

2022 Hawai‘i 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 in the region. 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, 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 (PIFSC) 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 Hawai‘i fisher observations meeting

The Council convened a meeting on February 8, 2023, from 6–8pm (Hawai‘i Standard Time) to review observations collected in 2022 from Hawai‘i fishers. The meeting was attended by 18 Hawai‘i fishers (from the islands of Hawai‘i, Kaua‘i, Maui, and O‘ahu), 3 Council staff, and 2 social scientists from the National Oceanic and Atmospheric Administration (NOAA) Pacific Islands Fisheries Science Center (PIFSC). The meeting was facilitated by Clay Tam and Roy Morioka and notes were taken by a Council staff member and 2 PIFSC social scientists. Roy Morioka, Clay Tam, and Council staff member Zach Yamada streamlined the interview guide for 2023 (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 the Hawai‘i fishing community via their social networks to invite fishers to attend the meeting and contribute their observations for the year. Advisory Panel members are typically proficient using one or more gear types, have many years of fishing experience, and are well-informed in fishery changes. For the 2022 Hawai‘i fisher observations meeting, they tried to secure participation and gather data from current or past ‘highliners’ from all Hawaiian Islands with different fishery specializations, whether it was individuals that target archipelagic species using shoreline or spearfishing gear, venture from shore to fish from kayaks, or small boats that target Deep 7 bottomfish, uku, and pelagic management unit species. Highliners are those who have more fishery knowledge than less experienced fishers and thus may offer deeper insights.

Participants at the 2023 meeting included 4 Advisory Panel members and several non-commercial, part-time commercial, and commercial fishers. Out of 18 meeting attendees, 8 were affiliated with the Council in some capacity, either a Council member or one of its advisory bodies, but a majority of participants (10) had no Council affiliation. Many participants were from Hawai‘i’s most populated island, O‘ahu (8); 5 were from Hawai‘i Island, and 1 each from Kaua‘i and Maui.

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 SEEM¹ 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 Hawai‘i meeting are organized using the SEEM categories and additional subthemes, including management unit species categories, in tables below. Management unit species

¹ 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.

(MUS) categories include pelagic (PMUS), bottomfish (BMUS), and ecosystem components (ECS).

Results

Social

Customary exchange remained an important social and cultural component of both archipelagic and pelagic fisheries in Hawai‘i in 2022. Fishers reported fishing infrastructure challenges such as crowded boat ramps in Hilo, the loss of a charter weigh-in station in Kailua-Kona, maintenance needed on fish aggregating devices (FADs), safety issues from fishers that were unfamiliar with navigation channels in Kawaihae, and conflicts associated with private FADs (PFADs) offshore. The boat ramp crowding and infrastructure needs affect access for both archipelagic and pelagic fishing, whereas the FADs and PFADs affect fishing trips targeting pelagic species. Changes in social networks included older fishers exiting the fishery and new, less experienced fishers replacing them. COVID-19 continued to affect fishing operations, making it difficult to find crew at times and potentially leading to more crowded remote fishing spots. See Table 1 for more coding results and direct quotes from Hawai‘i fishers.

Table 1. Social aspects of Hawai‘i fisher observations.

Themes/subthemes (counts)	Quote(s)
Fishing infrastructure (11) <ul style="list-style-type: none"> - Boat ramps (5) - Loss of charter weigh-in station in Kona (2) - Fish aggregating devices (FADs) (2) - Safety issues - Conflicts 	<p>“Like he said, dredging. We haven’t dredged Kawaihae [Kawailoa?] boat harbor in 10 years. A lot of sailboats can’t go out even on high tide because they’re stuck inside. On Pohoiki side, they’re still out of commission; any time there’s a good bite, tuna... ono season is starting, going to start, and it’s going to get crowded. We’re trying to work with the state to understand there’s no room for all these trailers to be parked at the boat ramp during these seasons. [The state should] work with them so that when they park across the street they don’t get ticketed; folks who park on the road get ticketed, which is sad.” (<i>Fishing infrastructure, Boat ramps</i>)</p> <p>“I want to re-emphasize, in between Christmas and New Year I counted 55 trailers—parking was absolutely full, and you can’t park across the street. And that’s midday, when the night people are gone. We are trying to work with the legislature, but with DOBOR, Hilo gets the short end of the stick.” (<i>Fishing infrastructure, Boat ramps</i>)</p> <p>“Hilo is one busy place! I don’t know why they [the state] took off the spigots. I don’t know if they’re trying to save water; that’s a stupid thing—people are waiting to wash</p>

