1.1 CNMI FISHERY DESCRIPTIONS

1.1.1 Background

The Commonwealth of the Northern Mariana Islands (CNMI) is a chain of islands in the Western Pacific Ocean. Along with the island of Guam, the chain is historically known as the Mariana Islands. The CNMI consists of 14 small islands situated in a north-south direction, stretching a distance of about 500 km. The surrounding waters of the CNMI play an integral role in the everyday lives of its citizens. The ocean is a major source of food and leisure activities for residents and tourists alike. Archeological research has also revealed evidence of fishing activities in the CNMI dating back 3,000 years. Although the composition of fishing activities in the Marianas has changed significantly since then, a common view of its importance remains.

Fisheries during the German occupation

During the German occupational period (1899-1914) a majority of the economic focus in the Northern Marianas was on the copra industry. Few commercial fisheries were noted during this period of time, as the German administration focused efforts on crop production and feral cattle trade (Russell, 1999). Chamorro and Carolinians utilized the protected lagoon and open waters with several fishing methods: talaya (cast net), chinchulu (surround net), gigao (fish weir), tokcha (spear), tupak (hook and line), and Carolinians additionally gleaned sea cucumbers for the Asian Markets. Most of these activities were for subsistence purposes, with the catch being distributed and bartered among relatives and acquaintances.

Fisheries during the Japanese occupation

Fisheries development prospered during the Japanese administration (1914-1945), becoming the nation's second largest industry. Small pelagic fishing operations were established and the Garapan port became the main area for drying fish. Large scale fishing activities occurred during the 1930s, shown as Saipan produced 11 percent of total tuna landed in Micronesia (Bowers, 2001). However, efforts to develop the tuna fishery shifted to Palau and Federated States of Micronesia (FSM) due to the availability of bait fish in the region. Subsistence fishing still persisted within the lagoon and fringing reefs, and was mainly conducted by the natives though a large extraction of sea cucumbers did occur. There were several main fishing methods used during this period: cast net, spear, gill net, surround net, hook and line, and gleaning. During this period, the topshell (*Trochus niloticus*) was also introduced into the Marianas.

Fisheries during the U.S. military occupation

The fishing industry was destroyed during World War 2, but quickly rebuilt afterwards with support from the U.S. military. Okinawans who operated the fishery prior to the war were hired to operate and train locals to fish commercially, targeting pelagic species. A company called Saipan Fishing Company operated during this time and contributed to the early re-development of post-war commercial fisheries in the CNMI (Bowers, 2001). Most of the fishing activities were for *Katsuwanus pelamis* (bonito) and other tuna species. However, other resources, such as big-eye scad, reef fish, and lobster, were also harvested during calm weather. The Chamorro and

Carolinians continued subsistence fishing in the lagoon after the war. Although limited quantities of monofilament nets were available during this period, they were used to capture lagoon fish and along the reef lines. The use of modern fishing gear such as masks, rubber fins, and flash lights made it much easier to harvest coral reef resources during this time.

Fisheries activities within the past two decades

The CNMI has had numerous changes in its fisheries over the past twenty years. In the mid-1990s, commercial fishing activities increased significantly. Commercial SCUBA fishing became a common method, not only to support local demand for reef fish, but to bolster exports to Guam as well. Large-scale commercial bottomfishing in the Northern Islands of the CNMI peaked starting in the mid-1990s through 2002, with landings being both sold locally and exported to Japan. Troll fishing continued to be dominant during this period. An exploratory, deepwater shrimp fishery also developed, but did not last due to internal company issues and gear losses. Around this time, a sea cucumber fishery also began on Rota before migrating to Saipan; ultimately, however, this fishery was found to be unstable and was subsequently halted.

Several fishing companies entered the fisheries only to close down a few years later. The CNMI reached its highest population during the last two decades, most of whom have been migrant workers from Asia. The tourism industry has also been increasing, which contributes to high demand for fresh fish. Subsistence fishing within the nearshore waters of Saipan, Tinian, and Rota has also increased.

In the 2000s, small-scale troll, bottom and reef fish fisheries persisted, with landings sold locally. Federal and state support was provided multiple times to further develop fisheries in the CNMI with intermittent success. An exploratory longline fishery was funded and operated in the CNMI in the mid-2000 for about two years, but eventually closed down due to low productivity of high-value, pelagic fish, among other issues within the business. A few larger (40-80') bottomfishing vessels were also operational during this period, with a majority of them fishing the northern islands and offshore banks. A few of these vessels were recipients of financial assistance to improve their fishing capacities.

Fisheries in the CNMI have generally been relatively small and fluid, with 16-20' boats fishing within 20 miles from Saipan. Many of these small vessels conduct multiple fishing activities during a single trip. For example, a company that is supported mainly by troll fishing may also conduct bottomfishing and spearfishing to supplement their income. Fishing businesses tend to enter and exit the fishery when it is economically beneficial to do so, as they are highly sensitive to changes in the economy, development, population, and regulations. Subsistence fishing continues; however, fishing methods and target species have shifted in step with population demographics and fishery restrictions. Nearshore hook and line, cast net, and spear fishing are common activities, but fishing methods such as gill net, surround net, drag net, and SCUBA-spear have been restricted or outright banned in the CNMI since the early 2000s.

