# NOAA Alaska Fisheries Science Center

# Longline Survey Database

| Date | Author | Change Comments | Version |
|---|---|---|---|
| 9/2011 | C. Rodgveller | New haul view; changes to age view | 3.0 |
| 1/15/2013 | R. Busch and C. Rodgveller | Updated haul_view and age view; added Stations_view data and removed area_view; removed mean length and weight from areaeffortsall. | 3.01 |
| 7/1/2013 | R. Busch | Added stratum2 to Catch and Depth views | 3.02 |
| 6/2/15 | C. Rodgveller | Added reports for lengthsfrequencies3to7 and areaeffortsall2b | 3.03 |
| 8/1/2021 | C. Rodgveller | Added new tables with RPNs/RPWs by multiple management area boundaries (e.g., FMP, AK-wide); added a series of tables that include sperm whale depredation effects, for sablefish only; variance added in the new tables for CPUE, RPN, and RPW; new area sizes are used in calculations in all tables. | 3.04 |

## Contents

# Background

**Survey History and Vessels** – Data is available from annual longline surveys conducted cooperatively by Japan (1979-1994) and the U.S. National Marine Fisheries Service, Alaska Fisheries Science Center (1988-present). Starting in 1988, the U.S. started conducting the survey, creating overlap between the two countries between1988-1994. Since 1994, the U.S. has conducted the survey independently. For standardization purposes, it is best to use the Japanese survey for the years 1979-1994 and the U.S. survey from 1990-present, although all data is available for catch, catch with nulls, and lengths.

**Stations and Sampling** – Stations are spaced systematically (~20-30 km apart) along the slope from the eastern Gulf of Alaska west to the Aleutian Islands and north into the eastern Bering Sea. At each station, depths from ~150-1000 meters are sampled. Each year the captain attempts to set the gear along the same path. However, this is not always the case. Weather and current can affect the setting pattern so setting on the exact station track line each year is difficult to achieve. Additionally, if fishing vessels are found fishing on the station it is common practice to move the station in order to alleviate any interactions with fishing activities. When this occurs, stations may be moved up to several miles away with the assumption that similar depths and habitat features are fished.

The same stations are sampled each year except in the Aleutian Islands and the Bering Sea, which are sampled every other year at the beginning of the survey (last week of May-early June).  Since 1995, in odd years the Bering Sea stations are sampled and in even years the Aleutian Islands are sampled. After the Aleutian Islands or the Bering Sea is sampled, the western Gulf of Alaska is sampled eastward towards Kodiak. The vessel then transits to Ketchikan and samples the eastern and central Gulf heading back west (finishing the survey in late August in Dutch Harbor). Some stations were sampled previously but are no longer sampled. For a complete list of which stations were sampled each year see Appendix A.

At each station 160 skates are set (1 skate = 45 hooks spaced 2 meters for a total of 7,200 hooks). The exceptions are gullies and Bering Sea stations.  At the gully stations (120-149), there is little variation in depth and so stations consist of 80 skates instead of 160. Within each gully two stations are fished in relatively close proximity. In the Bering Sea, from 1979-1994 stations had from 160-180 skates set, and from 1997-present stations have 180 skates instead of the typical 160.

Gear is set in the morning, allowed to soak a minimum of three hours, and then hauled through the rest of the day. Hooks are baited with squid. More information on the survey protocol can be found at http://www.afsc.noaa.gov/abl/MESA.

**Catch, Ages, Tags and Lengths by depth stratum–** The status of each hook is recorded. Otoliths are randomly taken from sablefish throughout each set; maturity, sex, length, and weight are recorded from these fish and specimen code is assigned. Sablefish,

shortspine thornyhead, and Greenland turbot caught on every 20th skate (i.e., 10th, 30th 50th…) are lengthed, tagged with spaghetti tags, and released.

Lengths are taken from major species including, sablefish, giant grenadier, Pacific grenadier, Greenland turbot, arrowtooth flounder, Pacific cod, shortspine thornyhead, and all rockfish caught. Lengths from spiny dogfish were taken beginning in 2010. Lengths are either taken randomly throughout the set or taken for every fish, depending on the species and the time allowed. Which years each species were lengthed and the protocol for each species can be found in the length summary view description.

Depth is recorded as the gear is being hauled on-board. Because a depth is taken for a skate when it is at the surface, it is not an accurate measurement of depth where the gear fished on-bottom. Because this depth measurement is an approximation of where the gear was set, the depth is only collected from every 5th skate. The depth is interpolated for all other skates. For working with the data most prefer to group catch data by broader depth stratum designations (which are by 100 or 200 meter increments, more details under catch). Length and age data is only available by depth stratum, not by each skate.

**Relative population indices** – Catch per unit effort (number of fish per skate; CPUE), relative population numbers (RPN), and weights (RPW) are provided at various geographic management area levels. RPN and RPW indices are based on area size of geographic areas as catch rates within those areas. These are relative because we do not have a measurement of the area sampled for longline gear.

**Variance** – Variance for CPUE, RPNs, and RPWs were added in 2021. Variances for RPNs were calculated using standard stratified sampling estimation methods and also include the covariance among survey station estimates in each depth stratum (Hanselman et al. 2016). Because RPNs are assumed to covary among depth strata within a geographic area, variances by stratum (e.g. AreaStratumRPN) should not be summed to obtain a variance for larger areas. Variances for whale-adjusted sablefish RPNs (e.g. AreaRPN_depred) are further inflated to account for sperm whale presence at a survey station using coefficients estimated in Hanselman et al. (2018). CPUE and RPW variances are derived from the CV of the associated RPN and assumed to equal the product of the RPN CV and mean CPUE or RPW squared.

**Species with variances** – Only some species caught during the survey time series have variances in tables with RPNs and RPWs. The list was shortened to those that may be used in stock assessments. Species codes in the table below are from RACE trawl surveys.

| Common Name | RACE Species Code |
|---|---|
| Spiny dogfish | 310 |
| Pacific sleeper shark | 320 |
| Longnose skate | 440 |
| mud skate | 455 |
| commander skate | 475 |
| whiteblotched skate | 480 |
| Arrowtooth flounder | 10110 |

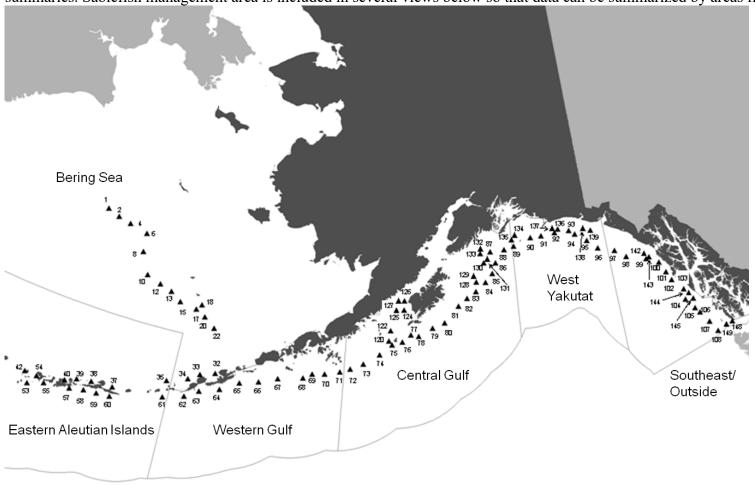| | |
|---|---|
| Kamchatka flounder | 10112 |
| Greenland turbot | 10115 |
| Pacific halibut | 10120 |
| Sablefish | 20510 |
| Pacific grenadier | 21220 |
| Giant grenadier | 21230 |
| Pacific cod | 21720 |
| Shortspine thornyhead | 30020 |
| Rougheye rockfish | 30050 |
| Yelloweye rockfish | 30470 |
| Shortraker rockfish | 30576 |
| Aleutian/Bering/Alaska Skate Complex | 99995 |

## Longline Survey Database

Catches, sablefish age and maturity data, lengths, and calculated relative population indices are described below. All information relevant to each of these data groupings has been included in the respective views so no relational queries need to be executed.

For questions on this document, longline survey data, or the database, contact Cara Rodgveller, 907-789-6052, cara.rodgveller@noaa.gov.  Please also contact Cara for specific details on calculations performed to get relative population numbers (RPNs), relative population weights (RPWs), catch per unit effort (CPUEs), average weights, and average lengths.

Tag data from fish released or captured on the longline survey are in a separate Tag Database at the Alaska Fisheries Science Center, Auke Bay Laboratories. Contact Katy Echave, katy.echave@noaa.gov.

Map of longline survey stations and sablefish management areas, used for relative population number and weight (RPN, RPW) summaries. Sablefish management area is included in several views below so that data can be summarized by areas if required.

## *1) Catch*

<u>View Name:</u> Catch_Summary_View_AKFIN
<u>View Description:</u> Catch by skate for each species with associated data.
<u>Explanation:</u> Every hook that is hauled is assigned one of four codes: a species code if it caught something, "baited" if a bait is still on the hook, "unbaited" if the hook was bare but effective, or "ineffective" if the hook was either snarled, bent or broken, missing, or otherwise unable to fish effectively. Although data is collected by hook, the catch data in the database is summarized by skate (45 hook groupings, also called hachi in the database). Each row in the catch table contains the cumulative catch of a species on a skate. So for example, if there were 4 species caught on 1 skate, there would be 4 rows in the catch table. If the next skate only caught three species, there would be three rows. The number of "baited" and "ineffective" hooks are not in the catch column, but have their own columns, so in the previous example all four rows would have the same value repeated for "baited" and "ineffective". In this table, the starting and ending locations are for the station, not the haul, as well as start and end depth and distanced fished.

Unbaited hooks are not documented in the database, but can be calculated by subtracting all other categories (catch of all species, baited, and ineffective) from 45.

To calculate the number of effective hooks, the metric commonly used for computing effort for catch rates, the number of ineffective hooks should be subtracted from 45 (which is the same as adding all species caught on a skate, plus # baited and # ineffective).

