Tables:**
  - Aleutian Islands: AI - Age Composition Totals, AI - Biomass by Stratum, AI - Biomass by NMFS Reporting Area, AI - Biomass by NMFS Reporting Area and Summary Depth, AI - Biomass by Regulatory Area, AI - Biomass by Summary Depth, AI - Size Composition by Stratum, AI - Total Biomass.
  - Gulf of Alaska: GOA - Age Composition Totals, GOA - Biomass By Stratum, GOA - Biomass by NMFS Reporting Area, GOA - Biomass by NMFS Reporting Area and Summary Depth, GOA - Biomass by Regulatory Area, GOA - Biomass by Summary Depth, GOA - Size Composition by Stratum.
  - Eastern Bering Sea - Shelf: EBS Shelf - Age Composition - Standard, EBS Shelf - Age Composition - Plus NW Area, EBS Shelf - Biomass By Stratum Plus NW Area, EBS Shelf - Biomass for Grouped Species by Stratum Plus NW Area, EBS Shelf - Biomass for Stratum - Standard, EBS Shelf - Biomass for Stratum - Standard for Grouped Species, EBS Shelf - CPUE by Haul.
  - Eastern Bering Sea - Slope: EBS Slope - Biomass By Stratum, EBS Slope - Length Frequencies by Stratum - Standard Area, EBS Slope - Biomass by Strata.
  - Northern Bering Sea: NBS - Age Composition by Strata, NBS - Biomass by Strata, NBS - Size Composition by Strata.
- Lookup Tables and Translations:**
  - Gear Accessory Codes, Gear Code, Haul Type Codes, Species Codes, Stratum Descriptions, Survey/Cruise Information.

Figure 7.1.: AKFIN platfrom.

## Web Service

AKFIN has developed web services (apis) to distribute GAP data. Like the GAP\_PRODUCTS schema, these are under active development. These do not require VPN or an oracle connection but they are protected by Oracle authentication, please contact matt.callahan@noaa.gov for information on how to get an api token to use this option.

The url structure is “[https://apex.psmfc.org/akfin/data\\_marts/gap\\_products/gap-\[base table name\]](https://apex.psmfc.org/akfin/data_marts/gap_products/gap-[base table name])” . For example “[https://apex.psmfc.org/akfin/data\\_marts/gap\\_products/gap\\_biomass](https://apex.psmfc.org/akfin/data_marts/gap_products/gap_biomass)” is the base url to get data from the akfin\_biomass table. Web services linked to large tables have mandatory parameters to reduce

### *Cite this data*

data download size. For example to get agecomp data for Bering Sea pollock in area\_id 10 in 2022 you would use "[https://apex.psmfc.org/akfin/data-marts/gap\\_products/gap\\_biomass?survey\\_definition\\_id=98&area\\_id=10&species\\_code=21740&start\\_year=2022&end\\_year=2022](https://apex.psmfc.org/akfin/data-marts/gap_products/gap_biomass?survey_definition_id=98&area_id=10&species_code=21740&start_year=2022&end_year=2022)".

If you're using R to pull data through web services you might find the akfingapdata (pronounced akfin-gap-data not ak-eff-ing-app-data) R package helpful.

### **Cite this data**

Use the below bibtext citations, as cited in our group's citation repository for citing the data created and maintained in this repo (Alaska Fisheries Information Network (AKFIN), 2024). Add "note = {Accessed: mm/dd/yyyy}" to append the day this data was accessed.

## 8. Data description

AKFIN Answers is an Oracle BI tool used for distributing data to stock assessors and other users. Usernames and passwords are distinct from direct AKFIN database credentials.

### 8.1. Data tables

#### 8.1.1. AKFIN\_AGECOMP

Mirror of GAP\_PRODUCTS.AGECOMP. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 680,094

Number of columns: 10

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

SURVEY\_DEFINITION\_ID

Survey ID

ID key code

NUMBER(38,0)

## *8. Data description*

The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey\_definition\_id is associated with the srvy and survey columns. Full list of survey definition IDs are in RACE\_DATA.SURVEY\_DEFINITIONS and in the code books.

YEAR

Survey year

year

NUMBER(10,0)

Year the observation (survey) was collected.

AREA\_ID

Area ID

ID key code

NUMBER(38,0)

Area ID key code for each statistical area used to produce production estimates (e.g., biomass, population, age comps, length comps). Each area ID is unique within each survey.

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

SEX

Sex of a specimen

ID key code

NUMBER(38,0)

Sex of a specimen where "1" = "Male", "2" = "Female", "3" = Unsexed.

AGE

Taxon age bin (yrs)

## *8. Data description*

integer

NUMBER(38,0)

Age bin of taxon. Age bin of a taxon in years estimated by the age comp estimate. Age -9 indicates unaged lengths for a particular sex because no otoliths were collected for that sex/length combination. Age -99 indicates a case where no lengths were collected within a stratum for a species/year even though catch numbers were recorded.

POPULATION\_COUNT

Estimated population

numeric

NUMBER(38,0)

The estimated population caught in the survey for a species, group, or total for a given survey.

LENGTH\_MM\_MEAN

Mean length at age weighted by numbers at length

numeric

NUMBER(38,3)

Mean length (millimeters)

LENGTH\_MM\_SD

Standard deviation of length at age weighted by numbers at length

numeric

NUMBER(38,3)

Variance of mean length.

AREA\_ID\_FOOTPRINT

Survey Footprint

text

VARCHAR2(4000 BYTE)

Survey footprint, usually equivalent to the SURVEY\_DEFINITION\_ID with the exception of the Standard and Standard +NW survey footprints in the Eastern Bering Sea shelf bottom trawl survey

## *8. Data description*

### **8.1.2. AKFIN\_AREA**

Mirror of GAP\_PRODUCTS.AREA. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at (<https://github.com/afsc-gap-products/gap-products>). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 395

Number of columns: 9

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

DESIGN\_YEAR

Design year

year

NUMBER(10,0)

Year ID associated with a given value AREA\_ID. This field describes the changes in the survey design over time.

SURVEY\_DEFINITION\_ID

Survey ID

ID key code

NUMBER(38,0)

The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey\_definition\_id is associated with the srvy and survey columns. Full list of survey definition IDs are in RACE\_DATA.SURVEY\_DEFINITIONS and in the code books.

AREA\_ID

Area ID

## *8. Data description*

ID key code

NUMBER(38,0)

Area ID key code for each statistical area used to produce production estimates (e.g., biomass, population, age comps, length comps). Each area ID is unique within each survey.

AREA\_TYPE

Area ID type description

category

VARCHAR2(255 BYTE)

The type of stratum that AREA\_ID represents. Types include: STRATUM (the smallest building-block unit of area in these surveys), REGION, DEPTH, SUBAREA, INPFC BY DEPTH, INPFC, SUBAREA BY DEPTH, REGULATORY AREA, NMFS STATISTICAL AREA.

AREA\_NAME

Area ID name

text

VARCHAR2(4000 BYTE)

Descriptive name of each AREA\_ID. These names often identify the region, depth ranges, or other regional information for the area ID.

DESCRIPTION

Description

text

VARCHAR2(4000 BYTE)

Description of row observation.

AREA\_KM2

Area (km<sup>2</sup>)

kilometers squared

NUMBER(38,3)

Area in square kilometers.

DEPTH\_MIN\_M

## *8. Data description*

Area ID minimum depth (m)

meters

NUMBER(38,3)

Minimum depth (meters).

DEPTH\_MAX\_M

Area ID maximum depth (m)

meters

NUMBER(38,3)

Maximum depth (meters).

### **8.1.3. AKFIN\_BIOMASS**

Mirror of GAP\_PRODUCTS.BIOMASS. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 2,656,482

Number of columns: 16

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

SURVEY\_DEFINITION\_ID

Survey ID

ID key code

NUMBER(38,0)

## *8. Data description*

The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey\_definition\_id is associated with the srvy and survey columns. Full list of survey definition IDs are in RACE\_DATA.SURVEY\_DEFINITIONS and in the code books.

YEAR

Survey year

year

NUMBER(10,0)

Year the observation (survey) was collected.

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

AREA\_ID

Area ID

ID key code

NUMBER(38,0)

Area ID key code for each statistical area used to produce production estimates (e.g., biomass, population, age comps, length comps). Each area ID is unique within each survey.

CPUE\_KGKM2\_MEAN

Mean weight CPUE

kilograms per kilometers squared

NUMBER(38,6)

The mean catch weight (kilograms) per unit effort (area swept by the net, units squared kilometers).

CPUE\_NOKM2\_MEAN

Mean numeric CPUE

## *8. Data description*

count per kilometers squared

NUMBER(38,6)

The mean of numerical catch per unit effort (area swept by the net, units square kilometers).

N\_HAUL

Valid hauls

count

NUMBER(38,0)

Total number of hauls.

N\_WEIGHT

Hauls with catch

count

NUMBER(38,0)

Total number of hauls with positive catch biomass.

N\_COUNT

Hauls with taxon counts

numeric

NUMBER(38,0)

Total number of hauls with positive count data.

N\_LENGTH

Hauls with taxon lengths

count

NUMBER(38,0)

Total number of hauls with length data.

BIOMASS\_MT

Estimated biomass

numeric

NUMBER(38,6)

## *8. Data description*

The estimated total biomass.

BIOMASS\_VAR

Estimated biomass variance

numeric

NUMBER(38,6)

The estimated variance associated with the total biomass.

POPULATION\_COUNT

Estimated population

numeric

NUMBER(38,0)

The estimated population caught in the survey for a species, group, or total for a given survey.

POPULATION\_VAR

Estimated population variance

numeric

NUMBER(38,6)

The estimated population variance caught in the survey for a species, group, or total for a given survey.

CPUE\_KGKM2\_VAR

Variance of the mean weight CPUE

kilograms per kilometers squared

NUMBER(38,6)

The variance of mean catch weight (kilograms) per unit effort (area swept by the net, units squared kilometers).

CPUE\_NOKM2\_VAR

Variance of the mean numeric CPUE

count per kilometers squared

NUMBER(38,6)

## *8. Data description*

The variance of mean numerical catch per unit effort (area swept by the net, units square kilometers).

### **8.1.4. AKFIN\_CATCH**

Catch subsetted for standard GAP bottom trawl stations (i.e., HAULJOIN values associated with ABUNDANCE\_HAUL = Y in RACEBASE.HAUL). This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 06 September 2024.

Number of rows: 973,540

Number of columns: 6

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

CRUISEJOIN

Cruise ID

ID key code

NUMBER(38,0)

Unique integer ID assigned to each survey, vessel, and year combination.

HAULJOIN

Haul ID

ID key code

NUMBER(38,0)

This is a unique numeric identifier assigned to each (vessel, cruise, and haul) combination.

CATCHJOIN

## *8. Data description*

Catch observation ID

ID key code

NUMBER(38,0)

Unique integer ID assigned to each survey, vessel, year, and catch observation combination.

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

WEIGHT\_KG

Sample or taxon weight (kg)

kilograms

NUMBER(38,3)

Weight (thousandths of a kilogram) of individuals in a haul by taxon.

COUNT

Taxon count

count, whole number resolution

NUMBER(38,0)

Total whole number of individuals caught in haul or samples collected.

## *8. Data description*

### **8.1.5. AKFIN\_CPUE**

Mirror of GAP\_PRODUCTS.CPUE. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at (<https://github.com/afsc-gap-products/gap-products>). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 21,848,430

Number of columns: 7

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

HAULJOIN

Haul ID

ID key code

NUMBER(38,0)

This is a unique numeric identifier assigned to each (vessel, cruise, and haul) combination.

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

WEIGHT\_KG

Sample or taxon weight (kg)

kilograms

## *8. Data description*

NUMBER(38,3)

Weight (thousandths of a kilogram) of individuals in a haul by taxon.

COUNT

Taxon count

count, whole number resolution

NUMBER(38,0)

Total whole number of individuals caught in haul or samples collected.

AREA\_SWEPT\_KM2

Area swept (km)

kilometers

NUMBER(38,6)

The area the net covered while the net was fishing (kilometers squared), defined as the distance fished times the net width.

CPUE\_KGKM2

Weight CPUE (kg/km<sup>2</sup>)

kilograms per kilometers squared

NUMBER(38,6)

Catch weight (kilograms) per unit effort (area swept by the net, units square kilometers).

CPUE\_NOKM2

Number CPUE (no/km<sup>2</sup>)

count per kilometers squared

NUMBER(38,6)

Numerical catch per unit effort (area swept by the net, units square kilometers).

## *8. Data description*

### **8.1.6. AKFIN\_CRUISE**

Cruise data for the five standard GAP bottom trawl regions. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 174

Number of columns: 10

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

CRUISEJOIN

Cruise ID

ID key code

NUMBER(38,0)

Unique integer ID assigned to each survey, vessel, and year combination.

CRUISE

Cruise Name

ID key code

NUMBER(38,0)

This is a six-digit integer identifying the cruise number of the form: YYYY99 (where YYYY = year of the cruise; 99 = 2-digit number and is sequential; 01 denotes the first cruise that vessel made in this year, 02 is the second, etc.).

YEAR

Survey year

year

## *8. Data description*

NUMBER(10,0)

Year the observation (survey) was collected.

SURVEY\_DEFINITION\_ID

Survey ID

ID key code

NUMBER(38,0)

The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey\_definition\_id is associated with the srvy and survey columns. Full list of survey definition IDs are in RACE\_DATA.SURVEY\_DEFINITIONS and in the code books.

SURVEY\_NAME

Survey name official

text

VARCHAR2(255 BYTE)

Long name of the survey conducted

VESSEL\_ID

Vessel ID

ID key code

NUMBER(38,0)

ID number of the vessel used to collect data for that haul. The column vessel\_id is associated with the vessel\_name column. Note that it is possible for a vessel to have a new name but the same vessel id number. For a complete list of vessel ID key codes, review the code books.

VESSEL\_NAME

Vessel name

text

VARCHAR2(255 BYTE)

Name of the vessel used to collect data for that haul. The column vessel\_name is associated with the vessel\_id column. Note that it is possible for a vessel to have a

## *8. Data description*

new name but the same vessel id number. For a complete list of vessel ID key codes, review the code books.

DATE\_START

Start date

YYYY-MM-DD

DATE

The date (YYYY-MM-DD) of the beginning of the event (e.g., cruise).

DATE\_END

End date

YYYY-MM-DD

DATE

The date (YYYY-MM-DD) of the end of the event (e.g., cruise).

### **8.1.7. AKFIN\_HAUL**

Standard GAP bottom trawl haul (station) data. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 06 September 2024.

Number of rows: 34,263

Number of columns: 25

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

CRUISEJOIN

Cruise ID

## *8. Data description*

ID key code

NUMBER(38,0)

Unique integer ID assigned to each survey, vessel, and year combination.

HAULJOIN

Haul ID

ID key code

NUMBER(38,0)

This is a unique numeric identifier assigned to each (vessel, cruise, and haul) combination.

HAUL

Haul number

ID key code

NUMBER(38,0)

This number uniquely identifies a sampling event (haul) within a cruise. It is a sequential number, in chronological order of occurrence.

HAUL\_TYPE

Haul sampling type

ID key code

NUMBER(38,0)

Type of haul sampling method. For a complete list of haul type ID key codes, review the code books.

PERFORMANCE

Haul performance code

category

NUMBER(38,0)

This denotes what, if any, issues arose during the haul. For more information, review the code books.

DATE\_TIME\_START

Start date and time

## *8. Data description*

MM/DD/YYYY HH::MM

TIMESTAMP

The date (MM/DD/YYYY) and time (HH:MM) of the beginning of the haul. All dates and times are in Alaska time (AKDT) of Anchorage, AK, USA (UTC/GMT -8 hours).

DURATION\_HR

Tow duration (decimal hr)

hours

NUMBER(38,1)

This is the elapsed time between start and end of a haul (decimal hours).

DISTANCE\_FISHED\_KM

Distance fished (km)

degrees Celsius

NUMBER(38,3)

Distance the net fished (thousands of kilometers).

NET\_WIDTH\_M

Net width (m)

meters

NUMBER(38,1)

Measured or estimated distance (meters) between wingtips of the trawl.

NET\_MEASURED

Net measured during haul

logical

BINARY\_DOUBLE

Logical, describing if the net was measured (TRUE) or not (FALSE) by wheelhouse and marport programs during the haul.

NET\_HEIGHT\_M

Net height (m)

meters

## *8. Data description*

NUMBER(38,1)

Measured or estimated distance (meters) between footrope and headrope of the trawl.

STRATUM

Stratum ID

ID key code

NUMBER(10,0)

RACE database statistical area for analyzing data. Strata were designed using bathymetry and other geographic and habitat-related elements. The strata are unique to each survey region. Stratum of value 0 indicates experimental tows.

LATITUDE\_DD\_START

Start latitude (decimal degrees)

decimal degrees

NUMBER(38,6)

Latitude (one hundred thousandth of a decimal degree) of the start of the haul.

LATITUDE\_DD\_END

End latitude (decimal degrees)

decimal degrees

NUMBER(38,6)

Latitude (one hundred thousandth of a decimal degree) of the end of the haul.

LONGITUDE\_DD\_START

Start longitude (decimal degrees)

decimal degrees

NUMBER(38,6)

Longitude (one hundred thousandth of a decimal degree) of the start of the haul.

LONGITUDE\_DD\_END

End longitude (decimal degrees)

decimal degrees

## *8. Data description*

NUMBER(38,6)

Longitude (one hundred thousandth of a decimal degree) of the end of the haul.

STATION

Station ID

ID key code

VARCHAR2(255 BYTE)

Alpha-numeric designation for the station established in the design of a survey.

DEPTH\_GEAR\_M

Depth of gear (m)

degrees Celsius

NUMBER(38,1)

Depth of gear (meters).

DEPTH\_M

Depth (m)

degrees Celsius

NUMBER(38,1)

Bottom depth (meters).

BOTTOM\_TYPE

Seafloor bottom type code

ID key code

NUMBER(38,0)

Bottom type on sea floor at haul location. For a complete list of bottom type ID key codes, review the code books.

SURFACE\_TEMPERATURE\_C

Surface temperature (degrees Celsius)

degrees Celsius

NUMBER(38,1)

## *8. Data description*

Surface temperature (tenths of a degree Celsius); NA indicates removed or missing values.

GEAR\_TEMPERATURE\_C

Gear temperature (degrees Celsius)

degrees Celsius

NUMBER(38,1)

Temperature recorded by net gear (tenths of a degree Celsius); NA indicates removed or missing values.

WIRE\_LENGTH\_M

Trawl wire length

meters

NUMBER(38,0)

Length of wire deployed during a given haul in meters.

GEAR

Type of gear used on the net

ID key code

NUMBER(38,0)

Type of gear used on net. For a complete list of gear ID key codes, review the code books.

ACCESSORIES

Type of gear accessories used on the net

ID key code

NUMBER(38,0)

Type of accessories used on net. For a complete list of accessories ID key codes, review the code books.

## *8. Data description*

### **8.1.8. AKFIN\_LENGTH**

Length data subsetted for standard GAP bottom trawl stations (i.e., HAULJOIN values associated with ABUNDANCE\_HAUL = Y in RACEBASE.HAUL). This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 06 September 2024.

Number of rows: 4,456,403

Number of columns: 7

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

HAULJOIN

Haul ID

ID key code

NUMBER(38,0)

This is a unique numeric identifier assigned to each (vessel, cruise, and haul) combination.

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

SEX

Sex of a specimen

## *8. Data description*

ID key code

NUMBER(38,0)

Sex of a specimen where "1" = "Male", "2" = "Female", "3" = Unsexed.

FREQUENCY

Count of observation

count

NUMBER(38,0)

Frequency, or count, of an observation.

LENGTH\_MM

Length of a specimen

millimeters

NUMBER(10,0)

Length bin in millimeters. A length of -9 indicates cases where no lengths were collected within a stratum for a species/year, even though catch numbers were recorded.

LENGTH\_TYPE

Length type

ID key code

NUMBER(38,0)

How the taxon was measured (e.g., fork length, carapace width). For a complete list of length\_type ID key codes, review the code books.

SAMPLE\_TYPE

Sample type

ID key code

NUMBER(38,0)

Sampling information on how the taxon was sampled. For a complete list of length\_type ID key codes, review the code books.

## *8. Data description*

### **8.1.9. AKFIN\_METADATA\_COLUMN**

Mirror of GAP\_PRODUCTS.METADATA\_COLUMN. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 06 September 2024.

Number of rows: 170

Number of columns: 5

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

METADATA\_COLNAME

Column name

text

VARCHAR2(4000 BYTE)

Name of the column in a table.

METADATA\_COLNAME\_LONG

Column name spelled out

text

VARCHAR2(4000 BYTE)

Long name for the column.

METADATA\_UNITS

Units

category

VARCHAR2(4000 BYTE)

## *8. Data description*

Units of the column.

METADATA\_DATATYPE

Oracle datatype code

text

VARCHAR2(4000 BYTE)

Oracle data type of data column.

METADATA\_COLNAME\_DESC

Column description

text

VARCHAR2(4000 BYTE)

Description of the column.

### **8.1.10. AKFIN\_SIZECOMP**

Mirror of GAP\_PRODUCTS.SIZECOMP. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 3,284,606

Number of columns: 7

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

SURVEY\_DEFINITION\_ID

Survey ID

ID key code

## *8. Data description*

NUMBER(38,0)

The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey\_definition\_id is associated with the srvy and survey columns. Full list of survey definition IDs are in RACE\_DATA.SURVEY\_DEFINITIONS and in the code books.

YEAR

Survey year

year

NUMBER(10,0)

Year the observation (survey) was collected.

AREA\_ID

Area ID

ID key code

NUMBER(38,0)

Area ID key code for each statistical area used to produce production estimates (e.g., biomass, population, age comps, length comps). Each area ID is unique within each survey.

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

LENGTH\_MM

Length of a specimen

millimeters

NUMBER(10,0)

Length bin in millimeters. A length of -9 indicates cases where no lengths were collected within a stratum for a species/year, even though catch numbers were recorded.

## *8. Data description*

SEX

Sex of a specimen

ID key code

NUMBER(38,0)

Sex of a specimen where "1" = "Male", "2" = "Female", "3" = Unsexed.

POPULATION\_COUNT

Estimated population

numeric

NUMBER(38,0)

The estimated population caught in the survey for a species, group, or total for a given survey.

### **8.1.11. AKFIN\_SPECIMEN**

Specimen data subsetted for standard GAP bottom trawl stations (i.e., HAULJOIN values associated with ABUNDANCE\_HAUL = Y in RACEBASE.HAUL). This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 06 September 2024.

Number of rows: 589,317

Number of columns: 12

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

HAULJOIN

Haul ID

## *8. Data description*

ID key code

NUMBER(38,0)

This is a unique numeric identifier assigned to each (vessel, cruise, and haul) combination.

SPECIMEN\_ID

Specimen unique ID

ID key code

NUMBER(38,0)

Each individual examined must have a number assigned to it that is unique within each haul (0001 to 9999), though specimen numbers may be repeated between hauls

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

LENGTH\_MM

Length of a specimen

millimeters

NUMBER(10,0)

Length bin in millimeters. A length of -9 indicates cases where no lengths were collected within a stratum for a species/year, even though catch numbers were recorded.

SEX

Sex of a specimen

ID key code

NUMBER(38,0)

Sex of a specimen where "1" = "Male", "2" = "Female", "3" = Unsexed.

WEIGHT\_G

## *8. Data description*

Specimen weight (g)

grams

NUMBER(38,1)

Weight of specimen (grams).

AGE

Taxon age bin (yrs)

integer

NUMBER(38,0)

Age bin of taxon. Age bin of a taxon in years estimated by the age comp estimate. Age -9 indicates unaged lengths for a particular sex because no otoliths were collected for that sex/length combination. Age -99 indicates a case where no lengths were collected within a stratum for a species/year even though catch numbers were recorded.

MATURITY

Specimen maturity code

ID key code

NUMBER(38,0)

The maturity code or the condition identified by the maturity code.

GONAD\_G

Weight of gonads (g)

grams

NUMBER(38,1)

Weight of specimen gonads (grams).