Themes/subthemes (counts)	Quote(s)
	<p>their boats. They should lower the pressure to save water. The pressure is so high it breaks the hose. It's ridiculous; there's parking for two, but only one spigot. Put the spigot back, please." (<i>Fishing infrastructure, Boat ramps</i>)</p>
	<p>"It's an oxymoron because we're experiencing the same issue. The water use is going to be there, either there or at home [to wash the boats]. That's DOBOR; we have to work with them." (<i>Fishing infrastructure, Boat ramps</i>)</p>
	<p>"There's a lot of pressure on our ramp. All the Pohohiki guys had come to Hilo." (<i>Fishing infrastructure, Boat ramps</i>)</p>
	<p>"I agree with what he said that the charter desk is important. We're a world-class fishery for marlin but we're not even in the magazines anymore. There's so much loss in that. I caught one of those big marlins and I wanted to use the scale but I had to call up [someone] to get that thing on the boat. I think it was worth having that [the charter desk] for all these reasons, but I don't know how it got lost. Is it because the people who lease that space in the corner are supposed to be keeping it going? The diving operator? Why wouldn't a world-class place like Kona have that advertising? And the data? We can't even sell it." (<i>Fishing infrastructure, Loss of charter weigh-in station in Kona</i>)</p>
	<p>"What happened is that the charter desk—the guys that had it went out of business. But the state has to keep the scale going, so the dive company is currently doing it, but after 4pm they are closed so you can't weigh your fish. And you can't weigh your fish until 9am, too. Whoever was running the charter desk went out of business and the divers don't like us at all. It's like that in Australia, too. They are required to let us use the scale and weigh the fish. They have one guy there from 9–4. Even when [another fish] has his tournaments, he has to make arrangements with the dive company to weigh after 4pm." (<i>Fishing infrastructure, Loss of charter weigh-in station in Kona</i>)</p>
	<p>"You asked about buoys—our buoys suck. With all that stuff that's around, none of them are working. There is no structure under them so they don't work. We don't have the</p>

Themes/subthemes (counts)	Quote(s)
	winds and currents like O‘ahu.” (<i>Fishing infrastructure, FADs</i>)
	“We had no FADs; we had one buoy. It’s sad. We need to do a better job without state FADs. They don’t hold any fish; they’re an old design. We saw back in the early 2000s when all of the state FADs were gone, the fish would return to their old migratory routes; we would catch them at the old ko‘as in Hilo Bay. This year, we didn’t see them on the ko‘as. We need to do a better job on state ko‘as. (<i>Fishing infrastructure, FADs</i>)
	“One of our regular offshore handliners tore up a couple units and are getting stuck in the harbor, and now several sailboats are stuck that can’t get out and now it’s more dangerous to navigate those waters. There is a safety issue there related to newcomers in the fishery and they want to get home and the river is running, and they don’t know what they’re doing. They don’t know how to navigate around the river running, which prevents people who do know what they’re doing from being able to pass by them. It’s especially bad for those with a single screw [fixed propulsion system that makes navigation more challenging, especially in reverse, compared to a twin screw].” (<i>Fishing infrastructure, Safety issues</i>)
	“They [‘ahi] bite around the rogue buoys. People are trying to own the ocean – ‘this is my buoy; you pay.’ We’ve had some problems with that. That’s about it, the change.” (<i>Fishing infrastructure, Conflicts</i>)
<p>Changes in social networks (8)</p> <ul style="list-style-type: none"> - COVID (2) <ul style="list-style-type: none"> • More people fishing remote spots • Could not secure crew during restrictions - Fishers exiting the fishery (2) 	<p>“I wasn’t planning on sharing, but something someone said did trigger a thought. I tend to fish in really remote areas because I like to get away. When COVID first started, those places were barren —no one around. I think COVID provided the opportunity for people to go to new spots, either because they had more time, if they were laid off, or needed food. In 2022, I now regularly see people in those remote areas; they’re not popular, not a lot people, but more than none. The spots that I typically go to have changed. This isn’t necessarily good or bad.” (<i>Changes in social networks, COVID, More people fishing remote spots</i>)</p>

Themes/subthemes (counts)	Quote(s)
<ul style="list-style-type: none"> - Changes in fishing effort (2) - Fewer akule boats <ul style="list-style-type: none"> • ECS (akule) - Social media 	<p>“COVID restrictions prevailed through March 27, 2022, affected ability to readily secure crews that affected number of trips during the quarter.” (<i>Changes in Social networks, COVID, Could not secure crew during restrictions</i>)</p> <p>“We have something to do with the spigot, too—in Maui, we have the same thing. They said it’s because of the drought. I’m going back further then up to 2022. What I have observed after the sampan days, a new generation of fishermen—they are young, newbies. The older generation is giving up.” (<i>Changes in social networks, Fishers exiting the fishery</i>)</p> <p>“The thing in Hilo is that we’ve had a lot of old timers stop fishing, and some have passed away.” (<i>Changes in social networks, Fishers exiting the fishery</i>)</p> <p>“I’m talking about my friends who go from Diamond Head or Barber’s Point. They seem to be catching the smaller ones not the bigger ones, not getting onaga. There seem to be a lot of recreational fishermen, the “weekend warriors”, hitting the same spots over and over.” (<i>Changes in social networks, Changes in fishing effort</i>)</p> <p>“The newer generation, their style of fishing is all in and out. This was starting before the pandemic. The style of fishing has changed – hardly no overnight fishing or multi-day fishing now. They leave at daybreak and are back by 7. Hardly anyone going out overnight or multi-day fishing. Fishers who anchor down stay longer in one spot. From co-op member – even if the anchor is down, they stay at one spot if biting, but if not, they move to another spot.” (<i>Changes in social networks, Changes in fishing effort</i>)</p> <p>“Not a lot of akule boats in the Bay.” (<i>Changes in social networks, Fewer akule boats, ECS, akule</i>)</p> <p>“The only advertising Kona has been getting is on Instagram. It worked—people were flying in for the weekend when those big fish were here. That’s pretty much our only advertising—Instagram and Facebook.” (<i>Changes in social networks, Social media</i>)</p>

