

Maunalua Bay

Lawai'a in Training Handbook

Preface

This document was developed to provide information on the top 15 significant fished species in Maunalua Bay, as well as the reasonings behind rules and best practices. This information is intended to educate users about responsible and sustainable use of Maunalua Bay's fishery resources.

The determination of fish significance for this project was based off of 1) targeting effort by bay fishers, 2) the ecological roles of fish as state indicator species, 3) cultural use, and 4) community importance based off of input from local NGO's.

Included in this packet:

- Background information on fish
- Rules and regulations for each fish
- Peak spawning seasons
- Size at maturity
- Pono fishing practices

About the Authors

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Maunalua Bay

Top 15 Significant, Targeted Species

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- **Fork-Length:** Straight line distance from tip of snout to middle edge of tail.
- **Size at Maturity:** The weight or length (fork length) at which 50% of fish of a given sex reach reproductive maturity.
- **Endemic:** Native and restricted to a certain place
- **Kapu:** Hawaiian word for a set of rules or prohibitions
- **Open Season:** The season during which it is legal to catch fish.
- **Closed Season:** The season during which it is illegal to catch fish.
- **Bag Limit:** A regulation imposed on fishermen restricting the number of animals within a specific species or group of species they may kill and keep.
- **Minimum Landing Size:** The minimum landing size (MLS) is the smallest fish measurement at which it is legal to keep or sell a fish.
- **Best Practices:** Best practices for harvesting fish, with generational sustainability of fish stocks as the main priority.
- **State Indicator Species:** Indicator species are those which are indicative of the overall condition of the ecosystem. The Hawaii Coral Reef Strategy is a collaborative project by DAR, DLNR and NOAA that aims to increase the abundance and average size of ten targeted coral reef fisheries species critical to reef health and ecological function. These state indicator species were organized into 3 tiers in order of overall significance as a proxy of significance to reef health.
- **DLNR:** Department of Land and Natural Resources
- **NOAA:** National Oceanic and Atmospheric Administration
- **CBSFA:** Community-Based Subsistence Fishing Area

Pono Fishing Practices

- Only take what you need
- Catch fish according to season
- Use the right fishing equipment
- Rotate grounds
- Clean and nurture your harvest area
- Make your own observations
- Teach the youth

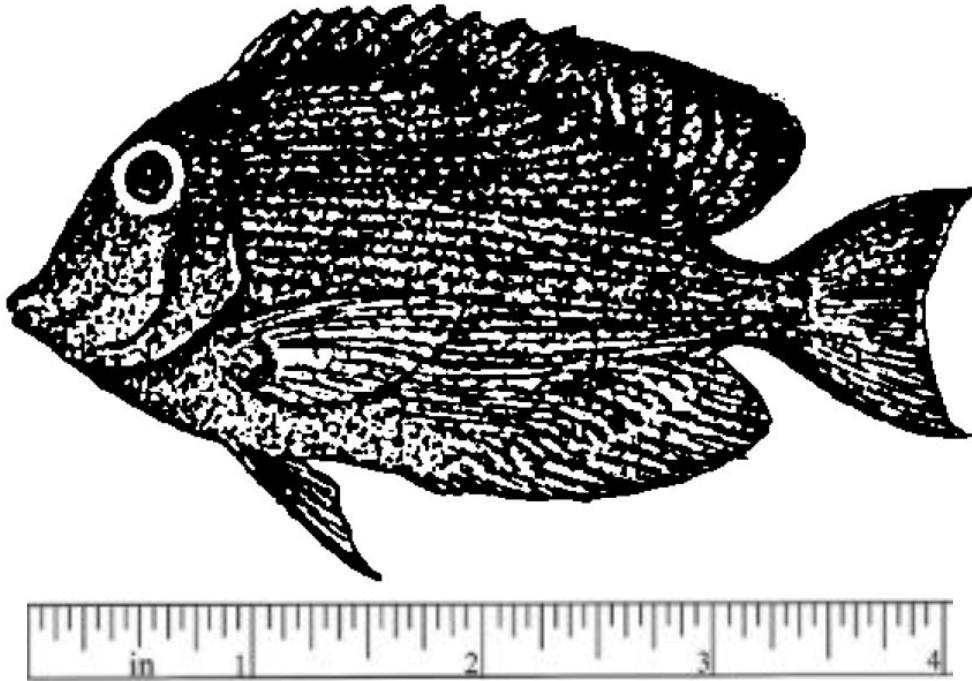
Kole

Goldring Surgeonfish
Ctenochaetus strigosus

Rules/Special Restrictions: None

Peak spawning season: March-June

Size at maturity: Males ~4", Females ~3.3"



Description: Dark brown with about 35 light blue horizontal lines extending into the fins, small blue spots on the head, bright yellow ring around the eye; single retractable caudal spine on each side.

The Kole or Goldring Surgeonfish are common to Hawaii's reefs. Kole are detritivores, meaning they consume decomposing plant and animal materials and are key to nutrient cycling. 'Kole', which means raw in Hawaiian, reflects the manner in which Hawaiians preferred to consume this fish species. A 2014 report found that all Kole sampled in the Maunalua Bay area reached the smallest size at maturity compared to other locations sampled.

While no regulations exist for the management of Kole, best harvesting practices should consider respecting peak spawning season (March-June) and should account for size at spawning maturity. An example of proposed fishing rules for a subsistence fishing area on Maui, proposed sustainable harvest of Kole as: a bag limit of 20 individuals per day, and a minimum fork length of 5 inches.

‘Opelu

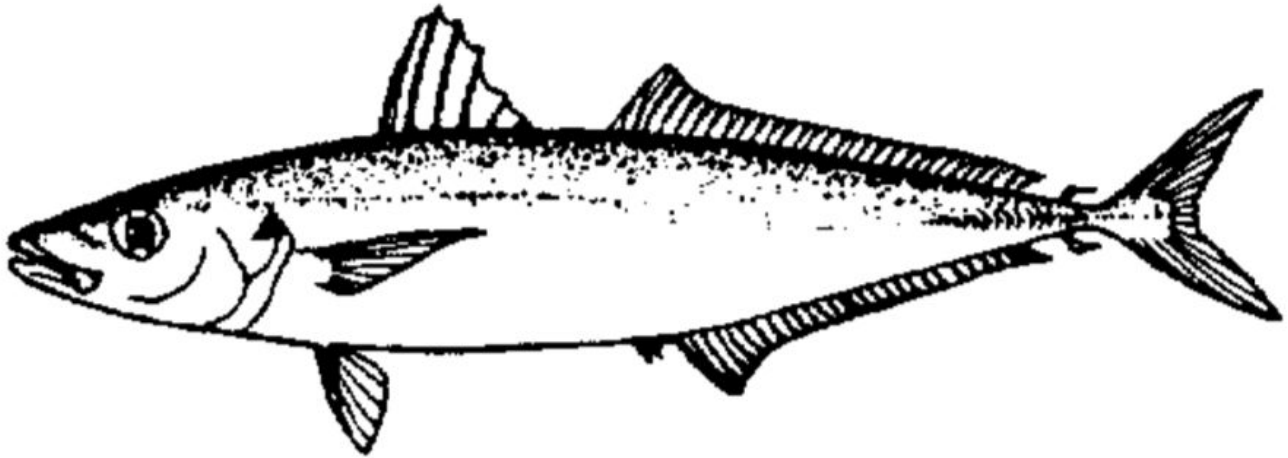
Mackerel Scad

Decapterus macarellus

Rules/Special Restrictions: None

Peak spawning season: April-August

Size at maturity: 9.6” or ~18 months old



Description: Blue-ish or green-ish above fading to silvery white below, dark spot on upper part of gill cover.