SPECIMEN\_SUBSAMPLE\_METHOD

Specimen subsample method

ID key code

NUMBER(38,0)

For a complete list of specimen subsample method ID key codes, review the code books.

SPECIMEN\_SAMPLE\_TYPE

## *8. Data description*

Specimen sample type

ID key code

NUMBER(38,0)

The specimen sample type ID key code as defined in the RACE\_DATA.SPECIMEN\_SAMPLE\_TYPES table. For a complete list of Specimen sample type ID key codes, review the code books.

AGE\_DETERMINATION\_METHOD

Aging method

ID key code

NUMBER(10,0)

Numeric code corresponding to the method of age determination. For a complete list of age determination codes, review the code books.

### **8.1.12. AKFIN\_STRATUM\_GROUPS**

Mirror of GAP\_PRODUCTS.STRATUM\_GROUPS. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 768

Number of columns: 4

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

AREA\_ID

Area ID

ID key code

## *8. Data description*

NUMBER(38,0)

Area ID key code for each statistical area used to produce production estimates (e.g., biomass, population, age comps, length comps). Each area ID is unique within each survey.

SURVEY\_DEFINITION\_ID

Survey ID

ID key code

NUMBER(38,0)

The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey\_definition\_id is associated with the srvy and survey columns. Full list of survey definition IDs are in RACE\_DATA.SURVEY\_DEFINITIONS and in the code books.

DESIGN\_YEAR

Design year

year

NUMBER(10,0)

Year ID associated with a given value AREA\_ID. This field describes the changes in the survey design over time.

STRATUM

Stratum ID

ID key code

NUMBER(10,0)

RACE database statistical area for analyzing data. Strata were designed using bathymetry and other geographic and habitat-related elements. The strata are unique to each survey region. Stratum of value 0 indicates experimental tows.

## *8. Data description*

### **8.1.13. AKFIN\_SURVEY DESIGN**

Mirror of GAP\_PRODUCTS.SURVEY DESIGN. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 87

Number of columns: 3

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

SURVEY\_DEFINITION\_ID

Survey ID

ID key code

NUMBER(38,0)

The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey\_definition\_id is associated with the srvy and survey columns. Full list of survey definition IDs are in RACE\_DATA.SURVEY\_DEFINITIONS and in the code books.

YEAR

Survey year

year

NUMBER(10,0)

Year the observation (survey) was collected.

DESIGN\_YEAR

Design year

## *8. Data description*

year

NUMBER(10,0)

Year ID associated with a given value AREA\_ID. This field describes the changes in the survey design over time.

### **8.1.14. AKFIN\_TAXONOMIC\_CLASSIFICATION**

Mirror of GAP\_PRODUCTS.TAXONOMIC\_CLASSIFICATION, subsetting for SURVEY\_SPECIES = 1 includes taxonomic classification information accepted by the AFSC GAP bottom trawl survey. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 06 September 2024.

Number of rows: 2,718

Number of columns: 19

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

SPECIES\_NAME

Scientific name of species

text

VARCHAR2(255 BYTE)

Scientific name of species.

COMMON\_NAME

Taxon common name

text

VARCHAR2(255 BYTE)

## *8. Data description*

The common name of the marine organism associated with the scientific\_name and species\_code columns. For a complete species list, review the code books.

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

ID\_RANK

Lowest taxonomic rank

text

VARCHAR2(255 BYTE)

Lowest taxonomic rank of a given species entry.

DATABASE\_ID

Species ID in database

ID key code

VARCHAR2(255 BYTE)

Species ID key code of a species in the taxonomic “DATABASE” source.

DATABASE

Database source

category

VARCHAR2(255 BYTE)

Taxonomic database source, either ITIS or WoRMS.

GENUS\_TAXON

Genus phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of genus of a given species.

## *8. Data description*

SUBFAMILY\_TAXON

Subfamily phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of subfamily of a given species.

FAMILY\_TAXON

Family phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of family of a given species.

SUPERFAMILY\_TAXON

Superfamily phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of superfamily of a given species.

SUBORDER\_TAXON

Suborder phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of suborder of a given species.

ORDER\_TAXON

Order phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of order of a given species.

SUPERORDER\_TAXON

Superorder phylogenetic rank

## *8. Data description*

category  
VARCHAR2(255 BYTE)  
Phylogenetic latin rank of superorder of a given species.  
SUBCLASS\_TAXON  
Subclass phylogenetic rank  
category  
VARCHAR2(255 BYTE)  
Phylogenetic latin rank of subclass of a given species.  
CLASS\_TAXON  
Class phylogenetic rank  
category  
VARCHAR2(255 BYTE)  
Phylogenetic latin rank of class of a given species.  
SUPERCLASS\_TAXON  
Superclass phylogenetic rank  
category  
VARCHAR2(255 BYTE)  
Phylogenetic latin rank of superclass of a given species.  
SUBPHYLUM\_TAXON  
Subphylum phylogenetic rank  
category  
VARCHAR2(255 BYTE)  
Phylogenetic latin rank of subphylum of a given species.  
PHYLUM\_TAXON  
Phylum phylogenetic rank  
category  
VARCHAR2(255 BYTE)

## *8. Data description*

Phylogenetic latin rank of phylum of a given species.

KINGDOM\_TAXON

Kingdom phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of kingdom of a given species.

### **8.1.15. AKFIN\_TAXONOMIC\_GROUPS**

Mirror of GAP\_PRODUCTS.TAXON\_GROUPS. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 06 September 2024.

Number of rows: 2,758

Number of columns: 21

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

GROUP\_CODE

Species or Complex ID

ID key code

NUMBER(38,0)

Equivalent to the SPECIES\_CODE if the taxon is reported as a single taxon in GAP\_PRODUCTS, otherwise denotes a SPECIES\_CODE of a higher taxonomic group to which the taxon is aggregated in the GAP\_PRODUCTS CPUE and BIOMASS tables.

SPECIES\_CODE

## *8. Data description*

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

SPECIES\_NAME

Scientific name of species

text

VARCHAR2(255 BYTE)

Scientific name of species.

COMMON\_NAME

Taxon common name

text

VARCHAR2(255 BYTE)

The common name of the marine organism associated with the scientific\_name and species\_code columns. For a complete species list, review the code books.

ID\_RANK

Lowest taxonomic rank

text

VARCHAR2(255 BYTE)

Lowest taxonomic rank of a given species entry.

DATABASE

Database source

category

VARCHAR2(255 BYTE)

Taxonomic database source, either ITIS or WoRMS.

DATABASE\_ID

Species ID in database

## *8. Data description*

ID key code

VARCHAR2(255 BYTE)

Species ID key code of a species in the taxonomic “DATABASE” source.

GENUS\_TAXON

Genus phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of genus of a given species.

SUBFAMILY\_TAXON

Subfamily phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of subfamily of a given species.

FAMILY\_TAXON

Family phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of family of a given species.

SUPERFAMILY\_TAXON

Superfamily phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of superfamily of a given species.

INFRAORDER\_TAXON

Infraorder phylogenetic rank

category

VARCHAR2(255 BYTE)

## *8. Data description*

Infraorder phylogenetic rank. Phylogenetic latin rank of infraorder of a given species.

SUBORDER\_TAXON

Suborder phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of suborder of a given species.

ORDER\_TAXON

Order phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of order of a given species.

SUPERORDER\_TAXON

Superorder phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of superorder of a given species.

SUBCLASS\_TAXON

Subclass phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of subclass of a given species.

CLASS\_TAXON

Class phylogenetic rank

category

VARCHAR2(255 BYTE)

Phylogenetic latin rank of class of a given species.

SUPERCLASS\_TAXON

## *8. Data description*

Superclass phylogenetic rank  
category  
VARCHAR2(255 BYTE)  
Phylogenetic latin rank of superclass of a given species.  
SUBPHYLUM\_TAXON  
Subphylum phylogenetic rank  
category  
VARCHAR2(255 BYTE)  
Phylogenetic latin rank of subphylum of a given species.  
PHYLUM\_TAXON  
Phylum phylogenetic rank  
category  
VARCHAR2(255 BYTE)  
Phylogenetic latin rank of phylum of a given species.  
KINGDOM\_TAXON  
Kingdom phylogenetic rank  
category  
VARCHAR2(255 BYTE)  
Phylogenetic latin rank of kingdom of a given species.

## 9. Access data via Oracle and R

### Access data via Oracle (AFSC only)

AFSC Oracle users can access the database via SQL developer to view and pull the production data directly from the GAP\_PRODUCTS Oracle schema. The user can also use SQL developer to view and pull the GAP Products data directly from the GAP\_PRODUCTS Oracle schema.

#### 9.0.1. Connect to Oracle from R

Many users will want to access the data from Oracle using R. The user will need to install the RODBC R package and ask OFIS (IT) connect R to Oracle. Then, use the following code in R to establish a connection from R to Oracle:

Here, the user can establish the oracle connection by entering their username and password in the channel <- gapindex::oracle\_connect() function. Never save usernames or passwords in scripts that may be intentionally or unintentionally shared with others. If no username and password is entered in the function, pop-ups will appear on the screen asking for the username and password.

After you connect to VPN, you'll be able to log into Oracle.

```
library(RODBC)
channel <- gapindex::get_connected()
```

### Data SQL Query Examples:

*Data SQL Query Examples:*

```
library(gapindex)
library(RODBC)
library(flextable)
library(ggplot2)
library(magrittr)
library(dplyr)
```

### 9.0.1. Ex. Select all data from tables

You can download all of the tables locally using a variation of the code below. Once connected, pull and save the tables of interest into the R environment.

```
locations <- c(
  "GAP_PRODUCTS.AKFIN_AGECOMP",
  "GAP_PRODUCTS.AKFIN_AREA",
  "GAP_PRODUCTS.AKFIN BIOMASS",
  "GAP_PRODUCTS.AKFIN_CATCH",
  "GAP_PRODUCTS.AKFIN_CPUE",
  "GAP_PRODUCTS.AKFIN_CRUISE",
  "GAP_PRODUCTS.AKFIN_HAUL",
  "GAP_PRODUCTS.AKFIN_LENGTH",
  "GAP_PRODUCTS.AKFIN_METADATA_COLUMN",
  "GAP_PRODUCTS.AKFIN_SIZECOMP",
  "GAP_PRODUCTS.AKFIN_SPECIMEN",
  "GAP_PRODUCTS.AKFIN_STRATUM_GROUPS",
  "GAP_PRODUCTS.AKFIN_SURVEY DESIGN",
  "GAP_PRODUCTS.AKFIN_TAXONOMIC_CLASSIFICATION"
)

for (i in 1:length(locations)) {
  print(locations[i])
  a <- RODBC::sqlQuery(channel, paste0("SELECT * FROM ", locations[i]))
  write.csv(x = a, file = here::here("data", paste0(locations[i], ".csv")))
}
```

```
library(odbc)
library(RODBC)
library(dbplyr)
```

*Data SQL Query Examples:*

```
my_spp_codes <- c(
  30010, # Sebastolobus sp.    thornyhead unid.
  30020, # Sebastolobus alascanus shortspine thornyhead
  30025, # Sebastolobus macrochir broadfin thornyhead
  30330, # Sebastes melanops black rockfish
  30430, # Sebastes proriger redstripe rockfish
  30470, # Sebastes ruberrimus yelloweye rockfish
  30475, # Sebastes babcocki redbanded rockfish
  30535, # Sebastes variegatus harlequin rockfish
  30560, # Sebastes zacentrus sharpchin rockfish
  30600, # Sebastes reedi yellowmouth rockfish
  30030, # Sebastolobus altivelis longspine thornyhead
  30040, # Sebastes sp. rockfish unid.
  30100, # Sebastes brevispinis silvergray rockfish
  30150, # NA dusky and dark rockfishes unid.
  30152, # Sebastes variabilis dusky rockfish
  30170, # Sebastes crameri darkblotched rockfish
  30270) # Sebastes helvomaculatus rosethorn rockfish

a <- dplyr::tbl(channel, dplyr::sql('gap_products.akfin_biomass')) %>%
  dplyr::rename_all(tolower) %>%
  dplyr::select(survey_definition_id, area_id, species_code, year, biomass_mt, biomass_var)
  dplyr::filter(species_code %in% my_spp_codes &
      area_id %in% 99904 &
      year >= 1991) %>%
  dplyr::collect()

flextable::flextable(head(a)) %>%
  flextable::fit_to_width(max_width = 6) %>%
  flextable::theme_zebra()
```

### 9.0.2. Ex. CPUE for all EBS and NBS stations with associated haul, cruise, and species information.

```
a <- RODBC::sqlQuery(channel = channel, # NOT RACEBASE.HAUL
                      query = paste0(
                        ""
-- Select columns for output data
```

*Data SQL Query Examples:*

```
SELECT
cr.CRUISEJOIN,
cr.CRUISE,
cr.YEAR,
cr.SURVEY_DEFINITION_ID,
cr.SURVEY_NAME,
cr.VESSEL_ID,
cr.VESSEL_NAME,
cp.HAULJOIN,
cp.SPECIES_CODE,
tt.SPECIES_NAME,
tt.COMMON_NAME,
cp.WEIGHT_KG,
cp.COUNT,
cp.AREA_SWEEPED_KM2,
cp.CPUE_KGKM2,
cp.CPUE_NOKM2,
hh.HAUL,
hh.STATION

-- Identify what tables to pull data from
FROM GAP_PRODUCTS.AKFIN_HAUL hh
LEFT JOIN GAP_PRODUCTS.AKFIN_CRUISE cr
ON hh.CRUISEJOIN = cr.CRUISEJOIN
LEFT JOIN GAP_PRODUCTS.AKFIN_CPUE cp
ON hh.HAULJOIN = cp.HAULJOIN
LEFT JOIN GAP_PRODUCTS.TAXONOMIC_CLASSIFICATION tt
ON cp.SPECIES_CODE = tt.SPECIES_CODE

-- Filter for EBS and NBS observations
WHERE SURVEY_DEFINITION_ID IN (143, 98) -- 143 NBS, 98 EBS
AND tt.SURVEY_SPECIES = 1

-- Only return the first 3 rows because otherwise this would be a huge table!
FETCH FIRST 3 ROWS ONLY;"))

flextable::flextable(head(a[,2:8])) %>%
  flextable::fit_to_width(max_width = 6) %>%
  flextable::theme_zebra()
```

*Data SQL Query Examples:*

Table 9.1.: CPUE for all EBS and NBS stations with associated haul, cruise, and species information.

CRUISE	YEAR	SURVEY - DEFINITION_ID	SURVEY - NAME	VESSEL - ID	VESSEL - NAME	HAULJOIN
198,203	1,982	98	Eastern Bering Sea Crab/Groun Bottom Trawl Survey	1	CHAPMAN	877
198,203	1,982	98	Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey	1	CHAPMAN	878
198,203	1,982	98	Eastern Bering Sea Crab/Groun Bottom Trawl Survey	1	CHAPMAN	879

**9.0.3. Ex. CPUE for all stations contained in the INPFC Shumagin region (AREA\_ID = 919) for Pacific cod.**

```
dat <- RODBC::sqlQuery(channel = channel,
                        query =
                          "
-- Select columns for output data
SELECT
HAULJOIN,
SPECIES_CODE,
STRATUM,
LATITUDE_DD_START,
```

*Data SQL Query Examples:*

```

LONGITUDE_DD_START,
CPUE_KGKM2,
GEAR_TEMPERATURE_C

-- Identify what tables to pull data from
FROM GAP_PRODUCTS.AKFIN_CPUE cpue
LEFT JOIN GAP_PRODUCTS.AKFIN_HAUL haul
USING (HAULJOIN)

-- Filter for P. Cod observations
WHERE SPECIES_CODE IN (21720)

-- Select all stratum within the area_id 919 (INPFC Shumagin region)
AND haul.STRATUM IN
(
SELECT
STRATUM
FROM GAP_PRODUCTS.AKFIN_STRATUM_GROUPS
WHERE AREA_ID = 919
);"
)
```

```

dat <- dat %>%
  dplyr::select(HAULJOIN, STRATUM, SPECIES_CODE, LATITUDE_DD_START, LONGITUDE_DD_START, CPUE_KGKM2)
  dplyr::mutate(SPECIES_CODE = as.character(SPECIES_CODE),
                STRATUM = as.character(STRATUM)) %>%
  dplyr::arrange(SPECIES_CODE)

flextable::flextable(head(dat)) %>%
  flextable::fit_to_width(max_width = 6) %>%
  flextable::theme_zebra()
```

Table 9.2.: CPUE for all stations contained in the Shumagin region (AREA\_ID = 919).

HAULJOIN	STRATUM	SPECIES_CODE	LATITUDE_DD_START	LONGITUD_DD_START	CPUE_KGKM2	GEAR_TEMPERATURE_C
-12,880	210	21720	52.55793	-169.7829	6,863.3672	
-12,881	10	21720	52.63840	-169.7815	1,536.8594	4.9

*Data SQL Query Examples:*

HAULJOIN STRATUM	SPECIES_CODE	LATITUDE_DD_START	LONGITUDE_DD_START	CPUE_KGKM2	GEAR_TEMPERATURE_C
-12,882 111	21720	52.67131	-169.4279	10,044.840	4.7
-12,883 10	21720	53.24099	-168.0725	1,937.7294	5.2
-12,884 10	21720	53.16771	-167.9810	830.2039	5.1
-12,885 111	21720	53.06838	-167.6713	2,891.8092	4.9

#### 9.0.4. Ex. EBS Pacific Ocean perch CPUE and akgfmaps map

Pacific Ocean perch catch-per-unit-effort estimates for EBS in 2021 from GAP\_PRODUCTS.AKFIN\_CPUE and map constructed using akgfmaps. Here, we'll use AKFIN HAUL and CRUISES data also included in this repo, for convenience, though they are very similar to their RACEBASE analogs.

```
dat <- RODBC::sqlQuery(channel = channel,
                        query =
                        ""
-- Select columns for output data
SELECT
(cp.CPUE_KGKM2/100) CPUE_KGHA, -- akgfmaps is expecting hectares, but can take any units
hh.LATITUDE_DD_START LATITUDE,
hh.LONGITUDE_DD_START LONGITUDE

-- Use HAUL data to obtain LATITUDE & LONGITUDE and connect to cruisejoin
FROM GAP_PRODUCTS.AKFIN_CPUE cp
LEFT JOIN GAP_PRODUCTS.AKFIN_HAUL hh
ON cp.HAULJOIN = hh.HAULJOIN

-- Use CRUISES data to obtain YEAR and SURVEY_DEFINITION_ID
LEFT JOIN GAP_PRODUCTS.AKFIN_CRUISE cc
ON hh.CRUISEJOIN = cc.CRUISEJOIN

-- Filter data
WHERE cp.SPECIES_CODE = 30060
AND cc.SURVEY_DEFINITION_ID = 98
AND cc.YEAR = 2021;")
```

*Data SQL Query Examples:*

```
dat %>%
  dplyr::arrange(desc(CPUE_KGHA)) %>%
  head() %>%
  flextable::flextable() %>%
  flextable::fit_to_width(max_width = 6) %>%
  flextable::theme_zebra()
```

Table 9.3.: EBS Pacific Ocean perch CPUE and akgfmaps map.

CPUE_- KGHA	LATITUDE	LONGITUDE
10.1768965	57.64871	-173.3735
6.2734470	56.36952	-169.4604
3.0252034	56.66253	-171.9549
1.8214628	57.98912	-173.4816
0.5535672	55.65865	-168.1804
0.2813533	57.32545	-173.3217

```
# devtools::install_github("afsc-gap-products/akgfmaps", build_vignettes = TRUE)
library(akgfmaps)

figure <- akgfmaps::make_idw_map(
  x = dat, # Pass data as a data frame
  region = "bs.south", # Predefined EBS area
  set.breaks = "jenks", # Gets Jenks breaks from classint::classIntervals()
  in.crs = "+proj=longlat", # Set input coordinate reference system
  out.crs = "EPSG:3338", # Set output coordinate reference system
  grid.cell = c(20000, 20000), # 20x20km grid
  key.title = "Pacific Ocean perch") # Include in the legend title

[inverse distance weighted interpolation]
[inverse distance weighted interpolation]

figure$plot
```

### Data SQL Query Examples:

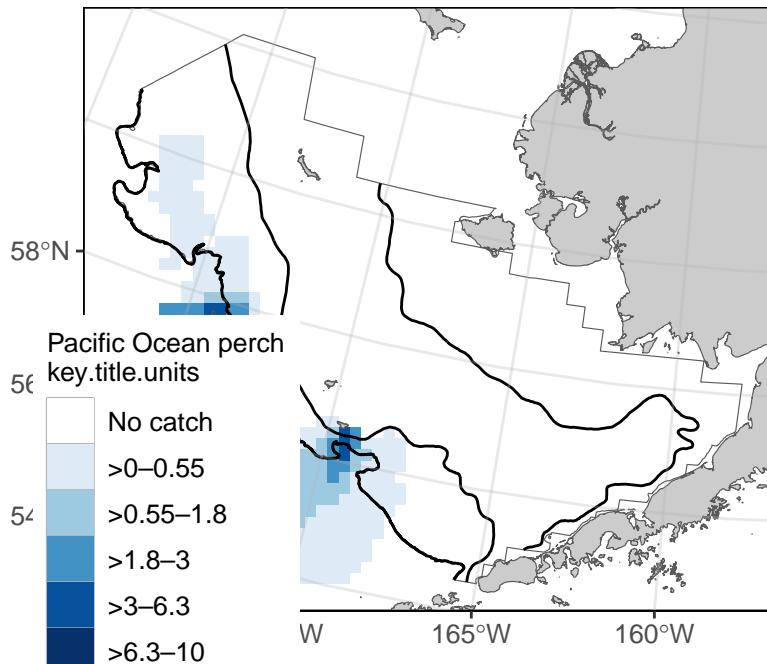


Figure 9.1.: EBS Pacific Ocean perch CPUE and akgfmaps map.

#### 9.0.5. Ex. GOA Pacific Ocean perch biomass and abundance

Biomass and abundance for Pacific Ocean perch from 1990 – 2023 for the western/central/eastern GOA management areas as well as for the entire region.

```
dat <- RODBC::sqlQuery(channel = channel,
                        query =
                        ""
-- Manipulate data to join to
WITH FILTERED_STRATA AS (
SELECT AREA_ID, DESCRIPTION FROM GAP_PRODUCTS.AKFIN_AREA
WHERE AREA_TYPE in ('REGULATORY AREA', 'REGION')
AND SURVEY_DEFINITION_ID = 47
-- Use the AREA records associated with the GOA stratification prior to 2025
AND DESIGN_YEAR = 1984)

-- Select columns for output data
SELECT
```

*Data SQL Query Examples:*

```
BIOMASS_MT,  
POPULATION_COUNT,  
YEAR,  
DESCRIPTION  
  
-- Identify what tables to pull data from  
FROM GAP_PRODUCTS.AKFIN_BIOMASS BIOMASS  
JOIN FILTERED_STRATA STRATA  
ON STRATA.AREA_ID = BIOMASS.AREA_ID  
  
-- Filter data results  
WHERE BIOMASS.SPECIES_CODE = 30060  
AND BIOMASS.YEAR BETWEEN 1990 AND 2023")
```

```
dat0 <- dat %>%  
  janitor::clean_names() %>%  
  dplyr::select(biomass_mt, population_count, year, area = description) %>%  
  pivot_longer(cols = c("biomass_mt", "population_count"),  
               names_to = "var",  
               values_to = "val") %>%  
  dplyr::mutate(  
    val = ifelse(var == "biomass_mt", val/1e6, val/1e9),  
    var = ifelse(var == "biomass_mt", "Biomass (Mmt)", "Population (B)'),  
    area = gsub(x = area, pattern = " - ", replacement = "\n"),  
    area = gsub(x = area, pattern = ": ", replacement = "\n"),  
    type = sapply(X = strsplit(x = area, split = "\n", fixed = TRUE), `[[`, 2)) %>%  
  dplyr::arrange(type) %>%  
  dplyr::mutate(  
    area = factor(area, levels = unique(area), labels = unique(area), ordered = TRUE))  
  
flextable::flextable(head(dat)) %>%  
  flextable::fit_to_width(max_width = 6) %>%  
  flextable::theme_zebra() %>%  
  flextable::colformat_num(x = ., j = "YEAR", big.mark = "")
```

*Data SQL Query Examples:*

Table 9.4.: GOA Pacific Ocean perch biomass and abundance.

