

Marine Fishes

Eels

Muraenidae

Anarchias sp.

Enchelycore pardalis

Gymnothorax nuttingi

Gymnothorax polyspondylus

Gymnothorax steindachneri

Ophichthidae

Callechelys lutea

Ichthyapus platyrhynchus

Ophichthus fowleri

Ophichthus kunaloa

Scolecenchelys puhiolo

Congridae

Acromycter alcocki

Bathycongrus aequorea

Gorgasia hawaiiensis



Enchelycore pardalis
Courtesy Keoki Stender

SPECIES STATUS:

IUCN Red List - Not considered
Endemic

SPECIES INFORMATION: Morays and snake eels (ophichthids) are carnivores of fishes and invertebrates. Morays are often nocturnal. Hawaiian garden eel (*Gorgasia*) is a planktivore. Other conger eels are largely nocturnal carnivores. Many moray eels are hermaphrodites of one form or another. The species common names and Hawaiian names are *Anarchias* sp. (no common name), *Enchelycore pardalis* (dragon eel, puhi-kauila), *Gymnothorax nuttingi* (Nutting's moray), *Gymnothorax polyspondylus* (many-vertebrate moray), *Gymnothorax steindachneri* (Steindachner's moray, puhi), *Callechelys lutea* (yellow-spotted snake eel, puhi), *Ichthyapus platyrhynchus* (no common name), *Ophichthus fowleri* (Fowler's snake eel), *Ophichthus kunaloa* (no common name), *Scolecenchelys puhiolo* (no common name), *Acromycter alcocki* (no common name), *Bathycongrus aequorea* (no common name), and *Gorgasia hawaiiensis* (Hawaiian garden eel, puhi).

DISTRIBUTION: The many-vertebrate moray has been found off O‘ahu only. Steindachner’s moray has been found from O‘ahu through the Northwestern Hawaiian Islands (NWHI). Fowler’s snake eel occurs off Maui, Lāna‘i, and O‘ahu. *Ophichthus kunaloa* is found from the island of Hawai‘i to O‘ahu. *Scolecenchelys puhiolo* is known from only two specimens from O‘ahu and Maro Reef. *Acromycter alcocki* has been collected from Maui to O‘ahu. *Bathycongrus* occurs from the island of Hawai‘i to Kaua‘i and maybe further northwest. Hawaiian garden eels occur from the island of Hawai‘i to O‘ahu. The other species occur throughout the Hawaiian Islands.

ABUNDANCE: The shallow water species are surveyed for in surveys of coral reef fishes in the Main and NWHI, both by the National Oceanic and Atmospheric Administration and the Division of Aquatic Resources and data are available online.

LOCATION AND CONDITION OF KEY HABITAT: All species except Nutting’s moray, many-vertebrate moray, *Ophichthus kunaloa*, *Scolecenchelys*, *Acromycter*, and *Bathycongrus* are found in shallow water. Nutting’s moray is found deeper than 110 meters (350 feet), the many-vertebrate moray was collected deeper than 180 meters (600 feet), and *Ophichthus kunaloa* and *Scolecenchelys puhiolo* are collected only greater than 210 meters (700 feet) deep. *Acromycter* and *Bathycongrus* have been collected only deeper than 300 meters (1,000 feet). Steindachner’s moray is only found deeper than 30 meters (100 feet) in the main islands. Snake eels and Hawaiian garden eels occur in sandy habitat. The rest are found throughout coral reef habitats. Puhi-kauila (dragon eel) is more common in the NWHI.

THREATS:

- Puhi-kauila (dragon eel) and Hawaiian garden eels are prized by aquarists;
- Hawaiian garden eels may be threatened by habitat alteration.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. Commercial licenses are required for aquarium collectors. In addition to common statewide and island conservation actions, specific actions include:

- Restoration of habitat;
- Maintain healthy populations with appropriate fishing regulations and education.

MONITORING:

- Continue to survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size;
- Support aquaculture research to develop captive breeding for species used in the aquarium trade.

References:

Gulko D. 2004. Hawaiian marine species for Endangered Species Act candidate listing, revised candidate list 2004. Honolulu, HI: Hawai‘i Division of Aquatic Resources. 21 pp.

Gulko D. 2005. Hawaii Endemic Species Status Chart spreadsheet. Honolulu, HI: Hawai‘i Division of

Aquatic Resources.

Hoover J. 1993. Hawaii's fishes. Honolulu, HI: Mutual Publishing. 183 pp.

Mundy B. In press. A checklist of the fishes of the Hawaiian Archipelago. Bishop Museum Bulletin of Zoology, B. P. Bishop Museum Press. 1340 ms. pages.

Randall JE. 1998. Shore fishes of Hawaii. Honolulu, HI: University of Hawaii Press. 216 pp.

Tinker S. 1978. Fishes of Hawaii. Honolulu HI: Hawaiian Service, Inc. 532 pp.

Marine Fishes

Active Reef Fishes



Chaetodon tinkeri
Courtesy Keoki Stender

Chaetodontidae

Chaetodon fremblii

Chaetodon tinkeri

Prognathodes sp.

Pomacanthidae

Apolemichthys arcuatus

Centropyge fisheri

Centropyge loricula

Genicanthus personatus

Pomacentridae

Chromis hanui

Chromis ovalis

Chromis struhsakeri

Plectroglyphidodon sindonis



Genicanthus personatus male
Courtesy Keoki Stender

Priacanthidae

Priacanthus meeki

Cheilodactylidae

Cheilodactylus vittatus

Ammodytidae

Ammodytoides pylei

Lepidammodytes macrophthalmus

Monacanthidae

Cantherhines verecundus

Thamnaconus garretti

Ostraciidae

Ostracion whitleyi

Tetraodontidae

Torquigener randalli

SPECIES STATUS:

IUCN Red List - Not considered

All Endemic except *Chaetodon tinkeri*, *Apolemichthys*, *Centropyge loricula*, and *Ostracion*

SPECIES INFORMATION: The Hawaiian rock damselfish (*Plectroglyphidodon*) is territorial. *Chaetodon* and *Centropyge* feed on invertebrates and algae. *Apolemichthys* prefers sponges. Masked Angelfish (*Genicanthus*) is a protogynous sex changer and primarily feeds on zooplankton and algae. The *Chromis* species and the ammodytids (sand lances) are also planktivores and often feed in groups. Hawaiian rock damselfish (*Plectroglyphidodon*) mostly feeds on algae and occasionally on invertebrates. 'Āweoweo (*Priacanthus*) is nocturnal and feed on larger zooplankton and may school on occasion. Hawaiian morwong (*Cheilodactylus*) and Randall's pufferfish (*Torquigener*) feed on invertebrates. The monacanthids (filefishes) are omnivorous. The eggs of the damselfishes (Pomacentridae) are demersal and guarded by males until hatching. Male Whitley's boxfish are rare in Hawai'i. All of these fishes are 30 centimeters (one foot) or less in size except Hawaiian morwong (*Cheilodactylus*) which can reach 40 centimeters (16 inches). The species common names and Hawaiian names are *Chaetodon fremblii* (bluestriped butterflyfish, kīkākapu), *Chaetodon tinkeri* (Tinker's butterflyfish), *Prognathodes* sp. (orange-margin butterflyfish), *Apolemichthys arcuatus* (bandit angelfish), *Centropyge fisheri* (Fisher's angelfish), *Centropyge loricula* (Hawaiian flame angelfish), *Genicanthus personatus*, (masked angelfish), *Chromis hanui* (chocolate-dip chromis), *Chromis ovalis* (oval chromis), *Chromis struhsakeri* (Struhsaker's chromis), *Plectroglyphidodon sindonis* (Hawaiian rock damselfish), *Priacanthus meeki* (Hawaiian bigeye, 'āweoweo), *Cheilodactylus vittatus* (Hawaiian morwong, kīkākapu), *Ammodytoides pylei* (Pyle's sand lance), *Lepidammodytes macrophthalmus* (no common name), *Cantherhines verecundus* (shy filefish, 'o'ili), *Thamnaconus garretti* (no common name), *Ostracion whitleyi* (Whitley's boxfish), and *Torquigener randalli* (Randall's pufferfish).

DISTRIBUTION: Tinker's butterflyfish is found from Hawai'i Island through O'ahu. Orange-margin butterflyfish and Hawaiian flame angelfish occur from French Frigate Shoals southeast through the rest of the chain. Hawaiian morwong, ('o'ili), and Randall's pufferfish occur from O'ahu through Kure Atoll. Pyle's sand lance occurs from Maui through all of the NWHI and *Lepidammodytes* has been collected from Maui through Maro Reef. All the other species occur throughout the Hawaiian Islands.

ABUNDANCE: The shallow water species are surveyed for in surveys of coral reef fishes in the Main and Northwestern Hawaiian Islands, both by the National Oceanic and Atmospheric Administration and the Division of Aquatic Resources and data are available online. Masked Angelfish were not found in the main islands WCRP survey. 'Āweoweo commercial catch has gone from over 2,270 kilograms (5,000 pounds) in the late 1990s to 950 kilograms (2,100 pounds) in 2003.

LOCATION AND CONDITION OF KEY HABITAT: All species except Tinker's butterflyfish, orange-margin butterflyfish and Struhsaker's chromis can be found in shallow water depths. Tinker's butterflyfish is found deeper than 30 meters (100 feet). Orange-margin butterflyfish and Struhsaker's chromis occurs at depths greater than 100 meters (300 feet). Hawaiian flame angelfish prefers finger coral at depths of 60 feet or more. The masked angelfish occurs only at 20 meters (60 feet) depth or greater and prefers drop offs. *Thamnaconus* occurs at least 60 meters (200 feet) deep. Chocolate-dip chromis prefer ledges, walls, or the sides of coral heads. Hawaiian rock damselfish is restricted to shallow surge zones. 'Āweoweo are often found in caves and under ledges during the day. The sand lances occur over sandy habitats. Randall's pufferfish is found over sandy habitats usually 15 meters (50 feet) or deeper. The rest are found throughout coral reef habitats.

THREATS:

- These species are almost all prized by aquarists except for Hawaiian rock damselfish, 'āweoweo, and Hawaiian morwong, and the ammodytids. Masked angelfish in particular command a very high price;
- 'Āweoweo is fished recreationally and commercially.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. Commercial licenses are required for aquarium collectors. In addition to common statewide and island conservation actions, specific actions include:

- Restoration of habitat;
- Maintain healthy populations with appropriate fishing regulations and education.

MONITORING:

- Continue to survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size and distribution;
- Support aquaculture research to develop captive breeding for species used in the aquarium trade.

References:

Gulko D. 2004. Hawaiian marine species for Endangered Species Act candidate listing, revised candidate list 2004. Honolulu, HI: Hawai'i Division of Aquatic Resources. 21 pp.

Gulko D. 2005. Hawaii Endemic Species Status Chart spreadsheet. Honolulu, HI: Hawai'i Division of Aquatic Resources.

Hoover J. 1993. Hawaii's fishes. Honolulu, HI: Mutual Publishing. 183 pp.

Howe JC. 1993. A comparative analysis of the feeding apparatus in pomacanthids, with special emphasis of oesophageal papillae in *Genicanthus personatus*. J. Fish Biology 43(4):593-602.

International Union for the Conservation of Nature and Natural Resources. [Internet] Threatened Red List. Available from: <http://www.redlist.org/search/search-expert.php> (Accessed May 2005).

Mundy B. In press. A checklist of the fishes of the Hawaiian Archipelago. Bishop Museum Bulletin of Zoology, B. P. Bishop Museum Press. 1340 ms. pages.

Randall JE. 1998. Shore fishes of Hawaii. Honolulu, HI: University of Hawaii Press. 216 pp.



Liopropoma aurora
Courtesy Keoki Stender

Marine Fishes

Sex Changing Reef Fishes

Serranidae

Liopropoma aurora

Pseudanthias thompsoni

Pseudogramma polyacanthum hawaiiensis



Anampses chrysocephalus male
Courtesy Keoki Stender

Labridae

Ammolabrus dicrus

Anampses chrysocephalus

Bodianus sp.

Coris flavovittata

Coris venusta

Cymolutes lecluse

Iniistius umbrilatus

SPECIES STATUS:

IUCN Red List - Not considered
Endemic

SPECIES INFORMATION: These fishes belong to the sea bass and wrasse families. These species are all carnivorous; Hawaiian anthias (*Pseudanthias*) more on zooplankton than the others, which feed in sand or on animals in the reef matrix. Most are less than 30 centimeters (one foot) long. It is likely that all are protogynous hermaphrodites. Many have males with harem territories. The species common names and Hawaiian names are: sunset basslet (*Liopropoma*), Hawaiian anthias (*Pseudanthias*), palespotted podge (*Pseudogramma*), sand wrasse (*Ammolabrus*), psychedelic wrasse (*Anampses chrysocephalus*), Hawaiian pigfish (*Bodianus*), yellowstripe coris (*Coris flavovittata*, hilu), elegant coris (*Coris venusta*), Hawaiian knifefish (*Cymolutes*), and blackside razorfish (*Iniistius*, lae-nihi).

DISTRIBUTION: Hawaiian anthias have been reported from Moloka'i throughout the rest of the chain to the northwest. Palespotted podge has been found from the island of Hawai'i to O'ahu. The sand wrasse has only been found off O'ahu. Lae-nihi have only been found from the island of Hawai'i to Necker Island. All the other species occur throughout the Hawaiian Islands.

ABUNDANCE: The shallow water species are surveyed for in surveys of coral reef fishes in the Main and Northwestern Hawaiian Islands, both by the National Oceanic and Atmospheric Administration and the Division of Aquatic Resources and data are available online.