1.1.1.1 Bottomfish Fishery

The bottomfish fishery has not changed much from its early years in certain aspects. Relatively small (<25 ft.) fishing vessels are still being used to access bottom fishing grounds around

Saipan and Tinian, while the larger (>25 ft.) vessels are used to access bottomfish resources in the Northern Islands. Only a handful of these larger bottom fishing vessels are operating within the CNMI. Most of the small bottomfishing vessels are owned by vendors; there are, however, a few subsistence bottomfishers that participate in the fishery intermittently. More recently, improved technologies, such as sophisticated electronics to locate fish and various types of reels replacing handlines, have entered the CNMI bottomfish fishery.

Two distinct types of bottomfish fisheries are identified in the CNMI: shallow-water bottom fishing, which targets fish at depths down to 150 m, and deepwater bottom fishing, which targets fish at depths greater than 150 m. Species targeted by the shallow-water fishery consist of the Redgill Emperor (*Lethrinus rubrioperculatus*), Black Jack (*Caranx lugubris*), Matai (*Epinephelus fasciatus*), Sas (*Lutjanus kasmira*), and Lunartail Grouper (*Variola louti*), among other fish residing at similar depths. Species targeted by the deepwater bottom fishing depths (>150m) include onaga (*Etelis corsucans*), ehu (*E. carbunculus*), yellowtail kalekale (*Pristipomiodes auricilla*), amberjack (*Seriola dumerili*), blueline gindai (*P. argyrogrammicus)*, gindai (*P. zonatus*), opakapaka (*P. filamentosus*), and eightbanded grouper (*Hyporthodus octofasciatus*), among other fish residing at similar depths.

Bottomfish Management Unit Species (BMUS) are not the only species caught in the shallow-bottom fishery. Deep-water bottomfishing requires more efficient fishing gears, such as hydraulic reels. Bottomfishing trips generally return during the day, but there is an unmeasured amount that occurs outside of survey hours from 2 AM to 10 AM. Fishing trips to the Northern Islands can take two to four days depending on vessel size and refrigeration capacity. These trips are most productive during calm weather months. Successful fishermen targeting deep-water bottomfish tend to fish for one to four years before leaving the fishery, whereas the majority of fishermen targeting shallow-water bottomfish tend to leave the fishery after the first year.

The overall participation of fishermen in the bottomfish fishery tends to occur on a relatively short-term basis (i.e., less than four years). The slight difference between shallow-water and deep-water fishermen likely reflects the greater skill and investment required to participate in the deepwater bottomfish fishery. In addition, deepwater bottomfishing tends to include larger ventures that are more buffered from the impulses of individual choice and are usually dependent on a skilled captain and fishermen. Overall, the long-term commitment to hard work, maintenance and repairs, and staff retention appear to be challenging for CNMI bottomfish fishermen to sustain their efforts for more than a few years. A full list of BMUS species is provided in Appendix A.

1.1.1.2 Coral Reef Fishery

Coral reef fisheries have been generally steady in recent years relative to previous decades. Small-scale nearshore fisheries in the CNMI continue to be important socially, culturally, recreationally, financially, and for subsistence. Most fishermen are subsistence fishers, with a number of them selling a portion of their catch to roadside vendors and some of these vendors employing the fishermen to maintain a constant supply of reef fish. Most of the fishing for coral reef species occurs within the Saipan lagoon and fringing reefs around the islands, targeting

mainly finfish and invertebrates. All reef fish catches are sold to local markets or used for personal consumption with a minimal portion exported for off-island residents. Shoreline access is the most common way to harvest coral reef resources. Vessels are generally used during calm weather to fish areas not as accessible other times of the year, with fishing trips to other islands being made when the weather is favorable. Fishing methods have not changed significantly compared to previous years; hook and line, cast netting, spear fishing, and gleaning are methods still being used today. Some of the common families found in the CNMI reef fish markets are Acanthuridae (surgeonfish), scaridae (parrotfish), mullidae (goatfish), serranidae (grouper), labridae (wrasse), holocentridae (soldier/squirrelfish), carangidae (jacks), scombridae (scad), haemulidae (sweetlips), gerridae (mojarra), kyphosidae (rudderfish), and mugilidae (mullet), as well as other non-finfish families.

1.1.2 Fishery Data Collection System

A majority of the information collected by the CNMI Division of Fish and Wildlife (DFW) is fishery dependent. Since the early-1980s, attempts were made to establish a data collection program for the nearshore fisheries but failed due to intergovernmental issues. Over recent decades, significant time and effort has been made to further develop nearshore fishery data collection. This effort has resulted in the re-establishment of the shore-based creel survey program by DFW in collaboration with other local and federal agencies.

1.1.2.1 Creel Surveys

Currently the CNMI maintains both a boat- and shore-based creel survey for the island of Saipan, with plans for expansion to the populated neighboring islands. The programs were established in 2000 and 2005, respectively, in order to strengthen the capacity of DFW in providing sufficient information to the public regarding local fisheries. Other programs, such as the invoicing system and importation monitoring, provide supplemental information on harvest and demand for the fishery.

Effective management of Saipan's marine fishery resources requires the collection of fishing effort, methods used, and harvest. The CNMI boat- and shore-based creel surveys are some of the major data collection systems used by DFW to estimate the total annual boat-based participation, effort, and harvest while surveying nearshore fishery resources. These surveys were formerly known as the “CNMI offshore creel survey” but are now referred to as “boat-based” because they cover all fishing done from a boat. This is an important distinction because where the fishing activity is initiated (i.e. boat vs. shore) determines how that type of activity will be accounted for in the survey systems. For instance, very small boats launched from non-standard launching areas (e.g. from the back of a pickup truck on a beach) are not included in the boat-based creel survey.

