CANDIDATE ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Megalagrion nesiotes*

COMMON NAME: Flying earwig Hawaiian Damselfly

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: February 2003

STATUS/ACTION (Check all that apply):
___ New candidate
_X_ Continuing candidate
_X_ Non-petitioned
___ Petitioned - Date petition received: ___
___ 90-day positive - FR date: ___
___ 12-month warranted but precluded - FR date: ___
___ Is the petition requesting a reclassification of a listed species?
___ Listing priority change
Former LP: ___
New LP: ___
Latest date species first became a Candidate: February 28, 1996
___ Candidate removal: Former LP: ___ (Check only one reason)
___ A - Taxon more abundant or widespread than previously believed or not subject to a 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.
___ 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:
Coenagrionidae (Damselfly)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Maui and Hawaii

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Maui

LEAD REGION CONTACT (Name, phone number): Scott McCarthy, 503-231-6131

LEAD FIELD OFFICE CONTACT (Office, name, phone number): Pacific Islands (Ecological Services), Mike Richardson, 808-541-3441

BIOLOGICAL INFORMATION:

Because of the extreme geographic isolation of the Hawaiian islands and the poor dispersal capabilities of many aquatic insects, the freshwater insect fauna of Hawaii is depauperate compared to continental areas despite the diversity of aquatic habitats. Many groups of insects that typify freshwater habitats in continental areas are absent from the native fauna. Some notable examples of such groups are mayflies (Ephemeroptera), stoneflies (Plecoptera), caddisflies (Trichoptera), and alderflies and dobsonflies (Neuroptera), all of which are absent from Hawaii. Like most of the native fish, mollusc, and crustacean faunas (Ford and Kinsey 1994), most of Hawaii's freshwater insects evolved from marine or intertidal ancestors (Hardy and Delfinado 1980) that could easily colonize the islands.

One group of insects in Hawaii that does appear to be derived from the unlikely colonization by a continental freshwater ancestor is the narrow-winged damselflies (Coenagrionidae) in the genus *Megalagrion*. The genus *Megalagrion* is endemic to the Hawaiian Islands and appears to be most closely related to species of *Pseudagrion* elsewhere in the Indo-Pacific (Zimmerman 1948b).

Native Hawaiians apparently did not differentiate among the different species, but referred to the native damselflies collectively as pinao>ula. There has been no traditional European use of a common name for species in the genus *Megalagrion*. In a recent taxonomic review of the candidate species of insects in Hawaii, Nishida (1994b) proposed the name, Hawaiian damselflies. Because this name reflects the restricted distribution of these insects and should be easy for use by nontechnical persons, the name, Hawaiian damselflies, is adopted for use in this proposed rulemaking, with additional descriptive terms that identify each species.

The general biology of Hawaiian damselflies is typical of other narrow-winged damselflies. The males of most species are territorial, guarding areas of habitat where females will lay eggs (Moore 1983a). During copulation, and often while the female lays eggs, the male grasps the female behind the head with his terminal abdominal appendages to guard her against rival males, thus males and females are frequently seen flying in tandem. In species with fully aquatic immature stages, females lay eggs in submerged aquatic vegetation or in mats of moss or algae on submerged rocks, and hatching occurs in about ten days (Williams 1936; Polhemus 1994b). In most species of Hawaiian damselflies, the immature stages (naiads) are aquatic, breathing though three flattened, abdominal gills, and are predacious, feeding on small aquatic invertebrates or fish (Williams 1936). Naiads may take up to 4 months to mature (Williams 1936), after which they crawl out of the water onto rocks or vegetation, molt into winged adults, which typically remain very close to the aquatic habitat from which they emerged. Adults are also predacious and feed on small flying insects such as midges. In a remarkable example of adaptive radiation in Hawaii, some species of Hawaiian damselflies have foregone the aquatic lifestyle, either partly, with naiads living on wet rock faces, or completely, with terrestrial naiads living in the damp leaf litter, or others inhabiting moist leaf axils of native plants up to several meters above the ground (Zimmerman 1970; Simon *et al*. 1984). Adults are also unusual in that they have a highly developed behavior of feigning death when caught or attacked (Moore 1983b).

The Hawaiian damselflies are represented by 23 species and five subspecies, all confined to the Hawaiian Islands. Historically these were among the most common and conspicuous native Hawaiian insects. Some species inhabited water gardens in residential areas, artificial reservoirs, and watercress farms, and were abundant in the city of Honolulu (Perkins 1913; Williams 1936).

