## 1.2     GUAM FISHERY DESCRIPTIONS

### 1.2.1   Bottomfish Fishery

Bottomfishing on Guam is a combination of recreational, subsistence, and small-scale commercial fishing. It can be separated into two distinct fisheries separated by depth and species composition. The shallow water complex (< 500 ft.) comprises the largest portion of the total bottomfish harvest and effort, and primarily includes: reef-dwelling snappers of the genera *Lutjanus*, *Aphareus*, and *Aprion*; groupers of the genera *Epinephelus*, *Variola*, and *Cephalopholis*; jacks of the genera *Caranx* and *Carangoides*; Holocentrids (*Myripristis* spp. and *Sargocentron* spp.); emperors of the genera *Lethrinus* and *Gymnocranius*; and Dogtooth Tuna (*Gymnosarda unicolor*). The deep-water complex (>500 ft.) consists primarily of groupers of the genera *Hyporthodus* and *Cephalopholis*, jacks of the genera *Caranx* and *Seriola*, and snappers of the genera *Pristipomoides*, *Etelis*, and *Aphareus*. In recent years, deep water species have made up a significant portion of the total expanded bottomfishing catch.

Many people that participate in the bottomfish fishery are either subsistence or part-time commercial fishermen, operate boats less than 25 feet in length, and target primarily the shallow water bottomfish complex. It is not uncommon to intercept fishermen combining bottomfishing with other methods such as trolling, spearing, and jigging to maximize their catch. High demand has made it profitable to sell locally caught bottomfish, although overhead costs including fuel and gear may be significant factors for in determining a fisherman's selection of fishing method. The demand for local bottomfish, when combined with environmental pressures, however, may cause stress to local bottomfish stocks.

The majority of bottomfishing around Guam takes place on offshore banks, though practically no information exists on the condition of the reefs on offshore banks. On the basis of anecdotal information, most of the offshore banks are in good condition due to their isolation. According to Myers (1997), less than 20 percent of the total coral reef resources harvested in Guam are taken from the EEZ, primarily because the reefs are often associated with less accessible offshore banks. As such, finfish make up most of the catch in the EEZ. Most offshore banks are deep, remote, and subject to strong currents. Generally, these banks are only accessible during calm weather in the summer months (May to August/September). Galvez Bank is the closest and most accessible and, consequently, fished most frequently. In contrast, other banks (White Tuna and Santa Rose, Rota) are remote and generally are fished only during exceptional weather conditions (Green, 1997). Local fishermen report that up to ten commercial boats, with two to three people per boat, and some recreational boats, make use of the banks when the weather is good (Green, 1997).

At present, the banks are fished using two methods: bottomfishing by hook and line and jigging at night for bigeye scad (*Selar crumenophthalmus*; Myers, 1997). In recent years, the estimated annual catch in these fisheries has ranged from 14 to 22 metric tons of shallow bottomfish and 3 to 15 metric tons of bigeye scad (Green, 1997). The shallow water component accounted for nearly 68 percent (35,002 to 65,162 lbs.) of the aggregate bottomfish landings in fiscal years 1992–1994 (Myers, 1997). Catch composition of the shallow water bottomfish complex (and coral reef species) is dominated by lethrinids, with a single species (*Lethrinus rubrioperculatus*) alone accounting for 28 percent of the total catch. Other important components of the bottomfish catch include lutjanids, carangids, other lethrinids, and serranids. Holocentrids, mullids, labrids,

scombrids, and balistids are minor components of the shallow water bottomfish complex. It should be noted that at least two of these species (*Aprion virescens* and *Caranx lugubris*) are also found in deeper waters, and as a result comprise a portion of the catch of the deep-water fishery.

Species that are commonly taken in the shallow-bottom fishery of Guam are: *Aphareus furca*, *Aprion virescens, Lutjanus kasmira*, *L. fulvus*, *Carangoides orthogrammus*, *Caranx lugubris*, *C. melampygus*, *C. ignobilis*, *Selar crumenophthalmus*, *Cephalopholis argus*, *C. spiloparaea*, *C. urodeta*, *Epinephelus fasciatus*, *Gymnocranius* spp., *Lethrinus atkinsoni*, *L. erythracanthus*, *L. olivaceus*, *L. rubrioperculatus*, *L. xanthochilus*, *Gymnosarda unicolor*, *Sargocentron* spp., *Myripristis* spp., *Variola albimarginata*, and *V. louti*.

Species that are commonly taken in the deep-bottom fishery of Guam are: *Aphareus rutilans*, *Aprion virescens*, *Caranx lugubris*, *Seriola dumerilii*, *Cephalopholis igarashiensis*, *C. sonnerati*, *Hyporthodus octofasciatus*, *Etelis carbunculus*, *E. coruscans*, and *Pristipimoides* spp.

### 1.2.2   Ecosystem Component (formerly Coral Reef) Fishery

Shore-based fishing accounts for most of the fish and invertebrate harvest from coral reefs around Guam. The coral reef fishery harvests more than 100 species of fish, including members of the families Acanthuridae, Carangidae, Gerreidae, Holocentridae, Kyphosidae, Labridae, Lethrinidae, Lutjanidae, Mugilidae, Mullidae, Scaridae, and Siganidae (Hensley and Sherwood, 1993). There are several pulse fisheries for juvenile fish that can be major components of the coral reef fishery, but totals in these can vary year to year. These include juvenile rabbitfish (manahak and lesso'), juvenile jacks (i'e), and juvenile goatfish (ti'ao).

Species that are commonly taken in the coral reef fishery of Guam are: *Naso unicornis, N. lituratus*, *Acanthurus xanthopterus*, *A. lineatus*, *A. triostegus*, *Caranx melampygus*, *C. papuensis* (i'e), *Selar crumenophthalmus*, *Gerres acinaces*, *Myripristis* spp., *Sargocentron* spp., *Neoniphon* spp., *Kyphosus cinerascens*, *K. vaigiensis*, *Cheilinus undulatus*, *Cheilinus* spp., *Halichoeres* spp., *Lethrinus harak*, *L. obseletus*, *L. atkinsoni*, *Gnathodentex aurolineatus*, *Lutjanus fulvus*, *L. monostigma*, *L. bohar*, *L. argentimaculatus*, *Mulloidichthys flavolineatus*, *M. vanicolensis* (ti'ao), *Parupeneus multifasciatus*, *P. barberinus*, *P. cyclostomus*, *Ellechelon vaigiensis*, *Moolgarda engeli*, *M. seheli*, *Chlorurus spilurus*, *C. frontalis, Scarus psittacus*, *S. altipinnis*, *S. rubrioviolaceus*, *S. ghobban*, *S. schlegeli*, *Siganus spinus*, and *S. argenteus* (manahak, lesso).

Hook and line is the most common method of fishing for coral reef fish on Guam. In 2019, hook and line fishing accounted for around 62% of fishers and 67% of gear. Throw net (talaya) is the second most common method, accounting for about 16% of fishers and 15% of gear. Other methods include gill net, snorkel spearfishing, SCUBA spearfishing, surround net, drag net, hooks and gaffs, and gleaning.

Guam has continued to experience high levels of commercial activity targeting reef fish. This has primarily been performed by recent migrants from the Federated States of Micronesia. The fishers are generally hired by retail shops to fish six days per week; there have been as many as eight or nine of these stores open at a time. Gathering commercial sales data from these vendors has been difficult due to vendor anxiety surrounding the reason data is being collected and the lack of perceived benefit to the vendor for reporting sales. There have been several instances during data collection where the vendors were not able to comfortably communicate in English. Data collected from these vendors is of limited value, as fish are not identified to species level,

and are frequently labeled simply as "reef fish". In 2019, there were six vendors reporting sales. In order to improve this situation, the Council, DAWR, and PIFSC partnered to increase vendor participation in the data collection program through the Territory Science Initiative. Extensive training, follow-ups, education, and outreach efforts were conducted to vendors and fishermen to increase participation in data collection.

In 2018, the Council drafted an Amendment 4 to the Mariana Archipelago FEP that reclassified a large number MUS as Ecosystem Component Species (ECS; WPRFMC, 2018). The final rule was posted in the Federal Register in early 2019 (84 FR 2767). This amendment reduces the number of MUS from 227 species/families to 13 in the Mariana Archipelago FEP. All former CREMUS and CMUS were reclassified as ECS that do not require ACL specifications or accountability measures but are still to be monitored regularly to prioritize conservation and management efforts and to improve efficiency of fishery management in the region. All existing management measures, including reporting and record keeping, prohibitions, and experimental fishing regulations apply to the associated ECS. If an ECS stock becomes a target of a Federal fishery in the future, NMFS and the Council may consider including that stock as a MUS to actively manage that stock. These species are still regularly monitored via other means (see Sections 1.2.6.3 and 2.1.3).