LOCATION AND CONDITION OF KEY HABITAT: All species except the sunset basslet and the Hawaiian pigfish species can be found in shallow water depths. Sunset basslets occur in deeper water, usually over 60 meters (200 feet) but sometimes to SCUBA diving depths. The undescribed species of Hawaiian Pigfish has only been found in depths greater than 140 meters (450 feet). Psychedelic wrasse terminal phase males are usually only found in depths greater than 15 meters (50 feet). Hawaiian anthias can often be found around reef ledges and drop offs while palespotted podge are more common on coral and rubble substrates. Sand wrasses, Hawaiian knifefish, and blackside razorfish spend most of their time over sandy substrates and the last two can dive into the sand to avoid predators. The rest are found throughout coral reef habitats.

THREATS:

- These species are almost all prized by aquarists except for palespotted podge, sand wrasses, and Hawaiian knifefish. Many of these species have different color phases for each sex and also juveniles, and in particular the juvenile color phases are often targeted by collectors.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. Commercial licenses are required for aquarium collectors. In addition to common statewide and island conservation actions, specific actions include:

- Maintain healthy populations with appropriate fishing regulations and education.

MONITORING:

- Continue to survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size;
- Support aquacultural research to develop captive breeding for species used in the aquarium trade.

References:

Gulko D. 2005. Hawaii Endemic Species Status Chart spreadsheet. Honolulu, HI: Hawai'i Division of Aquatic Resources.

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Tinker S. 1978. Fishes of Hawaii. Honolulu HI: Hawaiian Service, Inc. 532 pp.

Marine Fishes

Cryptic Reef Fishes



Apogonidae

Apogon maculiferus

Bleniidae

Cirripectes obscurus

Enchelyurus brunneolus

Entomacrodus marmoratus

Entomacrodus strasburgi

Istiblennius zebra

Plagiotremus ewaensis

Plagiotremus goslinei

Callionymidae

Callionymus caeruleonotatus

Callionymus comptus

Callionymus decoratus

Draculo pogognathus

Synchiropus hawaiiensis

Synchiropus kinmeiensis

Gobiidae

Cabillus caudimacula

Eviota rubra

Eviota susanae

Oxyurichthys heisei

Oxyurichthys lonchotus

Pleurosicya larsonae

Psilogobius mainlandi

Tripterygiidae

Enneapterygius atriceps

Antennariidae

Antennarius commerson



Scorpaenopsis cacopsis
Courtesy Keoki Stender

Caracanthidae

Caracanthus typicus

Scorpaenidae

Pterois sphex

Scorpaena pele

Scorpaenopsis altirostris

Scorpaenopsis brevifrons

Scorpaenopsis cacopsis

Scorpaenopsis pluralis

Synodontidae

Synodus falcatus

Synodus janus

SPECIES STATUS:

IUCN Red List – Not considered

All Endemic except *Antennarius*

SPECIES INFORMATION: These are mostly small (less than 18 centimeters or seven inches) site-attached reef fishes. Decorated dragonets (*Callionymus decoratus*) reach 28 centimeters (eleven inches) in length as does Commerson's frogfish (*Antennarius*), and some of the scorpionfishes are also large. 'Upāpalu (*Apogon*) is a zooplanktivore. The blennies mostly feed on algae except for the *Plagiotremus* species which feed on mucus and skin tissue of other fishes. The callionymids (dragonets) and gobies are carnivorous on small invertebrates. The Hawaiian triplefin (*Enneapterygius*) is omnivorous. Commerson's frogfish (*Antennarius*) is a sit-and-wait predator using a modified dorsal fin spine as a fishing lure. The scorpionfishes (Scorpaenidae) and lizardfishes (Synodontidae) are ambush predators of fishes and invertebrates. 'Upāpalu (*Apogon*) males brood young in their mouths until hatching. Male blennies and gobies of most species guard demersal eggs until hatching. Mainland's goby (*Psilogobius*) lives in commensal burrows with an alpheid shrimp and *Oxyurichthys lonchotus* may do the same. Hawaiian

orbicular velvetfish (*Caracanthus*) may be a protogynous hermaphrodite. The species common names and Hawaiian names are: *Apogon maculiferus* (spotted cardinalfish, 'upāpalu), *Cirrepecetes obscurus* (gargantuan blenny, pao'ō), *Enchelyurus brunneolus* (no common name), *Entomacrodus marmoratus* (marbled blenny, pao'ō), *Entomacrodus strasburgi* (Strasburg's blenny), *Istiblennius zebra* (zebra blenny, pao'ō), *Plagiotremus ewaensis* (Ewa blenny), *Plagiotremus goslinei* (scale-eating blenny), *Callionymus caeruleonotatus* (bluespotted dragonet), *Callionymus comptus* (ornamented dragonet), *Callionymus decoratus* (longtail dragonet), *Draculo pogognathus* (no common name), *Synchiropus hawaiiensis* (no common name), *Synchiropus kinmeiensis* (no common name), *Cabillus caudimacula* (no common name), *Eviota rubra* (no common name), *Eviota susanae* (no common name), *Oxyurichthys heisei* (ribbon goby), *Oxyurichthys lonchotus* (no common name), *Pleurosicya larsonae* (no common name), *Psilogobius mainlandi* (Mainland's goby), *Enneapterygius atriceps* (Hawaiian Triplefin), *Antennarius commerson* (Commerson's frogfish), *Caracanthus typicus* (Hawaiian orbicular velvetfish), *Pterois sphex* (Hawaiian turkeyfish, nohu pinao), *Scorpaena pele* (no common name), *Scorpaenopsis altirostris* (no common name), *Scorpaenopsis brevifrons* (shortnose scorpionfish), *Scorpaenopsis cacopsis* (titan scorpionfish, nohu), *Scorpaenopsis pluralis* (no common name), *Synodus falcatus* (no common name), and *Synodus janus* (no common name). *Synchiropus hawaiiensis* and *Synchiropus kinmeiensis* may be the same species. Bruce Mundy (National Marine Fisheries Service (NMFS)) reports that Jack Randall (Bishop Museum) will publish a manuscript reporting that *S. janus* is a junior synonym of *S. falcatus* so these are probably just a single species.

DISTRIBUTION: *Enchelyurus* occurs from O'ahu to Lisianski. *Entomacrodus strasburgi* occurs from Moloka'i to O'ahu. Zebra blennies occur from Hawai'i Island to Lisianski. The scale-eating blenny occurs from the island of Hawai'i to Pearl and Hermes Atoll. Bluespotted dragonets occur in the main islands only. Ornamented dragonet, Mainland's goby, and *Scorpaena pele* have been found from Maui to O'ahu. The longtail dragonet is found from Maui to Pearl and Hermes Atoll. *Draculo* has been found from Moloka'i to Kaua'i. *Synchiropus hawaiiensis* has been found from Maui to Moloka'i. *Synchiropus kinmeiensis* has been collected from Maro Reef through Kure Atoll and the Emperor Seamounts. *Cabillus*, the two *Eviota* species, and *Pleurosicya* have only been found off O'ahu. The ribbon goby is found off Lāna'i and Moloka'i. *Oxyurichthys lonchotus* has been collected from Hawai'i Island to O'ahu. Hawaiian orbicular velvetfish have been found from O'ahu through Midway Atoll. *Scorpaenopsis altirostris* is found from the island of Hawai'i to Moloka'i. *Scorpaenopsis pluralis* is known only from the holotype from near Laysan. *Synodus falcatus* has been found from Moloka'i through Laysan Island. *Synodus janus* is only known from the holotype collected off the island of Hawai'i. All the other species occur throughout the Hawaiian Islands.

ABUNDANCE: The shallow water species are surveyed for in surveys of coral reef fishes in the Main and Northwestern Hawaiian Islands (NMWHI), both by NMFS and the Division of Aquatic Resources and data are available online. Nohu pinao (Hawaiian turkeyfish) and titan scorpionfish may have declined from historic levels and a few hundred pounds of titan scorpionfish are reported in State commercial catch data each year.

LOCATION AND CONDITION OF KEY HABITAT: All species except bluespotted dragonet, the two *Synchiropus* species, ribbon goby, *Synodus falcatus*, *Scorpaena pele*, and *Scorpaenopsis altirostris* can be found in shallow water depths. *Callionymus caeruleonotatus* is found in depths

over 45 meters (150 feet), *Oxyurichthys heisei*, the *Synchiropus* species and *Scorpaenopsis altirostris* and *Scorpaenopsis pluralis* occur over 90 meters (300 feet) deep, *S. falcatus* has only been found in depths greater than 30 meters (100 feet), and *Scorpaena pele* has been found deeper than 150 meters (500 feet). 'Upāpalu (spotted cardinalfish) occurs in caves during the day and feeds nocturnally over a wider area. The gargantuan blenny lives on rocky shores exposed to wave action. Zebra blennies and the *Entomacrodus* species live in shallow, rocky surge zones and can even leap from pool to pool. *Enchelyurus* occupies dead coral heads. Most callionymids, *Cabillus*, *Oxyurichthys lonchotus*, and the lizardfishes occur in sandy or muddy habitats. The two *Eviota* species have been found around Kāne'ōhe Bay, *E. rubra* from deeper spur and groove and *E. susanae* from shallow waters inside the bay. The Hawaiian orbicular velvetfish occurs among the branches of live coral. The scorpionfishes are often found hidden or under ledges. The rest are found throughout coral reef habitats.

THREATS:

- Only a few of these species are prized by aquarists. These are gargantuan blenny, zebra blenny, Commerson's frogfish, Hawaiian orbicular velvetfish, and nohu pinao (Hawaiian turkeyfish);
- Titan scorpionfish are fished commercially and recreationally;
- Many species have restricted ranges within the State (see above).

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. Commercial licenses are required for aquarium collectors. In addition to common statewide and island conservation actions, specific actions include:

- Maintain healthy populations with appropriate fishing regulations and education.

MONITORING:

- Continue to survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size;
- Support aquaculture research to develop captive breeding for species used in the aquarium trade.

References:

- Gulko D. 2004. Hawaiian marine species for Endangered Species Act candidate listing, revised candidate list 2004. Honolulu, HI: Hawai'i Division of Aquatic Resources. 21 pp.
- Gulko D. 2005. Hawaii Endemic Species Status Chart spreadsheet. Honolulu, HI: Hawai'i Division of Aquatic Resources.
- Hoover J. 1993. Hawaii's fishes. Honolulu, HI: Mutual Publishing. 183 pp.
- Howe JC. 1993. A comparative analysis of the feeding apparatus in pomacanthids, with special emphasis of oesophageal papillae in *Genicanthus personatus*. J. Fish Biology 43(4):593-602.
- Mundy B. In press. A checklist of the fishes of the Hawaiian Archipelago. Bishop Museum Bulletin of Zoology, B. P. Bishop Museum Press. 1340 ms. pages.

Randall JE. 1998. Shore fishes of Hawaii. Honolulu, HI: University of Hawaii Press. 216 pp.

Tinker S. 1978. Fishes of Hawaii. Honolulu HI: Hawaiian Service, Inc. 532 pp.

Waples RS, Randall JE. 1988. A revision of the Hawaiian USA lizardfishes of the genus *Synodus* with descriptions of four new species. *Pacific Science* 42(3-4): 178-213.



Etelis coruscans
Courtesy Keoki Stender

Marine Fishes

Bottomfishes

**Ulua aukea or
Giant ulua**
Caranx ignobilis

Black ulua
Caranx lugubris

Butaguchi or Thick or Pig ulua
Pseudocaranx dentex

Kahala or Amberjack
Seriola dumerii

Giant grouper
Epinephelus lanceolatus

Hāpu‘u or Hawaiian grouper
Epinephelus quernus



Epinephelus quernus
Courtesy Keoki Stender

Lehi
Aphareus rutilans

Uku or Jobfish
Aprion virescens

Ula‘ula or Ehu
Etelis carbunculus

Ula‘ula koa‘e or Onaga

Etelis coruscans

Goldflag jobfish

Pristipomoides auricilla

Opakapaka

Pristipomoides filamentosus

Kalekale

Pristipomoides seiboldii

Ukikiki or Gindai

Pristipomoides zonatus

SPECIES STATUS:

IUCN Red List – Vulnerable (giant grouper)

Near Threatened (Hawaiian grouper)

Others Not considered

SPECIES INFORMATION: Ulua aukea, black ulua, butaguchi, and kahala are jacks (Lutjanidae); the giant grouper and hāpu‘u are sea basses (Serranidae); and onaga, ehū, kalekale, opakapaka, gindai, goldflag jobfish, lehi, and uku are snappers (Lutjanidae). All of these bottomfishes are included in the Western Pacific Regional Fisheries Management Council’s (WPRFMC) Bottomfish and Seamount Fisheries Management Plan. This plan also includes the snapper *Lutjanus kasmira* or ta‘ape; however, this is an introduced species in Hawai‘i and thus is not included in our Species of Greatest Conservation Need list. All jacks are agile, strong swimming predators. The ulua aukea is a “near-apex” predator that feeds on a large array of prey including parrotfishes, ‘ōpelu, wrasses, big eyes, eels, cephalopods, and crustaceans. They primarily feed nocturnally, but may also feed to a lesser extent during the day. Black ulua feed primarily on fish, while kahala feed on octopus and other bottom dwelling prey in the Northwestern Hawaiian Islands and feed within the water column in the Main Hawaiian Islands. Groupers are ambush predators of other fishes and crustaceans. Snappers also are carnivorous and their diets consist primarily of fishes, crustaceans and cephalopods. Some species such as the kalekale, opakapaka, and onaga have a broader diet. Onaga feed close to the bottom and are morning feeders as are the ehū. Opakapaka are nocturnal feeders and uku are daytime feeders. Most bottomfishes are slow-growing and long-lived; however, the jacks are relatively fast growing. Female ulua aukea and kahala are reproductive at four years of age. Male and female ulua aukea spawn in pairs. Spawning occurs during new and

full moon periods, and peaks in summer from May to August. Kahala spawn from February to June. More than one clutch may be produced in a year for both ulua aukea and kahala. Ulua aukea eggs hatch 24 to 48 hours after spawning and larvae are pelagic. Juvenile ulua aukea can recruit into estuaries and can be found in areas with salinities as low as 1.5 parts per thousand. Groupers are often protogynous hermaphrodites, starting life as female and changing sex to male later in life. For most snappers, maximum spawning occurs during the summer months and peaks from July to August. Opakapaka, onaga, uhu and uku, however, may spawn “serially” over an extended time period. Ehu have the shortest and most defined spawning period lasting from July to September. Snapper eggs are small and pelagic, hatching 17 to 36 hours after spawning. Larvae are estimated to remain in pelagic waters from 25 to 47 days. These species range in size from the kalekale that reaches a maximum of 55 centimeters (two feet) to the giant grouper that can reach 2.7 meters (nine feet).

