Seafood Watch
Seafood Report:

# Hawaiian Crabs

**(Kona crab, kuahonu crab, and Samoan crab)**




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**update**
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| List of Five Component Ranks | Green | Yellow | Red | Avoid |
|---|---|---|---|---|
| Inherent Vulnerability | √ | | | |
| Status of Stocks | | √ | | |
| Bycatch | √ | | | |
| Habitat Effects | √ | | | |
| Management Effectiveness | | √ | | |

**Overall Seafood Rank:** Good Alternative

## About Seafood Watch® and the Seafood Reports

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch defines sustainable seafood as species, whether fished or farmed, that can exist into the long-term by maintaining or increasing stock abundance and conserving the structure, function, biodiversity and productivity of the surrounding ecosystem. Seafood Watch® makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from the web (www.montereybayaquarium.org) or obtained from the program by emailing seafoodwatch@mbayaq.org. The program's goals are to raise awareness of important ocean conservation issues and to shift the buying habits of consumers, restaurateurs and other seafood purveyors to support sustainable fishing and aquaculture practices.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices", "Good Alternative" or "Avoid". In producing the Seafood Reports, Seafood Watch seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch Fishery Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch's sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

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**Executive Summary:**

Kona crab, kuahonu crab, and Samoan crab are the three main crabs fished commercially in Hawaii. All are fecund and quick to mature, thus most likely inherently resistant to fishing pressure. The fishing methods (baited lines; various types of net rings) are benign to habitat (when not set too close to coral reefs) and take little bycatch. However, basic biological information is unavailable for the Hawaiian populations of these species. None have had a stock assessment, and no fisheries management plan is in place. Landings are the main indicator of abundance. Average landings data suggest, but do not prove, that Hawaii's combined-species crab harvests have been relatively stable for the last 22 years. However, because almost all important stock factors are unknown for all three species, stock status must be classified as "unknown". Management seems moderately effective. State managers have established minimum sizes for all three species; a closed season for Kona crab; and gear restrictions for Hawaii's commercial crab fishery. There are no seasons in place for kuahonu or Samoan crab. The only bag limit in place covers Samoan crab in Hilo Harbor.
Kona crab is mentioned in the NMFS Western Pacific Crustacean FMP, but only as incidental take in the spiny lobster fishery. The directed kona crab fishery is not covered under this FMP or any other. Essential fish habitat has been defined for kona crab under the NMFS Western Pacific Coral Reef FMP, but the habitat is not specially protected. Essential fish habitat has not been defined for kuahonu or Samoan crab.

In 2000, the latest year for which figures are available, Hawaii landed 14.2 metric tons of locally-caught crab, but imported 90.3 metric tons of crab from Australia and Canada. An unknown amount of Dungeness crab may also have been "imported" from the mainland United States. Australia's kona crab fishery and U.S./Canadian Dungeness crab fisheries are well-managed, with established management plans, stock assessments, and fisheries-independent research programs. All of these fisheries take little bycatch; all use methods that are thought to cause little damage to habitat. The Australian kona crab fishery was recently reviewed and deemed sustainable by Environment Australia, and the Dungeness crab fisheries have already received a Seafood Watch rating of "Best Choice".

***A Note on Outside Review:***

***Seafood Watch is indebted to an anonymous reviewer, who graciously reviewed this paper for scientific accuracy. It is important to note that scientific review does not constitute an endorsement of Seafood Watch on the part of the reviewing scientists; the Seafood Watch staff is solely responsible for the conclusions reached in this report.***

# Hawaiian Crabs
**(Kona crab, kuahonu crab, and Samoan crab)**

## Kona Crab
*Ranina ranina*
**Other names: Päpa‘i kualoa [Pickett, 2003]; spanner crab, frog crab [QFS,2001]**

**Figure 1: Kona crab, side and top views. Photos from coralreefnetwork.com**

Kona crab (spanner crab) is found throughout the warmer sections of the Indian and Pacific oceans [WPFMC, 2001], and supports commercial fisheries throughout its range [QFS, 1999]. This crab inhabits bare, sandy seafloor, where it buries itself and waits to ambush prey [QFS, 2001; WPFMC, 2001]. In Hawaii, it is fished on sandy seafloor adjacent to fringing reefs and rocky areas [HI Aquatic Resources, 2003].

## Kuahonu Crab
*Portunus sanguinolentus*

**Other names: kuanona crab, white crab [DLNR, 2002], haole crab [DAR, 2003]. threespot crab [marinefood.com.pk], bloodspotted crab [FAO 1994], redspotted swimmer crab [Queensland Museum, 2003].**

**Figure 2: Kuahonu crab. Photo from marinefood.com.pk**

The kuahonu crab (threespot crab) supports commercial fisheries throughout the Pacific and Indian oceans [FAO, 1994; CFD, 2001]. It is found on mud or sand substrates and is also capable of swimming in the water column [FAO, 1994].

## Samoan Crab

*Scylla serrata*

Other names: serrate swimming crab [State Records, 2002]; mangrove crab, mud crab [University of Hawaii/Bishop Museum, 2002].

**Figure 3: Samoan crab, male, state record holder, caught in Pearl Harbor on a handline baited with tilapia [State Records, 2002]. Photo from hawaiifishingnews.com**

Samoan crab is found throughout the Indian and Pacific oceans and has also been introduced into the Gulf of Mexico [University of Hawaii/Bishop Museum, 2002]. This species was not originally native to Hawaii, but was introduced from Samoa in 1926 for the express purpose of starting a fishery [University of Hawaii/Bishop Museum, 2002]. It is now found in brackish-water habitat—along shorelines, in mangrove forests, at river mouths—on all the main Hawaiian Islands [University of Hawaii/Bishop Museum, 2002]. It is reportedly difficult to harvest Samoan crab in any quantity; there is little directed fishing; the locally-caught Samoan crab marketed in Hawaii are taken as incidental catch in other fisheries [Kushima, 2003]. Small amounts of Samoan crab (mud crab) are also imported to Hawaii from Australia [Kushima, 2003].