Themes/subthemes (counts)	Quote(s)
Customary exchange (4) <ul style="list-style-type: none"> - PMUS - BMUS - ECS 	<p>“A lot of the fish aren’t getting counted; for tuna, the only ones counted are those sold, not those “getting cut” [and shared / given away / consumed directly].” (<i>Customary exchange, PMUS</i>)</p> <p>“We didn’t fish very much this past year. We only have a small boat—a 17-footer—fishing mostly on the south and west side, we didn’t go very far. It was just one of those years that we just didn’t fish. We did some bottomfishing; we have some spots where we can go, catch enough to give to our families and give away.” (<i>Customary exchange, BMUS</i>)</p> <p>“The guy I usually go fishing with went in for surgery, which took him out for a few months. He’s been going out now, catching off the shoreline pretty much at will. Some he keeps, some give away.” (<i>Customary exchange, ECS</i>)</p> <p>“The fish seem to be there. We seem to be catching enough to eat, pay for expenses, give to neighbors and friends.” (<i>Customary exchange</i>)</p>

Economic

Economic conditions were mixed; most O’ahu fishers reported good market conditions for pelagic species and bottomfish due to their closer proximity to the United Fishing Agency Auction in Honolulu. Markets on Hawai’i Island for Deep 7 bottomfish species such as opakapaka were challenging at times. Fuel prices were up for most of the year, as were prices for bait, tackle, and ice, with a slight dip late in the year. Fewer tuna imports may have helped secure better market prices for Hawai’i caught fish. Full coding results and quotes are displayed in Table 2.

Table 2. Economic aspects of Hawai’i fisher observations.

Themes/subthemes (counts)	Quote(s)
Market conditions <ul style="list-style-type: none"> - Fish prices (11) <ul style="list-style-type: none"> • BMUS (6) (opakapaka onaga, kalekale, ‘ehu) 	<p>“I was just going to say, last year the price of fish stayed really good the whole year. Could be because we had a couple good years of tourism that kept the prices up.” (<i>Market conditions, Fish prices</i>)</p>

Themes/subthemes (counts)	Quote(s)
<ul style="list-style-type: none"> • PMUS (5) ('ahi, monchong, mahimahi, ono) • uku - Fuel prices (3) - Ice (2) - Fewer tuna imports - Bait prices 	<p data-bbox="610 306 1378 411">“We had some flooding of the market over the summer when Suisun [Hilo fish market] stopped accepting paka.” (<i>Market conditions, Fish prices, BMUS, opakapaka</i>)</p> <p data-bbox="610 443 1378 730">“There are new places to sell. The co-op, we don’t have a contract with one place; they take it wherever they want. Some people get double digits—\$10–11 per pound. Only one guy targets uku, goes to the banks. Mostly bottomfishing, redfish, Deep 7. As far as I know, the prices are holding strong. You don’t see much Deep 7 in the market. My spot is more towards Hāna. (<i>Market conditions, Fish prices, uku, BMUS</i>)</p> <p data-bbox="610 768 1378 1094">“January/February: UFA prices excellent for Deep 7; Kalekale prices up from 2021 by \$1–2, return of Opakapaka met with good prices and drop in Onaga prices, Ehu prices excellent; March: Deep 7 prices still holding, average prices for the first quarter of 2022 Kalekale \$6-8, Opakapaka \$8–11, Ehu \$8–12, Onaga \$10–16; April: Deep 7 prices still excellent, triggered by the scarcity of Deep 7 fish being landed; May: Deep 7 prices still excellent, triggered by the scarcity of D7 fish being landed;</p> <p data-bbox="610 1129 1378 1417">June: prices still excellent, triggered by the scarcity of Deep 7 fish being landed; Slow LL landings resulted in better than average Yellowfin tuna prices at UFA; Yellowfin tuna fishing sporadic; July: Prices excellent for Deep 7; October/November: prices excellent for Deep 7; December: Prices excellent for Deep 7 Christmas to New Year’s holidays.” (<i>Market conditions, Fish prices, BMUS, kalekale, opakapaka, ehu, onaga, PMUS, yellowfin tuna</i>)</p> <p data-bbox="610 1453 1378 1707">“Fish prices on O‘ahu, I think, is a completely different story from other islands. We never really had a time when prices dropped. Other than around Christmas, where there was a whole lot of [something]. If they want to sell onagas outside, they will get \$11 a pound in cash. \$8 a pound for paka. People will take as much as they can get.” (<i>Market conditions, Fish prices, BMUS, onaga, opakapaka</i>)</p> <p data-bbox="610 1743 1378 1879">“In that pocket from the valleys, it’s fishable while all the other places are not. Those are the times you have to take the fish to the block. They are shipping onaga, 500 pounds. Only average \$7 after the block fee, freight. The</p>