‘Opelu or Mackerel Scad are a schooling species that were heavily depended upon for food by native Hawaiians. They were often “kapu” (off-limits) every year during their spawning periods, which modern scientists estimate to be from April - August. ‘Opelu were so regarded that there was a special heiau (Hawaiian temple) called Kalalea, that was created specifically to worship ‘Opelu, as they were regarded as ‘aumakua (a family god/deity) for some Hawaiians.

While no specific regulations limit the harvest of ‘Opelu, fishers should consider size at maturity (9.6”) and avoiding over-harvest during peak spawning season, April - August to ensure the sustainability of local populations.

Akule + Halalū

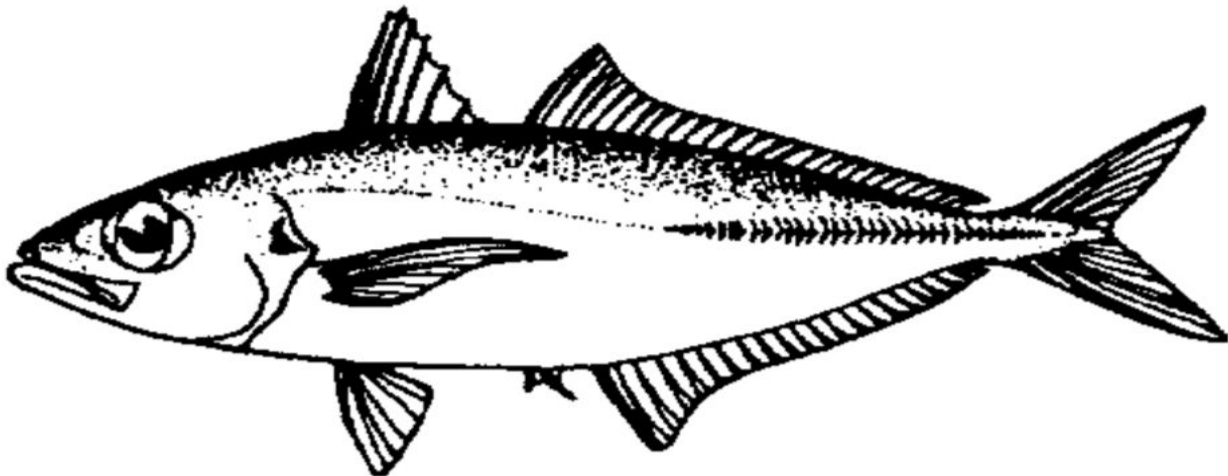
Bigeye Scad

Selar crumenophthalmus

Rules/Special Restrictions: Unlawful to take akule under 8 ½ inches with net during July-Oct; or possess or sell more than 200lbs of akule less than 8 ½ inches per day during July-Oct.

Peak spawning season: July - October

Size at maturity: ~7.9 “



Description: Silvery blue above fading to silvery white below, yellow tail fin; very large eyes.

Akule and their younger growth stage, Halalū, are a schooling species, recounted by native Hawaiians as fish that are known to go from place to place and travel as a school. Stages of growth as described by native Hawaiians are: pa'ā'a (stripling), 2-3 inches long ; halalū, 5-6 inches long; akule, adult. They were also a favorite fish for drying and were good for palu (chumming). Regulations to limit collection of Akule under 8 ½ “ with net between July - October aligns with the Akule peak spawning season and also takes into account measures to ensure that a high number of Akule under maturity are not taken in order to make certain that populations remain steady.

Akule net regulations: Unlawful for any person without a valid commercial marine license to take akule with any net that has less than 2¾" stretched mesh, except landing nets as indicated below. Unlawful for any person without a valid commercial marine license to take akule using the bag net fishing method. Unlawful for any commercial marine licensee to take akule while using: a) lay net fishing method with net that has less than 2¾" stretched mesh; b) surround net fishing method with net that has less than 2½" stretched mesh; c) bag net fishing method with net that has less than 1½" stretched mesh; Unlawful for any commercial marine licensee to keep akule in a bag net in the ocean for more than 3 days without notifying DLNR, explaining the reasons, and when the bag net will be removed. Use of landing nets of any mesh size is permitted, provided the opening of the landing net is less than 4 feet in any dimension, excluding handle.

‘Ō‘io

Bonefish

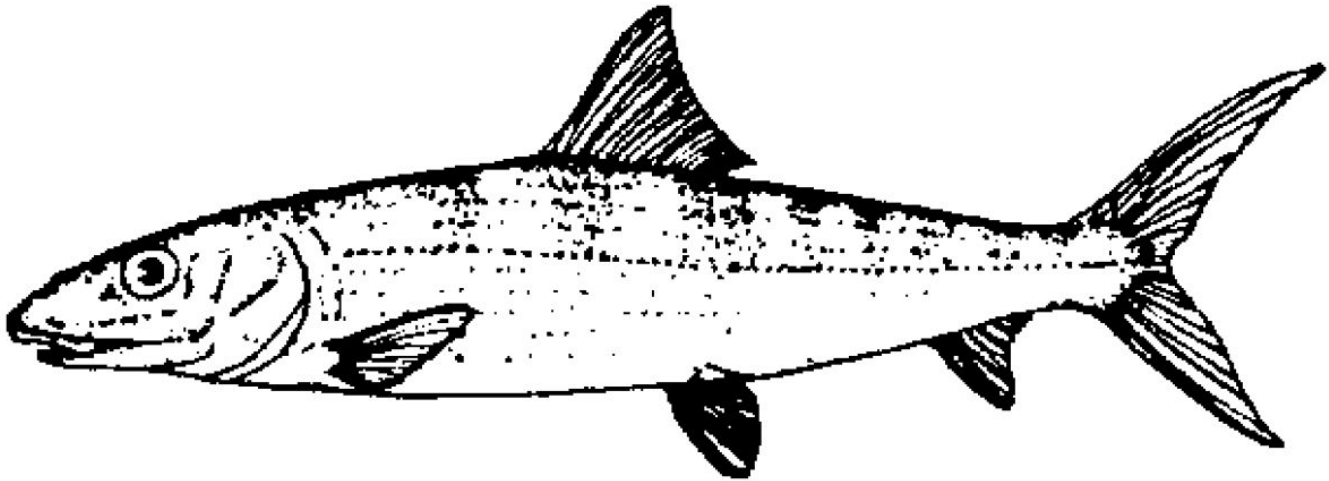
Albula glossodonta, *A. virgata*

Rules/Special Restrictions: Min. size 14”

Peak spawning season: November-April

Size at Maturity: 14” - 19” (species

dependent), 3-4 years



Description: Bright iridescent silver, with greenish tinge on dorsal area; elongated upper jaw.

