

Recovery Outline for
Two Hawaiian
Damselflies

March 2011



- Common Name** Flying earwig Hawaiian damselfly
Pacific Hawaiian damselfly
- Scientific Name** *Megalagrion nesiotes*
Megalagrion pacificum
- Listing Status and Date** Endangered; June 24, 2010 (75 FR 35990)
- Lead Agency/Region** U.S. Fish and Wildlife Service, Region 1
- Lead Field Office** Pacific Islands Fish and Wildlife Office
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Purpose of the Recovery Outline: This document lays out a preliminary course of action for the survival and recovery of the flying earwig Hawaiian damselfly (*Megalagrion nesiotes*) and Pacific Hawaiian damselfly (*Megalagrion pacificum*). It is meant to serve as interim guidance to direct recovery efforts and inform consultation and permitting activities until a comprehensive draft recovery plan has been completed. Recovery outlines are intended primarily for internal use by the U.S. Fish and Wildlife Service, and public participation will be formally invited upon the release of the draft recovery plan. However, we will consider any new information or comments that members of the public may wish to offer in response to this outline during the recovery planning process. For more information on Federal survival and recovery efforts for the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly, or to provide

additional comments, interested parties may contact the lead field office for this species at the above address and telephone number.

Scope of Recovery and Available Information: The scope of this recovery effort addresses the needs for two distinct species with non-overlapping habitat ranges.

We believe the quantity, quality, and reliability of the information regarding the historical and current distribution of the Pacific Hawaiian damselfly is sufficient for us to understand some recovery needs for this species, including the potential extent of future range, number of populations, and distribution patterns within each island (i.e., leeward streams vs. windward, upland vs. lowland, etc). The amount, reliability, and quality of information on its biology is generally adequate; however, additional research on fecundity will enhance our ability to assess potential for recruitment and population growth after specific threats have been ameliorated, habitat has been restored, and / or translocation efforts have been completed.

In contrast, the information available for the flying earwig Hawaiian damselfly is unfortunately inadequate. Despite extensive survey efforts, we believe additional research on the current extent of that species' range is needed before even preliminary recovery criteria can be developed concerning the population size, number of populations, and range extent necessary for this species to be recovered. Likewise, additional research is needed on its biology. In particular, the biology of the larval stage remains a complete mystery and we are unable to conjecture about its specific needs or threats during this life stage.

I. Overview

A. ASSESSMENT OF BIOLOGICAL STATUS

1. Species Description and Life History

The flying earwig Hawaiian damselfly and the Pacific Hawaiian damselfly are insects in the order Odonata, which includes dragonflies and damselflies. Both species are endemic to the Hawaiian Islands. The general biology of all Hawaiian damselflies of the genus *Megalagrion* is typical of other narrow-winged damselflies (Polhemus and Asquith 1996, pp. 2-7). The males of most species are territorial, guarding areas of habitat where females lay eggs (Moore 1983, p. 89). During copulation, and often while the female lays eggs, the male grasps the female behind the head with terminal abdominal appendages to guard the female against rival males; thus males and females are frequently seen flying in tandem.

Female damselflies lay eggs in submerged aquatic vegetation or in mats of moss or algae on submerged rocks, and hatching occurs in about 10 days (Williams 1936, pp. 303, 306, 318; Evenhuis *et al.* 1995, p. 18). In most species of Hawaiian damselflies, the

immature larval stages (naiads) are aquatic, breathing through three flattened abdominal gills, and are predaceous, feeding on small aquatic invertebrates or fish (Williams 1936, p. 303). Naiads may take up to 4 months to mature (Williams 1936, p. 309), after which they crawl out of the water onto rocks or vegetation to molt into winged adults, typically remaining close to the aquatic habitat from which they emerged. The Pacific Hawaiian damselfly exhibits this typical aquatic life history.