> **NOTE:** If the catch table is filtered by one or more species that were not caught on every skate, there will be no row for that skate. Therefore, there will be no record of that effort in this view. If you require complete documentation of effort, even when there was not catch, see catch with nulls (below).
> Shortraker and rougheye rockfish data is not broken out by species for Japanese cruises because they were not separated by species.
> Ineffective hooks were not recorded during surveys on Japanese vessels until 1985.
> Views with haul data have start data from haul 1 and end data from haul 2 since there are generally 2 hauls at a station.
> Exploitable field flags experimental stations too because it flags the whole geographic area.
> There have been several changes in what species code have been used for <u>shortraker and rougheye rockfish</u>. We combine the codes behind the scenes for RPN and RPW calculations.

| Year | Year of the survey. |
|---|---|
| Cruise_Number | Code used to differentiate cruises. The first four numbers are the year. |
| Vessel_Number | Code used to differentiate vessels. Japanese vessels have 3 digits and start with a 5. United states survey vessels are either 96 or 81. |

| | |
|---|---|
| Vessel_name | Name of the vessel. |
| Country | Country that conducted the survey. Can be either "Japan" or "United States". |
| Station_Number | The same station code is kept for the same location through time. Stations starting with >499 are experimental stations. |
| Active | Either currently sampled or no longer sampled. |
| Geographic_area_code | Code specific to each Geographic_area_name. |
| haul_date | Date of the set. |
| start_latitude | Start latitude in decimal degrees, generally at the shallow end of the set. |
| start_hemi_ns | Hemisphere of the start position; can be n for north, or s for south. |
| start_longitude | Start longitude in decimal degrees, generally at the shallow end of the set. |
| start_hemi_ew | Hemisphere at the start position; can be e for east or w for west |
| end_latitude | End latitude in decimal degrees, generally at the deep end of the set. |
| end_hemi_ns | Hemisphere of the end position; can be n for north, or s for south. |
| end_longitude | End longitude in decimal degrees, generally at the deep end of the set. |
| end_hemi_ew | Hemisphere at the end position; can be e for east or w for west |
| set_start_time | Time when gear set begins. |
| set_end_time | Time when gear set is finished. |
| haul_start_time | Time when haul-back begins. |
| haul_end_time | Time when haul-back is finished. |
| soak time | Elapsed time (in minutes) between set_start_time and haul_end_time. |
| distance_fished | Distance in kilometers between the start and end locations. |
| starting_depth | Depth where first hachi is set. |
| ending_depth | Depth where last hachi is set. |
| surface_temperature | Temperature in Celsius at the sea surface taken at start of haul-back (available since 1984). |
| gear_temperature | Temperature in Celsius taken at depth (recorded placed on gear; available since 1997). See "tdr_depth" for depth the temperature was taken at. |
| intrpdep | Depth either taken every 5th skate, or interpolated for all other skates. |
| stratum | Depth stratum used to identify broad depth ranges. See definitions in the table below, or see |

| | |
|---|---|
| | the field called "Stratum Description". |
| Stratum2 | Same as stratum for all strata >= 3, but stratum 2 is split between 2a and 2b. See definitions in the table below, or see the field called "Stratum Description2". |
| species_code | RACE species codes used for documenting catch (see view #2 below for details). |
| Common_name | Common name of species. |
| catch_freq | Number of fish of a species caught on each skate of gear (45 hooks). |
| hachi | Another word for skate. Generally, the lowest number was set at the shallow end of the set and the largest number was set at the deeper end of the set. |
| Catch w/ depredation | Number of fish that were caught per skate that were depredated by sperm or killer whales. Determined by presence or heads or lips. Some may have been unidentifiable and are under species code 99. |
| Catch w/o depredation | Number of fish that were caught per skate that were not depredated by sperm or killer whales. |
| baited | Number of hooks retrieved with bait on them, but no catch, summed by hachi. |
| ineffective | The number of hooks retrieved that were snarled, bent or broken, missing, or hooks otherwise unable to fish effectively, summed by hachi. |
| rpn_filter | Used to filter out skates for relative population number (RPN), relative population weight (RPW), and CPUE calculations. A "k" or "K" is used to code for killer whale depredation by each hachi. A "g" is used when the skate of gear was not fishing effectively. |
| Station_Type | Experimental or standard survey station. Only standard stations are used in RPN and RPW calculations. |
| Council_sablefish_management_area | Bering Sea, Aleutian Islands, Western Gulf of Alaska, Central Gulf of Alaska, West Yakutat, and Southeast/Outside. |
| Geographic_area_name | Smaller areas within the management areas dictated by depth and habitat (e.g., Kodiak, Bering I, Yakutat, Shumagin). |
| Exploitable | Code used to flag each Geographic Area for calculations of relative population weights and numbers for RPN's summarized by Sablefish Council Management area. Most gullies are not included. |

| Habitat_Type | Can be either deep cross-shelf gully, shallow cross-shelf gully, or continental slope. Gully stations are shallower and less steep. |
|---|---|
| mammal_sighting | Used to flag a station for sperm whale presence (with an "S") if at least 1 whale was near the vessel when gear was being hauled. This data is at the station level, not the hachi level. Data is not filtered out of RPN & RPW calculations for sperm whale presence or depredation. |
| depredation_flag | Value = "True" when there is evidence of sperm whale depredation somewhere at the station. This data is at the station level, not the hachi level. |
| depredation_freq | Number of fish that were caught per skate that were depredated by sperm or killer whales, as determined by presence oh heads or lips. Some may have been unidentifiable and are under species code 99. |
| non_depredated_freq | Number of fish that were caught per skate that were not depredated by sperm or killer whales. |
| haul | Haul # is consecutive for each year. Number start over each year. There are usually 2 hauls per station except gully stations, where there is 1. |
| StratumDescription | Description specifying the range of depths in meters of the stratum value. |
| StratumDescription2 | Description specifying the range of depths in meters of the stratum2 value. |
| tdr depth | Depth in m where temperature-depth recorder settled and the "gear temperature" was taken. |
| depth | Depth in m recorded at haul back. The depth is taken at approximately every 5th skate. |
| depth_time | Time that the depth measurement was taken. |
| Cruise_Station_ID | Internal identifier for the Cruise_Station |
| Depth_ID | Internal identifier for the Depth record. Used to join to records in DepthSummaryView |
| NMFS_area_code | NMFS management area codes (610, 620…) |

Table of depth stratum used on the survey for categorizing catch rates for relative population number and weight calculations, and for length frequencies. Depth stratum is a column in views where stratum is included.

| Depth Stratum | Description |
|---|---|
| 0 | No definition |
| 1 | 0-100 meters |
| 2 | 101-200 meters |
| 2a | 101-150 meters |

| 2b | 151-200 meters |
|---|---|
| 3 | 201-300 meters |
| 4 | 301-400 meters |
| 5 | 401-600 meters |
| 6 | 601-800 meters |
| 7 | 801-1000 meters |
| 8 | 1001-1200 meters |
| 9 | 1201 + meters |

Table of species that were not collected consistently through the time series. Since the use of codes sometimes differs between the Japanese and United States (U.S.) surveys, they are listed separately. For the Japanese surveys, many rockfish, including rougheye and shortraker, were grouped into "rockfish unidentified".  See table for details.

<u>Shortraker and rougheye</u> are identified to species only after lengths are taken and not when catch is tallied. More than one code has been used for shortraker and rougheye rockfish catch in the past.  We combine the codes behind the scenes for RPN and RPW calculations, and we are in the process of splitting catch in the raw catch tables (catch summary view and catch with nulls). Other rockfish were broken out by species only in some years of the cooperative Japan-U.S. survey.

| 10110 | Arrowtooth flounder | X | 1988-present | X | 1979-1994 |
|---|---|---|---|---|---|
| 10112 | Kamchatka flounder | X | 2019-present | | |
| For 10110/10112: 10110 was used for two species (10110 & 10112) until 2019, when the species were split into 2 codes. | | | | | |

| Species Code | Species Name | U.S. Years | Japan Years | Notes |
|---|---|---|---|---|
| 400 | Skate unident. | 1994-present | 1979-1994 | In U.S. survey 400 used for all skates through 2009. Is still sometimes used 2009-present when skate is unknown. |
| 420 | Big skate | 2009-present | | |
| 440 | Longnose skate | 2009-present | | |
| 455 | Mud skate | 2009-present | | |
| 460 | Roughtail skate | 2009-present | | |
| 475 | Commander skate | 2009-present | | |
| 480 | Whiteblotched skate | 2009-present | | |
| 485 | Whitebrow skate | 2009-present | | |
| 10110 | Arrowtooth flounder | 1988-present | 1979-1994 | This species code included Kamchatka flounder until 2019, when the species was split out. |
| 10112 | Kamchatka flounder | 2019-present | | This species was given the code 10110 until 2019, when it was identified in the lengths and catch |

| | | | | and given its own code. |
|---|---|---|---|---|
| 99995 | Aleutian/Bering/Alaska Skate Complex | 2009-present | | |
| 21300 | Sculpin unidentified | | 1982-1994 | |
| 21320 | Slim sculpin | | 1982-1994 | |
| 21340 | Blackfin sculpin | 1988-present | 1982-1994 | |
| 21341 | Darkfin sculpin | 1988-present | 1982-1994 | |
| 21344 | Brown Irish lord | | 1982-1994 | |
| 21347 | Yellow Irish lord | 1988-present | 1982-1994 | |
| 21370 | Great sculpin | 1988-present | 1982-1994 | |
| 21390 | Spinyhead sculpin | | 1982-1994 | |
| 21395 | Blob sculpin | | 1982-1994 | |
| 21420 | Bigmouth sculpin | | 1982-1994 | |
| 30090 | Aurora rockfish | 1988-present | | |
| 30330 | Black rockfish | 1988-present | 1980, 1989-1994 | |
| 30340 | Blackgill rockfish | 1988-present | | |
| 30400 | Bocaccio | 1988-present | | |
| 30410 | Canary rockfish | 1988-present | | |
| 30170 | Darkblotched rockfish | 1988-present | | |
| 30150 | Dusky rockfish | 1988-present | 1980, 1989-1994 | |
| 30200 | Greenstriped rockfish | 1988-present | | |
| 30535 | Harlequin rockfish | 1988-present | 1989-1994 | |
| 30420 | Northern rockfish | 1988-present | 1989-1994 | |
| 30060 | Pacific Ocean Perch | 1988-present | 1989-1994 | |
| 30320 | Quillback rockfish | None Found | 1980, 1989-1994 | |
| 30475 | Redbanded rockfish | 1988-present | 1980, 1989-1994 | |
| 30430 | Redstripe rockfish | 1988-present | | |
| 30270 | Rosethorn rockfish | 1988-present | 1980, 1989-1994 | |