‘Ō‘io or bonefish, are present in two species (*A. glossodonta* and *A. virgata*) in Hawai‘i and are often difficult for fishermen to tell apart, and are therefore regulated similarly although *A. virgata* is endemic. The minimum size requirement of 14” imposed by the state generally aligns with estimates for ‘Ō‘io size at maturity, which ranges from 14” - 19” depending on species. Fish are full grown at an estimated 24” - 28”. It should be noted that neither of the two species are considered common in Hawaii due to overfishing and habitat degradation. ‘Ō‘io are typically found in shallow lagoons and they typically feed on sand dwelling organisms meaning that Maunalua may provide suitable habitat for this species.

When fishing for this species, it should be noted that they exhibit K fecundity meaning that they take longer to reach sexual maturity, have longer reproductive cycles, and have less offspring. This results in this species being more vulnerable. This species was historically caught in two ways, by net (especially throw net or *upena*) and also by hook and line. Catching by hook and line results in less take of the species and can be considered a more sustainable way to take this fish.

Awa

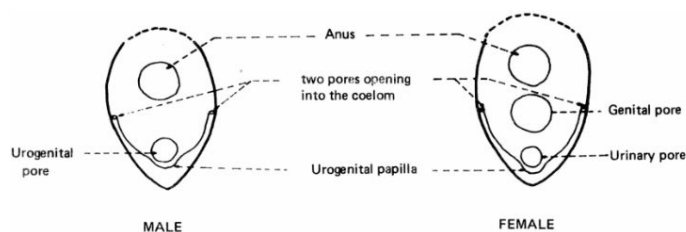
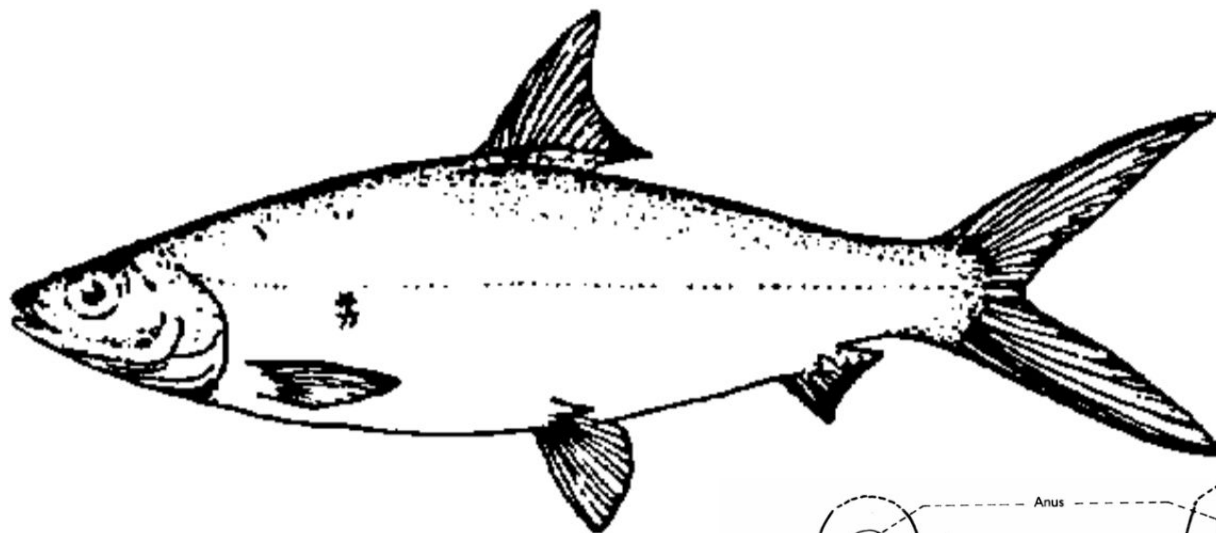
Milkfish

Chanos chanos

Rules/Special Restrictions: Min. size 9" (spearing and sale)

Peak spawning season: Apr-July, Sept-Nov

Size at maturity: 9", 5 years



Description: Grayish green above, fading to silvery below.

Schematic diagram of the anal region of the milkfish (Chaudhuri et al., 1977) to differentiate between the male and female milkfish.

Awa, commonly known as Milkfish, are a white-fleshed species that were often reserved for Hawaiian chiefs during times that they were not particularly abundant. Awa are usually targeted when they enter shallow water to feed on algae. The awa spawning cycle is complex and their spawning activity is most often correlated with the new or full moon phases, and generally has 1 to 2 seasonal peaks, however, Hawaiian awa spawning patterns have not been well documented. Generally, spawning occurs mainly at night and takes place near coral reefs during the warm months of the year, whereas populations near the equator spawn year-round. Due to a long population doubling time of 4.5-14 years, resilience is low for this species. Hawaiians described awa stages of growth as: pua awa (puaawa) young; awa 'aua, medium size, awa, commercial size, awa kalamoho, very large.

While there is no regulated closed season for the awa, best practices should include limited targeting of mature female awa during peak spawning periods from April - July and September - November. The easiest way to differentiate between male and female milkfish is to inspect the external reproductive areas of the fish. Male awa have 2 holes near their anal fin, whereas female awa have 3 holes. Inspection of catch can allow for gentle release of female awa during peak spawning seasons to ensure sustainability of local awa populations.

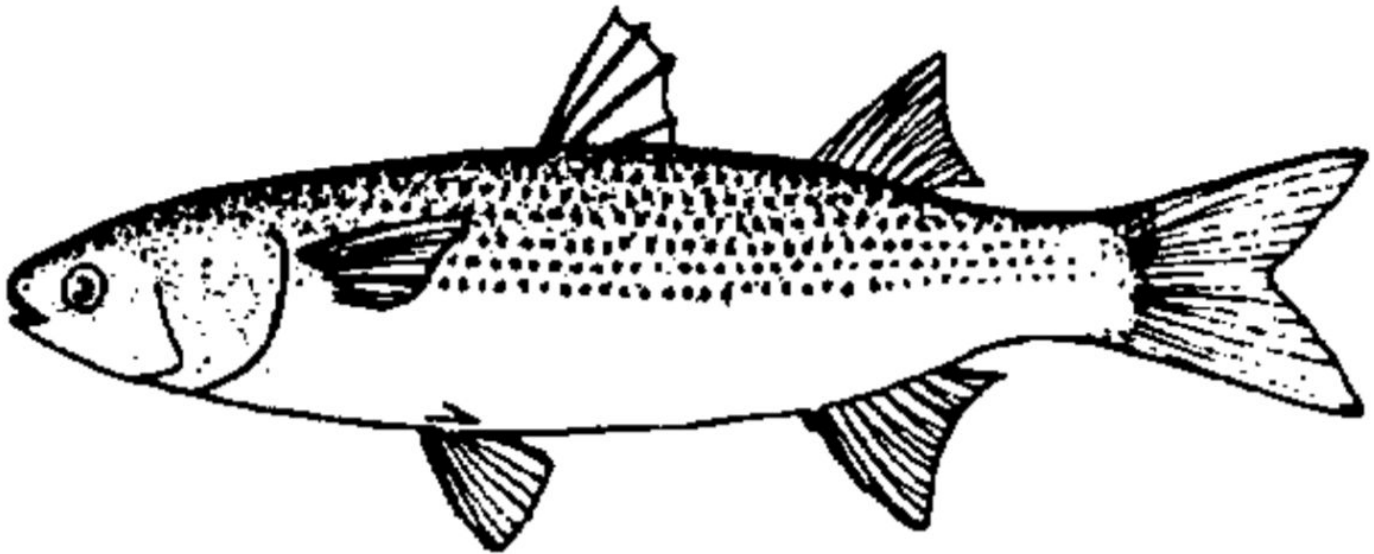
'Ama'ama

Striped Mullet
Mugil Cephalus

Rules/Special Restrictions: Season closed: Dec-March, Min. size 11"