BIOMASS_POPULATION	YEAR	DESCRIPTION
MT	COUNT	
31,074.24	60,111,107	CENTRAL 1990 GOA - INPFC
101,678.29	177,314,827	EASTERN 1990 GOA - INPFC
24,542.58	79,703,473	WESTERN 1990 GOA - INPFC
157,295.11	317,129,408	GOA 1990 Region: All Strata
256,485.83	454,379,671	CENTRAL 1993 GOA - INPFC
151,580.88	235,121,936	EASTERN 1993 GOA - INPFC

```
# install.packages("scales")
library(scales)
figure <- ggplot2::ggplot(
  dat = dat0,
  mapping = aes(x = year, y = val, color = type)) +
  ggplot2::geom_point(size = 3) +
  ggplot2::facet_grid(cols = vars(area), rows = vars(var), scales = "free_y") +
  ggplot2::scale_x_continuous(name = "Year", n.breaks = 3) +
  ggplot2::scale_y_continuous(name = "Estimate", labels = comma) +
  ggplot2::labs(title = 'GOA Pacific Ocean perch biomass and abundance 1990 - 2023') +
  ggplot2::guides(color=guide_legend(title = "Region Type"))+
  ggplot2::scale_color_grey() +
  ggplot2::theme_bw() +
  ggplot2::theme(legend.direction = "horizontal",
```

*Data SQL Query Examples:*

```
legend.position = "bottom")  
figure
```

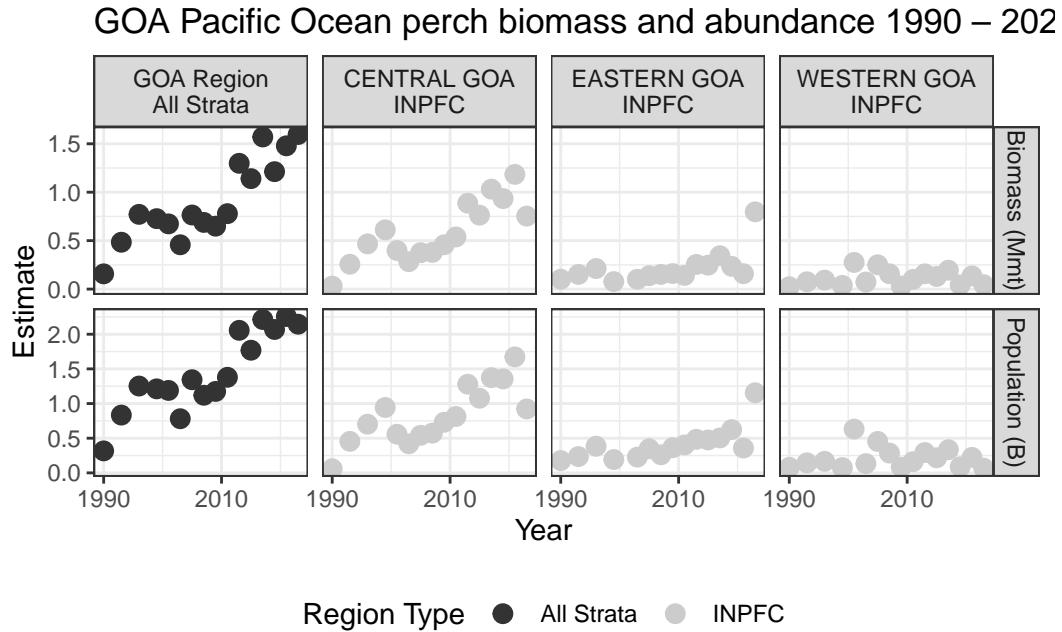


Figure 9.2.: GOA Pacific Ocean perch biomass and abundance.

### 9.0.6. Ex. AI rock sole size compositions and ridge plot

Northern and Southern rock sole size composition data from 1991 – 2022 for the Aleutian Islands, with Ridge plot from `ggridges`.

```
dat <- RODBC::sqlQuery(channel = channel,  
                        query = "  
SELECT  
YEAR,  
LENGTH_MM / 10 AS LENGTH_CM,  
SUM(POPULATION_COUNT) AS POPULATION_COUNT  
  
-- Identify what tables to pull data from
```

*Data SQL Query Examples:*

```
FROM GAP_PRODUCTS.AKFIN_SIZECOMP

-- 99904 is the AREA_ID that codes for the whole AI survey region
WHERE AREA_ID = 99904
-- including northern rock sole, southern rock sole, and rock sole unid.
AND SPECIES_CODE IN (10260, 10261, 10262)
-- remove the -9 LENGTH_MM code
AND LENGTH_MM > 0
-- sum over species_codes and sexes
GROUP BY (YEAR, LENGTH_MM)"
```

```
dat0 <- dat %>%
  janitor::clean_names() %>%
  head() %>%
  flextable::flextable() %>%
  flextable::fit_to_width(max_width = 6) %>%
  flextable::theme_zebra() %>%
  flextable::colformat_num(x = ., j = "year", big.mark = "")
```

dat0

Table 9.5.: AI Rock sole size compositions and ridge plot.

year	length_- population_- cm	count
1991	23	4,625,236
1991	38	2,254,964
1991	42	820,614
1991	52	11,225
1994	16	741,246
1994	26	9,762,322

```
# install.packages("ggridges")
library(ggridges)
figure <- ggplot(dat,
  mapping = aes(x = LENGTH_CM,
  y = YEAR,
```

*Data SQL Query Examples:*

```
height = POPULATION_COUNT,  
group = YEAR)) +  
ggridges::geom_density_ridges(stat = "identity", scale = 1) +  
ggplot2::ylab(label = "Year") +  
ggplot2::scale_x_continuous(name = "Length (cm)") +  
ggplot2::labs(title = paste0('Aleutian Islands Rock sole Size Compositions'),  
             subtitle = paste0(min(dat$YEAR), ' - ', max(dat$YEAR))) +  
ggplot2::theme_bw()  
  
figure
```

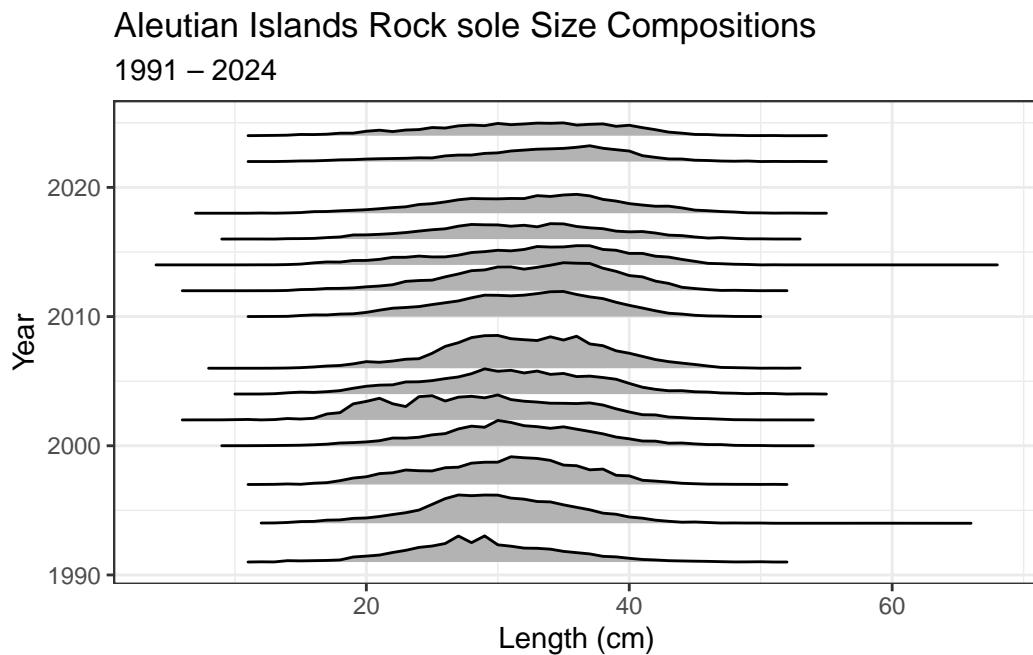


Figure 9.3.: AI Rock sole size compositions and ridge plot.

#### **9.0.7. Ex. 2023 EBS Walleye Pollock Age Compositions and Age Pyramid**

Walleye pollock age composition for the EBS standard + NW Area from 2023, with age pyramid plot.

*Data SQL Query Examples:*

```
dat <- RODBC::sqlQuery(channel = channel,
                        query = "
-- Manipulate data to join to
WITH FILTERED_STRATA AS (
SELECT
AREA_ID,
DESCRIPTION
FROM GAP_PRODUCTS.AKFIN_AREA
-- Filter for EBS Standard + NW Area
WHERE AREA_ID = 99900)

-- Select columns for output data
SELECT
AGECOMP.AGE,
AGECOMP.POPULATION_COUNT,
AGECOMP.SEX

-- Identify what tables to pull data from
FROM GAP_PRODUCTS.AKFIN_AGECOMP AGECOMP
JOIN FILTERED_STRATA STRATA
ON STRATA.AREA_ID = AGECOMP.AREA_ID

-- Filter data results
WHERE SPECIES_CODE = 21740
AND YEAR = 2023
AND AGE >= 0")
```

```
dat0 <- dat %>%
  janitor::clean_names() %>%
  dplyr::filter(sex %in% c(1,2)) %>%
  dplyr::mutate(
    sex = ifelse(sex == 1, "M", "F"),
    population_count = # change male population to negative
      ifelse(sex=="M", population_count*(-1), population_count*1)/1e9)

flextable::flextable(head(dat)) %>%
  flextable::fit_to_width(max_width = 6) %>%
  flextable::theme_zebra()
```

*Data SQL Query Examples:*

Table 9.6.: EBS Walleye Pollock Age Compositions and Age Pyramid.

AGE	POPULATION COUNT	SEX
1	22,107,475	1
2	123,357,791	1
3	136,795,031	1
4	253,072,637	1
5	967,413,018	1
6	242,965,335	1

```
figure <- ggplot2::ggplot(
  data = dat0,
  mapping =
    aes(x = age,
        y = population_count,
        fill = sex)) +
  ggplot2::scale_fill_grey() +
  ggplot2::geom_bar(stat = "identity") +
  ggplot2::coord_flip() +
  ggplot2::scale_x_continuous(name = "Age") +
  ggplot2::scale_y_continuous(name = "Population (billions)", labels = abs) +
  ggplot2::ggtitle(label = "2023 EBS (Standard Area + NW) walleye pollock Age Composition") +
  ggplot2::guides(fill = guide_legend(title = "Sex"))+
  ggplot2::theme_bw()

figure
```

*Data SQL Query Examples:*

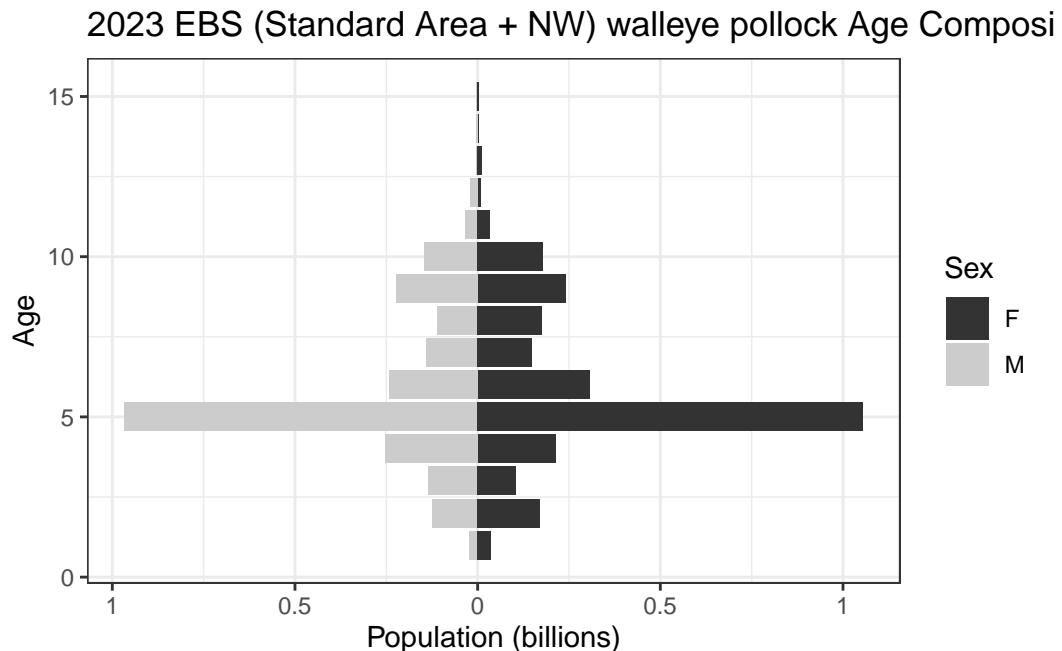


Figure 9.4.: 2023 EBS Walleye Pollock Age Compositions and Age Pyramid.

#### 9.0.8. Ex. NBS Pacific cod biomass and abundance

Pacific cod biomass and abundance data for the NBS by stratum.

```
dat <- RODBC::sqlQuery(channel = channel,
                        query =
                        "
SELECT YEAR, AREA_ID AS STRATUM, AREA_NAME, BIOMASS_MT, POPULATION_COUNT
FROM GAP_PRODUCTS.AKFIN_BIOMASS

JOIN ( -- join with area table
SELECT AREA_ID, AREA_NAME
FROM GAP_PRODUCTS.AKFIN_AREA
WHERE AREA_TYPE = 'STRATUM'
AND SURVEY_DEFINITION_ID = 143
AND DESIGN_YEAR = 2022)

USING (AREA_ID)
```

*Data SQL Query Examples:*

```
-- Filter data results to NBS Pacific cod
WHERE SURVEY_DEFINITION_ID IN 143
AND SPECIES_CODE = 21720
ORDER BY YEAR, STRATUM")
```

```
dat0 <- dat %>%
  janitor::clean_names() %>%
  dplyr::select(year, area_name, biomass_mt, population_count) %>%
  pivot_longer(cols = c("biomass_mt", "population_count"),
               names_to = "var",
               values_to = "val") %>%
  dplyr::mutate(
    val = ifelse(var == "biomass_mt", val/1e6, val/1e9),
    var = ifelse(var == "biomass_mt", "Biomass (Mmt)", "Population (B)"),
    area = factor(area_name, levels = unique(area_name), labels = unique(area_name), ordered = TRUE))
flextable::flextable(dat) %>%
  flextable::fit_to_width(max_width = 6) %>%
  flextable::theme_zebra() %>%
  flextable::colformat_num(x = ., j = "YEAR", big.mark = "")
```

Table 9.7.: NBS Pacific cod biomass and abundance.

YEAR	STRATUM	AREA_NAME	BIOMASS_MT	POPULATION_COUNT
2010	70	Inner Domain	7,462.5586	4,724,153
2010	71	Inner Domain	20,983.3757	3,928,600
2010	81	Middle Domain	680.4357	250,837
2017	70	Inner Domain	132,490.1518	186,187,245
2017	71	Inner Domain	147,971.4565	65,078,489

*Data SQL Query Examples:*

YEAR	STRATUM	AREA_NAME	BIOMASS_MT	POPULATION_COUNT
2017	81	Middle Domain	7,089.8740	4,191,118
2019	70	Inner Domain	107,096.72	102,734,142
2019	71	Inner Domain	194,846.72	38,495,085
2019	81	Middle Domain	63,061.278	25,926,805
2021	70	Inner Domain	95,849.983	38,767,498
2021	71	Inner Domain	53,814.633	17,941,471
2021	81	Middle Domain	77,917.108	32,991,939
2022	70	Inner Domain	96,500.697	60,433,135
2022	71	Inner Domain	26,747.074	10,447,602
2022	81	Middle Domain	30,487.278	15,157,597
2023	70	Inner Domain	76,708.432	39,605,860
2023	71	Inner Domain	19,130.004	8,459,469
2023	81	Middle Domain	12,507.8566	4,128,368

```
figure <- ggplot2::ggplot(
  dat = dat0,
  mapping = aes(y = val, x = year, fill = area)) +
  ggplot2::geom_bar(position="stack", stat="identity") +
  ggplot2::facet_grid(rows = vars(var), scales = "free_y") +
```

*Data SQL Query Examples:*

```
ggplot2::scale_y_continuous(name = "Estimate", labels = comma) +  
ggplot2::scale_x_continuous(name = "Year", breaks = unique(dat0$year)) +  
ggplot2::labs(title = 'NBS Pacific cod biomass and abundance by stratum') +  
ggplot2::guides(fill=guide_legend(title = "Domain Type"))+  
ggplot2::scale_fill_grey() +  
ggplot2::theme_bw() +  
ggplot2::theme(legend.direction = "horizontal",  
              legend.position = "bottom")
```

```
figure
```

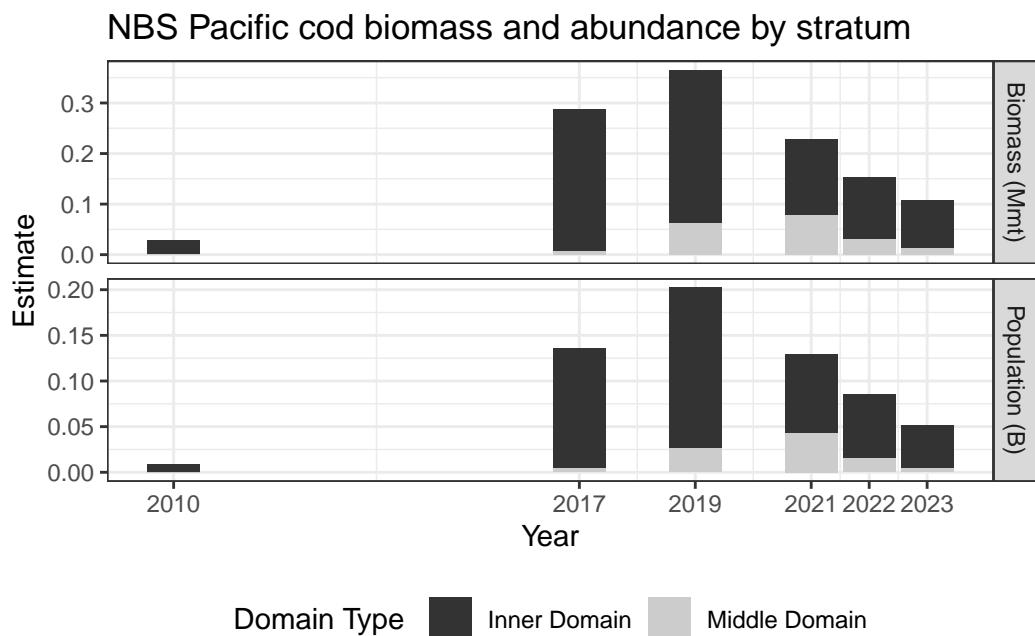


Figure 9.5.: NBS Pacific cod biomass and abundance.

#### 9.0.9. Ex. GOA Pacific Ocean perch biomass and line plot

Pacific Ocean perch biomass totals for GOA between 1984-2021 from GAP\_PRODUCTS.AKFIN\_BIOMASS

*Data SQL Query Examples:*

```

dat <- RODBC::sqlQuery(channel = channel,
                        query = "
-- Select columns for output data
SELECT
SURVEY_DEFINITION_ID,
BIOMASS_MT / 1000000 AS BIOMASS_MMT,
(BIOMASS_MT - 2 * SQRT(BIOMASS_VAR)) / 1000000 AS BIOMASS_CI_DW,
(BIOMASS_MT + 2 * SQRT(BIOMASS_VAR)) / 1000000 AS BIOMASS_CI_UP,
YEAR

-- Identify what tables to pull data from
FROM GAP_PRODUCTS.AKFIN_BIOMASS

-- Filter data results
WHERE SPECIES_CODE = 30060
AND SURVEY_DEFINITION_ID = 47
AND AREA_ID = 99903
AND YEAR BETWEEN 1990 AND 2023" ) %>%
  janitor::clean_names()

```

```

flextable::flextable(head(dat)) %>%
  flextable::fit_to_width(max_width = 6) %>%
  flextable::theme_zebra() %>%
  flextable::colformat_num(x = ., j = "year", big.mark = "")

```

Table 9.8.: GOA Pacific Ocean perch biomass and line plot.

survey_definition_id	biomass_mmt	biomass_ci_dw	biomass_ci_up	year
47	0.1572951	0.06303638	0.2515538	1990
47	0.4836226	0.26633581	0.7009093	1993
47	0.7714128	0.36430515	1.1785204	1996
47	0.7270635	0.05006854	1.5041955	1999
47	0.6731551	0.22914901	1.1171611	2001

*Data SQL Query Examples:*

survey_definition_id	biomass_mmt	biomass_ci_dw	biomass_ci_up	year
47	0.4574216	0.31339204	0.6014511	2003

```
a_mean <- dat %>%
  dplyr::group_by(survey_definition_id) %>%
  dplyr::summarise(biomass_mmt = mean(biomass_mmt, na.rm = TRUE),
                    minyr = min(year, na.rm = TRUE),
                    maxyr = max(year, na.rm = TRUE))

figure <-
  ggplot(data = dat,
         mapping = aes(x = year,
                        y = biomass_mmt)) +
  ggplot2::geom_point(size = 2.5, color = "grey40") +
  ggplot2::scale_x_continuous(
    name = "Year",
    labels = scales::label_number(
      accuracy = 1,
      big.mark = "")) +
  ggplot2::scale_y_continuous(
    name = "Biomass (Mmt)",
    labels = comma) +
  ggplot2::geom_segment(
    data = a_mean,
    mapping = aes(x = minyr,
                  xend = maxyr,
                  y = biomass_mmt,
                  yend = biomass_mmt),
    linetype = "dashed",
    linewidth = 2) +
  ggplot2::geom_errorbar(
    mapping = aes(ymin = biomass_ci_dw, ymax = biomass_ci_up),
    position = position_dodge(.9),
    alpha = 0.5, width=.2) +
  ggplot2::ggtitle(
    label = "GOA Pacific Ocean Perch Biomass 1984-2021",
    subtitle = paste0("Mean = ",
                     formatC(x = a_mean$biomass_mmt,
```

*Data SQL Query Examples:*

```
    digits = 2,
    big.mark = ",",
    format = "f"),
" Mmt")) +
ggplot2::theme_bw()

figure
```

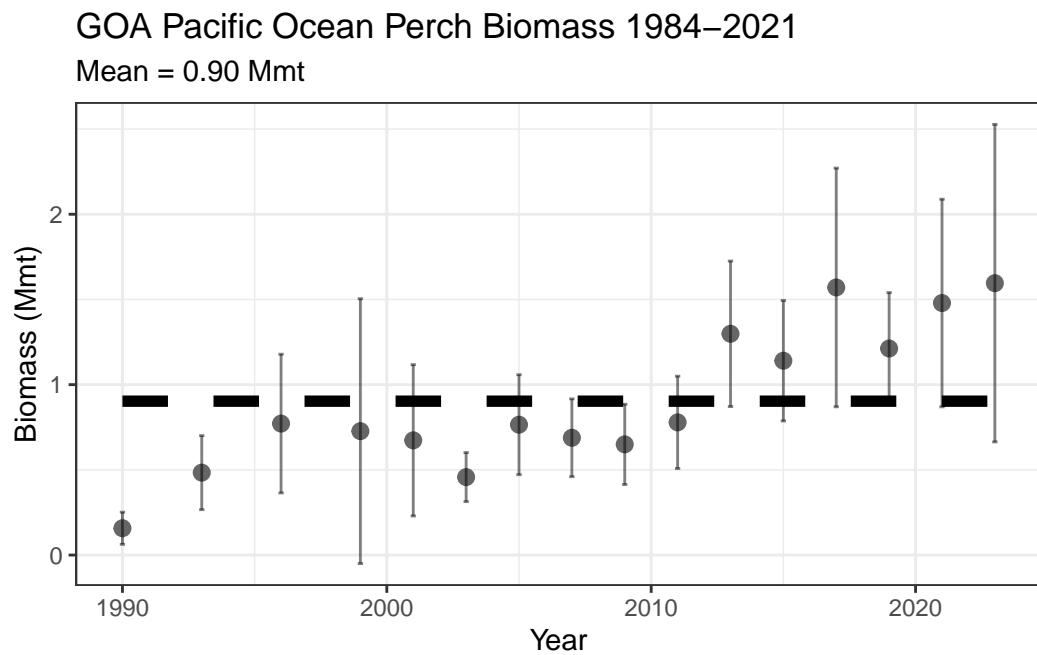


Figure 9.6.: GOA Pacific Ocean perch biomass and line plot.