| 30100 | Silvergray rockfish | 1988-present | 1980, 1989-1994 | |
|---|---|---|---|---|
| 30380 | Tiger rockfish | 1988-present | 1980 | |
| 30470 | Yelloweye rockfish | 1988-present | 1980, 1989-1994 | |
| 30560 | Sharpchin rockfish | 1988-present | | |
| 41500 | Gorgonian coral unidentified | 1988-present | | In U.S. survey, used for all coral through 2004 (except sea whips and sea pens). Also used from 2004-present. |
| 41520 | Red tree coral | 2004-present | | |
| 41525 | Black coral unidentified | 2004-present | | |
| 41580 | Bubble gum coral | 2004-present | | |
| 42000 | Sea pen or sea whip | 1988-present | | |
| 44004 | Cup coral | 2004-present | | |
| 44029 | Hyrocoral unidentified | 2004-present | | |
| 44088 | Bamboo coral unidentified | 2004-present | | |
| 99996 | Lips and Jaws | 2001-present | | Limited data in 2000 and regular data in 2001. |

## 2) Species Catch with Nulls

<u>View Name:</u> Created by AKFIN
<u>View Description:</u> Like the catch table (catch_summary_view), there will be a row for each species for each skate. Unlike the catch table, there is a row for each species even if there is no catch for that species. For example, if you filtered for four species and two of them had catch on skate 1, then there would be four rows for skate 1, two for the species with no catch and two for the species with catch. If the data is not filtered for specific species, all species will appear (~50 million rows).  For more details see the description for the catch view.

There have been several changes in what species code have been used for <u>shortraker and rougheye rockfish</u>.  We combine the codes behind the scenes for RPN and RPW calculations.

| | |
|---|---|
| Year | Year of the survey. |
| Cruise_Number | Code used to differentiate cruises. The first four numbers are the year. |
| Vessel_Number | Code used to differentiate vessels. Japanese vessels have 3 digits and start with a 5. United states survey vessels are either 96 or 81. |
| Vessel_name | Name of the vessel. |
| Country | Country that conducted the survey. Can be either "Japan" or "United States". |
| Station_Number | The same station code is kept for the same location through time. Stations starting with >499 are experimental stations. |
| Habitat_Type | Can be either deep cross-shelf gully, shallow cross-shelf gully, or continental slope. Gully stations are shallower and less steep. |
| Station_type | Experimental or standard survey station. Experimental stations (station numbers >499) are not used for RPN or RPW calculations. |
| Active | Either currently sampled or no longer sampled. |
| Council_sablefish_management_area | Bering Sea, Aleutian Islands, Western Gulf of Alaska, Central Gulf of Alaska, West Yakutat, and Southeast/Outside. |
| Geographic_area_name | Smaller areas within the management areas dictated by depth and habitat (e.g., Kodiak, Bering I, Yakutat, Shumagin). |
| Geographic_area_code | Code specific to each Geographic_area_name. |
| NMFS_area_code | NMFS management area codes (610, 620…) |
| Exploitable | Code used to flag each Geographic Area for calculations of relative population weights and numbers for RPN's summarized by Sablefish Council Management area. Most gullies are not |

| | |
|---|---|
| | included. |
| mammal_sighting | Used to flag a station for sperm whale presence (with an "S") if at least 1 whale was near the vessel when gear was being hauled. This data is at the station level, not the hachi level. Data is not filtered out of RPN & RPW calculations for sperm whale presence or depredation. |
| depredation_flag | Value = 1 when there is evidence of sperm whale depredation somewhere at the station. This data is at the station level, not the hachi level. |
| haul | Haul # is consecutive for each year. Number start over each year. There are usually 2 hauls per station except gully stations, where there is 1. |
| haul_date | Date of the set. |
| start_latitude | Start latitude in decimal degrees, generally at the shallow end of the set. |
| start_hemi_ns | Hemisphere of the start position; can be n for north, or s for south. |
| start_longitude | Start longitude in decimal degrees, generally at the shallow end of the set. |
| start_hemi_ew | Hemisphere at the start position; can be e for east or w for west |
| end_latitude | End latitude in decimal degrees, generally at the deep end of the set. |
| end_hemi_ns | Hemisphere of the end position; can be n for north, or s for south. |
| end_longitude | End longitude in decimal degrees, generally at the deep end of the set. |
| end_hemi_ew | Hemisphere at the end position; can be e for east or w for west |
| set_start_time | Time when gear set begins. |
| set_end_time | Time when gear set is finished. |
| haul_start_time | Time when haul-back begins. |
| haul_end_time | Time when haul-back is finished. |
| soak time | Elapsed time (in minutes) between set_start_time and haul_end_time. |
| distance_fished | Distance in kilometers between the start and end locations. |
| starting_depth | Depth where first hachi is set. |
| ending_depth | Depth where last hachi is set. |
| depth | Depth in m recorded at haul back. The depth is taken at approximately every 5th skate. |
| depth_time | Time that the depth measurement was taken. |
| surface_temperature | Temperature in Celsius at the sea surface taken at start of haul-back (available since 1984). |
| gear_temperature | Temperature in Celsius taken at depth (recorded |

| | |
|---|---|
| | placed on gear; available since 1997). See "tdr_depth" for depth the temperature was taken at. |
| tdr depth | Depth where temperature-depth recorder settled and the "gear temperature" was taken. |
| intrpdep | Depth either taken every $5^{th}$ skate, of interpolated for all other skates. |
| stratum | Depth stratum used to identify broad depth ranges. See definitions in the table below, or see the field called "Stratum Description". |
| Stratum2 | Same as stratum for all strata >= 3, but stratum 2 is split between 2a and 2b. See definitions in the table below, or see the field called "Stratum Description2". |
| rpn_filter | Used to filter out skates for relative population number (RPN), relative population weight (RPW), and CPUE calculations. A "k" or "K" is used to code for killer whale depredation by each hachi. A "g" is used when the skate of gear was not fishing effectively. |
| species_code | RACE species codes used for documenting catch (see view #2 below for details). |
| Common_name | Common name of species. |
| catch_freq | Number of fish of a species caught on each skate of gear (45 hooks). |
| hachi | Another word for skate. Generally, the lowest number was set at the shallow end of the set and the largest number was set at the deeper end of the set. |
| depredation_freq | Number of fish that were caught per skate that were depredated by sperm or killer whales, as determined by presence oh heads or lips. Some may have been unidentifiable and are under species code 99. |
| non_depredated_freq | Number of fish that were caught per skate that were not depredated by sperm or killer whales. |
| baited | Number of hooks retrieved with bait on them, but no catch, summed by hachi. |
| ineffective | The number of hooks retrieved that were snarled, bent or broken, missing, or hooks otherwise unable to fish effectively, summed by hachi. |
| StratumDescription | Description specifying the range of depths in meters of the stratum value. |
| StratumDescription2 | Description specifying the range of depths in meters of the stratum2 value. |

### 3) Species Codes

View Name: Specie_Catch_Codes
View Description: This table includes a list of all species that could potentially be encountered on the survey.

| | |
|---|---|
| Specie_catch_code_ID | Auto generated ID used in database. |
| Polycorder_Number | Code used to code for species on hand-held computer on the survey. |
| Species_Code | RACE species code. |
| Common_Name | Species common name. |
| Scientific_Name | Species scientific name. |
| a_vonBert | Weight = $aL^b$ where a_vonBert = b |
| b_vonBert | Weight = $aL^b$ where a_vonBert = b |
| web_reporting_flag | Flag used for species that have summarized data available on the web. |
| SurveySpeciesFlag | Flag for inclusion in catch with nulls. |
| NW_AI_ratio | Species specific ratios of northeast and northwest Aleutian Islands (AI) RPNs from Japanese surveys (1985-1994) used to extrapolate northeastern AI RPNs, RPWs, and CPUEs for current surveys. |
| SW_AI_ratio | Species specific ratios of southeast and southwest Aleutian Islands (AI) RPNs from Japanese surveys (1985-1994) used to extrapolate southeastern AI RPNs, RPWs, and CPUEs for current surveys. |

### 4) Sablefish maturity and ages

View Name: Age_View_AKFIN
View Description: Data taken from sablefish that had their otoliths sampled for aging, but were not always aged. See Background section above for sampling protocol.
Explanation:  Since 1996 sablefish have been randomly sampled throughout each set for ageing. For samples from 1996-present, maturity, length, weight, and sex is available for all sampled fish. Specimen are then sub-sampled for age reading and so ages are available for only a subset of these fish.