The objective of the boat-based creel survey program is to quantify fishing participation, effort, and catch done from on a vessel in CNMI’s waters. DFW had an early creel survey data collection program in 1984, and 1990 to 1994, however since the methods were not standardized, the data collected with that early program is not currently being used. The early program was

eventually terminated due to a lack of resources. On April 2, 2000, the DFW fishery staff reinitiated the boat-based creel survey program on the island's boat-based fishery following a three-year hiatus. The fishery survey collects data on the island's boating activities and interviews returning commercial and noncommercial fishermen at the three most active launching ramps/docks on the island: Smiling Cove, Sugar Dock, and Fishing Base. Essential fishery information is collected and processed from both commercial and noncommercial vessels to help better inform management decisions. The two types of data collection programs utilized by Saipan's boat-based creel survey program include: boat-based participation count to collect participation data, and a boat-based access point survey to collect catch and effort data (through survey maps, boat logs, and interviews) at the three major boat ramp areas listed above. The data collected are then expanded at a stratum level (quarterly vs. annually, charter vs. non-charter, weekday vs. weekend, etc.) to create estimated landings by gear type for CNMI's boat-based fishery. The shore-based survey currently covers the Western Lagoon of Saipan. Some pilot surveys are being conducted on Saipan's Eastern beaches such as Laolao Bay, Obyan Beach, and Ladder Beach. Other accessible areas are not covered at this time due to existing limited resource availability and logistical constraints. With the assistance of the WPacFIN program at PIFSC, data processing software and a database were developed to process these survey data.

In May 2005, DFW fishery staff reinitiated the creel survey program for the island's shore-based fishery following a hiatus of 11 years. The Western Lagoon starts from the northwest (Wing Beach) and extends to the southwest (Agingan Point) of Saipan, encompassing over twenty accessible and highly active shoreline access points. Saipan's shore-based creel survey is also a stratified randomized data collection program. This program collects two types of data to estimate catch and effort information in the shore-based fishery: participation count and interview. The participation count involves counting the number of people fishing on randomly selected days and their method of fishing along the shoreline. The interview involves dialoging with fishermen to determine catch, method used, length and weights of fish, species composition, catch disposition, and if any fish were not kept (i.e., bycatch). The data collected from this program have been used to expand and create annual estimated landings for the shore-based fishery in the CNMI.

In October 2018, the islands of Saipan and Tinian were directly hit by Super Typhoon Yutu. The damage inflicted by the typhoon delayed both creel surveys and collection of commercial receipt invoices. Shore-based surveys resumed by February 2019 but were limited to daylight hours due to the lack of lighting on southern Saipan and the heavy presence of debris at several sample sites. Night shore-based surveys and whole-day boat-based surveys resumed in March 2019. Vendors prioritized repairing typhoon-related damages to their businesses, and the number of invoices collected decreased as a result.

30 boat-based surveys were conducted between January 1, and June 30, 2019. 32 interviews were completed with an expanded catch of 591,875 lbs. The vessel/trailer participation survey is ongoing and includes all launching areas on the west coast of Saipan, where all boat-based fishing occurs. For this reporting period, a total of 312 boat vessels/trailers were recorded out fishing. During this period, the most common fishing methods encountered were trolling and

bottom fishing. The expanded harvest estimate was 587,928 lbs. for trolling, while the estimate catch was 3,947 lbs. for bottomfishing.

11 boat-based surveys were conducted between July 1 and December 31, 2019. 37 interviews were completed with an expanded catch of 220,742 lbs. 215 boat vessels/trailers were registered as "out fishing". Because the same vessel may be out fishing on more than one day, this count should not be used to estimate the total number of unique fishing vessels. During this period, the most common fishing methods encountered were trolling and bottom fishing. The expanded harvest estimate was 195,470 lbs. for trolling, while estimated catch was 19,653 lbs. for bottomfishing, and 5,619 lbs. for spear/snorkel.

Delays in accepting and processing the WPacFIN grant award resulted in boat-based surveys taking a hiatus from July to September. Surveys resumed after, and staff were instructed to be fastidious while conducting them to account for the potential data loss.

1.1.2.2 Vendor Invoice

The DFW has been collecting fishery statistics on Saipan's commercial fishing fleet since the mid-1970s. With the assistance of the NMFS WPacFIN program, the DFW also expanded its fisheries monitoring programs to include the other two major inhabited islands in the CNMI, Rota and Tinian. The DFW's principal method of collecting domestic commercial fisheries data is a dealer invoicing system, sometimes referred to as a "trip ticket" system. The DFW provides numbered two-part invoices to all purchasers of fresh fishery products (including hotels, restaurants, stores, fish markets, and roadside vendors). Dealers then complete an invoice each time they purchase fish directly from fishers; one copy goes to the DFW and one copy goes to their records. Some advantages of this data collection method are that it is relatively inexpensive to implement and maintain, and it is fairly easy to completely cover the commercial fisheries. The DFW can also provide feedback to dealers and fishers to ensure data accuracy and continued cooperation over time.

There are some disadvantages to the trip ticket system, including: (1) dependency on non-DFW personnel to identify the catch and record the data, (2) restrictions on the types of data that can be collected, (3) required education and cooperation of all fish purchasers, and (4) limited recordings of fish actually sold to dealers. Therefore, a potentially important portion of the total landings typically goes unrecorded. Since 1982, the DFW has tried to minimize these disadvantages in several ways by (1) maintaining a close working relationship with dealers, (2) adding new dealers to their list and educating them, and (3) implementing a creel survey to help estimate total catch (including recreational and subsistence portion). The current system collects data from dealers in Saipan, where the DFW estimates more than 90 percent of all CNMI commercial landings are made. The DFW also estimates that the proportion of total commercial landings that have been recorded in the Saipan database since 1983 is about 90 percent; however, coverage has been relatively mottled over the years. Previous volumes of FSWP reported only recorded landings, but in recent volumes, the data have been adjusted to represent 100 percent coverage and are referenced as "estimated commercial landings" in the tables and figures.