DISTRIBUTION: All species can be found throughout the State, although they are currently much rarer, especially the giant grouper. Ulua aukea are more abundant and larger in the Northwestern Hawaiian Islands (NWHI). Butaguchi are also more common in the NWHI.

ABUNDANCE: Ulua are looked for in surveys of coral reef fishes in the Main and Northwestern Hawaiian Islands, both by the National Oceanic and Atmospheric Administration (NOAA) and the Division of Aquatic Resources (DAR). Commercial landings have varied over the past few years for ulua aukea and black ulua, but show no overall decrease, though longer-term declines have occurred. From 1999 to 2003, ulua aukea landings range from a low of approximately 2,700 kilograms (6,000 pounds) in 2000 to a high of 5,000 kilograms (11,000 pounds) in 2003. black ulua landings range from a low of approximately 120 kilograms (260 pounds) in 1998 to a high of 680 kilograms (1,500 pounds) in 2003. Butaguchi landings are highly variable but average around 13,600 kilograms (30,000 pounds) per year with no declining trend. Kahala commercial landings also have varied but have shown a decrease from 2000 to 2003 with landings of approximately 6,600 kilograms (14,500 pounds) and 2,540 kilograms (5,600 pounds), respectively.

Groupers also are looked for in surveys of coral reef fishes in the MHI and NWHI, both by NOAA and DAR. A recent survey in shallow reefs of the main islands found no individuals of either grouper species. Commercial landings in recent years have been about 18,000 kilograms (40,000 pounds) a year for the hāpu‘u. Overall landings in the past few years are lower in the main islands and the Hoomalu zone. Catch Per Unit Effort (CPUE) has been decreasing for the past 40 years in the main islands. Size of fish caught in the main islands is 30 to 40 percent less than those caught in the NWHI.

Commercial landings in recent years have been about 2,270 kilograms (5,000 pounds) a year for gindai. Uku landings have varied from approximately 53,500 kilograms (118,000 pounds) in 1998 to 50,800 kilograms (112,000 pounds) in 2001 to 61,700 kilograms (136,000 pounds) in 2003. Other species have shown declines in commercial catch. Opakapaka commercial landings have decreased each year for the past six years from 102,500 kilograms (226,000 pounds) in 1998 to 60,300 kilograms (133,000 pounds) in 2003. Ehu landings have gone from approximately 18,100 kilograms (40,000 pounds) 1998 to 10,900 kilograms (24,000 pounds) in 2003. Lehi and kalekale landings have been declining since 2000, although less dramatically. Onaga and goldflag

jobfish values were not recorded over this time period by DAR. Over the last 40 to 50 years partial CPUE's for onaga, ehu and hāpu'u has been reduced to half of what it was.

LOCATION AND CONDITION OF KEY HABITAT: Jacks have a variety of habitat preferences. Uluu aukea key habitat includes all nearshore habitats from rocky shores to embayments and reefs. They also occur in deeper waters up to 100 meters (300 feet) deep. Shallow waters over reefs and open waters are key foraging habitats. Juveniles prefer protected habitats such as sand flats and lagoons; however, many juveniles also utilize estuaries, although they are not "estuarine-dependent." Black ulua key habitat is off reef slopes in waters deeper than 30 meters (100 feet). Butaguchi occur in deep waters around the MHI and prefer banks and deep slopes. Key foraging grounds are near the bottom of deeper waters. Kahala inhabit areas with a large range of depth from nearshore to waters over 350 meters (1,100 feet). Hāpu'u were probably historically found in shallower water but are now only found in water deeper than 100 meters (300 feet) in the Main Hawaiian Islands with occasional sightings of juveniles in diving depths. In the NWHI, juveniles and adults have been seen as shallow as five meters (15 feet). Giant grouper are usually found from 12 meters to 60 meters (40 to 200 feet) deep. They can often be found in caves or overhangs. Most snappers inhabit intermediate to deep waters ranging anywhere from 30 meters to 4,570 meters (100 feet to 15,000 feet). Specifically, they prefer areas of high relief and deep slope with hard substrates and complex structures. Uku, however, are found in shallower waters than any of the other snappers. Opakapaka are known to migrate to shallower waters from 30 to 80 meters (100 to 250 feet) at night. Onaga often prefer areas close to or on the bottom of vertical drop-offs, pinnacles and ledges. Key habitat for juvenile snappers varies. Juvenile opakapaka, onaga and lehu prefer flat areas of shallower waters with few features, while ehu juveniles prefer habitats with carbonate, basalt, or mudstone substrate.

THREATS:

- Localized heavy fishing pressure threatens these bottomfishes. All jacks are fished commercially and recreationally; however, kahala is not of high commercial value due to its toxicity from ciguatoxin. Uluu aukea are also fished for subsistence by Native Hawaiians. Uluu aukea populations in the Main Hawaiian Islands are documented as depressed. Hāpu'u are fished commercially and recreationally, while giant grouper are too rare to be targeted commercially. Size of groupers caught in the Main Hawaiian Islands (MHI) is about half that of those caught in the less-intensively fished NWHI. The protogynous sex-change in this family makes them particularly vulnerable to fishing pressure. All eight snapper species also are fished commercially and recreationally; however, the gindai is not a considerable part of the commercial bottomfish fishery. Ehu and onaga are considered locally depleted in the MHI, while all bottomfish populations are considered "relatively healthy" in the NWHI. Additionally, NMFS recently made a declaration of "overfishing" for all of Hawaii's bottomfish;
- Additionally, coastal water quality may negatively affect uluas, especially juveniles that spend time in estuaries;
- Global climate change has been suggested to affect their abundance and their prey.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. Since 1998, seven species of bottomfish have been managed by DAR under special Hawai'i

Administrative Rule 13-94. The rule limits fishing to hand lines only and establishes zones where bottomfishing is prohibited. Kaho'olawe has its own fishing regulations. In the NWHI, the bottomfish are managed under the WPRFMC Bottomfish Fishery Management Plan, which limits fishing there. Additionally, in response to NMFS declaration of "overfishing" for Hawaii's bottomfish, the WPRFMC has resolved to review a variety of different management alternatives and will probably decide to take action on these at their meeting in March 2006. In addition to common statewide and island conservation actions, specific actions include:

- Collaborate with the Western Pacific Regional Fisheries Management Council to decrease fishing effort in response to the declaration by NMFS of "overfishing" for Hawaii's bottomfish;
- Increase and improve data gathering on recreational bottomfish fishery;
- Consider increasing the number or location of Marine Protected Areas to protect bottomfishes;
- Improve coastal water quality to protect juvenile habitat;
- Maintain healthy populations with appropriate fishing regulations, enforcement, and education.

MONITORING:

- Continue surveys of population and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting population size and basic ecology and biology of these species.

References:

- Gulko D. 2004. Hawaiian marine species for Endangered Species Act candidate listing, revised candidate list 2004. Honolulu, HI: Hawai'i Division of Aquatic Resources. 21 pp.
- Haight WR. 2004. [Internet]. Seafood Watch seafood reports. International Maritime Alliance and Monterey Bay, Aquarium. Available from: http://www.mbayaq.org/cr/cr_seafoodwatch/sfw_factsheet.aspx?fid=168 (accessed May 2005).
- Hawai'i Division of Aquatic Resources Fishery Statistics. [Internet]. Available from: <http://www.hawaii.gov/dlnr/dar/stats.htm> (accessed May 2005).
- Honebrink RR. 2000. A review of the biology of the family Carangidae, with emphasis on species found in Hawaiian waters. DAR Technical Report 20-01. Honolulu, HI: Division of Aquatic Resources. 43 pp.
- Hoover J. 1993. Hawaii's fishes. Honolulu, HI: Mutual Publishing. 183 pp.
- International Union for the Conservation of Nature and Natural Resources. [Internet] Threatened Red List. Available from: <http://www.redlist.org/search/search-expert.php> (Accessed May 2005).
- Randall JE. 1998. Shore fishes of Hawaii. Honolulu, HI: University of Hawaii Press. 216 pp.
- Rick Gaffney & Associates. 2000. Evaluation of the status of the recreational fishery for ulua in Hawai'i and recommendations for future management. DAR Technical Report 20-02. Honolulu, HI: Division of Aquatic Resources. 35 pp.

Smith GC, Parrish JD. 2002. Estuaries as nurseries for the jacks *Caranx ignobilis* and *Caranx melampygus* (Carangidae) in Hawai`i. *Estuarine, Coastal and Shelf Science* 55:347-359.

Western Pacific Fishery Information Network. online data. Available from:
<http://www.pifsc.noaa.gov/wpacfin/> (accessed May 2005).

Western Pacific Regional Fishery Management Council. 2003 annual report for the bottomfish and seamount groundfish management plan. Available from: <http://www.wpcouncil.org/bottomfish.htm>.



Ijimaia plicatellus
Courtesy Chris Kelley

Marine Fishes

Deep Fishes

Ateleopodiformes

Ijimaia plicatellus

Beryciformes

Aulotrachichthys heptalepis

Gadiformes

Caelorinchus doryssus

Caelorinchus gladius

Hymenocephalus antraeus

Hymenocephalus tenuis

Kumba hebetata

Malacocephalus hawaiiensis

Nezumia ectenes

Nezumia holocentra

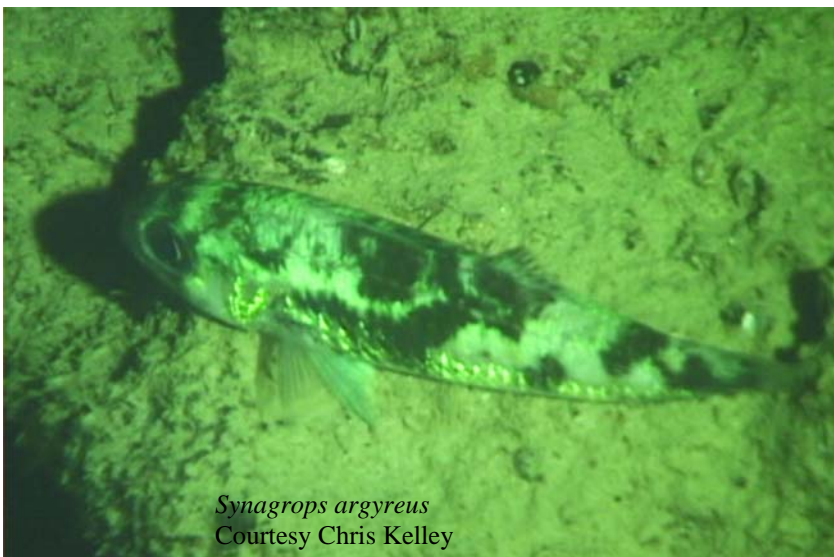
Sphagemacrurus gibber

Ventrifossa ctenomelas

Gadella molokaiensis

Physiculus sterops

Bathygadus bowersi



Synagrops argyreus
Courtesy Chris Kelley

Gonorynchiformes

Gonorynchus moseleyi

Lophiiformes

Halieutaea retifera

Linophryne escaramosa

Lophiodes bruchius

Solocisquama erythrina

Ophidiiformes

Luciobrotula lineata
Pycnocraspedum armatum
Cataetyx hawaiiensis
Grammonus waikiki
Microbrotula rubra
Saccogaster hawaii

Osmeriformes

Glossanodon struhsakeri

Perciformes

Champsodon fimbriatus
Epigonus devaneyi
Epigonus glossodontus
Osopsaron incisum
Synagrops argyreus

Squaliformes

Etmopterus villosus

Stomiiformes

Araiophos gracilis
Argyripnus brocki
Eustomias albibulbus
Eustomias bulbiramis
Eustomias magnificus

SPECIES STATUS:

IUCN Red List – Not considered
Endemic

SPECIES INFORMATION: Deep fishes usually live on soft sediment substrates and feed on fishes and invertebrates in or above those sediments. The grenadiers (gadiformes) are elongate fishes with tails that end in a point. The lophiiformes use a modified dorsal fin spine as a lure

to catch prey. Males are permanent parasites of females in *Linophryne*. The bythitids (last four Ophidiiformes) are live-bearers. Struhsaker's deep-sea smelt (*Glossanodon*) is a midwater pelagic planktivore. *Champsodon* is also a vertically migrating and schooling predator. The stomiiformes have bioluminescent organs. The *Eustomias* species are mesopelagic and vertically migrate diurnally. None of the species have Hawaiian names and only some have common names. The species with common names are: *Ijimaia plicatellus* (deep water ateleopid), *Caelorinchus doryssus* (spear-nosed grenadier), *Caelorinchus gladius* (sharp-snouted grenadier), *Hymenocephalus antraeus* (common big-eyed grenadier), *Hymenocephalus tenuis* (slender grenadier), *Kumba hebetate* (dull grenadier), *Malacocephalus hawaiiensis* (Hawaiian softhead grenadier), *Nezumia ectenes* (elongated grenadier), *Nezumia holocentra* (Cramer's grenadier), *Sphagemacurus gibber* (humped grenadier), *Ventrifossa ctenomelas* (Hawaiian grenadier), *Bathygadus bowersi* (Bower's grenadier), *Gonorynchus moseleyi* (beaked salmon), *Haliutaea retifera* (net bat fish), *Solocisquama* (red bat fish), *Glossanodon* (Struhsaker's deep-sea smelt), *Champsodon fimbriatus* (fringed champsodontid), *Etmopterus* (Hawaiian lanternshark), and *Argyripnus brocki* (Brock's bristlemouth).