### 9.0.10. Ex. 2022 AI Atka mackerel age specimen summary

#### 9.0.10.1. All ages determined:

```
dat <- RODBC::sqlQuery(channel = channel,
                        query =
-- Select columns for output data
SELECT SURVEY_DEFINITION_ID, YEAR, SPECIES_CODE, AGE
```

*Data SQL Query Examples:*

```
-- Identify what tables to pull data from
FROM GAP_PRODUCTS.AKFIN_SPECIMEN
JOIN (SELECT HAULJOIN, CRUISEJOIN FROM GAP_PRODUCTS.AKFIN_HAUL)
USING (HAULJOIN)
JOIN (SELECT CRUISEJOIN, YEAR, SURVEY_DEFINITION_ID FROM GAP_PRODUCTS.AKFIN_CRUISE)
USING (CRUISEJOIN)

-- Filter data results
WHERE GAP_PRODUCTS.AKFIN_SPECIMEN.SPECIMEN_SAMPLE_TYPE = 1
AND SPECIES_CODE = 21921
AND YEAR = 2022
AND SURVEY_DEFINITION_ID = 52") %>%
  janitor::clean_names()
```

```
flextable::flextable(head(dat) %>%
  dplyr::arrange(age)) %>%
  flextable::fit_to_width(max_width = 6) %>%
  flextable::theme_zebra() %>%
  flextable::colformat_num(x = ., j = c("year", "species_code"), big.mark = "")
```

Table 9.9.: 2022 Al Atka mackerel age specimen summary: all ages determined.

survey_definition_id	year	species_code	age
52	2022	21921	3
52	2022	21921	3
52	2022	21921	4
52	2022	21921	4
52	2022	21921	4
52	2022	21921	7

*Data SQL Query Examples:*

**9.0.10.2. How many of each age was found:**

```
dat <- RODBC::sqlQuery(channel = channel,
                        query = "
-- Select columns for output data
SELECT SURVEY_DEFINITION_ID, YEAR, SPECIES_CODE, AGE,
COUNT(AGE) AS COUNTAGE

-- Identify what tables to pull data from
FROM GAP_PRODUCTS.AKFIN_SPECIMEN
JOIN (SELECT HAULJOIN, CRUISEJOIN FROM GAP_PRODUCTS.AKFIN_HAUL)
USING (HAULJOIN)
JOIN (SELECT CRUISEJOIN, YEAR, SURVEY_DEFINITION_ID FROM GAP_PRODUCTS.AKFIN_CRUISE)
USING (CRUISEJOIN)

-- Filter data results
WHERE AGE >= 0
AND SPECIES_CODE = 21921
AND YEAR = 2022
AND SURVEY_DEFINITION_ID = 52
GROUP BY (YEAR, SURVEY_DEFINITION_ID, SPECIES_CODE, AGE)

ORDER BY AGE") %>%
  janitor::clean_names()

flextable::flextable(dat) %>%
  flextable::fit_to_width(max_width = 6) %>%
  flextable::theme_zebra() %>%
  flextable::colformat_num(x = ., j = c("year", "species_code"), big.mark = "")
```

Table 9.10.: Ex.: 2022 AI Atka mackerel age specimen summary: how many of each age were determined.

survey_definition_id	year	species_code	age	countage
52	2022	21921	1	1

*Data SQL Query Examples:*

survey_definition_id	year	species_code	age	countage
52	2022	21921	2	40
52	2022	21921	3	295
52	2022	21921	4	119
52	2022	21921	5	130
52	2022	21921	6	116
52	2022	21921	7	108
52	2022	21921	8	61
52	2022	21921	9	88
52	2022	21921	10	73
52	2022	21921	11	20
52	2022	21921	12	9
52	2022	21921	13	1

#### 9.0.10.3. How many otoliths were aged:

Using SQL

```
dat <- RODBC::sqlQuery(channel = channel,
                        query = "
-- Select columns for output data
SELECT SURVEY_DEFINITION_ID, YEAR, SPECIES_CODE,
COUNT(AGE) AS COUNTAGE

-- Identify what tables to pull data from
FROM GAP_PRODUCTS.AKFIN_SPECIMEN
JOIN (SELECT HAULJOIN, CRUISEJOIN FROM GAP_PRODUCTS.AKFIN_HAUL)
USING (HAULJOIN)
JOIN (SELECT CRUISEJOIN, YEAR, SURVEY_DEFINITION_ID FROM GAP_PRODUCTS.AKFIN_CRUISE)
USING (CRUISEJOIN)
```

*Data SQL Query Examples:*

```
-- Filter data results
WHERE GAP_PRODUCTS.AKFIN_SPECIMEN.SPECIMEN_SAMPLE_TYPE = 1
AND SPECIES_CODE = 21921
AND YEAR = 2022
AND SURVEY_DEFINITION_ID = 52
GROUP BY (YEAR, SURVEY_DEFINITION_ID, SPECIES_CODE)") %>%
  janitor::clean_names()
```

Using dbplyr:

```
library(odbc)
library(keyring)
library(dplyr)
library(dbplyr)

channel <- DBI::dbConnect(odbc::odbc(), "akfin", uid = keyring::key_list("akfin")$username,
                           pwd = keyring::key_get("akfin", keyring::key_list("akfin")$username))

dat <- dplyr::tbl(src = channel, dplyr::sql('gap_products.akfin_specimen')) %>%
  dplyr::rename_all(tolower) %>%
  dplyr::select(hauljoin, specimen = specimen_id, species_code, length = length_mm,
                weight = weight_g, age, sex, age_method = age_determination_method) %>%
  dplyr::left_join(dplyr::tbl(akfin, dplyr::sql('gap_products.akfin_haul')) %>%
    dplyr::rename_all(tolower) %>%
    dplyr::select(cruisejoin, hauljoin, haul, date_collected = date_time,
                  latitude = latitude_dd_start, longitude = longitude_dd,
                  by = join_by(hauljoin)) %>%
    dplyr::left_join(dplyr::tbl(akfin, dplyr::sql('gap_products.akfin_cruise')) %>%
      dplyr::rename_all(tolower) %>%
      dplyr::select(cruisejoin, year, vessel = vessel_id, survey_definition =
                    by = join_by(cruisejoin)) %>%
    dplyr::filter(year == YEAR &
                  survey_definition_id == 52 &
                  species_code %in% spp_codes &
                  !is.na(age)) %>%
  dplyr::collect()
```

Both scripts will produce this table:

*Data SQL Query Examples:*

```
flextable::flextable(head(dat)) %>%
  flextable::fit_to_width(max_width = 6) %>%
  flextable::theme_zebra() %>%
  flextable::colformat_num(x = ., j = c("year", "species_code"), big.mark = "")
```

Table 9.11.: 2022 Al Atka mackerel age specimen summary: how many otoliths were aged. This query was created using SQL.

survey_definition_id	year	species_code	countage
52	2022	21921	1,061

## 10. Access API data via R

AKFIN has developed web services (apis) to distribute GAP data. Like the GAP\_PRODUCTS schema, these are under active development. These do not require VPN or an oracle connection but they are protected by Oracle authentication, please contact matt.callahan@noaa.gov for information on how to get an api token to use this option.

The url structure is "https://apex.psmfc.org/akfin/data\_marts/gap\_products/gap-[base table name]" . For example "https://apex.psmfc.org/akfin/data\_marts/gap\_products/gap\_biomass" is the base url to get data from the akfin\_biomass table. Web services linked to large tables have mandatory parameters to reduce data download size. For example to get agecomp data for Bering Sea pollock in area\_id 10 in 2022 you would use "https://apex.psmfc.org/akfin/data\_marts/gap\_products/gap\_biomass?survey\_definition\_id=98&area\_id=10&species\_code=21740&start\_year=2022&end\_year=2022".

If you're using R to pull data through web services you might find the akfingapdata (pronounced **akfin-gap-data** not **ak-eff-ing-app-data**) R package helpful.

### 10.0.1. Load packages and helpful functions

### 10.1. Ex. Direct database query in R using the akfingapdata R package README:

Sign into akfin with token (need to request token from AKFIN)

```
akfingapdata::get_gap_catch() [,1:6] %>%  
  head() %>%  
  flextable::flextable() %>%  
  flextable::theme_zebra()
```

**Part IV.**

**Public Data (FOSS)**

The final, validated survey data are publicly accessible soon after surveys are completed on the Fisheries One Stop Shop (FOSS) platform. This data includes catch, haul, and environmental data collected at each station. On the FOSS data platform, users can interactively select, view, and download data. Descriptive documentation and user-examples are available on the metadata page.

This data contains all of the catch, environmental, and haul data from the fisheries-independent Groundfish and Shellfish Assessment Program surveys in the Bering Sea, Aleutian Islands, and Gulf of Alaska. This data is sought after by the general public, private entities, and NOAA partners alike, including tribal organizations, K-12 classrooms, academic institutions, for-profit groups, and non-profit groups. This data is compiled and approved once a year after each summer survey season and is available for open access.

**Part V.**

**Collaborators and data users**

## *Access Constraints*

Below are a few packages and products currently using this data. If you have developed a product, performed an analysis, or exhibited this data in any way, reach out so we can showcase your hard work.

- **NOAA Fisheries Distribution Mapping and Analysis Portal;** *NOAA Fisheries Office of Science and Technology*
- **Pull data with python and explore the in-browser visualization tool. Reference their example Python notebook;** *The Eric and Wendy Schmidt Center for Data Science and the Environment at UC Berkeley, including sam.pottinger@berkeley.edu, ccmartinez@berkeley.edu, gzarpellon@berkeley.edu, and kkoy@berkeley.edu.*

## **Access Constraints**

**User Constraints:** Users must read and fully comprehend the metadata prior to use. Data should not be used beyond the limits of the source scale. Acknowledgment of AFSC Groundfish Assessment Program, as the source from which these data were obtained, in any publications and/or other representations of these data, is suggested.

**General questions and more specific data requests** can be sent to nmfs.afsc.gov.metadata@noaa.gov or submitted as an issue on our GitHub Organization. The version of this data used for stock assessments can be found through the Alaska Fisheries Information Network (AKFIN). For questions about the eastern Bering Sea surveys, contact Duane Stevenson (Duane.Stevenson@noaa.gov). For questions about the Gulf of Alaska or Aleutian Islands surveys, contact Ned Laman (Ned.Laman@noaa.gov). For questions specifically about crab data in any region, contact Mike Litzow (Mike.Litzow@noaa.gov), the Shellfish Assessment Program lead.

For questions, comments, and concerns specifically about the Fisheries One Stop Shop (FOSS) platform, please contact us using the Comments page on the FOSS webpage.

## **Cite this data**

Use the below bibtext citations, as cited in our group's citation repository for citing the data created and maintained in this repo (NOAA Fisheries Alaska Fisheries Science Center, 2024). Add "note = {Accessed: mm/dd/yyyy}" to append the day this data was accessed.

## **11. Data description**

The Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC) conducts fisheries-independent bottom trawl surveys to monitor the condition of the demersal fish and crab stocks of Alaska. These data are developed to describe the temporal distribution and abundance of commercially and ecologically important groundfish species, examine the changes in the species composition of the fauna over time and space, and describe the physical environment of the groundfish habitat.

There are no legal restrictions on access to the data. They reside in the public domain and can be freely distributed. Users must read and fully comprehend the metadata prior to use. Data should not be used beyond the limits of the source scale. Acknowledgement of NOAA, as the source from which these data were obtained, in any publications and/or other representations of these data, is suggested. These data are compiled and approved annually after each summer survey season. The data from previous years are unlikely to change substantially once published.

These data are zero-filled (presence and absence) observations from surveys conducted on fishing vessels. These surveys monitor trends in distribution and abundance of groundfish, crab, and bottom-dwelling species in Alaska's marine ecosystems. These data include estimates of catch-per-unit-effort (CPUE) for all identified species for index stations. Some survey data are excluded, such as non-standard stations, surveys completed in earlier years using different/non-standard gear, and special tows and non-standard data collections.

Though not included in the public data, these surveys also collect oceanographic and environmental data, and biological data such as length, weight, stomach contents (to learn more about diet), otoliths (fish ear bones to learn about age), and tissue samples for genetic analysis, all of which can be shared upon special request. Also not included in the public data are estimated biomass (average total weight of all fish and crabs sampled) of crabs and groundfish that support the creation of annual stock assessments.

## *11. Data description*

### **11.1. Data tables**

#### **11.1.1. FOSS\_CATCH**

Positive catch and effort from GAP\_PRODUCTS.CPUE with associated taxonomic confidence. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 890,349

Number of columns: 7

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

HAULJOIN

Haul ID

ID key code

NUMBER(38,0)

This is a unique numeric identifier assigned to each (vessel, cruise, and haul) combination.

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

CPUE\_KGKM2

## *11. Data description*

Weight CPUE (kg/km2)

kilograms per kilometers squared

NUMBER(38,6)

Catch weight (kilograms) per unit effort (area swept by the net, units square kilometers).

CPUE\_NOKM2

Number CPUE (no/km2)

count per kilometers squared

NUMBER(38,6)

Numerical catch per unit effort (area swept by the net, units square kilometers).

COUNT

Taxon count

count, whole number resolution

NUMBER(38,0)

Total whole number of individuals caught in haul or samples collected.

WEIGHT\_KG

Sample or taxon weight (kg)

kilograms

NUMBER(38,3)

Weight (thousandths of a kilogram) of individuals in a haul by taxon.

TAXON\_CONFIDENCE

Taxon confidence rating

category

VARCHAR2(255 BYTE)

Confidence in the ability of the survey team to correctly identify the taxon to the specified level, based solely on identification skill (e.g., not likelihood of a taxon being caught at that station on a location-by-location basis). Quality codes follow: **High**: High confidence and consistency. Taxonomy is stable and reliable at this level, and field identification characteristics are well known and reliable. **Moderate**: Moderate

## *11. Data description*

confidence. Taxonomy may be questionable at this level, or field identification characteristics may be variable and difficult to assess consistently. **Low:** Low confidence. Taxonomy is incompletely known, or reliable field identification characteristics are unknown. Documentation: Species identification confidence in the eastern Bering Sea shelf survey (1982-2008), Species identification confidence in the eastern Bering Sea slope survey (1976-2010), and Species identification confidence in the Gulf of Alaska and Aleutian Islands surveys (1980-2011).

### **11.1.2. FOSS\_HAUL**

Mirror of GAP\_PRODUCTS.HAUL with additional year and survey data. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 33,991

Number of columns: 27

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

LONGITUDE\_DD\_START

Start longitude (decimal degrees)

decimal degrees

NUMBER(38,6)

Longitude (one hundred thousandth of a decimal degree) of the start of the haul.

LATITUDE\_DD\_END

End latitude (decimal degrees)

decimal degrees

NUMBER(38,6)

## *11. Data description*

Latitude (one hundred thousandth of a decimal degree) of the end of the haul.

LONGITUDE\_DD\_END

End longitude (decimal degrees)

decimal degrees

NUMBER(38,6)

Longitude (one hundred thousandth of a decimal degree) of the end of the haul.

BOTTOM\_TEMPERATURE\_C

Bottom temperature (degrees Celsius)

degrees Celsius

NUMBER(38,1)

Bottom temperature (tenths of a degree Celsius); NA indicates removed or missing values.

SURFACE\_TEMPERATURE\_C

Surface temperature (degrees Celsius)

degrees Celsius

NUMBER(38,1)

Surface temperature (tenths of a degree Celsius); NA indicates removed or missing values.

DEPTH\_M

Depth (m)

degrees Celsius

NUMBER(38,1)

Bottom depth (meters).

DISTANCE\_FISHED\_KM

Distance fished (km)

degrees Celsius

NUMBER(38,3)

Distance the net fished (thousands of kilometers).

## *11. Data description*

DURATION\_HR

Tow duration (decimal hr)

hours

NUMBER(38,1)

This is the elapsed time between start and end of a haul (decimal hours).

NET\_WIDTH\_M

Net width (m)

meters

NUMBER(38,1)

Measured or estimated distance (meters) between wingtips of the trawl.

NET\_HEIGHT\_M

Net height (m)

meters

NUMBER(38,1)

Measured or estimated distance (meters) between footrope and headrope of the trawl.

AREA\_SWEPT\_KM2

Area swept (km)

kilometers

NUMBER(38,6)

The area the net covered while the net was fishing (kilometers squared), defined as the distance fished times the net width.

PERFORMANCE

Haul performance code

category

NUMBER(38,0)

This denotes what, if any, issues arose during the haul. For more information, review the code books.

## *11. Data description*

YEAR

Survey year

year

NUMBER(10,0)

Year the observation (survey) was collected.

SRVY

Survey abbreviation

text abbreviated

VARCHAR2(255 BYTE)

Abbreviated survey names. The column srvy is associated with the survey and survey\_definition\_id columns. Northern Bering Sea (NBS), Southeastern Bering Sea (EBS), Bering Sea Slope (BSS), Gulf of Alaska (GOA), Aleutian Islands (AI).

SURVEY

Survey name

text

VARCHAR2(255 BYTE)

Name and description of survey. The column survey is associated with the srvy and survey\_definition\_id columns.

SURVEY\_DEFINITION\_ID

Survey ID

ID key code

NUMBER(38,0)

The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey\_definition\_id is associated with the srvy and survey columns. Full list of survey definition IDs are in RACE\_DATA.SURVEY\_DEFINITIONS and in the code books.

SURVEY\_NAME

Survey name official

text

## *11. Data description*

VARCHAR2(255 BYTE)

Long name of the survey conducted

CRUISE

Cruise Name

ID key code

NUMBER(38,0)

This is a six-digit integer identifying the cruise number of the form: YYYY99 (where YYYY = year of the cruise; 99 = 2-digit number and is sequential; 01 denotes the first cruise that vessel made in this year, 02 is the second, etc.).

CRUISEJOIN

Cruise ID

ID key code

NUMBER(38,0)

Unique integer ID assigned to each survey, vessel, and year combination.

HAULJOIN

Haul ID

ID key code

NUMBER(38,0)

This is a unique numeric identifier assigned to each (vessel, cruise, and haul) combination.

HAUL

Haul number

ID key code

NUMBER(38,0)

This number uniquely identifies a sampling event (haul) within a cruise. It is a sequential number, in chronological order of occurrence.

STRATUM

Stratum ID

ID key code

## *11. Data description*

NUMBER(10,0)

RACE database statistical area for analyzing data. Strata were designed using bathymetry and other geographic and habitat-related elements. The strata are unique to each survey region. Stratum of value 0 indicates experimental tows.

STATION

Station ID

ID key code

VARCHAR2(255 BYTE)

Alpha-numeric designation for the station established in the design of a survey.

VESSEL\_ID

Vessel ID

ID key code

NUMBER(38,0)

ID number of the vessel used to collect data for that haul. The column vessel\_id is associated with the vessel\_name column. Note that it is possible for a vessel to have a new name but the same vessel id number. For a complete list of vessel ID key codes, review the code books.

VESSEL\_NAME

Vessel name

text

VARCHAR2(255 BYTE)

Name of the vessel used to collect data for that haul. The column vessel\_name is associated with the vessel\_id column. Note that it is possible for a vessel to have a new name but the same vessel id number. For a complete list of vessel ID key codes, review the code books.

DATE\_TIME

Date and time

MM/DD/YYYY HH::MM

DATE

## *11. Data description*

The date (MM/DD/YYYY) and time (HH:MM) of the haul. All dates and times are in Alaska time (AKDT) of Anchorage, AK, USA (UTC/GMT -8 hours).

LATITUDE\_DD\_START

Start latitude (decimal degrees)

decimal degrees

NUMBER(38,6)

Latitude (one hundred thousandth of a decimal degree) of the start of the haul.

### **11.1.3. FOSS\_SPECIES**

List of GAP SPECIES\_CODE values with associated WORMS and ITIS database values. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 1,894

Number of columns: 6

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

SCIENTIFIC\_NAME

## *11. Data description*

Taxon scientific name

text

VARCHAR2(255 BYTE)

The scientific name of the organism associated with the common\_name and species\_code columns. For a complete taxon list, review the code books.

COMMON\_NAME

Taxon common name

text

VARCHAR2(255 BYTE)

The common name of the marine organism associated with the scientific\_name and species\_code columns. For a complete species list, review the code books.

ID\_RANK

Lowest taxonomic rank

text

VARCHAR2(255 BYTE)

Lowest taxonomic rank of a given species entry.

WORMS

World register of marine species (WoRMS) taxonomic serial number

ID key code

NUMBER(38,0)

Species code as identified in the World Register of Marine Species (WoRMS) (<https://www.marinespecies.org/>).

ITIS

Integrated taxonomic information system (ITIS) serial number

ID key code

NUMBER(38,0)

Species code as identified in the Integrated Taxonomic Information System (<https://itis.gov/>).

## *11. Data description*

### **11.1.4. FOSS\_SURVEY\_SPECIES**

List of observed SPECIES\_CODE values for each survey region. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 5,030

Number of columns: 2

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

SURVEY\_DEFINITION\_ID

Survey ID

ID key code

NUMBER(38,0)

The survey definition ID key code is an integer that uniquely identifies a survey region/survey design. The column survey\_definition\_id is associated with the srvy and survey columns. Full list of survey definition IDs are in RACE\_DATA.SURVEY\_DEFINITIONS and in the code books.

## *11. Data description*

### **11.1.5. FOSS\_TAXON\_GROUP**

This reference table will allow for easier searching and sorting of species in FOSS. This table was created by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). The GitHub repository for the scripts that created this code can be found at ([https://github.com/afsc-gap-products/gap\\_products](https://github.com/afsc-gap-products/gap_products)). There are no legal restrictions on access to the data. Last updated on 12 September 2024.

Number of rows: 33,845

Number of columns: 3

Column name from data

Descriptive column Name

Units

Oracle data type

Column description

RANK\_ID

Taxonomic rank

category

VARCHAR2(255 BYTE)

The taxonomic rank of a taxon identification.

CLASSIFICATION

Taxonomic classification rank group

category

VARCHAR2(255 BYTE)

Phylogenetic classification group rank for a given species.

SPECIES\_CODE

Taxon code

ID key code

NUMBER(38,0)

## *11. Data description*

The species code of the organism associated with the common\_name and scientific\_name columns. For a complete species list, review the code books.

## 12. Using the FOSS platform

### 12.1. Select and filter

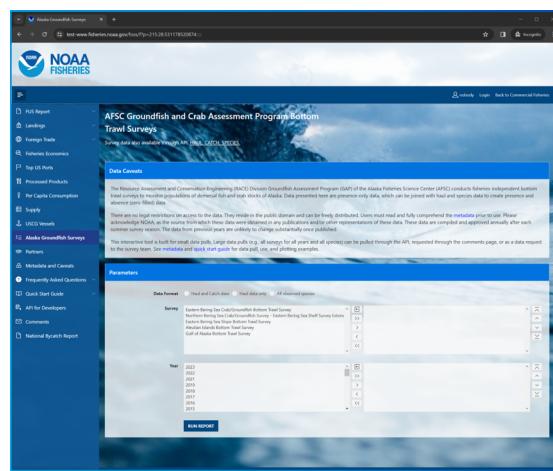


Figure 12.1.: AFSC Groundfish and Crab Assessment Program Bottom Trawl Survey data interface on the Fisheries One Stop Shop platform.