These data elements are collected for all purchases of fishery products; however, species identification is frequently identified only to a group level, especially for reef fish.

From January 01, 2019 to June 30, 2019, 930 invoices were collected from 23 vendors on Saipan. A total of 33,264.30 lbs. of fish were recorded from the sales receipt program valued at $102,973.89. From July 01, 2019 to December 31, 2019, 1,090 invoices were collected from 24 vendors on Saipan. 28,864.40 lb of fish were recorded from the sales receipt program with a value of $80,510.49. Vendor participation increased to similar levels observed before Super Typhoon Yutu in the latter half of the 2019.

1.1.2.3 Bio-Sampling

The bio-sampling database contains general and specific bio-data obtained from individual commercial spearfish catches landed on Saipan from six different vendors over the course of 2011. The following data was captured for each fishing trip sampled: date, fishing gear type, time/hours fished, location fished, number/names of fishers, lengths/weights of individual fish, number/weight of octopus and squid, number/carapace size/weight/sex of lobster, and whether it was boat- or shore-based fishing trip.

Although sampling effort was intended to be spread evenly among all participating vendors, smaller vendors were inherently much more difficult to sample within the time constraints allowed. Therefore, a regular sampling schedule was implemented for the island's two largest vendors that included two weekdays and one weekend day each week starting in January-February 2011. Problems encountered in sampling the smaller vendors included: more days in any given month where no fish were purchased, the work area wasn't conducive for sampling, and communication problems. The bio-sampling database focuses on nighttime (non-SCUBA) spearfishing activities. Due to vendor-imposed limitations, other gear types that typically land their catch during normal business hours were not sampled.

1.1.2.4 Exemption Netting

In 2003, the use of gill nets was prohibited in the CNMI. In 2005, the DFW decided to allow gill netting under special circumstances. Gill netting is now allowed under strict conditions provided by the DFW with their permission such that all gill netting activities are to be monitored and recorded by DFW personnel.

In 2010, a law was passed allowing for the use of gill nets for the purpose of subsistence on the island of Rota. The following year, a regulation allowing subsistence net fishing was passed for the island of Tinian.

For a majority of the permitted gillnet activities, length and weight measurements were taken at the fishing site. Fork lengths were measured in millimeters and weights were measured in grams. If time did not permit for individual measurements, then length measurements were taken for each fish and total weight was taken for each species. Length/weight ratios were used to estimate weights of sampled fish. Information has been collected for activities conducted on the island of Saipan, but no official collection of information has been collected for Rota or Tinian.

1.1.2.5 Life History

The CNMI DFW life history program began in 1996 sampling the redgill emperors (*Lethrinus rubrioperculatus*). Since then, sampling has been conducted on other species, including *A. lineatus*, Myriprestinae (*Myripristis violacea, M. kuntee, M. pralinea, M. bernti, M. murdjan), L. harak, Naso lituratus, Chlorurus sordidus*, and *C. undulatus*. Other life history programs have also developed over the past years. In collaboration with NMFS, DFW personnel collect life history information on *Scarus rubroviolaceus*, *Lethrinus atkinsoni*, and *Parupeneus barbarinus* through funding provided by NOAA-NMFS. The life history survey captures biological information, including reproductive cycle, age at length, and age at maturity. The DFW is continually working to improve the understanding of reef fish life history in the CNMI through these types of programs.

1.1.2.6 Monitoring of Imported Fish

The DFW Fisheries Data Sections collect fisheries-related importation invoices from the Department of Commerce at the end of every month. The data is then entered into a ticket receipt system and reviewed prior to being sent out for compilation by PIFSC. A majority of the information entered into the system can only be identified to the family taxa.

1.1.2.7 Vessel Inventory

Most recent records obtained from CNMI Department of Public Safety (DPS) are from 2018. Their records are hand-written and do not exist electronically. 138 vessels were scheduled to be renewed by December 31, 2019. 10 vessels were registered as commercial fishing vessels. 91 were registered for personal use although an unknown amount was and continue to be used for commercial fishing regardless of their intended use specified on their registration. Others were registered for commercial recreation and government use. This work is also impacted by policies of the DPS, which manages vessel licensing. Going forward, additional emphasis will be put on improving the vessel inventory project, especially once the data technician and data manager positions are filled at the CNMI DFW.

1.1.3 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 a random-stratified design applied to pre-scheduled surveys. The number of sampling days, participation runs, and catch interviews can be used to determine if there are sufficient 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.