DISTRIBUTION: *Ijimaia*, common big-eyed grenadier, *Physiculus*, *Pycnocraspedum*, *Epigonus glossodontus* and *Argyripnus* have been found from the island of Hawai'i to O'ahu. *Aulotrachichthys* has been found from Maui to Maro Reef. The spear-nosed grenadier has been found from Maui through the Northwestern Hawaiian Islands (NWHI). The sharp-snouted grenadier and *Ventrifossa* are found in the Main Hawaiian Islands (MHI). The slender grenadier, dull grenadier, elongated grenadier, and *Linophryne* are known only from holotypes collected off O'ahu; and Cramer's grenadier, *Grammonus*, *Microbrotula*, *Saccogaster*, and the *Eustomias* species have also only been collected off O'ahu. The Hawaiian softhead grenadier and the humped grenadier are found from the island of Hawai'i to French Frigate Shoals. Bower's grenadier is found from Kaua'i to French Frigate Shoals. Beaked salmon have been collected from Maui to O'ahu. *Lophiodes* is found from Maui to Necker Island. Red bat fish are found from Maui to Kaua'i. *Luciobrotula* and *Cataetix* are known only from the island of Hawai'i. *Epigonus devaneyi* has been found from Necker Island to Maro Reef. *Osopsaron* occurs from Maui to Laysan Island. *Synagrops* occurs from the island of Hawai'i to Laysan Island. *Araiophos* is known from the island of Hawai'i to St. Rogatien Bank. All the other species occur throughout the Hawaiian Islands.

ABUNDANCE: Little abundance data appears to exist for these species and trends are unknown. The common big-eyed grenadier is the most common macrourid.

LOCATION AND CONDITION OF KEY HABITAT: All species except *Aulotrachichthys*, *Physiculus*, beaked salmon, Net bat fish, *Grammonus*, *Microbrotula*, *Epigonus devaneyi*, *Araiophos*, and Brock's bristlemouth can be found in water depths greater than 300 meters (1,000 feet). *Aulotrachichthys* is found from 45 to 275 meters (150 to 900 feet) deep. *Physiculus*, net bat fish and *Epigonus devaneyi* are found from about 100 to 300 meters (300 to 1,000 feet) deep. Beaked salmon are found from 110 to 180 meters (350 to 600 feet) deep. *Grammonus* and *Microbrotula* are known from a few specimens caught in shallow reef habitat. *Araiophos*, *Eustomias albibulbus* and *Eustomias bulbiramis* have been collected from the surface to 400 meters (1,300 feet) deep. *Eustomias magnificus* has been collected from the surface to 1,800 meters (6,000 feet). Brock's bristlemouth has been collected from 180 to 300 meters (600 to 1,000 feet) deep. *Ijimaia* can be found as shallow as 240 meters (800 feet) as well as deeper than 300 meters (1,000 feet). *Gadella*

and Struhsaker's deep-sea smelt can also be found as shallow as 180 meters (600 feet). *Gadella* can be found in rocky crevices. *Synagrops* can be found as shallow as 75 meters (250 feet) deep.

THREATS: Deep offshore aquaculture may become a threat in the future.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common statewide and island conservation actions, specific actions include:

- Maintenance of habitat.

MONITORING:

- Survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size.

References:

Mundy B. In press. A checklist of the fishes of the Hawaiian Archipelago. Bishop Museum Bulletin of Zoology, B. P. Bishop Museum Press. 1340 ms. pages.

Nelson, J.S. 1994. Fishes of the World. 3rd edition. John Wiley and Sons, Inc. NY, NY. 600 pp.

Tinker S. 1978. Fishes of Hawaii. Honolulu HI: Hawaiian Service, Inc. 532 pp.

Marine Fishes



Flatfishes

Bothidae

Bothus thompsoni

Engyprosopon hawaiiensis

Engyprosopon xenandrus

Parabothus chlorospilus

Taeniopsetta radula

Pleuronectidae

Poecilopsetta hawaiiensis



Samaridae

Samariscus corallinus

Soleidae

Aseraggodes borehami

Aseraggodes holcomi

Aseraggodes therese

SPECIES STATUS:

IUCN Red List – Not considered
Endemic

SPECIES INFORMATION: Flatfishes usually live on soft sediment substrates and feed on fishes and invertebrates in those sediments. None of these species has a Hawaiian name. The species common names are: *Bothus thompsoni* (Thompson's flounder), *Engyprosopon hawaiiensis* (no common name), *Engyprosopon xenandrus* (Gilbert's small flounder), *Parabothus chlorospilus* (green-spotted flounder), *Taeniopsetta radula* (round-bodied flounder), *Poecilopsetta hawaiiensis* (no common name), *Samariscus corallinus* (coralline-red flounder), *Aseraggodes borehami* (Boreham's sole), *Aseraggodes holcomi* (no common name), and *Aseraggodes therese* (Therese's sole).

DISTRIBUTION: Thompson's flounder occurs from Maui to Maro Reef. Gilbert's small flounder and the round-bodied flounder occur from the island of Hawai'i to Laysan Island. The coralline-red flounder occurs from Moloka'i to Maro Reef. Boreham's sole has been found from

the island of Hawai'i to O'ahu. *Aseraggodes holcomi* has only been collected off O'ahu. All the other species occur throughout the Hawaiian Islands.

ABUNDANCE: Little abundance data appears to exist for these species.

LOCATION AND CONDITION OF KEY HABITAT: All species except Thompson's flounder, green-spotted flounder, round-bodied flounder, *Poecilopsetta*, and the coralline-red flounder can be found in shallow water depths. Thompson's flounder, round-bodied flounder, *Poecilopsetta*, and the coralline-red flounder are found in depths over 80 meters (250 feet), and the green-spotted flounder is found in depths over 120 meters (400 feet). These fishes live on soft sediment substrates though the coralline-red flounder has been found on live sponge bottoms and Therese's sole has been found over reef and rubble.

THREATS: None identified.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common statewide and island conservation actions, specific actions include:

- Restoration of habitat;
- Maintain healthy populations with appropriate fishing regulations and education.

MONITORING:

- Survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size.

References:

Mundy B. In press. A checklist of the fishes of the Hawaiian Archipelago. Bishop Museum Bulletin of Zoology, B. P. Bishop Museum Press. 1340 ms. pages.

Randall JE. 1998. Shore fishes of Hawaii. Honolulu, HI: University of Hawaii Press. 216 pp.

Tinker S. 1978. Fishes of Hawaii. Honolulu HI: Hawaiian Service, Inc. 532 pp.



Marine Fishes

Hawaiian surf sardine

Iso hawaiiensis

‘Iao or

Hawaiian silverside

Atherinomorus insularum

Nehu or

Hawaiian anchovy

Encrasicolina purpurea

SPECIES STATUS:

IUCN Red List – Not Considered
Endemic

SPECIES INFORMATION: These are all relatively small, silvery, schooling planktivores. ‘Iao and Hawaiian surf sardines are atherinids that attach their eggs by filaments to aquatic plants. Nehu (Hawaiian anchovy) lay oval, floating eggs that hatch in a couple of days.

DISTRIBUTION: They are found throughout the State.

ABUNDANCE: ‘Iao are looked for in surveys of coral reef fishes in the Main and Northwestern Hawaiian Islands by the National Oceanic and Atmospheric Administration. The others are not formally surveyed. There is little quantitative evidence of decline.

LOCATION AND CONDITION OF KEY HABITAT: They all occur in shallow water near the shoreline. Nehu especially can also be found in estuaries.

THREATS:

- They are fished commercially and recreationally;
- Introduced baitfish species may compete with the native species for resources;
- Coastal water quality may also be a threat in many areas but needs research.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. Regulations set maximum catch at one gallon (four liters) for Nehu and nets over 50 feet (15

meters) are allowed only for commercial fishers. In addition to common statewide and island conservation actions, specific actions include:

- Restoration of habitat;
- Maintain healthy populations with appropriate fishing regulations and education.

MONITORING:

- Continue and expand surveys of population and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size.

References:

Gulko D. 2005. Hawaii Endemic Species Status Chart spreadsheet. Honolulu, HI: Hawai'i Division of Aquatic Resources.

Tinker S. 1978. Fishes of Hawaii. Honolulu HI: Hawaiian Service, Inc. 532 pp.



Marine Fishes

Spectacled parrotfish

Uhu

Chlorurus perspicillatus

Yellowbar parrotfish

Uhu

Calotomus zonarchus

Calotomus zonarchus male
Courtesy Keoki Stender

SPECIES STATUS:
IUCN Red List – Not considered

Endemic, except spectacled parrotfish which also occurs at Johnston Atoll

SPECIES INFORMATION: These species are herbivorous and reach over 30 centimeters (one foot) in length. They are protogynous hermaphrodites. Terminal phase males maintain harem territories. These species have relatively fast growth and maturity. They graze algae from rock and coral surfaces. Young can sometimes be aggregated.

DISTRIBUTION: Spectacled parrotfish occur throughout the State. Yellowbar parrotfish occur from O'ahu and northwest throughout the Northwestern Hawaiian Islands.

ABUNDANCE: They are surveyed for in surveys of coral reef fishes in the Main and NWHI, both by the National Oceanic and Atmospheric Administration and the Division of Aquatic Resources and available online. Spectacled parrotfish numbers have declined in the populated areas of the main islands.

LOCATION AND CONDITION OF KEY HABITAT: Both species occur in coral reef areas. Spectacled parrotfish occur from the surface to over 60 meters (200 feet) deep, while yellowbar parrotfish only occur deeper than ten meters (35 feet).

THREATS:

- They are fished commercially and recreationally. They are sensitive to night-time spear fishing because members of this family rest at night in exposed reef crevices protected by a thin mucus covering they produce across the opening to the crevice.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. Regulations set minimum catch size at 12 inches (30 centimeters). In addition to common statewide and island conservation actions, specific actions include:

- Maintain healthy populations with appropriate fishing regulations and education.

MONITORING:

- Continue to survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size.

References:

Gulko D. 2004. Hawaiian marine species for Endangered Species Act candidate listing, revised candidate list 2004. Honolulu, HI: Hawai'i Division of Aquatic Resources. 21 pp.

Gulko D. 2005. Hawai'i Endemic Species Status Chart spreadsheet. Honolulu, HI: Hawai'i Division of Aquatic Resources.

Hoover J. 1993. Hawaii's fishes. Honolulu, HI: Mutual Publishing. 183 pp.

Mundy B. In press. A checklist of the fishes of the Hawaiian Archipelago. Bishop Museum Bulletin of Zoology, B. P. Bishop Museum Press. 1340 ms. pages.

Randall JE. 1998. Shore fishes of Hawaii. Honolulu, HI: University of Hawaii Press. 216 pp.

Marine Fishes

Hawaiian sea moth

Eurypegasus papilio

Ball's pipefish

Cosmocampus balli

Redstripe pipefish

Doryrhampus baldwini

Edmondson's pipefish

Halicampus edmondsoni



Fisher's seahorse

Hippocampus fisheri

Spiny seahorse

Hippocampus histrix

Yellow seahorse

Hippocampus kuda

SPECIES STATUS:

IUCN Red List - Not considered except:

Hippocampus fisheri and *H. histrix*, and *Eurypegasus* listed as Data Deficient

H. kuda listed as vulnerable

All Endemic except *Hippocampus histrix* and *H. kuda*

SPECIES INFORMATION: These species all share a body structure made of bony rings. The pipefishes and seahorses have sex-role reversal where the males accept and guard eggs in internal pouches or on their skin until the young hatch. This takes from ten to 50 days. They are predators that feed mostly on small crustaceans. The Hawaiian sea moth is a deeper water species. Redstripe pipefish often occur in small groups of mixed age. They have also been

observed cleaning other fishes. Fisher's seahorse is apparently pelagic, attaching to floating algae. All species are less than 30 centimeters (one foot) in length and mostly half of that.

DISTRIBUTION: Hawaiian sea moths and Edmondson's pipefish are found statewide. Ball's pipefish has been found from O'ahu to Kaua'i. The redstripe pipefish has only been found from the island of Hawai'i to O'ahu. Fisher's seahorse is found from Maui to the island of Hawai'i but may be more widespread. The spiny seahorse is only known from a specimen from Maui. The Yellow seahorse is found in the main islands and up to Necker Island.

ABUNDANCE: These species (except the deep Hawaiian sea moths) are looked for in surveys of coral reef fishes in the Main and Northwestern Hawaiian Islands, both by the National Oceanic and Atmospheric Administration and the Division of Aquatic Resources. A recent survey in the main islands found that seahorses and pipefishes were rare.

LOCATION AND CONDITION OF KEY HABITAT: Seahorses use plants to anchor themselves by their tails. Pipefishes often use the area under ledges. They all occur in moderately shallow water, except the sea moth which occurs in water over 60 meters (200 feet) deep, often in algal beds. Juvenile Hawaiian sea moths can be found in shallow water. Edmondson's pipefish can often be found in tidepools. The Yellow seahorse can be found in brackish waters.

THREATS:

- These species are prized by aquarists, and seahorses are used in some Asian cultures for medicinal and other purposes. Aquaculture research collection may also be a threat.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. Seahorses are listed in CITES Appendix II and pipefishes are being considered for such protection. Commercial licenses are required for aquarium collectors. In addition to common state-wide and island conservation actions, specific actions include:

- Maintain healthy populations with appropriate fishing regulations and education.