Themes/subthemes (counts)	Quote(s)
	<p>bottomfish market is not like it was before. You can flood it and you will get a lower price. One fishery has to be steady. When we had the NWHI fishery, the price was steady. Now there's times when you only have a few hundred pounds on the block, and you get \$12 a pound. You catch more than 500 pounds and you need to have a marketing strategy." (<i>Market conditions, Fish prices, BMUS, onaga</i>)</p>
	<p>"['Ahi] prices are good. Still a lot of peddling on the side." (<i>Market conditions, Fish prices, PMUS, 'ahi</i>)</p>
	<p>"Market paying well. Increased around September. November, lot of small fish. La Niña. Hopefully El Niño will change conditions. Summer was deeper. Market-wise, demand on the lower size." (<i>Market conditions, Fish prices, BMUS, PMUS, yellowfin tuna</i>)</p>
	<p>"One Hilo boat that is very effective at catching monchong, but I don't think they sell so the appearance of monchong in catch records is probably not there." (<i>Market conditions, Fish prices, PMUS, monchong</i>)</p>
	<p>"Now prices are decent with the Super Bowl and the white fish are still hot. What we're missing is Japanese tourists. Monchong is \$9 every day at the auction. Selling a lot— monchong, mahimahi, ono hotel demand. Mahimahi catches haven't been strong, and more of the smaller sizes, but the prices are still strong." (<i>Market conditions, Fish prices, PMUS, monchong, mahimahi</i>)</p>
	<p>"In 2021 a lot of tuna imports were restricted, so the price for us in 2021 was a better year because the cost of production was lower and there was demand for our fish. In 2022 they [imports] all started selling here." (<i>Market conditions, Fish prices, Fewer tuna imports</i>)</p>
	<p>"March: Bulk purchase diesel fuel increased by \$.80/gallon through March, bait and ice prices also increased, credit card sales now subject to convenience fees of 3–4%; September: diesel fuel prices skyrocketed by another \$1/gallon; bait prices increased by 21%; December: Diesel prices reduced by \$1.00/gal (thank</p>

Themes/subthemes (counts)	Quote(s)
	God!); no change for bait prices. (<i>Market conditions, Fuel prices, Bait prices, Ice</i>)
	“Gas prices were a big thing in 2022. Gas prices go up, you gotta plan your expenses.” (<i>Market conditions, Fuel prices</i>)
	“The cost of diesel went to \$5. 2022 was a harder year than 2021.” (<i>Market conditions, Fuel prices</i>)
	“Suisun—the ice machine was broken from the start of the year and that had a big impact. If you were going to sell to Suisun, you’d get your ice from them for 4–5 cents per pound. Now, you gotta go to Hilo Fish for ice, or 7–11, but you’re going to be paying more. That really affects your [fishing] effort.” (<i>Market conditions, Ice</i>)

Ecological

Biological

Fishers reported greater abundance and availability of archipelagic, pelagic, bottomfish species, and forage items with a few exceptions. One exception is West Hawai‘i fisheries, where abnormal currents affected fish aggregations including aku, which were more difficult to find and those caught were in smaller size classes. Sharks continued to predate during fishing trips and a few fishers reported predation by porpoises on O‘ahu bottomfish trips. Table 3 presents coding results and fisher quotes for biological aspects of Hawai‘i fisheries.

Table 3. Biological aspects of Hawai‘i fisher observations.

Themes/subthemes (counts)	Quote(s)
Juvenile and adult recruitment (32)	“I’m retired so I don’t fish very much anymore. I only went out 4–5 times in 2022. I caught about 100 lb of ‘ōpelu and 4–6 ono, and that’s about it.” (<i>Juvenile and adult recruitment, Amount of fish, ECS, ‘ōpelu</i>)
- Amount of fish (24)	
• ECS (‘ōpelu, nabeta, ‘ō‘io, nabeta, nehu)	“We’ve been fishing on windward side, starting 2021 catching nabeta and juvenile paka in a certain spot (10–12 inch size) where the paka hadn’t been seen before. They just showed up and have been sticking around. Really large schools, just off the bottom, by Sacred Falls. Flat
• PMUS (‘ahi, ono, bigye tuna, marlin)	
• BMUS	

Themes/subthemes (counts)	Quote(s)
<ul style="list-style-type: none"> • Uku 	<p>sand.” (<i>Juvenile and adult recruitment, Amount of fish, ECS, nabeta, BMUS, opakapaka</i>)</p>
<ul style="list-style-type: none"> - Size of fish (8) 	<p>“I guess the ‘ōpelu did bite more this year than other years—more plentiful. The size maybe wasn’t bigger, but there was a lot more.” (<i>Juvenile and adult recruitment, Amount of fish, ECS, ‘ōpelu</i>)</p>
<ul style="list-style-type: none"> • PMUS (‘ahi, bigeye tuna, marlin, striped marlin) 	<p>“‘Ō‘io fishing was moderate; nothing to brag about.” (<i>Juvenile and adult recruitment, Amount of fish, ECS, ‘ō‘io</i>)</p>
<ul style="list-style-type: none"> • BMUS (onaga, ‘ehu, opakapaka) 	<p>“I talk to my friends with some spots at Barber’s Point, Pearl Harbor, and they don’t catch as much as they used to. Me personally and others who go for the Deep 7, we used to be able to get aku, ‘ōpelu easily—buy them or trade off—but it’s been more difficult this last year. A lot of my friends who troll, we used to trade off fish. Even them trolling are having trouble catching aku. I think it’s the people hitting the buoys, catching fish under 2–3 pounds and selling it. I think this is a problem.” (<i>Juvenile and adult recruitment, Amount of fish, PMUS, aku, ECS, ‘ōpelu</i>)</p>
	<p>“Nabeta—I’ve seen more than I’ve ever seen.” (<i>Juvenile and adult recruitment, Amount of fish, ECS, nabeta</i>)</p>
	<p>Got choke nehu in the bay. (<i>Juvenile and adult recruitment, Amount of fish, ECS, nehu</i>)</p>
	<p>“For Hilo trollers, it’s the worst season we’ve ever had. In the August tournament, there were no qualifying flag fish, which never happened before. Trollers [for tournaments] run on a pre-set schedule—the first Sunday of every month. How that aligns with the moon and tides and likely bites is random [which might obscure observations].” (<i>Juvenile and adult recruitment, Amount of fish, PMUS</i>)</p>
	<p>“For the tuna, I would say for the past 3 years we’ve had tuna all year round. In the past, every year since the ‘70s there were tuna at the ko‘a at those three sites—Keahou, Kahulu‘u. If it’s Kona current you have to go to [location]. The fish would not be as much as tuna.</p>