1.1.3.1 Creel Survey Meta-Data Statistics

Calculation: Boat-based creel survey 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 CNMI boat-based creel survey meta-data from 2000-2019

Year	# Sample Days	# Catch Interviews	
		Regular	Opportunistic
2000	44	168	9
2001	67	285	0
2002	75	200	25
2003	90	299	40
2004	77	272	16
2005	78	417	29
2006	71	342	22
2007	62	314	1
2008	55	250	1
2009	64	241	25
2010	65	161	82
2011	67	162	87
2012	72	166	0
2013	71	191	0
2014	71	166	0
2015	57	119	2
2016	65	117	3
2017	66	120	6
2018	54	126	1
2019	33	65	8
10-year avg.	**62**	**139**	**19**
10-year SD	**11**	**35**	**33**
20-year avg.	**65**	**209**	**18**
20-year SD	**12**	**88**	**25**

1.1.3.2 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 CNMI commercial receipt book meta-data from 1998-2019

Year	# Vendors	# Invoices Collected	# BMUS Vendors	# BMUS Invoices Collected
1983	42	2,930	13	55
1984	45	3,452	11	50
1985	*	*	*	*
1986	*	*	*	*
1987	27	1,908	11	30
1988	16	2,204	7	23
1989	24	2,454	8	51
1990	23	2,218	5	19
1991	30	2,240	4	16
1992	55	3,233	3	4
1993	48	3,426	15	53
1994	55	3,722	17	89
1995	61	4,637	21	167
1996	73	5,870	25	231
1997	56	4,920	20	171
1998	53	6,374	21	220
1999	52	5,771	21	213
2000	49	6,892	16	210
2001	42	5,820	19	431
2002	33	5,611	17	268
2003	27	4,726	14	172
2004	25	3,720	13	99
2005	24	4,245	11	116
2006	21	4,541	10	154
2007	18	3,688	11	212
2008	13	3,242	10	221
2009	6	2,649	6	238
2010	5	1,708	5	134
2011	3	1,210	3	127
2012	20	1,630	12	192
2013	17	2,277	13	222
2014	17	2,034	12	152
2015	15	1,045	4	19
2016	16	2,407	9	175

Year	# Vendors	# Invoices Collected	# BMUS Vendors	# BMUS Invoices Collected
2017	32	2,832	14	134
2018	38	4,530	16	98
2019	36	3,924	11	109
10-year avg.	**20**	**2,360**	**10**	**136**
10-year SD	**11**	**1,073**	**4**	**53**
20-year avg.	**23**	**3,437**	**11**	**174**
20-year SD	**12**	**1,578**	**4**	**82**

* Confidential (less than three vendors)

1.1.4 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 years) and long-term (recent 20 years) 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*
- *decreasing trend in the time series*
- *no trend in the time series*
- *above 1 standard deviation*
- *below 1 standard deviation*
- *within 1 standard deviation*

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

Table 3. Annual indicators for CNMI bottomfish fisheries describing performance comparing estimates from 2019 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	**21,012[▼45%]**	**21,012[▼44%]**
	All BMUS from commercial purchase data	**15,697[▲21%]**	**15,697[▲6%]**
	Catch-per-unit-effort (from boat-based creel surveys)		
Bottomfishing (BMUS only)	Bottomfishing lbs./trip	**23[▼56%]**	**23[▼41%]**
	Bottomfishing lbs./gr-hr	**0.2464[▼48%]**	**0.2464[▼8%]**

Fishery	Fishery statistics	Short-term (10 years)	Long-term (20 years)
	Fishing effort (from boat-based creel surveys)		
Bottomfishing (BMUS only)	Estimated total bottomfishing trips	**9[▼50%]**	**9[▼68%]**
	Estimated total bottomfishing gear hours	**836[▼97%]**	**7836[▼97%]**
	Fishing participants (from boat-based creel surveys)		
Bottomfishing (BMUS only)	Estimated number of bottomfishing vessels	**8[▼20%]**	**8[▼56%]**
	Estimated average number of fishermen per bottomfishing trip	**2[▼67%]**	**2[▼60%]**
	Bycatch		
	# fish caught	**139[▼56%]**	**139[▼75%]**
	# fish kept	**139[▼56%]**	**139[▼75%]**
	# fish released	**0[no change]**	**0[▼100%]**

Table 4. Annual indicators for CNMI 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	**Estimated catch (lbs.)**		
Prioritized ECS	*Acanturus lineatus* from creel survey data	**0[▼100%]**	**0[▼100%]**
	Acanturus lineatus from commercial purchase data	**0[▼100%]**	**0[▼100%]**
	Naso lituratus from creel survey data	**346[▲50%]**	**346[▼52%]**
	Naso lituratus from commercial purchase data	**320[▼73%]**	**320[▼73%]**
	Naso unicornis from creel survey data	**0[▼100%]**	**0[▼100%]**
	Naso unicornis from commercial purchase data	**0[▼100%]**	**0[▼100%]**
	Scarus ghobban from creel survey data	**0[▼100%]**	**0[▼100%]**
	Lethrinus harak from creel survey data	**1,979[▲14%]**	**1,979[▼4%]**
	Lethrinus harak from commercial purchase data	**0[no change]**	**0[no change]**
	Siganus argenteus from creel survey data	**0[▼100%]**	**0[▼100%]**
	Siganus argenteus from commercial purchase data	**293[▼84%]**	**293[▼93%]**

Fishery	Fishery statistics	Short-term (10 years)	Long-term (20 years)
	Mulloidichthys flavolineatus from creel survey data	**0[▼100%]**	**0 [▼100%]**
	Mulloidichthys flavolineatus from commercial purchase data	**0[▼100%]**	**0[▼100%]**

1.1.5 Catch Statistics

The following section summarizes the catch statistics for bottomfish, the top ten landed species, and seven prioritized ECS in CNMI as decided by DFW. 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.

1.1.5.1 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 the fishery 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 data collection (boat-based creel and the commercial purchase reports).