MONITORING:

- Continue to survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size;
- Support aquacultural research to develop captive breeding for species used in the aquarium trade.

References:

Gulko D. 2004. Hawaiian marine species for Endangered Species Act candidate listing, revised candidate list 2004. Honolulu, HI: Hawai'i Division of Aquatic Resources. 21 pp.

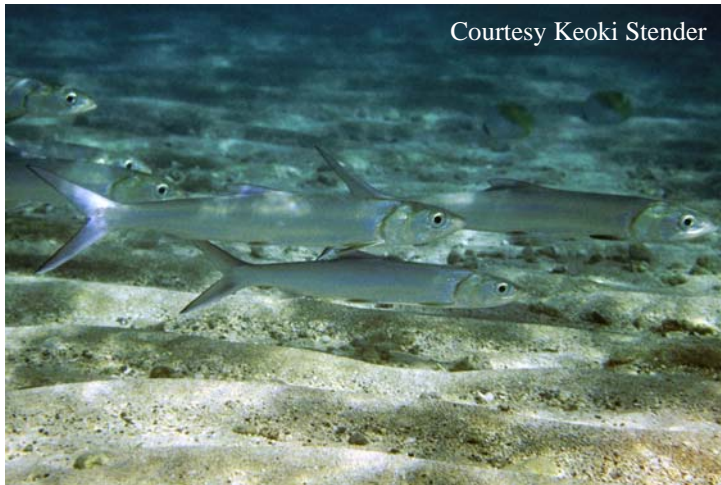
Gulko D. 2005. Hawai'i Endemic Species Status Chart spreadsheet. Honolulu, HI: Hawai'i Division of Aquatic Resources.

Hoover J. 1993. Hawaii's fishes. Honolulu, HI: Mutual Publishing. 183 pp.

International Union for the Conservation of Nature and Natural Resources. [Internet] Threatened Red List. Available from: <http://www.redlist.org/search/search-expert.php> (Accessed May 2005).

Mundy B. In press. A checklist of the fishes of the Hawaiian Archipelago. Bishop Museum Bulletin of Zoology, B. P. Bishop Museum Press. 1340 ms. pages.

Tinker S. 1978. Fishes of Hawaii. Honolulu HI: Hawaiian Service, Inc. 532 pp.



Courtesy Keoki Stender

Marine Fishes

Hawaiian ladyfish

Awa'aua

Elops hawaiiensis

SPECIES STATUS:

IUCN Red List - Not considered

Endemic

SPECIES INFORMATION: The awa'aua is one of the most primitive bony fish. They are often confused with mullet. Spawning takes place offshore. The larvae are leptocephalus (eel-like) and as they develop they move into inshore waters and can be found in tidal streams, salt water marshes, and canals. It feeds on fishes and crustaceans. They swim in schools. They are noted for their hard-fighting nature when caught.

DISTRIBUTION: Found throughout the State and especially common at Hanauma Bay, O'ahu.

ABUNDANCE: Commercial landings in the Main Hawaiian Islands have been about 225 kilograms (500 pounds) a year in recent years. No other abundance data are available.

LOCATION AND CONDITION OF KEY HABITAT: Awa'aua prefer shallow waters around the shoreline or shallow protected waters over sandy or silty bottoms. They may also be found in brackish water as well as fish ponds.

THREATS:

- Localized heavy fishing pressure and susceptibility to nearshore pollution and runoff.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common statewide and island conservation actions, specific actions include:

- Restoration of habitat through reduction in pollution;
- Restore healthy populations with appropriate fishing regulations and education.

MONITORING:

- Survey populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting population size, ecology, and basic biology of this species.

References:

Fishbase. [Internet] online data. <http://fishbase.sinica.edu.tw/Summary/SpeciesSummary.cfm?genusname=Elops&speciesname=hawaiiensis> (accessed May 2005).

Hoover J. 1993. Hawaii's fishes. Honolulu, HI: Mutual Publishing. 183 pp.

Randall JE. 1998. Shore fishes of Hawaii. Honolulu, HI: University of Hawaii Press. 216 pp.

Tinker S. 1978. Fishes of Hawaii. Honolulu HI: Hawaiian Service, Inc. 532 pp.

Western Pacific Fishery Information Network. online data. Available from:
<http://www.pifsc.noaa.gov/wpacfin/> (accessed May 2005).



Courtesy Keoki Stender

Marine Fishes

Hawaiian flagtail Āholehole

Kuhlia xenura

SPECIES STATUS:
IUCN Red List – Not considered
Endemic

SPECIES INFORMATION: Āholehole in Hawai'i used to be considered a single species in the species *Kuhlia sandvicensis* but have recently been determined to be two species. One of those species is endemic and thus qualifies under the CWCS criteria. This is *K. xenura*, sometimes now called the big eyed mullet. They reach about nine inches in length. They may be found in schools. They are planktivores, primarily nocturnally. They facultatively use streams as well. When in streams they feed on fishes, invertebrates, and insects.

DISTRIBUTION: They are found throughout the State.

ABUNDANCE: They are looked for in surveys of coral reef fishes in the Main and Northwestern Hawaiian Islands, both by the National Oceanic and Atmospheric Administration and the Division of Aquatic Resources. Commercial landings for both *Kuhlia* spp. in the Main Hawaiian Islands have averaged about 1,350 kilograms (3,000 pounds) a year in recent years, except there was a decrease to less than 900 kilograms (2,000 pounds) in 2003, the most recent year of data.

LOCATION AND CONDITION OF KEY HABITAT: Young *K. xenura* can be found in shallow water along the coast and in tide pools and estuaries, where this species is denser than *K. sandvicensis*, which prefers higher salinity. Adults are found along the outer edge of the reefs. They can often be found in areas of high surge. At night they spread out to feed on plankton.

THREATS:

- They are fished commercially and recreationally;
- Historically they were important in Native Hawaiian religious ceremonies.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. Regulations set minimum catch size at five inches. In addition to common statewide and island conservation actions, specific actions include:

- Maintain healthy populations with appropriate fishing regulations and education.

MONITORING:

- Continue surveys of population and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size.

References:

Benson, Lori. Personal communication.

Benson LK, Fitzsimons JM. 2002. Life history of the Hawaiian fish *Kuhlia sandvicensis* as inferred from daily growth rings of otoliths. *Environmental Biology of Fishes*. 65(2):131-137.

Hawai'i Division of Aquatic Resources, State of Hawaii. Commercial marine landings data. 1997 - 2003. Honolulu, HI: Division of Aquatic Resources.

Hoover J. 1993. Hawaii's fishes. Honolulu, HI: Mutual Publishing. 183 pp.

Mundy B. In press. A checklist of the fishes of the Hawaiian Archipelago. Bishop Museum Bulletin of Zoology, B. P. Bishop Museum Press. 1340 ms. pages.

Tinker S. 1978. Fishes of Hawaii. Honolulu HI: Hawaiian Service, Inc. 532 pp.



Marine Fishes

Whitesaddled goatfish

Kūmū

Paurupeneus porphyreus

SPECIES STATUS:
IUCN Red List – Not considered
Endemic

SPECIES INFORMATION: Kūmū are goatfish that feed on invertebrates in the sediments around reefs. They reach about 38 centimeters (15 inches) in length. They may be found in schools during the day.

DISTRIBUTION: They are found throughout the State.

ABUNDANCE: They are looked for in surveys of coral reef fishes in the Main and Northwestern Hawaiian Islands, both by the National Oceanic and Atmospheric Administration and the Division of Aquatic Resources. Commercial landings in the Main Hawaiian Islands have dropped from about 1,800 to 2,300 kilograms (4,000 to 5,000 pounds) a year to 1,040 kilograms (2,300 pounds) in 2003, the most recent year of data.

LOCATION AND CONDITION OF KEY HABITAT: Young are common in shallow water in the summer. Adults can be found throughout reef habitats.

THREATS:

- They are fished commercially and recreationally. In traditional Native Hawaiian culture they were sometimes substituted for pigs when certain offerings were called for. They could only be consumed by men.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. Regulations set minimum catch size at ten inches (25 centimeters). In addition to common statewide and island conservation actions, specific actions include:

- Maintain healthy populations with appropriate fishing regulations and education.

MONITORING:

- Continue surveys of population and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size.

References:

Hawai'i Division of Aquatic Resources, State of Hawaii. Commercial marine landings data. 1997 – 2003.

Honolulu, HI: Division of Aquatic Resources.

Hoover J. 1993. Hawaii's fishes. Honolulu, HI: Mutual Publishing. 183 pp.

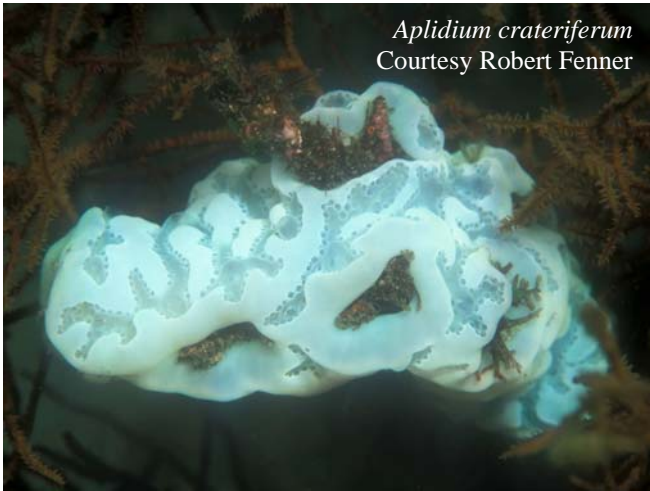
Tinker S. 1978. Fishes of Hawaii. Honolulu HI: Hawaiian Service, Inc. 532 pp.

Marine Invertebrates

Miscellaneous Filter Feeders

Brachiopod

Lingula reevii



Yellow crust bryozoan

Parasmittina sp.

Ascidians

Aplidium crateriferum

Aplidium sp.

SPECIES STATUS:

IUCN Red List - Not considered

Endemic

SPECIES INFORMATION: All of these species are filter-feeders. *Lingula reevii* reproduces asexually and has low dispersal potential. Like other *Lingula*, it resides in burrows in sand or mud. Yellow crust bryozoan (*Parasmittina sp.*), cratered aplidium (*Aplidium crateriferum*), and gold ring aplidium (*Aplidium sp.*) are part of the “fouling community” that grows especially well on boat hulls and other man-made structures. Yellow crust bryozoan is colonial and also reproduces asexually. The ascidians are hermaphrodites and brood their eggs internally. Once the eggs hatch, the next stage is a tadpole-like larvae.

DISTRIBUTION: *Lingula reevii* is found only in Kāneʻohe Bay, Oʻahu. The yellow crust bryozoan is found throughout the Main Hawaiian Islands, but is abundant at Molokini Islet, Maui. Cratered aplidium is found throughout the Main Hawaiian Islands and the Northwestern Hawaiian Islands, but it is most common on the North Shore of Oʻahu. Gold ring aplidium is found at Makena and Molokini Islet, Maui.

ABUNDANCE: *Lingula reevii* is declining based on Division of Aquatic Resources surveys in Kāneʻohe Bay, but abundances are unknown for the other species.

LOCATION AND CONDITION OF KEY HABITAT: *Lingula reevii* primary habitat is the sandy reef flats of Kāneʻohe Bay, Oʻahu, and this habitat is degraded. Yellow crust bryozoan primary habitat includes corals, shells, and stones onto which they encrust. Cratered aplidium prefers crevices and the underside of overhangs on vertical walls that are exposed. Gold ring aplidium occurs at “scuba depths.”

THREATS:

- Habitat degradation due to urbanization and sedimentation of Kāneʻohe Bay, Oʻahu threatens *Lingula reevii*;
- Aquarium trade collectors harvest *Lingula reevii*.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common state-wide and island conservation actions, specific actions include:

- Restore habitat of *Lingula*;
- Maintain healthy populations with appropriate aquarium fishing regulations, enforcement, and education.

MONITORING:

- Continue to survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size and distribution;
- Support aquaculture research to develop captive breeding for *Lingula*'s use in the aquarium trade.

References:

Gulko D. 2004. Hawaiian marine species for ESA Candidate listing revised Candidate list. Honolulu, HI: Division of Aquatic Resources, State of Hawai`i.

Hoover JP. 1998. Hawaii's sea creatures, A guide to Hawaii's marine invertebrates. Honolulu, HI: Mutual Publishing. 366 pp.

Marine Invertebrates

Euprymna scolopes
Courtesy Keoki Stender



Cephalopods

He'e or Hawaiian octopus

Octopus hawaiiensis

Mūhe'e or Bobtail squid

Euprymna scolopes

SPECIES STATUS:

IUCN Red List - Not considered
Endemic

SPECIES INFORMATION: He'e or Hawaiian octopus (*Octopus hawaiiensis*) and mūhe'e or bobtail squid (*Euprymna scolopes*) are endemic cephalopods. Both are nocturnal predators using venoms or poisons to capture and kill their prey. Hawaiian octopus feed primarily on crabs and other mollusks and occasionally on fish. Mūhe'e feed mainly on the shrimp *Palemon debilis*, but also feed on small worms. He'e and mūhe'e have complex mating behaviors. Males use a specially modified arm to insert sperm into the female's mantle cavity. Eggs are laid on the bottom of the ocean in clusters. He'e guards their eggs. Larvae are pelagic. Mūhe'e bury themselves during the day. They protect themselves from predators on moonlit nights by masking their silhouette using organs that contain bioluminescent bacteria. Little is known of the habits of Hawaiian octopus.

DISTRIBUTION: Both species are found throughout the Hawaiian Islands.

ABUNDANCE: Not known for either species.

