

# 2022 Guam and CNMI Fisher Observations Data Summary and Analysis

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## Background

### *History and purpose*

Fisher observations is an initiative led by Hawai'i fishermen Clay Tam and Roy Morioka to document on the water observations for fisheries across the U.S. Pacific Islands Region. Their goal was to provide context to fisheries-dependent data presented in the Annual Stock Assessment and Fishery Evaluation (SAFE) reports and add local and traditional ecological knowledge to science and management processes. By publishing these data reports and documenting fisher observations over time, our hope is to better understand fishery and ecosystem linkages, uncover trends, and validate observations made by people who fish in the U.S. Pacific Islands Region.

### *Previous work*

In 2021, fishers on the Western Pacific Regional Fishery Management Council's (Council) Advisory Panel from American Samoa, the Commonwealth of the Northern Mariana Islands (CNMI), Guam, and Hawai'i met each quarter and provided updates on social, economic, ecological, and management aspects of pelagic and archipelagic fisheries around their islands. These data were presented in their respective pelagic (WPRFMC 2021a: 196) and archipelagic (WPRFMC 2016: 37; WPRFMC 2021b: 77; WPRFMC 2021c: 85) SAFE reports for 2020. In 2022, the Council collected fisher observations for 2021 which were published in 2 Pacific Islands Fisheries Science Center data reports (Ayers et al. 2022a; Ayers et al. 2022b). Additional fisher observations collected from quarterly Advisory Panel meetings along with findings from the annual meeting were summarized in the 2021 pelagic (WPRFMC 2022a: 159) and archipelagic (WPRFMC 2022b: 70; WPRFMC 2022c: 37; WPRFMC 2022d: 79) SAFE reports

### *2023 Guam and CNMI fisher observations meeting*

The Council convened a meeting on February 7, 2023, from 6–8pm (Chamorro Standard Time) to review observations collected in 2022 by fishers from Guam and the CNMI. The meeting was attended by 9 Guam fishers, 11 CNMI fishers, 4 Council staff, and 2 social scientists from the National Oceanic and Atmospheric Administration (NOAA) Pacific Islands Fisheries Science Center (PIFSC). The meeting was remotely facilitated by Clay Tam and Roy Morioka and notes were taken by a Council staff member and the PIFSC social scientist. Roy Morioka, Clay Tam, and Council staff member Zach Yamada streamlined the interview guide (see Appendix), but it did not substantially change the responses provided by fishers. Facilitators Tam and Morioka started off the meeting by

welcoming the group, introducing participants, and instructing fishers to share their 2022 fishing experiences.

## **Data collection and data analysis**

### *Sampling protocol*

Advisory Panel members reached out to Guam and CNMI fishing communities via their social networks to invite fishers to attend the meeting and contribute their observations for the year. Advisory Panel members are typically proficient in one or more gear types, have many years of fishing experience, and are well-informed of fishery changes. For the 2022 Guam and CNMI fisher observations meeting, they tried to secure participation and gather data from current or past ‘highliners’ with different fishery specializations, whether it was individuals that target archipelagic species using shoreline or spearfishing gear, or on small boats that target bottomfish and pelagic species. Highliners are those who have more fishery knowledge than less experienced fishers and thus may offer deeper insights.

Attendees included non-commercial and part-time commercial fishers. Guam participants at the 2023 meeting included 5 Advisory Panel members and 4 participants with no Council affiliation. CNMI participants included 6 Advisory Panel members and 4 fishers with no Council affiliation.

### *Data collection*

Council staff and PIFSC social scientists took detailed notes during the February 2023 meeting, collecting direct quotes where possible. If note takers could not record verbatim quotes, main ideas were still reported from meeting attendees. All meeting note versions were combined and proofed into a main document, taking care to remove any identifying information from meeting attendees.

### *Data analysis*

Using the main notes document, we coded responses using thematic categories, starting with the four SEEM<sup>1</sup> categories: Social, Economic, Ecological, and Management Uncertainty (Hospital et al. 2019). SEEM categories were chosen to code responses because they can be used to provide context and complement the acceptable risk of overfishing (P\*) when setting Acceptable Biological Catch under Annual Catch Limits (Hospital et al. 2019: 2).

We also used subthemes from the main SEEM categories to add detail. Using themes and subthemes to organize and analyze qualitative data is often referred to as qualitative data analysis (Miles and Huberman 1994). This process was also used in previous fisher observations data reports (Ayers et al. 2022a; Ayers et al. 2022b). Findings from the Guam and CNMI meeting are separated first by Guam and CNMI, then further organized using the SEEM categories and additional subthemes, including management unit species

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<sup>1</sup> A Council working group developed the SEEM process to create a framework that could quantify social, economic, ecological, and management uncertainty for annual catch limit (ACL) specification.

categories in tables below. Management unit species (MUS) categories include pelagic (PMUS), bottomfish (BMUS), and ecosystem components species (ECS).

## Results

Below, results from Guam are presented first for each SEEM category, followed by results from the CNMI.

### Social

In Guam, fishers described up to 30 new boats entering fisheries, loss of Fish Aggregating Devices (FADs), crowding and thefts at boat ramps, fishers transitioning from trolling reels to electric, and customary exchange of fish in the community. More detailed results are presented in Table 1.