Before 1996 sablefish sampling was length stratified and data is only available from samples that were aged. Ages are only available from 1987, 1989, 1991, and 1993. Data also exists for 1981 and 1985; however this data is not in the database because there is no information on depth stratum in these years and stratum is a required field in the database. If information from these years is needed, please contact the database manager, cara.rodgveller@noaa.gov.

| | |
|---|---|
| Vessel_Number | Code used to differentiate vessels. Japanese vessels have 3 digits and start with a 5. United states survey vessels are 81 or 96. |
| Country | Country that conducted the survey. Can be either "Japan" or "United States". |

| Station_Number | The same station code is kept for the same location through time. Stations starting with >499 are experimental stations, not standard survey stations. |
|---|---|
| Year | Year of the survey. |
| Haul_date | Date station was sampled. |
| StartLat | Start latitude in decimal degrees, generally at the shallow end of the set |
| StartLong | Start longitude in decimal degrees, generally at the shallow end of the set. |
| EndLat | End latitude in decimal degrees, generally at the deep end of the set. |
| EndLong | End latitude in decimal degrees, generally at the deep end of the set. |
| Council_sablefish_management_area | Bering Sea, Aleutian Islands, Western Gulf of Alaska, Central Gulf of Alaska, West Yakutat, and Southeast/Outside. |
| Geographic_area_name | Smaller areas within the management areas dictated by depth and habitat (e.g., Kodiak, Bering I, Yakutat, Shumagin). |
| stratum | Depth stratum used to identify broad depth ranges. |
| description | Depth range for each depth strata. |
| sex | Sex of lengthed fish, available for select species only, 1 = male, 2 = female, 3 = unknown. |
| age | Age in years. |
| maturity | Maturity code for sablefish gonads during the summer months. |
| length | Fork length in cm. |
| weight | Total body weight in grams. |
| error_flag | Numerical value described under ErrorDescription. |
| ErrorDescription | "Incomplete specimen" if missing length, weight, or sex; "Above Standard" or "Below Standard" if residual is larger or smaller than a threshold value indicating that the weight is out of the normal range for the sablefish length-weight relationship (selects ~ 2 specimen per year); "No Error" if there is no missing data and length-weight combination is reasonable. |
| residual | Deviation from fit to sablefish length-weight data. See document on Flagging Specimen data for details. |
| AgeNotes | Space for comments |
| NMFS_area_code | NMFS management area codes (610, 620…) |
| area_code | Code specific to each Geographic_area_name. |
| SexDescription | Female, male, unknown |
| Maturity Description | Defines maturity. See table below for descriptions. |
| Specimen_number | ID assigned to each specimen. Not unique (start at 1 |

| | every year). |
|---|---|

Maturity Definitions for sablefish gonads during the summer longline survey. Codes used in view above under field called "maturity".

| 1 | **Female**: Immature, string like, two lobes  **Male**: Immature, ribbon like, four lobes |
|---|---|
| 2 | **Female**: Immature, enlarging lobes, no ova  **Male**: Immature, four distinct ribbons, light pink, enlarging |
| 3 | **Female**: Maturing, large, white-pink, ova visible  **Male**: Mature, much enlarged, white lobes |
| 4 | **Female**: Spawning, ova loose, extrude under pressure  **Male**: Spawning, sperm extruded under pressure |
| 5 | **Female**: Spent, deflated, flaccid, bloodshot **Male**: Spent, large, shriveled, wrinkled, no sperm |

## *5) Lengths*

View Name: Length_Summary_View_AKFIN
View Description: Lengths for select species by station and depth stratum.
Explanation:  In this view there are lengths of several species caught on the survey including the following: shortraker and rougheye rockfish, giant grenadier, Pacific grenadier, shortspine thornyhead (SST), spiny dogfish, Pacific cod, sablefish, arrowtooth flounder, Greenland turbot, and other rockfish species (lengths are taken on all commonly caught rockfish species when possible). When time allows, lengths are taken from all shortraker, rougheye, SST, and sablefish, Pacific cod, and other rockfish.  If there are too many fish to handle, lengths are taken on a random subsample of fish from each depth stratum.  For giant grenadier, Pacific grenadier, arrowtooth flounder, and spiny dogfish, 50 fish from each depth stratum are randomly sampled. Sablefish, giant grenadier, pacific cod, and spiny dogfish are currently sexed. Pacific grenadier were sexed from 2006-2009. Each row is the total number ("frequency") of fish lengthed by cm, grouped by species, stratum, sex (for some species), station, cruise, and vessel (or country).

> **NOTE:** In 2011, the length-weight curve parameters were updated based on all available trawl survey data. Sablefish parameters were not changed and are from Sasaki 1985. Past values were from the trawl survey prior to 1988. See Zenger et al. 1994. NOAA Tech. Memo NMFS-AFSC-39 for details.
> Views with haul data have start data from haul 1 and end data from haul 2 since there are generally 2 hauls at a station.
> Exploitable field flags experimental stations too because it flags the whole geographic area.

| Year | Year of the survey. |
|---|---|
| Country | Country that conducted the survey; either "Japan" or "United States". |
| Vessel_Number | Code use to differentiate vessels. Japanese vessels have 3 digits and start with a 5. United states survey |

| | |
|---|---|
| | vessels are 96 or 81. |
| Station_Number | The same station code is kept for the same location through time. Stations starting with >499 are experimental stations. |
| Geographic_area_name | Smaller areas within the management areas dictated by depth and habitat (e.g., Kodiak, Bering I, Yakutat, Shumagin). |
| Geographic_area_code | Code specific to each Geographic_area_name. |
| Council_sablefish_management_area | Bering Sea, Aleutian Islands, Western Gulf of Alaska, Central Gulf of Alaska, West Yakutat, and Southeast/Outside. |
| Exploitable | Code used to flag Geographic Areas for calculations of relative population weights and numbers. |
| Station Type Description | Experimental or standard survey station. Experimental stations (station numbers >499) are not used for RPN or RPW calculations. |
| Active | Either currently sampled or no longer sampled. |
| NMFS_area_code | NMFS management area codes (610, 620…) |
| stratum | Depth stratum used to identify broad depth ranges. See the field called "Description" for details. |
| stratum description | A description of the depth stratum. |
| StartLat | Start latitude in decimal degrees, generally at the shallow end of the set. |
| start_hemi_ns | Hemisphere of the start position; can be n for north, or s for south. |
| StartLong | Start longitude in decimal degrees, generally at the shallow end of the set. |
| start_hemi_ew | Hemisphere at the start position; can be e or w. |
| EndLat | End latitude in decimal degrees, generally at the deep end of the set. |
| end_hemi_ns | Hemisphere of the end position; can be n or s. |
| EndLong | End longitude in decimal degrees, generally at the deep end of the set. |
| end_hemi_ew | Hemisphere at the end position; can be e for east or w for west |
| Species_code | RACE species codes used for documenting catch. |
| Common_name | Common name of species. |
| sex | Sex of lengthed fish, available for select species only, 1 = male, 2= female, 3 = unknown. |
| length | Fork length in cm for most species. For grenadiers lengths are taken from the snout to start of the anal fin, for spiny dogfish length is taken from the snout to the pre-caudal notch. |
| frequency | Number of lengths taken. |

Table of which years and surveys lengths were taken in the United States (U.S.) and Japanese surveys.

| Species Code | Species Name | U.S. | U.S. Years | Japan | Japan Years |
|---|---|---|---|---|---|
| 10110 | Arrowtooth flounder | X | 1988-present | X | 1979-1994 |
| 10112 | Kamchatka flounder | X | 2019-present | | |
| For 10110/10112: 10110 was used for two species (10110 & 10112) until 2019, when the species were split into 2 codes. | | | | | |
| 30570 | Chameleon rockfish | | | X | 1992 |
| 23220 | Chinook salmon | X | 1989 | | |
| 30150 | Dusky rockfish | X | 1988-present | | |
| 21230 | Giant grenadier | X | 1988-present | X | 1979-1994 |
| 10115 | Greenland turbot | X | 1995-present | X | 1979-1994 |
| 30420 | Northern rockfish | | | X | 1983, 1985 |
| 21720 | Pacific cod | X | 1988-present | X | 1979-1994 |
| 10120 | Pacific halibut | | | X | 1979-1994 |
| 21220 | Pacific grenadier | X | all except 1991-1993 | X | 1979-1994 |
| 21232 | Popeye grenadier | X | 1991-1996 | X | 1980, 1992 |
| 30475 | Redbanded rockfish | X | 1988-present | X | 1981, 1982, 1985 |
| 30040 | Rockfish unident. | | | X | 1994 |
| 30270 | Rosethorn rockfish | X | 1988-present | | |
| 30050 | Rougheye rockfish | X | 1988-present | X | 1979-1994 |
| 20510 | Sablefish | X | 1988-present | X | 1979-1994 |
| 30576 | Shortraker rockfish | X | 1988-present | X | 1979-1994 |
| 30020 | Shortspine thornyhead | X | 1988-present | X | 1979-1994 |
| 30100 | Silvergray rockfish | X | 1988-1991 | | |
| 10150 | Slender sole | | | X | 1979-1994 |
| 310 | Spiny dogfish | X | 2010-present | | |
| 30010 | Thornyhead unident. | X | 1988 | | |
| 21740 | Walleye pollock | X | 1990 | X | 1979-1994 |

| 30470 | Yelloweye rockfish | X | 1988-present | X | 1985 |

## Notes on Tables with RPNs and RPWs

*Variance*
Variances for RPNs are calculated using standard stratified sampling estimation methods and include the covariance among survey station estimates in each depth stratum (Hanselman et al. 2016). Because stratum-specific RPNs are assumed to correlated within a geographic area, variances by depth stratum (e.g. AreaStratumRPN) should not be summed to obtain variances for larger areas. In the GOA, variance at the geographic area level (e.g. AreaRPN_3to7 and AreaRPN_AllStrata) can be summed to higher levels, like NPFMC Council Sablefish Management area or FMP subarea. In off-survey years in the BS and AI, the coefficient of variation (CV) is fixed to 0.05, which reflects the long-term mean CV in these regions. CPUE and RPW variances are derived from the CV of the associated RPN and assumed to be equal the product of the RPN CV and mean CPUE or RPW squared.

