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

Scientific Name:

Palaemonella burnsi

Common Name:

Anchialine Pool shrimp

Lead region:

Region 1 (Pacific Region)

Information current as of:

04/15/2012

Status/Action

___ Funding provided for a proposed rule. Assessment not updated.

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

___ New Candidate

_X_ Continuing Candidate

___ Candidate Removal

> ___ 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
>
> ___ Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species
>
> ___ Range is no longer a U.S. territory
>
> ___ Insufficient information exists on biological vulnerability and threats to support listing
>
> ___ Taxon mistakenly included in past notice of review
>
> ___ Taxon does not meet the definition of "species"
>
> ___ Taxon believed to be extinct
>
> ___ Conservation efforts have removed or reduced threats

___ More abundant than believed, diminished threats, or threats eliminated.

Petition Information

___ Non-Petitioned

_X_ Petitioned - Date petition received: 05/11/2004

90-Day Positive:05/11/2005

12 Month Positive:05/11/2005

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing? **Yes**

Explanation of why precluded:

Precluded by higher priority listing actions, including court-ordered listing actions.

Historical States/Territories/Countries of Occurrence:

- **States/US Territories**: Hawaii
- **US Counties**: Hawaii, HI, Maui, HI
- **Countries**: United States

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories**: Hawaii
- **US Counties**: Hawaii, HI, Maui, HI
- **Countries**: Japan, United States

Land Ownership:

The three known Maui pool groups containing Palaemonella burnsi are located on State land within the Ahihi-Kinau Natural Area Reserve (NAR); the only known pool group on Hawaii Island is on Federal property, in the Kaloko-Honokohau National Historic Park (Park); and, one group of pools is located on State property in the Manuka NAR.

Lead Region Contact:

ARD-ECOL SVCS, Marilet Zablan, 503-231-6131, marilet_zablan@fws.gov

Lead Field Office Contact:

PACIFIC ISLANDS FISH AND WILDL OFC, Christa Russell, (808) 792-9451, christa_russell@fws.gov

Biological Information

Species Description:

The carapace length of *Palaemonella burnsi* (Holthuis 1973) ranges from 0.2 to 0.3 inches (6 to 9 millimeters). This anchialine pool shrimp is transparent, greyish-green to red, the body being somewhat transparent with coloration dependent on chromatophore (pigment cells) expansion/contraction. There is often a transverse, median pale band across the carapace arranged of white chromatophores. The conspicuous, elongate chelapeds (claws) typically are greyish-green. Black pigments are associated with the well developed eyes. It is likely the shrimp are omnivorous and feed upon algae and detritus. Collected females have been found to carry numerous, small eggs on the ventral abdomen (Holthuis 1973, pp. 24-30).

Taxonomy:

Palaemonella burnsi was described as a new species by Holthuis in 1973 and this species is recognized as a valid taxon in McLauglin et al. (2005). We have reviewed the taxonomic background of *Palaemonella burnsi* and find it to be a valid taxon.

Habitat/Life History:

Palaemonella burnsi is known to occur from high-salinity (24 to 27 parts per thousandth (ppt)) anchialine pools. Anchialine pools are land-locked bodies of water that occur coastally but are not openly connected to the ocean (Macioleck 1983, pp. 607-612). 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 (Macioleck 1983, pp. 607-612); Brock et al. 1987 p.200). 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 or Predation below) (Bailey-Brock and Brock 1993 p.354; Brock 2004 p.i). In the most recent surveys conducted by the State Division of Forestry and Wildlife (DOFAW) at Ahihi-Kinau NAR, surveyors noted seeing *Pallaemonella burnsi* at night in multiple tidepools adjacent to anchialine pools. *P. burnsi* were not seen in the tide pools during the day (M. Ramsey, DOFAW, *in litt*. 2010).

Historical Range/Distribution:

Although anchialine pools are widespread, being found in areas such as Saudi Arabia, Madagascar, Fiji, and other Indo-Pacific islands, the total area occupied by them globally is extremely small (Maciolek 1983, p. 607). While a number of species of anchialine shrimp have disjunct, global distributions within these habitats, most geographic locations contain some endemic taxa (Maciolek 1983, p. 607). *Palaemonella burnsi* is one of these endemic taxa known only from the islands of Hawaii and Maui in the state of Hawaii.

Current Range Distribution:

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. Originally, only one pool located in the Park on the island of Hawaii was known to contain this species. During recent monitoring efforts by the State's Division of Aquatic Resources (DAR), *Palaemonella burnsi* has been found in multiple pools within the Manuka NAR (T. Sakihara, DAR, *in litt.* 2010). On the island of Maui, this species is found at three sites in the State's Ahihi-Kinau NAR (Brock 2004, pp. 30-57; Holthuis 1973, pp. 24-30; Maciolek, 1983, pp. 607-612).