Peak spawning season: Dec-March

Size at Maturity: ~11" or about 1 year old



Description: Body silver with grayish-green above, changing to white below, reddish tinge around mouth and gills.

The 'Ama'ama or striped mullet is and was one of the most important freshwater, or brackish water, fish of the Hawaiians. Early Hawaiians caught the spawn in nets along the coast, and grew them in ponds to always have a constant and sustainable supply. Hawaiians named the life stages of the 'ama'ama based on length : finger length, pua 'ama'ama; hand-length, kahaka; about 8 inches, 'ama'ama; 12 inches or more, 'anae. Observations made by early Hawaiians found that the 'anae made seasonal migrations around part of the island of O'ahu. When migrating they are called 'anae holo (running or travelling mullet); when they remain more or less offshore, or have returned from the journey, they are called 'anae pali (cliff mullet).

Maunalua Bay has many estuarine areas where 'Ama'ama are present and are targeted by fishers. The state imposed closed season for 'Ama'ama aligns with their observed peak spawning season from December to March and is designed to help the species reproduce sustainably with less fishing pressure, essentially protecting the species from overharvest during critical spawning periods. Minimum size is roughly identical to size at reproductive maturity.

Manini

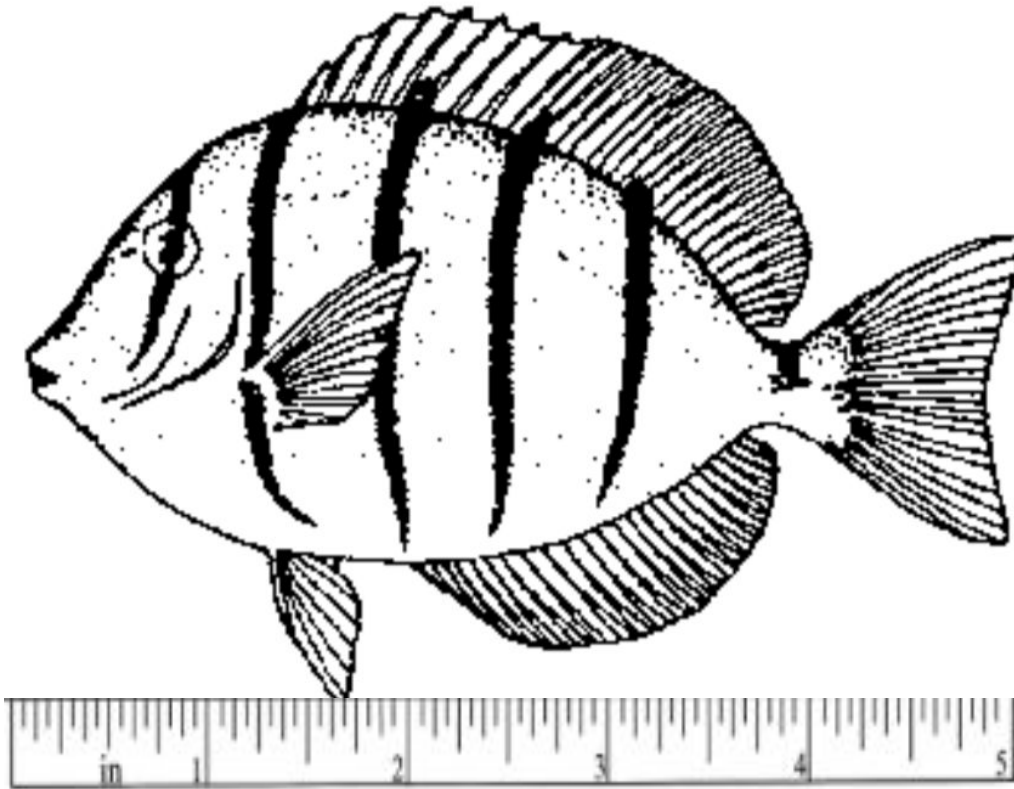
Rules/Special Restrictions: Min. size 5"

Peak spawning season: Feb - June

Size at maturity: ~5"

Convict Tang

Acanthurus triostegus sandvicensis



Description: Silvery, may have yellowish tinge; six black vertical bars, the first passing through the eye and the last near the base of the tail; single small retractable caudal spine on each side.

The manini, or Convict tang, are a solitary species that are abundant and common across Hawaii's nearshore reef environments. Juveniles are often found in inlets, tidepools and brackish water environments. Manini were a favored food fish in old Hawai'i and are still favored by some fishermen today and sadly are often overharvested. Best practices should be mindful of personal bag-limits when collecting this species in order to limit over-harvesting. Fishers should also avoid targeting manini during peak spawning season from February to June to ensure stocks remain abundant.

Moi

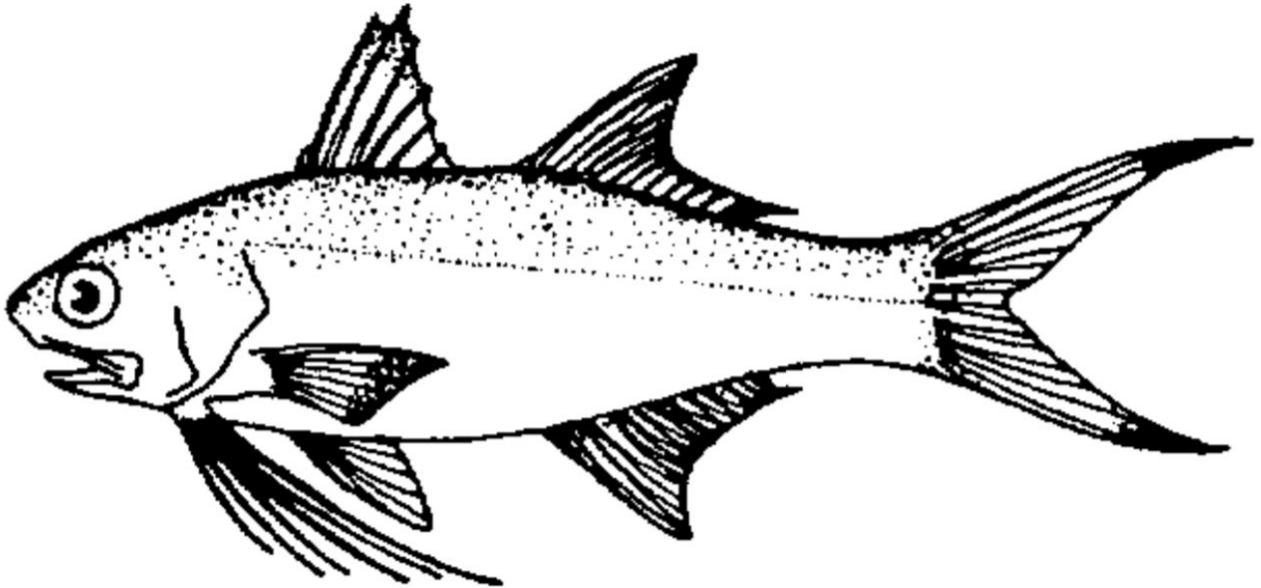
Six-fingered Threadfin *Polydactylus sexfilis*