*Killer whales*
When killer whale depredation occurs, stations are removed from RPN, RPW, and CPUE calculations. Killer whale depredation was only recorded since 1996.

*Sperm whales and sablefish*
Unlike killer whales, stations where sperm whales were present or depredating are not excluded from CPUE, RPN, or RPW calculations. Using depredation correction factors estimated in Hanselman et al. (2018), sablefish catches are adjusted at stations with evidence of sperm whale depredation (e.g. missing body parts, crushed tissues, blunt tooth marks, or shredded bodies), and variance estimates are inflated at all stations where sperm whale presence is recorded within 100 m of the survey vessel. The correction values are specific to sablefish only and are therefore presented in separate tables ending with "depred." These values may be recalculated as more whale depredation data become available and adjustments would change the sablefish CPUE, RPN, and RPW values.

*Gully inclusion and exclusion*
Only non-gully stations (with the exception of gully stations 142-145, 148, 149) are included in data summed above the geographic area level: FMP subarea, Council Sablefish Management Area, FMP Area, or AK-wide. Gullies are not included in these summary tables, except for stations 142-144 (Spencer Gully and Ommaney Trench) and 148-149 (Dixon Entrance). For gully stations 142 and 143, strata 6 is extrapolated from CPUE from stations in the same management area in strata 6. For station 144 and 145, stratum 5 is extrapolated using the same method.

*Area sizes*
Starting in 2021, new area sizes were used in calculations in for all years and variances were also added (Echave et al. 2013). These measurements were obtained using GIS software and are more accurate than historical values derived from paper charts and a planimeter.

*Some stations and skates not included*
Experimental stations (station number > 499) are not included in any calculations. Skates with >5 ineffective hooks (bent, broken, snarled) are not included in calculations because it is assumed that the skate was not fishing effectively.

*No lengths – lack of index data*
If there are no lengths for a species in a stratum, there will be no RPWs.
Shortraker and rougheye rockfish data is not available for Japanese cruises because there are no species specific lengths to separate catch. There are also some areas without lengths for these species through 1991 and therefore abundance will be 0.

Skates were split into different species codes will have short time series in some cases (see species code table by year and survey).

From <u>1988-1992</u> for giant grenadier, shortraker and rougheye rockfish, arrowtooth flounder, and shortspine thornyhead, most lengths did not have a strata assigned so there are no RPWs. Also, <u>no RPNs are available for shortraker and rougheye</u> because cannot split catch without lengths.

From 1988-1992 for giant grenadier, shortraker, rougheye, arrowtooth, shortspine, most lengths did not have a strata assigned so there are no RPWs. Also no RPNs are available for shortraker and rougheye because cannot split catch without lengths.

*Bering Sea and Aleutian Islands Extrapolations*
Because the Bering Sea and Aleutian Islands are sampled every other year since 1996, Aleutians in even years and Bering Sea in odd, data for the off years is extrapolated by multiplying the ratio of RPNs in the Gulf of Alaska (GOA) by the previous year's RPN or CPUE or RPW. For example, in 2010 the Aleutian Islands were sampled. To extrapolate RPNs for 2010 the Bering Sea we use the following calculation:

2010 Bering Sea RPN = 2010 GOA RPN/2009 GOA (all areas in the Gulf combined) *
2009 Bering Sea RPN

*Sablefish fixed values*
RPN and RPW values for the Japanese surveys for sablefish are fixed, and not calculated based on the available catch data in the survey database. However, the variances estimates for the fixed Japanese survey values are calculated using the available raw Japanese catch data. The northeast Aleutian Island values are also fixed in 1996 because raw catch data are not available for this area, however, RPNs, RPWs, and CPUEs are.


## 6) RPN by depth stratum and geographic area
<u>View Name:</u> AreaStratumRPN; AreaStratumRPN_depred

View Description: Calculated Relative Population Indices by depth stratum and small geographic areas. There are 2 tables; table (1) is unadjusted data and (2) is for sablefish data adjusted for effects of sperm whale depredation.
Explanation:  This view contains calculated relative population numbers (RPNs), catch per unit effort (CPUEs), and relative population weights (RPWs; only for species that have lengths taken on the survey) by small geographic areas and depth strata. In this view all values are calculated from catch data in the database and no data is fixed. In this table, values from United States surveys are reported from 1990-present only.

| | |
|---|---|
| Year | Year of the survey. |
| Survey | Country that conducted the survey. Can be either "Japan" or "United States". |
| FMP_management_area | "BSAI" or "GOA" |
| Council_managemetn_area_id | identifier |
| Council_management_area | Management areas (5) - Bering Sea, Aleutian Islands, Western Gulf, Central Gulf, Eastern Gulf |
| Council_sablefish_management_area_ID | identifier |
| Council_sablefish_management_area | Fishery management plan subareas (6) - Bering Sea, Aleutian Islands, Western Gulf, Central Gulf, West Yakutat, East Yakutat/Southeast |
| Geographic_area_name | Smaller areas within the management areas dictated by depth and habitat (e.g., Kodiak, Bering I, Yakutat, Shumagin). |
| area_code | Code specific to each Geographic_area_name. |
| Exploitable | Positive if Geographic_area_name is used for RPN calculations |
| Species_Code | RACE species code. |
| species | Species common name. |
| stratum | Depth stratum code used to identify broad depth ranges. See definitions in the table above for a description |
| area_size_km | Area size (kilometers squared) by geographic area and depth strata. |
| num_stations | A count of the number of stations in each Geographic Area and stratum. |
| num_rpw_stations | Count of the number of RPW flagged stations in each Geographic Area and stratum. |
| CPUE | Catch per unit effort (CPUE, as number of fish per hachi) for each species by Geographic Area and stratum. CPUE is calculated by dividing the number of fish caught by the number of skates set at a station within a depth stratum. Skates are not included if they had killer whale depredation or if there were greater than 5 |

| | ineffective hooks, indicating that the gear was not fishing effectively. |
|---|---|
| CPUE_var | CPUE variance, derived from the RPN coefficient of variation (CV; i.e. var(CPUE) = (CPUE*CV(RPN))^2). CPUE variances by stratum are not additive to larger area, because they are not independent. |
| RPN | Relative population number (RPN) for each Geographic Area and stratum. RPN is an index of abundance and not an absolute estimate of the total number of fish. It is calculated for each stratum at each station by multiplying the CPUE for each stratum at each station by the area of the stratum in the Geographic Area. The RPN for a stratum in a Geographic Area is then calculated by averaging the RPN's for all stations within each stratum in a Geographic Area. A null value means there were no fish caught. |
| RPN_var | RPN variance, assuming stratified random sampling design. RPN variances by stratum are not additive to larger areas, because they are not independent. |
| RPW | Relative population weight (RPW) is available for species that have lengths taken. RPW is calculated the same as RPN except in the first step the CPUE is multiplied by the area size AND the mean weight for each species at each stratum in each Geographic Area. A null value means that either there were no fish caught (CPUE = 0) or lengths are not taken for this species. |
| RPW_var | RPW variance, derived from the RPN coefficient of variation (CV; i.e. var(RPW) = (RPW*CV(RPN))^2). RPW variances by stratum are not additive to larger area, because they are not independent. |
| mean_length | Mean length by strata and Geographic Area for species that are lengthed. |
| mean_weight | Mean weight in kilograms by strata and Geographic Area for species that are lengthed. Weights are calculated from predetermined length-weight relationships for each species. |
| LastModifiedDate | Date when data was populated |

For Further Calculations:

To summarize data into larger areas refer to the RPN by geographic area or RPN by NPFMC Council_Sablefish_Management_Areas tables. Or, if you prefer to summarize this table into larger areas by hand follow these instructions:

- To calculate CPUE for larger areas (such as Council Sablefish Management Area) (keeping strata separated), average the CPUE values for all geographic areas within the larger area for each stratum.
- To calculate CPUE for larger areas for multiple strata, $\sum (CPUE_i \times Size_i) / \sum Size_i$ , where $i$ is the individual stratum for each geographic area. This in an average CPUE for the larger area weighted by the strata sizes in each geographic area.
- To calculate RPN or RPW for larger areas (keeping strata separated) sum the values for all geographic areas within the larger area for each stratum. The values are already weighted by area size.
- To calculate RPN or RPW for larger areas for multiple strata, sum the values for all strata for all geographic area.

  **NOTE**: RPN, RPW, and CPUE is null if no data is available (either because no fish were caught or, in the case of RPW's, no lengths were taken). Some geographic areas contain only gully stations (which are shallower and less steep than slope stations).

CPUE, RPN, and RPW variances by depth stratum and geographic area are not additive to larger area sizes because they are assumed to covary among strata within a geographic area.