### 1.2.3   Fishery Data Collection System

Guam currently has three fishery-dependent collection programs which can be described as long-term data collection programs with different approaches for gathering important information on fishery harvest methods performed by fishermen. The three programs are the offshore data program and the commercial fishery program. The Sportfish Restoration Grant from the U.S. Fish and Wildlife Service (USFWS) provides the significant portion of the funding for these programs. Training of the fishery staff to collect information is rigorous, and year-end totals are calculated by an expansion process done with in collaboration with NOAA PIFSC. Identification of fish to the species level is the goal of Guam's fishery staff.

The boat-based creel survey is a long-term program that collects participation, effort, and catch data from fishermen. Collaboration with PIFSC has resulted in a reproducible computer database program that can analyze the data to produce various types of trends that describe status of both charter and non-charter fisheries in federal and local waters. The commercial receipt book program is an important source of information for fish that enter the commercial market; however, obtaining information from dealers has been sporadic, occasionally with less than three dealers providing data. In order to improve this situation, the Council, DAWR, and PIFSC partnered to increase vendor participation in the data collection program through the Territory Science Initiative (TSI).

Oram et al. (2011) and Jasper et al. (2016) describe the fishery data collection process for the offshore program on Guam. In general, DAWR staff collect fishery information through a series of random-stratified surveys for participation (i.e. accounting for fishing effort) and catch interviews (i.e. accounting for catch composition, size frequency, and catch-per-unit effort, CPUE). These data are transcribed into the WPacFIN database, and the annual catch estimates are expanded from the effort and CPUE information. Monthly commercial vendor reports are tallied at the end of the year and adjusted based on the coverage estimates provided by the vendor and/or the data collection program staff.

### 1.2.4  Meta-Data Dashboard Statistics

The meta-data dashboard statistics describe the amount of data used or available to calculate the fishery-dependent information. Creel surveys are sampling-based systems that require random-stratified design applied to pre-scheduled surveys. The number of sampling days, participation runs, and catch interviews would determine if there are enough samples to run the expansion algorithm. The trends of these parameters over time may infer survey performance. Monitoring the survey performance is critical for explaining the reliability of the expanded information.

Commercial receipt book information depends on the number of invoices submitted and the number of vendors participating in the program. Variations in these meta-data affect the commercial landing and revenue estimates.

### 1.2.4.1  Creel Survey Meta-Data Statistics

Calculation: Boat-based data

# Sample days: Count of the total number of unique dates found in the boat log data sampling date data.

# Catch Interviews: Count of the total number of data records found in the interview header data (number of interview headers). This is divided into two categories, interviews conducted during scheduled survey days (Regular) and opportunistic interviews (Opportunistic), which are collected on non-scheduled days.

**Table 1. Summary of Guam boat-based creel survey meta-data from 1982-2019**

| Year | # Sample Days | # Catch Interviews | |
|------|---------------|---------|---------------|
| | | **Regular** | **Opportunistic** |
| 1982 | 46 | 469 | 8 |
| 1983 | 47 | 431 | 34 |
| 1984 | 53 | 531 | 0 |
| 1985 | 66 | 812 | 0 |
| 1986 | 49 | 522 | 0 |
| 1987 | 48 | 612 | 0 |
| 1988 | 48 | 949 | 0 |
| 1989 | 48 | 931 | 2 |
| 1990 | 48 | 1,028 | 0 |
| 1991 | 48 | 1,019 | 1 |
| 1992 | 48 | 1,110 | 0 |
| 1993 | 52 | 1,119 | 0 |
| 1994 | 55 | 1,168 | 0 |
| 1995 | 96 | 1,613 | 4 |
| 1996 | 96 | 1,608 | 0 |
| 1997 | 96 | 1,358 | 0 |
| 1998 | 96 | 1,581 | 0 |
| 1999 | 96 | 1,367 | 3 |
| 2000 | 96 | 1,246 | 1 |

| Year | # Sample Days | # Catch Interviews | |
| | | Regular | Opportunistic |
|---|---|---|---|
| 2001 | 96 | 908 | 6 |
| 2002 | 84 | 610 | 1 |
| 2003 | 78 | 446 | 0 |
| 2004 | 95 | 530 | 1 |
| 2005 | 97 | 552 | 0 |
| 2006 | 96 | 556 | 0 |
| 2007 | 96 | 500 | 0 |
| 2008 | 96 | 571 | 2 |
| 2009 | 96 | 803 | 0 |
| 2010 | 96 | 902 | 0 |
| 2011 | 96 | 645 | 0 |
| 2012 | 74 | 371 | 0 |
| 2013 | 96 | 561 | 1 |
| 2014 | 90 | 635 | 9 |
| 2015 | 97 | 651 | 13 |
| 2016 | 93 | 900 | 2 |
| 2017 | 92 | 820 | 10 |
| 2018 | 89 | 795 | 11 |
| 2019 | 93 | 786 | 3 |
| **10-year avg.** | **92** | **707** | **5** |
| **10-year SD** | **6** | **158** | **5** |
| **20-year avg.** | **92** | **689** | **3** |
| **20-year SD** | **6** | **200** | **4** |

### 1.2.4.2 Commercial receipt book statistics

Calculations:

# Vendors: Count of the number of unique buyer codes found in the commercial purchase header data from the Commercial Receipt Book.

# Invoices: Count of the number of unique invoice numbers found in the commercial header data from the Commercial Receipt Book.

**Table 2. Summary of Guam commercial receipt book meta-data from 1982-2019**

| Year | # Vendors | # Total Invoices Collected | # BMUS Vendors | # BMUS Invoices Collected |
|---|---|---|---|---|
| 1982 | * | * | * | * |
| 1983 | 3 | 2,312 | * | * |
| 1984 | 3 | 2,587 | 3 | 48 |
| 1985 | * | * | * | * |
| 1986 | * | * | * | * |

| Year | # Vendors | # Total Invoices Collected | # BMUS Vendors | # BMUS Invoices Collected |
|------|-----------|----------------------------|----------------|----------------------------|
| 1987 | * | * | * | * |
| 1988 | * | * | * | * |
| 1989 | * | * | * | * |
| 1990 | 4 | 2,803 | 3 | 72 |
| 1991 | 3 | 2,512 | * | * |
| 1992 | 3 | 2,737 | * | * |
| 1993 | 3 | 2,664 | * | * |
| 1994 | * | * | * | * |
| 1995 | 3 | 1,565 | * | * |
| 1996 | 6 | 1,965 | 3 | 27 |
| 1997 | 7 | 2,923 | 4 | 41 |
| 1998 | 4 | 3,591 | 3 | 69 |
| 1999 | 5 | 3,410 | 3 | 177 |
| 2000 | 3 | 3,868 | 3 | 174 |
| 2001 | 3 | 4,155 | 3 | 286 |
| 2002 | 3 | 3,494 | * | * |
| 2003 | * | * | * | * |
| 2004 | 3 | 3,104 | * | * |
| 2005 | 3 | 2,649 | * | * |
| 2006 | 4 | 2,589 | * | * |
| 2007 | * | * | * | * |
| 2008 | * | * | * | * |
| 2009 | * | * | * | * |
| 2010 | * | * | * | * |
| 2011 | * | * | * | * |
| 2012 | * | * | * | * |
| 2013 | * | * | * | * |
| 2014 | 8 | 1,355 | * | * |
| 2015 | 9 | 1,361 | * | * |
| 2016 | 8 | 1,661 | * | * |
| 2017 | 11 | 1,996 | 4 | 104 |
| 2018 | 10 | 1,748 | 4 | 56 |
| 2019 | 6 | 1,176 | * | * |
| **10-year avg.** | **6** | **1,548** | * | * |
| **10-year SD** | **4** | **296** | * | * |
| **20-year avg.** | **4** | **2,188** | * | * |
| **20-year SD** | **3** | **876** | * | * |

* Confidential (less than three vendors)

### 1.2.5   Fishery Summary Dashboard Statistics

The Fishery Summary Dashboard Statics section consolidates all fishery-dependent information comparing the most recent year with short-term (recent 10-year) and long-term (recent 20-year) average (shown bolded in [brackets]). Trend analysis of the past 10 years will dictate the trends (increasing, decreasing, or no trend). The right-most symbol indicates whether the mean of the short-term and long-term years were above, below, or within one standard deviation of the mean of the full time series.