Themes/subthemes (counts)	Quote(s)
	Everywhere there's no tuna, but at least Kona has some tuna. Fish are way inside." (<i>Juvenile and adult recruitment, Amount of fish, PMUS, 'ahi</i>)
	"The 'ahi has been staying around." (<i>Juvenile and adult recruitment, Amount of fish, PMUS, 'ahi</i>)
	"There was a striped marlin pulse in November and December; I don't know if this is normal." (<i>Juvenile and adult recruitment, Amount of fish, PMUS, striped marlin</i>)
	"2022 from the longline fishery was kind of up and down. The catch rates were on the lower side for bigeye in March to September. It wasn't great for bigeye." (<i>Juvenile and adult recruitment, Amount of fish, PMUS, bigeye tuna</i>)
	"Bottomfish, they've been killing it. But the problem is marketing. Because they catch so much it's hard to sell it for a good price. It's not a waste, but it's hard to sell it. I think Kona is coming back to its norm but it took a lot of the year to get there." (<i>Juvenile and adult recruitment, Amount of fish, BMUS, ECS, nehu, 'ahi</i>)
	"It's not the season for uku yet. In 2022, people weren't going for uku yet because there was a lot of 'ahi; they were going up north instead and catching redfish. There were a lot of redfish this year." (<i>Juvenile and adult recruitment, Amount of fish, BMUS, uku</i>)
	"I did go out with [a friend] for the first time bottomfishing overnight. Really nice—hardly any current, wind. Out at Penguin Banks. Not a lot of fishing action—caught some 'ehu, onaga. Not real big, but nice size." (<i>Juvenile and adult recruitment, Amount of fish, BMUS, 'ehu, onaga</i>)
	"I can't really say whether it has been a better or worse season." (<i>Juvenile and adult recruitment, Amount of fish</i>)
	"I was trying to say if the fish stock is poor. He says no, the fish are there, they just stop biting. So if they stop biting, they [the fishers] just move around. They're still getting 300–400 pounds per trip, with only 8 hours of fishing. Redfish. We can't complain about the depletion

Themes/subthemes (counts)	Quote(s)
	of the stock.” (<i>Juvenile and adult recruitment, Amount of fish, BMUS</i>)
	“The stock, recruitment seems to be good. Wind—they’re taking a beating, the small boat fleet especially. They anchor down, stay usually overnight. ‘If no bite, I moving’ kind of thing. Not much information on the trolling.” (<i>Juvenile and adult recruitment, Amount of fish, BMUS</i>)
	“Redfish bit pretty good, too. Bottomfishing was pretty good—we caught... we probably shouldn’t be going out that far in our little boat. Catching onagas and ‘ehus, mostly onagas though.” (<i>Juvenile and adult recruitment, Amount of fish, BMUS, onaga, ‘ehu</i>)
	“I was only able to make four trips so far since finally getting the boat running—all to Makapu‘u, O‘ahu. Noticed more uku than paka on the south side of the ledge, and finding more piles of kalekale and 3–5 pound paka on the north side of the ledge. Found larger fish in the shallows.” (<i>Juvenile and adult recruitment, Amount of fish, BMUS, opakapaka, kalekale, uku</i>)
	“We had a nice late ‘ahi bite—September, October, almost to Christmas, and still biting. Tuna have been around pretty good. I thought 2021 was one really slow year for ‘ahi, but last year was pretty good.” (<i>Juvenile and adult recruitment, Amount of fish, PMUS, ‘ahi</i>)
	“Ono were kind of slow [in 2022]; 2021 ono were good, but 2022 they never bit as much as they should.” (<i>Juvenile and adult recruitment, Amount of fish, PMUS, ono</i>)
	“‘Ōpelu fishing pretty good; the ledges look pretty lively. I heard somebody mention about the baby paka; we get that, too. We usually find them 80–100 feet. Anywhere you have freshwater coming out you’re going to find them—Port Allen in Hanapēpē, Pokole Point on west side. Where rivers come out you’re going to find plenty. Especially when rains come out by ditches. Shaka size kine, all hanging out together. When they get big, the