LOCATION AND CONDITION OF KEY HABITAT: Hawaiian octopus primary habitat is rocky substrate in waters ranging from approximately five to nine meters (15 to 30 feet) deep. Mūhe'e are found in sand and mud flats in shallow waters. This habitat is important to the squid, because it uses the substrate during the day to burrow, and its main prey is found in this area. Its habitat is in decline, especially in areas like Kāne'ohe Bay, O'ahu where the bay is affected by urbanization and sedimentation.

THREATS:

- Habitat degradation is the primary threat to the mūhe'e and results from urbanization, runoff, and sedimentation. These threats not only alter its habitat but may negatively affect prey availability;
- Recreational collectors fish for Hawaiian octopus;
- Aquarium and research fishing pressure also is a concern for mūhe'e.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common state-wide and island conservation actions, specific actions include:

- Restore and maintain habitat, especially for mūhe'e;
- Cooperate with other agencies to minimize pollution in areas such as Kāne'ohe Bay;
- Enforce regulations for aquarium trade and recreational collectors.

MONITORING:

- Continue and expand surveys of population and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Research life history and biological characteristics to better understand management needs.

References:

Gulko D. 2004. Hawaiian marine species for ESA Candidate listing revised Candidate list. Honolulu, HI: Division of Aquatic Resources, State of Hawai'i.

Hoover JP. 1998. Hawaii's sea creatures, A guide to Hawaii's marine invertebrates. Honolulu, HI: Mutual Publishing. 366 pp.

Marine Invertebrates

Other Crustaceans

Unauna or Hermit crabs



Dromia dormia
Courtesy Keoki Stender

Aniculus hopperae

Calcinus hazletti

Calcinus laurentae

Crabs

Aethra edentata

Carpilius maculatus

Dromia dromia

Ligia hawaiiensis

Lybia edmondsoni

Pseudopalicus oahuensis

Shrimps



Hymenocera picta
Courtesy Keoki Stender

Cinetorhynchus hawaiiensis

Cinetorhynchus hendersoni

Gnathophyllum precipuum

Hymenocera picta

Levicularis mammilata

Liomera supernodosa

Metapenaeopsis sp.

Rhynchocinetes rathbunae

Stenopus earlei

SPECIES STATUS:

IUCN Red List - Not considered

All Endemic except for *Carpilius*, *Dromia*, and *Hymenocera*

SPECIES INFORMATION: The following are the Hawaiian, common, and scientific names for the Unauna or hermit crabs, true crabs, and shrimps: Hopper's hermit crab (*Aniculus hopperae*), Hazlett's hermit crab (*Calcinus hazletti*) and Laurent's hermit crab (*Calcinus laurentae*); flat elbow

crab (*Aethra edentata*), alakuma or 7-11 crab (*Carpilius maculatus*), makua-o-ka-lipoa or sponge crab (*Dromia dormia*), *Ligia hawaiiensis* (no common name), kūmimi pua or Hawaiian pom pom crab or (*Lybia edmondsoni*), and button crab (*Pseudopalicus oahuensis*); Hawaiian hinge-beaked shrimp (*Cinetorhynchus hawaiiensis*), Henderson's hinge-beaked shrimp (*Cinetorhynchus hendersoni*), Hawaiian cave shrimp (*Gnathophyllum precipuum*), harlequin shrimp (*Hymenocera picta*), red pencil urchin shrimp (*Levicaris mammilata*), knotted liomera (*Liomera supernodosa*), bicolor sand shrimp (*Metanpenaeopsis* sp.), Rathbun's hinge-beaked shrimp (*Rhynchocinetes rathbunae*), and Earl's coral shrimp (*Stenopus earlei*). The unauna, alakuma, button crab, hinge-beaked shrimp, Hawaiian cave shrimp, and the bicolor sand shrimp are nocturnal. Hermit crabs are scavengers, Earl's coral shrimp are cleaners, alakuma crush other crustaceans and snails, button crabs feed on algae, and kūmimi pua use anemones on their claws to capture prey and feed on invertebrates. Harlequin shrimp are predators of seastars, including crown-of-thorns starfish. It is also monogamous and pair-bonding. Specific feeding information for the other species is unknown, but they are likely scavengers. All species have separate sexes and reproduce through copulation. All females brood eggs under their tails, except for the bicolor sand shrimp that releases eggs directly into the ocean. Newly hatched larvae are part of the plankton community for weeks to months. Makua-o-ka-lipoa is the largest sponge crab in the world. Rathbun's hinge-beaked shrimp is known as the mandarin shrimp in the aquarium trade.

DISTRIBUTION: Earl's coral shrimp is found off O'ahu and Kaua'i. The other species are found throughout the Hawaiian Islands. Knotted liomera is found throughout the Main Hawaiian Islands, but it is more common in the Northwestern Hawaiian Islands.

ABUNDANCE: Unknown. Henderson's hinge-beak shrimp are found throughout the islands, but they are abundant of the coast of Kona, Hawai'i. Earl's coral shrimp is rare.

LOCATION AND CONDITION OF KEY HABITAT: Most of these crustaceans are bottom dwellers. Hopper's hermit crab has primary habitat in caves and under ledges, but on exposed rocky shores from three feet to seventy feet (one to 21 meters). Hazeltt's and Laurent's hermit crabs live below the intertidal zone from six meters (20 feet) or deeper and occur on branching corals. The flat elbow crab is found on sandy bottom areas and kūmimi pua is found under stones in sand or on rubble in waters from approximately a meter to 30 meters (few feet to 100 feet) deep. The button crab is found on rocky bottom habitat. The shrimp species inhabit a large range of areas. Hawaiian hinge-beak shrimp inhabit finger coral; Henderson's hinge-beak shrimp inhabit shallow, sheltered reefs; and Rathbun's hinge-beak shrimp prefer rocky substrates. Hawaiian cave shrimp are found only in caves. Red pencil urchin shrimp live commensally with the sea urchin *Heteroentrotus mammillatus*. The knotted liomera is found on reef and reef flats. Bicolor sand shrimp prefer sandy rubble while Earls' coral shrimp inhabit caves, crevices and under ledges. Hinge-beak shrimp live on reefs.

THREATS:

- Aquarists collect alakuma, kūmimi pua, and makua-o-ka-lipoa, the hinge-beaked shrimps, and harlequin shrimp.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common state-wide and island conservation actions, specific actions include:

- Maintain healthy populations with appropriate fishing regulations, enforcement, and education.

MONITORING:

- Survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population sizes and distributions;
- Support aquaculture research to develop captive breeding for species used in the aquarium trade.

References:

- Fiedler GC. 2002. The influence of social environment on sex determination in harlequin shrimp (*Hymenocera picta*: Decapoda, Gnathophyllidae). *Journal of Crustacean Biology* 22 (4): 750-761.
- Gulko D. 2005. Hawai'i endemic species status chart spreadsheet. Honolulu, HI: Hawai'i Division of Aquatic Resources.
- Gulko D. 2004. Hawaiian marine species for ESA Candidate listing revised Candidate list. Honolulu, HI: Division of Aquatic Resources, State of Hawai'i.
- Hoover JP. 1998. Hawaii's sea creatures: A guide to Hawai'i's marine invertebrates. Honolulu, HI: Mutual Publishing. 366 pp.
- Kay AE. 1979. Hawaiian marine shells reef and shore fauna of Hawaii, section 4: Mollusca. Honolulu, HI: Bishop Museum Press. 653 pp.



Marine Invertebrates

Ula poni or Spiny lobster *Panulirus marginatus*

SPECIES STATUS:
IUCN Red List - Not considered
Endemic

SPECIES INFORMATION: Ula poni or the spiny lobster (*Panulirus marginatus*) lacks large pincers on its first pair of legs and has one pair of antennae that is often bigger than its other antennae. Ula poni feed across sandy bottom areas that are next to reefs. They are carnivorous and feed at night on mollusks, echinoderms, crustaceans and fish. They may spawn up to four times a year from May to August and November to December. Females can produce up to half a million bright orange eggs each time they spawn. The mass of eggs is held in the female's swimmerets under her abdomen. They hatch in four weeks and go through various pelagic larval stages that last almost a year. After a year in the open ocean, they return to the reef. Juveniles are usually a few centimeters (one inch) long.

DISTRIBUTION: Historically, ula poni were distributed throughout the Hawaiian Archipelago. Today, they are still are found throughout the Archipelago. Pelagic larval distribution is not well understood, but one study shows that larvae move with ocean currents northwest along the ridge of the Archipelago to the southeast and then southwest.

ABUNDANCE: Numbers can be relatively high in pristine areas; however, numbers are greatly reduced from historic abundance due to over-fishing. Over the past four years, commercial catch has continued a long decline, slipping below 4,500 kilograms (10,000 pounds) for the past three years. The recreational fishery catch is unknown.

LOCATION AND CONDITION OF KEY HABITAT: Ula poni are found in crevices and caves, as well as under ledges. They may be found in shallow waters of approximately a meter (three feet) or in areas up to 180 meters (600 feet) deep. Key foraging habitats are sandy areas next to coral reefs. Healthy coral reefs are important habitat. Not much is known of the pelagic lifecycle of ula poni larvae.

THREATS: Ula poni were traditionally eaten by Native Hawaiians and were taken commercially in the trap fishery from the mid-1970s to 1999 in the Northwestern Hawaiian Islands (NWHI), specifically at Necker Island and Maro Reef. Populations experienced a serious decline in the early 1990s that continued until the late 1990s.

- Localized heavy fishing pressure remains a serious threat in the commercial and recreational fishery, although the fishery is closed in the NWHI and regulated in the Main Hawaiian Islands. Young are also collected for the aquarium trade;
- Habitat alteration such as degradation to coral reefs may also be an issue.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common state-wide and island conservation actions, specific actions include:

- Maintain healthy populations with appropriate fishing regulations, enforcement, and education.

MONITORING:

- Continue to monitor population size to determine if fishing regulations and other conservation actions are successful.

RESEARCH PRIORITIES:

- Continue studies of larval distribution;
- Improve understanding of factors affecting the species population size and distribution.

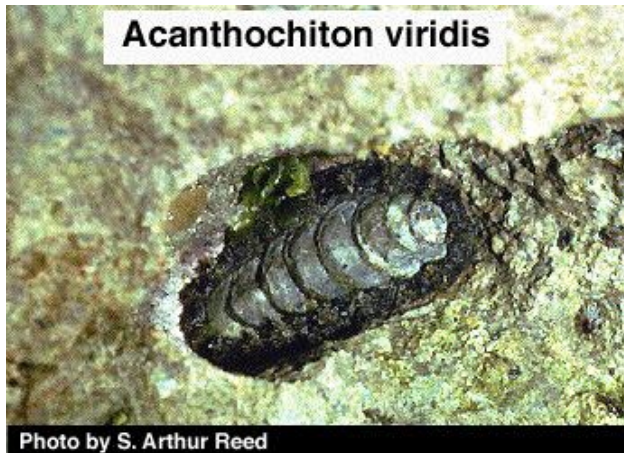
References:

Gulko D. 2005. Hawai'i Endemic Species Status Chart spreadsheet. Hawai'i Division of Aquatic Resources.

Hoover JP. 1998. Hawaii's sea creatures, A guide to Hawaii's marine invertebrates. Honolulu, HI: Mutual Publishing. 366 pp.

Kanciruk P. 1980. Ecology of juvenile and adult Palinuridae (spiny lobsters). pp. 59-66 In: JS Cobb and BF Phillips, editors. The Biology and Management of Lobsters. Volume II.

Polovina JJ, Kleiber P, and Kobayashi DR. 1999. Application of TOPEX-POSEIDON Satellite Altimetry to Simulate Transport Dynamics of Larvae of Spiny Lobster, *Panulirus marginatus*, in the Northwestern Hawaiian Islands, 1993-1996. Fisheries Bulletin 97: 132-143.



Marine Invertebrates

Pūpū mo‘o or chitons

Acanthochiton viridis
Ischnochiton petaloides

SPECIES STATUS:
IUCN Red List - Not considered
Endemic

SPECIES INFORMATION: Pūpū mo‘o or chitons are primitive seashore molluscs. They both feed by browsing on algae adhered to hard substrates. Both the kuakulu or green chiton (*A. viridis*) and the flat chiton (*I. petaloides*) have separate sexes and external fertilization. The adult kuakulu, 28 millimeters long (one inch), is larger than the adult flat chiton (10 millimeters long or one-half inch).

DISTRIBUTION: They occur on rocky and hard substrates throughout the islands.

ABUNDANCE: Unknown

LOCATION AND CONDITION OF KEY HABITAT: Key habitat for both the kuakulu and flat chiton are reef flats and tidepools. Kuakulu, however, prefers small depressions on limestone reef flats and holes or areas underneath the rubble of tidepools. Flat chitons prefer areas under rocks in both tidepools and reef flats.

THREATS: None identified.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common state-wide and island conservation actions, specific actions include:

- Ensure healthy habitat is maintained.

MONITORING:

- Survey for populations and distribution in known and likely habitats.

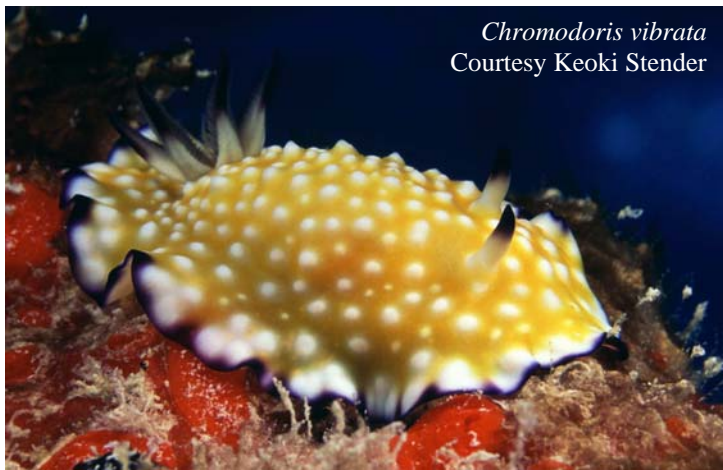
RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size and distribution.