Hawaii's crab is fished artesianally, exclusively by small-boat operators [Haight, 2003]. Hawaii's commercial crab landings totaled approximately 8.7 metric tons (19,146 lbs) in 1999, the last year for which figures are available [DAR, 2002]. Several species are fished commercially in Hawaii, including kona crab, kuahonu crab [Haight, 2003], and Samoan crab, although kona crab predominates.

This table details Hawaii's commercial crab landings, 1999-2001, in metric tons (and pounds).

| | **1999** | **2000** | **2001*** |
|---|---|---|---|
| **Hawaii crab landings** | 21.7 mt (47,949 lbs) | 14.2 mt (31,209 lbs) | 8.7 mt (19,146 lbs) |

Sources: State of Hawaii Data Book, 2001; *DAR/WPacFIN, 2002.

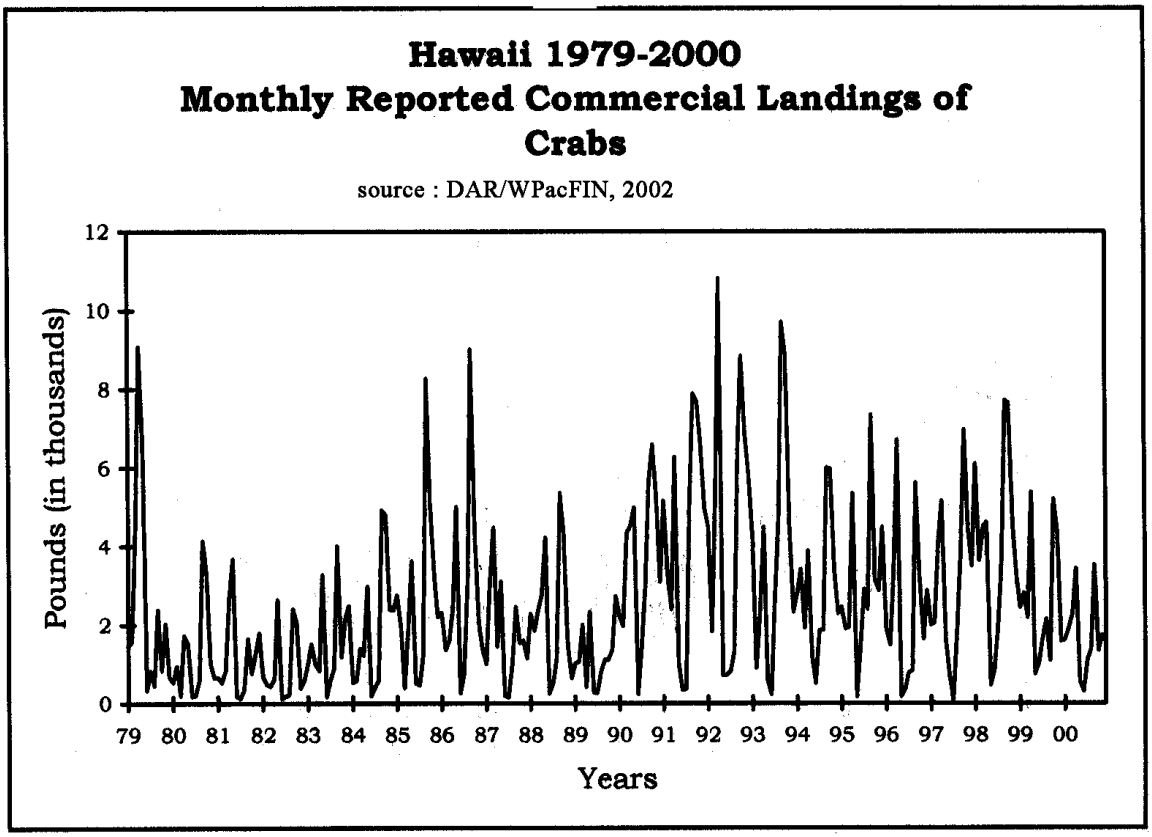


**Figure 4: Hawaiian commercial crab landings, 1979-2000. Source: DAR/WPacFin, 2002**

Hawaii imports far more crab than it harvests domestically [NMFS SWFSC Stats 2002; Haight, 2003; Takenaka, 2003; Bertram, 2003]. In 2000, the last year for which figures are available, Hawaii imported 90.3 metric tons of crab [NMFS SWFSC Stats 2002]. Two nations are listed as sources of this crab: Australia and Canada [NMFS SWFSC Stats 2002]. These import statistics are not broken down as to species of crab. However, market research tells us that the most common imports are kona crab and Dungeness crab [Haight, 2003; Takenaka, 2003; Bertram, 2003]; only small amounts of Samoan (mud) crab are imported from Australia [Kushima, 2003]. Kona crab is imported from Australia [Takenaka, 2003; Bertram, 2003], where it is fished under the name of "spanner crab" [QFS, 2001]. This imported kona crab is marketed both cooked and uncooked [Takenaka, 2003]. The amount of kona crab imported from Australia far exceeds Hawaii's domestic harvest [Haight 2003; NMFS SWFSC Stats 2002]. In addition, a considerable amount of the crab sold in Hawaii is Dungeness crab [Haight 2003]. Import statistics list Canada as a source of crab imported into Hawaii [NMFS SWFSC Stats 2002], and this is likely Dungeness crab from British Columbia [Haight, 2003]. However, it should be noted that the crab import statistics do not count seafood shipped between regions of the United States [NMFS SWFSC Stats 2002]. The U.S. West Coast supports extensive Dungeness crab fisheries, and any Dungeness crab caught in U.S. waters would **not** be included in Hawaii's "import" total.

