



NOAA Technical Memorandum NMFS-XXX-##

GAP Production Data Documentation

Emily Markowitz, Zack Oyafuso

U.S. DEPARTMENT OF COMMERCE

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



**NOAA
FISHERIES**

GAP Production Data Documentation

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AFSC RACE Groundfish and Shellfish Assessment Program Design-Based Production 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.

What is the research objective?

The objectives of these surveys are to:

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

Learn more about the program

What is the research objective?



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.

Part I.

Introduction

Part II.

Objective

Please refer to our Draft Data Changes Brief. Once finalized, this language will be included here.

Part III.

Data levels

User Resources

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 1A:** 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
- **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

User Resources

- GitHub repository.
- Access Tips and Documentation for All Production Data
- Fisheries One Stop Shop (FOSS)

User Resources

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

Part IV.

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, 2023).
- AFSC RACE Groundfish Data for AKFIN (Alaska Fisheries Information Network (AKFIN), 2023).
- Public Data hosted on the Fisheries One Stop Shop (FOSS) Data Platform (NOAA Fisheries Alaska Fisheries Science Center, 2023).

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  copyright = {Public Domain}
}

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  author = {{NOAA Fisheries Alaska Fisheries Science Center}},
  year = {2023},
  title = {Fisheries One Stop Shop Public Data: RACE Division Bottom Trawl Survey Data Query},
  howpublished = {https://www.fisheries.noaa.gov/foss},
  publisher = {{U.S. Dep. Commer.}},
  copyright = {Public Domain}
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@misc{GAPakfin,
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  institution = {{NOAA Fisheries Alaska Fisheries Science Center, Goundfish Assessment Program}},
  year = {2023},
  title = {AFSC Goundfish Assessment Program Design-Based Production Data},
  howpublished = {https://www.psmfc.org/program/alaska-fisheries-information-network-akfin},
  publisher = {{U.S. Dep. Commer.}},
  copyright = {Public Domain}
}
```

Or cite our latest data reports for survey-specific data and other findings:

Alaska Fisheries Information Network (AKFIN). (2023). *AFSC groundfish assessment program design-based production data*. NOAA Fisheries Alaska Fisheries Science Center, Goundfish Assessment Program; <https://www.psmfc.org/program/alaska-fisheries-information-network-akfin>; U.S. Dep. Commer.

Hoff, G. R. (2016). *Results of the 2016 eastern Bering Sea upper continental slope survey of groundfishes and invertebrate resources* (NOAA Tech. Memo. NOAA-AFSC-339). U.S. Dep. Commer. <https://doi.org/10.7289/V5/TM-AFSC-339>

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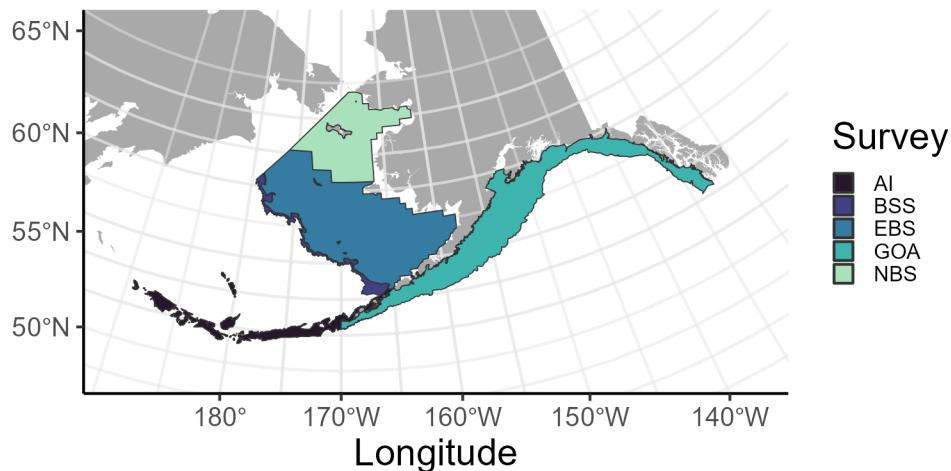
Von Szalay, P. G., and Raring, N. W. (2018). *Data report: 2017 Gulf of Alaska bottom trawl survey* (NOAA Tech. Memo. NMFS-AFSC-374). U.S. Dep. Commer. <https://doi.org/10.7289/V5/TM-AFSC-374>

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Bottom trawl surveys and regions

Bottom Trawl Survey Regions

AFSC RACE Groundfish and Shellfish Public Data Coverage



- **Aleutian Islands (AI)** (Von Szalay and Raring, 2020)
 - Triennial (1990s)/Biennial since 2000 in even years
 - Modified Index-Stratified Random of Successful Stations Survey Design
- **Eastern Bering Sea Slope (BSS)** (Hoff, 2016)
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Access Constraints

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

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. 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.

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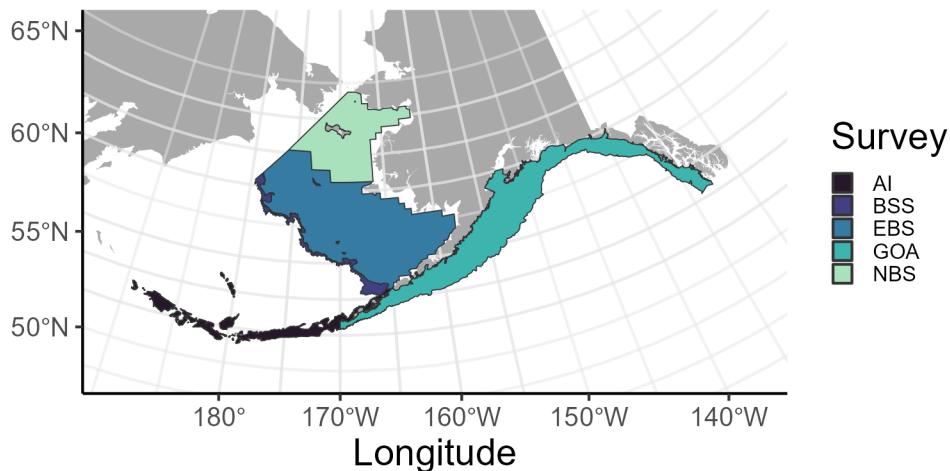
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5. Contact us

General questions and more specific data requests can be sent to 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 webpage.

Alaska Fisheries Science Center (AFSC)
National Oceanic and Atmospheric Administration (NOAA)
Resource Assessment and Conservation Engineering Division (RACE)
Groundfish Assessment Program (GAP)
7600 Sand Point Way, N.E. bldg. 4
Seattle, WA 98115 USA

6. 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.

7. News

7.1. Early 2023

The main goal here to simplify the data management or to also standardize the way stock assessors are using RACE data.

We have decided to undergo this organizational change to meet the following best practices and long-term data goals. Let us know how we can better meet these objectives and best work with IT:

- Minimize duplication (both in tables and in columns within tables)
- Minimize schemata and Oracle objects to the extent possible
- Streamlined integration of tables
- Minimize work for data creators
- Minimize confusion and obstacles for data users
- Security and data management best practices

Part V.

AFSC RACE Groundfish Survey 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.

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.

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, Goundfish Assessment Program, 2023). Add "note = {Accessed: mm/dd/yyyy}" to append the day this data was accessed.