In contrast, the naiads of a few species of Hawaiian damselflies are terrestrial or semiterrestrial, living on wet rock faces or in damp terrestrial conditions, inhabiting wet leaf litter or moist leaf axils (the angled juncture of the leaf and stem) of native plants up to several feet above ground (Zimmerman 1970, p. 37; Simon *et al.* 1984, p. 13; Polhemus and Asquith 1996, p. 17). The naiads of these terrestrial and semiterrestrial species have evolved short, thick, hairy gills and in many species are unable to swim (Polhemus and Asquith 1996, p. 75). Although direct observations are lacking, the flying earwig Hawaiian damselfly is believed to exhibit a similar terrestrial or semiterrestrial naiad life history due to its close evolutionary relationship with terrestrial damselfly species *Megalagrion oahuense* (Jordan *et al.* 2003).

2. Historical and Current Population Status

The flying earwig Hawaiian damselfly and the Pacific Hawaiian damselfly are unique, endemic insects found only in the Hawaiian Islands. The Pacific Hawaiian damselfly was historically found on all of the main Hawaiian Islands except Kahoolawe and Niihau. Currently, the species can be found only on the islands of Hawaii, Maui and Molokai. The flying earwig Hawaiian damselfly was historically found on the islands of Hawaii and Maui. However, it has not been seen on the island of Hawaii for over 80 years, and is currently known only from one location on Maui.

3. Habitat Description and Landownership

Historically, the Pacific Hawaiian damselfly was known from lower elevations (below 2,000 feet [600 meters]) on all of the main Hawaiian Islands except Kahoolawe and Niihau (Perkins 1899, p. 64). This species was known to breed primarily in lentic (standing water) systems such as marshes, seepage-fed pools, large ponds at higher elevations, and small, quiet pools in gulches that have been cut off from the main stream channel (Moore and Gagne 1982, p. 4; Polhemus and Asquith 1996, p. 83). The Pacific Hawaiian damselfly is no longer found in most lentic habitats in Hawaii, such as ponds and taro (*Colocasia esculenta*) fields, due to predation on larvae by nonnative fish that now occur in these systems (Moore and Gagne 1982, p. 4; Englund *et al.* 2007, p. 215). Observations have confirmed that the Pacific Hawaiian damselfly is now restricted almost exclusively to seepage-fed pools along overflow channels in the terminal reaches of perennial streams, usually in areas surrounded by thick vegetation (Moore and Gagne 1982, pp. 3-4; Polhemus 1994, p. 54; Englund 1999, p. 236; Englund *et al.* 2007, p. 216; Polhemus 2007, p. 238). Adults usually do not stray far from the vicinity of the breeding pools, perching on bordering vegetation and flying only short distances when disturbed (Polhemus and Asquith 1996, p. 83). This species is rarely seen along main stream channels, and its ability to disperse long distances over land or water is suspected to be poor compared to other Hawaiian damselflies (Jordan *et al.* 2007, p. 254).

The biology of the flying earwig Hawaiian damselfly is not well understood, and it is unknown whether this species is more likely to be associated with standing water or flowing water (Kennedy 1934, p. 345; Polhemus 1994, p. 40). The only confirmed population found in the last 6 years occurs along a single East Maui stream and the adjacent steep, moist, riparian talus slope (a slope formed by an accumulation of rock debris), which is densely covered with *Dicranopteris linearis* (uluhe), a native fern. Adults of the flying earwig Hawaiian damselfly have been observed to perch on vegetation and boulders and to fly slowly for short distances in the vicinity of this one known remaining stream site. When disturbed, the adults fly downward within nearby vegetation or between rocks, rather than up and away as is usually observed with aquatic Hawaiian damselfly species. Immature individuals have not been located. However, based on habitat, the behavior of the adults, and life histories of closely related species (Jordan *et al.* 2003), it is believed that the naiads may be terrestrial or semiterrestrial, occurring in damp leaf litter (Kennedy 1934, p. 345) or possibly within moist soil or seeps between boulders in suitable habitat (Preston 2007). The highest elevation at which this species has been recorded is 3,000 feet (914 meters), but its close association with uluhe habitat suggests that its potential range may extend upward to close to 4,000 feet (1,212 meters) (Foote 2007).

The majority of both species' currently occupied habitat is owned by the State of Hawaii and a few private landowners. The State of Hawaii considers all natural flowing surface water (streams, springs, and seeps) as State property (Hawaii Revised Statutes 174c 1987).