Australia's spanner (kona) crab fishery appears to meet all Seafood Watch criteria for a sustainable fishery. Stock assessments are in place and stocks are holding steady around BMSY [QFS,1999]. Harvests are controlled, seasons and gear restrictions are in place, the fishery is limited-entry, and CPUE is steady [QPICEA 2001]. Managers conduct fisheries-independent research and have a management plan in place [QFS, 1999; Brown 1995; Kenelly 1996; Chen 1999]. The main fishing method is tangle nets, which take little or no bycatch, and they are set on sandy seafloor, where they cause little or no habitat damage [QFS 2001; QPICEA 2001]. Australia's spanner crab fishery was

recently reviewed and certified as environmentally sustainable by Environment Australia (Australia's government department of "environment and heritage") [QPICEA, 2001; QG Newsletter 2002]. Although it was not possible to conduct a thorough review in the brief time allotted to this report, it is fairly safe to say that Australian spanner crab would rate a "Best Choice" listing on the Seafood Watch card.

The Dungeness crab fisheries of the United States and Canada have been reviewed by Seafood Watch and found to be sustainable [Cascorbi, 2002]. Dungeness crab already appears on the Seafood Watch "Best Choices" list.

# Analysis of Seafood Watch Criteria for Sustainable Wild Caught Products Relative to Hawaii

## Criterion 1: Inherent Vulnerability to Fishing Pressure

**Intrinsic rate of increase ('r'):**
Not found for Hawaiian crab species as of this writing.

**Age at 50% sexual maturity:** Low: Less than 5 years

Determining the age of wild crabs is always difficult, as they lose in the molting process many of the characteristics that scientists use to define age [Abbott, 1980]. For crabs, managers often refer to "size at maturity" rather than "age at maturity".

Female kona crabs reach sexual maturity at a size of 54.3-63 mm carapace length [WPFMC, 2001]. Males tend to grow larger than female, and about 60% of males are sexually mature by the size of 60 mm carapace length [WPFMC, 2001]. Because these are tropical crabs, it is reasonable to assume that they achieve this size in less than five years.

In laboratory studies, Samoan crabs became sexually mature at less than one year of age [University of Hawaii/Bishop Museum, 2001].

No references on first reproduction of kuahonu crab were found in the brief search time allotted to this report. It may be reasonably assumed that kuahonu crab shares with other warm-water crabs a relatively early sexual maturity and a pelagic larval stage [Swingle et al. 2001; WPFMC, 2001].

**Validated maximum age:** Low: Less than 10 years
No references on maximum age of Hawaiian kona or kuahonu crab were found. Determining the age of crabs is difficult in any case, as they lose in the molting process many of the characteristics that scientists use to define age [Abbott, 1980]. Australian attempts to develop an age structure for kona crab using tag-recapture methods have had only limited success [Brown, 1995]. However, a low age of reproductive maturity in a crab generally means a short lifespan [Abbot, 1980].

**Reproductive potential (fecundity):** Medium (e.g. egg layer)
All three species of Hawaiian crab lay eggs, which are brooded for some weeks on the female's abdomen until hatching [DLNR, 2002]. In kona crabs, the fertilized eggs hatch about 29 days after fertilization [WPFMC, 2001]. In the Hawaiian archipelago, kona crabs spawn at least twice during the May-September spawning season, laying a second batch of eggs about nine days after the first batch hatches [WPFMC, 2001]. No data on exact fecundity (egg count and/or number of clutches per year) was discovered for Samoan crab or threespot crab in the brief search time allotted to this report. However, the blue crab, a relative of the threespot crab, spawns more than a million eggs at a time, several times a year, in the warmwater environment of the Gulf of Mexico[Guillory et al. 2000].

**Additional Factors to evaluate:**
***Species range:*** Broad (e.g. species exists in multiple ocean basins, has multiple intermixing stocks or is highly migratory)

Kona crab (spanner crab) is found throughout the tropical Pacific and Indian oceans [QFS, 1999; WPFMC, 2001]. Kuahonu crab (threespot crab) is also found throughout the tropical Pacific and Indian oceans [FAO, 1994; CFD, 2001]. Samoan crab is found throughout the Indian and Pacific oceans and has also been introduced into the Gulf of Mexico [University of Hawaii/Bishop Museum, 2001]. The Samoan crab is a recent (1926) introduction to Hawaii. As a large and aggressive crab which feeds on native invertebrates, it is considered an "invasive species" by some ecologists [University of Hawaii/Bishop Museum, 2001].

***Evidence of special behaviors that increase ease of capture (spawning aggregations, site fidelity, etc):*** No

***Evidence of high population variability driven by physical environmental change (e.g El Nino, Decadal Oscillations):*** Yes
Most crustaceans with a pelagic larval phase are vulnerable to high population variability based on oceanographic conditions that influence larval survival [NPFMC 1999; Idoine 2001].

## Synthesis, analysis and evaluation of relevant factors

Hawaiian crabs appear to be short-lived and quick to mature, like other tropical crabs. The Hawaiian crab species are all are egg layers, and crabs with similar life histories typically spawn prolifically. All three species are widespread across the Pacific basin, and the kuahonu crab and Samoan crab are found in other oceans as well. However, like other crustaceans with pelagic larval stages, these crabs may be very vulnerable to recruitment effects of oceanographic conditions.

Because of the assumed high fecundity, low age at sexual maturity, and short lifespan, Hawaii crabs receive the rank of "inherently resilient".