```
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  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-data},
  publisher = {{U.S. Dep. Commer.}},
  copyright = {Public Domain}
}
```

Data Creation

Data Creation

These data are created using the gapindex R package.

8. GAP Production Data Metadata

8.1. Data created in this repo

8.1.1. GAP_PRODUCTS.AGECOMP

Number of rows: 719695

Number of columns: 9

SURVEY_DEFINITION_ID	AREA_ID	YEAR	SPECIES_CODE	SEX	AGE	POPULATION_COUNT	LEM
143	99902	2010	21370	3	-9	620288	
143	99902	2017	21370	1	-9	1846350	
143	99902	2017	21370	2	-9	1927790	

8.1.2. GAP_PRODUCTS.AREA

This reference table stores all metadata and estimates for all estimates of stratum and subarea area estimates. Use this table with the STRATUM_GROUPS and SURVEY_DESIGN tables. by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 443

Number of columns: 10

8. GAP Production Data Metadata

SURVEY_DEFINITION_ID	DESIGN_YEAR	AREA_ID	TYPE	AREA_NAME	DESCRIPTION
98	2022	62	STRATUM	Outer Domain	100-200 m, NW sec
143	2022	70	STRATUM	Inner Domain	<50 m , N of standa
143	2022	71	STRATUM	Inner Domain	<50 m, Norton Sour

8.1.3. GAP_PRODUCTS.BIOMASS

Number of rows: 5343337

Number of columns: 16

SURVEY_DEFINITION_ID	AREA_ID	SPECIES_CODE	YEAR	N_HAUL	N_WEIGHT	N_COUNT	N_L
143	70	71525	2010	58	8	8	
143	70	71526	2010	58	0	0	
143	70	71535	2010	58	1	1	

8.1.4. GAP_PRODUCTS.CPUE

All haul-level zero-filled haul-level catch-per-unit-effort (units in kg/km²) data, by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 42200740

Number of columns: 7

HAULJOIN	SPECIES_CODE	WEIGHT_KG	COUNT	AREA_SWEPT_KM2	CPUE_KGKM2	CPUE_NOH
-22025	72758	0	0	0.044405	0	
-22025	72759	0	0	0.044405	0	
-22025	72760	0	0	0.044405	0	

8. GAP Production Data Metadata

8.1.5. GAP_PRODUCTS.DESIGN_SURVEY

Number of rows: 42S02 942 [Oracle][ODBC][Ora]ORA-00942: table or view does not exist

Number of columns:

x

42S02 942 [Oracle][ODBC][Ora]ORA-00942: table or view does not exist

[RODBC] ERROR: Could not SQLExecDirect 'SELECT * FROM GAP_PRODUCTS.DESIGN_SURVEY' FETC

8.1.6. GAP_PRODUCTS.METADATA_TABLE

Number of rows: 8

Number of columns: 3

METADATA_SENTENCE_NAME	METADATA_SENTENCE_TYPE	METADATA_SENTENCE
survey_institution	fragment	by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC).
legal_restrict	sentence	There are legal restrictions on access to the data.
legal_restrict_none	sentence	There are no legal restrictions on access to the data.

8.1.7. GAP_PRODUCTS.STRATUM_GROUPS

This reference table identifies which STRATUM (the lowest common denominator of statistical area groupings in this survey) relate to what greater statistical areas (AREA_ID), along with what year (DESIGN_YEAR) and survey (SURVEY_DEFINITION_ID) that pairing is relevant to. Use this table with the AREA and SURVEY_DESIGN tables. by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 744

Number of columns: 4

8. GAP Production Data Metadata

AREA_ID	SURVEY_DEFINITION_ID	DESIGN_YEAR	STRATUM
799	52	1980	721
799	52	1980	712
799	52	1980	722

8.1.8. GAP_PRODUCTS.SIZECOMP

Number of rows: 3439200

Number of columns: 7

SURVEY_DEFINITION_ID	YEAR	AREA_ID	SPECIES_CODE	LENGTH_MM	SEX	POPULATION_COUNT
143	2021	99902	10110	540	2	43
143	2021	99902	10110	560	2	70
143	2021	99902	10110	570	2	43

, ### GAP_PRODUCTS.AGECOMP

Number of rows: 719695

Number of columns: 9

SURVEY_DEFINITION_ID	AREA_ID	YEAR	SPECIES_CODE	SEX	AGE	POPULATION_COUNT	LEN
143	99902	2010	21370	3	-9	620288	
143	99902	2017	21370	1	-9	1846350	
143	99902	2017	21370	2	-9	1927790	

8.1.9. GAP_PRODUCTS.AREA

This reference table stores all metadata and estimates for all estimates of stratum and subarea area estimates. Use this table with the STRATUM_GROUPS and SURVEY_DESIGN tables. by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

8. GAP Production Data Metadata

Number of rows: 443

Number of columns: 10

SURVEY_DEFINITION_ID	DESIGN_YEAR	AREA_ID	TYPE	AREA_NAME	DESCRIPTION
98	2022	62	STRATUM	Outer Domain	100-200 m, NW sec
143	2022	70	STRATUM	Inner Domain	<50 m , N of standa
143	2022	71	STRATUM	Inner Domain	<50 m, Norton Sour

8.1.10. GAP_PRODUCTS.BIOMASS

Number of rows: 5343337

Number of columns: 16

SURVEY_DEFINITION_ID	AREA_ID	SPECIES_CODE	YEAR	N_HAUL	N_WEIGHT	N_COUNT	N_L
143	70	71525	2010	58	8	8	
143	70	71526	2010	58	0	0	
143	70	71535	2010	58	1	1	

8.1.11. GAP_PRODUCTS.CPUE

All haul-level zero-filled haul-level catch-per-unit-effort (units in kg/km²) data, by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 42200740

Number of columns: 7

HAULJOIN	SPECIES_CODE	WEIGHT_KG	COUNT	AREA_SWEEPED_KM2	CPUE_KGKM2	CPUE_NO
-22025	72758	0	0	0.044405	0	
-22025	72759	0	0	0.044405	0	
-22025	72760	0	0	0.044405	0	

8. GAP Production Data Metadata

8.1.12. GAP_PRODUCTS.DESIGN_SURVEY

Number of rows: [RODBC] ERROR: Could not SQLExecDirect 'SELECT COUNT(*) FROM GAP_PRODUCTS.DESIGN_SURVEY;'

Number of columns:

x

42S02 942 [Oracle][ODBC][Ora]ORA-00942: table or view does not exist

[RODBC] ERROR: Could not SQLExecDirect 'SELECT * FROM GAP_PRODUCTS.DESIGN_SURVEY' FETC

8.1.13. GAP_PRODUCTS.METADATA_TABLE

Number of rows: 8

Number of columns: 3

METADATA_SENTENCE_NAME	METADATA_SENTENCE_TYPE	METADATA_SENTENCE
survey_institution	fragment	by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC).
legal_restrict	sentence	There are legal restrictions on access to the data.
legal_restrict_none	sentence	There are no legal restrictions on access to the data.

8.1.14. GAP_PRODUCTS.STRATUM_GROUPS

This reference table identifies which STRATUM (the lowest common denominator of statistical area groupings in this survey) relate to what greater statistical areas (AREA_ID), along with what year (DESIGN_YEAR) and survey (SURVEY_DEFINITION_ID) that pairing is relevant to. Use this table with the AREA and SURVEY_DESIGN tables. by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 744

Number of columns: 4

8. GAP Production Data Metadata

AREA_ID	SURVEY_DEFINITION_ID	DESIGN_YEAR	STRATUM
799	52	1980	721
799	52	1980	712
799	52	1980	722

8.1.15. GAP_PRODUCTS.SIZECOMP

Number of rows: 3439200

Number of columns: 7

SURVEY_DEFINITION_ID	YEAR	AREA_ID	SPECIES_CODE	LENGTH_MM	SEX	POPULATION_CO
143	2021	99902	10110	540	2	43
143	2021	99902	10110	560	2	70
143	2021	99902	10110	570	2	43

9. Universal Column Metadata

9. Universal Column Metadata

Table 9.1.: Universal stock metadata that users can use to document their table columns.

Column name from data	Descriptive column Name
ABUNDANCE_HAUL	Design-based index approved haul
ACTIVE	Vessel Active/Inactive
AGE	Age bin of taxon
AGENCY_ACRONYM	Acronym of listed Agency
AGENCY_JOIN	Agency's ID code
AGENCY_LONG	Agency's Official Name
AGENCY_SHORT	Agency's Shorthand Name
AREA_ID	Area ID code
AREA_KM2	Area (km ²)
AREA_NAME	Area ID Name
AREA_SWEPT_KM2	Area Swept (km)
AREA_TYPE	Area ID Type Description
BIOMASS_CI_LOWER	Estimated Biomass Lower Confidence Interval
BIOMASS_CI_UPPER	Estimated Biomass Upper Confidence Interval
BIOMASS_DF	Estimated Biomass Degrees of Freedom
BIOMASS_MT	Estimated Biomass
BIOMASS_VAR	Estimated Biomass Variance
BOTTOM_TEMPERATURE_C	Bottom Temperature (Degrees Celsius)
BOTTOM_TYPE_CODE	Seafloor bottom type code
CLASS	Subphylum phylogenetic rank
CLASSIFICATION	Taxonomic classification rank group
COMMENTS	Comments
COMMON_NAME	Taxon Common Name
COUNT	Taxon Count
COUNTRY_ID	Vessel Name
CPUE_KGHA	Weight CPUE (kg/ha)
CPUE_KGKM2	Weight CPUE (kg/km ²)
CPUE_KGKM2_MEAN	Mean Weight CPUE
CPUE_KGKM2_VAR	Variance of the Mean Weight CPUE
CPUE_NOHA	Number CPUE (no/ha)
CPUE_NOKM2	Number CPUE (no/km ²)
CPUE_NOKM2_MEAN	Mean Numeric CPUE
CPUE_NOKM2_VAR	Variance of the Mean Numeric CPUE
CRS	Coordinate Reference System
CRUISE	Cruise ID
CRUISEJOIN	Cruise ID
DATABASE	Genus phylogenetic rank
DATABASE_ID	Subfamily phylogenetic rank
DATE	Date
DATE_END	End Date
DATE_START	Start Date
DATE_TIME	Date and Time
DATE_TIME_END	End Date and Time
DATE_TIME_START	Start Date and Time
DEPTH_M	Depth (m)
DEPTH_MAX_M	Area ID Maximum Depth (m)
DEPTH_MIN_M	Area ID Minimum Depth (m)

10. GAP Production Data - Created using {gapindex}

Our production data is created using the {gapindex} R package. [Insert info and examples from {gapindex}]

Part VI.

AFSC RACE Groundfish Data for AKFIN

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), 2023). Add "note = {Accessed: mm/dd/yyyy}" to append the day this data was accessed.