## *7) RPN by geographic area*

View Name: (1) AreaRPN_3to7; (2) areaRPN_AllStrata
View Description: Calculated Relative Population Indices by small geographic areas.
Explanation:  Thse tables contains calculated relative population numbers (RPNs), catch per unit effort (CPUEs), and relative population weights (RPWs; only for species that have lengths taken on the survey) by small geographic areas. This table is the same as the RPN by depth and geographic area table except that this data is summarized by only geographic area and not depth strata. Table (1) has data for only strata 3-7 (200 – 1,000 m); table (2) has data from all strata (including 150 – 200 m). Extrapolations for the northwest and southwest Aleutian Islands are done using species specific ratios (for the U.S. only, from ratios of RPNs between eastern and western Aleutians from Japanese survey data from 1985-1994). Sablefish values for the Japanese surveys are fixed from values published in Japanese survey reports for sablefish, and not calculated using catch data. All depth strata are included where there are area sizes available for computing RPNs and RPWs.  Variances were added for CPUE, RPN, and RPWs for the time series starting in 2021. In this table, values from United States surveys are reported from 1990-present only.

| year | Year of the survey. |
|------|---------------------|
| Country | Country that conducted the survey, either |

| | |
|---|---|
| | "Japan" or "United States". |
| FMP_management_area | "BSAI" or "GOA" |
| Council_management_area_id | identifier |
| Council_management_area | Management areas (5) - Bering Sea, Aleutian Islands, Western Gulf, Central Gulf, Eastern Gulf |
| Area | Council_Sablefish_Management_Area, area designation used for management of sablefish. |
| Council_sablefish_management_area_id | identifier |
| Council_sablefish_management_area | Fishery management plan subareas (6) - Bering Sea, Aleutian Islands, Western Gulf, Central Gulf, West Yakutat, East Yakutat/Southeast |
| Geographic_area_name | Smaller areas within the management areas dictated by depth and habitat (e.g., Kodiak, Bering I, Yakutat, Shumagin). |
| area_code | Code specific to each Geographic_area_name. |
| Exploitable | Flagged as 1 (or true) if indices in this area are included when data is summarized by Council Sablefish Management Area. |
| species_code | RACE species code. |
| species | Species common name. |
| area_size_km | Area size (kilometers squared) by geographic area and depth strata. |
| CPUE | Average CPUE (number fish/hachi) for all strata and stations within the Area weighted by strata size. |
| CPUE_var | CPUE variance, derived from the RPN coefficient of variation (CV; i.e. var(CPUE) = $(CPUE*CV(RPN))^2$). |
| RPN | Sum of RPN's (relative population numbers) of all strata in the Area. A null value means there were no fish caught. |
| RPN_var | RPN variance, assuming stratified random sampling design. |
| RPW | Sum of RPW's (relative population weights) of all strata in the Area. A null value means that either there were no fish caught (CPUE = 0) or lengths are not taken for this species. |
| RPW_var | RPW variance, derived from the RPN coefficient of variation (CV; i.e. var(RPW) = $(RPW*CV(RPN))^2$). |
| mean_length | mean length by geographic_area_name and stratum |
| mean_weight | mean weight by geographic_area_name and stratum |

| LastModifiedDate | Date when data was populated |
|---|---|

## 8) RPN by FMP subarea

View Name: FMPSubarea_AllStrata, (2) FMPSubArea_3to7_depred

View Description: Table (1) includes data from all strata (150 – 1,000 m) for all species; table (2) includes data for strata 3 – 7 (200 – 1,000 m), for sablefish only, and data is adjusted for sperm whale depredation. FMP subareas include - Bering Sea, Aleutian Islands, Western Gulf, Central Gulf, and the Eastern Gulf. In the table the field is called "Council_management_area".

Explanation: Extrapolations for the northwest and southwest Aleutian Islands are done for each species (for the U.S. only, from ratios of RPNs between eastern and western Aleutians from Japanese survey data from 1985-1994). The Aleutian Islands area includes data from both the western and eastern areas. Values for the Japanese surveys for sablefish are fixed from values published in Japanese survey reports. In this table, values from United States surveys are reported from 1990-present only.

| year | Year of the survey. |
|---|---|
| survey | Country that conducted the survey, either "Japan" or "United States". |
| Council_management_area_id | identifier |
| Council_management_area | Management areas (5) - Bering Sea, Aleutian Islands, Western Gulf, Central Gulf, Eastern Gulf |
| species_code | RACE species code. |
| species | Species common name. |
| area_size_km | area of the geographic_area_name by stratum in km^2 |
| CPUE | Average CPUE (number fish/hachi) for all strata and stations within the Area weighted by strata size. |
| CPUE_var | CPUE variance, derived from the RPN coefficient of variation (CV; i.e. var(CPUE) = (CPUE*CV(RPN))^2). |
| RPN | Sum of RPN's (relative population numbers) of all strata in the Area. A null value means there were no fish caught. |
| RPN_var | RPN variance, assuming stratified random sampling design. |
| RPW | Sum of RPW's (relative population weights) of all strata in the Area. A null value means that either there were no fish caught (CPUE = 0) or lengths are not taken for this species. |
| RPW_var | RPW variance, derived from the RPN coefficient of variation (CV; i.e. var(RPW) = (RPW*CV(RPN))^2). |
| LastModifiedDate | Date when data was populated |

## 9) RPN by NPFMC Council Sablefish Management Areas

View Name: **(1) CouncilSablefishArea_3to7_depred; (2) CouncilSablefishArea_AllStrata**

View Description: Table (1) includes RPNs and RPWs for only strata 3-7 (200 – 1,000 m), for sablefish only, and data is adjusted for sperm whale depredation; table (2) includes data from all strata (150 – 1,000 m) for all species.

Explanation:  This view contains RPN, CPUE, and RPW by NPFMC Council Sablefish Management Areas. Values for the Japanese surveys for sablefish are fixed from values published in Japanese survey reports. Extrapolations for the northwest and southwest Aleutian Islands are done for each species (for the U.S. only, from ratios of RPNs between eastern and western Aleutians from Japanese survey data from 1985-1994). The Aleutian Island NPFMC Sablefish Management Area includes data from both the western and eastern areas. In this table, values from United States surveys are reported from 1990-present only.

| | |
|---|---|
| year | Year of the survey. |
| survey | Country that conducted the survey, either "Japan" or "United States". |
| Council_sablefish_management_area_id | identifier |
| Council_sablefish_management_area | Fishery management plan subareas (6) - Bering Sea, Aleutian Islands, Western Gulf, Central Gulf, West Yakutat, East Yakutat/Southeast |
| species_code | RACE species code. |
| species | Species common name. |
| CPUE | Average CPUE (number fish/hachi) for all strata and stations within the Area weighted by strata size. |
| CPUE_var | CPUE variance, derived from the RPN coefficient of variation (CV; i.e. var(CPUE) = $(CPUE*CV(RPN))^2$). |
| RPN | Sum of RPN's (relative population numbers) of all strata in the Area. A null value means there were no fish caught. |
| RPN_var | RPN variance, assuming stratified random sampling design. |
| RPW | Sum of RPW's (relative population weights) of all strata in the Area. A null value means that either there were no fish caught (CPUE = 0) or lengths are not taken for this species. |
| RPW_var | RPW variance, derived from the RPN coefficient of variation (CV; i.e. var(RPW) = $(RPW*CV(RPN))^2$). |
| LastModifiedDate | Date when data was populated |

## 10) RPN by NPFMC FMP Areas

<u>View Name:</u> **FMP_AllStrata**

<u>View Description:</u> This table includes RPNs and RPWs for all strata (150 – 1,000 m) for all species.

<u>Explanation:</u>  This view contains RPN, CPUE, and RPW by NPFMC FMP Areas (BSAI or GOA). For all other species they are calculated. Extrapolations for the northwest and southwest Aleutian Islands are done for each species (for the U.S. only, from ratios of RPNs between eastern and western Aleutians from Japanese survey data from 1985-1994). The Aleutian Island NPFMC Sablefish Management Area includes data from both the western and eastern areas. In this table, values from United States surveys are reported from 1990-present only.

| | |
|---|---|
| year | Year of the survey. |
| survey | Country that conducted the survey, either "Japan" or "United States". |
| Council_sablefish_management_area_id | identifier |
| Council_sablefish_management_area | Fishery management plan subareas (6) - Bering Sea, Aleutian Islands, Western Gulf, Central Gulf, West Yakutat, East Yakutat/Southeast |
| species_code | RACE species code. |
| species | Species common name. |
| CPUE | Average CPUE (number fish/hachi) for all strata and stations within the Area weighted by strata size. |
| CPUE_var | CPUE variance, derived from the RPN coefficient of variation (CV; i.e. var(CPUE) = $(CPUE*CV(RPN))^2$). |
| RPN | Sum of RPN's (relative population numbers) of all strata in the Area. A null value means there were no fish caught. |
| RPN_var | RPN variance, assuming stratified random sampling design. |
| RPW | Sum of RPW's (relative population weights) of all strata in the Area. A null value means that either there were no fish caught (CPUE = 0) or lengths are not taken for this species. |
| RPW_var | RPW variance, derived from the RPN coefficient of variation (CV; i.e. var(RPW) = $(RPW*CV(RPN))^2$). |
| LastModifiedDate | Date when data was populated |

## 11) RPN – AK-wide (sablefish only)

<u>View Name:</u> **AK_wide_3to7_depred**

View Description: This table includes RPNs and RPWs for all strata (150 – 1,000 m) for all species.

Explanation:  This view contains RPN, CPUE, and RPW for all of Alaska for sablefish. Data is restricted to strata 3 – 7 (200 – 1,000 m) and is adjusted for sperm whale depredation. In this table, values from United States surveys are reported from 1990-present only.

| | |
|---|---|
| year | Year of the survey. |
| survey | Country that conducted the survey, either "Japan" or "United States". |
| species_code | RACE species code. |
| species | Species common name. |
| area_size_km | area of the geographic_area_name by stratum in km^2 |
| CPUE | Average CPUE (number fish/hachi) for all strata and stations within the Area weighted by strata size. |
| CPUE_var | CPUE variance, derived from the RPN coefficient of variation (CV; i.e. var(CPUE) = (CPUE*CV(RPN))^2). |
| RPN | Sum of RPN's (relative population numbers) of all strata in the Area. A null value means there were no fish caught. |
| RPN_var | RPN variance, assuming stratified random sampling design. |
| RPW | Sum of RPW's (relative population weights) of all strata in the Area. A null value means that either there were no fish caught (CPUE = 0) or lengths are not taken for this species. |
| RPW_var | RPW variance, derived from the RPN coefficient of variation (CV; i.e. var(RPW) = (RPW*CV(RPN))^2). |
| LastModifiedDate | Date when data was populated |

## 12) Lengths extrapolated to RPNs (Length Frequencies)

View Name: **(1)** LengthRPN_byArea_3to7; (2) LengthRPN_byArea_3to7_depred; (3) LengthRPN_byArea_AllStrata

View Description: This table extrapolates the length frequencies by species to relative population numbers (RPNs) and i.e., number of fish at each length in the "population" and to Relative Population weights (RPWs). Table (1) contains the RPNs and RPWs for all species by geographic area for only strata 3 – 7 (200 – 1,000 m); table (2) has only sablefish data for strata 3-7 and it is adjusted for the effects of sperm whale depredation; table (3) has the data for all species for all strata.