**Inherent Vulnerability Rank** **Inherently Resilient**

## Criterion 2: Status of Wild Stocks

**Classification status:** Fully fished OR unknown
No Hawaiian crab species is listed as overfished, but stock assessments have not been performed for any Hawaiian crab species [Kushima, 2003].

**Current population abundance relative to BMSY:** Close to BMSY (50 – 125%) OR unknown
Unknown. No BMSY data was found .

**Short- and long-term trend in population abundance, as measured by fishery-independent means (stock assessment):** Trend is flat or variable OR unknown
Trend is unknown, and no stock assessments have been done [Kushima, 2003].

**Trend in catch and fishing effort: Catch and effort are stable OR unknown**
As measured by landings, Hawaii's total crab catch appears to have been roughly stable over the 22-year period, 1979-2000, as shown in Figure 5 below. The period 1986-1999 seems especially stable.

This table details Hawaii's commercial crab landings, 1999-2001, in metric tons (and pounds).

| | 1999 | 2000 | 2001* |
|---|---|---|---|
| **Hawaii crab landings** | 21.7 mt (47,949 lbs) | 14.2 mt (31,209 lbs) | 8.7 mt (19,146 lbs) |

Sources: State of Hawaii Data Book, 2001; *DAR Stats, 2003.

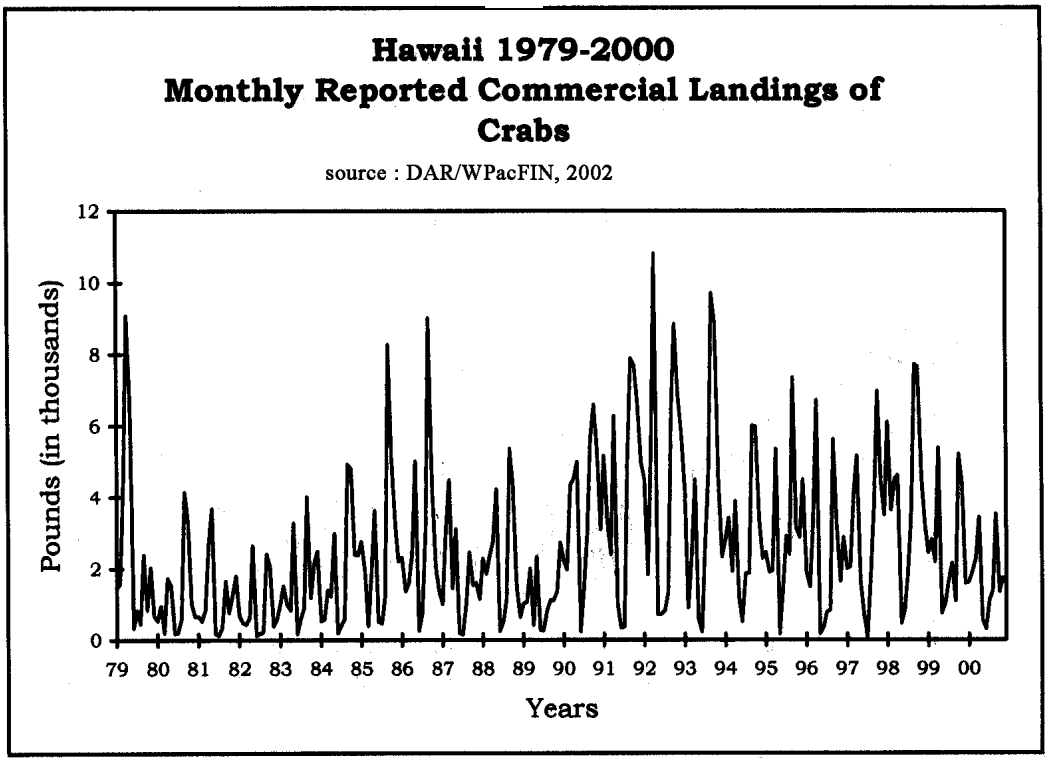


**Figure 5: Hawaiian commercial crab landings, 1979-2000. Source: DAR/WPacFin, 2002**

Between 1961 and 1979, catches of kona crab from the main Hawaiian Islands averaged 13.5 metric tons per year [WPFMC, 2001].

Commercial landings of Hawaiian crabs have decreased markedly since 1999 [Hawaii Data Book, 2002]. Catch per unit effort (CPUE) was not found, so it is impossible to say whether the decreased landings are due to a decline in crab stocks or simply to this putative decrease in fishing effort. Crabs were taken as incidental catch in Hawaii's spiny lobster fishery [DAR NTD Activity Report, 2002], which has been closed since 1999 [NMFS FMEP, 2002]. It is possible that the lobster closure has influenced the landings of crab. However, Kushima [2003] reports that because most lobster fishing was in remote areas of the Northwest Hawaiian Islands, and because Kona crab cannot survive the long journey back to the main Islands in marketable condition, Kona crab was an insignificant part of the marketed catch from the lobster fishery [Kushima, 2003]. Many crustaceans are also subject to wide population fluctuations due to differential larval survival caused by oceanographic conditions [NPFMC 1999; Idoine 2001]. It is possible that the decline in landings is related to a natural and reversible oceanographic trend. However, Kushima [2003] suggests that another explanation is a decline in domestic fishing effort. She notes that imports have provided a more consistent, reasonably-priced supply of crab to the retail market, and that it has been difficult for the local crab fisheries to compete [Kushima, 2003]. Thus, the decline in local catch may simply be a decline in local effort, in response to market conditions.

For kona crab, the 1961-1979 average landings seem in line with the reported landings 1999-2001. These data suggest that landings in Hawaii's kona crab fishery have been relatively stable, on average, over the last 40 years. Similarly, Figure 5 above shows monthly and annual landings of all crabs to have been relatively stable over the last 22 years, and especially so between 1986 and 1999.