```
@misc{GAPakfin,
  author = {{Alaska Fisheries Information Network (AKFIN)}},
  institution = {{NOAA Fisheries Alaska Fisheries Science Center, Goundfish Assessment Program}},
  year = {2023},
  title = {AFSC Goundfish Assessment Program Design-Based Production Data},
  howpublished = {https://www.psmfc.org/program/alaska-fisheries-information-network-akfin},
  publisher = {{U.S. Dep. Commer.}},
  copyright = {Public Domain}
}
```

Part VII.

NEWS

After the 2023 field season, we will deprecate the old tables and completely replace the current tables with these new proposed tables.

11. AFSC RACE Groundfish Data for AKFIN Metadata

11.1. Data description

In development

11.2. Data created in this repo

11.2.1. AKFIN_AGECOMP

[There is currently no description for this table.]

Number of rows: 719695

Number of columns: 9

SURVEY_DEFINITION_ID	AREA_ID	YEAR	SPECIES_CODE	SEX	AGE	POPULATION_COUNT	LEN
143	99902	2010	21370	3	-9	620288	
143	99902	2017	21370	1	-9	1846350	
143	99902	2017	21370	2	-9	1927790	

11.2.2. AKFIN_AREA

All cruise, vessel, and timing data for all relevant, standard cruises. These data were calculated using all standard hauls that can be applied to production data and abundance calculations. These data are produced by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The data from this dataset are shared on the Fisheries One Stop Stop (FOSS)

11. AFSC RACE Groundfish Data for AKFIN Metadata

platform (<https://www.fisheries.noaa.gov/foss/>). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 443

Number of columns: 10

SURVEY_DEFINITION_ID	DESIGN_YEAR	AREA_ID	TYPE	AREA_NAME	DESCRIPTION
98	2022	62	STRATUM	Outer Domain	100-200 m, NW sec
143	2022	70	STRATUM	Inner Domain	<50 m , N of standa
143	2022	71	STRATUM	Inner Domain	<50 m, Norton Sou

11.2.3. AKFIN_BIOMASS

All cruise, vessel, and timing data for all relevant, standard cruises. These data were calculated using all standard hauls that can be applied to production data and abundance calculations. These data are produced by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The data from this dataset are shared on the Fisheries One Stop Stop (FOSS) platform (<https://www.fisheries.noaa.gov/foss/>). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 5343337

Number of columns: 16

SURVEY_DEFINITION_ID	AREA_ID	SPECIES_CODE	YEAR	N_HAUL	N_WEIGHT	N_COUNT	N_L
143	70	71525	2010	58	8	8	
143	70	71526	2010	58	0	0	
143	70	71535	2010	58	1	1	

11. AFSC RACE Groundfish Data for AKFIN Metadata

11.2.4. AKFIN_CATCH

All cruise, vessel, and timing data for all relevant, standard cruises. These data were calculated using all standard hauls that can be applied to production data and abundance calculations. These data are produced by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The data from this dataset are shared on the Fisheries One Stop Stop (FOSS) platform (<https://www.fisheries.noaa.gov/foss/>). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 1641259

Number of columns: 6

CRUISEJOIN	HAULJOIN	CATCHJOIN	SPECIES_CODE	WEIGHT_KG	COUNT
-608	-13124	-388837	23010	51.328	1647
-608	-13124	-388844	50160	0.018	1
-608	-13124	-388845	66031	2.774	596

11.2.5. AKFIN_CPUE

All cruise, vessel, and timing data for all relevant, standard cruises. These data were calculated using all standard hauls that can be applied to production data and abundance calculations. These data are produced by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The data from this dataset are shared on the Fisheries One Stop Stop (FOSS) platform (<https://www.fisheries.noaa.gov/foss/>). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the

11. AFSC RACE Groundfish Data for AKFIN Metadata

survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 42200740

Number of columns: 7

HAULJOIN	SPECIES_CODE	WEIGHT_KG	COUNT	AREA_SWEPT_KM2	CPUE_KGKM2	CPUE_NOF
-22025	72758	0	0	0.044405	0	
-22025	72759	0	0	0.044405	0	
-22025	72760	0	0	0.044405	0	

11.2.6. AKFIN_CRUISES

All cruise, vessel, and timing data for all relevant, standard cruises. These data were calculated using all standard hauls that can be applied to production data and abundance calculations. These data are produced by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The data from this dataset are shared on the Fisheries One Stop Stop (FOSS) platform (<https://www.fisheries.noaa.gov/foss/>). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 184

Number of columns: 10

CRUISEJOIN	CRUISE	YEAR	SURVEY_DEFINITION_ID	SURVEY_NAME
-717	201702	2017	143	Northern Bering Sea Crab/Groundfish Survey
-718	201702	2017	143	Northern Bering Sea Crab/Groundfish Survey
-660	201002	2010	143	Northern Bering Sea Crab/Groundfish Survey

11. AFSC RACE Groundfish Data for AKFIN Metadata

11.2.7. AKFIN_HAUL

All cruise, vessel, and timing data for all relevant, standard cruises. These data were calculated using all standard hauls that can be applied to production data and abundance calculations. These data are produced by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The data from this dataset are shared on the Fisheries One Stop Stop (FOSS) platform (<https://www.fisheries.noaa.gov/foss/>). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 35096

Number of columns: 27

CRUISEJOIN	HAULJOIN	HAUL	HAUL_TYPE	VESSEL_ID	PERFORMANCE	DATE_TIME_START
-608	-12880	1	3	143	0.00	2005-05-21 15:34:16
-608	-12881	2	3	143	1.11	2005-05-21 18:51:09
-608	-12882	3	3	143	0.00	2005-05-22 13:19:04

11.2.8. AKFIN_LENGTH

All cruise, vessel, and timing data for all relevant, standard cruises. These data were calculated using all standard hauls that can be applied to production data and abundance calculations. These data are produced by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The data from this dataset are shared on the Fisheries One Stop Stop (FOSS) platform (<https://www.fisheries.noaa.gov/foss/>). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the

11. AFSC RACE Groundfish Data for AKFIN Metadata

survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 131890698

Number of columns: 7

HAULJOIN	SPECIES_CODE	SEX	FREQUENCY	LENGTH	LENGTH_TYPE	SAMPLE_TYPE
-6619	10140	1	1	240	1	1
-8177	10140	1	1	240	1	1
-8920	10140	1	1	240	1	1

11.2.9. AKFIN_METADATA_COLUMN

All cruise, vessel, and timing data for all relevant, standard cruises. These data were calculated using all standard hauls that can be applied to production data and abundance calculations. These data are produced by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The data from this dataset are shared on the Fisheries One Stop Stop (FOSS) platform (<https://www.fisheries.noaa.gov/foss/>). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 133

Number of columns: 5

METADATA_COLNAME	METADATA_COLNAME_LONG	METADATA_
VESSEL_COAST GUARD NUMBER	Vessel Coast Guard Number	ID code
VESSEL_ID	Vessel ID	ID code
VESSEL IMO	Vessel International Maritime Organization Number	ID code

11. AFSC RACE Groundfish Data for AKFIN Metadata

11.2.10. AKFIN_SIZECOMP

All cruise, vessel, and timing data for all relevant, standard cruises. These data were calculated using all standard hauls that can be applied to production data and abundance calculations. These data are produced by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The data from this dataset are shared on the Fisheries One Stop Stop (FOSS) platform (<https://www.fisheries.noaa.gov/foss/>). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 3439200

Number of columns: 7

SURVEY_DEFINITION_ID	YEAR	AREA_ID	SPECIES_CODE	LENGTH_MM	SEX	POPULATION_CO
143	2021	99902	10110	540	2	43
143	2021	99902	10110	560	2	70
143	2021	99902	10110	570	2	43

11.2.11. AKFIN_SPECIMEN

All cruise, vessel, and timing data for all relevant, standard cruises. These data were calculated using all standard hauls that can be applied to production data and abundance calculations. These data are produced by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The data from this dataset are shared on the Fisheries One Stop Stop (FOSS) platform (<https://www.fisheries.noaa.gov/foss/>). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the

11. AFSC RACE Groundfish Data for AKFIN Metadata

survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 1471307

Number of columns: 17

CRUISEJOIN	HAULJOIN	REGION	VESSEL_ID	SPECIMEN_ID	STRATUM	SPECIES_CODE	LENGTH
-608	-12880	GOA	143	1	0	21921	
-608	-12880	GOA	143	2	0	21921	
-608	-12880	GOA	143	3	0	21921	

11.2.12. AKFIN_STRATUM_GROUPS

All cruise, vessel, and timing data for all relevant, standard cruises. These data were calculated using all standard hauls that can be applied to production data and abundance calculations. These data are produced by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The data from this dataset are shared on the Fisheries One Stop Stop (FOSS) platform (<https://www.fisheries.noaa.gov/foss/>). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 744

Number of columns: 4

AREA_ID	SURVEY_DEFINITION_ID	DESIGN_YEAR	STRATUM
799	52	1980	721
799	52	1980	712
799	52	1980	722

11. AFSC RACE Groundfish Data for AKFIN Metadata

11.2.13. AKFIN_SURVEY DESIGN

All cruise, vessel, and timing data for all relevant, standard cruises. These data were calculated using all standard hauls that can be applied to production data and abundance calculations. These data are produced by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The data from this dataset are shared on the Fisheries One Stop Stop (FOSS) platform (<https://www.fisheries.noaa.gov/foss/>). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 126

Number of columns: 3

SURVEY_DEFINITION_ID	YEAR	DESIGN_YEAR
52	1980	1980
52	1983	1980
52	1986	1980

11.2.14. AKFIN_TAXONOMICS_WORMS

All cruise, vessel, and timing data for all relevant, standard cruises. These data were calculated using all standard hauls that can be applied to production data and abundance calculations. These data are produced by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are legal restrictions on access to the data. These data are not intended for public dissemination and should not be shared without the explicit written consent of the data managers and owners (NOAA Fisheries). The data from this dataset are shared on the Fisheries One Stop Stop (FOSS) platform (<https://www.fisheries.noaa.gov/foss/>). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the

11. AFSC RACE Groundfish Data for AKFIN Metadata

survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 2762

Number of columns: 21

REASON	SURVEY_NAME	ACCEPTED_NAME	COMMON_NAME	SPECIES_CODE	
NA	Anarrhichthys ocellatus	Anarrhichthys ocellatus	wolf-eel	20320	
NA	Anatoma crispata	Anatoma crispata	crispate scissurelle	71333	
synon	Thieleella baxteri	Anatoma lyra	NA	71332	

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

12.1. 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.

12.1.1. Access data via Oracle

If the user has access to the AFSC Oracle database, the user can use SQL developer to view and pull the GAP Products data directly from the GAP_PRODUCTS Oracle schema.

12.1.2. 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.

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

12.2. Data SQL Query Examples:

12.2.1. Ex. 0: Select all data from a table

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_CRUISES",
  "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_TAXONOMICS_WORMS"
)

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")))
}
```

12.2.2. Ex. 1: 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 =
"WITH FILTERED_STRATA AS (
SELECT AREA_ID, DESCRIPTION FROM GAP_PRODUCTS.AKFIN_AREA
```

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

```

WHERE TYPE in ('REGULATORY_AREA', 'REGION')
AND SURVEY_DEFINITION_ID = 47)
SELECT
BIOMASS_MT,
POPULATION_COUNT,
YEAR,
DESCRIPTION
FROM GAP_PRODUCTS.AKFIN_BIOMASS BIOMASS
JOIN FILTERED_STRATA STRATA
ON STRATA.AREA_ID = BIOMASS.AREA_ID
WHERE BIOMASS.SURVEY_DEFINITION_ID IN 47
AND BIOMASS.SPECIES_CODE = 30060")

```