**Table 1. Social aspects of Guam fisheries.**

Themes/subthemes (counts)	Quote(s)
New entrants (6)	<p>“I launch out of Agat, and the fleet of Micronesians, it’s like over 13 boats that fish every day for bonito. And we’re beginning to see them out at Galvez Bank, Finger Bank, all the way down to Baby Bank. And these are pounder style boats. So they’re coming way out. More than 25 mi. Summer comes and they discover bottomfishing out at the banks? We’ll see.” (<i>New entrants</i>)</p> <p>“I noticed that last year. There was several that followed us at the banks at night. The next morning, there were two more. But they were trolling for bonito, and one was bottomfishing. Surprising, because they were small boats going 25 mi out.” (<i>New entrants</i>)</p> <p>“20–30 (new boats) at least. No cover either, no tops.” (<i>New entrants</i>)</p> <p>“Over 15 at Agat [marina]. No one can launch or come in. They’re blocking the fire rescue. We need more parking. ‘Cause after fishing, they just wanna hang out.” (<i>New entrants</i>)</p> <p>“DAWR [Division of Aquatic &amp; Wildlife Resources] Creel surveys monitor boat numbers and license plates. I believe they’re tracking 30. They’re 18 feet [long] but they’re narrow. No helm. Just a 40 lb [outboard engine] kicker in the back.” (<i>New entrants</i>)</p>

Themes/subthemes (counts)	Quote(s)
	<p>“If you see the school first, they will come over to you and there will be 10 boats circling. They’re getting better manners now. Used to be they’d cut you out. I think they had some good run-ins. They used to show up if you had a spot.” (<i>New entrants</i>)</p>
<p>Fishing infrastructure (3)</p> <ul style="list-style-type: none"> <li>- Marina vandalism, theft (2)</li> <li>- FADs</li> </ul>	<p>“Sometimes dockside and marina gets crowded with Micronesians, but parking has become a huge issue at Agana [Small Boat Harbor]. Vandalism at Agat [marina]. Tires being slashed, cars being broken into. And just trying to find parking – fishermen are having to change fishing time to work around this. They want to avoid the rush. It avoids catchability when you’re used to staying to a certain time, but you don’t want to deal with the B.S. when you come home. So that in turn affects fishing.” (<i>Fishing infrastructure, Marina vandalism, theft</i>)</p> <p>“Two Sundays ago, Jeep and trailer stolen from Agana [small boat harbor].” (<i>Fishing infrastructure, Marina vandalism, theft</i>)</p> <p>“One or two out of 8 [left moored] up north. (Multiple people muttering) There’s only 4. Three in south? Agat, Merizo... 2 and 3 in the north. 9 Mile. Umatac... So yeah in the south, we only have 3 online. And then the north we have 2 online, so total of 5. Out of 14. Plus a wave buoy up north.” (<i>Fishing infrastructure, FADs</i>)</p>
<p>New technology</p> <ul style="list-style-type: none"> <li>- Gear</li> </ul>	<p>“Have seen some trolling reels or internationals being converted to electric.” (<i>New technology, Gear</i>)</p>
<p>Customary exchange</p>	<p>“Yeah, I gave away 150 lb just in the last day.” (<i>Customary exchange</i>)</p>

In the CNMI, fishers reported loss of FADs, a marina upgrade, and boats exiting the fishery and being delivered to Guam. They also described ongoing military exercises that interfere with fishing activity and reduced fishing effort. See Table 2 for more detail.

**Table 2. Social aspects of CNMI fisheries.**

Themes/subthemes (counts)	Quote(s)
Fishing infrastructure (2) <ul style="list-style-type: none"><li>- FADs</li><li>- Marina upgrade</li></ul>	<p>“All the FADs are gone. Only left that I saw, only GG buoy. Two weeks ago I fished in Rota and I couldn't see the FADs. None.” (<i>Fishing infrastructure, FADs</i>)</p> <p>“They started renovation work at our marina. Hopefully by Pika – not done, but it’s looking nice now. The Mayor is making sure that place has a nice restroom and facilities so people can hang out during the derby.” (<i>Fishing infrastructure, Marina upgrade</i>)</p>
People exiting the fishery (2)	<p>“And a lot of boats from CNMI were taken by Chinese and driven to Guam, abandoned at Guam beach and marinas and took off. According to Coast Guard report, there were 21 boats from CNMI into Guam.” (<i>People exiting the fishery</i>)</p> <p>“They’re local boats, they bought from local fishermen and took the boat. And the price of fuel for fishermen went up. Last year, a lot of fishermen were struggling with cost of fuel, maintaining engine and boat. So maybe that’s why they sold their boats to the Chinese (laughing).” (<i>People exiting the fishery</i>)</p>
Fishing/Military conflicts	<p>“Lot of military activity picking up around this time. Annual Cope North military exercises will run through Pika fest [Tinian Hot Pepper festival]. Maybe military folks will charter a boat or something.” (<i>Fishing/military conflicts</i>)</p>
Less spearfishing effort	<p>“Spearfishing has gone down. Spear hasn’t really been – I haven’t seen them go out in a while. They’ll either go trolling or bottom. We’re good on this side, turn it over to Saipan.” (<i>Less spearfishing effort</i>)</p>

## Economic

Guam fishers reported that fuel costs remained high and fish prices were down due to excess supply of fish (see Table 3).