**Occurrence of overfishing (current level of fishing mortality relative to overfishing threshold):**
Overfishing likely (mortality is near threshold) OR unknown
Overfishing threshold unknown.

**Current age, size or sex distribution of the stock relative to natural condition:**
Mostly unknown.
Distribution is unknown for kuahonu and Samoan crabs. For kona crabs, data from the 1972 and 1976 suggested a preponderance of males in the population around the main Hawaiian Islands [WPFMC, 2001]. These data are old, but still suggest that sex distribution be rated "yellow", not "green", for kona crab.

**Additional Factors to evaluate:**
***Scientific evidence that disputes the stock classification***
None found.

***Degree of uncertainty in status of stock***
Medium (e.g. Only limited, fishery-dependent data on stock status are available)

There are no state Stock Surveys for Hawaiian crab [Kushima, 2003]. There is limited federal coverage of the Kona crab under the Crustaceans FMP, but this does not extend to stock assessment [Kushima, 2003]. There is a large recreational fishery for Hawaiian crabs, but it is unquantified; the state Hawaii Marine Recreational Fishing Survey is ending its second year in 2003; in eight months, this creel survey intercepted only one recreational crab fisher, who had 12 kona crabs [Kushima, 2003].

## Synthesis, analysis and evaluation of relevant factors

Stock assessments and fisheries-independent data are unavailable for Hawaii crabs. Commercial landings have decreased markedly, from 21.7 metric tons in 1999 to 8.7 metric tons in 2001, but the reasons for this are unclear. Average landings data suggest, but do not prove, that kona crab harvests have been relatively stable for the last 40 years. However, because almost all important stock factors are unknown, stock status must be classified as "unknown".

**Status of the Stocks Rank** **Stocks Unknown**

## Criterion 3: Nature and Extent of Bycatch

**Composition of the bycatch, including any species of "special concern" (i.e. those identified as "endangered", "threatened" or "protected" under state, federal or international law):**
Bycatch includes a low diversity of organisms (e.g. a single or only a few species), none of which are of "special concern" ■

All of Hawaii's typical crab-fishing gears (crab net rings (both individual and on strings), baited line, and trap) are considered low-bycatch fishing methods [FAO 1996, FAO 1997]. No marine mammals or other species of special concern are considered to be impacted in Hawaii's crab fisheries [NMFS List of Fisheries, 2001].

As this document was being prepared, pelagic longlining interests asserted that Hawaii crab fisheries took bycatch of endangered sea turtles. The DAR's Jo-Anne Kushima [2003] is unaware of any reports of problems with bycatch of any kind, and particularly knows of no problem with sea turtles.

It should be noted that fishers using the strings of crab net ring are motivated to leave their gear in the water only for short periods, because the entangled crabs attract predators, which not only take the crabs, but can also damage the gear [Kushima, 2003].

**Population consequences of bycatch:**
Low: Quantity of bycatch is thought to have little or no impact on population levels ■

**For bycatch species of similar or lower trophic level relative to the targeted species-- Quantity of bycatch relative to the quantity of targeted landings:**

Not Applicable □

**Short and long-term trend in quantity and composition of bycatch as a result of management decisions including gear innovations:**
Trend in quantity and/or diversity of bycatch is good ■

This factor is rated "green" because the trend is flat around "minimal bycatch".

**Additional Factor to evaluate**
***Evidence that the ecosystem has been or will likely be altered in response to the removal of the bycatch species:*** No ■

### Synthesis, analysis and evaluation of relevant factors

By the nature of the fishing methods used, Hawaiian crab fisheries take little or no bycatch. The trend is "flat" around minimal bycatch. This is clearly a low-bycatch fishery.

### Nature and Extent of Bycatch Rank — Bycatch Low ■

## Criterion 4: Effect of Fishing Practices on Habitats and Ecosystems

**Effect of fishing gear on physical and biogenic habitats (known for specific fishery or inferred from other studies):** Minimal damage (e.g. crab ring net, baited line, and lobster trap)

Most of Hawaii's commercial kona crab harvest is taken with strings of "crab rings"--small tangle nets set on the seafloor [Haight, 2003]. Each ring consists of a metal frame (either circular or rectangular) fitted with fine mesh netting. By state law, the rings can be no larger than two feet (61 cm) in diameter, and the mesh holes no smaller than two inches (95.08 cm) when the net is stretched [DLNR, 2002; Kushima, 2003]. Bait of fish or chicken scraps is tied into the center of each net ring. A series or "string" of several rings is attached to a central "mainline" with a weight at one end , and the whole apparatus deployed on the seafloor. Crabs approach the bait and get their legs tangled in the net mesh [HI Aquatic Resources, 2003; Pacific Ocean Producers, 2001]. The nets are left to soak for a short period and then hauled to the surface. Kona crab fishermen report that the soak time is often no longer than it takes to deploy the whole set of rings; as soon as the last net is in the water, they head back to the start of the line and begin picking up the gear [Kushima, 2003]. As noted before, fishermen don't like to leave crab nets in the water for long, because predators rapidly gather to eat the entangled crab and may damage the gear in the process [DLNR, 2002; Kushima, 2003]. Crab rings are relatively light fishing gear. The mainline is typically ¼-inch steel cable covered in blue polyethylene, and the anchor weight is often a 10-pound old-style window weight or a large lead fishing sinker [Pacific Ocean Producers, 2001].