Rules/Special Restrictions: Season closed:

June-Aug, Min. size 11", Bag limit 15

Peak spawning season: June - Aug

Size at Maturity: ~11"



Description: Dusky above, silvery on sides and belly, with numerous narrow wavy horizontal lines along sides; fins black-tipped; characterized by presence of six long filaments extending from base of each pectoral fin, and overhanging snout.

Moi have a complicated history in Hawai'i due to decades of overfishing. Because of the hermaphroditic nature of moi, best management practices include not harvesting large moi, as they transition from male to female during their larger stages. The Hawaiians named the four stages of growth for this species: moi li'i (little) 2-3 inches long, palā-moi (growing into moi - Kaua'i term), or mana moi (Hawai'i island term) about 5 inches long, and moi, adult females, average length about 18 inches. Hawaiians long observed and recognized the life stages of Moi, and part of Hawaiian traditional management strategies were to not disturb nursery grounds and spawning sites, as well as to leave larger adult female individuals to ensure successful breeding.

Pono harvesting methods should include only throw nets or pole-and-line, whereas, gill nets should be avoided due to their lethal nature which could inhibit the release of female moi if accidentally captured. Best harvesting practices should also include the release of any females caught (generally 12 inches or longer). Outer island community based subsistence fishing areas employ maximum size regulations for this species, which places a kapu on collection of individuals 18" or larger. The closed season during June - August helps sustain moi populations by protecting them during their critical summer spawning period. Moi is considered a tier 3 state indicator species in Hawai'i.

Kala

Rules/Special Restrictions: Min. size 14"

Bluespine Unicornfish

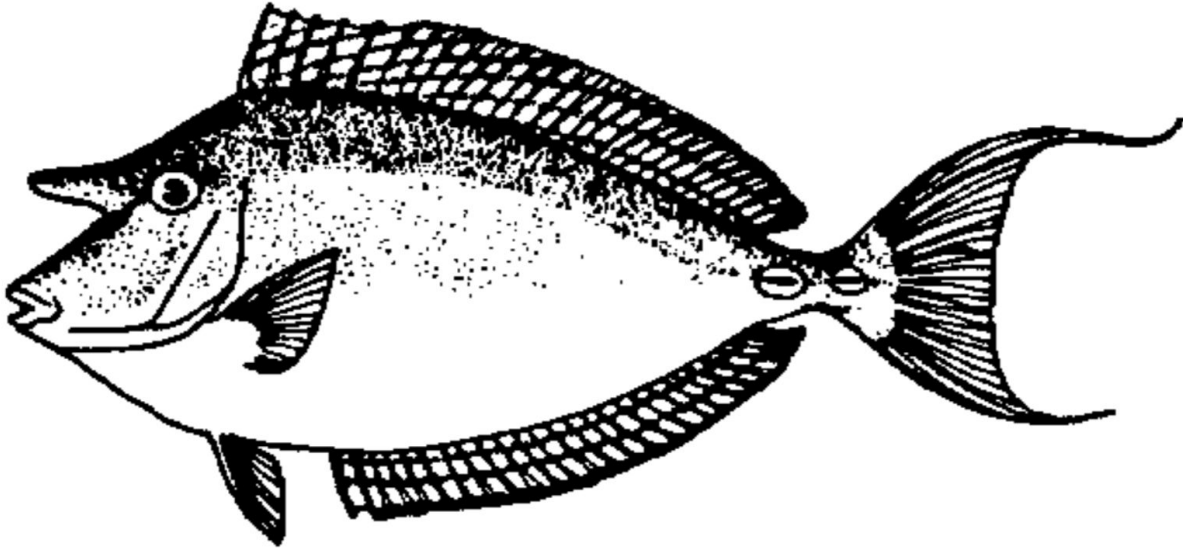
Peak spawning season: May - June

Short-nosed Unicornfish

Size at maturity: ~14.2", 2 years old

Long-horn Unicornfish

Naso unicornis, *N. brevirostris*, *N. annulatus*



Description: Dusky olive, with light blue of the fins and around the caudal spines; horn protruding from front of head about eye level (lengthens with age). A similar species *N. brevirostris* is grayish green with numerous small spots or dark lines on the sides, and a body that is less deep.

Kala is and was a very popular food fish, often eaten broiled, dried, salted, and baked. Kala is known to take on the fragrance of the limu that they eat, which is why it is seldom eaten raw. The soft parts of the kala that were not consumed, were often used for palu (chum). Younger individuals of kala lack the distinctive horn, which makes the horn a relatively good age indicator. Little is known about reproductive behavior and spawning of unicornfish, but most observations explain that spawning occurs near the surface and in channels with current for better dispersal. Scientific studies indicate that kala reach spawning maturity at about 14.2 inches or 2 years of age, and have been documented to reach up to 27 inches, however, Kala of this size are uncommon.

Best practices should limit harvest around peak spawning months of May through June and avoid harvesting larger spawning individuals who may be more reproductively active than smaller individuals. Male specimens have tail streamers which makes it easier to identify sex differences for this species. When possible, females of spawning maturity should be released to ensure sustainability of the local population. *Naso unicornis* is considered Tier 2 state indicator species in Hawai'i.