**Table 3. Economic aspects of Guam fisheries.**

Themes/subthemes (counts)	Quote(s)
Market conditions (3) - Fuel costs (2) - Fish prices	<p>“Mahi and wahoo season started really early. Started as early as September. End of September. That was really good, despite high price of fuel, were able to load up on mahi and wahoo very early in the season. And it’s still going on. Weather, not a problem. That’s about it.” (<i>Market conditions, Fuel costs</i>)</p> <p>“I was fishing in Galvez Bank and Baby Bank, the wahoo. And occasionally mahi. We were surprised the fish were early last year. About 30 miles south. And the fuel was just outrageous.” (<i>Market conditions, Fuel costs</i>)</p> <p>“Because there’s a good supply of mahi, markets are pretty much flooded now. People are selling roadside, word of mouth. But restaurants, hotels flooded. Lent’s coming up, so people tend to buy more fish during Lent. Others tend to prefer wahoo. But never had an issue with deep bottom. Don’t care to compete with pelagics. But markets are flooded now. Spoke to customers and they’re loaded.” (<i>Market conditions, Fish prices, PMUS, mahimahi, wahoo</i>)</p>

Market conditions remain challenging in the CNMI, as noted in previous social research in fishing community profiles (Allen and Amesbury 2012; Ayers 2018), but fishers still found some markets for their catch or consumed the fish at home. Fuel costs, normally high in the Marianas, reached \$7.29/gallon in 2022 (see Table 4).

**Table 4. Economic aspects of CNMI fisheries.**

Themes/subthemes (counts)	Quote(s)
Market conditions (3) - Market demand - Fish prices • BMUS (opakapaka, kalekale)	<p>“But enough folks out keeping local market happy, restaurants and hotels.” (<i>Market conditions, Market demand</i>)</p> <p>“The economy isn’t too good here in the CNMI so people are going after more affordable fish. Harder to sell bottomfish, paka, kale, because atulai’s still around at \$3/lb. Rather than buying bottomfish at \$5.50–6.50/lb. I’m telling people you</p>

Themes/subthemes (counts)	Quote(s)
<ul style="list-style-type: none"> <li>• ECS (atulai)</li> <li>• PMUS (mahimahi)</li> <li>- Subsistence fishing</li> </ul>	<p>have to be flexible. Folks are going around house to house to sell their catch. Very hard to sell because of the atulai and also mahi (sold at \$1/lb).” (<i>Market conditions, Fish prices</i>)</p> <p>“People are going for cheaper fish even if they do go out. So there’s actually no market for us, self-sustainability. That’s my observation.” (<i>Market conditions, Subsistence fishing</i>)</p>
<p>Costs of fishing</p> <ul style="list-style-type: none"> <li>- Fuel costs</li> </ul>	<p>“Not hearing a lot of fishermen’s observations here, due to \$7.29/gallon fuel cost.” (<i>Costs of fishing, Fuel costs</i>)</p>

## Ecological

### *Biological*

Most Guam fishers reported good fishing in 2022, both in terms of amount and size of fish. Mahimahi was particularly abundant, and some fishers explained that it may be part of a longer 5–7 year cycle. Guam fishers also reported larger sizes of bottomfish and shark depredation (see Table 5).

**Table 5. Biological aspects of Guam fisheries.**

Themes/subthemes (counts)	Quote(s)
<p>Juvenile and Adult recruitment (18)</p> <ul style="list-style-type: none"> <li>- Amount of fish (13) <ul style="list-style-type: none"> <li>• ECS (atulai, shallow bottomfish)</li> <li>• PMUS (blue marlin, wahoo, marlin mahimahi, aku/bonito, kawakawa)</li> <li>• BMUS (opakapaka, onaga, lapulapu, grouper, black</li> </ul> </li> </ul>	<p>“2022 was a great year. Picked up 17 blue marlins, largest 400 lb. And yellowfin, were picking up 25 lb to 50, 60 lb yellowfins. Close by Guam. At 11-mile or 9-mile banks. Despite the fuel cost, 2022 was awesome. Shallow bottom was excellent, but this was Santa Rosa bank. Coolers were 320, we would fill that up.” (<i>Juvenile and Adult recruitment, Amount of fish, ECS, atulai, shallow bottomfish, PMUS, blue marlin, yellowfin tuna</i>)</p> <p>“Trolling has been good with mahi and wahoo.” (<i>Juvenile and Adult recruitment, Amount of fish, PMUS, mahimahi, wahoo</i>)</p> <p>“Trolling’s been really good. I gutted the marlin on Sunday and pulled out a 3lb bonito from the belly.” (<i>Juvenile and Adult recruitment, Amount of fish, PMUS, marlin</i>)</p> <p>“For 2022 also, schools of atulai lasted several months and is continuing. Another school came into Agana marina. One of the biggest runs I’ve ever seen in terms of how long they’ve</p>