As early as 1948, Zimmerman noted a decline of the more common species, particularly on Oahu. By the late 1970s, less than six populations of the Pacific Hawaiian damselfly could be located (Harwood 1976; Gagne 1980; Moore and Gagne 1982), and the conservation of this species was identified as a priority by the International Union for Conservation of Nature and Natural Resources (Moore 1982). A review of the status of Hawaiian damselflies in 1981 (Gagne and Howarth 1982) lead to the placement of several species on the Service's list of candidate species for Federal listing (49 FR 21664). Due to a continued decline of these damselflies, particularly on the island of Oahu, intensive surveys were initiated in 1990, supported by both the Service and the State of Hawaii. The results of these surveys demonstrate that six species of Hawaiian damselflies are now threatened with extinction.

Historically, the flying earwig Hawaiian damselfly (*Megalagrion nesiotes*) was known from the following general localities, Kau (Polhemus 1994b), Kilauea (Perkins 1907), Olaa, Kau, and Kona (Perkins 1899) on the island of Hawaii, and Haipuaena, Honomanu, Kailua, and Keanae on windward East Maui (Kennedy 1934). Despite extensive surveys for damselflies recently on the island of Hawaii (Polhemus 1994b) this species has not been seen since 1906 and is probably extinct on that island. Likewise on Maui, this species has not been seen at its historical localities, and the only known population occurs along East Wailuaiki Stream (Polhemus 1994b).

Little known about the biology of this species, but it is not associated with standing or flowing water (Perkins 1899; Polhemus 1994b). The only known population occurs along a steep, moist, talus slope, densely covered with *Dicranopteris linearis* (uluhe) and *Rubus* sp. (blackberry). Adults are usually seen perched on vegetation, and fly slowly and only short distances. When disturbed, the adults actually fly into the tangled vegetation rather than up and away as in the aquatic Hawaiian damselflies. Although immature stages have not been found, based on the habitat and the behavior of the adults, it is believed that the naiads are terrestrial or semi-terrestrial, occurring among the damp leaflitter (Kennedy 1934; Polhemus 1994b). The primary threats to this species are predation by ants and other alien arthropods, and habitat loss due to disturbance by feral ungulates (Cuddihy and Stone 1990; Stone 1985).

THREATS:

A. <u>The present or threatened destruction, modification, or curtailment of its habitat or range</u>.

Animals such as pigs, goats, axis deer, black-tailed deer, and cattle were introduced either by the early Hawaiians (pigs) or more recently by European settlers (all ungulate species) for food and/or commercial ranching activities. Over the 200 years following their introduction, their numbers increased and the adverse impacts of feral ungulates on native vegetation have become increasingly apparent. Beyond the direct effect of trampling and grazing native plants, feral ungulates have contributed significantly to the heavy erosion still taking place on most of the main Hawaiian islands.

Pigs (*Sus scrofa*), originally native to Europe, Africa, and Asia, were introduced to Hawaii by the Polynesian ancestors of Hawaiians, and later by western immigrants. The pigs escaped domestication and invaded primarily wet and mesic forests and grasslands of Kauai, Oahu, Molokai, Maui, and Hawaii. They presently threaten the existence of the flying earwig damselfly in mesic forest on Maui. While foraging, pigs root and trample the forest floor,

encouraging the establishment of alien plants in the newly disturbed soil. In moist depressions, pigs completely remove all vegetation by wallowing, leaving nothing but mud and water (Cuddihy and Stone 1990; Stone 1985). Pigs are degrading the habitat of the flying earwig damselfly on Maui.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

Healthy populations of stream-inhabiting Hawaiian damselflies are composed of large numbers of individuals. Moore (1983a) recorded 75 males per 100 meters (m) (328 feet (ft)) of stream edge for *Megalagrion heterogamias* on Kauai. In addition, there are often more males than suitable territorial habitat, and when males are removed from a territory they are immediately replaced by other individuals (Moore 1983a). However, populations of these damselflies, are now extremely reduced, typically with fewer than 10 males per 100 m (328 ft) of stream edge at all localities. Publication of the rarity of these species will likely increase the interest of professional and amateur Odonata collectors. Unrestricted collecting and handling could impact these small populations and are considered significant threats to the species.