In 2005 (Bruce 2005, p. 211), a single specimen of *Palaemonella burnsi* was identified from the Ryukyu Islands of Japan. Additional information (De Grave in litt.,2012) was provided on a second individual from

the collection identifying it as an ovigerous (egg bearing) female, making it likely that there is an established population somewhere in the Ryukyu Islands. The Service is currently seeking any additional information on the status of and the threats to the population(s) of *P. burnsi* in any location outside of the United States. The Service may consider removing this species as a candidate for listing depending upon our review of new informtaion regarding the status and distribution of this species outside the United States.

Population Estimates/Status:

Like other anchialine pool shrimp species, 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 more accurate population size estimates during surveys for the species (Holthuis 1973, p. 36; Maciolek 1983, pp. 613-616). Many of the rare species of anchialine shrimp, including *Palaemonella burnsi*, have merely been noted as present or absent from pools that have been surveyed (often with the aid of baiting). Loss of shrimp species from suitable habitat is likely the best or only, measure of species decline since population sizes are not easily determined (Holthuis 1973, pp. 7-12; Maciolek 1983, pp. 613-616).

The status and estimates of any populations outside of Hawaii is unknown at this time.

Threats

A. The present or threatened destruction, modification, or curtailment of its habitat or range:

On the island of Hawaii it is estimated that up to 90 percent of the anchialine pools have been destroyed or altered by human activities (Brock 2004, p. i). The more recent human modifications of anchialine pools include the bulldozing and filling of pools (Bailey-Brock and Brock 1993 p.354). Dumping of refuse and the introduction of nonnative fish (see Disease or Predation below) has impacted other anchialine pools on this island (Brock 2004, pp. 13-17).

In December 2006, a draft environmental impact statement for the Kona Kai Ola development project on the island of Hawaii, stated that 22 anchialine pools would be destroyed (Oceanit 2006). The one pool in which *Palaemonella burnsi* occurs is adjacent to the area proposed for development. While destruction of the pool containing *P. burnsi* is not expected, the hydrology of this pool may be negatively impacted by the increased water withdrawal required during the life of the project, if it proceeds as planned.

The three known Maui pools that contain *Palaemonella burnsi*, were modified by early Hawaiians and later inhabitants of the area, but are within Ahihi-Kinau NAR. Dumping occurs in the Maui NAR, and while none has yet occurred within these pools, this threat remains a possibility (Brock 2004, p. i).

Damage from use of anchialine pools for swimming and bathing has been documented in the Hawaiian Islands (Brock 2004, pp. 13-17). Similar impacts to the anchialine pools for this species on the island of Hawaii and Maui are possible but have not, at present, been documented.

B. Overutilization 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. (Ecosphere Associates 2006, p. 1). One company located in Hawaii, Fuku Bonsai, has already begun using Hawaiian anchialine pool species for the aquarium hobby market (Fuku-Bonsai 2007, p. 1). For commercial purposes, a DLNR-DOFAW issued Native Invertebrate Research and Collecting permit is required to collect anchialine pool shrimp. All terrestrial and aquatic invertebrates (including

anchialine pool shrimp) are protected under the State of Hawaii Revised Statutes (1993) Chapter 195D-4-f License; and (2) DLNR Chapter 124 Indigenous Wildlife, endangered and Threatened Wildlife, and Introduced wild Birds. Collection is prohibited in State NARs but not in the State Parks or City and County property (Conry 2012, *in litt*.).

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, p. 354; Brock 2004, pp. 13-17). Anchialine pools have been used to discard or hold bait-fish and/or aquarium fish (Bailey-Brock and Brock 1993, p. 354). 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 (Bailey-Brock and Brock 1993 p. 354). Introduction of nonnative fish including bait-fish into such pools may have been a major contributor to the decline of these shrimp (Brock 2004 pp.13-17). No alien fish species were seen during the most recent survey of the pools where these shrimp occur (Brock 2004 pp. 13-17).

Invasion, with human assistance, of anchialine pools by nonnative fish is a potential threat and is the most significant impact to pool shrimp and their habitat. Within the State NARs, disturbance of the pools is prohibited and informative signs have been placed at the sites. However, there are concerns that this may not be adequate protection. For example, since 1985 signage was used to keep people from entering the Waikoloa Achialine Pond Preserve at Waikoloa, North Kona, Hawaii. Visitors were not allowed into the pool preserve but could walk around the perimeter. In December 2003, it was discovered that someone had released tilapia and mosquito fish into the system. Within six months time, alien fish had invaded two thirds of the system and all the anchialine pool shrimp disappeared (Brock 2004, pp. 13-17).