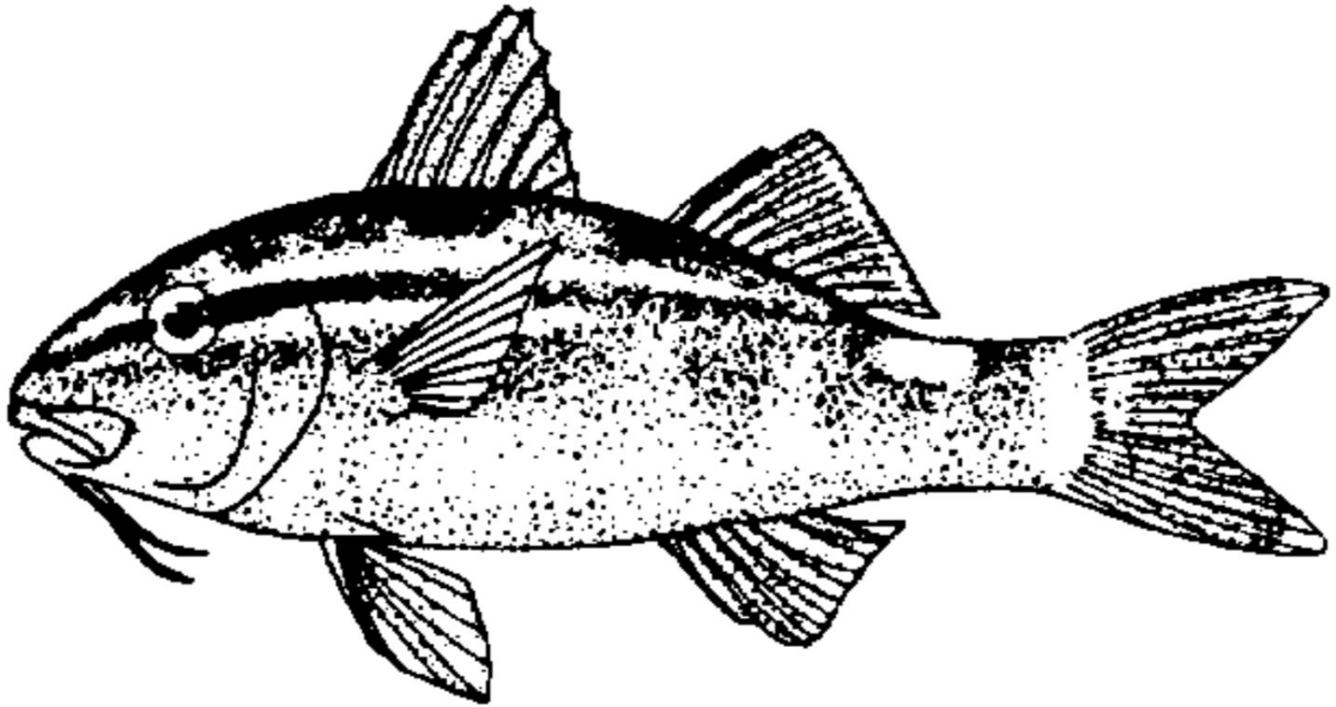
Kūmū

White-saddle Goatfish *P. Porphyreus*

Rules/Special Restrictions: Min. size 10"

Peak spawning season: Year round, peaks
Nov-Aug

Size at maturity: 10.4"-11.3", ~1.5 years



Description: Juveniles greenish with red fins, body coloration becomes brick red with age; white saddle behind soft dorsal fin; dark stripe running through eye from near snout to below first dorsal fin, darker spot between eye and upper edge of gill cover.

Kūmū are and were a highly valued endemic species that were sometimes used in Hawaiian offerings, and considered a prized food fish. Hawaiians described the stages of growth as: Kolokolopā, 'āhuluhulu, kumu a'e, and the adult kūmū. Adult kūmū are crepuscular or night feeders, whereas juveniles feed by day. Kūmū spawn year round with peaks from November to August, however, mature females only spawn once per year. Best practices from community managed subsistence fishing areas on other Hawaiian islands follow bag limits of 1 individual per day, and set a maximum size limit of 16", in order to keep larger breeding individuals in the system to ensure sustainability of the local stock.

Weke 'ā

White Weke

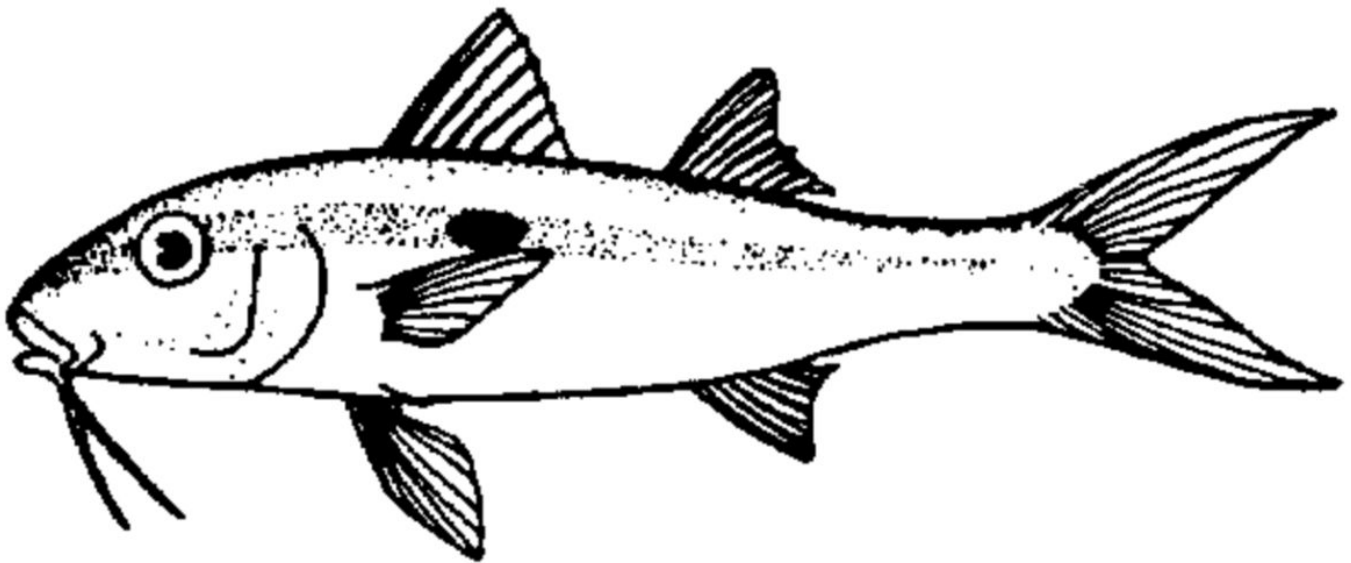
Yellowstripe Goatfish

Mulloidichthys flavolineatus

Rules/Special Restrictions:Min. size 7”
(sale), Bag limit 50 'oama (hook & line only)

Peak spawning season: April - June

Size at maturity: ~6.6”



Description: Silvery white; yellow band extends from eye to tail when schooling; band becomes less distinct when feeding, and a black spot appears below first dorsal fin; very slender body compared with most other goatfish.

Weke, commonly known as squarespot goatfish or yellowstripe goatfish, is distinguishable from weke 'ula due to their black spot mid-body. Weke'a are occasionally encountered in schools, but are more likely to be seen in pairs or small groups foraging or resting in the sand. Weke'ā are usually encountered by day in aggregations that remain in the same general area, and disperse at night when most feeding takes place. Weke'ā are known to reach up to 16 inches but are usually smaller. Best practices should consider harvesting Weke'ā, when possible, well above reproductive size but also leaving larger individuals to reproduce to ensure stock stability.