Select, filter, and download this and other NOAA Fisheries data from the Fisheries One Stop Shop (FOSS) platform. A user guide for the FOSS platform can be found here. To begin a report, select the kind of data you need: Haul and catch data, Haul data only, All observed species.

In this example, we'll select for 2023 eastern Bering Sea Arctic cod data. Here, we used the Search Species box to search for species with the term "cod" in their common names and selected "Pacific cod" from that shortened list.

## 12. Using the FOSS platform

### 12.1.1. Catch and haul

The screenshot shows the 'CATCH AND HAUL DATA' section of the FOSS platform. At the top, there are dropdown menus for 'Survey' (Gulf of Alaska Bottom Trawl Survey, Aleutian Islands Bottom Trawl Survey, Eastern Bering Sea Slope Bottom Trawl Survey, Northern Bering Sea Crab/Groundfish Survey - Eastern Bering Sea Shelf Survey Extens), 'Year' (2020-2023), and 'Species' (Aluterus spp., Acanthocephalus sp., Acanthocephala sp., Acanthocephala sp., Acanthocephala sp., Acanthocephala sp., Acanthocephala sp.). Below these are buttons for 'Search', 'Reset All Parameters', and 'RUN REPORT'. The main table has columns: Survey year, Survey ID, Survey name official, Survey name, Survey abbreviation, Cruise ID, Cruise code, Station ID, Station name, Head number, Vessel ID, Vessel name, Date and time, Start latitude (decimal degrees), Start longitude (decimal degrees), End latitude (decimal degrees), End longitude (decimal degrees). Two rows of data are shown:

Survey year	Survey ID	Survey name official	Survey name	Survey abbreviation	Cruise ID	Cruise code	Station ID	Station name	Head number	Vessel ID	Vessel name	Date and time	Start latitude (decimal degrees)	Start longitude (decimal degrees)	End latitude (decimal degrees)	End longitude (decimal degrees)
2023	98	Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey	eastern Bering Sea	EBS	202301	-759	42	X0019	125	162	ALASKA KNIGHT	28-JUN-2023 0305PM	57.8403	-168.27002	57.82725	-168.36125
2023	98	Eastern Bering Sea Crab/Groundfish Survey	eastern Bering Sea	EBS	202301	-760	42	J-19	106	162	ALASKA	02-JUL-2023 14:00:00	58.00771	-168.00000	58.00011	-168.11048

Figure 12.2.: Catch data on the AFSC Groundfish and Crab Assessment Program Bottom Trawl Survey data interface on the Fisheries One Stop Shop platform.

### 12.1.2. Haul

The screenshot shows the 'HAUL DATA' section of the FOSS platform. At the top, there are dropdown menus for 'Survey' (Gulf of Alaska Bottom Trawl Survey, Aleutian Islands Bottom Trawl Survey, Eastern Bering Sea Slope Bottom Trawl Survey, Northern Bering Sea Crab/Groundfish Survey - Eastern Bering Sea Shelf Survey Extens), 'Year' (2022-2023), and 'Species' (Aluterus spp., Acanthocephalus sp., Acanthocephala sp., Acanthocephala sp., Acanthocephala sp., Acanthocephala sp.). Below these are buttons for 'RUN REPORT'. The main table has columns: Survey year, Survey ID, Survey name official, Survey name, Survey abbreviation, Cruise ID, Cruise code, Station ID, Station name, Head number, Vessel ID, Vessel name, Date and time, Start latitude (decimal degrees), Start longitude (decimal degrees), End latitude (decimal degrees), End longitude (decimal degrees). Two rows of data are shown:

Survey year	Survey ID	Survey name official	Survey name	Survey abbreviation	Cruise ID	Cruise code	Station ID	Station name	Head number	Vessel ID	Vessel name	Date and time	Start latitude (decimal degrees)	Start longitude (decimal degrees)	End latitude (decimal degrees)	End longitude (decimal degrees)
2023	98	Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey	eastern Bering Sea	EBS	-759	202301	42	F-21	147	162	ALASKA KNIGHT	01-JUL-2023 12:46PM	56.67915	-170.14347	56.65574	-170.12189
2023	98	Eastern Bering Sea Crab/Groundfish Survey	eastern Bering Sea	EBS	-760	202301	42	J-19	106	134	NORTHWEST EXPLORER	25-JUN-2023 *****	57.98219	-169.07093	58.00846	-169.0791

Figure 12.3.: Haul data on the AFSC Groundfish and Crab Assessment Program Bottom Trawl Survey data interface on the Fisheries One Stop Shop platform.

## 12. Using the FOSS platform

### 12.1.3. Species

The screenshot shows a web-based application interface for managing survey data. At the top, there's a 'Parameters' section with 'Data Format' (set to 'All observed species'), 'Survey' (set to 'Gulf of Alaska Bottom Trawl Survey'), and a 'RUN REPORT' button. Below this is a 'SPECIES' section with a search bar and a table. The table has columns: Survey ID, Survey name official, Taxon code, Taxon scientific name, Taxon common name, Lowest taxonomic rank, World register of marine species (WoRMS) scientific serial number, and Integrated Taxonomic Information System (ITIS) serial number. The data in the table is as follows:

Survey ID	Survey name official	Taxon code	Taxon scientific name	Taxon common name	Lowest taxonomic rank	World register of marine species (WoRMS) scientific serial number	Integrated Taxonomic Information System (ITIS) serial number
47	Gulf of Alaska Bottom Trawl Survey	1		fish-eggs unid.			
47	Gulf of Alaska Bottom Trawl Survey	2		fish-larva unid.			
47	Gulf of Alaska Bottom Trawl Survey	3		fish unid.			
47	Gulf of Alaska Bottom Trawl Survey	10	Pentomyidae	Sampsony unid.	family	101163	159607
47	Gulf of Alaska Bottom Trawl Survey	21	Estromphus tridentatus	Pacific Sampsony	species	314348	159609

Figure 12.4.: All species observed by survey on the AFSC Groundfish and Crab Assessment Program Bottom Trawl Survey data interface on the Fisheries One Stop Shop platform.

## 12.2. Search options

The user must select a option in each of the three option boxes as they appear for catch, haul, and species:

- **Survey:** Each survey has different in design, time series, and history. More information on each survey and their designs can be found in our annual data reports.
- **Year:** Surveys are not conducted in all years, so only data from the years for which the survey was conducted will be returned.
- **Species:** Common name of all species ever encountered in the survey. Find more information about these species in our survey code books.

For a given box, select one or a few options from the options box (list on the left) to query. To select multiple options, hold down the **CTRL** key while clicking on the options of interest, or click and drag down the list. Once the options you wish to be included in your query are highlighted, click the right-pointing arrow (>) to move them into the “selection box” (list on the right). This can also be achieved by double clicking the option item of interest. If you accidentally select an option that you do not want to query, simply select the unwanted option from the selection box and click the left-pointing arrow (<).

If you wish to select all options from the options box and send them to the selection box, simply click the double right-pointing arrow (>>). If you want to unselect all

## 12. Using the FOSS platform

options from the selection box, use the double left-pointing arrow (<<) or the reset icon.

To find a specific species or group more quickly you can use the Search Species option to quickly narrow the options. Search for parts of species common names in the Search Species box by entering a term and clicking the search button. The platform will return a shorter list in the Species options box of only species that contain a match to that search term.

Use the Reset All Parameters button to reset all parameters for entire form.

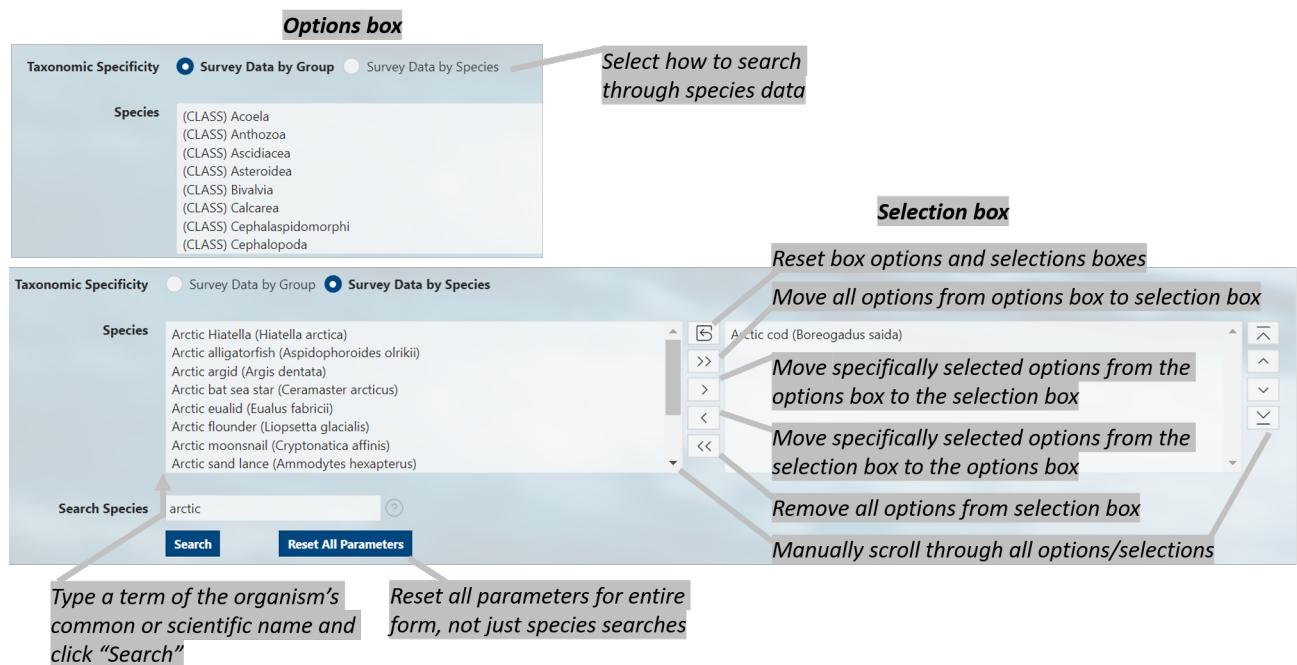


Figure 12.5.: Diagram of selection and search tools available on the FOSS platform.

### 12.3. Run report

Click the RUN REPORT button. Below the select and filter area, the results of your query will appear below the page in the format you selected. To change the format, make a different selection and run the report again. Further modifications to your results can be made by clicking on the Actions button above your data. Here you can download

## 12. Using the FOSS platform

your data, select columns included in your results, and apply a variety of filters and mathematical tools.

The screenshot illustrates the FOSS platform's data management features. At the top, a modal window titled "Select columns to display in your report" lists various survey-related fields like Survey year, Survey ID, and Survey name official. A "Display in Report" section shows the selected items. Below this, a "Filter data displayed in report" dialog is open, allowing users to filter by Survey year. The main interface shows a table titled "CATCH AND HAUL DATA" with columns for Survey year, Survey ID, Survey name official, Survey name, Survey code, Cruise ID, Stratum ID, and Haul number. A search bar at the top of the table allows users to "Search for elements of the data". A context menu is open over the table, with arrows pointing to specific options: "Determine how many rows per page to display" points to the "Rows Per Page" option; "Apply mathematical aggregations to data" points to the "Pivot" option. The menu also includes "Filter", "Format", "Flashback", and "Reset".

Figure 12.6.: Example data returned from running the report.

### 12.4. API

APIs, or Application Programming Interfaces, allows users to pull data through a IDE, or integrated development environment, like RStudio or VS Code. Explore the API pages for each of the data pages (Haul and catch data, Haul data only, All observed species).

## **13. Use data**

Learn how to pull and use this data through the

- API and R programming language
- API and python programming language using the `afscgap` python package
- Oracle and R programming language (AFSC scientists only)

## 14. Access via API and R

**An application programming interface (API) is a way for two or more computer programs to communicate with each other.** More information about how to amend API links can be found here. Useful introductions to using APIs in R can be found here.

There are three tables the user can pull from the API. Learn more about them on the FOSS data description page. Here, you can see them in their raw JSON format:

- haul: [https://apps-st.fisheries.noaa.gov/ods/foss/afsc\\_groundfish\\_survey\\_haul/](https://apps-st.fisheries.noaa.gov/ods/foss/afsc_groundfish_survey_haul/)
- catch: [https://apps-st.fisheries.noaa.gov/ods/foss/afsc\\_groundfish\\_survey\\_catc h/](https://apps-st.fisheries.noaa.gov/ods/foss/afsc_groundfish_survey_catc h/)
- species: [https://apps-st.fisheries.noaa.gov/ods/foss/afsc\\_groundfish\\_survey\\_sp ecies/](https://apps-st.fisheries.noaa.gov/ods/foss/afsc_groundfish_survey_sp ecies/)

Here are some examples of how to use the data with R:

### 14.1. Ex. Load all rows of the catch, haul, and species data tables

Note that without specifying, a basic query to the API will only return 25 entries.

#### 14.1.1. Load haul data

```
# link to the API  
api_link_haul <- 'https://apps-st.fisheries.noaa.gov/ods/foss/afsc_groundfish_survey_haul/'
```

## 14. Access via API and R

### 14.1.1.1. Load first 25 rows of data

```
res <- httr::GET(url = api_link_haul)
# res ## Test connection

## convert from JSON format
dat <- jsonlite::fromJSON(base::rawToChar(res$content))$items

# Find how many rows and columns are in the data pull
print(paste0("rows: ", nrow(dat), "; cols: ", ncol(dat)))

[1] "rows: 25; cols: 28"
```

### 14.1.1.2. Load all data:

Since the maximum number of rows a user can pull is 10,000 rows in a query, the user needs to cycle through by offsetting to the next 10,000 rows (as is shown here).

```
dat <- data.frame()
for (i in seq(0, 500000, 10000)){
  ## find how many iterations it takes to cycle through the data
  print(i)
  ## query the API link
  res <- httr::GET(url = paste0(api_link_haul, "?offset=", i, "&limit=10000"))
  ## convert from JSON format
  data <- jsonlite::fromJSON(base::rawToChar(res$content))

  ## if there are no data, stop the loop
  if (is.null(nrow(data$items))) {
    break
  }

  ## bind sub-pull to dat data.frame
  dat <- dplyr::bind_rows(dat,
                         data$items %>%
                           dplyr::select(-links)) # necessary for API accounting, but not
}
```

## 14. Access via API and R

```
[1] 0  
[1] 10000  
[1] 20000  
[1] 30000  
[1] 40000
```

Explore the data contents:

```
# Find how many rows and columns are in the data pull  
print(paste0("rows: ", nrow(dat), "; cols: ", ncol(dat)))
```

```
[1] "rows: 33991; cols: 27"
```

```
# learn about the structure of the data  
summary(dat)
```

year	srvy	survey	survey_name
Min. :1982	Length:33991	Length:33991	Length:33991
1st Qu.:1997	Class :character	Class :character	Class :character
Median :2006	Mode :character	Mode :character	Mode :character
Mean :2005			
3rd Qu.:2015			
Max. :2024			

survey_definition_id	cruise	cruisejoin	hauljoin
Min. : 47.00	Min. :198201	Min. : -770	Min. : -23911
1st Qu.: 47.00	1st Qu.:199701	1st Qu.: -697	1st Qu.: -14104
Median : 78.00	Median :200601	Median : -616	Median : -4314
Mean : 74.55	Mean :200543	Mean : 294616	Mean : 289722
3rd Qu.: 98.00	3rd Qu.:201501	3rd Qu.: 837799	3rd Qu.: 816124
Max. :143.00	Max. :202401	Max. :1225395	Max. :1225635

haul	stratum	station	vessel_id
Min. : 1.0	Min. : 10.0	Length:33991	Min. : 1.0
1st Qu.: 56.0	1st Qu.: 31.0	Class :character	1st Qu.: 88.0
Median :112.0	Median : 50.0	Mode :character	Median : 94.0
Mean :117.3	Mean :130.9		Mean :107.8
3rd Qu.:170.0	3rd Qu.:142.0		3rd Qu.:147.0
Max. :355.0	Max. :794.0		Max. :178.0

## 14. Access via API and R

```

vessel_name      date_time      latitude_dd_start longitude_dd_start
Length:33991    Length:33991    Min.   :51.19      Min.   :-180.0
Class :character Class :character  1st Qu.:55.00      1st Qu.:-170.7
Mode  :character Mode  :character Median :57.16      Median :-165.3
                           Mean   :56.86      Mean   :-139.6
                           3rd Qu.:58.97      3rd Qu.:-154.4
                           Max.   :65.34      Max.   : 180.0

latitude_dd_end longitude_dd_end bottom_temperature_c surface_temperature_c
Min.   :51.19      Min.   :-180.0     Min.   :-2.100      Min.   :-1.100
1st Qu.:55.00      1st Qu.:-170.7    1st Qu.: 2.700      1st Qu.: 5.800
Median :57.16      Median :-165.3    Median : 4.100      Median : 7.400
Mean   :56.86      Mean   :-139.6    Mean   : 3.829      Mean   : 7.794
3rd Qu.:58.96      3rd Qu.:-154.4    3rd Qu.: 5.200      3rd Qu.: 9.300
Max.   :65.35      Max.   : 180.0     Max.   :15.300      Max.   :18.100
NA's   :4          NA's   :4          NA's   :1601       NA's   :852
depth_m           distance_fished_km duration_hr      net_width_m
Min.   : 9.0        Min.   :0.135      Min.   :0.0250      Min.   : 7.51
1st Qu.: 68.0       1st Qu.:1.497      1st Qu.:0.2710      1st Qu.:15.58
Median :102.0       Median :2.528      Median :0.4900      Median :16.40
Mean   :137.8       Mean   :2.206      Mean   :0.4006      Mean   :16.42
3rd Qu.:156.0       3rd Qu.:2.833      3rd Qu.:0.5090      3rd Qu.:17.21
Max.   :1200.0      Max.   :4.334      Max.   :0.9800      Max.   :23.82

net_height_m      area_swept_km2      performance
Min.   : 0.000      Min.   :0.002314      Min.   :0.0000
1st Qu.: 2.383      1st Qu.:0.024261      1st Qu.:0.0000
Median : 5.865      Median :0.039562      Median :0.0000
Mean   : 4.822      Mean   :0.036378      Mean   :0.2779
3rd Qu.: 6.788      3rd Qu.:0.047280      3rd Qu.:0.0000
Max.   :11.038      Max.   :0.077795      Max.   :7.0000
NA's   :3269

# Print the first few lines of the data
dat %>%
  head(3) %>%
  flextable::flextable() %>%
  flextable::colformat_num(
    x = .,
    j = c("year", "cruise", "cruisejoin"),

```

## 14. Access via API and R

```
big.mark = "") %>%  
flextable::theme_zebra()
```

year	srvy	survey	survey_name	survey_definition_id	cruise	cruisejoin	hauljoin	haul
1998	EBS	eastern Bering Sea	Eastern Bering Sea Crab/Ground Bottom Trawl Survey	98	199801	937213	937,531	125
1998	EBS	eastern Bering Sea	Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey	98	199801	937213	937,532	126
1998	EBS	eastern Bering Sea	Eastern Bering Sea Crab/Ground Bottom Trawl Survey	98	199801	937213	937,533	127

```
# save outputs for later comparison  
dat_haul_api <- dat
```

### 14.1.2. Load catch data

```
# link to the API  
api_link_catch <- 'https://apps-st.fisheries.noaa.gov/ods/foss/afsc_groundfish_survey_catch'
```

## 14. Access via API and R

### 14.1.2.1. Load first 25 rows of data

```
res <- httr::GET(url = api_link_catch)
# res ## Test connection

## convert from JSON format
dat <- jsonlite::fromJSON(base:::rawToChar(res$content))$items

# Find how many rows and columns are in the data pull
print(paste0("rows: ", nrow(dat), "; cols: ", ncol(dat)))

[1] "rows: 25; cols: 8"
```

### 14.1.2.2. Load all data

Since the maximum number of rows a user can pull is 10,000 rows in a query, the user needs to cycle through by offsetting to the next 10,000 rows (as is shown here).

```
dat <- data.frame()
# for (i in seq(0, 100000, 10000)){
for (i in seq(0, 1000000, 10000){
    ## find how many iterations it takes to cycle through the data
    # print(i)
    ## query the API link
    res <- httr::GET(url = paste0(api_link_catch, "?offset=", i, "&limit=10000"))
    ## convert from JSON format
    data <- jsonlite::fromJSON(base:::rawToChar(res$content))

    ## if there are no data, stop the loop
    if (is.null(nrow(data$items))) {
        break
    }

    ## bind sub-pull to dat data.frame
    dat <- dplyr::bind_rows(dat,
                           data$items %>%
                               dplyr::select(-links)) # necessary for API accounting, but not
}
```

## 14. Access via API and R

Explore the data contents:

```
# Find how many rows and columns are in the data pull  
print(paste0("rows: ", nrow(dat), "; cols: ", ncol(dat)))
```

```
[1] "rows: 890349; cols: 7"
```

```
# learn about the structure of the data  
summary(dat)
```

```
      hauljoin      species_code      cpue_kgkm2      cpue_nokm2  
Min.   : -23911   Min.   :    1   Min.   :     0   Min.   :    13  
1st Qu.: -14398   1st Qu.: 20510   1st Qu.:     6   1st Qu.:    58  
Median : -5225    Median : 40500    Median :    49   Median :   213  
Mean   : 281196   Mean   : 45121   Mean   : 1253   Mean   : 4618  
3rd Qu.: 802468   3rd Qu.: 71800   3rd Qu.:   375   3rd Qu.: 1134  
Max.   :1225635   Max.   :99999    Max.   :3226235  Max.   :21780780  
NA's   :89147  
      count      weight_kg      taxon_confidence  
Min.   :    1   Min.   : 0.001   Length:890349  
1st Qu.:    2   1st Qu.: 0.200   Class :character  
Median :    8   Median : 1.814   Mode  :character  
Mean   : 181   Mean   : 41.827  
3rd Qu.:  43   3rd Qu.: 13.900  
Max.   :867119  Max.   :18187.700  
NA's   :89147
```

```
# Print the first few lines of the data  
dat %>%  
  head(3) %>%  
  flextable::flextable() %>%  
  flextable::colformat_num(  
    x = .,  
    j = c("species_code"),  
    big.mark = "") %>%  
  flextable::theme_zebra()
```

## 14. Access via API and R

hauljoin	species_code	cpue_kgkm2	cpue_nokm2	count	weight_kg	taxon_confidence
-20,640	69086	447.0032314,735.5788		214	20.200	High
-20,640	69095	7.435301	265.5465	12	0.336	High
-20,640	71001	33.082665			1.495	

```
# save outputs for later comparison  
dat_catch_api <- dat
```

### 14.1.3. Load species data

Since there are less than 10,000 rows of species data (and the maximum number of rows a user can pull from this API is 10,000 rows in a query), we can simply call `?offset=0&limit=10000` in our query call.

```
# link to the API  
api_link_species <- 'https://apps-st.fisheries.noaa.gov/ods/foss/afsc_groundfish_survey_sp  
  
res <- httr::GET(url = paste0(api_link_species, "?offset=0&limit=10000"))  
  
## convert from JSON format  
data <- jsonlite::fromJSON(base::rawToChar(res$content))  
dat <- data$items %>%  
  dplyr::select(-links) # necessary for API accounting, but not part of the dataset
```

Explore the data contents:

```
# Find how many rows and columns are in the data pull  
print(paste0("rows: ", nrow(dat), "; cols: ", ncol(dat)))
```

```
[1] "rows: 1894; cols: 6"
```

```
# learn about the structure of the data  
summary(dat)
```

## 14. Access via API and R

```

species_code  scientific_name   common_name      id_rank
Min.       : 1    Length:1894        Length:1894      Length:1894
1st Qu.:30105  Class :character  Class :character  Class :character
Median :70061   Mode  :character  Mode  :character  Mode  :character
Mean    :58788
3rd Qu.:80543
Max.     :99999

```

worms	itis
Min. : 51	Min. : 46861
1st Qu.: 134297	1st Qu.: 79427
Median : 254545	Median : 157164
Mean   : 314551	Mean   : 210096
3rd Qu.: 369147	3rd Qu.: 167414
Max.   :1757986	Max.   :1206057
NA's   :225	NA's   :389

```

# Print the first few lines of the data
dat %>%
  head(3) %>%
  flextable::flextable() %>%
  flextable::colformat_num(
    x = .,
    j = c("species_code", "worms", "itis"),
    big.mark = "") %>%
  flextable::theme_zebra()

```

species_- scientific_- common_- id_rank	worms	itis
code name	name	
10130 Hippoglossus flathead elassodon sole	species	274289
20731 Rathbunella smooth hypoplecta ronquil	species	282556
21308 Thyriiscus sponge anoplus sculpin	species	282971

```

# save outputs for later comparison
dat_species_api <- dat

```

## 14.2. Ex. Create zero-filled data using data loaded in last example

It is important to create and have access to zero-fill (presence and absence) so you can do simple analyses and plot data.