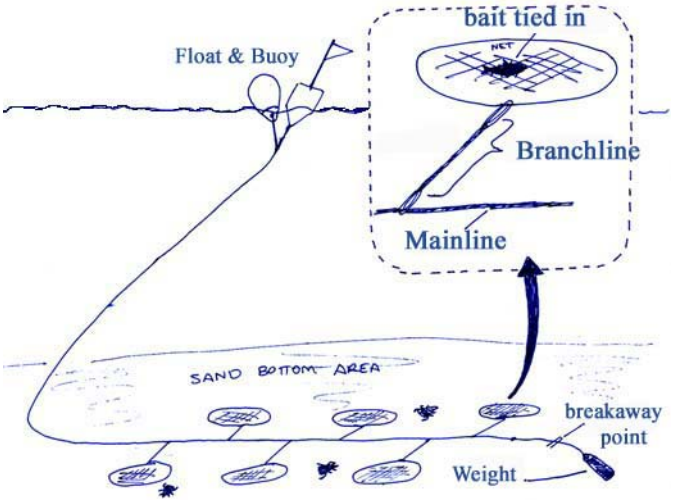


**Figure 3: Crab ring set for Kona crab. From pop-hawaii.com .**

An industry site recommends that boats hauling crab rings by hand keep their crab strings to no more than 10 or 15 nets for ease of handling [Pacific Ocean Producers, 2001]. Boats using mechanical pullers may deploy strings of 10 to 50 nets [Pacific Ocean Producers, 2001].

Some crab, especially Samoan crab, is also taken from piers, bridges, or shore sites with baited lines [DLNR, 2002]. In a few areas, Samoan crab is taken using individual net rings, which by law may be no larger than 2 feet in diameter [Kushima, 2003]. Some kona and kuahonu crab is taken as incidental catch in spiny lobster traps; it must be reported but can be marketed if it meets State requirements for season and minimum size [DAR NTD Activity Report, 2002; Kushima, 2003]. It is illegal to take any Hawaiian crab by spearing [DLNR, 2002].

**Resilience of physical and biogenic habitats to disturbance:** High (e.g. sandy seafloor)
All three commercial crabs of Hawaii inhabit soft-bottom habitat, which is usually considered resistant to disturbance. The effect on habitat depends on how close to coral reefs the crab gear is set [Kushima, 2003].

For kona crab, strings of crab rings are set on sandy seafloor at depths of 6 to 30 fathoms [Pacific Ocean Producers, 2001], often adjacent to fringing reefs and rocky areas [HI Aquatic Resources, 2003]. It should be noted that kona crab rings are one of the few fishing methods allowed around sensitive coral reefs, according to the Coral Reef Fisheries Management Plan for the Western Pacific [WPFMC, 2001].

**Evidence that the removal of targeted species has or will likely substantially disrupt the food web:** Science is uncertain
This issue was not addressed in the literature found. However, it should be noted that Samoan crab is considered an invasive species by some ecologists [University of Hawaii/Bishop Museum, 2002] and its removal might be assumed to improve the ecosystem, at least for the native invertebrates which are the Samoan crab's prey.

**Evidence that the fishing method has caused or is likely to cause ecosystem state changes, including alternate stable states or regime shifts:** Science is uncertain
No evidence for this was found in the literature.

## Synthesis, analysis and evaluation of relevant factors

The fishing methods used in the Hawaiian crab fishery have little impact on habitat. In addition, these crab fisheries are carried out over sandy seafloor and other soft bottom, which is considered fairly resistant to disturbance. There is no science to suggest that removal of the targeted crabs negatively affects the ecosystem. To the contrary, some ecologists consider the Samoan crab an invasive species in Hawaii, and would presumably see removal of this species as beneficial to Hawaiian ecosystems.

## Effect of Fishing Practices Rank — Fishing Effects Benign

## Criterion 5: Effectiveness of the Management Regime

As a nearshore fishery, the Hawaiian crab fishery is regulated by the State of Hawaii through its Division of Aquatic Resources (DAR). The commercial kona crabbing season opens September 1 and closes April 30 [Pacific Ocean Producers, 2001]. Possession or sale of kona crab is prohibited throughout May, June, July and August [DLNR 2002]; restaurants can purchase a special license to serve Kona crab during those months (crab that was caught legally in season and then frozen) [DLNR 2002]. The minimum size for kona crab is 4 inches carapace length (back to front); for kuahonu crab it is 4 inches width (across the back) , and for Samoan crab it is 6 inches carapace width (across the back) [DLNR 2002; Kushima 2003]. The DAR recently reviewed its minimum size regulations to make sure they were in line with biological reality [Kushima 2003].

It is illegal to take, possess or sell any crabs bearing eggs, or to remove eggs from a crab [DLNR 2002; Kushima, 2003]. It is also illegal to hold any berried crabs for live sale; berried crabs or those that become berried while in a holding tank must be released [Kushima, 2003]. It is illegal to take any crab by spearfishing; only trap, baited line, and net gear may be used [DLNR 2002]. In Hilo Harbor of the Big Island, there is a daily bag limit of 3 Samoan crabs [DLNR 2002], but otherwise no bag limits are in place for any Hawaiian crab in any area [Kushima, 2003].

Kona crab is mentioned in the NMFS Western Pacific Crustacean FMP, but only as incidental take in the spiny lobster fishery [WPFMC, 1983]. The directed kona crab fishery is not regulated under this FMP or any other [Kushima, 2003]. In state waters, it is an open-access fishery; anyone with a commercial marine fishing license may harvest crab to sell [Kushima, 2003]. There is also a substantial subsistence and recreational fisheryEssential fish habitat has been defined for kona crab under the NMFS Western Pacific Coral Reef FMP [WPFMC, 2001], but the habitat is not specially protected. Only minimal biological information is given on kona crab in these two FMPs [WPFMC, 1983; WPFMC, 2001]. Essential kona crab habitat is defined as shoreline to depth of 100 meters for juveniles and adults, and the water column to a depth of 150 meters for pelagic larvae [WPFMC, 2001]. Essential fish habitat has not been defined for kuahonu or Samoan crab [WPFMC, 2001].

**Stock Status: Management implements a stock assessment that seeks scientific knowledge related to the short and long-term status of the stock:**
No stock assessment available or planned in the near future 
No stock assessments have been published for any Hawaiian crab species, and no recent research is available [Kushima, 2003]. The WPFMC refers to studies from the 1970s and 80s when discussing the life history and abundance of kona crab in the 2001 Coral Reefs FMP [WPFMC, 2001].

**Scientific Monitoring: Management regularly collects data and analyzes it with respect to stock abundance:** Regular collection of fishery dependent data only 
Commercial landings are recorded each year by the DAR [DAR/WPacFIN, 2002].

**Bycatch: Management implements an effective bycatch reduction plan:**
No bycatch plan needed because bycatch is "low" 

**Fishing practices: Management addresses the effect of the fishing method(s) on the habitats and ecosystems:**
No measures needed because fishing method is deemed to be "benign" 

**Enforcement: Management and appropriate government bodies enforce fishery regulations:** Hawaii's commercial crab fishermen are required to report their landings to the DAR [DAR/WPacFIN, 2002]. Fishermen must fill out a form detailing their targeted catch, bycatch, animals released, and animals landed. This form also records fishing hours for estimates of fishing effort [DAR NTD, 2002].

## Synthesis, analysis and evaluation of relevant factors

In Hawaii's small commercial crab fishery, management has been minimal, because there has not seemed a pressing need for strict control. Crab harvests have been steady, and the resource has been managed with minimum sizes, closed seasons, prohibition on taking egg-bearing females, and prohibition of spear fishing [Kushima, 2003].

**Effectiveness of Management Rank:** **moderately effective**

## Overall Evaluation and Seafood Ranking

According to our criteria, a seafood must be ranked "Good Alternative" when both stock status and management are yellow, regardless of other criteria. I have rated stock status yellow for the lack of basic data, and management yellow because stock assessments are not planned and because landings seem to be the main data available. Although kona crab, kuahonu crab, and Samoan crab are all most likely inherently resistant to fishing pressure, and although fishing methods are benign to habitat and take little bycatch, our criteria demand that the Hawaiian crab fishery receive a ranking of "Good Alternative".

In 2000, the latest year for which figures are available, Hawaii landed 14.2 metric tons of locally-caught crab, but imported 90.3 metric tons of crab from Australia and Canada. The Australian crab was predominantly Kona (spanner) crab, with very small amounts Samoan (mud) crab. An unknown amount of Dungeness crab may also have been "imported" from the mainland United States. Australia's kona crab fishery and U.S./Canadian Dungeness crab fisheries are well-managed, with established management plans, stock assessments, and fisheries-independent research programs. All of these fisheries take little bycatch; all use methods that are thought to cause little damage to habitat. The Australian kona crab fishery was recently reviewed and deemed sustainable by Environment Australia, and the Dungeness crab fisheries have already received a Seafood Watch rating of "Best Choice".

### Overall Seafood Rank

### Hawaii-caught crabs: Good Alternative

**Imported Australian kona and U.S./Canadian Dungeness crabs: Best Choice**

**Hawaii Crab References**


Abbott, J. (1980). Chapter 25--Brachyura: the True Crabs. *In* Intertidal Invertebrates of California, Robert H. Morris, Eugene C. Haderlie, editors. Stanford, California, Stanford University Press.

Bartram, Paul. 2003. Seafood distributor, Akala Products, Inc., Honolulu. HI. Personal communication, email, 3/6/03. Email address hapahauoli@tripleb.com tel: 808-531-5866.

Brown, Ian. 1995. Population dynamics and management of spanner crabs in southern Queensland. Report to Queensland Department of Primary Industries, Southern Fisheries Center. Available online at www.frdc.com/au/pub/reports/files/95-022.htm

Cascorbi, Alice. 2002. Dungeness Crab. Seafood Watch Seafood Report.

CFD, 2001. Crustacean Fisheries Division website, of India's Central Marine Fisheries Research Institute. Available online at www.cmfri.com/cmfri_cfd01.html

Chen, Y. and S. Kennelly. 1999. Growth of spanner crab, *Ranina ranina*, off the east coast of Australia. Freshwater and Marine Research 50:319-325 (HAVE ABSTRACT ONLY).

DAR, 2002. State of Hawaii, Department of Land and Natural Resources, Division of Resources, Commercial Marine Landings Summary Trend Report 1999. State of Hawaii Department of Land and Natural Resources, Division of Aquatic Resources, Honolulu, HI. Available online at www.state.hi.us/dlnr/dar

DAR, 2003. Regulated Species—Marine Invertebrates. Commercial fishing regulations for Hawaiian marine invertebrates. Division of Aquatic Resources, Hawaii Department of Land and Natural Resources. Available online at www.hawaii.gov/DLNR/regbk/pages/marinverts.html

DAR NTD 2002. Net, trap and dive activity report, to be used by commercial fishermen. Division of Aquatic Resources, Hawaii Department of Land and Natural Resources.

DAR/WPacFIN, 2002. State of Hawaii, Department of Land and Natural Resources, Division of Resources, 2000 Fishery Statistics. Compiled by State of Hawaii Department of Land and Natural Resources and Western Pacific Fishery Information Network.

DBEDT, 2002. Hawaii Seafood Buyer's Guide, produced by Hawaii Department of Business, Economic Development and Tourism, Ocean Resources Branch, P.O. Box 2359, Honolulu, HI 96804 tel. 808-587-2680. Available online at www.state.hi.us/dbedt/seafood/index.html

FAO, 1994. A global assessment of fisheries bycatch and discards. United Nations Food and Agriculture Organization, Rome. Prepared by Dayton Alverson, Mark Freeberg, Steven Murawski and J.G. Pope. Available online at www.fao.org/DOCREP/003/T4890E/T4890E00.HTM

FAO, 1996.The marine fisheries of Sri Lanka. United Nations Food and Agriculture Organization, Rome. Prepared by George De Bruin, Barry C. Russel, and Andre Bogush. Available online at www.fao.org/

FAO, 1997. A study of the options for utilization of bycatch and discards from marine capture fisheries. United Nations Food and Agriculture Organization, Rome. Prepared by Ican Clucas. Available online at www.fao.org/docrep/W6602E/W6602E00.htm

Guillory, V., H. Perry, and S. VanderKooy (eds). 2000. The Blue Crab Fishery of the Gulf of Mexico, United States: A Regional Management Plan (Draft). Gulf States Marine Fisheries Commission.

Haight, Wayne. 2003. Biologist, International Marine Life Alliance, Honolulu, HI. Personal communication, email, 3/5/03. Email address whaight@marine.org tel: 808-523-0144.

Hawaii Aquatic Resources, 2003. A summary of gillnet and related fishing methods. From Aquatic Resources Hawaii, Kimberly Lowe, 808-587-0115
Idoine, J., 2001. Northern Shrimp. *In* Status of fishery resources off the northeastern United States, S.H. Clask, Editor. NOAA.

Kennelly, S.J. 1996. Relative abundance of spanner crabs and the development of a population model for managing the New South Wales spanner crab fishery. Report to the New South Wales Fisheries Research Institute. Available online at www.frdc.com/au/pub/reports/files/96-135.htm

Kushima, Jo-Anne. Hawaii Division of Aquatic Resources. Personal communication with Alice Cascorbi, by phone and email, June 12, 2003 and in the review of this document. Email address Jo-Anne.N.Kushima@hawaii.gov

DLNR, 2002. Department of Land and Natural Resources, Amendments to Chapter 13-95, Hawaii Administrative Rules. Ramseyer drafts 1/08/02 and 5/1/02.

NMFS FMEP. 2002. National Marine Fisheries Service, Fishery Monitoring Economics Program, "Lobster Data" and "Colorful Hawaii". Available online at www.nmfs.hawaii.edu/fmpi/fmep/lobster.html and www.nmfs.hawaii.edu/fmpi/fmep/reef/spiny_b16.htm. Downloaded Dec. 12, 2002.

NMFS List of Fisheries, 2001. List of Fisheries with marine mammal interactions, required under the Marine Mammal Protection Act. Federal Register 66(14):6545-6556
Available online at
http://europa.eu.int/comm/fisheries/doc_et_publ/liste_publi/studies/bycatch/07_9.pdf

NMFS SWFSC statistics, 2002. NMFS Southwest Fisheries Science Center, Fisheries Statistics and Economics Division. Data query: imports, all products, 2000-2002; district Honolulu. Available online at http://swr.ucsd.edu/fmd/bill/azhi.htm

NOAA Restoration Center, 2002. Fisheries management plans and the reasons for inclusion under the programmatic Environmental Assessment. Available online at www.nmfs.noaa.gov/restoration/community/crp_ea/Table%201.htm

NPFMC, 1999. Ecosystem Committee Report to the North Pacific Fishery Management Council, February.

Pickett, Mary. Waikiki Aquarium, education department. Personal communication, via email, 4/25/03. Email address mpickett@waquarium.org.

Pacific Ocean Producers, 2001. 2000-2001 Kona Crab Season. Available online at www.pop-hawaii.com/whats_new/KonaCrabNet.htm

QFS, 1999. Fisheries (Spanner Crab) Management Plan, 1999. Queensland Fisheries Service, Queenlsland Subordinate Legislation 1999 # 56.

QFS, 2001. Spanner crab (frog crab), *Ranina ranina*. Queensland Fisheries Service Fishweb. Available online at www.dpi.qld.gov.au/fishweb/2455.html

QPICEA, 2001. Assessing the ecological sustainability of the Queensland spanner crab fishery. Queensland Department of Primary Industries for Environment Australia. Available online at http://ea.gov.au/coasts/fisheries/assessments/qld/spanner/

Queensland Government Newsletter, 2002. "Green" light for spanner crabs. Queensland Government Newsletter, volume 1, issue 1, winter 2002. Available online at www.dpi.qld.gov.au/fish/10546.html

State Records, 2002. Hawaii state records for recreational fisheries. Available online at www.hawaiifishingnews.com

State of Hawaii Data Book, 2001. Commercial fish catch, by species, 1999-2000-2001. Available online at www.state.hi.us/dbedt/db01/sec20.html

Swingle, Wayne; Antonio Lamberte, Roy Williams and Georgia Cranmore. 2001. Amendment 7 to the Fishery Management Plan for the Stone Crab Fishery of the Gulf of Mexico, including Environmental Assessment and Regulatory Impact Review. NMFS Gulf of Mexico Fishery Management Council, Tampa, FL.

Takenaka, Brooks. 2003. Seafood distributor, United Fishing Agency, HI. Personal communication, email, 3/5/03. Email address BrksTknk@netscape.net tel: 808-536-2148.

University of Hawaii/Bishop Museum, 2002. Introduced marine species of Hawaii--Samoan Crab, *Scylla serrata.* Factsheet online at www2.bishopmuseum.org/HBS/invertguide/species/scylla_serrata.htm

WPFMC, 1983. Final fishery management plan for crustaceans of the Western Pacific region. See especially pages 36 and 78, for the role of kona crab in the FMP and the limited availability of biological knowledge.

WPFMC, 2001. Final fishery management plan for coral reef ecosystems of the Western Pacific region. See especially page 232, for kona crab life history. Available online at www.wpcouncil.org/coral.htm