Weke 'ula

Yellowfin Goatfish

Red Weke

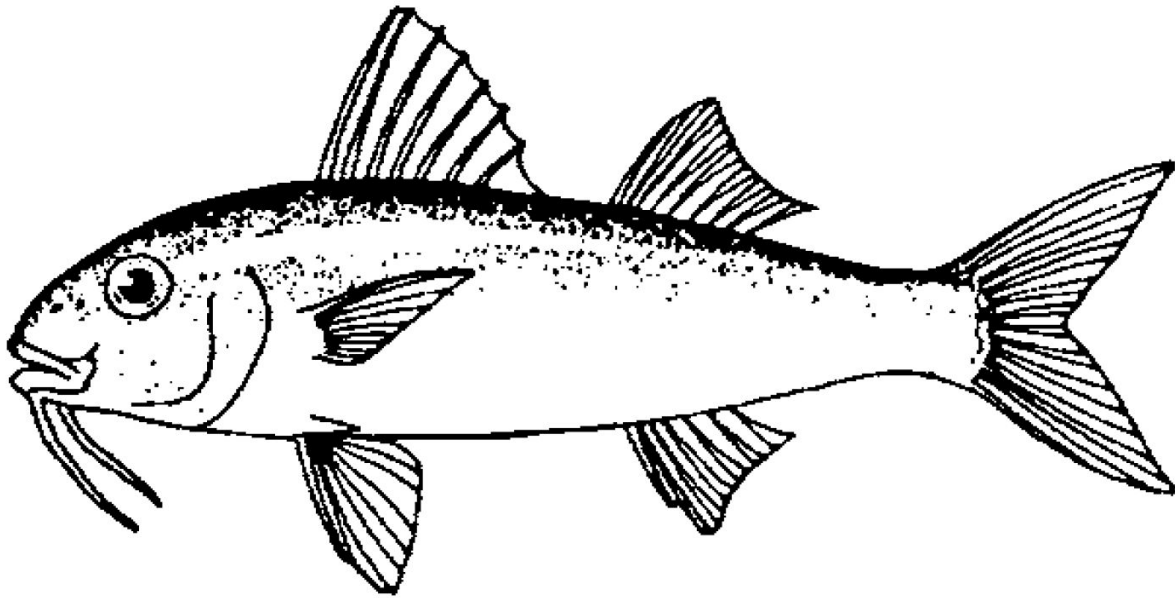
Mulloidichthys vanicolensis

Mulloidichthys auriflamma

Rules/Special Restrictions: Min. size 7", Bag limit 50 'oama (hook & line only)

Peak spawning season: March- June

Size at Maturity: 6" (peak at 12")"



Description: Light pink with yellow hues; long yellow band extending from eye to base of tail; fish becomes reddish when dead; inner lining of abdomen is black.

Weke 'ula, commonly known as yellowfin goatfish and red weke, are a tight schooling species considered the best eating fish of all of the weke. Weke 'ula form semi-stationary schools over reefs by day and forage individually at night over sandy bottom zones. Weke, meaning to open, were often used in Hawaiian cultural ceremonies as an offering or as a prayer. Weke under 7 inches are called 'oama, and can grow up to 15 inches in length (weke 'ula). Weke begin spawning at 6", producing ~90k eggs/yr, but reach peak spawning at about 12" where they spawn 4-5 times a year producing roughly 180,000,000 eggs/yr. A best practice for harvesting this species should be to refrain from targeting larger spawners, in order to ensure reproductive success of the local stock. Weke 'ula is considered a tier 2 state indicator species in Hawai'i.

'Ōmilu

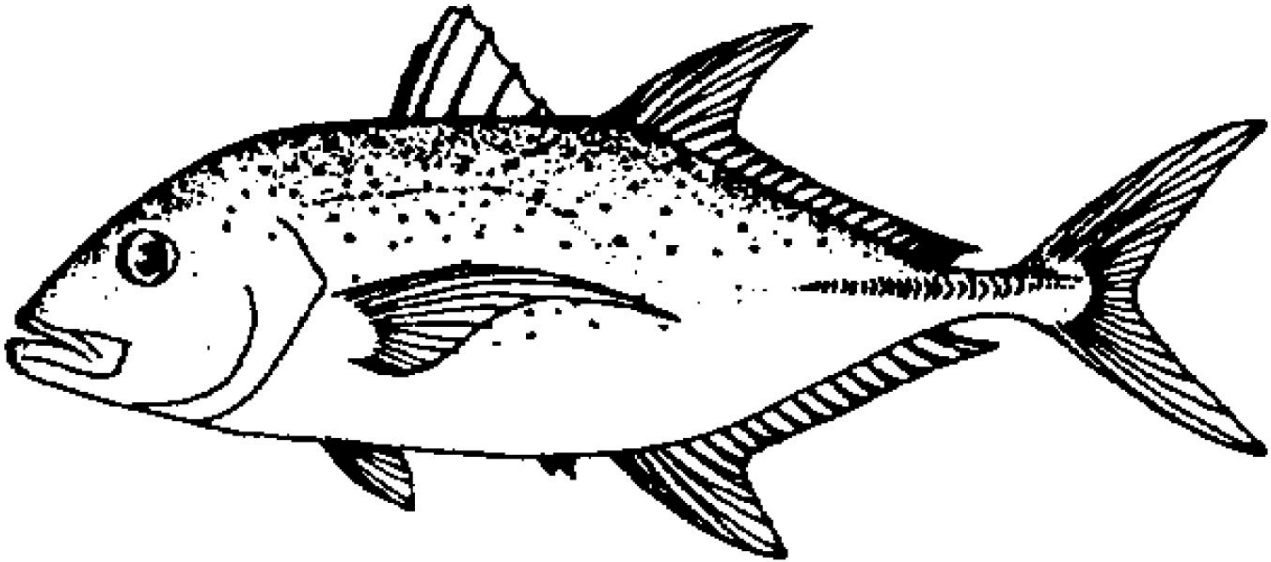
Bluefin Trevally

Caranx melampygus

Rules/Special Restrictions:Min. size 10"
(sale 16"), Bag limit 20 (all species)

Peak spawning season: May - Aug

Size at maturity: ~12-16", about 2 years



Description: Juveniles silvery blue above fading to silver below, with yellow pectoral fins; as fish ages bluish-black spots begin to appear all over, and body changes to neon blue; fins, especially first dorsal, also blue; breast completely scaled.

The 'Ōmilu or bluefin trevally is a popular food fish in Hawai'i. This species has complex spawning patterns and is known to reproduce at different times throughout its range, reaching sexual maturity at roughly 12-16 inches in length. The Hawaiians also had names for the different growth stages of the ulua, the three categories include: pāpio (young), pa'u'u (intermediate), and ulua (adult). The ulua played an important role in Hawaiian religious rites and was offered to the god Kū in his war ritual as a substitute for a human victim. Culturally and religiously, the ulua was seen as an Akua (a god). In ancient times ulua were fished for sport by the Ali'i (royalty) much the same way the māno (shark) were. A certain mystique therefore surrounded the ulua, and they were not pursued by the commoners, who apparently caught them only by happenstance, while fishing for other species. Young pāpio can be found in small schools and sometimes in estuarine conditions. Ulua can be found from coastal reef conditions to pelagic conditions, and their hunting behavior has been observed to intensify in the early morning or later afternoon, as they hunt smaller species of fish.