Themes/subthemes (counts)	Quote(s)
snapper, mafute, yellowtail snapper, uku)	been around.” ( <i>Juvenile and Adult recruitment, Amount of fish, ECS, atulai</i> )
- Size of fish (5)	“Number 2 and 3 pretty productive off and on. Dry as of this weekend. This time of year is when mahi tend to scatter across ocean. Small packs, singles, doubles. But generally all over the place.” ( <i>Juvenile and Adult recruitment, Amount of fish, PMUS, mahimahi</i> )
• PMUS (mahimahi, yellowfin tuna dogtooth tuna, spearfish, marlin, bonito)	“Not too much bottomfishing, in 2022 did a lot of trolling. But lost more marlins than I caught. Maybe caught 15, 17- something. When you’re losing them you don’t wanna keep track. Prior year, 2020, 2021, was really good for marlin season for me.” ( <i>Juvenile and Adult recruitment, Amount of fish, PMUS, marlin</i> )
• BMUS (onaga, opakapaka)	<p>“For right now, it’s a transition when they start to show up again. Summer’s usually prime time, but now it’s a transition when we start to get a mixed bag of pelagics. October through December some mahi, wahoo, yellowfin, aku mixed in. Now you could probably go out and get all of them (grand slam). Boats have been coming in pretty early. Launching mid-afternoon and coming in evening.” (<i>Juvenile and Adult recruitment, Amount of fish, PMUS, mahimahi, yellowfin tuna, skipjack</i>)</p> <p>“Want to echo what [another fisher] had mentioned, haven’t been able to find paka. We’re having a hard time pinpointing where the onaga are at for 2022 compared to the two previous years.” (<i>Juvenile and Adult recruitment, Amount of fish, BMUS, opakapaka, onaga</i>)</p> <p>“As well as bottom fishing, bottom fishing was spectacular. 70 lb grouper, 24 lb rainbow runner, big amberjacks, oilfish, mafute, etc. All awesome. Last year I didn’t do a lot of bottomfishing, did more trolling, but that was just because of the charters, more for trolling. I did some shallow bottom. New spots—right outside Hospital Point. At about 80 ft I caught 6 different species on that drop. The lapu lapu, grouper, black snapper, mafute, and the yellowtail snapper, and another fish, might’ve been uku. Didn’t think there’d be that many different species at that spot.” (<i>Juvenile and Adult</i></p>



Themes/subthemes (counts)	Quote(s)
	<i>recruitment, Amount of fish, BMUS, lapu lapu, grouper, black snapper, mafute, yellowtail snapper, uku)</i>
	<p>“Bonito. It’s hit or miss. October the boats are coming back with 3–4 pieces. In the last few weeks after half day, they have whole coolers full. The fishers targeting with aku are competing with mahi now. Recently they’ve been able to load their coolers pretty quick. Maybe 4–6 pounders.”  <i>(Juvenile and Adult recruitment, Amount of fish, PMUS, aku, mahimahi)</i></p>
	<p>“Echo what [another fisher] said about that 7-yr cycle and seeing some of these pulse-type recruitment over the years. Even being with the co-op, you see weird pulses.”  <i>(Juvenile and Adult recruitment, Amount of fish)</i></p>
	<p>“Mixed in with the mahi this year, and I haven’t seen in quite a number of years, was more frequent kawakawa, and larger than we normally see. Could be an indicator of some kind of cycle/weather change.”  <i>(Juvenile and Adult recruitment, Amount of fish, PMUS, mahimahi, kawakawa)</i></p>
	<p>“Bottomfish fishery in Guam still very healthy.”  <i>(Juvenile and Adult recruitment, Amount of fish, BMUS)</i></p>
	<p>“Average. Medium-sized to smaller mahi now, but at start decent sizes. Typical that mahi are larger at start, and the wahoo are rats. February, March is the 6–10 lb. Toward tail end, April–May, 20 pounders that roll in. And not along entire west coast, scattered. Like Sunday, up north. Or some at SE coast of island. Eventually they move out west toward Agatna, that should happen in the next month.  <i>(Juvenile and Adult recruitment, Size of fish, PMUS, mahimahi)</i></p>
	<p>“Some years a lot of juvenile dogtooth (&lt;5 lb), some years large dogtooth (80+ lb). This year, pulse of small spearfish.”  <i>(Juvenile and Adult recruitment, Size of fish, PMUS, dogtooth tuna, spearfish)</i></p>
	<p>“Also on bottom, I did share before that we started seeing larger paka (<i>P. filamentosus</i>) in 2020. Continuing to find them. Not in large schools, but 1–3 here and there. That’s something we never really caught before. 6–9 lb. Nice, Hawai’i-size. We can consistently check some spots and</p>