First prepare a table with all combinations of what species should be listed for what hauls/surveys. For zero-filled data, all species caught in a survey need to have zero or non-zero row entries for a haul

```
comb <- dplyr::full_join(
  # find all species that have been caught, by survey
  x = dplyr::left_join(dat_catch_api, dat_haul_api, by = "hauljoin") %>%
    dplyr::select(survey_definition_id, species_code) %>%
    dplyr::distinct(),
  # find all haul events (hauljoins), by survey
  y = dat_haul_api %>%
    dplyr::select(survey_definition_id, hauljoin) %>%
    dplyr::distinct(),
  relationship = "many-to-many",
  by = "survey_definition_id"
) %>%
  dplyr::select(-survey_definition_id) # now, redundant
```

Explore the data contents:

```
print(paste0("rows: ", nrow(comb), "; cols: ", ncol(comb)))
```

```
[1] "rows: 21802167; cols: 2"
```

```
comb %>% head(3) %>%
  flextable::flextable() %>%
  flextable::colformat_num(
    x = .,
    j = c("species_code", "hauljoin"),
    big.mark = "") %>%
  flextable::theme_zebra()
```

## 14. Access via API and R

species_code	hauljoin
69086	-7112
69086	-7113
69086	-7115

Now, using that table of combinations (here, called `comb`), join data to make a full zero-filled CPUE dataset. When all of the data have been full joined together, there should be the maximum number of rows in `comb`.

```
dat <- comb %>%
  # add species data
  dplyr::left_join(dat_species_api) %>% # , "species_code"
  # add haul data
  dplyr::left_join(dat_haul_api) %>% # , c("hauljoin")
  # add catch data
  dplyr::left_join(dat_catch_api) %>% # , c("species_code", "hauljoin")
  # modify/clean up zero-filled rows
  dplyr::mutate(
    cpue_kgkm2 = ifelse(is.na(cpue_kgkm2), 0, cpue_kgkm2),
    cpue_nokm2 = ifelse(is.na(cpue_nokm2), 0, cpue_nokm2),
    count = ifelse(is.na(count), 0, count),
    weight_kg = ifelse(is.na(weight_kg), 0, weight_kg))
```

```
TRUE Joining with `by = join_by(species_code)`
TRUE Joining with `by = join_by(hauljoin)`
TRUE Joining with `by = join_by(species_code, hauljoin)`
```

Explore the data contents:

```
# Find how many rows and columns are in the data pull
print(paste0("rows: ", nrow(dat), "; cols: ", ncol(dat)))
```

```
[1] "rows: 21802167; cols: 38"
```

## 14. Access via API and R

```
# learn about the structure of the data
summary(dat)
```

species_code	hauljoin	scientific_name	common_name
Min. : 1	Min. : -23911	Length:21802167	Length:21802167
1st Qu.:21815	1st Qu.: -14005	Class :character	Class :character
Median :68000	Median : -4364	Mode :character	Mode :character
Mean :50613	Mean : 298144		
3rd Qu.:75021	3rd Qu.: 821813		
Max. :99999	Max. :1225635		

id_rank	worms	itis	year
Length:21802167	Min. : 51	Min. : 46861	Min. :1982
Class :character	1st Qu.: 126995	1st Qu.: 97687	1st Qu.:1997
Mode :character	Median : 254512	Median : 160846	Median :2006
	Mean : 265801	Mean : 203926	Mean :2006
	3rd Qu.: 292719	3rd Qu.: 167452	3rd Qu.:2015
	Max. :1699283	Max. :1206057	Max. :2024
	NA's :1950005	NA's :2635604	

srvy	survey	survey_name	survey_definition_id
Length:21802167	Length:21802167	Length:21802167	Min. : 47.00
Class :character	Class :character	Class :character	1st Qu.: 47.00
Mode :character	Mode :character	Mode :character	Median : 52.00
			Mean : 69.02
			3rd Qu.: 98.00
			Max. :143.00

cruise	cruisejoin	haul	stratum
Min. :198201	Min. : -770	Min. : 1.0	Min. : 10
1st Qu.:199701	1st Qu.: -697	1st Qu.: 59.0	1st Qu.: 31
Median :200601	Median : -616	Median :117.0	Median : 61
Mean :200556	Mean : 302940	Mean :122.6	Mean :142
3rd Qu.:201501	3rd Qu.: 837800	3rd Qu.:177.0	3rd Qu.:212
Max. :202401	Max. :1225395	Max. :355.0	Max. :794

station	vessel_id	vessel_name	date_time
Length:21802167	Min. : 1	Length:21802167	Length:21802167
Class :character	1st Qu.: 88	Class :character	Class :character
Mode :character	Median : 94	Mode :character	Mode :character
	Mean :110		

## 14. Access via API and R

```

3rd Qu.:147
Max.    :178

latitude_dd_start longitude_dd_start latitude_dd_end longitude_dd_end
Min.    :51.19      Min.   :-180.0       Min.    :51.19      Min.   :-180.0
1st Qu.:54.68      1st Qu.:-169.9       1st Qu.:54.68      1st Qu.:-169.9
Median  :56.98      Median :-163.4       Median :56.98      Median :-163.4
Mean    :56.61      Mean   :-136.6       Mean    :56.61      Mean   :-136.6
3rd Qu.:58.67      3rd Qu.:-152.1       3rd Qu.:58.67      3rd Qu.:-152.1
Max.    :65.34      Max.    : 180.0       Max.    :65.35      Max.    : 180.0
                                         NA's    :2279        NA's    :2279

bottom_temperature_c surface_temperature_c depth_m distance_fished_km
Min.    :-2.1        Min.   :-1.1         Min.    : 9        Min.   :0.135
1st Qu.: 3.1        1st Qu.: 5.9         1st Qu.: 71       1st Qu.:1.481
Median  : 4.3        Median : 7.6         Median : 109      Median :1.681
Mean    : 4.1        Mean   : 8.0         Mean    : 142      Mean   :2.097
3rd Qu.: 5.4        3rd Qu.: 9.7         3rd Qu.: 167      3rd Qu.:2.801
Max.    :15.3        Max.    :18.1         Max.    :1200      Max.   :4.334
NA's    :1108488     NA's    :599913

duration_hr net_width_m net_height_m area_swept_km2
Min.    :0.0250     Min.   : 7.51       Min.    : 0.0       Min.   :0.002314
1st Qu.:0.2690     1st Qu.:15.54       1st Qu.: 2.6       1st Qu.:0.023805
Median  :0.3060     Median :16.33       Median : 6.2       Median :0.027887
Mean    :0.3801     Mean   :16.36       Mean    : 5.2       Mean   :0.034451
3rd Qu.:0.5000     3rd Qu.:17.12       3rd Qu.: 6.9       3rd Qu.:0.046306
Max.    :0.9800     Max.    :23.82       Max.    :11.0       Max.   :0.077795
                                         NA's    :1746006

performance cpue_kgkm2 cpue_nokm2 count
Min.    :0.0000     Min.   : 0        Min.    : 0        Min.   : 0.0
1st Qu.:0.0000     1st Qu.: 0        1st Qu.: 0        1st Qu.: 0.0
Median  :0.0000     Median : 0        Median : 0        Median : 0.0
Mean    :0.2924     Mean   : 51        Mean   : 170      Mean   : 6.7
3rd Qu.:0.0000     3rd Qu.: 0        3rd Qu.: 0        3rd Qu.: 0.0
Max.    :7.0000     Max.   :3226235    Max.   :21780780    Max.   :867119.0

weight_kg taxon_confidence
Min.    : 0.000 Length:21802167
1st Qu.: 0.000 Class :character
Median : 0.000 Mode  :character
Mean   : 1.708
3rd Qu.: 0.000

```

## 14. Access via API and R

Max. : 18187.700

```
# Print the first few lines of the data
dat %>%
  head(3) %>%
  flextable::flextable() %>%
  flextable::colformat_num(
    x = .,
    j = c("species_code", "worms", "itis", "hauljoin", "year", "cruise", "cruisejoin"),
    big.mark = "") %>%
  flextable::theme_zebra()
```

species_- code	hauljoin	scientific_- common_- name	id_rank	worms	itis	year	srvy
69086	-7112	Pagurus trigonocheir	fuzzy hermit crab	species	254490	97796	2010 NBS
69086	-7113	Pagurus trigonocheirus	fuzzy hermit crab	species	254490	97796	2010 NBS

species_code	hauljoin	scientific_name	common_name	id_rank	worms	itis	year	srvy
69086	-7115	Pagurus trigonocheil	fuzzy hermit crab	species	254490	97796	2010	NBS

```
# save outputs for later comparison
dat_zerofill_api <- dat
```

### 14.3. Ex. Visualize zero-filled data for 2023 eastern Bering Sea walleye pollock in CPUE data in distribution map

Using the zero-filled data from the previous example, we can make a few plots!

Here is some example data of 2023 through 2019 (year %in% 2019:2023) eastern and northern Bering Sea (srvy %in% c("EBS", "NBS")) walleye pollock (species\_code == 21740).

```
dat <- dat_zerofill_api %>%
  dplyr::filter(year %in% 2019:2023 &
                srvy %in% c("EBS", "NBS") &
                species_code == 21740) %>%
  dplyr::select(year, common_name, longitude_dd_start, latitude_dd_start, cpue_kgkm2)

# Find how many rows and columns are in the data pull
print(paste0("rows: ", nrow(dat), "; cols: ", ncol(dat)))
```

```
[1] "rows: 2052; cols: 5"
```

## 14. Access via API and R

```
# # learn about the structure of the data
# summary(dat)

# Print the first few lines of the data
dat %>%
  head(3) %>%
  flextable::flextable() %>%
  flextable::colformat_num(
    x = .,
    j = c("year"),
    big.mark = "") %>%
  flextable::theme_zebra()
```

year	common_name	longitude_dd_start	latitude_dd_start	cpue_kgkm2
2022	walleye pollock	-161.5309	64.01371	0.000000
2022	walleye pollock	-162.2692	64.00619	0.000000
2022	walleye pollock	-163.0456	63.97936	0.868724

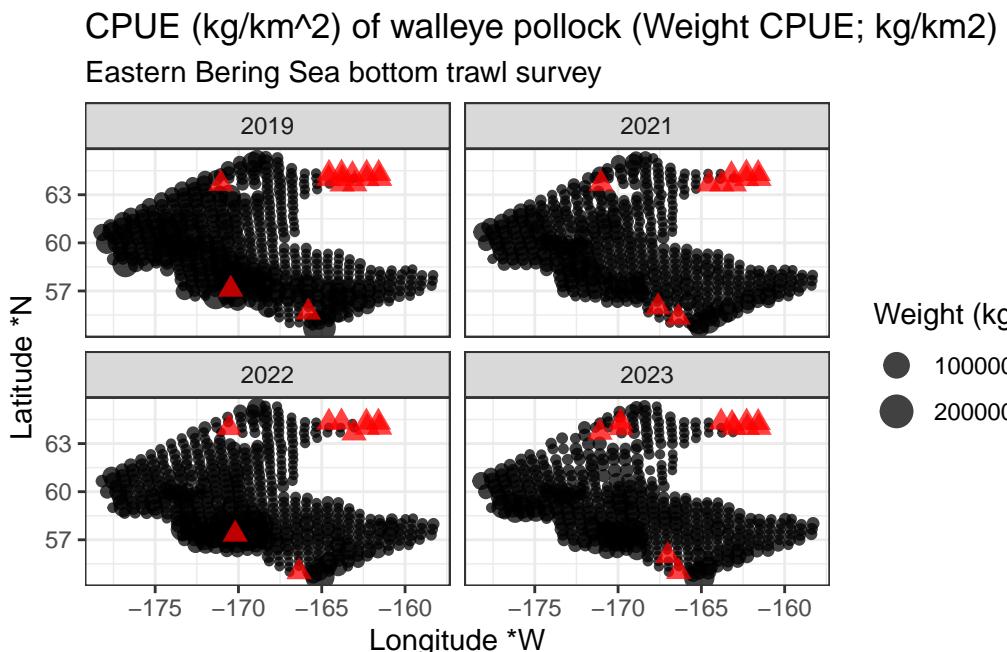
### 14.3.1. Plot locations on map

```
library(ggplot2)

ggplot2::ggplot(data = dat %>% dplyr::filter(cpue_kgkm2 != 0),
                 mapping = aes(x = longitude_dd_start,
                               y = latitude_dd_start,
                               size = cpue_kgkm2)) +
  ggplot2::geom_point(alpha = .75) +
  ggplot2::geom_point(data = dat %>% dplyr::filter(cpue_kgkm2 == 0),
                      color = "red",
                      shape = 17,
                      alpha = .75,
                      size = 3) +
```

## 14. Access via API and R

```
ggplot2::xlab("Longitude *W") +  
  ggplot2::ylab("Latitude *N") +  
  ggplot2::ggttitle(label = "CPUE (kg/km^2) of walleye pollock (Weight CPUE; kg/km2)",  
                     subtitle = "Eastern Bering Sea bottom trawl survey") +  
  ggplot2::scale_size_continuous(name = "Weight (kg)") +  
  ggplot2::facet_wrap(facets = vars(year)) +  
  ggplot2::theme_bw()
```



### 14.3.2. Plot inverse-distance weighted plot of CPUE

This map is constructed using `akgfmaps`. To make IDW plots, you must have data from all stations surveyed, even if no fish of interest were found there.

These plots are similar to those published in the annual Bering Sea data reports.

```
# devtools::install_github("afsc-gap-products/akgfmaps", build_vignettes = TRUE)  
library(akgfmaps)  
idw <- akgfmaps::make_idw_stack(  
  x = dat %>%
```

## 14. Access via API and R

```
dplyr::select(COMMON_NAME = common_name,
               CPUE_KGHA = cpue_kgkm2,
               LATITUDE = latitude_dd_start,
               LONGITUDE = longitude_dd_start,
               year),
grouping.vars = "year",
region = "bs.all", # Predefined EBS area
set.breaks = "jenks", # Gets Jenks breaks from classint::classIntervals()
in.crs = "+proj=longlat", # Set input coordinate reference system
out.crs = "EPSG:3338", # Set output coordinate reference system
extrapolation.grid.type = "sf")
```

```
[inverse distance weighted interpolation]
```

```
shps <- akgfmaps::get_base_layers(
  select.region = "bs.all",
  include.corners = TRUE,
  set.crs = "EPSG:3338")

# set.breaks <- akgfmaps::eval_plot_breaks(CPUE = dat$cpue_kgkm2, n.breaks = 5)
# set.breaks <- as.vector(unlist(set.breaks[set.breaks$style == "pretty", -1]))
set.breaks <- c(0, 50000, 100000, 150000, 200000, 250000)

figure_print <- ggplot() +
  # add map of alaska
  ggplot2::geom_sf(data = shps$akland,
                    color = NA,
                    fill = "grey50") +
  # add IDW plots
  geom_sf(data = idw$extrapolation.stack,
          mapping = aes(fill = var1.pred),
          na.rm = FALSE,
```

## 14. Access via API and R

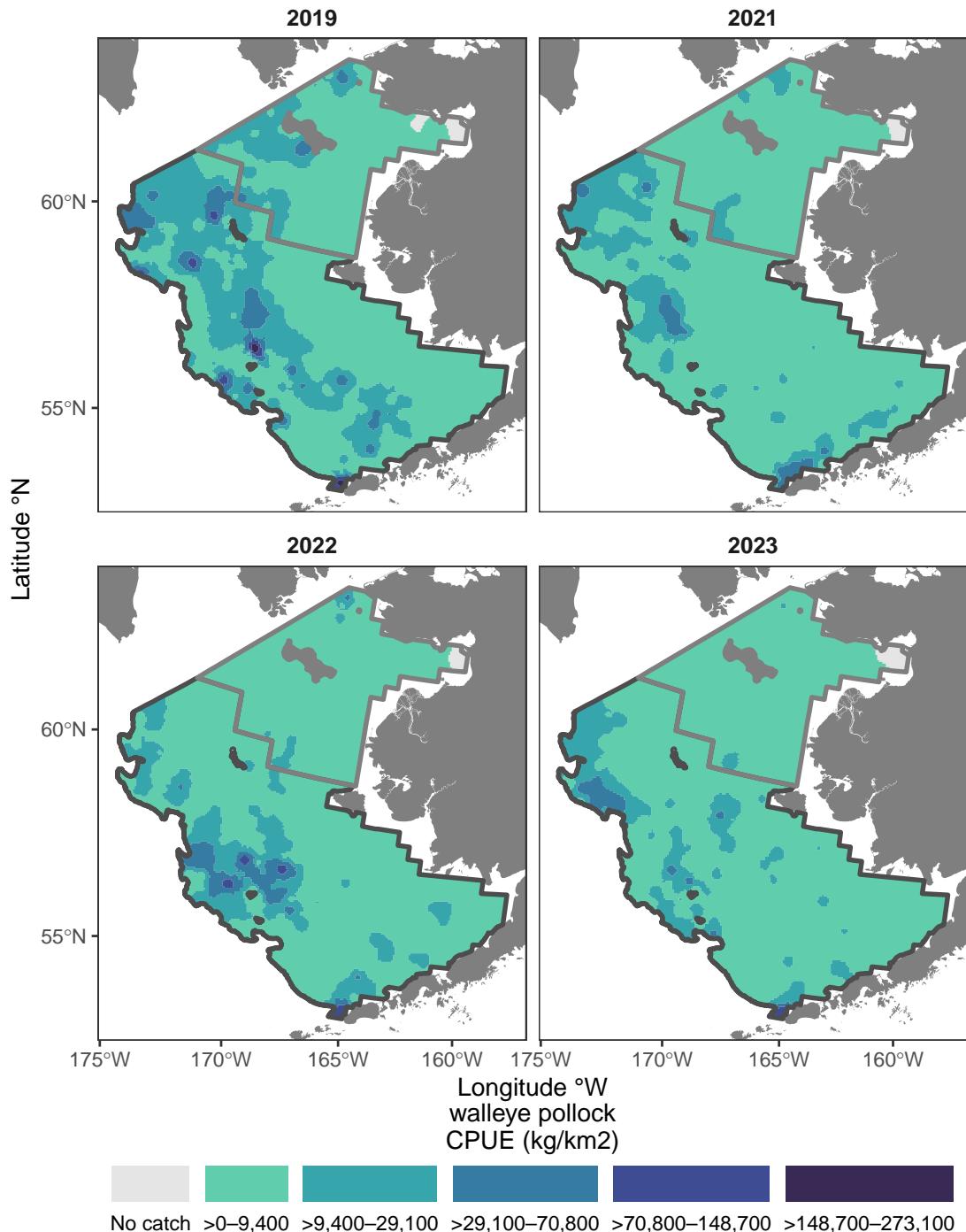
```
show.legend = TRUE,
color = NA) +
ggplot2::scale_fill_manual(
  name = "walleye pollock\nCPUE (kg/km2)",
  values = c("gray90",
    viridis::viridis(
      option = "mako",
      direction = -1,
      n = length(set.breaks)-1,
      begin = 0.20,
      end = 0.80)),
  na.translate = FALSE, # Don't use NA
  drop = FALSE) +
# seperate plots by year
ggplot2::facet_wrap(facets = vars(year), nrow = 2) +
# add survey area
ggplot2::geom_sf(
  data = shps$survey.area,
  mapping = aes(color = SURVEY,
    geometry = geometry),
  fill = "transparent",
  linewidth = 1,
  show.legend = FALSE) +
ggplot2::scale_color_manual(
  name = " ",
  values = c("grey30", "grey50"),
  breaks = shps$survey.area$SURVEY,
  labels = shps$survey.area$SRVY) +
# lat/lon axis and map bounds
ggplot2::scale_x_continuous(name = "Longitude °W",
  breaks = seq(-180, -150, 5)) +
ggplot2::scale_y_continuous(name = "Latitude °N",
  breaks = seq(50, 65, 5)) + # seq(52, 62, 2)
ggplot2::coord_sf(xlim = sf::st_bbox(shps$survey.area)[c(1,3)],
  ylim = sf::st_bbox(shps$survey.area)[c(2,4)]) +
# add theme aesthetics
ggplot2::guides(
  fill = guide_legend(
    order = 1,
    title.position = "top",
```

## 14. Access via API and R

```
label.position = "bottom",
title.hjust = 0.5,
override.aes = list(color = NA),
nrow = 1),
color = "none") +
ggplot2::theme(
  panel.background = element_rect(fill = "white", colour = NA),
  panel.border = element_rect(fill = NA, colour = "grey20"),
  strip.background = element_blank(),
  strip.text = element_text(size = 10, face = "bold"),
  legend.text = element_text(size = 9),
  legend.background = element_rect(colour = "transparent",
                                    fill = "transparent"),
  legend.key = element_rect(colour = "transparent",
                            fill = "transparent"),
  legend.position = "bottom",
  legend.box = "horizontal",
  legend.box.spacing = unit(0, "pt"), # reduce space between legend & plot
  legend.margin=margin(0, 0, 0, 0) )

figure_print
```

## 14. Access via API and R



#### 14.4. Ex. Show catch data for 2023 eastern Bering Sea Walleye Pollock (one species in one survey region in one year)

Data downloads and joins for just one species, survey, and year are much faster and easier to do.

First, because `year` is identified in the haul table, we need to identify all of the hauls (or more specifically, `hauljoin` codes) that were completed in the eastern Bering Sea ("`srvy`": "EBS") in 2023 ("`year`": 2023).