While they can grow up to 30 inches, best practices should include refraining from collecting larger individuals as they are known to be the most reproductively active and successful. The 'Ōmilu is considered a tier 1 state indicator species in Hawai'i.

Uhu

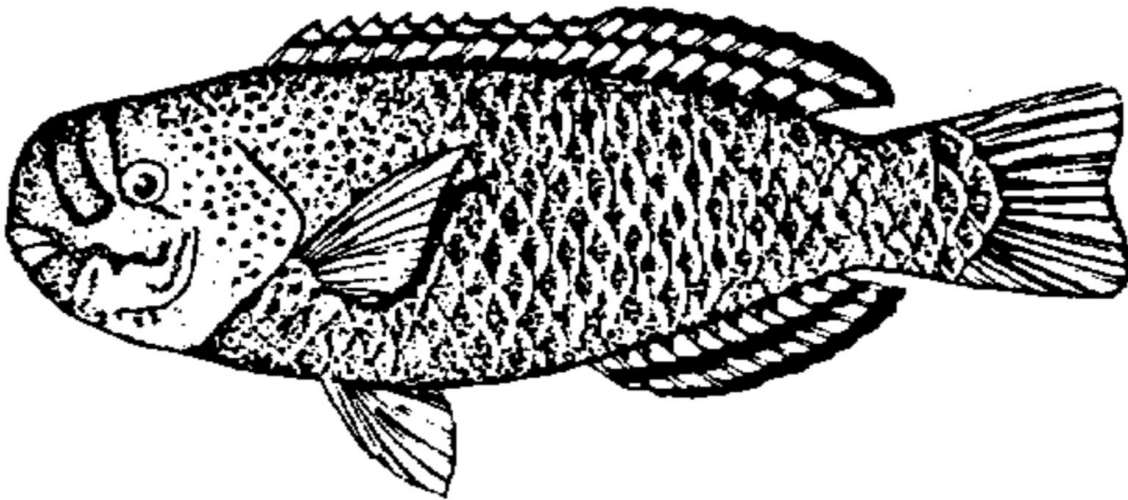
Parrotfish

Scarus rubroviolaceus, *S. dubius*,
S. psittacus, *Chlorus spilurus*, *C.*
perspicillatus

Rules/Special Restrictions:Min. size 12", Ponuhunuhu legal = female

Peak spawning season: June - Aug

Size at maturity: Palukaluka 14"; Uhu uliuli 14"; Ponuhunuhu 12"; Uhu (Bullethead *Chlorus spilurus*) 9"; Uhu (Yellowbar *Calotomus Zonarchus*) 8"; Panunu 8"



Description: Coloration varies with species, sex and age; males are generally more gaudy, with colors dominated by blues and greens. Females are generally more bland with colors dominated by reddish browns or grays. Teeth are fused together and resemble a beak.

Many species of Uhu or parrotfish are present in Hawai'i and therefore vary by size at maturity, however, generally share the same peak spawning season from June to August. Uhu are a popular food fish among locals and Hawaiians and were often eaten dried, broiled and raw by native Hawaiians. Uhu have a complicated reproductive process due to their hermaphroditic nature. Juvenile Uhu possess both male and female parts, and as they move into the next stage, the initial stage, they generally become female. The terminal stage, adult uhu, are most often male that started as an initial female or juvenile hermaphrodite. During spawning season, uhu form harems with one male (blue-green) and several females (red). If you remove the male, or blue uhu, it will disrupt the spawning cycle because another initial female or juvenile hermaphrodite will have to make the change to terminal male, **a process long enough to halt reproduction in that harem for the year.**

Best practices should include refraining from harvesting any blue/green males, to ensure success of spawning harems, especially during peak spawning from June to August. Because Uhu are also very sound sleepers, night collection is not considered a pono harvesting method. Uhu serve a niche ecological role as major sand producers. The ember parrotfish (*Scarus rubroviolaceus*) variety of uhu is considered a tier 1 state indicator species.

He'e Maui

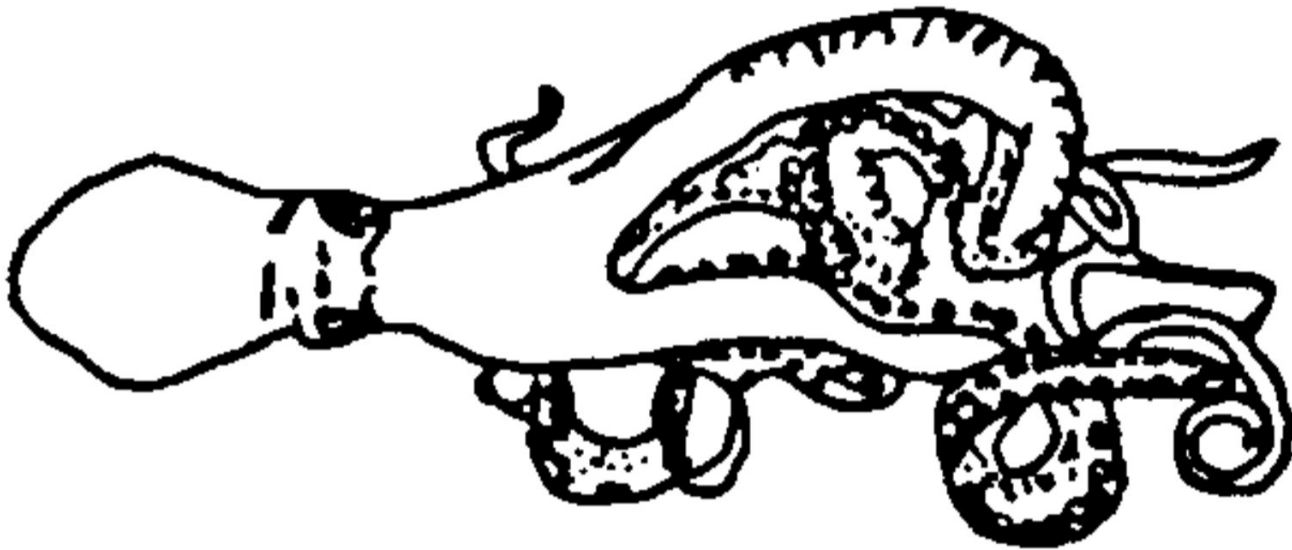
Day Octopus

Octopus cyanea

Rules/Special Restrictions: Min. size 1lb

Peak spawning season: Dependent upon maturity/size, year round

Size at Maturity: 10-12 months, average size is ~2.6lb (1200g)



He'e maui also known locally as “day tako” is the most frequently seen octopus in Hawai'i because they are most active during the day - retreating to their lairs (holes in the reef) at night. He'e maui is the kinolau (embodiment) of Kanaloa, the Hawaiian ocean god. He'e Maui reach their full sizes between 13-15 months, right before reproduction, however, size is dependent upon food availability. Female he'e die after expending all of their energy caring for their brood of eggs in their lair. Best practices for targeting he'e when diving, should including carefully luring the octopus out of its lair and checking for eggs before harvest, if he'e is undersized or eggs are present in the lair, refrain from harvesting to ensure reproductive success.

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