Themes/subthemes (counts)	Quote(s)
	<p>we'll get a couple, once in a blue moon. Wouldn't catch these prior to 2020. 2020 every boat was catching a couple, to several, at quite a few locations—along the banks, coasts.” (<i>Juvenile and Adult recruitment, Size of fish, BMUS, opakapaka</i>)</p> <p>“Want to add, last year, the bonitos I was picking up like 5, but big—20 lb. But only like 4–5 pieces. Out of nowhere, no birds or anything. Just hit them at the bank.” (<i>Juvenile and Adult recruitment, Size of fish, PMUS, kawakawa/bonito</i>)</p> <p>“I personally think the onaga stock are from as far as FSM, Yap. And north of the Marianas like the Bonin islands to Okinawa, Iwo Jima, a lot of onaga are being caught. It comes right down the trench. This stock could very easily be—these fish could easily ride the current and go. They're big fish, robust, got that long tail.” (<i>Juvenile and Adult recruitment, Size of fish, BMUS, onaga</i>)</p>
<p>Forage items (5)</p> <ul style="list-style-type: none"> <li>- PMUS (mahimahi, oilfish, bonito, marlin, flying fish)</li> <li>- ECS (mañahak, triggerfish, ti'ao/goatfish)</li> </ul>	<p>“Usual mañahak run didn't really happen in 2022.” (<i>Forage items, ECS, mañahak</i>)</p> <p>“Last one, mix of squid and juvenile fish (unidentifiable baitfish). Some spitting out ti'ao/goatfish” (<i>Forage items, ECS, ti'ao/goatfish, PMUS, mahimahi</i>)</p> <p>“Yeah, and [the ti'ao spit up at FADs] would be the length that you'd find them on shore, 2–3, silver and blue.” (<i>Forage items, PMUS, mahimahi</i>)</p> <p>“And onaga feeding on squids, juvenile oilfish.” (<i>Forage items, oilfish, PMUS, mahimahi</i>)</p> <p>“I hooked up on a marlin on the coastline, wahoo depth. I recently picked up several decent sized YFT as well, up north. Like 25–50 lb. And dogtooth tuna, picked one up recently. I've noticed, I took a picture, there was a pulonon (triggerfish) inside a wahoo. Something I rarely see, almost never. Also the flying fish inside their stomachs were really big. Couple times I found wahoo with bonito inside, with the lure.” (<i>Forage items, PMUS, flying fish, bonito, ECS triggerfish</i>)</p>

Themes/subthemes (counts)	Quote(s)
Phenology (4)	
- Timing of migration patterns	“Although we did get mahi early, in between Agat and Apra harbor—we didn’t get any wahoo until January. A terrible season down south. Up north they were killing it. South they didn’t make it down ‘til this new year. Really strange—we didn’t even have a wahoo season in my area. Everything was up north.” ( <i>Phenology, Timing of migration patterns, PMUS, mahimahi, wahoo</i> )
• PMUS (mahimahi, wahoo, shortbill spearfish)	“Mahi season started around October 2022. Last big run for mahi was 2016. So this is that every 5–7 year phase that we get.” ( <i>Phenology, Timing of migration patterns, PMUS, mahimahi</i> )
	“Mahi run is pretty good run this season, going strong still now. But because don’t have all FADs in place, we’re finding them along the coastal and at closer FADs. Same with wahoo. But what I can say is it’s probably one of the strongest seasons for mahi and wahoo since 2016, based on my records.” ( <i>Phenology, Timing of migration patterns, PMUS, mahimahi, wahoo</i> )
	“For 2022, summer of 2022, we did see a small pulse of spearfish. Almost every boat was coming in with at least a 40–60 lb spearfish. Most would’ve been shortbill. Kinda makes you think you got a large wahoo but then it’s just a spearfish.” ( <i>Phenology, Timing of migration patterns, PMUS, shortbill spearfish</i> )
Depredation (2)	
- Sharks	“[Sharks are] still a problem. I picked up yellowfin or bonito, they’re right there. They’re chasing them. A 30 lb yellowfin, I picked up the head. Another one took the fish and lure. That’s just the past 3 weeks.” ( <i>Depredation, PMUS, yellowfin tuna, bonito, sharks</i> )
• PMUS (yellowfin tuna, bonito)	“On Saturday, first time I observed the shark jump out of the water. 8-footer. Really fat. Just scraped a bonito, a 9 lb bonito.” ( <i>Depredation, PMUS, bonito, sharks</i> )

CNMI fishers also reported a strong mahimahi year in 2022, larger numbers of wahoo, and larger numbers of ecosystem component species around coral reefs. Fishers described seeing larger numbers of sea turtles in lagoon areas and continued shark depredation. Fishers also noted a strong atulai year and larger numbers of other forage items (see Table 6).