4. Summary Assessment of Biological Status

Howarth (1991, p. 490) described the Pacific Hawaiian damselfly as the most common and most widespread of the native damselfly species at the end of the 19th century. However, population declines were noted as early as 1905 due to the introduction nonnative fish for mosquito control. The Pacific Hawaiian damselfly is now believed to be extirpated from the islands of Oahu, Kauai, and Lanai (Polhemus and Asquith 1996, p. 83). On the island of Oahu, due to its occupation of particularly vulnerable habitat within sidepools of lowland streams, the Pacific Hawaiian damselfly was rare by the 1890s and appears to have been extirpated from this island by 1910 (Liebherr and Polhemus 1997, p. 494). It is unknown when the Kauai and Lanai populations of the Pacific Hawaiian damselfly disappeared. Until 1998, it was believed that the species was extirpated from the island of Hawaii. That year, one population was discovered within a small stream located just above, but isolated from, Maili Stream, which is known to be occupied by nonnative fish (Englund 1998, pp. 15-16). On Maui and Molokai, fewer than six populations of the Pacific Hawaiian damselfly could be located by the 1970s (Harwood 1976, pp. 251-253; Gagne 1980, pp. 119, 125; Moore and Gagne 1982, p. 1). The conservation of this species was identified as a priority by the International Union for the Conservation of Nature and Natural Resources (Moore 1982, p. 209). The Pacific Hawaiian damselfly is currently found in at least seven streams on Molokai and may possibly be extant in other unsurveyed streams on Molokai's northern coast that have not been invaded by nonnative fish (Englund 2008). On the island of

Maui, the species is currently known from 14 streams. The Pacific Hawaiian damselfly is no longer found along the entire reaches of these Maui streams, but only in restricted areas along each stream where steep terrain prevents access by nonnative fish, which inhabit degraded, lower stream reaches (Polhemus and Asquith 1996, p. 13; Englund *et al.* 2007, p. 215). The species is known from a single population on the island of Hawaii, last observed in 1998. No quantitative estimates of the size of the extant populations are available.

Historically, the flying earwig Hawaiian damselfly was known from the islands of Hawaii and Maui. On Hawaii, it was originally known from seven or more general localities. The species has not been seen on Hawaii for over 80 years, although extensive surveys within apparently suitable habitat in the Kau and Oloa areas were conducted from 1997 to 2008 (Polhemus 2008). On Maui, the flying earwig Hawaiian damselfly was historically reported from five general locations on the windward side of the island (Kennedy 1934, p. 345). Since the 1930s, however, the flying earwig Hawaiian damselfly has only been observed in a single area along a particular stream on the windward side of east Maui, despite surveys from 1993 through 2008 at several of its historically occupied sites. Although the species is presumed extant, the last actual observation was in 2005 (Foote 2008); the species was not observed during the last survey at this location in 2008. No quantitative estimate of the size of this remaining population is available.

B. THREATS ASSESSMENT

1. Listing Factors/Primary Threats to the Species

As identified in the final listing rule (USFWS 2010), the primary threats to the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly are described below (Table 1). Each is classified according to the five listing/delisting factors identified in section 4 of the Endangered Species Act (“Act”; 16 USC 1531 *et seq.*). Additional detail and descriptions can be found in the final rule (USFWS 2010).

TABLE 1. SUMMARY OF THREATS TO THE FLYING EARWIG HAWAIIAN DAMSELFLY AND PACIFIC HAWAIIAN DAMSELFLY.

LISTING FACTOR	THREATS	SPECIES	
		Flying Earwig Hawaiian Damselfly	Pacific Hawaiian Damselfly
FACTOR A	Agriculture/urban development	X	X
	Stream alteration	P	X
	Habitat modification by pigs	X	—
	Habitat modification by nonnative plants	X	X
	Stochastic events	X	X
	Climate change	P	P
FACTOR B	Overcollection	P	—
FACTOR C	Predation	X ^(A) , P ^(BF)	X ^(A, B, F, BF)
FACTOR D	Inadequate habitat protection	X	X
	Inadequate protection from nonnative aquatic species	X	X
FACTOR E	Limited populations	X	X

X = known threat

P = potential threat

A = ants

B = backswimmers (predatory aquatic insects)

F = fish

BF = bullfrogs (*Rana catesbeiana*)