From 1988-1992 for giant grenadier, shortraker rockfish, rougheye rockfish, arrowtooth flounder, and shortspine thornyheard most lengths did not have a strata assigned so there are no RPWs.

| Year | Year of the survey. |
|---|---|
| cruise_number | Code used to differentiate cruises. The first four digits are the year. |
| Country | Country that conducted the survey. Can be either "Japan" or "United States". |
| vessel_number | Code use to differentiate vessels. Japanese vessels have 3 digits and start with a 5. United states survey vessels are 96 or 81. |
| vessel_name | Name of vessel, matches with code. |
| Cruise_Number | |
| area_code | Code specific to each geographic_area_name. |
| geographic_area_name | Smaller areas within the management areas dictated by depth and habitat (e.g., Kodiak, Bering I, Yakutat, Shumagin). |
| Council_sablefish_management_area | Bering Sea, Aleutian Islands, Western Gulf of Alaska, Central Gulf of Alaska, West Yakutat, and Southeast/Outside. |
| species_code | RACE species code. |
| common_name | Common name of species. |
| sex | 1 =male, 2 = female, 3 = unknown |
| length | Length of only species measured on survey in cm. |
| RPN | Sum of RPN's (relative population numbers) of all strata in the Area. A null value means there were no fish caught. |
| RPW | Sum of RPW's (relative population weights) of all strata in the Area. A null value means that either there were no fish caught (CPUE = 0) or lengths are not taken for this species. |
| LastModifiedDate | Date when data was populated |

## 13) Haul and hachi data

View Name: depths_summary_view
View Description: This table provides data related to each hachi, but does not include catch. The lat./long. locations are at the station level, not haul (i.e., the start location is at the start of the first haul and the end location is for the end of the second haul).

| Cruise_Number | Code used to differentiate cruises. The first four digits are the year. |
|---|---|
| Vessel_Number | Code used to differentiate vessels. Japanese vessels have 3 digits and start with a 5. United states survey vessels have 2 digits (either 96 or |

| | |
|---|---|
| | 81). |
| Vessel_name | Name of vessel, matches with code. |
| Year | Year of the survey. |
| Country | Country that conducted the survey. Can be either "Japan" or "United States". |
| Station_Number | The same station code is kept for the same location through time. Stations starting with >499 are experimental stations, not standard survey stations. |
| RPW flag | Code used to flag each station for calculations of relative population weights and numbers. |
| Active | Either currently sampled or no longer sampled. |
| Station_type_ID | Experimental or standard survey station. Experimental stations (station numbers >499) are not used for RPN or RPW calculations. |
| Council_sablefish_management_area | Bering Sea, Aleutian Islands, Western Gulf of Alaska, Central Gulf of Alaska, West Yakutat, and Southeast/Outside. |
| Geographic_area_name | Smaller areas within the management areas dictated by depth and habitat (e.g., Kodiak, Bering I, Yakutat, Shumagin). |
| Area_code | Code specific to each geographic_area_name. |
| Exploitable | Code used to flag each Geographic Area for calculations of relative population weights and numbers for RPN's summarized by Sablefish Council Management area. Most gullies are not included. |
| NMFS_area_code | NMFS management area codes (610, 620…) |
| Habitat_Type | Can be either deep cross-shelf gully, shallow cross-shelf gully, or continental slope. Gully stations are shallower and less steep. |
| haul | Haul # is consecutive for each year. Number start over each year. There are usually 2 hauls per station except gully stations, where there is 1. |
| haul_date | Date of the set. |
| Stratum | Depth stratum used to identify broad depth ranges. See definitions in the table above, or see the field called "Stratum Description". |
| Stratum2 | Depth stratum used to identify broad depth ranges. See definitions in the table above, or see the field called "Stratum Description". |
| StratumDescription | Depth range in m of each stratum (which is a code from 1-10) |
| StratumDescription2 | Depth range in m of each stratum (which is a code from 1-10 including 2a and 2b instead of 2) |
| mammal_sighting | Used to flag a station for sperm whale presence |

| | |
|---|---|
| | (with an "S") if at least 1 whale was near the vessel when gear was being hauled. This data is at the station level, not the hachi level. Data is not filtered out of RPN & RPW calculations for sperm whale presence or depredation. |
| depredation_flag | Value = "True" when there is evidence of sperm whale depredation. This data is at the station level, not the hachi level. |
| hachi | Another word for skate. Generally, the lowest number was set at the shallow end of the set and the largest number was set at the deeper end of the set. |
| Depth_time | Time hachi was hauled on-board |
| Depth | Depth taken at haul-back every 5$^{th}$ skate or at a depth stratum change. |
| intrpdep | Depths interpolated for each hachi. |
| surface_temperature | Temperature in Celsius at the sea surface taken at start of haul-back (available since 1984). |
| gear_temperature | Temperature in Celsius taken at depth (attached to gear; available since 1997). See "tdr_depth" for depth the temperature was taken at. |
| tdr_depth | Depth where temperature-depth recorder settled and the "gear temperature" was taken. |
| rpn_filter | Used to filter out skates for relative population number (RPN), relative population weight (RPW), and CPUE calculations. A "k" or "K" is used to code for killer whale depredation by each hachi. A "g" is used when the skate of gear was not fishing effectively. |
| start_latitude | Start latitude in decimal degrees, generally at the shallow end of the set. |
| start_hemi_ns | Hemisphere of the start position; can be n for north, or s for south. |
| start_longitude | Start longitude in decimal degrees, generally at the shallow end of the set. |
| start_hemi_ew | Hemisphere at the start position; can be e for east or w for west |
| end_latitude | End latitude in decimal degrees, generally at the deep end of the set. |
| end_hemi_ns | Hemisphere of the end position; can be n for north, or s for south. |
| end_longitude | End longitude in decimal degrees, generally at the deep end of the set. |
| end_hemi_ew | Hemisphere at the end position; can be e for east or w for west |
| set_start_time | Time when gear set begins. |

| set_end_time | Time when gear set is finished. |
|---|---|
| haul_start_time | Time when haul-back begins. |
| haul_end_time | Time when haul-back is finished. |
| soak time | Elapsed time (in minutes) between set_start_time and haul_end_time. |
| distance_fished | Distance in kilometers between the start and end locations. |
| starting_depth | Depth where first hachi is set (measured at haul back. |
| ending_depth | Depth where last hachi is set (measured at haul back) |
| surface_temperature | Temperature in Celsius at the sea surface taken at start of haul-back (available since 1984). |
| gear_temperature | Temperature in Celsius taken at depth (attached to gear; available since 1997). See "tdr_depth" for depth the temperature was taken at. |
| baited | Number of hooks retrieved with bait on them, but no catch, summed by hachi. |
| ineffective | The number of hooks retrieved that were snarled, bent or broken, missing, or hooks otherwise unable to fish effectively, summed by hachi. |

## 14) Haul data

View Name: Haul_view
View Description: This table provides data related to each haul. There are generally 2 hauls per station except at gully stations.

| Year | Year of the survey. |
|---|---|
| Vessel_Number | Code used to differentiate vessels. Japanese vessels have 3 digits and start with a 5. United states survey vessels have 2 digits (either 96 or 81). |
| Country | Country that conducted the survey. Can be either "Japan" or "United States". |
| Cruise_Number | Code used to differentiate cruises. The first four digits are the year. |
| Station_Number | The same station code is kept for the same location through time. Stations starting with >499 are experimental stations, not standard survey stations. |
| Active | Either currently sampled or no longer sampled. |
| RPW flag | Code used to flag each station for calculations of relative population weights and numbers. |
| Geographic_area_name | Smaller areas within the management areas dictated by depth and habitat (e.g., Kodiak, |

| | Bering I, Yakutat, Shumagin). |
|---|---|
| Habitat_Type | Can be either deep cross-shelf gully, shallow cross-shelf gully, or continental slope. Gully stations are shallower and less steep. |
| INPFC area | Same as Council sablefish management area except WY & EY are combined into one category. |
| Council_sablefish_management_area | Bering Sea, Aleutian Islands, Western Gulf of Alaska, Central Gulf of Alaska, West Yakutat, and Southeast/Outside. |
| Exploitable | Code used to flag each Geographic Area for calculations of relative population weights and numbers for RPN's summarized by Sablefish Council Management area. Most gullies are not included. |
| haul | Haul # is consecutive for each year. Number start over each year. There are usually 2 hauls per station except gully stations, where there is 1. |
| haul_date | Date of the set. |
| start_latitude | Start latitude in decimal degrees, generally at the shallow end of the set. |
| start_hemi_ns | Hemisphere of the start position; can be n for north, or s for south. |
| start_longitude | Start longitude in decimal degrees, generally at the shallow end of the set. |
| start_hemi_ew | Hemisphere at the start position; can be e for east or w for west. |
| end_latitude | End latitude in decimal degrees, generally at the deep end of the set. |
| end_hemi_ns | Hemisphere of the end position; can be n for north, or s for south. |
| end_longitude | End longitude in decimal degrees, generally at the deep end of the set. |
| end_hemi_ew | Hemisphere at the end position; can be e for east or w for west |
| set_start_time | Time when gear set begins. |
| set_end_time | Time when gear set is finished. |
| haul_start_time | Time when haul-back begins. |
| haul_end_time | Time when haul-back is finished. |
| soak time | Elapsed time (in minutes) between set_start_time and haul_end_time. |
| distance_fished | Distance in kilometers between the start and end locations. |
| starting_depth | Depth where first hachi is set (measured at haul back. |
| ending_depth | Depth where last hachi is set (measured at haul |

| | |
|---|---|
| | back). |
| surface_temperature | Temperature in Celsius at the sea surface taken at start of haul-back (available since 1984). |
| gear_temperature | Temperature in Celsius taken at depth (attached to gear; available since 1997). See "tdr_depth" for depth the temperature was taken at. |
| tdr_depth | Depth where temperature-depth recorder settled and the "gear temperature" was taken. |
| gear_type | |
| mammal_sighting | Used to flag a station for sperm whale presence (with an "S") if at least 1 whale was near the vessel when gear was being hauled. This data is at the station level, not the hachi level. Data is not filtered out of RPN & RPW calculations for sperm whale presence or depredation. |
| depredation_flag | Value = 1 when there is evidence of sperm whale depredation at the station level and not the hachi level. |

## 15) Stations

View Name: Stations_view
View Description: This view includes a list of all stations in the database, their standard locations, various management areas the stations are within, and other station-level data.

| | |
|---|---|
| Station_Number | The same station code is kept for the same location through time. Stations starting with >499 are experimental stations. |
| Description | Station description; experimental or standard (*NULL*). |
| Active | Either currently sampled or no longer sampled. |
| RPW flag | Code used to flag each station for calculations of relative population weights and numbers. |
| Station_Type_ID | Auto-generated ID for database relationships. |
| Longitude | Standard station location in decimal degrees. |
| Latitude | Standard station location in decimal degrees. |
| NMFS_area_code | NMFS management area codes (610, 620…) |
| Area_code | Auto-generated code specific to each geographic_area_name. |
| Geographic_area_name | Smaller areas within the management areas dictated by depth and habitat (e.g., Kodiak, Bering I, Yakutat, Shumagin). |
| Habitat_Type | Can be either deep cross-shelf gully, shallow |

| | cross-shelf gully, or continental slope. Gully stations are shallower and less steep. |
|---|---|
| INPFC area | Same as Council sablefish management area except WY & EY are combined into one category. |
| Council_management_area | Bering Sea, Aleutian Islands, Western Gulf of Alaska, Central Gulf of Alaska, Eastern Gulf of Alaska. |
| Council_sablefish_management_area | Bering Sea, Aleutian Islands, Western Gulf of Alaska, Central Gulf of Alaska, West Yakutat, and Southeast/Outside. |
| Region | Gulf of Alaska, Bering Sea, or Aleutian Islands |
| FMP_management_area | BSAI (Bering Sea and Aleutian Islands, or GOA (Gulf of Alaska) |

## 16) Areas

View Name: Area_View

| Station_Number | The same station code is kept for the same location through time. Stations starting with >499 are experimental stations. |
|---|---|
| Geographic_area_name | Smaller areas within the management areas dictated by depth and habitat (e.g., Kodiak, Bering I, Yakutat, Shumagin). |
| Council_sablefish_management_area | Bering Sea, Aleutian Islands, Western Gulf of Alaska, Central Gulf of Alaska, West Yakutat, and Southeast/Outside. |
| Habitat_type | Can be either deep cross-shelf gully, shallow cross-shelf gully, or continental slope. Gully stations are shallower and less steep. |
| Exploitable | Code used to flag each Geographic Area for calculations of relative population weights and numbers for RPN's summarized by Sablefish Council Management area. Most gullies are not included. |
| Longitude | Standard station location in decimal degrees. |
| Latitude | Standard station location in decimal degrees. |
| NMFS_area_code | NMFS management area codes (610, 620…) |
| Area_code | Auto-generated code specific to each geographic_area_name. |
| Active | Sampled in the United States time series |

## *Literature cited*

Echave, K., C. Rodgveller, and S. K. Shotwell. 2013. Calculation of the geographic sizes used to create population indices for the Alaska Fisheries Science Center longline survey. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-253, 93 p.

Hanselman, D. H., C. Lunsford, C. Rodgveller, and M. Peterson. 2016. Assessment of the sablefish stock in Alaska. *In* Stock assessment and fishery evaluation report for the groundfish resources of the GOA and BS/AI as projected for 2017. North Pacific Fishery Management Council, 605 W 4th Ave, Suite 306 Anchorage, AK 99501.

Hanselman, D. H., B. J. Pyper, and M. J. Peterson. 2018. Sperm whale depredation on longline surveys and implications for the assessment of Alaska sablefish. Fisheries Research 200: 75-83.

## Appendix A.

Table of which years each station was sampled by the United States survey.  Stations over 500 were experimental stations and were not regularly sampled. Aleutians and Bering Sea are sampled every other year. Over the years, some gully stations have been started or dropped.

| Station | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 2 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 4 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 6 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 7 | | | | | | | | | | | | | | 1 | | | | | | | | | |
| 8 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 10 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 12 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 13 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 15 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 17 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 18 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 20 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 22 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 32 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 33 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 34 | | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 35 | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 |
| 37 | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 |
| 38 | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 |
| 39 | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 |
| 40 | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 |
| 42 | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 |
| 53 | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 |

| Station | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 54 | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 |
| 55 | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 |
| 57 | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 |
| 58 | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 |
| 59 | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 |
| 60 | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 |
| 61 | | | | | | | | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 |
| 62 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 63 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 64 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 65 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 66 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 67 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 68 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 69 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 70 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 71 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 72 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 73 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 74 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 75 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 76 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 77 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 78 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 79 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 80 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 81 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 82 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Station | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 83 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 84 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 85 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 86 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 87 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 88 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 89 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 90 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 91 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 92 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 93 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 94 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 95 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 96 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 97 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 98 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 99 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 100 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 101 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 102 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 103 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 104 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 105 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 106 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 107 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 108 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 118 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | |

| Station | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 119 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | |
| 120 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 121 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 122 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 123 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 124 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 125 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 126 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 127 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 128 | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 129 | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 130 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 131 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 132 | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 133 | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 134 | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 135 | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 136 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 137 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 138 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 139 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 140 | | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | |
| 141 | | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | |
| 142 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 143 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 144 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 145 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Station | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 146 | | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | |
| 147 | | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | |
| 148 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 149 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 507 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| 508 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| 509 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| 510 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| 512 | | 1 | 1 | | 1 | | | | | | | | | | | | | | | | | | |
| 513 | | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 514 | | 1 | 1 | | | | | | | | | | | | | | | | | | | | |
| 515 | | 1 | 1 | | | | | | | | | | | | | | | | | | | | |
| 516 | | | 1 | | | | | | | | | | | | | | | | | | | | |
| 517 | | | 1 | | | | | | | | | | | | | | | | | | | | |
| 518 | | | | | 1 | | | | | | | | | | | | | | | | | | |
| 519 | | | | | 1 | | | | | | | | | | | | | | | | | | |
| 526 | | | | | | | | 1 | | | | | | | | | | | | | | | |
| 527 | | | | | | | | 1 | | | | | | | | | | | | | | | |
| 528 | | | | | | | | 1 | | | | | | | | | | | | | | | |
| 529 | | | | | | | | 1 | | | | | | | | | | | | | | | |
| 530 | | | | | | | | 1 | | | | | | | | | | | | | | | |
| 531 | | | | | | | | 1 | | | | | | | | | | | | | | | |
| 532 | | | | | | | | | 1 | | | | | | | | | | | | | | |
| 533 | | | | | | | | | 1 | | | | | | | | | | | | | | |
| 534 | | | | | | | | | 1 | | | | | | | | | | | | | | |
| 535 | | | | | | | | | 1 | | | | | | | | | | | | | | |
| 536 | | | | | | | | | 1 | | | | | | | | | | | | | | |
| 537 | | | | | | | | | 1 | | | | | | | | | | | | | | |

Table of years each station was sampled by the Japanese survey. Stations over 500 were experimental stations and were not regularly sampled.

| Station | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 4 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 6 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 8 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 9 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 10 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 11 |  |  |  | 1 |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 12 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 13 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 14 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 15 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 16 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 17 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 18 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 19 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 20 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 21 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 22 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 23 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 24 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 25 |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Station | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 |   |   |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 27 |   |   |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 28 | 1 |   |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 29 |   |   |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 30 |   |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |   | 1 | 1 | 1 |
| 31 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 32 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 33 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 34 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 35 | 1 | 1 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 |   | 1 | 1 | 1 | 1 | 1 |
| 36 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |   |   | 1 | 1 | 1 | 1 |
| 37 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 38 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 39 | 1 | 1 | 1 | 1 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 40 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 41 |   |   |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 42 |   | 1 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 43 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 44 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 45 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 46 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 47 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 48 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 49 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 50 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 51 |   |   |   | 1 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 52 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Station | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 53 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 54 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 55 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 56 |   |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 57 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 58 |   |   | 1 | 1 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 59 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 60 | 1 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 61 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 62 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 63 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 64 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 65 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 66 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 67 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 68 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 69 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 70 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 71 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 72 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 73 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 74 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 75 | 1 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 76 |   | 1 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 77 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 78 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 79 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Station | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 80 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 81 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 82 | 1 | 1 | 1 | 1 | 1 | 1 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 83 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 84 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 85 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 86 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 87 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 88 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 89 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 90 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 91 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 92 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 93 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 94 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 95 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 96 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 97 | 1 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 98 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 99 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 100 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 101 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 102 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 103 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |   | 1 | 1 | 1 | 1 | 1 | 1 |
| 104 |   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 105 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 106 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Station | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 107 | 1 |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 108 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 109 |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 | 1 | 1 | 1 |
| 110 |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 | 1 | 1 | 1 |
| 111 |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 | 1 | 1 | 1 |
| 112 |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 | 1 | 1 | 1 |
| 113 |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 | 1 | 1 | 1 |
| 114 |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 | 1 | 1 | 1 |
| 115 |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 | 1 | 1 | 1 |
| 116 |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 | 1 | 1 | 1 |
| 117 |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 | 1 | 1 | 1 |
| 500 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 501 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 502 |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 504 |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 505 |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 506 |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 511 |  |  |  |  |  |  |  |  |  |  | 1 |  |  |  |  |  |