Note: Check how many rows and columns are in the data pull. The eastern Bering Sea survey (before 2024) has 376 stations in it, and pollock are often found in throughout the region so this should have a similar number of rows.

```
## query the API link
res <- httr::GET(url = paste0(api_link_haul, '?limit=10000&q={"year":2023,"srvy":"EBS"}'))
```

```
## convert from JSON format
data <- jsonlite::fromJSON(base::rawToChar(res$content))
dat <- data$items %>%
  dplyr::select(-links) # necessary for API accounting, but not part of the dataset
```

```
## show summary of data to make sure it is subset correctly
summary(dat %>% dplyr::mutate(srvy = as.factor(srvy)))
```

	year	srvy	survey	survey_name
Min.	:2023	EBS:376	Length:376	Length:376
1st Qu.	:2023		Class :character	Class :character
Median	:2023		Mode :character	Mode :character
Mean	:2023			
3rd Qu.	:2023			
Max.	:2023			
	survey_definition_id	cruise	cruisejoin	hauljoin
Min.	:98	Min. :202301	Min. :-760.0	Min. :-23019
1st Qu.	:98	1st Qu.:202301	1st Qu.:-760.0	1st Qu.:-22776
Median	:98	Median :202301	Median :-759.0	Median :-22539
Mean	:98	Mean :202301	Mean :-759.5	Mean :-22552
3rd Qu.	:98	3rd Qu.:202301	3rd Qu.:-759.0	3rd Qu.:-22333
Max.	:98	Max. :202301	Max. :-759.0	Max. :-22110
	haul	stratum	station	vessel_id

## 14. Access via API and R

```

Min.    : 7.00   Min.    :10.00   Length:376      Min.    :134.0
1st Qu.: 65.75  1st Qu.:31.00   Class  :character  1st Qu.:134.0
Median  :114.00  Median  :41.00   Mode   :character  Median  :162.0
Mean    :114.16  Mean    :39.22
3rd Qu.:161.25  3rd Qu.:50.00
Max.    :224.00  Max.    :90.00

vessel_name          date_time        latitude_dd_start longitude_dd_start
Length:376           Length:376       Min.    :54.66     Min.    :-178.2
Class  :character    Class  :character  1st Qu.:57.00     1st Qu.:-172.7
Mode   :character    Mode   :character   Median :58.02     Median :-168.9
                           Mean    :58.26     Mean    :-168.8
                           3rd Qu.:59.50     3rd Qu.:-165.2
                           Max.    :62.01     Max.    :-158.3

latitude_dd_end longitude_dd_end bottom_temperature_c surface_temperature_c
Min.    :54.68   Min.    :-178.2   Min.    :-1.600    Min.    : 1.700
1st Qu.:57.01   1st Qu.:-172.7   1st Qu.: 1.200    1st Qu.: 4.200
Median  :58.02   Median :-168.9   Median : 2.700    Median : 6.550
Mean    :58.26   Mean    :-168.8   Mean    : 2.249    Mean    : 6.386
3rd Qu.:59.50   3rd Qu.:-165.2   3rd Qu.: 3.500    3rd Qu.: 8.525
Max.    :62.01   Max.    :-158.3   Max.    : 5.400    Max.    :11.000

depth_m            distance_fished_km duration_hr      net_width_m
Min.    :20.00    Min.    :1.065     Min.    :0.1890   Min.    :12.90
1st Qu.:54.75    1st Qu.:2.805     1st Qu.:0.5100   1st Qu.:16.66
Median  :74.00    Median :2.889     Median :0.5180   Median :17.27
Mean    :80.75    Mean    :2.854     Mean    :0.5129   Mean    :17.15
3rd Qu.:105.00   3rd Qu.:2.945     3rd Qu.:0.5260   3rd Qu.:17.83
Max.    :171.00   Max.    :3.849     Max.    :0.6560   Max.    :20.29

net_height_m      area_swept_km2 performance
Min.    :1.300    Min.    :0.02017   Min.    :0.0000
1st Qu.:1.875    1st Qu.:0.04725   1st Qu.:0.0000
Median  :2.064    Median :0.04944   Median :0.0000
Mean    :2.107    Mean    :0.04892   Mean    :0.1075
3rd Qu.:2.343    3rd Qu.:0.05134   3rd Qu.:0.0000
Max.    :3.196    Max.    :0.06369   Max.    :6.2200

```

```

## Find how many rows and columns are in the data pull.
print(paste0("rows: ", nrow(dat), "; cols: ", ncol(dat)))

```

```
[1] "rows: 376; cols: 27"
```

## 14. Access via API and R

```
# save outputs for later comparison
dat_haul_ex <- dat
```

```
# Print the first few lines of the data
dat_haul_ex %>%
  head(3) %>%
  flextable::flextable() %>%
  flextable::colformat_num(
    x = .,
    j = c("year", "hauljoin", "cruise"),
    big.mark = "") %>%
  flextable::theme_zebra()
```

year	srvy	survey	survey_name	survey_definition_id	cruise	cruisejoin	hauljoin	haul
2023	EBS	eastern Bering Sea	Eastern Bering Sea Crab/Groun Bottom Trawl Survey	98	202301	-759	-22123	25
2023	EBS	eastern Bering Sea	Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey	98	202301	-759	-22125	27
2023	EBS	eastern Bering Sea	Eastern Bering Sea Crab/Groun Bottom Trawl Survey	98	202301	-759	-22126	28

#### 14.4.1. Identify species\_code for walleye pollock

In the catch data, we itemize species catches by species\_code. To find out which species\_code to use, you can check variations on the following code. Note that here the word pollock is case sensitive. All species common\_name entries are lower case except for proper nouns (e.g., "Pacific"). The notation for finding a string is to use % around the phrase. Since % is a reserved character in a URL, you have to replace % with %25. Similarly, %20 needs to be used in place of a space (e.g., between "walleye" and "pollock": "walleye%20pollock"}').

```
## query the API link. Use:
res <- httr::GET(url = paste0(api_link_species, '?q=%22common_name%22:%22walleye%20pollock'))
# OR
res <- httr::GET(url = paste0(api_link_species, '?q={"common_name":{"$like": "%pollock%25"}'))
# OR
res <- httr::GET(url = paste0(api_link_species, '?q={"common_name":"walleye%20pollock"}'))

## convert from JSON format
data <- jsonlite::fromJSON(base::rawToChar(res$content))

# save outputs for later comparison
dat_species_ex <- data$items %>% dplyr::select(-links) # necessary for API accounting, but

# Print the first few lines of the data
dat_species_ex %>%
  head(3) %>%
  flextable::flextable() %>%
  flextable::colformat_num(
    x = .,
    j = c("species_code"),
    big.mark = "") %>%
  flextable::theme_zebra()
```

Table 14.8.: Walleye pollock species information.

<b>species_- scientific_- common_- code name</b>	<b>id_rank</b>	<b>worms</b>	<b>itis</b>
Gadus 21740 chalcogram mus	walleye pollock	species	300,735    934,083

#### 14.4.2. Then, apply the hauljoins and species\_code to catch query

We'll use the data from the haul and species table we collected before to select 2023 eastern Bering Sea walleye pollock catch data.

```
## query the API link
# data for all walleye pollock caught in all 2023 eastern Bering Sea survey hauls
dat <- data.frame()
# there must be a better way to select multiple values for one parameter,
# but saving that, we will loop through each hauljoin and collect the data of interest
for (i in 1:nrow(dat_haul_ex)) {
  res <- httr::GET(url = paste0(
    api_link_catch,
    '?q={"species_code":21740,"hauljoin":', dat_haul_ex$hauljoin[i], '}'))
  ## convert from JSON format
  data <- jsonlite::fromJSON(base::rawToChar(res$content))
  if (length(data$items) != 0) {
    dat <- dplyr::bind_rows(
      dat,
      data$items %>%
        dplyr::select(-links)) # necessary for API accounting, but not part of the dataset
  }
}
```

Explore data:

```
# Find how many rows and columns are in the data pull
print(paste0("rows: ", nrow(dat), "; cols: ", ncol(dat)))
```

```
[1] "rows: 374; cols: 7"
```

## 14. Access via API and R

```
# learn about the structure of the data
summary(dat)
```

hauljoin	species_code	cpue_kgkm2	cpue_nokm2
Min. :-23019	Min. :21740	Min. : 10.34	Min. : 18.26
1st Qu.:-22777	1st Qu.:21740	1st Qu.: 1454.44	1st Qu.: 2278.72
Median :-22540	Median :21740	Median : 3286.76	Median : 5875.33
Mean :-22553	Mean :21740	Mean : 6364.85	Mean : 11565.45
3rd Qu.:-22324	3rd Qu.:21740	3rd Qu.: 6956.25	3rd Qu.: 12512.98
Max. :-22110	Max. :21740	Max. :148679.68	Max. :202321.08
NA's :1			
count	weight_kg	taxon_confidence	
Min. : 1	Min. : 0.492	Length:374	
1st Qu.: 114	1st Qu.: 71.560	Class :character	
Median : 286	Median : 162.310	Mode :character	
Mean : 574	Mean : 315.419		
3rd Qu.: 619	3rd Qu.: 350.399		
Max. :9997	Max. :7346.495		
NA's :1			

```
# Print the first few lines of the data
dat %>%
  head(3) %>%
  flextable::flextable() %>%
  flextable::colformat_num(
    x = .,
    j = c("hauljoin", "species_code"),
    big.mark = "") %>%
  flextable::theme_zebra()
```

hauljoin	species_code	cpue_kgkm2	cpue_nokm2	count	weight_kg	taxon_confidence
-22123	21740	3,969.8145	4,413.416	207	186.194	High
-22125	21740	3,872.0254	8,477.396	423	193.204	High
-22126	21740	172.2526	553.941	24	7.463	High

## 14. Access via API and R

```
# save outputs for later comparison  
dat_catch_ex <- dat
```

For reference and to help break down the above query, see these other query examples:

```
# data for haul -22775 (i.e., one specific haul)?  
res <- httr::GET(url = paste0(api_link_catch,  
                               '?offset=', i, '&limit=10000&q={"hauljoin":-22775}'))  
  
# data for all walleye pollock (i.e., one species) caught in all years and surveys  
res <- httr::GET(url = paste0(api_link_catch,  
                               '?offset=', i, '&limit=10000&q={"species_code":21740}'))
```

### 14.4.3. Create zero-filled data for 2023 eastern Bering Sea walleye pollock and plot

It is important to create and have access to zero-fill (presence and absence) so you can do simple analyses and plot data.

```
dat <- dplyr::full_join(  
  dat_haul_ex,  
  dat_catch_ex) %>%  
dplyr::full_join(  
  dat_species_ex) %>%  
# modify zero-filled rows  
dplyr::mutate(  
  cpue_kgkm2 = ifelse(is.na(cpue_kgkm2), 0, cpue_kgkm2),  
  cpue_nokm2 = ifelse(is.na(cpue_nokm2), 0, cpue_nokm2),  
  count = ifelse(is.na(count), 0, count),  
  weight_kg = ifelse(is.na(weight_kg), 0, weight_kg))
```

Explore data

```
# Find how many rows and columns are in the data pull  
print(paste0("rows: ", nrow(dat), "; cols: ", ncol(dat)))
```

```
[1] "rows: 376; cols: 38"
```

## 14. Access via API and R

```
# learn about the structure of the data
summary(dat)
```

year	srvy	survey	survey_name
Min. :2023	Length:376	Length:376	Length:376
1st Qu.:2023	Class :character	Class :character	Class :character
Median :2023	Mode :character	Mode :character	Mode :character
Mean :2023			
3rd Qu.:2023			
Max. :2023			

survey_definition_id	cruise	cruisejoin	hauljoin
Min. :98	Min. :202301	Min. :-760.0	Min. :-23019
1st Qu.:98	1st Qu.:202301	1st Qu.:-760.0	1st Qu.:-22776
Median :98	Median :202301	Median :-759.0	Median :-22539
Mean :98	Mean :202301	Mean :-759.5	Mean :-22552
3rd Qu.:98	3rd Qu.:202301	3rd Qu.:-759.0	3rd Qu.:-22333
Max. :98	Max. :202301	Max. :-759.0	Max. :-22110

haul	stratum	station	vessel_id
Min. : 7.00	Min. :10.00	Length:376	Min. :134.0
1st Qu.: 65.75	1st Qu.:31.00	Class :character	1st Qu.:134.0
Median :114.00	Median :41.00	Mode :character	Median :162.0
Mean :114.16	Mean :39.22		Mean :148.3
3rd Qu.:161.25	3rd Qu.:50.00		3rd Qu.:162.0
Max. :224.00	Max. :90.00		Max. :162.0

vessel_name	date_time	latitude_dd_start	longitude_dd_start
Length:376	Length:376	Min. :54.66	Min. :-178.2
Class :character	Class :character	1st Qu.:57.00	1st Qu.:-172.7
Mode :character	Mode :character	Median :58.02	Median :-168.9
		Mean :58.26	Mean :-168.8
		3rd Qu.:59.50	3rd Qu.:-165.2
		Max. :62.01	Max. :-158.3

latitude_dd_end	longitude_dd_end	bottom_temperature_c	surface_temperature_c
Min. :54.68	Min. :-178.2	Min. :-1.600	Min. : 1.700
1st Qu.:57.01	1st Qu.:-172.7	1st Qu.: 1.200	1st Qu.: 4.200
Median :58.02	Median :-168.9	Median : 2.700	Median : 6.550
Mean :58.26	Mean :-168.8	Mean : 2.249	Mean : 6.386

## 14. Access via API and R

3rd Qu.:59.50	3rd Qu.:-165.2	3rd Qu.: 3.500	3rd Qu.: 8.525
Max. :62.01	Max. :-158.3	Max. : 5.400	Max. :11.000
depth_m	distance_fished_km	duration_hr	net_width_m
Min. : 20.00	Min. :1.065	Min. :0.1890	Min. :12.90
1st Qu.: 54.75	1st Qu.:2.805	1st Qu.:0.5100	1st Qu.:16.66
Median : 74.00	Median :2.889	Median :0.5180	Median :17.27
Mean : 80.75	Mean :2.854	Mean :0.5129	Mean :17.15
3rd Qu.:105.00	3rd Qu.:2.945	3rd Qu.:0.5260	3rd Qu.:17.83
Max. :171.00	Max. :3.849	Max. :0.6560	Max. :20.29
net_height_m	area_swept_km2	performance	species_code
Min. :1.300	Min. :0.02017	Min. :0.0000	Min. :21740
1st Qu.:1.875	1st Qu.:0.04725	1st Qu.:0.0000	1st Qu.:21740
Median :2.064	Median :0.04944	Median :0.0000	Median :21740
Mean :2.107	Mean :0.04892	Mean :0.1075	Mean :21740
3rd Qu.:2.343	3rd Qu.:0.05134	3rd Qu.:0.0000	3rd Qu.:21740
Max. :3.196	Max. :0.06369	Max. :6.2200	Max. :21740
NA's :2			
cpue_kgkm2	cpue_nokm2	count	weight_kg
Min. : 0	Min. : 0	Min. : 0.0	Min. : 0.00
1st Qu.: 1431	1st Qu.: 2238	1st Qu.: 111.5	1st Qu.: 70.64
Median : 3273	Median : 5842	Median : 280.0	Median : 161.44
Mean : 6331	Mean : 11473	Mean : 569.4	Mean : 313.74
3rd Qu.: 6946	3rd Qu.: 12345	3rd Qu.: 611.5	3rd Qu.: 349.81
Max. :148680	Max. :202321	Max. :9997.0	Max. :7346.49
taxon_confidence	scientific_name	common_name	id_rank
Length:376	Length:376	Length:376	Length:376
Class :character	Class :character	Class :character	Class :character
Mode :character	Mode :character	Mode :character	Mode :character
worms	itis		
Min. :300735	Min. :934083		
1st Qu.:300735	1st Qu.:934083		
Median :300735	Median :934083		
Mean :300735	Mean :934083		
3rd Qu.:300735	3rd Qu.:934083		

## 14. Access via API and R

```
Max.    :300735   Max.    :934083
NA's     :2        NA's     :2
```

```
# Print the first few lines of the data
dat %>%
  head(3) %>%
  flextable::flextable() %>%
  flextable::colformat_num(
    x = .,
    j = c("year", "cruise", "cruisejoin", "species_code"),
    big.mark = "") %>%
  flextable::theme_zebra()
```

year	srvy	survey	survey_name	survey_definition_id	cruise	cruisejoin	hauljoin	haul
2023	EBS	eastern Bering Sea	Eastern Bering Sea Crab/Groun Bottom Trawl Survey	98	202301	-759	-22,123	25
2023	EBS	eastern Bering Sea	Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey	98	202301	-759	-22,125	27
2023	EBS	eastern Bering Sea	Eastern Bering Sea Crab/Groun Bottom Trawl Survey	98	202301	-759	-22,126	28

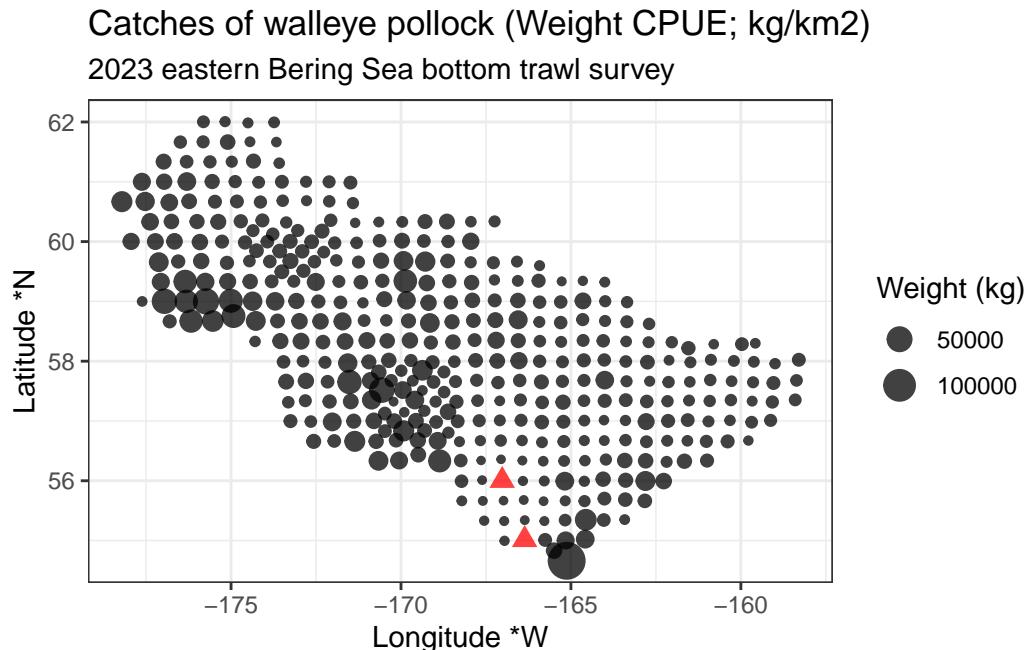
### 14.4.4. Visualize CPUE data in distribution map

Using the zero-filled data from the previous example, we can make a few plots!

## 14.5. Plot locations

```
library(ggplot2)

ggplot2::ggplot(data = dat %>% dplyr::filter(cpue_kgkm2 != 0),
                 mapping = aes(x = longitude_dd_start,
                               y = latitude_dd_start,
                               size = cpue_kgkm2)) +
  ggplot2::geom_point(alpha = .75) +
  ggplot2::geom_point(data = dat %>% dplyr::filter(cpue_kgkm2 == 0),
                      color = "red",
                      shape = 17,
                      alpha = .75,
                      size = 3) +
  ggplot2::xlab("Longitude *W") +
  ggplot2::ylab("Latitude *N") +
  ggplot2::ggtitle(label = "Catches of walleye pollock (Weight CPUE; kg/km2)",
                    subtitle = "2023 eastern Bering Sea bottom trawl survey") +
  ggplot2::scale_size_continuous(name = "Weight (kg)") +
  ggplot2::theme_bw()
```



#### 14.5.1. Plot inverse-distance weighted modeled product of locations

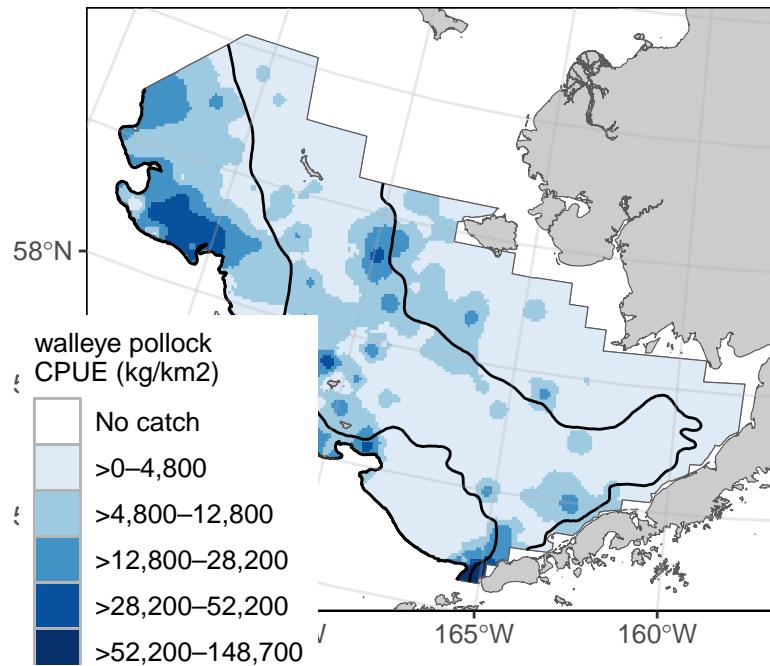
This map is constructed using `akgfmmaps`

```
# devtools::install_github("afsc-gap-products/akgfmmaps", build_vignettes = TRUE)
library(akgfmmaps)

figure0 <- akgfmmaps::make_idw_map(
  CPUE_KGHA = dat$cpue_kgkm2, # calculates the same, regardless of units.
  LATITUDE = dat$latitude_dd_start,
  LONGITUDE = dat$longitude_dd_start,
  region = "bs.south", # Predefined EBS area
  set.breaks = "jenks", # Gets Jenks breaks from classint::classIntervals()
  in.crs = "+proj=longlat", # Set input coordinate reference system
  out.crs = "EPSG:3338", # Set output coordinate reference system
  extrapolation.grid.type = "sf")

[inverse distance weighted interpolation]
[inverse distance weighted interpolation]

figure0$plot + # 20x20km grid
ggplot2::guides(fill=guide_legend(title = "walleye pollock\nCPUE (kg/km2)"))
```



## 14.6. Other query examples

### 14.6.1. Ex. Combination of year, srvy, stratum

Show haul data where year is less than 1989, srvy = "EBS", and stratum is not equal to 81.

```
res <- httr::GET(
  url = paste0(api_link_haul,
               '?&limit=10000&q={"year":{"$lt":1989}, "stratum":{"$ne":"81"}, "srvy":"EBS"})'
  data <- jsonlite::fromJSON(base::rawToChar(res$content))
  dat <- data$items %>%
    dplyr::select(-links) # necessary for API accounting, but not part of the dataset)
```

Explore data:

# 15. Access via API and Python

## 15.0.1. {afscgap} Library Installation

author: Sam Pottinger (sam.pottinger@berkeley.edu; GitHub::sampottinger)  
date: May 13, 2023

The third-party afscgap Python package interfaces with FOSS to access AFSC GAP data. It can be installed via pip:

```
#The reticulate package provides a comprehensive set of tools for interoperability between
library(reticulate)
```

```
pip install afscgap
pip install git+https://github.com/SchmidtDSE/afscgap.git@main
```

For more information on installation and deployment, see the library documentation.

## 15.0.2. Basic query

This first example queries for Pacific glass shrimp (*Pasiphaea pacifica*) in the Gulf of Alaska in 2021. The library will automatically generate HTTP queries, converting from Python types to ORDS query syntax.

```
import afscgap

query = afscgap.Query()
query.filter_year(eq=2021)
query.filter_srvy(eq='GOA')
query.filter_scientific_name(eq='Pasiphaea pacifica')

results = query.execute()
```

## 15. Access via API and Python

The `results` variable in this example is an iterator that will automatically perform pagination behind the scenes.

### 15.0.3. Iterating with a for loop

The easiest way to interact with results is a simple for loop. This next example determines the frequency of different catch per unit effort where Pacific glass shrimp were reported:

```
import afscgap

# Mapping from CPUE to count
count_by_cpue = {}

# Build query
query = afscgap.Query()
query.filter_year(eq=2021)
query.filter_srvy(eq='GOA')
query.filter_scientific_name(eq='Pasiphaea pacifica')
results = query.execute()

# Iterate through results and count
for record in results:
    cpue = record.get_cpue_weight(units='kg/ha')
    cpue_rounded = round(cpue)
    count = count_by_cpue.get(cpue_rounded, 0) + 1
    count_by_cpue[cpue_rounded] = count

# Print the result
print(count_by_cpue)
```

Note that, in this example, only records with Pacific glass shrimp are included ("presence-only" data). See zero catch inference below. In other words, it reports on CPUE only for hauls in which Pacific glass shrimp were recorded, excluding some hauls like those in which Pacific glass shrimp were not found at all.

## 15. Access via API and Python

### 15.0.4. Iterating with functional programming

A for loop is not the only option for iterating through results. List comprehensions and other functional programming methods can be used as well.

```
import statistics

import afscgap

# Build query
query = afscgap.Query()
query.filter_year(eq=2021)
query.filter_srvy(eq='GOA')
query.filter_scientific_name(eq='Pasiphaea pacifica')
results = query.execute()

# Get temperatures in Celsius
temperatures = [record.get_bottom_temperature(units='c') for record in results]

# Take the median
print(statistics.median(temperatures))
```

This example reports the median temperature in Celcius for when Pacific glass shrimp was reported.