(a) The present or threatened destruction, modification, or curtailment of its habitat or range (Factor A)

The effects of past, present, and potential future destruction, modification, and degradation of native riparian, wetland, and stream habitats threaten the continued existence of the flying earwig Hawaiian damselfly and the Pacific Hawaiian damselfly, both which depend on these habitats throughout their respective ranges. These effects resulted from or continue to be caused by: agricultural and urban development; stream

diversion, channelization, and improper well placement; introduced feral pigs (*Sus scrofa*); introduced plants; and hurricanes, landslides, and drought. The ongoing and likely increasing effects of global climate change, while currently unquantifiable, are also likely to directly or indirectly impact the habitat of these two species.

Agriculture and urban development have caused the loss of at least 30 percent of Hawaii's coastal plain wetlands and 80 to 90 percent of lowland freshwater habitat in Hawaii (Kosaka 1990, p. 1). Ongoing and extensive stream diversions continue to degrade the quality of Pacific Hawaiian damselfly habitat and its capability to support viable populations of this species, and they may also negatively affect the habitat of the flying earwig Hawaiian damselfly. Ongoing habitat destruction and degradation caused by feral pigs in remaining tracts of uluhe-dominated riparian habitat promote the establishment and spread of nonnative plants which, in turn, lower or destroy the capability of the habitat to support viable populations of the flying earwig Hawaiian damselfly. The invasive nonnative grass *Urochloa mutica* (California grass) continues to alter the habitat of the Pacific Hawaiian damselfly through conversion of marshlands to meadowlands.

The above threats have caused the extirpation of many Pacific Hawaiian damselfly populations and possibly some flying earwig Hawaiian damselfly populations, resulting in restricted existing ranges. The combination of restricted range, limited habitat quantity and quality, and low population size makes each of these species especially vulnerable to extinction.

(b) Overutilization for commercial, recreational, scientific, or educational purposes (Factor B)

Individuals from what may be the single remaining population of the flying earwig Hawaiian damselfly were collected by amateur collectors as recently as the mid-1990s (Polhemus 2008, pp. 14-15). Although it is not known how many individuals were collected at that time, Polhemus (2008, pp. 14-15) inferred that this collection resulted in a noticeable decrease in the population size. Furthermore, if the species is limited to one population, the decreased reproduction that would result from the removal of potential breeding adults may negatively impact the species.

The existing market for damselflies increases the incentive to collect them, as shown by internet websites that offer damselfly specimens or parts (e.g., wings) for sale. Additionally, the internet abounds with "how to" guides for collecting and preserving damselfly specimens. After butterflies and large beetles, dragonflies and damselflies are probably the most frequently collected insects in the world (Polhemus 2008, pp. 14-15). A rare specimen such as the flying earwig Hawaiian damselfly may be particularly attractive to potential collectors (Polhemus 2008, pp. 14-15).

Unlike the flying earwig Hawaiian damselfly, which is restricted to one remaining population site and which is known to have previously been of interest to odonata enthusiasts (collectors of insects in the order Odonata) (Polhemus 2008, pp. 14-15), we do not believe overcollection is currently a threat to the Pacific Hawaiian damselfly,

because it is comparatively more widespread across several population sites on three islands and we are unaware of hobbyist collection of this species.

(c) Disease or predation (Factor C)

Predation by nonnative animal species (fish, bullfrogs, ants, and backswimmers) poses an immediate and significant threat to the Pacific Hawaiian damselfly and flying earwig Hawaiian damselfly throughout their ranges for the following reasons:

- The absence of Hawaiian damselflies, including the aquatic Pacific Hawaiian damselfly, in many streams and other aquatic habitat on the main Hawaiian Islands, is strongly correlated with the presence of predatory nonnative fish as documented in numerous observations and reports (Englund 1999, p. 237; Englund 2004, p. 27; Englund *et al.* 2007, p. 215), suggesting that nonnative predatory fishes have eliminated native Hawaiian damselflies from these aquatic habitats. Over 51 species of nonnative fishes are established in freshwater habitats on the Hawaiian Islands from sea level to over 3,800 feet (1,152 meters) elevation (Devick 1991, p. 190; Staples and Cowie 2001, p. 32; Brasher 2003, p. 1054; Englund 1999, p. 226; Englund and Polhemus 2001; Englund 2004, p. 27; Englund *et al.* 2007, p. 232). Predation by nonnative fishes is considered a significant and immediate threat to the Pacific Hawaiian damselfly.
- The presence of nonnative bullfrogs (*Rana catesbeiana*) is strongly correlated with the absence of Hawaiian damselflies (Englund *et al.* 2007, pp. 215, 219). Bullfrogs are reported on all of the main Hawaiian Islands, except Kahoolawe and Niihau. The Pacific Hawaiian damselfly is likely threatened by bullfrog predation, due to their shared preference for similar habitat, and the flying earwig Hawaiian damselfly may also be threatened within its riparian habitat by bullfrogs, which are capable of breeding within small pools of water.
- Damselfly naiads are vulnerable to predation by ants in terrestrial habitats and when emerging from water for metamorphosis, and the ranges of both the Pacific Hawaiian damselfly and flying earwig Hawaiian damselfly overlap that of several particularly aggressive, nonnative, predatory ant species (*Pheidole megalcephala*, *Anoplolepis gracilipes*, *Solenopsis papuana*, and *Solenopsis geminata*) that currently occur from sea level to 2,000 feet (610 meters) elevation on all of the main Hawaiian Islands. We consider both the Pacific Hawaiian damselfly and flying earwig Hawaiian damselfly to be threatened by predation by these nonnative ants.
- Backswimmers (aquatic insects in the family Notonectidae, which are nonnative to Hawaii) prey on damselfly naiads in streams and other aquatic habitat, and are considered a threat to the Pacific Hawaiian damselfly since this species has an aquatic naiad life stage. In addition, the presence of backswimmers inhibits the foraging behavior of damselfly naiads, with negative consequences for

development and survival. Backswimmers are reported on all of the main Hawaiian Islands except Kahoolawe.

(d) The inadequacy of existing regulatory mechanisms (Factor D)

The aquatic habitat of the flying earwig Hawaiian damselfly and the Pacific Hawaiian damselflies are under the jurisdiction of the State of Hawaii's Department of Land and Natural Resources, which has primary stewardship responsibility for all freshwater aquatic organisms in the state. The State Water Code mandates that minimum in-stream flow standards be set to ensure at least a minimum degree of ecosystem integrity, and that such mandated in-stream uses be given priority before off-stream uses are considered. This legal requirement has not been consistently enforced by the State's Commission on Water Resources Management, and in many cases the State Water Code's prioritization of in-stream versus off-stream uses have been inverted in recent Commission decisions, one of which (Waiahole) was overturned by the State of Hawaii Supreme Court, and several others are now in various states of litigation.

To date, administration of the Clean Water Act permitting program by the U.S. Army Corps of Engineers has not provided substantive protection of damselfly habitat, including any requirements for retention of adequate in-stream flows.

Additionally, existing State and Federal regulatory mechanisms are not adequately regulating the spread of nonnative animal species between islands and watersheds. Predation by nonnative animal species poses a major ongoing threat to the flying earwig Hawaiian damselfly and the Pacific Hawaiian damselfly. Because existing regulatory mechanisms are inadequate to maintain aquatic habitat for the damselflies and to regulate the spread of nonnative species, the inadequacy of existing regulatory mechanisms is considered to be a significant and immediate threat.

(e) Other natural or manmade factors affecting its continued existence (Factor E)

The threat to the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly from limited numbers of populations and individuals is significant and immediate for the following reasons:

- Each of these species is subject to potentially reduced reproductive vigor due to inbreeding depression, particularly the flying earwig Hawaiian damselfly, which is now apparently restricted to one population;
- Each of these species is subject to reduced levels of genetic variability that may diminish their capacity to adapt and respond to environmental changes, thereby lessening the probability of their long-term persistence;
- As there may be only one remaining population of the flying earwig Hawaiian damselfly occurring in a relatively restricted geographic location, a single catastrophic event, such as a hurricane or landslide, could result in the

extinction of the species. Likewise, the Pacific Hawaiian damselfly, with several small, widely dispersed populations, is vulnerable to the extirpation of remaining populations; and

- Species with few populations and a small number of individuals, such as the Pacific Hawaiian damselfly and flying earwig Hawaiian damselfly, are less resilient to threats that might otherwise have a relatively minor impact on a larger population. For example, reduction in availability of breeding habitat or increases in predation of naiads may result in a significant decrease in survivorship or reproduction, which might not have long-term effects on large populations but could increase the chance of extirpation for relatively small, isolated populations. The small population size of these two species thus magnifies the severity of the impact of the other threats discussed in the final rule.