```

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)) %>% theme_zebra()

```

Table 12.1.: Ex. 1: GOA Pacific Ocean perch biomass and abundance.

BIOMASS_POPULATI MT COUNT	YEARDESCRIPTION
220,910.5471,190,74	GOA 1,984Region: All Strata

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

BIOMASS_POPULATI MT COUNT	YEARDESCRIPTION
241,438.2482,466,826	GOA 1,987Region: All Strata
157,295.1317,129,40	GOA 1,990Region: All Strata
483,622.6833,902,161	GOA 1,993Region: All Strata
771,412.81,252,616,6	GOA 1,996Region: All Strata
727,063.51,212,034,913	GOA 1,999Region: All Strata

```
# 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",
                legend.position = "bottom")

figure
```

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

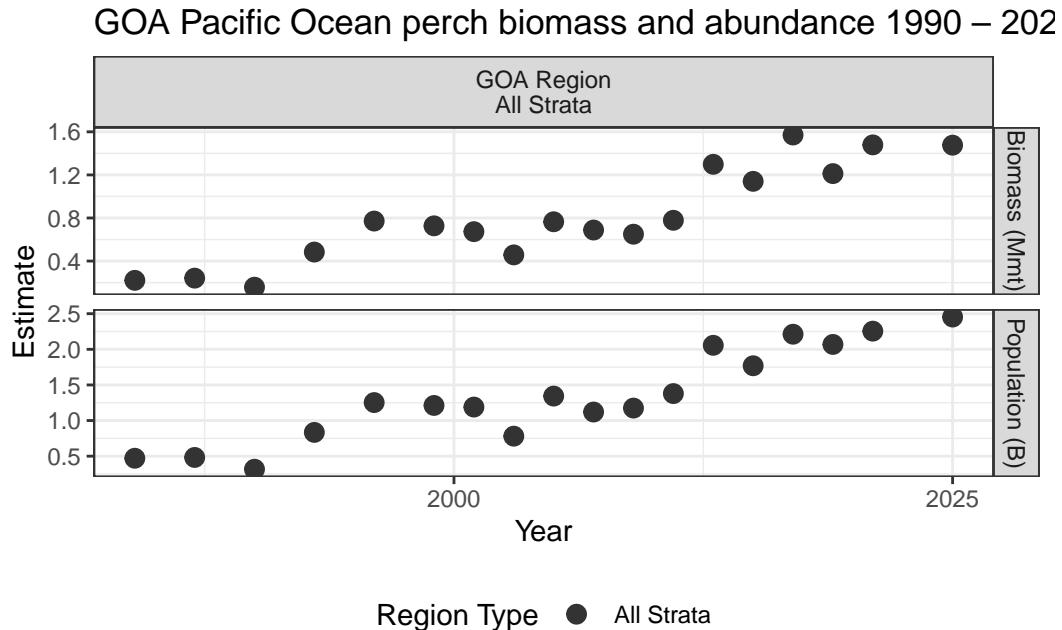


Figure 12.1.: Ex. 1: GOA Pacific Ocean perch biomass and abundance.

12.2.3. Ex. 2: 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 =
"WITH FILTERED_STRATA AS (
SELECT
AREA_ID,
DESCRIPTION
FROM GAP_PRODUCTS.AKFIN_AREA
WHERE TYPE = 'REGION'
AND SURVEY_DEFINITION_ID = 52)
SELECT
LENGTH_MM,
YEAR
FROM GAP_PRODUCTS.AKFIN_SIZECOMP SIZECOMP
```

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

```

JOIN FILTERED_STRATA STRATA
ON STRATA.AREA_ID = SIZECOMP.AREA_ID
WHERE SIZECOMP.SURVEY_DEFINITION_ID IN 52
AND SIZECOMP.SPECIES_CODE IN (10261, 10262)")

```

```

dat0 <- dat %>%
  janitor::clean_names() %>%
  dplyr::mutate(length_cm = length_mm/10)
flextable::flextable(head(dat)) %>% theme_zebra()

```

Table 12.2.: Ex. 2: AI Rock sole size compositions and ridge plot.

LENGTH-MM	YEAR
110	1,997
130	1,997
140	1,997
150	1,997
160	1,997
170	1,997

```

# install.packages("ggridges")
library(ggridges)
figure <-
  ggplot2::ggplot(
    data = dat0,
    mapping = aes(x = length_cm, y = as.factor(year), fill = stat(x))) +
  ggridges::theme_ridges(center_axis_labels = TRUE) +
  ggridges::geom_density_ridges_gradient(scale = 4, show.legend = FALSE) +
  ggplot2::scale_y_discrete(name = "Year", expand = c(0.01, 0)) +
  ggplot2::scale_x_continuous(name = "Length (cm)", expand = c(0.01, 0)) +
  # ggplot2::scale_fill_grey() +
  ggplot2::labs(title = 'AI Rock sole Size Compositions 1991 - 2022')

figure

```

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

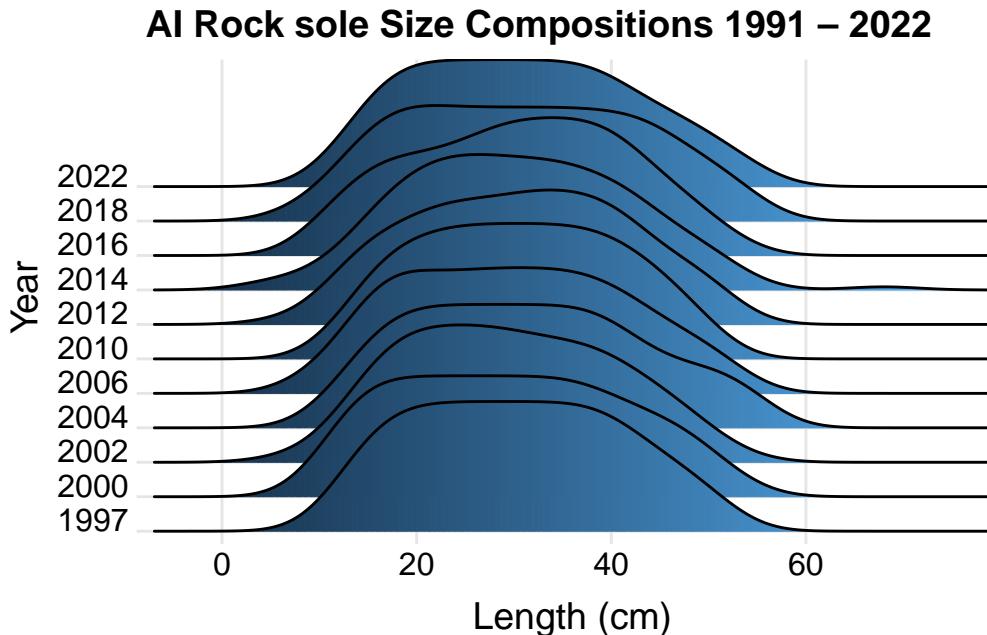


Figure 12.2.: Ex. 2: AI Rock sole size compositions and ridge plot.

12.2.4. Ex. 3: EBS Walleye Pollock Age Compositions and Age Pyramid

Walleye pollock age composition for the EBS Standard Area from 1982 – 2022 and the EBS + NW Area from 1987 – 2022, with age pyramid plot.

```
dat <- RODBC::sqlQuery(channel = channel,
                        query =
"WITH FILTERED_STRATA AS (
SELECT
AREA_ID,
DESCRIPTION
FROM GAP_PRODUCTS.AKFIN_AREA
WHERE TYPE = 'REGION' AND
SURVEY_DEFINITION_ID = 98)
SELECT
AGECOMP.AGE,
AGECOMP.POPULATION_COUNT,
AGECOMP.SEX
```

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

```
FROM GAP_PRODUCTS.AKFIN_AGECOMP AGECOMP
JOIN FILTERED_STRATA STRATA
ON STRATA.AREA_ID = AGECOMP.AREA_ID
WHERE SURVEY_DEFINITION_ID = 98
AND SPECIES_CODE = 21740
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)) %>% theme_zebra()
```

Table 12.3.: Ex. 3: EBS Walleye Pollock Age Compositions and Age Pyramid.

AGE	POPULATI COUNT	SEX
	1137,398,78	1
	21,040,787,296	1
	31,183,060,:	1
	41,661,729,359	1
	5507,355,47	1
	670,450,613	1

```
figure <- ggplot2::ggplot(
  data = dat0,
  mapping =
    aes(x = age,
        y = population_count,
        fill = sex)) +
  ggplot2::scale_fill_grey() +
  ggplot2::geom_bar(stat = "identity") +
```

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

```
ggplot2::coord_flip() +  
  ggplot2::scale_x_continuous(name = "Age") +  
  ggplot2::scale_y_continuous(name = "Population (billions)", labels = abs) +  
  ggplot2::ggttitle(label = "EBS Walleye Pollock Age Compositions 1982 - 2022") +  
  ggplot2::guides(fill = guide_legend(title = "Sex"))+  
  ggplot2::theme_bw()  
  
figure
```

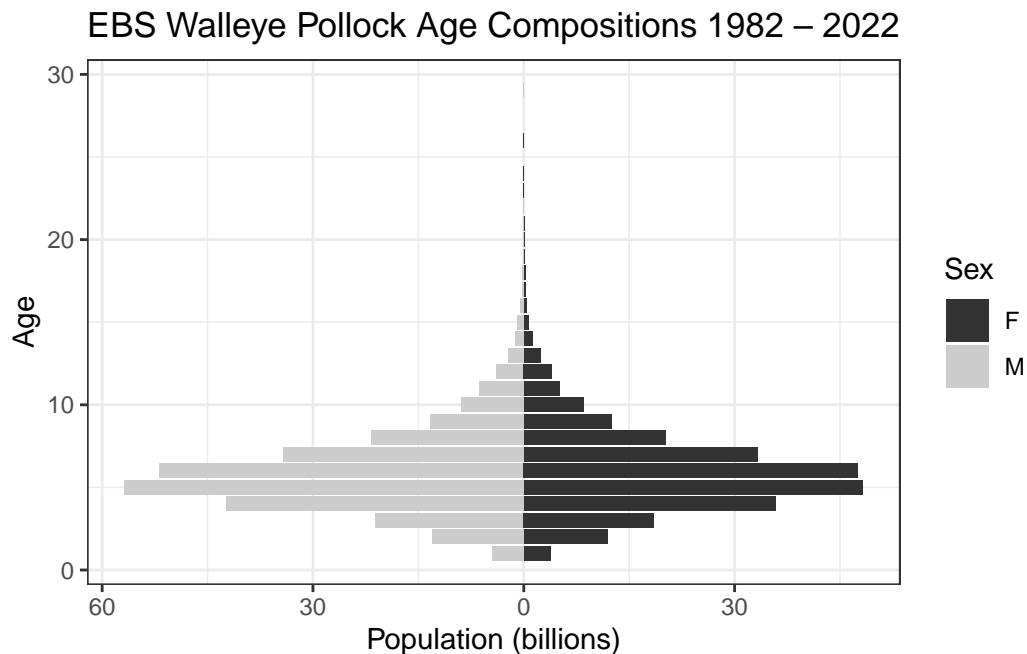


Figure 12.3.: Ex. 3: EBS Walleye Pollock Age Compositions and Age Pyramid.