### 15.0.5. Load into Pandas

The results from the afscgap package are serializable and can be loaded into other tools like Pandas. This example loads Pacific glass shrimp from 2021 Gulf of Alaska into a data frame.

```
import pandas

import afscgap

query = afscgap.Query()
query.filter_year(eq=2021)
query.filter_srvy(eq='GOA')
query.filter_scientific_name(eq='Pasiphaea pacifica')
```

## 15. Access via API and Python

```
results = query.execute()  
  
pandas.DataFrame(results.to_dicts())
```

Specifically, `to_dicts` provides an iterator over a dictionary form of the data that can be read into tools like Pandas.

### 15.0.6. Advanced filtering

Queries so far have focused on filters requiring equality but range queries can be built as well.

```
import afscgap  
  
# Build query  
query = afscgap.Query()  
query.filter_year(min_val=2015, max_val=2019)    # Note min/max_val  
query.filter_srvy(eq='GOA')  
query.filter_scientific_name(eq='Pasiphaea pacifica')  
results = query.execute()  
  
# Sum weight  
weights = map(lambda x: x.get_weight(units='kg'), results)  
total_weight = sum(weights)  
print(total_weight)
```

This example queries for Pacific glass shrimp data between 2015 and 2019, summing the total weight caught. Note that most users will likely take advantage of built-in Python to ORDS query generation which dictates how the library communicates with the API service. However, users can provide raw ORDS queries as well using manual filtering.

### 15.0.7. Zero-catch inference

Until this point, these examples use presence-only data. However, the `afscgap` package can infer negative or “zero catch” records as well.

## 15. Access via API and Python

```
import afscgap

# Mapping from CPUE to count
count_by_cpue = {}

# Build query
query = afscgap.Query()
query.filter_year(eq=2021)
query.filter_srvy(eq='GOA')
query.filter_scientific_name(eq='Pasiphaea pacifica')
query.set_presence_only(False) # Added to earlier example
results = query.execute()

# Iterate through results and count
for record in results:
    cpue = record.get_cpue_weight(units='kg/ha')
    cpue_rounded = round(cpue)
    count = count_by_cpue.get(cpue_rounded, 0) + 1
    count_by_cpue[cpue_rounded] = count

# Print the result
print(count_by_cpue)
```

This example revisits the earlier snippet for CPUE counts but `set_presence_only(False)` directs the library to look at additional data on hauls, determining which hauls did not have Pacific glass shrimp. This lets the library return records for hauls in which Pacific glass shrimp were not found. This can be seen in differences in counts reported:

Rounded CPUE	Count with <code>set_presence_only(True)</code>	Count with <code>set_presence_only(False)</code>
0 kg/ha	44	521
1 kg/ha	7	7
2 kg/ha	1	1

Put simply, while the earlier example showed CPUE counts for hauls in which Pacific glass shrimp were seen, this revised example reports for all hauls in the Gulf of Alaska in 2021.

## *15. Access via API and Python*

### **15.0.8. More information**

Please see the API documentation for the Python library for additional details.

## 16. Access via Oracle and R (AFSC Staff only)

If the user has access to the AFSC Oracle database, the user can use SQL developer to view and pull the FOSS public data directly from the GAP\_PRODUCTS Oracle schema.

### 16.0.1. Connect to Oracle from R

Many users will want to access the data from Oracle using R. The user will need to install the RODBC R package and ask OFIS (IT) connect R to Oracle. Then, use the following code in R to establish a connection from R to Oracle:

Here, the user can write in their username and password directly into the RODBC connect function. Never save usernames or passwords in scripts that may be intentionally or unintentionally shared with others. If no username and password is entered in the function, pop-ups will appear on the screen asking for the username and password.

```
library(gapindex)
channel <- gapindex::get_connected()
```

### 16.0.2. Ex. Wholesale download data and join data in R

```
locations <- c(
  "GAP_PRODUCTS.FOSS_CATCH",
  "GAP_PRODUCTS.FOSS_HAUL",
  "GAP_PRODUCTS.FOSS_SPECIES"
)

print(Sys.Date())

error_loading <- c() # log if any tables are unable to download
```

## 16. Access via Oracle and R (AFSC Staff only)

```
for (i in 1:length(locations)){
  print(locations[i])
  a <- RODBC::sqlQuery(channel, paste0("SELECT * FROM ", locations[i], "; "))
  if (is.null(nrow(a))) { # if an error in downloading has occurred
    error_loading <- c(error_loading, locations[i])
  } else { # if no error in downloading has occurred
    write.csv(x = a,
              # change file name to be more computer file storage friendly
              here::here(paste0(tolower(gsub(
                pattern = '.',
                replacement = "_",
                x = locations[i],
                fixed = TRUE)),
                ".csv"))))
  }
}
error_loading
```

Join downloaded files into presence-only table

```
# Load data
library(dplyr)
library(here)
library(readr)
catch <- readr::read_csv(file = here::here("data/gap_products_foss_catch.csv"))[,-1] # remove
haul <- readr::read_csv(file = here::here("data/gap_products_foss_haul.csv"))[,-1] # remove
species <- readr::read_csv(file = here::here("data/gap_products_foss_species.csv"))[,-1] # remove

dat <-
  # join haul and catch data to unique species by survey table
  dplyr::left_join(haul, catch) %>%
  # join species data to unique species by survey table
  dplyr::left_join(species) %>%
  # modify zero-filled rows
  dplyr::mutate(
    CPUE_KGKM2 = ifelse(is.null(CPUE_KGKM2), 0, CPUE_KGKM2), # just in case
    CPUE_KGHA = CPUE_KGKM2/100, # Hectares
    CPUE_NOKM2 = ifelse(is.null(CPUE_NOKM2), 0, CPUE_NOKM2), # just in case
    CPUE_NOHA = CPUE_NOKM2/100, # Hectares
```

## 16. Access via Oracle and R (AFSC Staff only)

```
COUNT = ifelse(is.null(COUNT), 0, COUNT),
WEIGHT_KG = ifelse(is.null(WEIGHT_KG), 0, WEIGHT_KG) )
```

Join downloaded files into zero-filled table

```
# Load data
library(dplyr)
library(here)
library(readr)
catch <- readr::read_csv(file = here::here("data/gap_products_foss_catch.csv"))[,-1] # remove
haul <- readr::read_csv(file = here::here("data/gap_products_foss_haul.csv"))[,-1] # remove
species <- readr::read_csv(file = here::here("data/gap_products_foss_species.csv"))[,-1] # remove

# come up with full combination of what species should be listed for what hauls/surveys
# for zero-filled data, all species caught in a survey need to have zero or non-zero row entries
comb <- dplyr::full_join(
  x = dplyr::left_join(catch, haul, by = "HAULJOIN") %>%
    dplyr::select(SURVEY_DEFINITION_ID, SPECIES_CODE) %>%
    dplyr::distinct(),
  y = haul %>%
    dplyr::select(SURVEY_DEFINITION_ID, HAULJOIN) %>%
    dplyr::distinct(),
  by = "SURVEY_DEFINITION_ID",
  relationship = "many-to-many"
)

# Join data to make a full zero-filled CPUE dataset
dat <- comb %>%
  # add species data to unique species by survey table
  dplyr::left_join(species, "SPECIES_CODE") %>%
  # add catch data
  dplyr::full_join(catch, c("SPECIES_CODE", "HAULJOIN")) %>%
  # add haul data
  dplyr::full_join(haul) %>% # , c("SURVEY_DEFINITION_ID", "HAULJOIN")
  # modify zero-filled rows
  dplyr::mutate(
    CPUE_KGKM2 = ifelse(is.null(CPUE_KGKM2), 0, CPUE_KGKM2),
    CPUE_KGHA = CPUE_KGKM2/100, # Hectares
    CPUE_NOKM2 = ifelse(is.null(CPUE_NOKM2), 0, CPUE_NOKM2),
    CPUE_NOHA = CPUE_NOKM2/100, # Hectares
```

## 16. Access via Oracle and R (AFSC Staff only)

```
COUNT = ifelse(is.null(COUNT), 0, COUNT),
WEIGHT_KG = ifelse(is.null(WEIGHT_KG), 0, WEIGHT_KG) )
```

### 16.0.3. Ex. Join data using Oracle

To join these tables in Oracle, you may use a variant of the following code:

```
SELECT
hh.YEAR,
hh.SRVY,
hh.SURVEY,
hh.SURVEY_DEFINITION_ID,
hh.SURVEY_NAME,
hh.CRUISE,
hh.CRUISEJOIN,
hh.HAUL,
hh.HAULJOIN,
hh.STRATUM,
hh.STATION,
hh.VESSEL_ID,
hh.VESSEL_NAME,
hh.DATE_TIME,
hh.LATITUDE_DD_START,
hh.LONGITUDE_DD_START,
hh.LATITUDE_DD_END,
hh.LONGITUDE_DD_END,
hh.BOTTOM_TEMPERATURE_C,
hh.SURFACE_TEMPERATURE_C,
hh.DEPTH_M,
cc.SPECIES_CODE,
ss.ITS,
ss.WORMS,
ss.COMMON_NAME,
ss.SCIENTIFIC_NAME,
ss.ID_RANK,
CASE WHEN cc.CPUE_KGKM2 IS NULL THEN 0 ELSE cc.CPUE_KGKM2 END AS CPUE_KGKM2,
CASE WHEN cc.CPUE_NOKM2 IS NULL THEN 0 ELSE cc.CPUE_NOKM2 END AS CPUE_NOKM2,
CASE WHEN cc.COUNT IS NULL THEN 0 ELSE cc.COUNT END AS COUNT,
```

## 16. Access via Oracle and R (AFSC Staff only)

```
CASE WHEN cc.WEIGHT_KG IS NULL THEN 0 ELSE cc.WEIGHT_KG END AS WEIGHT_KG,
CASE WHEN cc.TAXON_CONFIDENCE IS NULL THEN NULL ELSE cc.TAXON_CONFIDENCE END AS TAXON_CONFIDENCE,
hh.AREA_SWEPT_KM2,
hh.DISTANCE_FISHED_KM,
hh.DURATION_HR,
hh.NET_WIDTH_M,
hh.NET_HEIGHT_M,
hh.PERFORMANCE
FROM GAP_PRODUCTS.FOSS_SURVEY_SPECIES sv
FULL OUTER JOIN GAP_PRODUCTS.FOSS_SPECIES ss
ON sv.SPECIES_CODE = ss.SPECIES_CODE
FULL OUTER JOIN GAP_PRODUCTS.FOSS_HAUL hh
ON sv.SURVEY_DEFINITION_ID = hh.SURVEY_DEFINITION_ID
FULL OUTER JOIN GAP_PRODUCTS.FOSS_CATCH cc
ON sv.SPECIES_CODE = cc.SPECIES_CODE
AND hh.HAULJOIN = cc.HAULJOIN
```

### 16.0.4. Ex. Subset data

Here, we are pulling EBS Pacific cod from 2010 - 2021:

```
# Pull data
data <- RODBC::sqlQuery(
  channel = channel,
  query =
  "SELECT * FROM GAP_PRODUCTS.FOSS_CATCH cc
  JOIN GAP_PRODUCTS.FOSS_HAUL hh
  ON cc.HAULJOIN = hh.HAULJOIN
  WHERE SRVY = 'EBS'
  AND SPECIES_CODE = 21720 -- 'Pacific cod'
  AND YEAR >= 2010
  AND YEAR < 2021")

flextable::flextable(data[1:3,]) %>%
  flextable::theme_zebra()
```

16. Access via Oracle and R (AFSC Staff only)

HAULJOIN	SPECIES_CODE	CPUE_KGKM2	CPUE_NOKM2	COUNT	WEIGHT_KG	TAXON_CONFIDENCE	YEAR	SRVY
-19,461	21,720	646.8800	200.3345	10	32.29	High	2,019	EBS
-19,446	21,720	1,212.7733	164.7230	8	58.90	High	2,019	EBS
-19,422	21,720	313.8482	108.5980	6	17.34	High	2,019	EBS

**16.0.5. Ex. Find all species found in the eastern Bering Sea (EBS) survey in 2023**

```
# Pull data
data <- RODBC::sqlQuery(
  channel = channel,
  query =
  "SELECT DISTINCT
  ss.COMMON_NAME,
  ss.SCIENTIFIC_NAME,
  ss.ID_RANK,
  ss.WORMS
  FROM GAP_PRODUCTS.FOSS_CATCH cc -- get species codes
  LEFT JOIN GAP_PRODUCTS.FOSS_SPECIES ss -- get species info
  ON cc.SPECIES_CODE = ss.SPECIES_CODE
```

## 16. Access via Oracle and R (AFSC Staff only)

```
LEFT JOIN GAP_PRODUCTS.FOSS_HAUL hh -- filter by year and survey
ON cc.HAULJOIN = hh.HAULJOIN
WHERE hh.YEAR = 2023
AND hh.SURVEY_DEFINITION_ID = 98 -- EBS survey
ORDER BY COMMON_NAME")  
  
flextable::flextable(data[1:3,]) %>%
  # flextable::fit_to_width(max_width = 6) %>%
  flextable::theme_zebra()
```

COMMON_NAME	SCIENTIFIC_NAME	ID_RANK	WORMS
Alaska great-tellin	Megangulus luteus	species	423,511
Alaska plaice	Pleuronectes quadrituberculatus	species	254,564
Alaska skate	Arctoraja parmiifera	species	1,577,324

**Part VI.**

**Data Products & Tools**

To accompany these data, we also produce data products to make using our data more accessible and straightforward.

Table 16.3.: Survey of products developed by GAP

<b>Product</b>	<b>Point of Contact GOA/AI</b>	<b>Point of Contact BS</b>	<b>Description</b>
<b>Data</b>			
<b>Finalized bottom trawl data</b>	Ned Laman	Duane Stevenson	NOAA-NMFS-AFSC-RACE-GA trawl data that has completed post-survey internal QAQC procedures.
<b>Data requests</b>	Nancy Roberson	Nancy Roberson	To request a subset of the NOAA-NMFS-AFSC-RACE-GA trawl raw data or a data product.
<b>Species codebook</b>	Nancy Roberson	Chris Anderson	List of codes used for fish and other species identified in NOAA-NMFS-AFSC-RACE-GA surveys.
<b>Survey protocols</b>	Nancy Roberson	Nancy Roberson	Documentation of NOAA-NMFS-AFSC-RACE-GA bottom trawl survey protocols.
<b>Analysis</b>			
<b>Design-based indices for target species</b>	Ned Laman	Rebecca Haehn	Standard design-based indices of abundance from NOAA-NMFS-AFSC-RACE-GA trawl survey data.
<b>Design-based age or length composition</b>	Ned Laman	Rebecca Haehn	Standard design-based indices of age composition from NOAA-NMFS-AFSC-RACE-GA trawl survey data.
<b>Model-based indices, age comps (stock assessment), area occupied, and COG (ESP)</b>	Cecilia O'Leary	Lewis Barnett	Spatiotemporal model-based indices, abundance indices, age composition from NOAA-NMFS-AFSC-RACE-GA trawl survey data.

Product	Point of Contact GOA/AI	Point of Contact BS	Description
<b>Annual bottom and surface temperature summary (ESR, stock assessment)</b>	Cecilia O'Leary	Sean Rohan & Lewis Barnett	Summary metrics for bottom trawl and surface temperatures relative to historical baseline.
<b>Bering Sea cold pool index and temperature data products (ESR, ESP, stock assessment)</b>	-	Sean Rohan & Lewis Barnett	Create annual temperature raster for EBS, calculate the EBS cold pool index, temperature data products, and visualizations.
<b>Annual fish condition (ESR)</b>	Cecilia O'Leary	Bianca Prohaska & Sean Rohan	Groundfish morphometric condition in the Bering Sea, Aleutian Islands, and off Alaska.
<b>Rockfish indices vs environmental gradients (ESR)</b>	Alexandra Dowlin	-	GOA/AI survey trends in distribution and abundance of 6 rockfishes across environmental gradients in the Bering Sea.
<b>Structure-Forming Invertebrates-Habitat Areas of Particular Concern (SFI-HAPC) (ESR)</b>	Ned Laman	-	Relative abundance of sponge, hydrocorals, soft corals, Gorgonians, anemones, and Pennatulaceans from GOA and AI surveys.
<b>Forage fishes (ESR)</b>	Ned Laman	-	Relative abundance of capelin, sandfish, sand lance, and prickleback from GOA and AI surveys.
<b>Miscellaneous species (ESR)</b>	Ned Laman	Thaddeus Buser	Relative abundance of echinoderms, poachers, shrimp and eelpouts from GOA and AI surveys.
<b>Jellies (ESR)</b>	Ned Laman	Thaddeus Buser	Relative abundance of sea jellies from GOA and AI surveys.
<b>Essential fish habitat</b>	Megsie Siple	Sean Rohan	Habitat maps for groundfish areas based on species distribution models updated every five years.
<b>Visualization Tools</b>			
<b>Alaska groundfish maps (CPUE, etc.)</b>	-	Sean Rohan	Visualization tool for the Alaska groundfish regions.
<b>Communication</b>			

<b>Product</b>	<b>Point of Contact GOA/AI</b>	<b>Point of Contact BS</b>	<b>Description</b>
<b>Annual survey data report</b>	Megsie Siple & Bethany Riggle	Emily Markowitz, Sophia Wassermann, Nicole Charriere, Chris Anderson	Alaska Fisheries Science Center Technical Memorandum summarizing survey progress and findings. Available online and the latest results for each survey are listed below ( <a href="https://repository.library.noaa.gov">https://repository.library.noaa.gov</a> ).
<b>ADF&amp;G report of research activities</b>	Alexandra Dowlin	Nicole Charriere & Rebecca Haehn	Report on AI and GOA trawl survey activity inside and outside of Alaska waters.
<b>IPHC Report</b>	-	Rebecca Haehn	
<b>Plan team survey results presentation</b>	Ned Laman	Duane Stevenson	NOAA-NMFS-AFSC-RACE-Groundfish Plan Team; presentations, reports, attachments located here: <a href="https://www.npfmc.org/about-the-north-pacific-fisheries-management-council/plan-teams/bsai-and-groundfish/">https://www.npfmc.org/about-the-north-pacific-fisheries-management-council/plan-teams/bsai-and-groundfish/</a> .
<b>Community highlights report</b>	TBD	Emily Markowitz	Compilation of NOAA-NMFS-AFSC-RACE-Groundfish findings for communities around the world.
<b>Bottom Trawl Survey Temperature and Progress Maps</b>	Ned Laman	Emily Markowitz	Near real-time survey progress and temperatures recorded during surveys in the Aleutian Islands, Gulf of Alaska, and Beaufort Sea Bottom Trawl Surveys.

# **17. Open source code**

## **17.1. R Packages**

### **17.1.1. akgfmaps R package**

Bttom trawl survey maps layers and plotting examples. **POC:** Sean Rohan

### **17.1.2. coldpool R package**

Cold pool area and temperature data products for the Bering Sea. **POC:** Sean Rohan

### **17.1.3. akfishcondition R package**

Groundfish morphometric condition indicators for fish in the Bering Sea, Aleutian Islands, and Gulf of Alaska. **POC:** Sean Rohan

### **17.1.4. gapindex R package**

Calculation of Design-Based Indices of Abundance and Composition for AFSC GAP Bottom Trawl Surveys. **POC:** Zack Oyafuso and Margaret Siple

## **Part VII.**

### **Contact us**

*This code is primarally maintained by:*

Thank you for using our data guide!

This code is always in development. Find code used for various reports in the code releases.

## **This code is primarally maintained by:**

**Emily Markowitz** (Emily.Markowitz AT noaa.gov; @EmilyMarkowitz-NOAA)

**Zack Oyafuso** (Zack.Oyafuso AT noaa.gov; @zoyafuso-NOAA)

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Alaska Fisheries Science Center,

National Marine Fisheries Service,

National Oceanic and Atmospheric Administration,

Seattle, WA 98195

**General questions and more specific data requests** can be sent to nmfs.afsc.gap.metadata@noaa.gov or submitted as an issue on our GitHub Organization. The version of this data used for stock assessments can be found through the Alaska Fisheries Information Network (AKFIN). For questions about the eastern Bering Sea surveys, contact Duane Stevenson (Duane.Stevenson@noaa.gov). For questions about the Gulf of Alaska or Aleutian Islands surveys, contact Ned Laman (Ned.Laman@noaa.gov). For questions specifically about crab data in any region, contact Mike Litzow (Mike.Litzow@noaa.gov), the Shellfish Assessment Program lead.

For questions, comments, and concerns specifically about the Fisheries One Stop Shop (FOSS) platform, please contact us using the Comments page on the FOSS web-page.

## **18. Production run notes**

Report run date: Tuesday, October 08, 2024

## 19. R Version Metadata

```
R version 4.4.1 (2024-06-14 ucrt)
Platform: x86_64-w64-mingw32/x64
Running under: Windows 10 x64 (build 19045)

Matrix products: default

locale:
[1] LC_COLLATE=English_United States.utf8
[2] LC_CTYPE=English_United States.utf8
[3] LC_MONETARY=English_United States.utf8
[4] LC_NUMERIC=C
[5] LC_TIME=English_United States.utf8

time zone: America/Los_Angeles
tzcode source: internal

attached base packages:
[1] stats      graphics   grDevices utils      datasets   methods    base

loaded via a namespace (and not attached):
[1] compiler_4.4.1    fastmap_1.2.0    cli_3.6.3       tools_4.4.1
[5] htmltools_0.5.8.1 rstudioapi_0.16.0  yaml_2.3.10    rmarkdown_2.28
[9] knitr_1.48        jsonlite_1.8.8   xfun_0.47     digest_0.6.37
[13] rlang_1.1.4       evaluate_0.24.0
```

### 19.0.1. NOAA README

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## *19. R Version Metadata*

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## **20. Acknowledgments**

## **21. Community Acknowledgments**

We would like to thank the many communities of Alaska and their members who have helped contribute to this body of work. The knowledge, experiences, and insights have been instrumental in expanding the scope of our science and knowledge to encompass the many issues that face this important ecosystem. We appreciate feedback from those residing in the region that are willing to share their insights and participation in an open dialog about how we can improve our collective knowledge of the ecosystem and the region.

## **22. Land Acknowledgements**

We would like to thank the many communities of the Bering Strait region and their members who have helped contribute to this document. The knowledge, experiences, and insights of the people of the Bering Strait region have been instrumental in expanding the scope of our science and knowledge to encompass the many issues that face this important ecosystem. We appreciate feedback from those residing in the region that are willing to share their insights, including the local names used for the species covered by this document, identifying species of interest or concern that should be included in this document, and participation in an open dialog about how we can improve our collective knowledge of the ecosystem and the region.

NOAA Fisheries Alaska Fisheries Science Center's work is conducted in the waters and along the coastlines of Alaska, which include the traditional home lands and waters of the Inupiat, Yupiit, Siberian Yupiit, Unangax, Alutiiq/Sugpiaq, Eyak, Dena'ina Athabascan, Tlingit, Haida, and Tsimshian who have stewarded their lands and waters since time immemorial. We are indebted to these peoples for their wisdom and knowledge of their lands and waters.

This document was prepared in the greater Seattle area, which are the traditional lands of the Coast Salish people, including the Duwamish people, past and present. We are grateful for their continued sharing of vision, wisdom, values, and leadership.

## **23. Technical Acknowledgments**

This quarto book is based off the NOAA-quarto-book GitHub repo designed by Eli Holmes.

This repo and GitHub Action was based on the tutorial by Openscapes quarto-website-tutorial by Julia Lowndes and Stefanie Butland.

### **23.1. Partners**

Scientists from the Alaska Fisheries Science Center conduct these bottom trawl surveys with participation from the Alaska Department of Fish & Game (ADF&G), the International Pacific Halibut Commission (IPHC), and universities. This research is conducted on chartered fishing vessels.

### **23.2. Collaborators**

Our data are used in many annual publications, including but not limited to the list below:

- Alaska Stock Assessments
- North Pacific Groundfish Stock Assessment and Fishery Evaluation Reports
- Groundfish Economic Status Reports for the Gulf of Alaska and Bering Sea and Aleutian Islands
- Alaska Marine Ecosystem Status Report Database
- Southeast Alaska Coastal Monitoring Survey Reports
- Alaska Fisheries Life History Database
- Essential Fish Habitat Research Plan in Alaska

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