Table 5. Summary of CNMI BMUS total catch (lbs.) from expanded boat-based creel surveys and the commercial purchase system for all gear types from 1983-2019

Year	Boat-Based Creel Survey Estimates	Commercial Landings
1983		3,407
1984		3,463
1985		*
1986		*
1987		1,889
1988		2,413
1989		4,021
1990		1,273
1991		781

Year	Boat-Based Creel Survey Estimates	Commercial Landings
1992		158
1993		1,722
1994		5,459
1995		17,564
1996		32,294
1997		21,607
1998		25,529
1999		33,622
2000	67,252	14,751
2001	24,637	24,817
2002	24,603	24,296
2003	12,726	17,144
2004	30,407	11,292
2005	34,311	15,025
2006	35,279	11,837
2007	54,257	14,805
2008	21,118	15,098
2009	65,269	18,313
2010	56,007	12,971
2011	25,799	16,115
2012	137,495	10,591
2013	20,390	16,500
2014	7,740	16,334
2015	10,386	4,121
2016	54,335	17,717
2017	48,007	11,923
2018	650	7,258
2019	21,012	15,697
10-year avg.	**38,182**	**12,923**
10-year SD	**37,962**	**4,258**
20-year avg.	**37,584**	**14,830**
20-year SD	**29,692**	**4,723**

1.1.5.2 Expanded catch estimates by fishing methods

Catch information is provided for the top boat-based fishing methods that comprises 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 all BMUS species.

Table 6. BMUS total catch time series estimates (lbs.) using CNMI expanded boat-based creel survey data for bottomfishing gears from 2000-2019

Year	Bottomfishing		Spearfishing (Snorkel)	
	All	BMUS	All	BMUS
2000	99,106	62,990	27,918	4,262
2001	40,556	24,574	8,693	63
2002	37,621	23,945	9,990	159
2003	15,406	12,547	5,528	178
2004	40,060	30,407	7,452	0
2005	48,699	34,266	6,567	46
2006	61,157	34,951	8,553	15
2007	83,677	54,059	11,849	198
2008	51,075	19,744	15,516	1,334
2009	99,523	64,979	18,801	217
2010	82,211	56,007	5,814	0
2011	60,432	25,799	7,289	0
2012	157,445	137,495	8,513	0
2013	34,954	20,390	2,456	0
2014	15,291	7,740	2,257	0
2015	17,554	10,374	4,820	0
2016	56,983	53,906	0	0
2017	50,177	47,883	0	0
2018	4,347	90	4,087	0
2019	25,556	16,831	10,486	0
10-year avg.	**50,495**	**37,652**	**4,572**	**0**
10-year SD	**42,312**	**38,205**	**3,337**	**0**

20-year avg.	**54,092**	**36,949**	**8,329**	**324**
20-year SD	**35,520**	**29,686**	**6,421**	**949**

1.1.5.3 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, CNMI DFW selected seven species that were reclassified as ECS that are still of priority to CNMI DFW 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 7a. Top ten landed species (lbs.) in CNMI ECS fisheries in 2019 from expanded boat-based creel survey data

Common Name	Scientific Name	Catch
Surgeonfish	Acanthuridae (family)	4,060
Parrotfish (palakse)	Scaridae (family)	3,600
Amberjack	*Seriola dumerili*	3,003
Sling-jawed wrasse	*Epibulus insidiator*	1,671
Jobfish (uku)	*Aprion virescens*	808
Common parrotfish	*Scarus psittacus*	653
Octopus	*Octopus* spp.	594
Rudderfish (guili)	*Kyphosus* spp.	316
Grouper	Serranidae (family)	292
Yellowlip emperor	*Lethrinus xanthochilis*	268

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

Table 6b. Top ten landed species (lbs.) in CNMI ECS fisheries in 2019 from commercial landings data

Common Name	Scientific Name	Catch
Assorted reef fish	Actinopterygii (class)	9,499

Common Name	Scientific Name	Catch
Parrotfish (palakse)	Scaridae (family)	4,463
Surgeonfish	Acanthuridae (family)	2,849
Bigeye scad (atulai)	*Selar crumenophthalmus*	1,655
Emperor (mafute)	Lethrinidae (family)	1,640
Rudderfish (guili)	Kyphosus spp.	1,103
Goatfish (satmoneti)	Mullidae (family)	1,071
Spiny lobster	*Panulirus* spp.	971
Rabbitfish (sesjun)	*Siganus spinus*	955
Jacks	Carangidae (family)	954

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

Table 8a. Catch (lbs.) from boat-based expansion data for prioritized species in CNMI ECS fisheries in from 2000-2019

Year	*Acanthurus lineatus*	*Naso lituratus*	*Naso unicornis*	*Scarus ghobban*	*Lethrinus harak*	*Siganus argenteus*	*Mulloidichthys flavolineatus*
2000	0	1,189	43	0	0	955	0
2001	0	849	222	0	0	136	0
2002	0	2,238	981	0	0	1,034	0
2003	345	1,125	965	0	136	227	0
2004	601	458	323	0	0	11	0
2005	339	451	250	0	272	0	0
2006	249	375	1,662	0	2,676	28	7
2007	200	1,139	1,125	0	4,640	114	0
2008	0	636	135	0	7,318	317	0
2009	0	3,555	524	0	8,996	1,385	0
2010	0	600	0	0	1,063	615	0
2011	40	81	1,611	0	1,648	0	0
2012	155	190	0	0	6,941	0	0
2013	0	77	0	0	1,224	0	0

Year	*Acanthurus lineatus*	*Naso lituratus*	*Naso unicornis*	*Scarus ghobban*	*Lethrinus harak*	*Siganus argenteus*	*Mulloidichthys flavolineatus*
2014	34	223	0	0	1,819	736	0
2015	87	383	64	48	386	29	0
2016	0	0	0	0	408	0	0
2017	0	0	0	0	45	0	0
2018	0	412	0	0	1,896	489	47
2019	0	346	0	0	1,979	0	0
10-year avg.	**32**	**231**	**168**	**5**	**1,741**	**187**	**5**
10-year SD	**52**	**200**	**508**	**15**	**1,954**	**300**	**15**
20-year avg.	**103**	**716**	**395**	**2**	**2,072**	**304**	**3**
20-year SD	**166**	**856**	**558**	**11**	**2,734**	**423**	**11**

Calculations: Catch tallied from commercial purchase data for species identified as priority ECS by DFW (Appendix A). From the prioritized ECS list, *Scarus ghobban* is not included because there are no specific code for that species in the CNMI commercial coding system.