**Table 6. Biological aspects of CNMI fisheries.**

Themes/subthemes (counts)	Quote(s)
Juvenile and Adult recruitment (15)	<p>“It’s been a pretty good year for mahi. Can’t remember wahoo runs like the ones we’ve had this year and past year. Every boat coming in with minimum 3–4 wahoos, mahi. All 9 vendors out here are flooded with mahi and wahoo. Great year for mahi and wahoo.” (<i>Juvenile and Adult recruitment, Amount of fish, PMUS, wahoo, mahimahi</i>)</p>
- Amount of fish (11)	<p>“Same for atulai. Can’t remember a time when we were catching atulai for practically every month of last year and it’s still going. We’ve always been able to catch atulai at [the] banks, but now they’re finding them in lagoons. In the boat basin. Markets flooded with atulai.” (<i>Juvenile and Adult recruitment, Amount of fish, ECS, atulai</i>)</p>
<ul style="list-style-type: none"> <li>• PMUS (wahoo, mahimahi, yellowfin tuna, sailfish, marlin)</li> <li>• ECS (atulai, parrotfish)</li> <li>• BMUS (opakapaka, kalekale, gindai, ehū)</li> </ul>	<p>“Yellowfin, there’s been a few going out once a month to pick up a 50+ pounder, that’s nice. Another unusual thing, guys picking up sailfish. [Another fisher] picked up 2–3 this last year.” (<i>Juvenile and Adult recruitment, Amount of fish, PMUS, yellowfin tuna, sailfish</i>)</p>
- Size of fish (3)	<p>“Since bigeye scad fishing has been on since August until this date, fishermen would be out at night when there’s no moon. When atulai went inside lagoon, fishermen are fishing it 24/7, daytime, nighttime.” (<i>Juvenile and Adult recruitment, Amount of fish, ECS, atulai</i>)</p>
• BMUS	<p>“October–November [I] took a couple of guys freediving at daytime and night. Fishermen are posting on FB and Whatsapp, catching lots of parrotfish, healthy, at reproductive stage. That’s a plus telling us the population is healthy.” (<i>Juvenile and Adult recruitment, Amount of fish, ECS, parrotfish</i>)</p>
- Length of season	<p>“Bottom’s been great, especially if you can get out to banks.” (<i>Juvenile and Adult recruitment, Amount of fish, BMUS</i>)</p>
	<p>“And the number of fish seen last year has increased. But during some of the fishing derbies, not good.” (<i>Juvenile and Adult recruitment, Amount of fish</i>)</p>
	<p>“Saipan International Fishing Derby last year was only one marlin. The fish was really bad. That was July last year.”</p>

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*(Juvenile and Adult recruitment, Amount of fish, PMUS, marlin)*

“So for us, caught a lot of marlin last year. We’re averaging four runs a week. Almost every run we catch one or two marlins, last year.” *(Juvenile and Adult recruitment, Amount of fish, PMUS, marlin)*

“And the biggest run we caught was during the Beer, Beef, and Band in Tinian that was 772 lb. And caught another marlin west of Goat Island going back to Rota, maybe 200 lb. The small ones of less than 100lb only caught a few.” *(Juvenile and Adult recruitment, Amount of fish, PMUS, marlin)*

“For bottom, did four trips up north last year. One trip we did up to Maug. Most of them to Pagan last year. We fished only Pagan, just one day and a half and no more space for fish. Bottomfishing and pelagic. We just troll on the way down and up, not around the island. Lot of debris around the shore. One time last year we fished and the volcano went out in Pagan. We didn’t leave, we just stayed there and fished and then we left.” *(Juvenile and Adult recruitment, Amount of fish, BMUS, PMUS)*

“Next morning, we start fishing for pakapaka, kale, etc. Even though we try to devote 2–3h of our time, averaging 2–4 lb. Very rare to get larger fish, 15–20 pounders.” *(Juvenile and Adult recruitment, Size of fish, BMUS, opakapaka, kalekale)*

“Although we may not catch as many as we used to, fishes like paka, kale, gindai, ehu, dogtooth tuna, bigger by maybe 2–3 lb more, for all species. Also this boat owned by [a friend], whenever it goes to Tinian or Rota, Guam, never fails to catch marlin, mahi, yellowfin, wahoo—it’s been a pretty good run for CNMI fishers as far as I’m concerned.” *(Juvenile and Adult recruitment, Size of fish, PMUS, dogtooth tuna, mahimahi, yellowfin tuna, wahoo, marlin, BMUS, opakapaka, kalekale, gindai, ehu)*

“[Marlin] usually between 70–125 lb. Not so much the 200–300 lb. Maybe in a couple months.” *(Juvenile and Adult recruitment, Size of fish, marlin)*

“Also August–October, wahoo run came in, mahi came in, and as far as Saipan was concerned, lot of boats coming in catching marlins. First time seeing boats coming in with