Themes/subthemes (counts)	Quote(s)
	uku, too.” (<i>Juvenile and adult recruitment, Amount of fish, ECS, ‘ōpelu, BMUS, opakapaka, uku</i>)
	“I took a class and they told me about El Niños. I told him we have fish jumping 365 days a year, Keahole Point to South Point. You used to get two ‘ahi, 208 and 210 [pounds], you would get them almost the same in pairs. Last year and this year, fish over 150 pounds was a rare thing; even over 120 points was rare—the fish were all small.” (<i>Juvenile and adult recruitment, Size of fish, ‘ahi</i>)
	“I was asking him about the size—they’re smaller onaga, ‘ehu, paka. But the spawning is good; recruitment is good for bottomfish. For trolling for bigeye tuna, they were also biting good at one time; they were jigging for them but not so many boats use the dangles. Now it’s slowing down.” (<i>Juvenile and adult recruitment, Size of fish, BMUS, onaga, ‘ehu, opakapaka, PMUS, bigeye tuna</i>)
	“For trolling, we caught some ahi—120, 150 pound size. The times we went out, we had fun.” (<i>Juvenile and adult recruitment, Size of fish, PMUS, ‘ahi</i>)
	“I think what saved the [deep-set longline] trips was yellowfin, 50–70 pound size class, nice condition. (<i>Juvenile and adult recruitment, Size of fish, ‘ahi</i>)
	“It was the easiest marlin over 200 [pounds] I ever caught; came up dead in 30 minutes. Took longer to get into the boat than to get to the boat.” (<i>Juvenile and adult recruitment, Size of fish, PMUS, marlin</i>)
	“Trolling for ‘ahi was okay this year. I think we only caught about 5. The large shibis, had a lot of piles near buoys on south shore—people were catching 8–10 in one day.” (<i>Juvenile and adult recruitment, Size of fish, PMUS, ‘ahi</i>)
	Mid-summer, May to August, for Hilo Trollers [Fishing Club], aku were really small. Someone said warmer temperatures.” (<i>Juvenile and adult recruitment, Size of fish, PMUS, aku</i>)
	“January/February: Primarily opakapaka, kalekale, kahala, taape, hauliuli; First time that the aggregation of

Themes/subthemes (counts)	Quote(s)
	<p>large (8–12 lb) occurred at this location after 5 year absence; Possibly attributable to cooler water; assemblage of forage fish (possibly Hauliuli; etc.). Mixed sizes observed—opakapaka-smaller fish 2–3 lb although few, mixed in with larger fish; smaller specimens probably were there but hook (12/0, BKN 26) size limited the catching of smaller fish; Kalekale larger than average (2–3 lb) adding to improved Deep 7 CPUE; averaged 250 lb mixed Deep 7 only over 4 trips; Hooked and released two rough skin walu (escolar) one about 60”; March: Day trips, onaga bite was good (small fish 1.5–3.0 lb); small ehu (1 lb), Night trips opakapaka and kalekale absent at January and February 2022 locations, Aggregation of large paka at known spots absent and spent 3 hours searching for them, but found a distributed aggregation of smaller 1.5–3 lb opakapaka that saved the trip, search time increased although many “blind drops” were made on suspected targets without bites or catch, at 0330 following morning a school of opakapaka was located in 65 fathoms that produced 35 pieces in the 1.5–3.5 lb size that bit until 0500. Taape also in the mix, opakapaka less than a pound in good condition were released; forgot to tag.</p> <p>July: Made one pelagic troll trip to participate in Waialua Boat Club July 4th Tournament off Waianae Coast—0-0-0 = no strikes—no hook-ups—none landed; offshore life absent saw three flying fish and two schools of tiny aku all day; very few birds.</p> <p>September: Made two pelagic troll trip to participate in Waialua Boat Club Memorial Day and Labor Day Tournaments off of South Oahu. Landed two ‘ahi, 70 lb and 52 lb; Also made 2 bottomfish 2022 trips and 2 Deep 7 trips. Pelagic and D7, larger opakapaka being caught; presence of walu and associated predation up. Large uku appeared on Penguin Banks w/the large south swell which was unusual for October.” (<i>Juvenile and adult recruitment, Size of fish, BMUS, opakapaka, kalekale, taape, ehu, uku, PMUS, aku, ‘ahi, walu</i>)</p>
Forage items (8)	“There’s a lot of baitfish out there in Kona, which is why we have a steady season.” (<i>Forage items, Baitfish</i>)
- Baitfish (3)	