D. The inadequacy of existing regulatory mechanisms:

Palaemonella burnsi currently receives no protection under Hawaii's endangered species law (HRS, Sect. 195-D) or the Federal Endangered Species Act (16 U.S.C. §1531-1544). Although there are no existing regulatory mechanisms that specifically protect this species, the three Maui pools are located within the Ahihi-Kinau State NAR. This designation specifically prohibits the removal of any native organism and the disturbance of pools (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. Though 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.

E. Other natural or manmade factors affecting its continued existence:

Even if the threats responsible for the decline of this species 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 Biology 1994). Small populations are also demographically vulnerable to extinction caused by random fluctuations in population size and sex ratio (Lande 1988). In addition, large-scale water withdrawal from underground water sources may impact anchialine poools. This underground water withdrawal may increase salinity levels and negatively impact species that rely on the delicate balance of the mixohaline habitats (Conry 2012, *in litt*.).

Conservation Measures Planned or Implemented :

On the island of Hawaii, *Palaemonella burnsi* occurs in one pool group within the Kaloko-Honokohau National Historic Park and it is prohibited to collect the species or disturb the pool. *Palaemonella burnsi* also occurs in 21 pools within the Manuka NAR where species removal and disturbance to the pool is prohibited.

On Maui, three of the known pool groups containing *P. burnsi* lie within the Ahihi-Kinau State NAR. 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 this designation (Holthuis 1973, pp. 4-5). This species and the three other candidate anchialine pool shrimp species found within this NAR receive some protection under the state statutes that specifically prohibit the disturbance or removal of any plant or wildlife and the disturbance of any pond or lake.

In August 2007, we jointly resurveyed Ahihi-Kinau State NAR with the State DAR. We found *Palaemonella burnsi* in one of the pool groups it was known from and no evidence of any non-native fish. We concluded that our trapping methods were not as effective for *P. burnsi* as we had expected and have re-designed our traps and baits.

On June 16, 2008, a symposium on anchialine pool conservation and management was held at the 89th annual meeting of the American Association for the Advancement of Science, Pacific Division. In addition, a statewide meeting concerning the monitoring of anchialine pools was hosted by the Service on January 15, 2009. Results of that meeting include an update on the status of monitoring efforts across the State, initiating development of a common monitoring protocol, and the establishment of a listserv.

In May 2010, we again jointly resurveyed Ahihi-Kinau State NAR with personnel from both the State NAR and the State DAR. We found *Palaemonella burnsi* in one of the pool groups it was known from and no evidence of any non-native fish.

In February 2011, we reviewed and commented on the National Park Service's draft long term monitoring plan for anchialine pools within their boundaries on the island of Hawaii.

Summary of Threats :

Based on our evaluation of habitat degradation and loss due to impacts from the threat of human activities (e.g., development; trash dumping; introduction of nonnative fish) and the effects of predation by nonnative fish we conclude there is sufficient information to develop a proposed listing rule for this species due to the present and threatened destruction, alteration, or curtailment of its habitat and range, and the threat of the release of nonnative fish in any one of the four known pools. In addition, overcollection by the aquarium hobby market and impacts to anchialine pools from swimming and bathing are potential threats to *Palaemonella burnsi*. Both the NAR and the Park prohibit the collection of the species and the disturbance of the pools. However, enforcement of these prohibitions is difficult and the negative effects from the introduction of nonnative fish are extensive and happen quickly. We find that this species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:

_____ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

• Monitor known locations periodically
• Conduct ecological research on habitat requirements and basic life history of *Palaemonella burnsi*

Priority Table

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	Monotype genus	7
		Species	8
		Subspecies/Population	9
	Non-Imminent	Monotype genus	10
		Species	11
		Subspecies/Population	12

Rationale for Change in Listing Priority Number:

Magnitude:

The threats to *Palaemonella burnsi* from habitat degradation and destruction from human activities (e.g., development; trash dumping or fill; introduction of nonnative fish), and predation by nonnative fish are of high magnitude because this species occurs in only five pool groups. All individuals of this species within a pool may be adversely impacted by a single development project, dumping of trash or fill, release of nonnative fish in any of its four remaining sites. Collection of P. burnsi for sale or trade, and swimming and bathing in anchialine pools are potential threats. We are currently seeking information on the magnitude of threats to this species where it occurs outside of the United States.

Imminence :

Threats to *Palaemonella burnsi* from nonnative fish, trash dumping or fill, recreational activities, development and overcollection are nonimminent because they are not ongoing. On the island of Hawaii, P. burnsi occurs in one pool adjacent to an area proposed for development, though development has not yet begun. Nonnative fish are not present in the pools in which *P. burnsi* currently occurs. We are currently seeking information on the imminence to this species where it occurs outside of the United States.