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	<p>marlins left and right. August–November folks were coming in with 1–2 marlin. As far as wahoo and tuna, still more mahi until this point. Wahoo on and off, but mahi still around.” (<i>Juvenile and Adult recruitment, Length of season</i>)</p>
<p>Phenology (3)</p> <ul style="list-style-type: none"> <li>- Migration patterns <ul style="list-style-type: none"> <li>• sharks (hammerhead sharks)</li> </ul> </li> <li>- Protected species <ul style="list-style-type: none"> <li>• green sea turtles</li> </ul> </li> </ul>	<p>“Another thing, the onaga hasn’t been a very good run for 2022. For myself and two close fishing buddies. Sometimes to remote reefs. They’ve been telling me the onaga run hasn’t been around close to the islands. Not that their population is reduced but they move around. Anatahan, Sarigan, Guguan haven’t gone up as much because of rough weather. More around Saipan, Tinian, Goat Island.” (<i>Phenology, Migration patterns</i>)</p> <p>“And I’ve seen hammerhead in lagoon, in Saipan, maybe chasing the turtles in to eat them.” (<i>Phenology, Migration patterns, sharks, hammerhead sharks</i>)</p> <p>“Also what I’ve seen last year is a lot of turtles in the lagoons, in Saipan, all over Tinian. In Rota there was a turtle, 500lb that crawled up onto the highway and got run over. Seen them in Smiling Cove Marina, ~5 turtles. At the south and north sea plane ramps, out to Managaha, Oleai beach bar, commercial ramp [?]. All over.” (<i>Phenology, Protected species, green sea turtles</i>)</p>
<p>Depredation (3)</p> <ul style="list-style-type: none"> <li>- sharks</li> <li>- BMUS</li> </ul>	<p>“Other than that, by month of March when started going deep bottom, I went as far north as 10–15 mi north of Saipan. We fished all day and we didn’t have any shark intervention at all. No shark depredation. After that day of fishing, I continued on through the night and went on the next day. Same story next any, no shark interference at all. Other fishermen on Whatsapp said same thing about up north. “You were right.” Maybe 2–3 shark attacks, but that’s it. But compared to previous years, 2019, 2020, and 2021, it started. 2019 had depredation 90% of time. 2020, reduced 80%. Last year, I was amazed from about 95% every time to 10–15% only. So bottomfishers have been very happy. Before would always come in with bodiless fishes. March to December, shark depredation has been very slow.” (<i>Depredation, sharks, BMUS</i>)</p> <p>“I’ve seen tiger sharks around Tinian and Goat Island, eating our catch.” (<i>Depredation, sharks, tiger sharks</i>)</p> <p>“We went out, my partner and I, last week. On our first bottom drop, we had the tax man on us, sharks. We tried to</p>

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	<p>move away from that spot but it looks like they just keep following us, I guess we didn't file our 1040s. There's a lotta sharks here, no matter how cool or warm the water is." (<i>Depredation patterns, sharks</i>)</p>
<p>Changes in spatial distribution (2)</p> <ul style="list-style-type: none"> <li>- PMUS (mahimahi)</li> <li>- ECS (atulai, triggerfish)</li> </ul>	<p>"And, one of the fishers in Guam mentioned seeing triggerfish in cavities of fish; inside a mahi recently saw at least 2–3 triggerfish. Don't know if that's indicative of them coming closer to the islands." (<i>Changes in spatial distribution, PMUS, mahimahi</i>)</p> <p>"Observation for shore-based fisheries, atulai is still going. Another large school on Tinian. Positive for shore-based fisheries." (<i>Changes in spatial distribution, ECS, atulai</i>)</p>
<p>Forage items</p> <ul style="list-style-type: none"> <li>- ECS (longnose mafute/lililook, atulai)</li> </ul>	<p>"Fishermen focusing on mafute, trevally, longnose mafute/lililook. We do a combination of not just shallow bottom fishing but bigeye scad fishing, for big moon phase." (<i>Forage items, ECS, longnose mafute/lililook, atulai</i>)</p>

*Physical/Oceanographic*

Guam fishers noted stronger winds and weather which inhibited fishing trips. Currents also made bottomfishing difficult. Fishers also recorded cooler water temperatures (see Table 7).

**Table 7. Physical/Oceanographic aspects of Guam fisheries.**

Themes/subthemes (counts)	Quote(s)
Weather, wind patterns (5)	<p>"We haven't had a bad typhoon for a long time, but didn't seem to have a dry season either. 90–100 inches/year is typical. Not abnormally large amount of rain, but just more spread out." (<i>Weather, wind patterns</i>)</p> <p>"On the open water out on boat, weather-wise, 2022 throughout the year was a bit rougher than the prior years 2020, 2021. Coming off 2020, really calm year, through 2021. Then started to see changes in 2022." (<i>Weather, wind patterns</i>)</p> <p>"Other than that, rougher. Periods of larger swell. Not as many BF trips as previous years. But also due to us traveling throughout 2022." (<i>Weather, wind patterns</i>)</p>

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	<p>“For 2022, also saw a lot of—and could be systems around us, not bad weather, just heavier weather—a lot of wind direction changes. Instead of ENE, you had E, SE, S. (<i>Weather, wind patterns</i>)</p> <p>“But heavy weather last 3–4 weeks have prevented them from going out.” (<i>Weather, wind patterns</i>)</p>
<p>Currents (3)</p> <ul style="list-style-type: none"> <li>- BMUS (opakapaka, onaga)</li> </ul>	<p>“2022, current was going opposite. Prevailing current that we’re used to; the way mounds are, drop offs, the opposite side is hard to target because will end up on face of mound or off the deep end. But current, majority of the time was westerly to north. But it’s been going due east or due NE. Total opposite of what we’re used to. Some days it’ll go straight south instead of N. Some days just weren’t able to fish because current’s not in our favor.” (<i>Currents</i>)</p> <p>“Very strong current change especially toward end of last year was really bad. Couple times we saw each other, only few boats out.” (<i>Currents</i>)</p> <p>“Want to echo what [another person] had mentioned, haven’t been able to find paka. We’re having a hard time pinpointing where the onaga are at for 2022 compared to the two previous years.” (<i>Currents, BMUS, opakapaka, onaga</i>)</p>
<p>Water temperature (2)</p>	<p>“Maybe cooler, but don’t know for sure. Coldest I’ve ever seen last several years was 76. Usually year round it’s 84–87 [degrees].” (<i>Water temperature</i>)</p> <p>“It’s been fluctuating from high 79 to 81 [degrees F]. That’s what I’ve been getting the past 3–4 weeks. And then prior to that, November–December, at around 82 [degrees]. Before that, 83 [degrees]. In January and February, that’s been the lowest, 79–81 [degrees].” (<i>Water temperature</i>)</p>