Themes/subthemes (counts)	Quote(s)
- ECS	“A lot of bait [fish] all over the place.” (<i>Forage items, Baitfish</i>)
<ul style="list-style-type: none"> • nehu • triggerfish • sardines • herring • halālū 	“If you go stop and eat lunch, around 1000 fathoms—I always stop and eat lunch when it’s not the best time for fishing—your depth recorder would be full of bait. All the time I see a lot of big fish under my boat—the screen is red.” (<i>Forage items, Baitfish</i>)
- PMUS	
<ul style="list-style-type: none"> • ‘ahi • mahimahi • aku 	“Get nehu right now; last ball I seen in Kaula. Now the ika is still pretty heavy; aku, I cut the stomach and only ink came out. As far as bait goes, got plenty right now. The bite not so good, you really got to chase them, light line, light lure. Plenty aku right now.” (<i>Forage items, ECS, nehu, ika, PMUS, aku</i>)
- ika (squid)	“Honokohau Harbor has huge piles of halālū.” (<i>Forage items, ECS, halālū</i>)
	“I mainly do diving, shoreline fishing. Last year wasn’t too eventful, about average. An ito of halālū around the Ko‘olauloa coast. Sewage outflow at Kaka‘ako Park had hundreds of fishers for months. Started with just a few but, when packed, would get up to 50-100 people at a time catching halālū and sardines at the sewage outflow.” (<i>Forage items, ECS, halālū</i>)
	“This year there’s an anomaly in Kona; lots of nehu and ‘ahi in Kona, and lots of triggerfish in the ‘ahi stomachs.” (<i>Forage items, ECS, nehu, triggerfish, ‘ahi</i>)
	“In terms of popularity, sure. The island is only so big. I’m a real nerd so I keep a pretty big spreadsheet of what I catch. On the kayak, I probably went out the least I ever did in the last 3 years in the latter half of 2022 due to conditions. It seems like we had more of a north wrap than usual; swells and waves prevented me from going out. I was doing that mahi stomach sampling so I got to talk to people. People kept showing us pictures. One of the main [mahi] stomach contents is moana, not yellow-striped goatfish; they seem to be eating different goatfish offshore.” (<i>Forage items, PMUS, mahimahi, ECS, moana</i>)

Themes/subthemes (counts)	Quote(s)
Depredation (8)	“Good redfish bite, but a lot of sharks.”
- sharks (8)	<i>(Depredation, Sharks)</i>
- dolphins/porpoise (2)	<p>“Plenty shark predation.” <i>(Depredation, Sharks)</i></p> <p>“I haven’t gone as much as I did in 2021. I bottomfished for the Deep 7, launch out of Hawai‘i Kai or Sand Island and go to the banks. Usually go more towards Fingers. Experienced a lot of problems with sharks. 140–150 fathoms or even mid-depth or swimming under the boat. I’m the type of fisherman that doesn’t like to stay there and feed the sharks. We make a couple drops, get hit by the sharks, and move. Sharks are a real big problem, especially on the south tip side.” <i>(Depredation, Sharks)</i></p> <p>“With them [juvenile opakapaka, nabeta], there seem to be a lot of small sharks.” <i>(Depredation, Sharks)</i></p> <p>“Akule fishing was junk last year. Predation from dolphins and sharks.” <i>(Depredation, Dolphins, Sharks)</i></p> <p>“Didn’t go out too much due to weather. Times we did go out, current was strong or predation.” <i>(Depredation, Sharks)</i></p> <p>“Shark and porpoise problems are back.” <i>(Depredation, Sharks, Porpoise)</i></p> <p>“January/February: suspect walu taking kalekale as several kalekale and one paka came up badly damaged by teeth marks; March: moderate—during the morning bite one large silky and several smaller unidentified sharks took 8.75 pieces of opakapaka.</p> <p>August: Nominal depredation; September: Light depredation; presence of walu and associated predation up. October: Increasing shark and walu depredation; December: Nominal 2–5 fish per trip.” <i>(Depredation, BMUS, kalekale, opakapaka, PMUS, walu, Sharks, Silky sharks)</i></p>
Phenology	“I noticed what has happened in the last couple months, these anomalies [the aforementioned influx of nehu on the Kona coast] have happened over a period of time. I’ve
- Migration patterns	

Themes/subthemes (counts)	Quote(s)
<ul style="list-style-type: none"> - PMUS (‘ahi) - ECS (nehu) 	<p>been fishing full-time since 1986, part time my whole life. The anomalies happening in the last month and a half also happened in the late ‘80s in June; in the 90s in April the same thing; in the early 2000s; and now these things happen periodically with the amount of nehu and ‘ahi. (<i>Phenology, Migration patterns, PMUS, ECS</i>)</p>

Physical/Oceanographic

O‘ahu fishers reported few issues with currents, but Kona fishers explained that their regular current has changed due to La Niña and/or increases in easterly wind days. The departure from the regular current has negatively affected fishing in west Hawai‘i. Winds were up and down with extended periods of both strong and light winds.

Table 4. Physical/Oceanographic aspects of fisher observations

Themes/subthemes (counts)	Quote(s)
<p>Currents (6)</p> <ul style="list-style-type: none"> - PMUS (aku) - ECS (akule, ‘ōpelu) 	<p>“January/February: Generally good; one trip current kept changing affecting drift to target aggregation of fish; March: Currents good. August: Currents good; September: currents mixed; October: Mixed according to trip assignments; one week of large south swells; November: currents confused; December: Moderate to quiet seas upset by high swells and waves at times.” (<i>Currents</i>)</p> <p>“...and the currents have all been kind of slack. I think 2022 was a kind of good year.” (<i>Currents</i>)</p> <p>“The only things I get with the current, we had a couple windows that were nice. Water temperature, we didn’t have a good gauge, but the bait gets thick. So the water on the bottom must be good. Most of the fishers around here use blood bait – aku, akule, ‘ōpelu. There’s no real status report form the co-op guys on temperature. Other than that, the current depends on where you go. Kanai to Kaho‘olawe, you can travel 10 miles and there’s no current. It’s been like this for years; nothing that I would consider is a big change from anything.” (<i>Currents, ECS, akule, ‘ōpelu, PMUS, aku</i>)</p>