References:

Hoover JP. 1998. Hawaii’s sea creatures, A guide to Hawaii’s marine invertebrates. Honolulu, HI: Mutual Publishing. 366 pp.

Kay AE. 1979. Hawaiian marine shells reef and shore fauna of Hawaii, section 4: Mollusca. Honolulu, HI: Bishop Museum Press. 653 pp.



Chromodoris vibrata
Courtesy Keoki Stender



Halgerda terramtuentis
Courtesy Keoki Stender

Marine Invertebrates

Nudibranchs

- Aldisa pikokai*
- Ardeadoris scottjohnsoni*
- Chromodoris vibrata*
- Glossodoris poliahu*
- Halgerda terramtuentis*
- Hypselodoris andersoni*
- Melibe megaceras*
- Peltodoris fellowsi*
- Sclerodoris paliensis*

SPECIES STATUS:

IUCN Red List - Not considered
Endemic

SPECIES INFORMATION: The pitted nudibranch (*Aldisa pikokai*), Scott Johnson’s nudibranch (*Ardeadoris scottjohnsoni*), trembling nudibranch (*Chromodoris vibrata*), snow goddess nudibranch (*Glossodoris poliahu*), gold lace nudibranch (*Halgerda terramtuentis*), Anderson’s nudibranch (*Hypselodoris andersoni*), *Melibe megaceras* (no common name), Fellow’s nudibranch (*Peltodoris fellowsi*), and pali nudibranch (*Sclerodoris paliensis*) are carnivores and feed on a variety of organisms ranging from sponges, hydroids, and corals to other nudibranchs. The only nocturnal feeder is the pitted nudibranch. All nudibranchs are hermaphroditic and mate through mutual insemination. Eggs are laid in coiled ribbons. Eggs hatch and trochopore larvae develop into planktonic veligers that lose their shell once they settle. Most nudibranchs do not live longer than one year. It is interesting to note that nudibranchs have few natural predators. They are usually toxic, although they do not produce their own toxins, but recycle those of their prey.

DISTRIBUTION: Most species are found throughout the Hawaiian archipelago; however, the gold lace nudibranch is only found in the Main Hawaiian Islands.

ABUNDANCE: Snow goddess nudibranch is uncommon. There is little quantitative abundance or trend data for any of the species.

LOCATION AND CONDITION OF KEY HABITAT: The pitted nudibranch’s key habitat is in waters two to nine meters (six to 30 feet), but they can be found in waters up to 24 meters (80 feet) deep. They prefer areas with stones and crevices. Primary habitat for the trembling nudibranch is sea level to water down to 24 meters (80 feet) deep. Gold lace nudibranchs are

found around caves in waters from approximately five to 30 meters (15 to 100 feet). Anderson's nudibranch's primary habitat is in caves as well as under overhangs on exposed rocky shores from five to 18 meters (15 to 60 feet). Anderson's nudibranchs also live on the yellow sponge *Luffariella metachromia*. Additionally, they occasionally have been found in shallower waters of harbors and boat channels. Fellow's nudibranch is found at the entrance of caves from six to fifteen meters (20 to 50 feet) or more and live on sponges. The pali nudibranch's primary habitat is waters from two to six meters (six to 20 feet) deep. Specific habitat for the other species has not been delineated.

THREATS:

- The aquarium trade targets gold lace, Fellow's, and pali nudibranchs.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common state-wide and island conservation actions, specific actions include:

- Maintain healthy populations with appropriate aquarium fishing regulations, enforcement, and education.

MONITORING:

- Survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

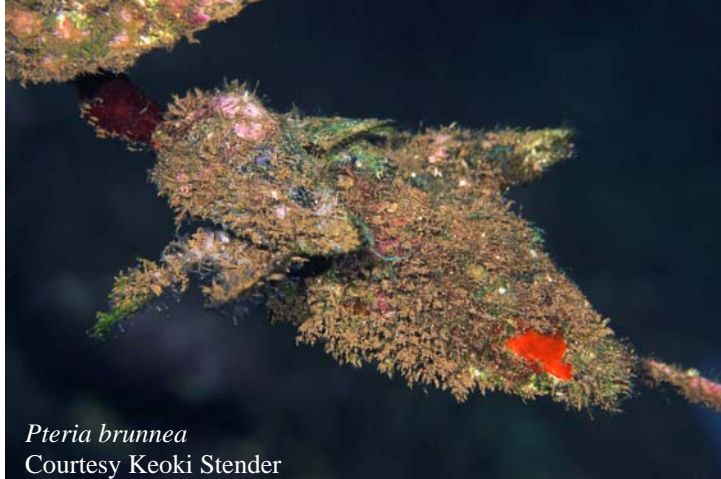
- Improve understanding of factors affecting the species population sizes and distributions.

References:

Gulko D. 2004. Hawaiian marine species for ESA Candidate listing revised Candidate list. Honolulu, HI: Division of Aquatic Resources, State of Hawai'i.

Hoover JP. 1998. Hawaii's sea creatures, A guide to Hawaii's marine invertebrates. Honolulu, HI: Mutual Publishing. 366 pp.

Kay AE. 1979. Hawaiian marine shells reef and shore fauna of Hawai'i, section 4: Mollusca. Honolulu, HI: Bishop Museum Press. 653 pp.



Pteria brunnea
Courtesy Keoki Stender

Marine Invertebrates

Bivalves

Judd's scallop

Haumea juddi

Nahawele li'i li'i or Hawaiian mussel

Brachidontes crebristriarius

Pa or Pearl oyster

Pinctada margaritifera

Winged pearl oyster

Pteria brunnea

Nahawele or Black purse shell

Isognomon californicum



Isognomon californicum
Courtesy Keoki Stender

SPECIES STATUS:

IUCN Red List - Not considered

All Endemic except for *Pinctada*

SPECIES INFORMATION: Judd's scallop (*Haumea juddi*), nahawele li'i li'i or the Hawaiian mussel (*Brachidontes crebristriarius*), the winged pearl oyster (*Pteria brunnea*) and nahawele or the black purse shell (*Isognomon californicum*) are endemic, filter feeding bivalves, while pa or the pearl oyster (*Pinctada margaritifera*) is a widespread species. All have separate sexes and external fertilization. Both nahawele li'i li'i and pa attach to their substrates using strong byssal threads, while nahawele can move using its large foot. Judd's scallop can swim by clapping its shells.

DISTRIBUTION: All species were historically distributed throughout the state. Today they are found throughout the Hawaiian Archipelago; however, nahawele is most abundant around

Maui and the island of Hawai'i. Nahawele li'i li'i is primarily found on the windward or Main Hawaiian Islands.

ABUNDANCE: Pearl oysters were harvested at Pearl and Hermes Atoll in the Northwestern Hawaiian Islands, the only place they were common, but overfishing in the 1930s led to their decline and regulations limiting their harvest. The National Marine Fisheries Service surveyed Pearl and Hermes recently and found that pearl oysters were not rare, but would still not support a commercial fishery. Abundance is unknown for the rest of the species.

LOCATION AND CONDITION OF KEY HABITAT: Judd's scallop's primary habitat is on sandy ocean bottoms at depths of eight to 100 meters (26 to 328 feet). They are situated so their open shells face into the current with their top shell thinly covered with sand. If disturbed, they have been documented to swim two to three meters (six to ten feet). Both Judd's scallop and nahawele li'i li'i form patches or beds. Nahawele li'i li'i primary habitat is limestone shoreline at the low tide mark. However, in shoreline areas where freshwater and salt water mix they grow to their largest size. They can also be found on basalt shorelines, although in lower densities. Pa is found in shallow waters in between corals. The winged pearl oyster's primary habitat is on species of black coral; however, they also can cluster on wire corals. They may also host bryozoans on their shells. Nahawele form clusters in crevices at the high tide mark and prefer brackish waters. Nahawele on islands other than Maui and the island of Hawai'i are found individually in more saline waters.

THREATS:

- Historically, pearl oysters were threatened by harvesting them for their pearls;
- Pollution is a direct threat to these species, because they are filter feeders. This also makes them potentially good indicators of water quality in their habitats.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common state-wide and island conservation actions, specific actions include:

- Collaborate to reduce nearshore pollution;
- Maintain healthy habitat.

MONITORING:

- Survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size and distribution.

References:

Hoover JP. 1998. Hawaii's sea creatures, A guide to Hawai'i's marine invertebrates. Honolulu, HI: Mutual Publishing. 366 pp.

Kay AE. 1979. Hawaiian marine shells reef and shore fauna of Hawaii, section 4: Mollusca. Honolulu, HI: Bishop Museum Press. 653 pp.



Marine Invertebrates

‘Opihi or Limpets

Cellana exarata

Cellana melanostoma

Cellana sandwicensis

Cellana talcosa

SPECIES STATUS:

IUCN Red List - Not considered
Endemic

SPECIES INFORMATION: The endemic ‘opihī makaiauli or black foot ‘opihī (*C. exarata*), the green foot ‘opihī (*C. melanostoma*), the ‘opihī ‘alinalina or yellow foot ‘opihī (*C. sandwicensis*), and the ‘opihī ko‘ele or giant ‘opihī (*C. talcosa*) are all protected by fishing regulations. All ‘opihī graze on algae and most may creep about to graze, but return to their “home scar” after feeding. Both ‘opihī ‘alinalina and ‘opihī ko‘ele often are covered with seaweed. Gametes are shed into the water where fertilization is external. Veligers have a short planktonic life. Spawning occurs mainly in December and January for ‘opihī makaiauli and ‘opihī ‘alinalina. Spawning information is unknown for the green foot ‘opihī and ‘opihī ko‘ele. ‘Opihī makaiauli grows to 40 millimeters (1.6 inches) in diameter, the green foot ‘opihī to 43 millimeters (1.7 inches), the ‘opihī ‘alinalina to 32 millimeters (1.3 inches), and ‘opihī ko‘ele to 90 millimeters (3.5 inches). Besides eating them, native Hawaiians used the shells as scrapers and tools.

DISTRIBUTION: The primary ranges for the ‘opihī makaiauli, ‘opihī ‘alinalina, and ‘opihī ko‘ele are along the basalt shorelines of the Main Hawaiian Islands; however, the ‘opihī makaiauli has been found on La Perouse Pinnacle and ‘opihī ‘alinalina on Necker and Nihoa. The green foot ‘opihī is found primarily in the Northwestern Hawaiian Islands, but it has been occasionally collected from Kaua‘i. Historically, it was found on O‘ahu and Maui as well.

ABUNDANCE: The abundance of ‘opihī makaiauli and ‘opihī ‘alinalina have declined in the past decades. ‘Opihī ko‘ele is rare, especially so on Kaua‘i and O‘ahu. About 3,175 kilograms (7,000 pounds) of ‘opihī were collected in the commercial fishery in 2003, which is a decline of about 2,268 kilograms (5,000 pounds) from recent years. The recreational fishery catch is unknown.

LOCATION AND CONDITION OF KEY HABITAT: Primary habitat for all ‘opihī is the intertidal zone to ten feet deep waters. ‘Opihī makaiauli thrives in the spray zone, although it may be found seaward to the calcareous algal zone. It is well suited for this variable environment due to its ability to ventilate its mantle cavity when it is dry. ‘Opihī ‘alinalina are found on and below the zero tide mark where there is a steady splash, and they are often on coralline algae. ‘Opihī ko‘ele are found below the tide mark from 0.5 to three meters (one to ten feet) deep, often between boulders.

THREATS:

- Localized heavy fishing pressure is the most significant threat to all 'opihi species, especially 'opihi ko'ele. Populations in the wild have decreased greatly and this can impact their reproductive success;
- Climate change, habitat disturbance, and nearshore pollution are also potential threats.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common statewide and island conservation actions, specific actions include:

- Maintain healthy populations with appropriate fishing regulations, enforcement, and education;
- Restore habitat.

MONITORING:

- Survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Research the impact of nearshore habitat disturbance and destruction;
- Improve understanding of factors affecting the species population size and distribution, especially for green foot and giant 'opihi.

References:

Gulko D. 2005. Hawai'i endemic species status chart spreadsheet. Honolulu, HI: Hawai'i Division of Aquatic Resources.

Gulko D. 2004. Hawaiian marine species for ESA Candidate listing revised Candidate list. Honolulu, HI: Division of Aquatic Resources, State of Hawai'i.

Hoover JP. 1998. Hawaii's sea creatures, A guide to Hawaii's marine invertebrates. Honolulu, HI: Mutual Publishing. 366 pp.

Kay AE. 1979. Hawaiian marine shells reef and shore fauna of Hawaii, section 4: Mollusca. Honolulu, HI: Bishop Museum Press. 653 pp.