Table 7b. Catch (lbs.) from commercial purchase data for prioritized species in CNMI ECS fisheries in from 2000-2019

Year	*Acanthurus lineatus*	*Naso lituratus*	*Naso unicornis*	*Lethrinus harak*	*Siganus argenteus*	*Mulloidichthys flavolineatus*
2000	0	4,883	0	0	12,677	0
2001	0	4,500	0	0	8,408	0
2002	0	1,041	0	0	9,141	0
2003	0	143	0	0	7,161	0
2004	0	2	0	0	3,714	0
2005	0	64	0	0	2,571	0
2006	0	70	0	0	8,354	0
2007	0	426	0	0	5,909	0
2008	0	323	0	0	2,599	0
2009	0	313	0	0	1,312	0
2010	717	1,123	462	0	1,880	0

Year	*Acanthurus lineatus*	*Naso lituratus*	*Naso unicornis*	*Lethrinus harak*	*Siganus argenteus*	*Mulloidichthys flavolineatus*
2011	0	2,804	1,804	0	2,185	0
2012	0	451	0	0	1,467	0
2013	0	759	0	0	2,331	0
2014	0	1,827	0	0	2,329	0
2015	0	1,380	0	0	1,569	0
2016	0	1,018	0	0	2,319	0
2017	0	1,664	0	0	3,063	18
2018	0	415	0	0	1,008	0
2019	0	320	0	0	293	0
10-year avg.	**72**	**1,176**	**227**	**0**	**1,844**	**2**
10-year SD	**227**	**774**	**573**	**0**	**790**	**6**
20-year avg.	**36**	**1,176**	**113**	**0**	**4,015**	**1**
20-year SD	**160**	**1,398**	**411**	**0**	**3,381**	**4**

1.1.6 Catch-per-Unit-Effort (CPUE) Statistics

This section summarizes the estimates for CPUE in the boat-based BMUS fisheries. The boat-based fisheries include the bottomfishing (handline gear) and spearfishing (snorkel). CPUE is reported as pounds per gear hour 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 9. CPUE (lbs./gear hour and lbs./trip) for bottomfishing gears in the CNMI boat-based fishery for all species and BMUS only from 2000-2019

Year	Bottomfishing				Spearfishing (Snorkel)			
	All		BMUS		All		BMUS	
	Lbs/trip	Lbs/gr-hr	Lbs/trip	Lbs/gr-hr	Lbs/trip	Lbs/gr-hr	Lbs/trip	Lbs/gr-hr
2000	50	0.1143	55	0.1812	35	0.1900	64	5.3333
2001	17	0.0333	21	0.0976	19	0.1117	2	0.1111
2002	28	0.0476	32	0.0927	20	0.1276	3	0.3750
2003	21	0.0429	21	0.0530	29	0.2527	4	0.1429
2004	25	0.0328	20	0.0287	15	0.0537	0	0
2005	26	0.0141	26	0.0170	21	0.0736	1	0.0500
2006	18	0.0126	17	0.0177	12	0.0472	1	0.1000
2007	28	0.0322	28	0.0491	15	0.0334	2	0.0308
2008	16	0.0127	13	0.0237	21	0.1236	6	0.0789
2009	19	0.0049	34	0.0261	21	0.0815	3	0.0833
2010	12	0.0022	11	0.0033	15	0.2492	0	0
2011	11	0.0018	16	0.0078	38	0.6609	0	0
2012	108	0.3416	156	0.6336	13	0.1058	0	0
2013	46	0.1398	44	0.2126	20	0.2500	0	0
2014	18	0.1139	32	0.6300	33	0.5848	0	0
2015	34	0.2013	43	0.4167	19	0.7813	0	0
2016	69	0.2584	78	0.3502	0	0	0	0
2017	81	0.7115	115	2.1791	0	0	0	0
2018	5	0.0322	1	0.0833	9	0.2250	0	0
2019	26	0.1618	23	0.2464	10	0.4222	0	0
10-year avg.	**41**	**0.1965**	**52**	**0.4763**	**16**	**0.3279**	**0**	**0.0000**
10-year SD	**35**	**0.2119**	**50**	**0.6401**	**12**	**0.2746**	**0**	**0.0000**
20-year avg.	**33**	**0.1156**	**39**	**0.2675**	**18**	**0.2187**	**4**	**0.3153**
20-year SD	**26**	**0.1692**	**38**	**0.4912**	**10**	**0.2247**	**14**	**1.1845**

1.1.7 Effort Statistics

This section summarizes the effort trends in the CNMI 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 a majority of the annual catch.