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CNMI fishers also reported rougher water due to prevailing weather and wind patterns, cooler water temperatures, and stronger currents. One fisher noted a lot of fishing debris in the water around CNMI waters (see Table 8).



**Table 8. Physical/Oceanographic aspects of CNMI fisheries**

**Table 8. Physical/Oceanographic aspects of CNMI fisheries.**

Themes/subthemes (counts)	Quote(s)
Weather, wind patterns (5)	<p data-bbox="586 432 1365 611">“As far as bonito, like Guam it’s been hit or miss. Guys have to go out further. Some runs closer in, but this past year and the beginning of this year has been unusually rough. Seems like weekly small craft warnings, so folks staying closer.” <i>(Weather, Wind patterns)</i></p> <p data-bbox="586 646 1365 751">“But it’s been a rough year on the water. We haven’t had a really good month of calm water. But other than that fishing’s been great.” <i>(Weather, Wind patterns)</i></p> <p data-bbox="586 787 1365 930">“Secondly, the weather just like Guam guy and [another fisher] said, weather has been rough year round. But when it comes down to current, depends where you’re fishing.” <i>(Weather, wind patterns)</i></p> <p data-bbox="586 966 1365 1144">“Before I go I always look at my tide chart. I try to avoid points of islands at high or low tide. Just a matter of knowing where to go to avoid the current. I was still able to fish at 20–25 mph winds. It’s just a matter of knowing the timing.” <i>(Weather, wind patterns)</i></p> <p data-bbox="586 1180 1365 1394">“For weather, my observation is between Guam up to 12 mi west of Goat Island, it’s been rougher than up here. And then the current is also between Rota and Guam, really strong. Stronger last year. From Tinian all the way up to Maug, water is a little calmer last year. And I agree, it’s cooler.” <i>(Weather, wind patterns)</i></p>
Water temperature (3) - PMUS (mahimahi) - ECS (atulai)	<p data-bbox="586 1430 1365 1646">“Temperature, I never used to pay attention to the temp sensor at Garmin, but this last year has been hovering around upper 70s. Usually 85–87. Lately appears water’s a little cooler. Maybe that’s why the mahi, wahoo, atulai runs have been good.” <i>(Water temperature, PMUS, mahimahi, ECS, atulai)</i></p> <p data-bbox="586 1682 1365 1822">“First couple of months, from January–March, temp’s been pretty cold. Water’s always been rough throughout that time period. I’d go out 2–3x/month. Fish weren’t biting as good as they used to.” <i>(Water temperature)</i></p>

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“I agree with what [another fisher] said about the water temperature, cold and super rough every day. Winds are never calm, but we still try to go out to keep up with our fishing habits.” (*Water temperature*)

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Currents (2)

“No drastic changes in currents other than the tide fluctuations. But we have noticed that with pickup in swell activity, current is a little out of whack. For bottomfish, we compensate a lot with heavier weights or waiting until the right time when tide hits. Just with rough conditions and bigger swells that seems to be most of the issues we’re facing.” (*Currents*)

“We’ve seen a lot of debris on the water, especially fish nets and buoys, metal tank with nets. There’s about 5 on the east side of Rota, 2 west of Goat Island, and one in Tinian. And then north of Saipan, saw about 4 up there.” (*Currents*)

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**Management Uncertainty**

No comments.

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## **Appendix A. Interview Guide**

### **ANNUAL FISHERMEN'S ASSESSMENT OF THE 2022 FISHING SEASON**

#### **ISLAND OR REGION FISHED:**

#### **NAME (optional):**

**a) NUMBER of TRIPS MADE:** Same, more, or less than previous seasons, and why? (e.g., available fish days due to weather conditions, availability of crewmembers, vessel issues, vehicle or trailer issues, absence or abundance of preferred targeted species, depredation concerns, etc.) Include all conditions (+ or -) that affected your ability to make trips.

**b) AT SEA CONDITIONS EXPERIENCED DURING TRIPS** (Changes in Weather than forecasted, current, wind, water temperature, murky waters, changes in bottom structure, other.)

**c) TARGETED SPECIES FOR THE SEASON** and your assessment of these trips. Good, excellent, bad or typical as compared to previous seasons. (provide species and your experience)

**d) DEPREDATION EXPERIENCES BY ALL PREDATORS** (Sharks, kahala, other)

**e) MARKET CONDITIONS:**

**f) OTHER:** Situations beyond your control that affected your ability to optimally fish during the 2022 season.