12.2.5. Ex. 4: NBS Pacific cod biomass and abundance

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

```
dat <- RODBC::sqlQuery(channel = channel,  
                        query =  
"WITH FILTERED_STRATA AS (  
SELECT
```

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

```

AREA_ID,
AREA_NAME,
DESCRIPTION
FROM GAP_PRODUCTS.AKFIN_AREA
WHERE TYPE in ('STRATUM') AND
SURVEY_DEFINITION_ID = 143)
SELECT
BIOMASS.BIOMASS_MT,
BIOMASS.POPULATION_COUNT,
BIOMASS.YEAR,
STRATA.AREA_NAME
FROM GAP_PRODUCTS.AKFIN_BIOMASS BIOMASS
JOIN FILTERED_STRATA STRATA
ON STRATA.AREA_ID = BIOMASS.AREA_ID
WHERE BIOMASS.SURVEY_DEFINITION_ID IN 143
AND BIOMASS.SPECIES_CODE = 21720")

```

```

dat0 <- dat %>%
  janitor::clean_names() %>%
  dplyr::select(biomass_mt, population_count, year, area = area_name) %>%
  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, levels = unique(area), labels = unique(area), ordered = TRUE))
flextable::flextable(head(dat)) %>% theme_zebra()

```

Table 12.4.: Ex. 4: NBS Pacific cod biomass and abundance.

BIOMASS_MT	POPULATI COUNT	YEAR	AREA_NAME
7,462.558	64,724,153.!	2,010	Inner Domain
7,462.558	64,724,153.5	2,010	Inner Domain

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

BIOMASS_POPULATI MT COUNT	YEAR	AREA_- NAME
7,462.55864,724,153.!	2,010	Inner Domain
7,462.55864,724,153.5	2,010	Inner Domain
7,462.55864,724,153.!	2,010	Inner Domain
680.4357 250,836.5	2,010	Middle Domain

```
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") +  
  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 = "Region Type"))+  
  ggplot2::scale_fill_grey() +  
  ggplot2::theme_bw() +  
  ggplot2::theme(legend.direction = "horizontal",  
                legend.position = "bottom")  
  
figure
```

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

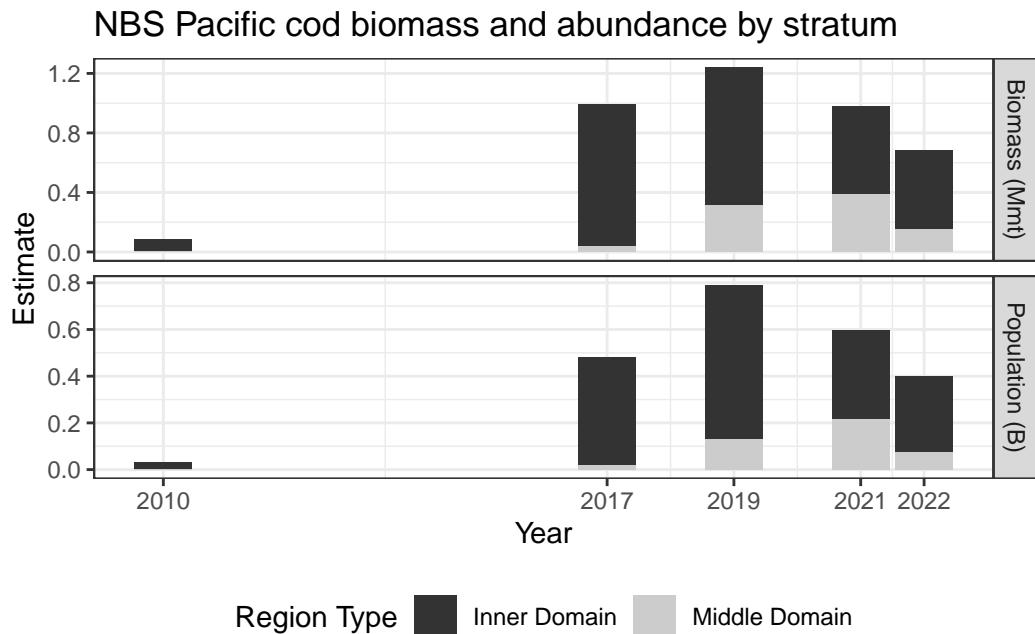


Figure 12.4.: Ex. 4: NBS Pacific cod biomass and abundance.

12.2.6. Ex. 5: GOA Pacific Ocean perch biomass and line plot

Pacific Ocean perch biomass totals for GOA between 1984-2021 from GAP_PRODUCTS.AKFIN_BIOMASS

```
dat <- RODBC::sqlQuery(channel = channel,
                        query =
"SELECT
SURVEY_DEFINITION_ID,
BIOMASS_MT,
YEAR
FROM GAP_PRODUCTS.AKFIN_BIOMASS
WHERE SPECIES_CODE = 30060
AND SURVEY_DEFINITION_ID = 47
AND AREA_ID = 99903
AND YEAR BETWEEN 1984 AND 2021;") %>%
  janitor::clean_names() %>%
  dplyr::mutate(biomass_mt = biomass_mt/1000)
```

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

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

Table 12.5.: Ex. 5: GOA Pacific Ocean perch biomass and line plot.

survey_- defini- tion_id	biomass_- mt	year
47	220.9105	1,984
47	241.4382	1,987
47	157.2951	1,990
47	483.6226	1,993
47	771.4128	1,996
47	727.0635	1,999

```
figure <-
  ggplot(data = dat,
         mapping = aes(x = year,
                       y = biomass_mt)) +
  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 (Kmt)",
    labels = comma) +
  ggplot2::geom_segment(
    data = a_mean,
    mapping = aes(x = minyr,
                  xend = maxyr,
```

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

```
y = biomass_mt,  
yend = biomass_mt),  
linetype = "dashed",  
linewidth = 2) +  
ggplot2::ggttitle(  
  label = "GOA Pacific Ocean Perch Biomass 1984–2021",  
  subtitle = paste0("Mean = ",  
    formatC(x = a_mean$biomass_mt,  
      digits = 2,  
      big.mark = ",",  
      format = "f"),  
    " Kmt")) +  
  ggplot2::theme_bw()  
  
figure
```

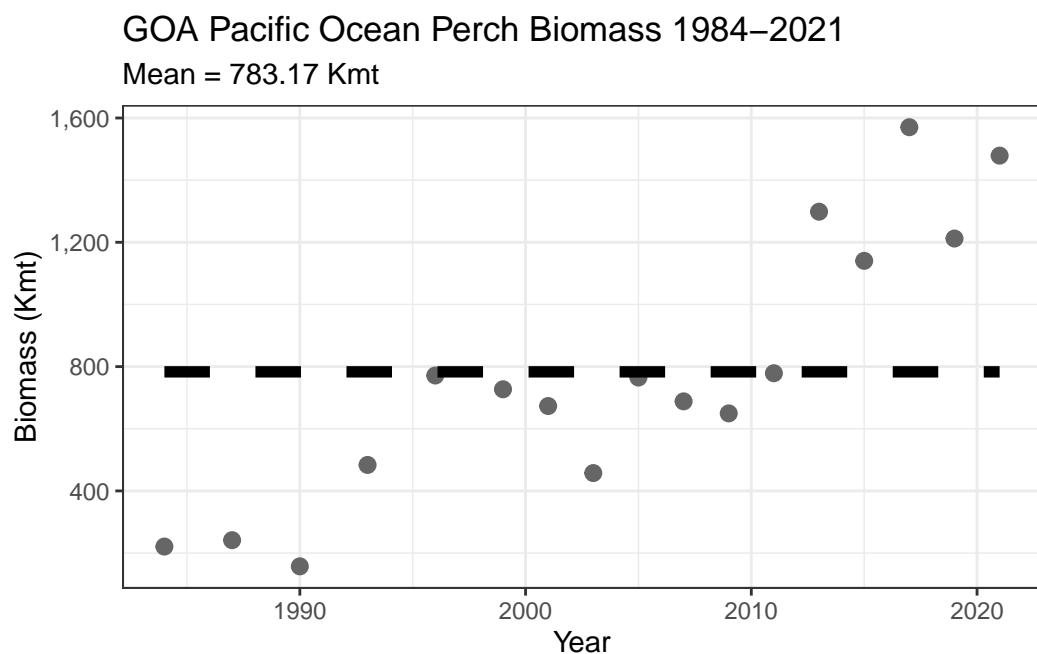


Figure 12.5.: Ex. 5: GOA Pacific Ocean perch biomass and line plot.