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

Emergency Listing Review

__No__ Is Emergency Listing Warranted?

Palaemonella burnsi is currently known from multiple pools, from two different State NARs and one in a National Historic Park. State and federal statutes may provide some protection to the species. 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. 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 *P. burnsi* 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.

Description of Monitoring:

We conducted literature searches for recent articles on this species and contacted relevant species experts. The U.S. Geological Survey-Biological Resource Discipline (BRD), State officials with the Department of Land and Natural Resources, and Bishop Museum, University of Hawaii, and Auburn University researchers were contacted regarding the current status of this species. No additional information on the species' status was found over the past year.

This level of monitoring is appropriate to update the status of the species because a thorough literature search was conducted as well as relevant species experts contacted. Information contained in this assessment form was verified by species experts.

List of Experts Contacted:
Name Date Affiliation

Thomas Iwai March 1, 2012 Division of Aquatic Resources (Retired)
Annette Tagawa March 1, 2012 Division of Aquatic Resources
Troy Sakihara March 1, 2012 Division of Aquatic Resources
Scott Santos March 1, 2012 Auburn University
Matt Ramsey March 1, 2012 NOAA
Hawaii Anchialine- Pool Listserv March 1, 2012

The Hawaii Biodiversity and Mapping Program (HBMP) lists this species as imperiled (HBMP 2006). Palaemonella burnsi is included in the list of species in Hawaii's 2005 Comprehensive Wildlife Conservation Strategy (Mitchell et al. 2005). In addition, in March 2007, the State of Hawaii initiated a separate strategic plan focusing exclusively on invertebrates. It is expected that *Palaemonella burnsi* will be one of the species covered by the new plan (Mitchell et al. 2005).

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

none

Indicate which State(s) did not provide any information or comment:

Hawaii

State Coordination:

On February 10, 2012, we provided the Hawaii DOFAW with copies of our most recent candidate assessments for their review and comment. We received comments from DOFAW on April 10, 2012. Any

updated information has been incorporated into the assessment form.

Literature Cited:

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, R.E. 2004. Anchialine Resources in Two Hawaii State Natural Area Reserves: Ahihi Kinau, Maui Island and Manuka, Hawaii Island with Recommendations for Their Management. Prepared for the U.S. Fish and Wildlife Service by Environmental Assessment, LLC.

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.

Bruce, A.J. 2005. Palaemonella burnsi Holthuis, 1973, a pontoniine shrimp (Crustacea: Decapoda: Palaemonidae) new to the Japanese fauna. Cah.Biol.Mar.(2005) 46:211-215.

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

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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.

Kensley, B. and D. Williams. 1986. New shrimps (families Procarididae and Atyidae) from a submerged lava tube on Hawaii. J. Crustacean Biol. 6: 417-437.

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.

McLaughlin, P.A., D.K. Camp, M.V. Angel. 2005. Common and scientific names of aquatic invertebrates from the United States and Canada: Crustaceans. American Fisheries Society Special Publication 31. Bethesda MD, USA. 545pp.

Mitchell, C., C. Ogura, D.W. Meadows, A. Kane, L. Strommer, S. Fretz, D. Leonard, and A. McClung. 2005. Hawaii's Comprehensive Wildlife Conservation Strategy. Department of Land and Natural Resources. Honolulu, Hawaii. 722 pp.

Oceanit. 2006. Kona Kai Ola draft environmental impact statement Kealakehe, North Kona district, island of Hawaii. Honolulu, Hawaii. 189pp.

Personal Communications:

Conry, P.J. CNOR 2012, Response to request for comments on USFWS species assessment and listing priority assignment forms, April 9, 2012.

Dr. Sammy De Grave. Oxford University Museum of Natural History, Oxford, UK. Email in response to request for information, dated March 2, 2012.

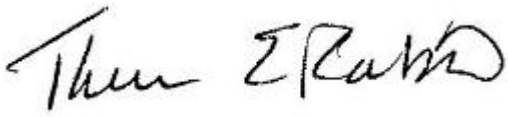
Gagne, Betsy, Executive Secretary for the Hawaii Natural Area Reserves System Commission. Email regarding State's response to candidate assessment forms, August 29, 2006.

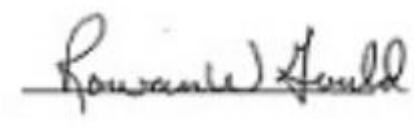
Ramsey, Matt, Ranger, Hawaii Divison of Forestry and Wildlife. Email in response to request for information, dated March 3, 2010.

Sakihara, Troy, Biologist, Hawaii Division of Aquatic Resources. Email in response to request for information, dated March 3, 2010.

Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:  05/25/2012
Date

Concur:  11/06/2012
Date

Did not concur: _____ _____
Date

Director's Remarks: