U. S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Antecaridina lauensis*

COMMON NAME: Anchialine pool shrimp (U.S. pops.)

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: June 2004

STATUS/ACTION:

____ Initial 12-month Petition Finding:
- ____ not warranted
- ____ warranted
- ____ warranted but precluded (also complete (c) and (d) in section on petitioned candidate species- why action is precluded)

____ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

____ New candidate

__X_ Continuing candidate
- ____ Non-petitioned
- __X_ Petitioned - Date petition received: May 11, 2004
  - ____ 90-day positive - FR date: _____
  - ____ 12-month warranted but precluded - FR date: _____
  - _N__ Is the petition requesting a reclassification of a listed species?
- ____ Listing priority change
  - Former LP: ____
  - New LP: ____

Latest Date species became a Candidate: 1989

____ Candidate removal: Former LP: ____
- ____ A - Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
- ____ F - Range is no longer a U.S. territory.
- ____ I - Insufficient information exists on biological vulnerability and threats to support listing.
- ____ M - Taxon mistakenly included in past notice of review.
- ____ N - Taxon may not meet the Act's definition of "species."
- ____ X - Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Animal; Crustacea; Atyidae anchialine pool shrimp

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, Islands

of Maui and Hawaii; Fiji, Europa Island (Mozambique), Dahlack (Saudi Arabia), Daito Islands and Ryukyu Islands (Japan), Solomon Islands.

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, Europa Island (Mozambique), Dahlack (Saudi Arabia), Daito Islands and Ryukyu Islands (Japan).

LEAD REGION CONTACT: Scott McCarthy (503) 231-6131

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish & Wildlife Office, Lorena Wada (808) 792-9400

BIOLOGICAL INFORMATION:

Species Description: *Antecaridina lauensis* (Holthuis 1973) is reported to be from 10 millimeters (mm) (0.4 inches (in)) to just over 15 mm (0.6 in) in total length. Coloration of the thorax, abdomen, mouth-parts, and legs are light-to bright-red. At other locations (e.g., Red Sea) this species has been documented to be present in a range of colors, from red to transparent. The relatively small chelae (claws) are noted to be whitish. Black pigments are associated with the eyes. Locomotion is accomplished by walking over the substrate. Observations suggest that *A. lauensis* is herbivorous and most active by night (Holthuis 1973).

Taxonomy: *Antecaridina lauensis* was described by Maciolek (in Holthuis 1973) and is recognized as a distinct taxon.

Habitat: Within the Hawaiian Islands, *Antecaridina lauensis* is known to occur in low- to high-salinity (2-30 parts per thousand (ppt)) anchialine pools. Anchialine pools are land-locked bodies of water that occur coastally but are not openly connected to the ocean (Maciolek 1983). They are mixohaline, with salinities typically ranging from 2 ppt to concentrations just below that of sea water (32 ppt), although there are pools recorded as having salinities as high as 41 ppt (Brock et al. 1987; Maciolek 1983). Anchialine pools are subject to tidal fluctuations. Except for some records of endemic eels, anchialine pools in Hawaii do not support native species of fish although some species of nonnative fish have been introduced and are currently recognized as problems (see Disease and Predation section below) (Bailey-Brock and Brock 1993; Richard Brock, Univ. of Hawaii, pers. comm., 2004; 1998). Anchialine pools are very limited in number and the total area occupied by them globally is extremely small (Maciolek 1983). While a number of species of anchialine shrimp (e.g., *Antecaridina lauensis, Calliasmata pholidota*) have disjunct, global distributions within these habitats, most geographic locations contain some endemic taxa (Maciolek 1983). Currently in the State of Hawaii, there are estimated to be over 650 anchialine pools, approximately 90 percent of which occur on the island of Hawaii. Of the approximately 585 anchialine pools found on the island of Hawaii, only two contain this species (Hawaii Natural Heritage Program (HNHP), in litt., 2004; Holthuis 1973; Maciolek 1983).

Historic and Current Range/Distribution: *Antecaridina lauensis* has a disjunct, Indo-Pacific distribution, as it has been reported from locations as distant as the Red Sea, islands near

Madagascar, the Ryukyu Islands, and the Hawaiian Islands (Holthuis 1973; Maciolek 1983). In Hawaii, *A. lauensis* is known from two pools in the Cape Kinau area (Maui) and two pools on the southern end of the island of Hawaii (HNHP, in litt., 2004). Like other anchialine pool shrimp species, it is believed that this species inhabits an extensive network of water-filled interstitial spaces (cracks and crevices) leading to and from the actual pool, and this trait has precluded researchers from obtaining population size estimates during surveys for the species. In one of the pools on the southern end of the island of Hawaii, *A. lauensis* co-occurs with two other candidate species of anchialine pool shrimp, *Calliasmata pholidota* and *Vetericaris chaceorum* (Holthuis 1973; Maciolek 1983). Population numbers and numbers of individuals outside the U.S. are unknown.

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.
On the island of Hawaii, Dr. Richard Brock (pers. comm. 2004; 1998) estimates that up to 90 percent of the anchialine pools have been destroyed or altered by human activities. The more recent human modifications of anchialine pools such as those on the island of Hawaii include the bulldozing and filling of pools (Bailey-Brock and Brock 1993). Dumping of refuse and the introduction of nonnative fish (see Disease and Predation section below) threaten the known populations of *Antecaridina lauensis* on the island of Hawaii and have impacted other anchialine pools on that island (R. Brock, pers. comm. 2004; R. Brock, in litt. 1985). Invasion, with human assistance, of these pools by nonnative fish is an imminent, ever present threat and is the most significant impact to anchialine pool shrimp and their habitat. The second known location on the island of Hawaii is on private land and its status is not currently known.

Damage from use of anchialine pools for swimming and bathing has been documented in the Hawaiian Islands (R. Brock, pers. comm. 2004; R. Brock, in litt. 1985). Such impacts to the anchialine pools on the island of Hawaii are possible but have not, at present, been documented. Swimming and bathing is not believed to be a serious problem in the Maui pools where *Antecaridina lauensis* is reported to occur.

The two Maui pools known to contain *Antecaridina lauensis*, were modified by early Hawaiians and later inhabitants of the area, but are within a State Natural Area Reserve (NAR). Dumping does occur on the Maui NAR, and while none has yet occurred within the pools to date, this threat remains a possibility (R. Brock, pers. comm. 2004).

B. Over-utilization for commercial, recreational, scientific, or educational purposes.
The U.S. Fish and Wildlife Service (Service) has become aware of companies and private collectors using anchialine pool shrimp and related shrimp species for self-contained aquariums similar to those marketed by Ecosphere Associates, Inc. (www.eco-sphere.com 2004). One company located in Hawaii, Fuko Bonsai, has already begun using Hawaiian anchialine pool species for the aquarium hobby market (www.fukubonsai.com 2004). For commercial purposes, currently only a State Commercial Marine License is required to collect anchialine pool shrimp (collection is prohibited from State Natural Area Reserves). The potential impacts to this species from collection for trade and business are difficult to estimate, however, the possibility of impact

is something that must be considered.

C. Disease or predation.
In Hawaii, predation by introduced nonnative fish is considered to be the greatest threat to native shrimp within anchialine pool ecosystems (Bailey-Brock and Brock 1993; R. Brock, pers. comm. 1998). Marine fish are occasionally seen in isolated pools, indicating that people are introducing these fish into the pools (Bill Evanson, Hawaii Department of Land and Natural Resources, pers. comm. 1998). Anchialine pools have been used to discard or hold bait-fish and/or aquarium fish (Bailey-Brock and Brock 1993). These fish either directly consume the native shrimp or as with introduced tilapia (*Oreochromis mossambica*), out-compete the native herbivorous species of shrimp that typically serve as the prey-base for the rarer, predatory species of shrimp. Introduction of nonnative fish including bait-fish into such pools may be a major contribution to the decline of these shrimp.

D. The inadequacy of existing regulatory mechanisms.
Although there are no existing regulatory mechanisms that specifically protect this species, the two Maui pools are located within the State Ahihi-Kinau Natural Area Reserve (NAR). This designation specifically prohibits the removal of any native organism and the disturbance of ponds according to State statutes within Administrative Rules, Sec. 13-209-4 (www.dofaw.net/nars 2004). The State NARs were created to preserve and protect samples of Hawaiian biological ecosystems and geological formations; and are actively managed and monitored for their unique ecosystems. However, while signs are posted that provide notice to the public that the pools are off-limits to bathers and other activities that could damage the pools, the State's NARs have no funding for proper enforcement to stop such activity. One pool on the island of Hawaii occurs on lands managed by a different State agency and is not afforded any protection, while a second pool is located on unprotected, remote private land.

E. Other natural or manmade factors affecting its continued existence.
Even if the threats responsible for the decline of this species in Hawaii were controlled, the persistence of existing populations is hampered by the small number of extant populations and the small geographic range of the known populations. This circumstance makes the species more vulnerable to extinction due to a variety of natural processes. Small populations are particularly vulnerable to reduced reproductive vigor caused by inbreeding depression, and they may suffer a loss of genetic variability over time due to random genetic drift, resulting in decreased evolutionary potential and ability to cope with environmental change (Lande 1988; Center for Conservation Update 1994). Small populations are also demographically vulnerable to extinction caused by random fluctuations in population size and sex ratio and to catastrophes such as hurricanes (Lande 1988).

The two Maui pools occur in areas that were volcanically active as little as 250 years ago. The anchialine pool on State land on the island of Hawaii occurs in an area that could be destroyed by on-going volcanic or land subsidence events. However, neither threat is imminent on either island.

SUMMARY OF REASONS FOR ADDITION, REMOVAL OR LISTING PRIORITY

CHANGE:

____ Is the removal based on a Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE) finding? If "Yes", summarize the specific PECE evaluation criteria that were met in determining that the conservation effort is sufficiently certain to be implemented and effective so as to have contributed to the elimination or adequate reduction of one or more threats to the species identified through the section 4(a)(1) analysis.

FOR PETITIONED CANDIDATE SPECIES (also complete c and d for initial 12-month petition findings):
a. Is listing warranted? Yes
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes
c. Is a proposal to list the species as threatened or endangered in preparation? No
d. If the answer to c. above is no, provide an explanation of why the action is still precluded:

We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions (including candidate species with lower LPNs). During the past 12 months, almost our entire national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, emergency listings, and essential litigation-related, administrative, and program management functions. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov/).

LAND OWNERSHIP: In Hawaii, the four anchialine pools known to contain *Antecaridina lauensis* occur on State and private lands.

PRELISTING: In Hawaii, two of the known pools containing *Antecaridina lauensis* lie within the Ahihi-Kinau State Natural Area Reserve located on east Maui. Ahihi-Kinau was the first NAR to be established by the State of Hawaii, and in fact, the presence of the anchialine pools and their rare resident shrimp species was a key reason this area received such designation (Holthuis 1973). This species and the three other candidate anchialine pool shrimp species found within this NAR receive some protection from the various threats to the group as a whole. Within all State NARs, statutes specifically prohibit the disturbance or removal of any plant or wildlife and the disturbance of any pond or lake.

On May 11, 2004, we received a petition dated May 4, 2004 to list 225 species including this species. No new information was provided for this species by the petitioners. Since the 2003 update of this assessment form, the Service has been made aware that the use of Rotenone to

remove nonnative fish from anchialine pool habitat is being investigated by State officials as a management option for these ponds.

DESCRIPTION OF MONITORING: We conducted literature searches for recent articles on this species and contacted relevant species experts, State officials with the Department of Land and Natural Resources, and Bishop Museum and University of Hawaii researchers regarding the current status of this species. Although, no additional information on the species' status was added to this update, the existing data regarding the species' status was verified.

REFERENCES:

Bailey-Brock, J.H. and R.E. Brock. 1993. Feeding, reproduction, and sense organs of the Hawaiian anchialine shrimp *Halocaridina rubra* (Atyidae). Pacific Science 47:338-355.

Brock, Richard. 2004. University of Hawaii at Manoa. Personal communication.

Brock, Richard. 1998. University of Hawaii at Manoa. Personal communication.

Brock, Richard. 1985. University of Hawaii at Manoa. Letter to the Fish and Wildlife Service, Honolulu, Hawaii.

Brock, R.E., J.E. Norris, D.A. Ziemann, and M.T. Lee. 1987. Characteristics of water quality in anchialine ponds of the Kona, Hawaii, coast. Pacific Science 41:200-208.

Center for Biological Diversity et al. 2004. Petition to list 225 species with critical habitat designation. May 4, 2004. 877 pp.

Center for Conservation Biology. 1994. Nectar, fecundity and conservation planning. Center for Conservation Biology Update, Vol. 8(1): 10 (summer).

Evanson, Bill. 1998. Department of Land and Natural Resources. Personal communication.

Hawaii Natural Heritage Program Database. 2004. Unpublished data.

Holthuis, L.B. 1973. Caridean shrimps found in land-locked saltwater pools at four Indo-west Pacific localities (Sinai Peninsula, Funafuti Atoll, Maui and Hawaii Islands), with the description of one new genus and four new species. Zool. Verhadenlingen 128:3-55.

Lande, R. 1988. Demographic models of the northern spotted owl (*Strix occidentalis caurina*). Oecologia 75: 601-607.

Maciolek, J.A. 1983. Distribution and biology of Indo-pacific insular hypogeal shrimps. Bulletin of Marine Science 33:606-618.

Www.eco-sphere.com. (website) 2004.

Www.fukubonsai.com (website) 2004.

LISTING PRIORITY:

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	**2 ***
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Rationale for listing priority number:

Magnitude:

This species is highly threatened throughout its limited range by invasion of nonnative fish (often with human assistance), an ever present threat and the single greatest impact to anchialine pool shrimp and their habitat. Modification or loss of the anchialine pool habitat by dumping or fill or from recreational activities is another potential threat. Lastly, collection of *Antecaridina lauensis* for sale or trade is also a potential threat to this species. The threat of nonnative fish introduction into anchialine pools occurs range-wide, and is expected to continue or increase without successful eradication of these nonnative fish species.

Imminence:

Threats to *Antecaridina lauensis* from nonnative fish are imminent because they are on-going.

Is Emergency Listing Warranted?

No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the species' total populations within the time frame of the routine listing process. In addition, two of the populations are in State protected NARs. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *Antecaridina lauensis* as new information becomes available. This review will determine if a

change in status is warranted, including the need to make prompt use of emergency listing procedures.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: David B. Allen
7/19/04
Regional Director,
Fish and Wildlife Service
Date

Concur: Matt Hogan, Acting 5/2/05
Director, Fish and Wildlife Service Date

Do not concur: _____ _____
Director, Fish and Wildlife Service Date

Director's Remarks: _____

_____

_____

Date of annual review: June 2004
Conducted by: _____

Comments: _____

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(rev. 4/22/04)