Themes/subthemes (counts)	Quote(s)
	<p>“Although I’ve only made four trips, current pattern seems to be changing; not as much strong southerly current making fishing on north side easier when porpoise not around. Still limited in time so missed a lot of fishable days, and fished some marginal conditions but feels good to be back!” (<i>Currents</i>)</p>
	<p>“The currents are fairly steady except for full moons; they pull hard from north on low tides. The tides were looking like the highs were really high. Sometimes there’s not enough concrete to keep the water off the roads. [Mentions king tides.] It’s been like this for a long time; the storm surges even on south side because of north wrap. I don’t know how they do the floating docks in Haleiwa.” (<i>Currents</i>)</p>
	<p>“Currents in Kona—a lot of easterly wind that causes variable current. The news might get it right 50% of the time. It gets variable still. Where I fish on the grounds, there hasn’t been life on the grounds for the past 2–3 years because there hasn’t been a steady current.” (<i>Currents, BMUS</i>)</p>
Weather/wind patterns (3)	<p>“The water was a lot better than what I was used to. I noticed that I was taking more leaves from work than I should, so the weather must have been better than usual.” (<i>Weather</i>)</p>
	<p>“Now the wind is strong. I’ve been mostly fishing charter, trolling kine. The weather, we’ve been having some big storms coming in but nothing out of the ordinary.” (<i>Weather/wind patterns</i>)</p>
	<p>“January/February: Winds moderate to calm 0-5 knots; Occasional gusts (10–15 kt) due to rain squalls; March: winds moderate to calm; April: Strong winds and rough seas limited small boat fleet’s Deep 7 effort as exemplified by the small landing recorded at UFA; May: Strong winds (15–25 kt) and rough seas limited small boat fleet’s Deep 7 effort as exemplified by the small landing recorded at UFA; June: Strong winds (15–25 kt w/ gusts to 35 kt) and rough seas (small craft</p>

Themes/subthemes (counts)	Quote(s)
	advisories limited small boat fleet's Deep 7 effort as exemplified by the small landing recorded at UFA; July: Month began with continuing strong winds (15–25 kt w/gusts to 35kt) and rough seas 8-9 feet at times limited small boat fleet's Deep 7 effort as exemplified by the small landing recorded at UFA; August: Periods of calm conditions availed; September: Continuing strong winds (15–25) and waves 8-9 feet limited small boat fleet's Deep 7 effort; October: Continued strong winds (15-20 kt) with rough seas 8–9 feet at times; November: Month had strong winds (15–20 kt) and rough seas 8–12 feet at times; December: Unusual for time of year; Month was blessed with several windows of light winds with blustery conditions between.” (<i>Weather/wind conditions</i>)
Water temperature (2)	<p>“I think the surface temperatures were pretty high for a while.” (<i>Water temperature</i>)</p> <p>“Seems like the water is pretty steady, stays around 79 [°F]. Doesn't change much. Nothing out of the ordinary.” (<i>Water temperature</i>)</p>
Freshwater flow	“Definitely. There's a lot of freshwater there lately.” (<i>Freshwater flow</i>)

Management Uncertainty

The comments related to management uncertainty dealt with the lack of data collection from unsold fish caught by Kona fishing charters, the lack of change in the formerly closed bottomfishing area off of Makapu'u, and the need for Hawai'i fishing communities to share the message of fishing's importance.

Table 5. Management aspects of fisher observations.

Themes/subthemes (counts)	Quote(s)
Data collection - PMUS (marlin)	“There is concern because 90% of the catch of blue marlins, over 35 blue marlin caught already this year, 8 over 500 pounds. Nobody puts tags in them. We just took pictures and let them go. We are having a hard time getting the tags from NOAA. In the old days we used to be able to get tags and put tags in all of the fish. It's hard to get

Themes/subthemes (counts)	Quote(s)
	<p>tags from San Diego or Long Beach or wherever NOAA is there. We save the tags we have for the tournaments. Nobody's recording this; only the fishermen are recording this themselves. When you let go of 90% of the fish, none of them get recorded on the CML. They're supposed to but who knows who is reporting. We don't have the charter desks keeping records anymore. Everyone would call in to put their name on the board. We don't have that anymore." (<i>Data collection, PMUS, marlin</i>)</p>
BRFAs	<p>"Makapu'u – myth of the BRFAs [bottomfish restricted fishing areas]. They closed it off for 10 years. The activity hasn't changed. Fish aren't any bigger. All the work of folks and fishery-independent research that went into ACL and finally convinced the state to open up those resources, allow people to fish closer to O'ahu and not have to go across the channel when the weather gets bad. Good for personal safety. As far as myself, I don't go fishing much." (<i>BRFAs</i>)</p>
Importance of fishing	<p>"Political conditions—it's important to get across how important the fisheries are; stick together getting that message across." (<i>Importance of fishing</i>)</p>

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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.