Legend Key:

⬈ - *increasing trend in the time series*          ➕ - *above 1 standard deviation*

⬊ - *decreasing trend in the time series*          ➖ - *below 1 standard deviation*

⬌ - *no trend in the time series*          ⬤ - *within 1 standard deviation*

10,000 [**1,000**] – *point estimate of fishery statistic* [***difference from short/long term average***]

**Table 3. Annual indicators for Guam bottomfish fisheries describing performance comparing 2019 estimates with short- (10-year) and long-term (20-year) averages**

| Fishery | Fishery statistics | Short-term (10 years) | Long-term (20 years) |
|---|---|---|---|
| **Bottomfish** | **Total estimated catch (lbs.)** | | |
| All gears (BMUS only) | All BMUS from creel survey data | **37,701[▲46%]** ⬌ ➕ | **37,701[▲29%]** ⬊ ⬤ |
| | All BMUS from commercial purchase data | **No trends available due to confidentiality** | **No trends available due to confidentiality** |
| | **Catch-per-unit-effort (from boat-based creel surveys)** | | |
| Bottomfishing (BMUS only) | Bottomfishing lbs./trip | **19[▲12%]** ⬌ ⬤ | **19[no change]** ⬌ ⬤ |
| | Bottomfishing lbs./gr-h. | **0.0196[▼19%]** ⬊ ⬤ | **0.0196[▼14%]** ⬌ ⬤ |
| | **Fishing effort (from boat-based creel surveys)** | | |
| Bottomfishing (BMUS only) | Estimated total bottomfishing trips | **76[▲36%]** ⬌ ➕ | **76[▲21%]** ⬊ ⬤ |
| | Estimated total bottomfishing gear hours | **75,276[▲28%]** ⬈ ⬤ | **75,276[▲19%]** ⬊ ⬤ |
| | **Fishing participants (from boat-based creel surveys)** | | |
| Bottomfishing (BMUS only) | Estimated number of bottomfishing vessels | **52[▲27%]** ⬌ ➕ | **52[▲13%]** ⬊ ⬤ |
| | Estimated average number of fishermen per bottomfishing trip | **3[no change]** ⬌ ⬤ | **3[no change]** ⬌ ⬤ |
| | **Bycatch** | | |
| | # fish caught | **865[▲47%]** ⬌ ➕ | **865[▲30%]** ⬊ ⬤ |
| | # fish kept | **862 [▲46%]** ⬌ ➕ | **862[▲30%]** ⬊ ⬤ |

| | # fish released | 3[▲200%] | 3[▼40%] |
|---|---|---|---|

**Table 21. Annual indicators for Guam ECS fisheries describing performance comparing 2019 estimates with short- (10-year) and long-term (20-year) averages**

| Fishery | Fishery statistics | Short-term (10 years) | Long-term (20 years) |
|---|---|---|---|
| **ECS** | **Total estimated catch (lbs.)** | | |
| Prioritized ECS | *Naso unicornis* from creel survey data | 2,500[▼11%] | 2,500[▼68%] |
| | *Siganus spinus* from creel survey data | 278[▲62%] | 278[▼19%] |
| | *Siganus spinus* from commercial purchase data | 614 [▼72%] | 614[▼50%] |
| | *Lethrinus harak* from creel survey data | 3,017[▼28%] | 3,017[▼25%] |
| | *Chlorurus frontalis* from creel survey data | 251[▼42%] | 251[▼56%] |
| | *Epinephelus fasciatus* from creel survey data | 1,704[▲7%] | 1,704[▼31%] |
| | *Caranx melampygus* from creel survey data | 1,920[▼31%] | 1,920[▼45%] |
| | *Lethrinus olivaceus* from creel survey data | 1,929[▲89%] | 1,929[▲3%] |
| | *Lutjanus fulvus* from creel survey data | 907[▲59%] | 907[▲76%] |
| | *Scarus rubroviolaceus* from creel survey data | 0[▼100%] | 0[▼100%] |

## 1.2.6   Catch statistics

The following section summarizes the catch statistics for bottomfish, the top ten landed species, and nine prioritized species in Guam as decided by DAWR. Estimates of catch are summarized from the creel survey and commercial receipt book data collection programs. Catch statistics provide estimates of annual harvest from the different fisheries. Estimates of fishery removals can provide proxies for the level of fishing mortality and a reference level relative to established quotas. This section also provides detailed levels of catch for fishing methods and the top species complexes harvested in the ECS and bottomfish fisheries.

### 1.2.6.1   Catch by Data Stream

This section describes the estimated total catch from the boat-based creel survey programs as well as the commercial landings from the commercial receipt book system. The difference between the creel total and the commercial landings is assumed to be the non-commercial component. However, there are cases where the commercial landing may be higher than the estimated creel total of the commercial receipt book program. In this case, the commercial receipt books can capture fishery data better than the creel surveys.

Calculations: Estimated landings are based on a pre-determined list of species (Appendix A) identified as BMUS regardless of the gear used, for each type of data collection (boat-based creel and the commercial purchase reports).

**Table 22. Summary of Guam BMUS total catch (lbs.) from expanded boat-based creel surveys and the commercial purchase system for all gear types from 1982-2019**

| Year | Boat-Based Creel Survey Estimates | Commercial Landings |
|------|------|------|
| 1982 | 20,677 | * |
| 1983 | 36,150 | * |
| 1984 | 14,655 | 3,445 |
| 1985 | 38,960 | * |
| 1986 | 16,404 | * |
| 1987 | 24,279 | * |
| 1988 | 33,986 | * |
| 1989 | 44,799 | * |
| 1990 | 33,816 | 4,277 |
| 1991 | 31,546 | * |
| 1992 | 36,316 | * |
| 1993 | 39,073 | * |
| 1994 | 40,719 | * |
| 1995 | 27,194 | * |
| 1996 | 40,498 | 1,251 |
| 1997 | 21,255 | 1,957 |
| 1998 | 22,296 | 4,576 |
| 1999 | 40,773 | 20,940 |
| 2000 | 58,640 | 12,184 |
| 2001 | 43,696 | 10,554 |
| 2002 | 20,366 | * |
| 2003 | 29,506 | * |
| 2004 | 25,233 | * |
| 2005 | 29,087 | * |
| 2006 | 33,414 | * |
| 2007 | 22,576 | * |
| 2008 | 31,103 | * |
| 2009 | 35,029 | * |
| 2010 | 23,928 | * |
| 2011 | 52,230 | * |
| 2012 | 17,518 | * |
| 2013 | 27,277 | * |
| 2014 | 20,687 | * |
| 2015 | 10,782 | * |
| 2016 | 24,479 | * |

| Year | Boat-Based Creel Survey Estimates | Commercial Landings |
|---|---|---|
| 2017 | 14,653 | 4,002 |
| 2018 | 28,364 | 3,029 |
| 2019 | 37,701 | * |
| **10-year avg.** | **25,762** | * |
| **10-year SD** | **11,396** | * |
| **20-year avg.** | **29,313** | * |
| **20-year SD** | **11,590** | * |

*Confidential (less than three vendors)

### 1.2.6.2  Expanded Catch Estimates by Fishing Method

Catch information is provided for the top boat-based fishing methods that comprise a majority of the annual BMUS catch in CNMI.

Calculations: The creel survey catch time series are the sum of the estimated weight for selected gear in all strata for all species and all BMUS species.

**Table 23. Total catch time series estimates (lbs.) for all species and BMUS only using Guam expanded boat-based creel survey data for bottomfishing gears from 1982-2019**

| Year | Bottomfish | | Spearfishing (Snorkel) | | Spearfishing (SCUBA) | |
|---|---|---|---|---|---|---|
| | **All** | **BMUS** | **All** | **BMUS** | **All** | **BMUS** |
| 1982 | 41,329 | 20,677 | 420 | 0 | 0 | 0 |
| 1983 | 50,415 | 36,150 | 1,355 | 0 | 4,399 | 0 |
| 1984 | 57,412 | 14,525 | 14,108 | 87 | 5,460 | 43 |
| 1985 | 88,047 | 36,660 | 18,737 | 481 | 12,761 | 76 |
| 1986 | 34,515 | 14,904 | 12,545 | 10 | 5,145 | 92 |
| 1987 | 44,459 | 23,510 | 12,448 | 261 | 7,474 | 198 |
| 1988 | 67,038 | 32,204 | 24,712 | 1,717 | 10,649 | 50 |
| 1989 | 79,973 | 43,732 | 30,931 | 46 | 13,985 | 9 |
| 1990 | 61,401 | 32,827 | 28,871 | 0 | 22,273 | 393 |
| 1991 | 60,753 | 31,113 | 27,898 | 49 | 37,027 | 339 |
| 1992 | 78,174 | 33,303 | 35,162 | 179 | 25,226 | 1,938 |
| 1993 | 107,130 | 37,092 | 39,435 | 0 | 22,848 | 293 |
| 1994 | 105,283 | 40,310 | 37,554 | 0 | 27,244 | 247 |
| 1995 | 101,075 | 25,125 | 40,554 | 60 | 74,735 | 1,246 |
| 1996 | 129,708 | 38,618 | 67,446 | 255 | 91,810 | 698 |
| 1997 | 109,345 | 20,779 | 37,363 | 82 | 41,920 | 177 |
| 1998 | 99,601 | 21,618 | 56,442 | 272 | 68,198 | 314 |
| 1999 | 122,930 | 39,717 | 45,200 | 168 | 80,859 | 263 |
| 2000 | 115,837 | 56,095 | 42,403 | 282 | 116,072 | 1,052 |
| 2001 | 123,975 | 43,119 | 74,369 | 0 | 65,105 | 535 |

| Year | Bottomfish | | Spearfishing (Snorkel) | | Spearfishing (SCUBA) | |
|---|---|---|---|---|---|---|
| | All | BMUS | All | BMUS | All | BMUS |
| 2002 | 55,447 | 19,092 | 21,712 | 39 | 34,766 | 347 |
| 2003 | 82,224 | 29,057 | 22,649 | 0 | 40,093 | 77 |
| 2004 | 61,874 | 23,268 | 33,601 | 130 | 50,442 | 1,726 |
| 2005 | 62,651 | 27,838 | 15,036 | 256 | 27,934 | 896 |
| 2006 | 89,865 | 32,132 | 12,796 | 1,178 | 4,129 | 0 |
| 2007 | 57,750 | 20,363 | 18,516 | 357 | 11,316 | 1,835 |
| 2008 | 59,639 | 30,872 | 29,715 | 124 | 24,647 | 0 |
| 2009 | 89,997 | 34,369 | 22,669 | 305 | 28,947 | 0 |
| 2010 | 56,164 | 22,958 | 23,635 | 233 | 1,775 | 0 |
| 2011 | 88,694 | 50,576 | 26,483 | 0 | 67,431 | 26 |
| 2012 | 40,214 | 17,518 | 23,986 | 0 | 12,204 | 0 |
| 2013 | 42,602 | 14,425 | 20,816 | 0 | 2,771 | 0 |
| 2014 | 69,299 | 18,011 | 28,088 | 274 | 32,316 | 0 |
| 2015 | 29,395 | 10,253 | 22,371 | 0 | 30,654 | 0 |
| 2016 | 51,475 | 23,872 | 28,985 | 376 | 21,517 | 0 |
| 2017 | 46,715 | 14,096 | 17,045 | 88 | 9,854 | 0 |
| 2018 | 57,904 | 27,022 | 23,051 | 130 | 65,998 | 672 |
| 2019 | 64,030 | 36,968 | 18,361 | 25 | 6,690 | 0 |
| **10-year avg.** | **54,649** | **23,570** | **23,282** | **113** | **25,121** | **70** |
| **10-year SD** | **15,934** | **11,574** | **3,696** | **130** | **23110** | **201** |
| **20-year avg.** | **67,288** | **27,595** | **26,314** | **190** | **32,733** | **358** |
| **20-year SD** | **23,765** | **11,784** | **12,806** | **261** | **27,987** | **572** |

### 1.2.6.3   Top and Prioritized Species in Boat-Based Fishery Catch

Catch time series can act as indicators of fishery performance. Variations in the catch can be attributed to various factors, and there is no single explanatory variable for the observed trends. A one-year reflection of the top ten harvested species (by weight) is included to monitor which ECS are being caught the most annually. Additionally, Guam DAWR selected nine species that were reclassified as ECS that are still of priority to the Guam DAWR for regular monitoring, and complete catch time series of these species are included in the report as well.

Calculations: Catch tallied from the boat-based expanded species composition data combining gear types for all species excluding BMUS, prioritized ECS, and pelagic MUS species.

**Table 4a. Top ten landed species (lbs.) in Guam ECS fisheries in 2019 from expanded boat-based creel survey data**

| Common Name | Scientific Name | Catch (lbs.) |
|---|---|---|
| Assorted reef fish | Assorted reef fish | 10,385 |
| Bigeye scad (atulai) | *Selar crumenophthalmus* | 4,349 |
| Jobfish | *Aprion virescens* | 4,286 |
| Orangespine unicornfish | *Naso lituratus* | 3,911 |

| Orange-striped emperor | *Lethrinus obsoletus* | 2,831 |
| Honeycomb grouper | *Epinephelus merra* | 1,311 |
| Greater amberjack | *Seriola dumerili* | 1,212 |
| Yellow spotted jack | *Carangoides orthogrammus* | 968 |
| Parrotfish | *Scarus globiceps* | 917 |
| Bigeye trevally | *Caranx sexfasciatus* | 903 |

Calculations: Catch tallied from commercial receipt data combining gear types for all species excluding BMUS, prioritized ECS, and pelagic MUS species.

**Table 24b. Top ten landed species (lbs.) in Guam ECS fisheries in 2019 from estimated commercial landings data**

| Common Name | Scientific Name | Catch (lbs.) |
|---|---|---|
| Reef fish | Actinopterygii (class) | 19,808 |
| Bigeye scad (atulai) | *Selar crumenophthalmus* | 12,218 |
| Parrotfish | Scaridae (family) | 5,489 |
| Emperor (mafute) | Lethrinidae (family) | 3,169 |
| Invertebrates | Animalia (kingdom) | 1,632 |
| Octopus | *Octopus* spp. | 1,118 |
| Jacks | Carangidae (family) | 1,074 |
| Grouper | Serranidae (family) | 954 |
| Blueline surgeonfish | *Acanthurus lineatus* | 564 |
| Rabbitfish (menahac) | *Siganus spinus* | 503 |

Calculations: Catch tallied from boat-based expanded species composition data for species identified as priority ECS (Appendix A).

**Table 25a. Catch (lbs.) from boat-based expansion data for prioritized species in Guam ECS fisheries in from 1982-2019**

| Year | *Naso unicornis* | *Siganus spinus* | *Lethrinus harak* | *Chlorurus frontalis* | *Epinephelus fasciatus* | *Caranx melampygus* | *Lethrinus olivaceus* | *Lutjanus fulvus* | *Scarus rubroviolaceus* |
|------|------|------|------|------|------|------|------|------|------|
| 1982 | 0 | 0 | 0 | 0 | 335 | 490 | 43 | 8 | 0 |
| 1983 | 10 | 0 | 0 | 16 | 1,505 | 670 | 0 | 109 | 0 |
| 1984 | 383 | 0 | 0 | 0 | 669 | 96 | 174 | 0 | 0 |
| 1985 | 1,177 | 0 | 296 | 502 | 3,313 | 2,961 | 765 | 100 | 175 |
| 1986 | 305 | 0 | 33 | 572 | 610 | 512 | 458 | 95 | 288 |
| 1987 | 227 | 66 | 21 | 517 | 1,482 | 1,286 | 77 | 103 | 138 |
| 1988 | 1,219 | 84 | 127 | 2,409 | 3,967 | 869 | 214 | 192 | 1,906 |
| 1989 | 4,402 | 422 | 1,185 | 105 | 2,046 | 1,451 | 397 | 1,269 | 892 |
| 1990 | 4,648 | 670 | 2,628 | 2 | 1,348 | 2,861 | 3,757 | 202 | 628 |
| 1991 | 6,683 | 570 | 2,022 | 225 | 2,827 | 1,936 | 744 | 2,024 | 2,395 |
| 1992 | 15,510 | 418 | 1,544 | 3,157 | 2,126 | 735 | 1,484 | 1,018 | 1,594 |
| 1993 | 5,335 | 2,103 | 2,263 | 181 | 5,950 | 2,087 | 353 | 617 | 1,126 |
| 1994 | 6,089 | 426 | 3,098 | 832 | 2,342 | 2,606 | 5,470 | 3,108 | 809 |
| 1995 | 23,433 | 2,133 | 3,268 | 1,874 | 7,747 | 5,038 | 1,628 | 1,514 | 1,262 |
| 1996 | 40,676 | 935 | 6,523 | 1,221 | 6,017 | 8,961 | 2,700 | 1,853 | 983 |
| 1997 | 18,354 | 1,541 | 6,151 | 197 | 4,581 | 3,843 | 2,073 | 704 | 457 |
| 1998 | 26,540 | 1,464 | 3,293 | 2,478 | 8,678 | 2,913 | 586 | 749 | 708 |
| 1999 | 23,985 | 2,096 | 4,185 | 1,114 | 6,348 | 2,985 | 2,309 | 477 | 495 |
| 2000 | 34,700 | 646 | 4,188 | 78 | 3,607 | 4,846 | 4,081 | 920 | 1,941 |
| 2001 | 17,222 | 989 | 4,705 | 508 | 3,590 | 2,822 | 3,615 | 625 | 940 |
| 2002 | 12,329 | 1,012 | 3,675 | 158 | 2,030 | 4,179 | 11,890 | 172 | 49 |
| 2003 | 8,643 | 740 | 4,108 | 1,911 | 9,998 | 3,376 | 629 | 504 | 830 |
| 2004 | 18,734 | 24 | 5,669 | 30 | 3,608 | 5,622 | 2,700 | 238 | 0 |
| 2005 | 12,089 | 71 | 5,451 | 956 | 1,446 | 4,460 | 1,161 | 104 | 814 |
| 2006 | 1,283 | 192 | 1,960 | 268 | 2,766 | 6,357 | 257 | 297 | 159 |

| Year | *Naso unicornis* | *Siganus spinus* | *Lethrinus harak* | *Chlorurus frontalis* | *Epinephelus fasciatus* | *Caranx melampygus* | *Lethrinus olivaceus* | *Lutjanus fulvus* | *Scarus rubroviolaceus* |
|------|------|------|------|------|------|------|------|------|------|
| 2007 | 4,848 | 18 | 1,354 | 98 | 2,616 | 1,365 | 799 | 616 | 4,175 |
| 2008 | 10,882 | 1,341 | 1,023 | 1,915 | 1,894 | 5,349 | 179 | 424 | 375 |
| 2009 | 6,588 | 101 | 6,741 | 1,165 | 2,003 | 3,134 | 1,870 | 694 | 0 |
| 2010 | 4,291 | 0 | 4,164 | 847 | 2,061 | 1,751 | 1,454 | 495 | 178 |
| 2011 | 2,341 | 0 | 6,954 | 0 | 2,246 | 1,218 | 1,319 | 1,018 | 0 |
| 2012 | 93 | 15 | 4,781 | 431 | 1,073 | 1,000 | 414 | 791 | 0 |
| 2013 | 3,269 | 158 | 7,195 | 551 | 1,962 | 9,524 | 113 | 324 | 785 |
| 2014 | 5,950 | 344 | 8,231 | 115 | 1,590 | 5,394 | 2,729 | 773 | 0 |
| 2015 | 2,064 | 235 | 2,550 | 0 | 1,917 | 371 | 741 | 324 | 0 |
| 2016 | 2,226 | 614 | 2,132 | 332 | 1,114 | 3,669 | 375 | 144 | 453 |
| 2017 | 711 | 79 | 2,289 | 32 | 1,632 | 2,162 | 356 | 793 | 0 |
| 2018 | 4,578 | 0 | 503 | 1,752 | 672 | 855 | 756 | 134 | 30 |
| 2019 | 2,500 | 278 | 3,017 | 251 | 1,704 | 1,910 | 1,929 | 907 | 0 |
| **10-year avg.** | **2,802** | **172** | **4,182** | **431** | **1,597** | **2,785** | **1,019** | **570** | **145** |
| **10-year SD** | **1,776** | **201** | **2,557** | **538** | **500** | **2,797** | **831** | **325** | **268** |
| **20-year avg.** | **7,767** | **343** | **4,035** | **570** | **2,476** | **3,468** | **1,868** | **515** | **536** |
| **20-year SD** | **8,309** | **406** | **2,203** | **646** | **1,950** | **2,294** | **2,627** | **292** | **992** |

Calculations: Catch tallied from commercial purchase data for species identified as priority ECS (Appendix A). From the prioritized ECS list, *Siganus spinus* is included because there are no specific species codes for the other eight species in the Guam commercial coding system, which tends to aggregate data into larger groups such as taxonomic family.

**Table 25b. Catch (lbs.) from commercial purchase data for prioritized species in Guam ECS fisheries in from 1982-2019**

| Year | *Siganus spinus* |
|------|------------------|
| 1982 | 0 |
| 1983 | 26 |
| 1984 | 32 |
| 1985 | 116 |
| 1986 | 8 |
| 1987 | |
| 1988 | |
| 1989 | 0 |
| 1990 | 419 |
| 1991 | 11 |
| 1992 | 18 |
| 1993 | |
| 1994 | 0 |
| 1995 | 0 |
| 1996 | 131 |
| 1997 | 84 |
| 1998 | 1,895 |
| 1999 | 3,450 |
| 2000 | |
| 2001 | 15 |
| 2002 | 891 |
| 2003 | 170 |
| 2004 | 48 |
| 2005 | 0 |
| 2006 | 62 |
| 2007 | 81 |
| 2008 | 0 |
| 2009 | 0 |
| 2010 | 0 |
| 2011 | 77 |
| 2012 | 0 |
| 2013 | 145 |
| 2014 | 1,088 |

| Year | *Siganus spinus* |
|---|---|
| 2015 | 572 |
| 2016 | 2,377 |
| 2017 | 10,941 |
| 2018 | 6,262 |
| 2019 | 614 |
| **10-year avg.** | **2,208** |
| **10-year SD** | **3,617** |
| **20-year avg.** | **1,229** |
| **20-year SD** | **2,775** |

### 1.2.7   Catch-per-Unit-Effort (CPUE) Statistics

This section summarizes the estimates for CPUE in the boat-based fisheries both for all species and for BMUS only. The boat-based fisheries include the bottomfishing (handline gear), spearfishing (snorkel), and spearfishing (SCUBA). CPUE is reported as both pounds per gear hour and pounds per fishing trip in the boat-based fishery.

Calculations**:** CPUE is calculated from interview data by gear type using ∑catch /∑(number of gears used*number of hours fished) or ∑catch /∑trips for boat-based data. If the value is blank (i.e., zero), then there was no interview collected for that method. Landings from interviews without fishing hours or number of gears are excluded from the calculations.

All - lbs./trip: All catch and trips are tallied from landings by gear level, including non-BMUS species.

All - lbs./gr-hr.: All catch and trips are tallied from trips with data on the number of gears used and numbers of hours fished, including non-BMUS species.

BMUS - lbs./trip: Only BMUS catch and trips that landed BMUS species are tallied from landings by gear level.

BMUS - lbs./gr-hr.: Only BMUS catch and trips that landed BMUS are tallied from trips with data on the number of gears used and numbers of hours fished.

**Table 26. CPUE (lbs./gear hour and lbs./trip) for bottomfishing gears in the Guam boat-based fishery for all species and BMUS only from 1982-2019**

| Year | Bottomfish | | | | Spearfish (Snorkel) | | | | Spearfish (SCUBA) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All | | BMUS | | All | | BMUS | | All | | BMUS | |
| | lbs/trip | lbs/gr-hr | lbs/trip | lbs/gr-hr | lbs/trip | lbs/gr-hr | lbs/trip | lbs/gr-hr | lbs/trip | lbs/gr-hr | lbs/trip | lbs/gr-hr |
| 1982 | 27 | 0.0317 | 17 | 0.0244 | 7 | 0.5538 | 0 | 0 | 0 | 0.0000 | 0 | 0 |
| 1983 | 23 | 0.0338 | 20 | 0.0351 | 7 | 0.2797 | 0 | 0 | 18 | 0.4421 | 0 | 0 |
| 1984 | 28 | 0.0265 | 17 | 0.0559 | 39 | 0.1264 | 8 | 0.6667 | 24 | 0.4524 | 1 | 0.3333 |
| 1985 | 27 | 0.0108 | 17 | 0.0104 | 48 | 0.2248 | 6 | 0.1287 | 25 | 0.1725 | 2 | 0.1563 |
| 1986 | 23 | 0.0242 | 24 | 0.0469 | 43 | 0.3189 | 1 | 0.2000 | 20 | 0.5362 | 3 | 0.5000 |
| 1987 | 23 | 0.0234 | 18 | 0.0254 | 28 | 0.2441 | 4 | 0.2500 | 30 | 0.5353 | 3 | 0.1778 |
| 1988 | 21 | 0.0123 | 13 | 0.0084 | 35 | 0.1804 | 34 | 3.7778 | 20 | 0.2578 | 2 | 0.4000 |
| 1989 | 20 | 0.0113 | 15 | 0.0119 | 26 | 0.1420 | 1 | 0.0714 | 31 | 0.2776 | 1 | 0.2500 |
| 1990 | 21 | 0.0131 | 16 | 0.0139 | 22 | 0.2174 | 0 | 0 | 46 | 0.6558 | 6 | 1.0000 |
| 1991 | 19 | 0.0144 | 16 | 0.0193 | 24 | 0.2401 | 1 | 0.0667 | 47 | 0.5976 | 5 | 0.1797 |
| 1992 | 17 | 0.0127 | 11 | 0.0112 | 24 | 0.1222 | 3 | 0.5000 | 24 | 0.1723 | 10 | 0.6667 |
| 1993 | 19 | 0.0116 | 18 | 0.0207 | 21 | 0.0909 | 0 | 0 | 58 | 0.6623 | 5 | 0.3167 |
| 1994 | 26 | 0.0127 | 21 | 0.0163 | 25 | 0.1028 | 0 | 0 | 55 | 0.4898 | 4 | 0.1607 |
| 1995 | 13 | 0.0031 | 11 | 0.0068 | 31 | 0.0707 | 3 | 0.2500 | 89 | 0.3054 | 10 | 0.1976 |
| 1996 | 18 | 0.0036 | 16 | 0.0125 | 33 | 0.0716 | 3 | 0.5000 | 76 | 0.2623 | 7 | 0.0924 |
| 1997 | 14 | 0.0033 | 11 | 0.0086 | 25 | 0.0773 | 10 | 2.0000 | 81 | 0.5877 | 4 | 0.3500 |
| 1998 | 14 | 0.0029 | 10 | 0.0062 | 21 | 0.0330 | 5 | 0.0795 | 98 | 0.3858 | 2 | 0.0432 |
| 1999 | 16 | 0.0036 | 17 | 0.0110 | 17 | 0.0432 | 7 | 3.5000 | 100 | 0.3562 | 2 | 0.0340 |
| 2000 | 18 | 0.0057 | 19 | 0.0127 | 21 | 0.0625 | 24 | 12.0000 | 90 | 0.3414 | 4 | 0.0559 |
| 2001 | 20 | 0.0080 | 15 | 0.0140 | 56 | 0.2057 | 21 | 1.3125 | 69 | 0.4117 | 4 | 0.1000 |
| 2002 | 17 | 0.0092 | 14 | 0.0168 | 21 | 0.1097 | 1 | 0.0833 | 58 | 0.6667 | 12 | 0.6389 |
| 2003 | 21 | 0.0148 | 16 | 0.0180 | 40 | 0.2458 | 0 | 0 | 108 | 1.0219 | 3 | 0.1020 |
| 2004 | 24 | 0.0162 | 20 | 0.0251 | 28 | 0.2048 | 2 | 0.0667 | 81 | 0.8506 | 11 | 0.3556 |
| 2005 | 27 | 0.0173 | 31 | 0.0317 | 20 | 0.1092 | 6 | 0.5238 | 61 | 0.8833 | 13 | 0.5200 |