C. Disease or predation.

The geographic isolation of the Hawaiian Islands has restricted the number of original successful colonizing arthropods and resulted in the development of an unusual fauna. An unusually small number (15 percent) of the known families of insects are represented by native Hawaiian species (Howarth 1990). Some groups that often dominate continental arthropod faunas, such as social Hymenoptera (group nesting ants, bees, and wasps), are entirely absent. Commercial shipping and air cargo to Hawaii has now resulted in the establishment of over 2,500 species of alien arthropods (Howarth 1990; Howarth *et al*. 1994), with a continuing establishment rate of 10-20 new species per year (Beardsley 1962, 1979). In addition to the accidental establishment of alien species, alien predators and parasites for biological control of pests have been purposefully imported and released by individuals, Republic, Territorial, State, and Federal agencies, since 1865. Between 1890 and 1985, 243 alien species were introduced, sometimes with the specific intent of reducing populations of native Hawaiian insects (Funasaki *et al*. 1988;Lai 1988). Alien arthropods, whether purposefully introduced or adventive, pose a serious threat to Hawaii's native insects, through direct predation and parasitism, and competition for food or space (Howarth and Medeiros 1989; Howarth and Ramsay 1991).

Ants are not a natural component of Hawaii's arthropod fauna, and endemic species evolved in the absence of predation pressure from ants. Ants can be particularly destructive predators because of their high densities, recruitment behavior, aggressiveness, and broad range of diet (Reimer 1993). The latter attribute allows some ants to affect prey populations independent of prey density, and ants can therefore locate and destroy isolated individuals and populations (Nafus 1993). At least 36 species of ants are known to be established in the Hawaiian Islands, and three particularly aggressive species have had severe effects on the native insect fauna (Zimmerman 1948a). By the late 1870s, the big-headed ant (*Pheidole megacephala*) was present in Hawaii and its predation on native insects was noted by Perkins (1913)—"It may be said that no native Hawaiian Coleoptera insect can resist this predator, and it is practically useless to attempt to collect where it is well established. Just on the limits of its range one may occasionally meet with a few native beetles, e.g., species of *Plagithmysus*, often with these ants attached to their legs and bodies, but sooner or later they are quite exterminated from these

localities."

With few exceptions, native insects, including most moths, have been eliminated from areas where the big-headed ant is present (Perkins 1913; Gillespie and Reimer 1993). This predator generally does not occur at elevations higher than 610 m (2,000 ft), and is also restricted by rainfall, rarely being found in particularly dry (less than ca 38-51 centimeter (cm) (15-20 inches (in.) annually) or wet areas (more than ca 250 cm (100 in.) annually) (Reimer *et al*. 1990).

The long-legged ant (*Anoplolepis longipes*) appeared in Hawaii in 1952 and now occurs on Oahu, Maui, and Hawaii (Reimer *et al*. 1990). It inhabits low elevation (less than 610 m [2,000 ft]), rocky areas of moderate rainfall (less than 250 cm (100 in.) annually) (Reimer *et al*. 1990). Direct observations indicate that Hawaiian arthropods are susceptible to predation by this species (Gillespie and Reimer 1993) and Hardy (1979) documented the disappearance of most native insects from Kipahulu Stream on Maui after the area was invaded by the long-legged ant.

At least two species of fire ants, *Solenopsis geminita* and *Solenopsis papuana*, are also important threats (Gillespie and Reimer 1993) and occur on all the major islands (Reimer *et al*. 1990). *Solenopsis geminita* is also known to be a significant predator on pest fruit flies in Hawaii (Wong and Wong 1988). *Solenopsis papuana* is the only abundant, aggressive ant that has invaded intact mesic forest above 610 m (2,000 ft) and is still expanding its range in Hawaii (Reimer 1993). The only known population of this damselfly taxa included in this proposed rule are threatened by one or more of the ant species described above.

D. <u>The inadequacy of existing regulatory mechanisms</u>.

This species is not currently protected by any regulatory mechanisms.

E. <u>Other natural or manmade factors affecting its continued existence</u>.

Not applicable.

FOR RECYCLED PETITIONS:

a. Is listing still warranted? ___
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? ___
c. Is a proposal to list the species as threatened or endangered in preparation? ___
d. If the answer to c. above is no, provide an explanation of why the action is still precluded.

LAND OWNERSHIP:

This species occurs on State land.

PRELISTING: Not applicable.

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LISTING PRIORITY (* after number)

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

Rationale for listing priority number:

Magnitude:

Imminence:

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 additions of species to the candidate list, removal of candidates, and listing priority changes.

Approve: Rowan Gould March 6, 2003
Regional Director, Fish and Wildlife Service Date

Concur: _____ _____
Director, Fish and Wildlife Service Date

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

Director's Remarks:

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Date of annual review: 2/03
Conducted by:_____

Comments:

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