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

12.2.7. Ex. 6: 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
(cp.CPUE_KGKM2/100) CPUE_KGHA, -- akgfmaps is expecting hectares
hh.LATITUDE_DD_START LATITUDE,
hh.LONGITUDE_DD_START LONGITUDE

FROM GAP_PRODUCTS.AKFIN_CPUE cp

-- Use HAUL data to obtain LATITUDE & LONGITUDE and connect to cruisejoin
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_CRUISES cc
ON hh.CRUISEJOIN = cc.CRUISEJOIN

WHERE cp.SPECIES_CODE = 30060
AND cc.SURVEY_DEFINITION_ID = 98
AND cc.YEAR = 2021;")

flextable::flextable(head(dat)) %>% theme_zebra()
```

Table 12.6.: Ex. 6: EBS Pacific Ocean perch CPUE and akgfmaps map.

CPUE_-KGHA	LATITUDE	LONGITUDE
0	56.66721	-159.7800
0	56.98080	-159.6926
0	56.97832	-159.1519

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

CPUE_-KGHA	LATITUDE	LONGITUDE
------------	----------	-----------

0	57.31992	-159.0614
---	----------	-----------

0	57.32157	-158.3811
---	----------	-----------

0	57.65189	-158.3673
---	----------	-----------

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

figure <- akgfmmaps::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 +
  ggplot2::guides(fill=guide_legend(title = "Pacific Ocean perch\nCPUE (kg/km2)")) |>
  change_fill_color(new.scheme = "grey", show.plot = FALSE)
```

12. AFSC RACE Groundfish Data for AKFIN in Oracle with SQL and R

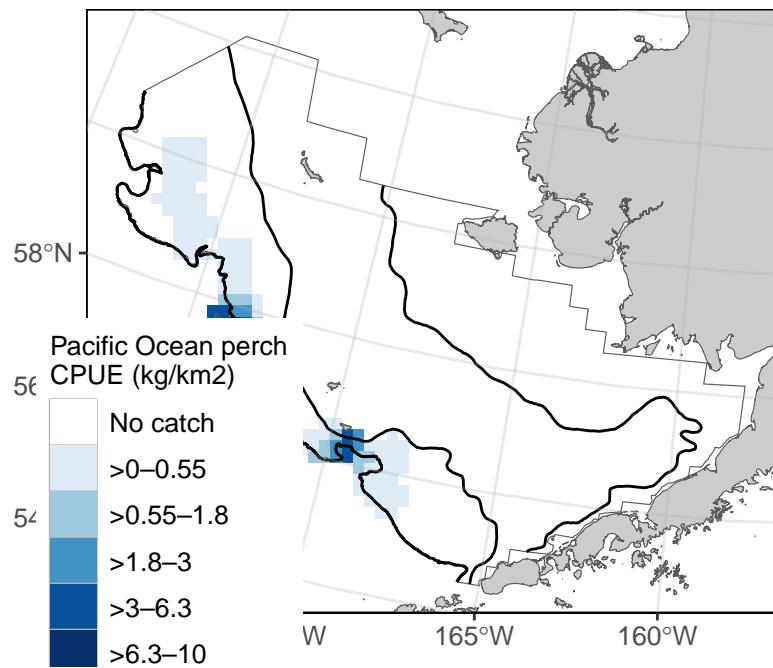


Figure 12.6.: Ex. 6: EBS Pacific Ocean perch CPUE and akgfmaps map.

Part VIII.

AFSC RACE Groundfish and Shellfish Survey Public Data

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 approved for open access.

Part IX.

Collabrators and data users

Cite this data

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.

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, 2023). Add "note = {Accessed: mm/dd/yyyy}" to append the day this data was accessed.

```
@misc{FOSSAFSCData,
  author = {{NOAA Fisheries Alaska Fisheries Science Center}},
  year = {2023},
  title = {Fisheries One Stop Shop Public Data: RACE Division Bottom Trawl Survey Data Query},
  howpublished = {https://www.fisheries.noaa.gov/foss},
  publisher = {{U.S. Dep. Commer.}},
  copyright = {Public Domain}
}
```

13. GAP FOSS Column Metadata

14. Metadata

14.1. 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.

14. Metadata

14.2. Data created in this repo

14.2.1. FOSS_CATCH

These datasets, FOSS_CATCH and FOSS_HAUL, when full joined by the HAULJOIN variable, includes zero-filled (presence and absence) observations and catch-per-unit-effort (CPUE) estimates for all identified species at for index stations by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are no legal restrictions on access to the data. The data from this dataset are shared on the Fisheries One Stop Stop (FOSS) platform (<https://www.fisheries.noaa.gov/foss/>). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 36940981

Number of columns: 12

HAULJOIN	SPECIES_CODE	CPUE_KGKM2	CPUE_NOKM2	COUNT	WEIGHT_KG	TAXON_CONFIDENCE
-22025	95039	0	0	0	0	
-22024	22200	0	0	0	0	
-22024	40504	0	0	0	0	

14.2.2. FOSS_HAUL

These datasets, FOSS_CATCH and FOSS_HAUL, when full joined by the HAULJOIN variable, includes zero-filled (presence and absence) observations and catch-per-unit-effort (CPUE) estimates for all identified species at for index stations by the Resource Assessment and Conservation Engineering Division (RACE) Groundfish Assessment Program (GAP) of the Alaska Fisheries Science Center (AFSC). There are no legal restrictions on access to the data. The data from this dataset are shared on the Fisheries One Stop Stop (FOSS) platform (<https://www.fisheries.noaa.gov/foss/>). The GitHub repository for the scripts that created this code can be found at https://github.com/afsc-gap-products/gap_products. For more information about codes used in the tables, please refer to the survey

14. Metadata

code books (<https://www.fisheries.noaa.gov/resource/document/groundfish-survey-species-code-manual-and-data-codes-manual>). These data were last updated June 27, 2023.

Number of rows: 31608

Number of columns: 27

YEAR	SRVY	SURVEY	SURVEY_DEFINITION_ID	SURVEY_NAME
2022	NBS	northern Bering Sea	143	Northern Bering Sea Crab/Groundfish
2022	NBS	northern Bering Sea	143	Northern Bering Sea Crab/Groundfish
2022	NBS	northern Bering Sea	143	Northern Bering Sea Crab/Groundfish

14.2.3. FOSS_TAXON_GROUPS

[There is currently no description for this table.]

Number of rows: 15775

Number of columns: 3

ID_RANK	CLASSIFICATION	SPECIES_CODE
class	Asteroidea	80525
class	Asteroidea	80535
class	Asteroidea	80536

15. Access public data using the FOSS Interactive Platform

16. Quick Start Guide: Access AFSC data interactively through the FOSS platform

16.1. Select and filter

Select, filter, and package 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 options from the boxes what you need data for.

For a given box, select one or a few options from the “options box” (list on the left) to query by highlighting them. 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). 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 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.

Filter options:

- 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.

16. Quick Start Guide: Access AFSC data interactively through the FOSS platform

The screenshot shows the AFSC Groundfish and Crab Assessment Program Bottom Trawl Surveys data interface. At the top, the NOAA Fisheries logo is visible. In the top right corner, there are links for 'guest', 'Login', and 'Back to Commercial Fisheries'. On the left side, a sidebar menu includes: FUS Report, Landings, Foreign Trade, Top US Ports, Processed Products, Per Capita Consumption, Supply, USCG Vessels, AFSC GAP Survey (which is currently selected), AFSC GAP Metadata, Partners, Metadata and Caveats, Frequently Asked Questions, Quick Start Guide, and Comments. The main content area has a header 'AFSC Groundfish and Crab Assessment Program' and 'Bottom Trawl Surveys'. Below this, a note states 'Survey data also available through API'. A 'Data Caveats' section explains the survey's purpose and limitations. The 'Parameters' section contains three dropdown menus: 'Survey' (with options: Aleutian Islands Bottom Trawl Survey, Eastern Bering Sea Slope Bottom Trawl Survey, Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey, Gulf of Alaska Bottom Trawl Survey, Northern Bering Sea Crab/Groundfish Survey - Eastern Bering Sea Shelf S), 'Year' (with options: 2022, 2021, 2019, 2018, 2017, 2016, 2015, 2014), and 'Species' (with options: Abalone Jingle, Abietinaria, Abyssal Crangon, Acanthascus, Acantholithodes, Achanax johnsoni, Acoel Turbellarian, Acteocina). Below these is a 'Search Species' input field with a search button and a 'Reset All Parameters' button. Under 'Data Format', there are several radio button options: 'All Data Fields', 'Catch Data: All Units', 'Catch Data: Hectares', 'Catch Data: Square Thousand km', 'Catch Data: Square km', and 'Haul Data'. At the bottom is a large blue 'RUN REPORT' button.

Figure 16.1.: AFSC Groundfish and Crab Assessment Program Bottom Trawl Survey data interface on the Fisheries One Stop Shop platform.

16. Quick Start Guide: Access AFSC data interactively through the FOSS platform

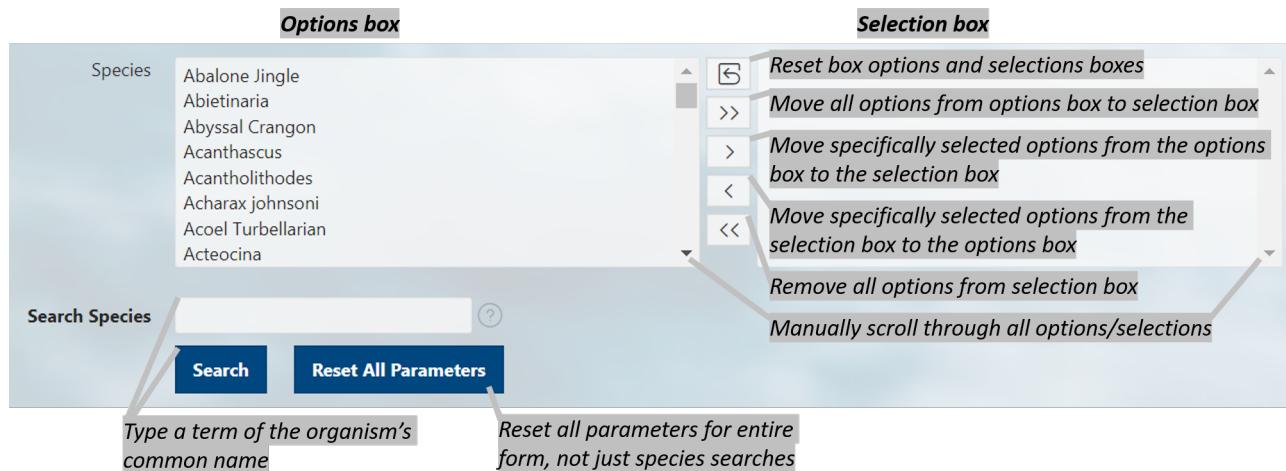


Figure 16.2.: Diagram of selection and search tools available on the FOSS platofrom.

- **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.

In this example, we'll select for 2022 eastern Bering Sea Pacific 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.

16.2. Select data format

Select from the below radio list of pre-designed output tables. Once you run the report, the user can further specify filter data and select columns of interest. The tables below will only include data from the selections made in the previous step.

- **All Data Fields: Presence and Absence (zero-filled):** The most complete version of the data, including species, catch, haul, and environmental data. This data will include catch data for where species were caught and zeros for where the species were not caught. This is important for calculating catch-per-unit-effort data, preparing distribution plots (e.g., using the akgfmaps R package), and many statistical analyses.

16. Quick Start Guide: Access AFSC data interactively through the FOSS platform

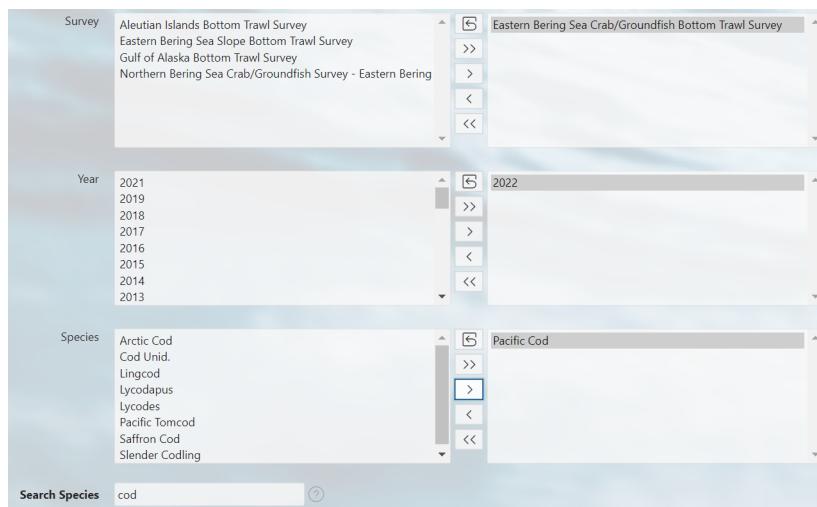


Figure 16.3.: Diagram of selection and search tools available on the FOSS platofrom.

- All Data Fields: Presence-only (non-zero): The second most complete version of the data, including species, catch, haul, and environmental data. However, this data only includes catch data for where species were caught and does not include zeros for where the species were not caught. This will return smaller, more focused data and can be useful for quickly assessing how many species were caught or how many stations species were caught at.
- Catch data: Presence and Absence (zero-filled): This data set is similar to All Data Fields: Presence and Absence (zero-filled), but only includes catch and species data columns.
- Catch data: Presence-only (non-zero): This data set is similar to All Data Fields: Presence-only (non-zero), but only includes catch and species data columns.
- Haul Data: This data set only includes haul and environmental data collected from the survey. This data will only include one observation per haul event/station.

In this example, we'll select All Data Fields: Presence and Absence (zero-filled).

16. Quick Start Guide: Access AFSC data interactively through the FOSS platform

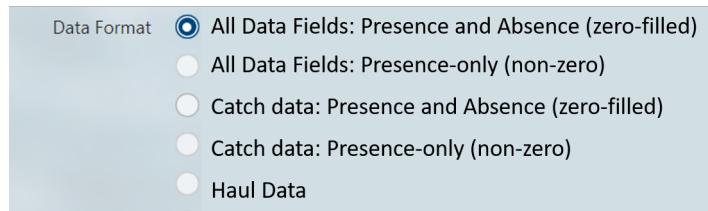


Figure 16.4.: Diagram of the pre-set data format options.

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

The screenshot shows a report interface with a table of survey data. A context menu is open over the first row of the table, listing options: Select Columns, Filter, Rows Per Page, Format, Flashback, Reset, Help, and Download.

Year	Srvy	Survey	Survey Id	Cruise	H		n	Vessel Name	Vessel Id	Date Time	Latitude Dd	Longitude Dd
2022	EBS	Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey	9.8E+001	2.02201E+005	1.0E			Alaska Knight	1.62E+002	06/02/2022 07:00:29	5.801872999999999E+001	-1.609424E+002
2022	EBS	Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey	9.8E+001	2.02201E+005	1.0E			Vesteraalen	9.4E+001	06/01/2022 10:22:04	5.698143999999999E+001	-1.603398E+002
2022	EBS	Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey	9.8E+001	2.02201E+005	1.0E			Vesteraalen	9.4E+001	06/29/2022 10:38:51	5.718580999999996E+001	-1.698646E+002
2022	EBS	Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey	9.8E+001	2.02201E+005	1.0E			Alaska Knight	1.62E+002	06/28/2022 07:02:04	5.781409E+001	-1.687324999999999E+
2022	EBS	Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey	9.8E+001	2.02201E+005	1.1E			Vesteraalen	9.4E+001	06/01/2022 13:18:48	5.731676999999998E+001	-1.603031E+002
2022	EBS	Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey	9.8E+001	2.02201E+005	1.1E			Alaska Knight	1.62E+002	06/02/2022 09:42:04	5.769637999999998E+001	-1.608723E+002

Figure 16.5.: Example data returned from running the report.

17. Access public data using the API and R

18. Connect to the API with 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](#).

18.1. Ex. 1: Load the first 25 rows (default) of data

```
# install.packages(c("httr", "jsonlite"))
library(httr)
library(jsonlite)
library(dplyr)
# link to the API
api_link <- "https://apps-st.fisheries.noaa.gov/ods/foss/afsc_groundfish_survey/"

res <- httr::GET(url = api_link)
# res # Test connection
data <- jsonlite::fromJSON(base::rawToChar(res$content))
# names(data)
flextable::flextable(head(data$items, 3))
```

18. Connect to the API with R

yearsrvy	survey	survey_id	cruise	haul	stratum	station	vessel_name	vessel_
2,002AI	Aleutian Islands Bottom Trawl Survey	5.2E+001	2.00201E+000	6.05E+000	7.22E+002	307-63	Vesteraale	0.4E+0
2,002AI	Aleutian Islands Bottom Trawl Survey	5.2E+001	2.00201E+000	6.05E+000	7.22E+002	307-63	Vesteraale	0.4E+0
2,002AI	Aleutian Islands Bottom Trawl Survey	5.2E+001	2.00201E+000	6.05E+000	7.22E+002	307-63	Vesteraale	0.4E+0

18.2. Ex. 2: Load the first 10000 rows of data

```
# Not run because too big:  
res <- httr::GET(url = paste0(api_link, "?offset=0&limit=10000"))  
data <- jsonlite::fromJSON(base::rawToChar(res$content))  
print(paste0("rows: ", dim(data$items)[1], "; cols: ", dim(data$items)[2]))  
  
[1] "rows: 10000; cols: 36"
```

18.3. Ex. 3: Filter by Year

Show all the data greater than the year 2020.

18. Connect to the API with R

```
res <- httr::GET(url = paste0(api_link, '?q={"year":{$gt":2020}}'))  
data <- jsonlite::fromJSON(base::rawToChar(res$content))  
flextable::flextable(  
  data$items[1:3, c("year", "srvy", "stratum", "species_code", "cpue_kgkm2")]) %>%  
  flextable::theme_zebra()
```

Table 18.2.: Ex. 3: Filter by Year.

year	srvy	stratum	species_code	cpue_kgkm2
2,022	AI	7.22E+002	1.0261E+01	6.7332582200000002E+002
2,022	AI	7.93E+002	8.054E+004	3.6112E-001
2,022	AI	7.22E+002	2.1347E+07	7.5809130500000003E+002

18.4. Ex. 4: Filter by species name

Show all the data where the product name contains pollock Please note that here the word pollock is case sensitive.

The notation for finding a string is to use % around it. Since % is a reserved character in a URL, you have to replace % with %25.

```
res <- httr::GET(  
  url = paste0(api_link, '?q={"common_name":{"$like":"%pollock%25"}'})')  
data <- jsonlite::fromJSON(base::rawToChar(res$content))  
flextable::flextable(  
  data$items[1:3, c("year", "srvy", "stratum", "species_code", "cpue_kgkm2")]) %>%  
  flextable::theme_zebra()
```

Table 18.3.: Ex. 4: Filter by species name.

yearsrvy	stratum	species_code	cpue_kgkm2
2,002AI	7.21E+002	2.174E+00	6.398909999999999E-001
2,002AI	7.22E+002	2.174E+00	4.7532226400000002E+002
2,002AI	7.22E+002	2.174E+00	1.0685806397E+004

18.5. Ex. 5: Combination of year and name filters

Show all the data where years > 2020 and the product name contains pollock

```
res <- httr::GET(
  url = paste0(api_link,
               '?q={"year": {"$gt": 2020}, "common_name": {"$like": "%pollock%"} }'))
data <- jsonlite::fromJSON(base:::rawToChar(res$content))
flextable::flextable(
  data$items[1:3, c("year", "srvy", "stratum", "species_code", "cpue_kgkm2")]) %>%
  flextable::theme_zebra()
```

Table 18.4.: Ex. 5: Combination of year and name filters.

yearsrvy	stratum	species_code	cpue_kgkm2
2,022AI	7.22E+002	2.174E+00	2.2754334435000001E+004
2,022AI	7.93E+002	2.174E+00	4.8536315350000004E+003
2,022AI	7.21E+002	2.174E+00	7.235010325999996E+003