| Year | Bottomfish | | | | Spearfish (Snorkel) | | | | Spearfish (SCUBA) | | | |
| | All | | BMUS | | All | | BMUS | | All | | BMUS | |
| | lbs/trip | lbs/gr-hr | lbs/trip | lbs/gr-hr | lbs/trip | lbs/gr-hr | lbs/trip | lbs/gr-hr | lbs/trip | lbs/gr-hr | lbs/trip | lbs/gr-hr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2006 | 31 | 0.0225 | 26 | 0.0264 | 24 | 0.1260 | 16 | 0.4923 | 13 | 0.5641 | 0 | 0 |
| 2007 | 30 | 0.0269 | 16 | 0.0224 | 31 | 0.2568 | 4 | 0.1778 | 100 | 4.0816 | 25 | 1.5625 |
| 2008 | 21 | 0.0168 | 17 | 0.0228 | 38 | 0.1170 | 2 | 0.0577 | 35 | 0.7301 | 0 | 0 |
| 2009 | 29 | 0.0147 | 25 | 0.0254 | 23 | 0.1039 | 2 | 0.0424 | 63 | 1.8900 | 0 | 0 |
| 2010 | 17 | 0.0075 | 13 | 0.0088 | 19 | 0.0954 | 1 | 0.0500 | 2 | 0.3333 | 0 | 0 |
| 2011 | 37 | 0.0273 | 29 | 0.0350 | 41 | 0.3378 | 0 | 0 | 140 | 2.8469 | 1 | 0.1667 |
| 2012 | 21 | 0.0363 | 18 | 0.0474 | 58 | 0.9226 | 0 | 0 | 70 | 3.2308 | 0 | 0 |
| 2013 | 19 | 0.0248 | 16 | 0.0375 | 28 | 0.1977 | 0 | 0 | 10 | 1.2500 | 0 | 0 |
| 2014 | 24 | 0.0153 | 13 | 0.0214 | 35 | 0.1461 | 4 | 0.5000 | 33 | 2.4750 | 0 | 0 |
| 2015 | 16 | 0.0177 | 15 | 0.0345 | 33 | 0.2023 | 0 | 0 | 58 | 0.5934 | 0 | 0 |
| 2016 | 21 | 0.0132 | 17 | 0.0183 | 27 | 0.1069 | 4 | 0.1458 | 68 | 0.2225 | 0 | 0 |
| 2017 | 19 | 0.0124 | 11 | 0.0109 | 16 | 0.0610 | 2 | 0.0750 | 43 | 1.2214 | 0 | 0 |
| 2018 | 26 | 0.0073 | 21 | 0.0088 | 41 | 0.2089 | 3 | 0.0556 | 97 | 0.4844 | 29 | 0.5867 |
| 2019 | 20 | 0.0132 | 19 | 0.0196 | 17 | 0.0760 | 1 | 0.1250 | 45 | 0.5094 | 0 | 0 |
| **10-yr avg** | **22** | **0.0175** | **17** | **0.0242** | **32** | **0.2355** | **3** | **0.1586** | **57** | **1.3167** | **15** | **0.3767** |
| **10-yr SD** | **6** | **0.0093** | **5** | **0.0136** | **12** | **0.2551** | **1** | **0.1716** | **39** | **1.1251** | **14** | **0.2970** |
| **20-yr avg.** | **23** | **0.0164** | **19** | **0.0229** | **31** | **0.1948** | **6** | **1.0472** | **62** | **1.2304** | **11** | **0.4543** |
| **20-yr SD** | **5** | **0.0079** | **5** | **0.0103** | **12** | **0.0000** | **7** | **3.0488** | **34** | **1.0000** | **9** | **0.4723** |

## 1.2.8   Effort Statistics

This section summarizes the effort trends in the Guam bottomfish fishery. Fishing effort trends provide insights on the level of fishing pressure through time. Effort information is provided for the top boat-based fishing methods that comprise most of the annual catch.

Calculations: Effort estimates (in both trips and gear hours) are calculated from boat-based interview data. Trips are tallied according the interview data in boat-based creel surveys. Gear hours are generated by summing the data on number of gears used*number of hours fished collected from interviews by gear type. For the boat-based estimates, data collection started in 1982.

All - Trips: All trips tallied by gear type.

All - Gear-hrs: Gear hours tallied by gear type.

BMUS - Trips: Trips that landed BMUS tallied by gear type.

BMUS - Gear-hrs: Gear hours tallied by gear type for trips landed BMUS with data on both number of gears used and numbers of hours fished.

**Table 27. Effort (trips and gear hours) for bottomfishing gears in the Guam boat-based fishery for all species and BMUS only from 1982-2019**

| Year | Bottomfish | | | | Spearfish (Snorkel) | | | | Spearfish (SCUBA) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All | | BMUS | | All | | BMUS | | All | | BMUS | |
| | Trips | Gr-hrs | Trips | Gr-hrs | Trips | Gr-hrs | Trips | Gr-hrs | Trips | Gr-hrs | Trips | Gr-hrs |
| 1982 | 97 | 81,620 | 74 | 51,824 | 5 | 65 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1983 | 89 | 59,512 | 66 | 37,639 | 6 | 143 | 0 | 0 | 13 | 527 | 0 | 0 |
| 1984 | 124 | 131,159 | 39 | 11,919 | 20 | 6,156 | 1 | 12 | 12 | 630 | 1 | 3 |
| 1985 | 217 | 532,350 | 139 | 233,261 | 19 | 4,092 | 4 | 171 | 36 | 5,304 | 3 | 32 |
| 1986 | 103 | 98,112 | 41 | 20,566 | 14 | 1,888 | 1 | 5 | 8 | 304 | 1 | 6 |
| 1987 | 114 | 113,442 | 72 | 50,856 | 20 | 2,257 | 3 | 44 | 11 | 624 | 3 | 45 |
| 1988 | 173 | 295,911 | 137 | 204,600 | 33 | 6,375 | 2 | 18 | 25 | 1,920 | 2 | 10 |
| 1989 | 187 | 331,525 | 127 | 165,025 | 24 | 4,416 | 3 | 42 | 24 | 2,655 | 1 | 4 |
| 1990 | 157 | 249,280 | 108 | 126,324 | 18 | 1,794 | 0 | 0 | 17 | 1,200 | 1 | 6 |
| 1991 | 152 | 197,964 | 92 | 77,700 | 20 | 2,016 | 2 | 30 | 27 | 2,142 | 5 | 128 |
| 1992 | 152 | 202,400 | 98 | 97,123 | 30 | 5,893 | 1 | 6 | 48 | 6,820 | 3 | 45 |
| 1993 | 164 | 270,758 | 81 | 68,629 | 38 | 8,961 | 0 | 0 | 29 | 2,520 | 4 | 60 |
| 1994 | 185 | 383,520 | 105 | 135,750 | 37 | 8,827 | 0 | 0 | 32 | 3,569 | 5 | 112 |
| 1995 | 302 | 1,258,615 | 127 | 200,970 | 56 | 24,497 | 1 | 12 | 56 | 16,268 | 8 | 420 |
| 1996 | 277 | 1,351,026 | 97 | 125,156 | 62 | 28,310 | 2 | 12 | 48 | 13,959 | 5 | 368 |
| 1997 | 238 | 1,017,597 | 75 | 98,800 | 41 | 13,144 | 1 | 5 | 27 | 3,713 | 2 | 20 |
| 1998 | 315 | 1,520,544 | 125 | 196,206 | 96 | 62,160 | 4 | 264 | 40 | 10,126 | 6 | 324 |
| 1999 | 285 | 1,230,288 | 112 | 169,641 | 51 | 20,574 | 1 | 2 | 43 | 12,060 | 9 | 588 |
| 2000 | 200 | 622,364 | 92 | 133,500 | 47 | 15,930 | 1 | 2 | 41 | 10,856 | 8 | 572 |
| 2001 | 197 | 483,060 | 95 | 104,810 | 22 | 5,940 | 1 | 16 | 29 | 4,860 | 4 | 150 |
| 2002 | 150 | 278,604 | 73 | 60,690 | 29 | 5,544 | 1 | 12 | 11 | 960 | 2 | 36 |
| 2003 | 107 | 148,160 | 55 | 47,724 | 22 | 3,596 | 0 | 0 | 13 | 1,369 | 2 | 49 |
| 2004 | 112 | 168,413 | 60 | 48,972 | 17 | 2,295 | 2 | 45 | 11 | 1,044 | 3 | 90 |
| 2005 | 121 | 190,400 | 69 | 66,696 | 24 | 4,368 | 2 | 21 | 7 | 480 | 1 | 25 |