Calculations: Effort estimates (in both trips and gear hours) are calculated from boat-based interview data. 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 10. Effort (trips and gear hours) for bottomfishing gears in the CNMI boat-based fishery for all species and BMUS only from 2000-2019

Year	Bottomfish				Spear Snorkel			
	All		BMUS		All		BMUS	
	Trips	Gr-hrs	Trips	Gr-hrs	Trips	Gr-hrs	Trips	Gr-hrs
2000	35	15,194	24	7,236	13	2,379	1	12
2001	50	26,076	20	4,272	14	2,400	1	18
2002	40	23,547	22	7,553	12	1,888	1	8
2003	34	16,492	25	9,975	8	918	2	56
2004	53	40,633	45	31,243	17	4,620	0	0
2005	124	228,456	85	130,594	25	7,062	3	80
2006	101	141,036	59	55,614	27	6,696	1	10
2007	81	70,168	48	27,242	32	14,602	4	260
2008	57	71,463	23	13,020	9	1,521	3	228
2009	100	296,810	34	27,540	19	4,774	2	24
2010	116	657,888	63	204,771	5	297	0	0
2011	134	838,352	37	75,231	4	230	0	0
2012	26	8,211	16	3,930	10	1,200	0	0
2013	29	9,480	16	3,330	5	392	0	0

Year	Bottomfish				Spear Snorkel			
	All		BMUS		All		BMUS	
	Trips	Gr-hrs	Trips	Gr-hrs	Trips	Gr-hrs	Trips	Gr-hrs
2014	17	2,625	6	300	3	171	0	0
2015	14	2,340	7	720	4	96	0	0
2016	20	5,376	16	3,552	0	0	0	0
2017	13	1,456	7	363	0	0	0	0
2018	12	1,802	2	24	4	160	0	0
2019	13	2,108	9	836	2	45	0	0
10-year avg.	**39**	**152,964**	**18**	**29,306**	**4**	**259**	**0**	**0**
10-year SD	**46**	**316,558**	**19**	**65,865**	**3**	**354**	**0**	**0**
20-year avg.	**53**	**122,976**	**28**	**30,367**	**11**	**2,473**	**1**	**35**
20-year SD	**41**	**230,217**	**22**	**52,420**	**9**	**3,625**	**1**	**75**

1.1.8 Participants

This section summarizes the estimated number of participants 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 over time 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 11a. Estimated number of unique vessels for bottomfishing gears in the CNMI boat-based fishery for all species and BMUS only from 2000-2019

Year	Bottomfishing		Spearfishing (Snorkel)	
	All	BMUS	All	BMUS
2000	24	18	12	1
2001	35	15	10	1
2002	25	15	11	1
2003	22	15	6	2

Year	Bottomfishing		Spearfishing (Snorkel)	
	All	BMUS	All	BMUS
2004	29	24	13	0
2005	67	51	22	3
2006	60	42	18	1
2007	58	36	26	4
2008	40	22	9	3
2009	55	27	16	2
2010	26	19	5	0
2011	31	15	4	0
2012	23	15	9	0
2013	25	15	4	0
2014	14	5	3	0
2015	12	6	4	0
2016	16	13	0	0
2017	12	6	0	0
2018	11	2	3	0
2019	12	8	2	0
10-year avg.	**18**	**10**	**3**	**0**
10-year SD	**7**	**5**	**2**	**0**
20-year avg.	**30**	**18**	**9**	**1**
20-year SD	**17**	**12**	**7**	**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 11b. Estimated number of fishermen per trip for bottomfishing gears in the CNMI boat-based fishery for all species and BMUS only from 2000-2019

Year	Bottomfishing		Spearfishing (Snorkel)	
	All	BMUS	All	BMUS
2000	4	3	4	8
2001	3	3	3	2
2002	4	4	3	2
2003	5	5	3	2
2004	4	5	4	0
2005	5	5	3	2
2006	4	4	3	3
2007	3	3	3	3
2008	6	6	4	4
2009	10	6	4	3
2010	21	19	2	0
2011	21	17	3	0
2012	2	2	4	0
2013	2	2	2	0
2014	2	2	3	0
2015	2	2	2	0
2016	2	2	0	0
2017	2	2	0	0
2018	3	5	3	0
2019	2	2	3	0
10-year avg.	**6**	**6**	**3**	**0**
10-year SD	**8**	**6**	**1**	**0**
20-year avg.	**5**	**5**	**3**	**3**

Year	Bottomfishing		Spearfishing (Snorkel)	
	All	BMUS	All	BMUS
20-year SD	6	5	1	2

1.1.9 Bycatch Estimates

This section focuses on Magnuson-Stevens Fishery Conservation and Management Act (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 established SBRMs at that time.

The following are recent bycatch estimates for the boat-based bottomfish fishery.

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 12. Time series of bycatch estimates in the CNMI bottomfish fishery from 2000-2019

Year	# Caught	Kept	Released	% Bycatch
2000	493	481	12	2.43
2001	268	268	0	0
2002	474	474	0	0
2003	627	624	3	0.48
2004	756	756	0	0
2005	2206	2202	4	0.18
2006	874	874	0	0
2007	1325	1325	0	0
2008	241	241	0	0
2009	596	596	0	0
2010	614	614	0	0
2011	482	482	0	0
2012	456	456	0	0
2013	519	519	0	0
2014	57	57	0	0
2015	102	102	0	0

Year	# Caught	Kept	Released	% Bycatch
2016	636	636	0	0
2017	120	120	0	0
2018	6	6	0	0
2019	139	139	0	0
10-year avg.	**313**	**313**	**0**	**0**
10-year SD	**236**	**236**	**0**	**0**
20-year avg.	**550**	**549**	**1**	**0.15**
20-year SD	**490**	**489**	**3**	**0.53**