18.6. Ex. 6: Combination of year, srvy, stratum

Show all the data where year = 1989, srvy = "EBS", and stratum is not equal to 81

18. Connect to the API with R

```

res <- httr::GET(
  url = paste0(api_link, '?q={"year":1989,"srvy":"EBS","stratum":{"$ne":"81"}})')
data <- jsonlite::fromJSON(base::rawToChar(res$content))
flextable::flextable(
  data$items[1:3, c("year", "srvy", "stratum", "species_code", "cpue_kgkm2")]) %>%
  flextable::theme_zebra()

```

Table 18.5.: Ex. 6: Combination of year, srvy, stratum.

year	srvy	stratum	species_- code	cpue_- kgkm2
1,989	EBS	1.0E+001	4.05E+004	9.6200360000000007E+000
1,989	EBS	1.0E+001	6.8578E+004	62003600000000007E+000
1,989	EBS	1.0E+001	2.1313E+01	1.8179039E+001

18.7. Ex. 7: Visualize CPUE data in distribution map

Pacific cod catch-per-unit-effort estimates for NBS in 2021 and map constructed using akgfmaps.

```

# res <- httr::GET(
#   url = paste0(api_link, "?offset=0&limit=10000"),
#   query = list(year = 2021, srvy = "EBS", species_code = 30060))
res <- httr::GET(
  url = paste0(api_link, '?q={"year":2021,"srvy":"NBS","species_code":21720}'))
data_catch <- jsonlite::fromJSON(base::rawToChar(res$content))$items %>%
  dplyr::select(stratum, station, cpue_kgkm2)

# zero-fill data (imperfectly, but effective for this example)
res <- httr::GET(
  url = paste0(api_link, '?q={"year":2021,"srvy":"NBS"}offset=0&limit=10000'))
data_haul <- jsonlite::fromJSON(base::rawToChar(res$content))$items %>%
  dplyr::select(stratum, station, latitude_dd, longitude_dd) %>%
  dplyr::distinct()

data <- dplyr::left_join(data_haul, data_catch) %>%

```

18. Connect to the API with R

```
dplyr::mutate(cpue_kgkm2 = ifelse(is.na(cpue_kgkm2), 0, cpue_kgkm2),
  dplyr::across(dplyr::everything(), as.numeric))

flextable::flextable(data[1:3,]) %>%
  flextable::theme_zebra()
```

Table 18.6.: Ex. 7: Visualize CPUE data in distribution map.

stratum	station	latitude_dd	longitude_dd	cpue_kgkm2
71		63.70028	-171.0225	1.183039
81		61.68600	-173.07761	3,256.716473
81		61.34965	-172.22516	00.958261

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

figure <- akgfmaps::make_idw_map(
  CPUE_KGHA = data$cpue_kgkm2, # calculates the same, regardless of units.
  LATITUDE = data$latitude_dd,
  LONGITUDE = data$longitude_dd,
  region = "bs.north", # 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 +
  ggplot2::guides(fill=guide_legend(title = "Pacific cod\nCPUE (kg/km2)"))
```

18. Connect to the API with R

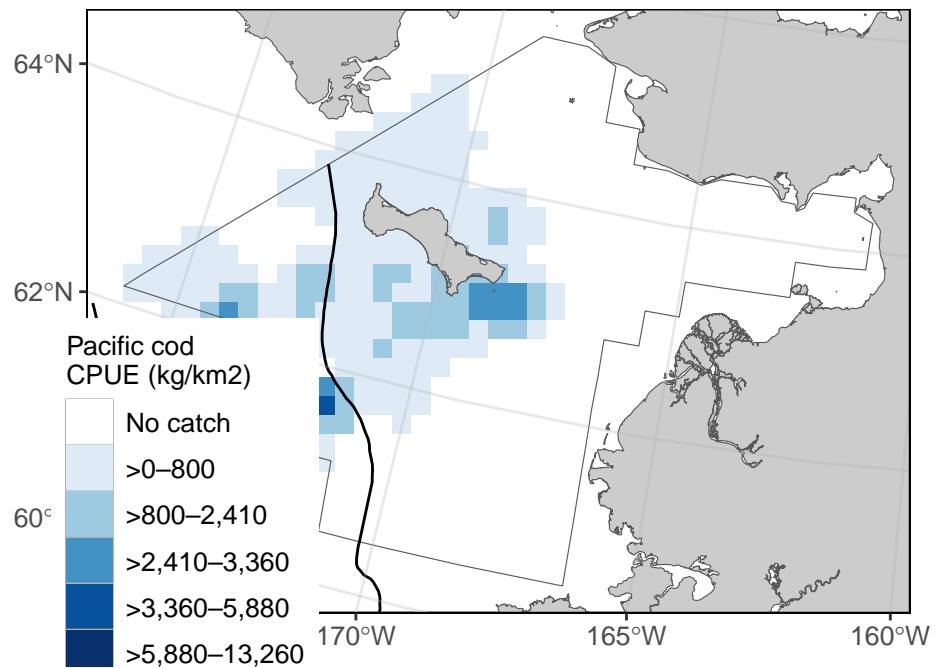


Figure 18.1.: Ex. 7: Visualize CPUE data in distribution map.

19. Access public data using the API and Python

19.0.1. {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.

19.0.2. 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')
```

19. Access public data using the API and Python

```
results = query.execute()
```

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

19.0.3. 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.

19. Access public data using the API and Python

19.0.4. 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.

19.0.5. 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')
```

19. Access public data using the 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.

19.0.6. 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.

19.0.7. 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.

19. Access public data using the 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.

19. Access public data using the API and Python

19.0.8. More information

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

20. Access public data using R in Oracle

20.1. Access data via Oracle (AFSC 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 RACEBASE_FOSS Oracle schema.

20.1.1. 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.

```
#' Define RODBC connection to ORACLE
#'
#' @param schema.default = 'AFSC'.
#'
#' @return oracle channel connection
#' @export
#'
#' @examples
#' # Not run
#' # channel <- oracle_connect()
oracle_connect <- function(
  schema='AFSC',
  username = NULL,
  password = NULL){(echo=FALSE)}
```

20. Access public data using R in Oracle

```
library("RODBC")
library("getPass")
if (is.null(username)) {
  username <- getPass(msg = "Enter your ORACLE Username: ")
}
if (is.null(password)) {
  password <- getPass(msg = "Enter your ORACLE Password: ")
}
channel <- RODBC::odbcConnect(
  paste(schema),
  paste(username),
  paste(password),
  believeNRows=FALSE)
return(channel)
}

channel <- oracle_connect()
```

20.1.2. Ex. 1: Join data

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

20.1.3. Ex. 2: Subset data

Once connected, pull and save (if needed) the tables into the R environment.

To pull a small subset of the data (especially since files like RACEBASE_FOSS.FOSS_-CPUE_ZEROILLED are so big), use a variation of the following code. Here, we are pulling EBS Pacific cod from 2010 - 2021:

```
# Pull data
a <- 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'
```

20. Access public data using R in Oracle

```
AND COMMON_NAME = 'Pacific cod'  
AND YEAR >= 2010  
AND YEAR < 2021")  
# Save table to local directory  
write.csv(x = a, file = "RACEBASE_FOSS-FOSS_CPUE_ZEROFILED-ebs_pcod_2010-2020.csv")
```

Part X.

Notes

[Add close out comments.]

21. Acknowledgments

22. 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.

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.

24. Production Run Notes

25. R Version Metadata

```
R version 4.3.0 (2023-04-21 ucrt)
Platform: x86_64-w64-mingw32/x64 (64-bit)
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_4.3.0    fastmap_1.1.1    cli_3.6.1      tools_4.3.0
[5] htmltools_0.5.5   rstudioapi_0.15.0  yaml_2.3.7    rmarkdown_2.23
[9] knitr_1.43        jsonlite_1.8.7   xfun_0.39     digest_0.6.33
[13] rlang_1.1.1       evaluate_0.21
```

25.0.1. NOAA README

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25. R Version Metadata

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References

- Alaska Fisheries Information Network (AKFIN). (2023). *AFSC groundfish assessment program design-based production data*. NOAA Fisheries Alaska Fisheries Science Center, Goundfish Assessment Program; <https://www.psmfc.org/program/alaska-fisheries-information-network-akfin>; U.S. Dep. Commer.
- Hoff, G. R. (2016). *Results of the 2016 eastern Bering Sea upper continental slope survey of groundfishes and invertebrate resources* (NOAA Tech. Memo. NOAA-AFSC-339). U.S. Dep. Commer. <https://doi.org/10.7289/V5/TM-AFSC-339>
- Markowitz, E. H., Dawson, E. J., Anderson, A. B., Rohan, S. K., Charriere, N. E., Prohaska, B. K., and Stevenson, D. E. (2023). *Results of the 2022 eastern and northern Bering Sea continental shelf bottom trawl survey of groundfish and invertebrate fauna* (NOAA Tech. Memo. NMFS-AFSC-469; p. 213). U.S. Dep. Commer.
- NOAA Fisheries Alaska Fisheries Science Center. (2023). *Fisheries one stop shop public data: RACE division bottom trawl survey data query*. <https://www.fisheries.noaa.gov/foss>; U.S. Dep. Commer.
- NOAA Fisheries Alaska Fisheries Science Center, Goundfish Assessment Program. (2023). *AFSC groundfish assessment program design-based production data*. <https://www.fisheries.noaa.gov/alaska/science-data/groundfish-assessment-program-bottom-trawl-surveys>; U.S. Dep. Commer.
- Von Szalay, P. G., and Raring, N. W. (2018). *Data report: 2017 Gulf of Alaska bottom trawl survey* (NOAA Tech. Memo. NMFS-AFSC-374). U.S. Dep. Commer. <https://doi.org/10.7289/V5/TM-AFSC-374>
- Von Szalay, P. G., and Raring, N. W. (2020). *Data report: 2018 Aleutian Islands bottom trawl survey* (NOAA Tech. Memo. NMFS-AFSC-409). U.S. Dep. Commer. <https://doi.org/10.25923/qe5v-fz70>