| Year | Bottomfish | | | | Spearfish (Snorkel) | | | | Spearfish (SCUBA) | | | |
| | All | | BMUS | | All | | BMUS | | All | | BMUS | |
| | Trips | Gr-hrs | Trips | Gr-hrs | Trips | Gr-hrs | Trips | Gr-hrs | Trips | Gr-hrs | Trips | Gr-hrs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2006 | 104 | 145,509 | 61 | 60,830 | 19 | 3,618 | 2 | 65 | 5 | 117 | 0 | 0 |
| 2007 | 84 | 92,820 | 55 | 38,982 | 13 | 1,550 | 2 | 45 | 2 | 49 | 1 | 16 |
| 2008 | 104 | 127,710 | 57 | 43,429 | 26 | 8,393 | 3 | 104 | 6 | 289 | 0 | 0 |
| 2009 | 146 | 285,891 | 76 | 74,112 | 28 | 6,072 | 4 | 165 | 3 | 100 | 0 | 0 |
| 2010 | 165 | 370,360 | 96 | 137,728 | 27 | 5,250 | 4 | 80 | 1 | 6 | 0 | 0 |
| 2011 | 101 | 136,284 | 62 | 51,240 | 15 | 1,800 | 0 | 0 | 4 | 196 | 1 | 6 |
| 2012 | 53 | 30,084 | 32 | 12,080 | 8 | 504 | 0 | 0 | 3 | 65 | 0 | 0 |
| 2013 | 60 | 47,061 | 31 | 13,050 | 12 | 1,710 | 0 | 0 | 3 | 24 | 0 | 0 |
| 2014 | 92 | 141,024 | 46 | 25,668 | 17 | 3,360 | 1 | 8 | 3 | 40 | 0 | 0 |
| 2015 | 73 | 64,666 | 34 | 14,300 | 17 | 2,744 | 0 | 0 | 4 | 391 | 0 | 0 |
| 2016 | 106 | 170,159 | 62 | 58,401 | 25 | 6,210 | 2 | 48 | 22 | 6,732 | 0 | 0 |
| 2017 | 115 | 174,097 | 69 | 69,580 | 31 | 8,051 | 2 | 40 | 4 | 140 | 0 | 0 |
| 2018 | 99 | 349,272 | 54 | 128,590 | 19 | 3,762 | 2 | 90 | 16 | 3,200 | 3 | 150 |
| 2019 | 127 | 193,200 | 76 | 75,276 | 20 | 4,130 | 1 | 8 | 6 | 532 | 0 | 0 |
| **10-year avg.** | **99** | **167,621** | **56** | **58,591** | **19** | **3,752** | **1** | **27** | **7** | **1,133** | **0** | **16** |
| **10-year SD** | **31** | **109,792** | **20** | **43,473** | **7** | **2,159** | **1** | **33** | **6** | **2,079** | **1** | **45** |
| **20-year avg.** | **116** | **210,957** | **63** | **63,283** | **22** | **4,741** | **2** | **37** | **10** | **1,573** | **1** | **55** |
| **20-year SD** | **39** | **145,629** | **18** | **36,978** | **8** | **3,299** | **1** | **43** | **10** | **2,760** | **2** | **127** |

### 1.2.9   Participants

This section summarizes the estimated participation in each fishery. The information presented here can be used in the impact analysis of potential amendments in the FEPs associated with the bottomfish fisheries. The trend in participation can also be used as an indicator for fishing pressure.

Calculations: For boat-based data, the estimated number of unique vessels is calculated by tallying the number of vessels recorded in the interview data via vessel registration or name.

All: Total unique vessels by gear type.

BMUS: Unique vessels from trips that landed BMUS by gear type.

**Table 28a. Estimated number of unique vessels for bottomfishing gears in the Guam boat-based fishery for all species and BMUS only from 1982-2019**

| Year | Bottomfish | | Spearfish (Snorkel) | | Spearfish (SCUBA) | |
|---|---|---|---|---|---|---|
| | All | BMUS | All | BMUS | All | BMUS |
| 1982 | 58 | 47 | 4 | 0 | 1 | 0 |
| 1983 | 51 | 41 | 5 | 0 | 4 | 0 |
| 1984 | 75 | 33 | 13 | 1 | 6 | 1 |
| 1985 | 97 | 66 | 9 | 3 | 21 | 3 |
| 1986 | 62 | 27 | 12 | 1 | 7 | 1 |
| 1987 | 71 | 42 | 14 | 3 | 8 | 2 |
| 1988 | 92 | 76 | 22 | 2 | 14 | 1 |
| 1989 | 100 | 70 | 20 | 3 | 18 | 1 |
| 1990 | 87 | 58 | 17 | 0 | 9 | 1 |
| 1991 | 96 | 65 | 19 | 2 | 19 | 4 |
| 1992 | 88 | 62 | 23 | 1 | 29 | 3 |
| 1993 | 116 | 53 | 25 | 0 | 20 | 4 |
| 1994 | 122 | 71 | 32 | 0 | 22 | 4 |
| 1995 | 170 | 82 | 39 | 1 | 30 | 5 |
| 1996 | 148 | 68 | 44 | 2 | 28 | 3 |
| 1997 | 126 | 51 | 31 | 1 | 18 | 2 |
| 1998 | 153 | 72 | 54 | 4 | 20 | 4 |
| 1999 | 152 | 69 | 44 | 1 | 16 | 6 |
| 2000 | 107 | 61 | 35 | 1 | 21 | 5 |
| 2001 | 131 | 73 | 18 | 1 | 16 | 3 |
| 2002 | 104 | 58 | 24 | 1 | 9 | 2 |
| 2003 | 80 | 48 | 21 | 0 | 9 | 2 |
| 2004 | 83 | 47 | 16 | 2 | 5 | 2 |
| 2005 | 78 | 42 | 16 | 2 | 6 | 1 |
| 2006 | 72 | 45 | 18 | 2 | 4 | 0 |

| Year | Bottomfish | | Spearfish (Snorkel) | | Spearfish (SCUBA) | |
|---|---|---|---|---|---|---|
| | **All** | **BMUS** | **All** | **BMUS** | **All** | **BMUS** |
| 2007 | 58 | 41 | 11 | 2 | 2 | 1 |
| 2008 | 78 | 44 | 19 | 3 | 3 | 0 |
| 2009 | 98 | 49 | 25 | 4 | 3 | 0 |
| 2010 | 103 | 61 | 22 | 4 | 1 | 0 |
| 2011 | 72 | 44 | 14 | 0 | 3 | 1 |
| 2012 | 46 | 29 | 8 | 0 | 2 | 0 |
| 2013 | 48 | 28 | 12 | 0 | 3 | 0 |
| 2014 | 69 | 39 | 12 | 1 | 3 | 0 |
| 2015 | 60 | 26 | 15 | 0 | 2 | 0 |
| 2016 | 75 | 41 | 18 | 2 | 10 | 0 |
| 2017 | 85 | 54 | 26 | 2 | 2 | 0 |
| 2018 | 67 | 37 | 16 | 2 | 7 | 3 |
| 2019 | 84 | 52 | 13 | 1 | 3 | 0 |
| **10-year avg.** | **71** | **41** | **16** | **1** | **4** | **0** |
| **10-year SD** | **16** | **11** | **5** | **1** | **3** | **1** |
| **20-year avg.** | **80** | **46** | **18** | **2** | **6** | **1** |
| **20-year SD** | **20** | **12** | **6** | **1** | **5** | **1** |

Calculations: For boat-based data, the estimated number of fishermen per trip is calculated by filtering interviews that recorded the number of fishers, and then ∑catch /∑trips. A blank cell indicates insufficient data to generate an estimate of average fishers.

All: Average fishers from all trips by gear type.

BMUS: Average fishers from trips that landed BMUS by gear type.