Marine Invertebrates

Snails

Charonia tritonis
Chicoreus insularum
Conus abbreviatus
Cypraea burgessi
Cypraea gaskoini
Cypraea granulate
Cypraea mauiensis
Cypraea ostergaardi
Cypraea rasleighana
Cypraea semiplota
Cypraea sulcidentata
Cypraea tessellata
Cypraea tigris
Duplicara gouldi
Epitonium ulu
Nerita picea
Nerita plicata
Nerita polita
Smaragdia bryannae
Strombus vomer hawaiiensis
Turbo sandwicensis



SPECIES STATUS:

IUCN Red List - Not considered

All Endemic except for *Charonia*, *Cypraea tigris*, and *Nerita polita*

SPECIES INFORMATION: The species common names and Hawaiian names are: pu or triton's trumpet (*Charonia tritonis*), burnt murex (*Chicoreus insularum*), pūpū'ala or abbreviated cone (*Conus abbreviatus*), Burgess' cowry (*Cypraea burgessi*), leho or Gaskoin's cowry (*C. gaskoini*), leho or granulated cowry, (*C. granulate*), leho or Maui cowry (*C. mauiensis*), leho or Ostergaard's cowry (*C. ostergaardi*), leho or Rasleigh's cowry (*C. rasleighana*), puleholeho or half-swimmer cowry (*C. semiplota*), leho or groove-toothed cowry (*C. sulcidentata*), leho or checkered cowry (*C. tessellata*), tiger cowry (*C. tigris*), pūpū loloa or Gould's auger (*Duplicara gouldi*),

fungiid wentletrap (*Epitonium ulu*), pipipi or black nerite (*N. picea*), *N. plicata* (none), kūpe'e or polished nerite (*N. polita*), Hawaiian seagrass snail (*Smaragdia bryannae*), alīlea or Hawaiian stromb (*Strombus vomer hawaiiensis*), and pūpū mahina or Hawaiian turban (*Turbo sandwicensis*). Pu reaches twenty inches in length (second largest snail in the Pacific) and feeds on sea stars and sea urchins, including crown-of-thorns starfish. *Chicoreus* and pūpū'ala are carnivores. *Chicoreus* feeds exclusively on bivalves drilling through the bivalve's shell and inserts a digestive enzyme and ingests the tissues through its proboscis. Pupu'ala feeds exclusively on polychaete worms using its teeth that are connected to a venom gland and paralyzes its prey and swallows it whole. Leho or cowries are nocturnal and can be herbivores and omnivores as well as sponge feeders (*C. gaskoini* and Puleholeho). Hawaiian individuals of *C. tigris* are the largest in the world. Pūpū loloa feed solely on the yellow acorn worm (*Ptychodera flava*). The fungiid wentletrap (*Epitonium*) is associated with a solitary coral *Fungia scutaria*. Nerites (*Nerita* and *Smaragdia*) and alīlea are exclusively herbivores and feed on algae. Kūpe'e is nocturnal. Pūpū'ala egg capsules are laid in clusters ranging from 80 to 1000 eggs. Female leho lay eggs in triangular capsules that are attached to the substrate. Eggs develop for one to two weeks. The fungiid wentletrap pelagic stage lasts about 39 days. Nerites lay eggs in capsules that adhere tightly to the surface of rocks and shells. Settlement of nerite veligers peaks in the winter.

DISTRIBUTION: Pu, the burnt murex, *Conus*, lehos, pipipi and kūpe'e, alīlea, pūpū mahina, and pūpū loloa are found throughout the Archipelago; however, pūpū loloa is rare or possibly absent on the island of Hawai'i. The fungiid wentletrap is found only in Kāne'ohe Bay, O'ahu. *Nerita plicata* is found only on the Northwestern Hawaiian Islands and *Smaragdia bryannae* is found specifically at Anini, Kaua'i; Kāne'ohe Bay, O'ahu; and near Kaunakakai, Moloka'i.

ABUNDANCE: Specific abundance for cowries is unknown, but many are rare such as pu, *Cypraea mauiensis*, *C. ostergaardi*, and *C. tigris*. Alīlea is also very rare today.

LOCATION AND CONDITION OF KEY HABITAT: The burnt murex is found at depths of 18 meters (60 feet) or more. Pūpū'ala key habitat is on benches and sandy substrate of reef platforms. Most Lehos including (*C. gaskoini*, *C. granulata*, Pulholeho, and *C. tessellata*) are found in shallow waters to 60 meters (200 feet). *C. mauiensis* is restricted to shallow waters, while *C. rashleighana* and *C. sulcidentata* are found in more moderately deep waters. *C. ostergaardi* is the only cowry found exclusively in deep waters. *C. mauiensis* has additional key breeding habitat on the leeward side of Maui. Pūpū loloa inhabits the casting of large acorn worms. The fungiid wentletrap lives on a solitary coral *Fungia scutaria* in Kāne'ohe Bay, an area that has been severely degraded. Key habitat for both pipipi and *N.plicata* is intertidal areas, but kūpe'e is found under sand at the high tide line. *Smaragdia bryannae* is found on fringing and patch reefs only in association with the marine angiosperm *Halophila hawaiiiana*. Alīlea lives up to 25 meters (80 feet) deep in sand. Pūpū mahina is common to 18 meters (60 feet) deep.

THREATS:

- Localized excessive harvesting of these species for their shells by collectors and for cultural uses is the primary threat to these snail species. Kūpe'e was eaten by native Hawaiians and used in shell lei. *Cypraea mauiensis* is extremely rare due to over collection;
- Pollution is another threat for those found in intertidal areas and shallow waters.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common state-wide and island conservation actions, specific actions include:

- Maintain healthy populations with appropriate fishing regulations, enforcement, and education.

MONITORING:

- Survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size and distribution.

References:

Gulko D. 2005. Hawai'i endemic species status chart spreadsheet. Honolulu, HI: Hawai'i Division of Aquatic Resources.

Gulko D. 2004. Hawaiian marine species for ESA Candidate listing revised Candidate list. Honolulu, HI: Division of Aquatic Resources, State of Hawai'i.

Hoover JP. 1998. Hawaii's sea creatures: A guide to Hawai'i's marine invertebrates. Honolulu, HI: Mutual Publishing. 366 pp.

Kay AE. 1979. Hawaiian marine shells reef and shore fauna of Hawai'i, section 4: Mollusca. Honolulu, HI: Bishop Museum Press. 653 pp.

No photo available

Marine Invertebrates

Hawaiian oyster

Ostraea sandvicensis

SPECIES STATUS:

IUCN Red List - Not considered
Endemic

SPECIES INFORMATION: This is an oyster endemic to Hawai'i. Little else is known about their life history.

DISTRIBUTION: Unknown.

ABUNDANCE: Unknown.

LOCATION AND CONDITION OF KEY HABITAT: Unknown.

THREATS: None identified.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common state-wide and island conservation actions, specific actions include:

- Work to clean estuaries with significant pollution;
- Restore habitat.

MONITORING:

- Establish survey schedule to determine population size and distribution.

RESEARCH PRIORITIES:

- Improve understanding of the life history, biology, and ecology of these oysters.

References:

None identified.

No Photo available

Marine Invertebrates

Black reef sponge

Spongia oceania

SPECIES STATUS:

IUCN Red List - Not considered

Endemic

SPECIES INFORMATION: The black reef sponge is a filter feeder, using its collar cells to filter out organic material from the water passing through its cells. The black reef sponge is hermaphroditic. Most often it reproduces asexually through budding or fragmentation; however, sexual reproduction does occur. Gametes are produced at different times within a sponge; therefore, sponges depend on another sponge for fertilization. Sperm is released into the open ocean and other sponges retrieve the sperm to fertilize their eggs internally. These fertilized eggs hatch into free-swimming larvae. Although the black reef sponge has no spicules, it is still too hard to be exploited commercially.

DISTRIBUTION: Once widespread, the black reef sponge is primarily found in Hanauma Bay, O'ahu and along the Kona Coast on the island of Hawai'i.

ABUNDANCE: Previously, it was the most common large sponge in the Hawaiian Islands and was very abundant in Hanauma Bay, O'ahu in the 1940s. Today, numbers have decreased significantly.

LOCATION AND CONDITION OF KEY HABITAT: The black reef sponge primary habitat is in shallow waters on hard substrate that is in open areas with a strong surge or current. Its habitat is threatened by pollution and degradation from trampling of tourists.

THREATS: Although this sponge is not suitable for commercial use, it has severely declined since the 1940s.

- Pollution or degradation from human interactions such as trampling may have caused the decline.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common state-wide and island conservation actions, specific actions include:

- Restore habitat.

MONITORING:

- Survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

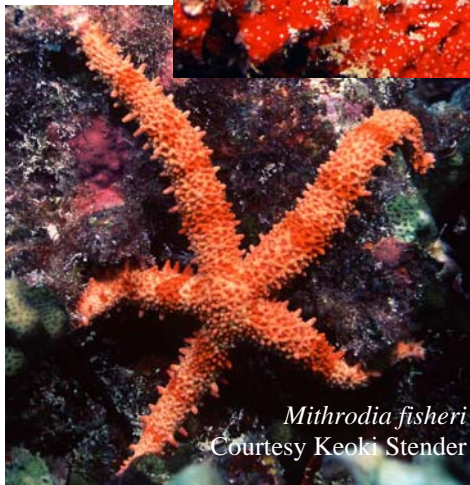
- Improve understanding of factors affecting the species population size and distribution.

References:

Hoover JP. 1998. Hawaii's sea creatures: A guide to Hawaii's marine invertebrates. Honolulu, HI: Mutual Publishing. 366 p.



Actinocidaris thomasi
Courtesy Keoki Stender



Mithrodia fisheri
Courtesy Keoki Stender

Marine Invertebrates

Echinoderms

Echinoids

Actinocidaris thomasi
Lissodiadema purpureum
Lovenia hawaiiensis

Asteroid

Mithrodia fisheri

Holothuroids

Stichopus sp.1
Stichopus sp. 2

SPECIES STATUS:

IUCN Red List - Not considered
Endemic

SPECIES INFORMATION: Thomas' sea urchin (*Actinocidaris thomasi*), fine spined urchin (*Lissodiadema purpureum*, *Leptodiadema* is a junior synonym), Hawaiian lovenia (*Lovenia hawaiiensis*), the sea star *Mithrodia fisheri*, the Hawaiian spiny sea cucumber (*Stichopus sp. 1*), and Hawaiian yellow-tip sea cucumber (*Stichopus sp. 2*) are all endemic. Specific feeding habits are known for two species: the fine spined sea urchin grazes on algae and *M. fisheri* probably feeds on sponges, bryozoans, and other sessile organisms. Little is known on the feeding habits of the two sea cucumbers as they have not been scientifically described. Thomas's urchin may host small molluscs in shallower waters and barnacles in deeper waters. The fine spined sea urchin hosts a commensal shrimp. They all have separate sexes and reproduce by releasing eggs and sperm into the water. Larvae are part of the planktonic community for a few days to weeks and then they settle to mature.

DISTRIBUTION: All species occur throughout Hawai'i.

ABUNDANCE: Unknown

LOCATION AND CONDITION OF KEY HABITAT: Thomas's sea urchin primarily is found in deeper waters, but may be found in waters as shallow as 9 meters (30 feet). It stays under coral slabs and in crevices during the day. Fine spined urchins live on rocky substrates from approximately 6 to over 46 meters (20 to over 150 feet). Small fine spined urchins are most often

found under stones, while larger ones in caves and crevices. Hawaiian lovenia lives in the sand. Hawaiian spiny sea cucumbers are found out in the open beside coral reefs in sand and rubble. They also can also be found on steep slopes from approximately 15 to 46 meters (50 to 150 feet). Hawaiian yellow-tip sea cucumbers prefer areas under stones during the day. *M. fisheri* primary habitat is on cave ceilings and walls.

THREATS:

- Aquarium collectors harvest Thomas's and fine spined sea urchins.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common state-wide and island conservation actions, specific actions include:

- Maintain healthy populations with appropriate fishing regulations, enforcement, and education.

MONITORING:

- Continue to survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population size and distribution.

References:

- Gulko, D. 2005. Hawai'i Endemic Species Status Chart spreadsheet. Honolulu, HI: Hawai'i Division of Aquatic Resources.
- Hoover JP. 1998. Hawaii's sea creatures, A guide to Hawaii's marine invertebrates. Honolulu, HI: Mutual Publishing. 366 pp.



Marine Invertebrates

Worms

Annelid worm

Vermiliopsis torquata

Flatworms

Pericelis hymanae

Pseudobiceros sp. 2

Ko'e kai or Ribbon worm

Baseodiscus cingulatus

SPECIES STATUS:

IUCN Red List - Not considered
Endemic

SPECIES INFORMATION: *Vermiliopsis torquata* (no common name), Hyman's flatworm (*Pericelis hymanae*), the Hawaiian spotted flatworm (*Pseudobiceros sp. 2*), and ko'e kai or banded ribbon worm (*Baseodiscus cingulatus*) are all endemic worms. All are carnivores and nocturnal. The ko'e kai uses its long proboscis to attack and entrap their prey. Hyman's and Hawaiian spotted flatworms are hermaphroditic. Fertilization is internal and eggs are laid in a gelatinous material. Eggs develop into free-swimming larvae or directly into small flatworms. The ko'e kai has separate sexes and eggs are laid in a gelatinous material and are fertilized externally. Both the flatworms and ko'e kai reproduce asexually by fragmentation or budding.

DISTRIBUTION: All species are found throughout the Hawaiian Archipelago.

ABUNDANCE: Unknown. Hyman's flatworm is common at Black Point, O'ahu.

LOCATION AND CONDITION OF KEY HABITAT: Hyman's flatworm prefers shallow waters and is commonly found under stones. They may also associate with the brown purse shell (*Isognomon perna*). Like Hyman's flatworm, the Hawaiian spotted flatworm is found under stones; however, it is found from the shoreline to waters down to 15 meters (50 feet) deep. Ko'e kai has a large range of primary habitat. It has been found as deep as 76 meters (250 feet), but also lives in shallow waters and tidepools.

THREATS: None identified.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. In addition to common state-wide and island conservation actions, specific actions include:

- Maintain healthy habitats.

MONITORING:

- Survey for populations and distribution in known and likely habitats.

RESEARCH PRIORITIES:

- Improve understanding of factors affecting the species population sizes and distributions.

References:

Barnes RD. 1980. Invertebrate zoology, 4th edition. Philadelphia, PA: Saunders College Publishing.

Hoover JP. 1998. Hawaii's sea creatures: A guide to Hawaii's marine invertebrates. Honolulu, HI: Mutual Publishing. 366 pp.