**Table 28b. Estimated number of fishermen per trip for bottomfishing gears in the Guam boat-based fishery for all species and BMUS only from 1982-2019**

| Year | Bottomfish | | Spearfish (Snorkel) | | Spearfish (SCUBA) | |
|---|---|---|---|---|---|---|
| | **All** | **BMUS** | **All** | **BMUS** | **All** | **BMUS** |
| 1982 | 2 | 2 | 3 | | 1 | |
| 1983 | 2 | 2 | 2 | | 1 | |
| 1984 | 3 | 3 | 4 | 3 | 2 | 1 |
| 1985 | 3 | 3 | 4 | 3 | 2 | 1 |
| 1986 | 3 | 2 | 3 | 1 | 3 | 2 |
| 1987 | 2 | 2 | 2 | 1 | 2 | 2 |
| 1988 | 3 | 3 | 3 | 2 | 2 | 1 |
| 1989 | 3 | 3 | 3 | 2 | 3 | 3 |
| 1990 | 3 | 3 | 4 | | 3 | 4 |
| 1991 | 3 | 3 | 3 | 3 | 3 | 4 |
| 1992 | 3 | 3 | 4 | 1 | 3 | 3 |

| Year | Bottomfish | | Spearfish (Snorkel) | | Spearfish (SCUBA) | |
|---|---|---|---|---|---|---|
| | **All** | **BMUS** | **All** | **BMUS** | **All** | **BMUS** |
| 1993 | 3 | 3 | 3 | | 4 | 4 |
| 1994 | 3 | 3 | 3 | | 4 | 4 |
| 1995 | 4 | 3 | 3 | 2 | 4 | 5 |
| 1996 | 5 | 3 | 3 | 1 | 4 | 6 |
| 1997 | 6 | 4 | 3 | 5 | 4 | 4 |
| 1998 | 4 | 3 | 3 | 4 | 4 | 5 |
| 1999 | 4 | 3 | 3 | 2 | 4 | 4 |
| 2000 | 4 | 3 | 3 | 2 | 4 | 4 |
| 2001 | 3 | 2 | 3 | 2 | 4 | 5 |
| 2002 | 3 | 2 | 3 | 2 | 4 | 4 |
| 2003 | 3 | 3 | 4 | | 4 | 4 |
| 2004 | 4 | 3 | 3 | 6 | 4 | 4 |
| 2005 | 3 | 2 | 3 | 3 | 3 | 5 |
| 2006 | 3 | 2 | 3 | 3 | 3 | |
| 2007 | 4 | 3 | 3 | 2 | 4 | 4 |
| 2008 | 3 | 2 | 3 | 3 | 3 | |
| 2009 | 3 | 2 | 3 | 3 | 4 | |
| 2010 | 3 | 3 | 3 | 3 | 3 | |
| 2011 | 3 | 3 | 4 | | 4 | 3 |
| 2012 | 3 | 3 | 3 | | 5 | |
| 2013 | 3 | 3 | 4 | | 3 | |
| 2014 | 3 | 3 | 4 | 4 | 3 | |
| 2015 | 4 | 4 | 4 | | 7 | |
| 2016 | 3 | 3 | 3 | 2 | 5 | |
| 2017 | 2 | 2 | 3 | 3 | 5 | |
| 2018 | 4 | 3 | 4 | 4 | 5 | 3 |
| 2019 | 3 | 3 | 4 | 5 | 7 | |
| **10-year avg.** | **3** | **3** | **4** | **4** | **5** | **3** |
| **10-year SD** | **1** | **0** | **0** | **1** | **1** | **0** |
| **20-year avg.** | **3** | **3** | **3** | **3** | **4** | **4** |
| **20-year SD** | **1** | **1** | **0** | **1** | **1** | **1** |

## 1.2.10  Bycatch Estimates

This section focuses on MSA § 303(a)(11), which requires that all FMPs establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery, and include conservation and management measures that, to the extent practicable, minimize bycatch and bycatch mortality. The MSA § 303(a)(11) standardized reporting methodology is commonly referred to as a ''Standardized Bycatch Reporting Methodology'' (SBRM) and was added to the

MSA by the Sustainable Fisheries Act of 1996 (SFA). The Council implemented omnibus amendments to FMPs in 2003 to address MSA bycatch provisions and establish SBRMs.

The following are recent bycatch estimates for the boat-based bottomfish fishery (Table 28).

Calculations: The number caught is the sum of the total number of individuals found in the raw data including bycatch. The number kept is the total number of individuals in the raw data that are not marked as bycatch. The number released is bycatch caught minus the number of bycatch kept. Percent bycatch is the sum of all bycatch divided by the total catch.

**Table 29. Time series of bycatch estimates in the Guam bottomfish fishery from 1982-2019**

| Year | # Caught | Kept | Released | % Bycatch |
|------|----------|------|----------|-----------|
| 1982 | 1062 | 1062 | 0 | 0 |
| 1983 | 940 | 940 | 0 | 0 |
| 1984 | 590 | 590 | 0 | 0 |
| 1985 | 1830 | 1830 | 0 | 0 |
| 1986 | 546 | 546 | 0 | 0 |
| 1987 | 1313 | 1313 | 0 | 0 |
| 1988 | 1399 | 1399 | 0 | 0 |
| 1989 | 2028 | 2028 | 0 | 0 |
| 1990 | 1542 | 1542 | 0 | 0 |
| 1991 | 1366 | 1366 | 0 | 0 |
| 1992 | 1046 | 1046 | 0 | 0 |
| 1993 | 946 | 946 | 0 | 0 |
| 1994 | 1663 | 1663 | 0 | 0 |
| 1995 | 1449 | 1449 | 0 | 0 |
| 1996 | 1281 | 1281 | 0 | 0 |
| 1997 | 983 | 983 | 0 | 0 |
| 1998 | 993 | 993 | 0 | 0 |
| 1999 | 1081 | 1081 | 0 | 0 |
| 2000 | 1090 | 1084 | 6 | 0.0055 |
| 2001 | 1023 | 1007 | 16 | 0.0156 |
| 2002 | 629 | 627 | 2 | 0.0032 |
| 2003 | 497 | 477 | 20 | 0.0402 |
| 2004 | 586 | 586 | 0 | 0 |
| 2005 | 616 | 616 | 0 | 0 |
| 2006 | 1140 | 1113 | 27 | 0.0237 |
| 2007 | 417 | 410 | 7 | 0.0168 |
| 2008 | 572 | 569 | 3 | 0.0052 |
| 2009 | 860 | 860 | 0 | 0 |
| 2010 | 890 | 890 | 0 | 0 |
| 2011 | 707 | 707 | 0 | 0 |
| 2012 | 309 | 309 | 0 | 0 |

| Year | # Caught | Kept | Released | % Bycatch |
|------|----------|------|----------|-----------|
| 2013 | 293 | 293 | 0 | 0 |
| 2014 | 658 | 652 | 6 | 0.0091 |
| 2015 | 366 | 366 | 0 | 0 |
| 2016 | 641 | 639 | 2 | 0.0031 |
| 2017 | 766 | 766 | 0 | 0 |
| 2018 | 406 | 404 | 2 | 0.0049 |
| 2019 | 865 | 862 | 3 | 0.0035 |
| **10-year avg.** | **590** | **589** | **1** | **0.0021** |
| **10-year SD** | **216** | **216** | **2** | **0.0029** |
| **20-year avg.** | **667** | **662** | **5** | **0.0065** |
| **20-year SD** | **246** | **242** | **7** | **0.0101** |

### 1.2.11  Number of Federal Permit Holders

In Guam, the following Federal permits are required for fishing in the EEZ:

### 1.2.11.1 Guam Large Vessel Bottomfish Permit

The Code of Federal Regulations (CFR), Title 50, Part 665 requires the following Federal permits for Guam fisheries in the exclusive economic zone (EEZ) under the Mariana FEP:

### 1.2.11.2 Guam Large Vessel Bottomfish Permit

Regulations require this permit for any large vessel (50 feet or longer in overall length) fishing for, landing, or transshipping bottomfish MUS or bottomfish ecosystem component species (ECS) in the EEZ seaward of Guam.

### 1.2.11.3 Special Coral Reef Ecosystem Permit

Regulations require the coral reef ecosystem special permit for anyone fishing for coral reef ECS in a low-use marine protected area (MPA), fishing for species on the list of Potentially Harvested Coral Reef Taxa, or using fishing gear not specifically allowed in the regulations. NMFS will make an exception to this permit requirement for any person issued a permit to fish under any fishery ecosystem plan who incidentally catches Guam coral reef ECSS while fishing for bottomfish MUS, crustacean ECS, western Pacific pelagic MUS, precious coral, or seamount groundfish. Regulations require a transshipment permit for any receiving vessel used to land or transship potentially harvested coral reef taxa, or any coral reef ecosystem ECS caught in a low-use MPA.

### 1.2.11.4 Western Pacific Precious Corals Permit

Regulations require this permit for anyone harvesting or landing black, bamboo, pink, red, or gold corals in the EEZ in the Western Pacific.

### 1.2.11.5 Western Pacific Crustaceans Permit (Lobster or Deepwater Shrimp)

Regulations require a permit by the owner of a U.S. fishing vessel used to fish for lobster or deep-water shrimp in the EEZ around American Samoa, Guam, Commonwealth of the Northern Mariana Islands (CNMI), Hawaii, and the Pacific Remote Islands Areas (PRIA).

There is no record of special coral reef or precious coral fishery permits issued for the EEZ around Guam since 2007. Table 30 provides the number of permits issued for Guam fisheries between 2010 and 2019. Historical data are from the PIFSC, and 2018–2019 data are from the PIRO Sustainable Fisheries Division permits program.

**Table 30. Number of federal permits holders for the crustacean and bottomfish fisheries of Guam from 2010-2019**

| Guam Fisheries | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|
| Lobster | 0 | 0 | 0 | 0 | 0 | 0 | 1** | 0 | 1** | |
| Shrimp | 2* | 1* | 0 | 0 | 0 | 0 | 1 | 0 | 0 | |
| Bottomfish | 1 | 1 | 4 | 2 | 2 | 1 | 1 | 1 | 1 | |

*Permits apply to multiple areas and may include American Samoa, Guam, CNMI, and PRIA.
**Area 5 CNMI and Guam.