2. Summary Threats Assessment

The survival and recovery potential of the Hawaiian damselflies are compromised by a combination of threats exacerbated by their inherent vulnerability to extinction. Immediate action is needed to address current threats throughout the entire range of both species. If no action is taken, these threats will be amplified and compounded in the future.

No new threats to the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly have been identified since the final listing rule was published. If additional information pertaining to new threats becomes available during the drafting period of the Recovery Plan, it will be evaluated for inclusion.

C. CONSERVATION ASSESSMENT

1. Conservation Efforts

One of the primary threats to the Pacific Hawaiian damselfly is loss of habitat through the introduction of nonnative fish. Concerted efforts have been ongoing over the past several years to resolve State regulatory and permitting issues to allow for the removal of nonnative fish and the restoration of stream habitat. In addition, studies have been ongoing into assessing damselfly population resiliency to determine if removal and translocation of damselflies can be successful. These studies will be used as the prototype for translocation efforts for both of these listed damselflies.

2. Summary Conservation Assessment

The translocation efforts are in their early stages and while preliminary data are positive, it is too early to determine their efficacy at this time. Future needs include stabilizing remaining occupied habitat, maintaining nonnative fish free habitat, removal of nonnative fish from streams, restoring and maintaining appropriate stream habitat

conditions, controlling stream runoff, and translocation or reintroduction of damselflies to restored habitat.

At this time there are no known conservation efforts focused specifically on these species or their habitats. There are no conservation agreements for these species.

The primary regulatory mechanisms that may play a role in the survival and recovery of these damselflies are those that relate to pesticide use, water quality, water use (i.e. diversions), and vegetation removal or replacement. Specific examples include but are not limited to, the Endangered Species Act (prohibitions under section 9, the permits issued under section 10, and the requirement for consultation under section 7); section 404 of the Clean Water Act (33 U.S.C. 1251 *et seq.*) and section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 401 *et seq.*), which affect dredging projects and construction of roads and bridges; U.S. Environmental Protection Agency–authorized discharges under the National Pollutant Discharge Elimination System (NPDES); and U.S. Department of Agriculture involvement in the release or permitting of the release of biological control agents under the Federal Plant Pest Act (7 U.S.C. 150aa-150jj). Any of these mechanisms can require best management practices to avoid impacts to the species or habitat and in some cases even require the improvement of habitat and population health of these species.

The flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly have a small but active conservation constituency. Actions such as the publication of a damselfly identification manual (Polhemus and Asquith 1996) have increased interest in these species among students, amateur naturalists and land managers.

D. SUMMARY ASSESSMENT OF RECOVERY STATUS

The key to survival and recovery of these species relies on the effective use of measures to keep nonnative species, particularly fish, out of currently occupied habitats. Recovery efforts must be aimed at maintaining and restoring stream integrity. In addition, captive propagation and translocation must be fully explored to increase numbers within damselfly populations and to reestablish populations in historical locations.

II. Preliminary Recovery Strategy

A. RECOVERY PRIORITY NUMBER

The flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly are both assigned a recovery priority number of 5 on a scale of 1C (highest) to 18 (lowest; the “C” indicates the potential for conflict with human economic activities), based on the high

degree of threat, a low potential for recovery as stated above, and their status as full species (USFWS 1983a, b). Potential for conflict with human economic activities is believed to be minor.

B. RECOVERY GOAL AND OBJECTIVES

The goal of the recovery program is to establish a framework within which recovery actions are undertaken to ensure the long-term survival of the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly, and to control or reduce the threats to the individual species to the extent that each no longer requires the protections afforded by the Endangered Species Act and therefore warrants delisting. Although subject to change, full recovery of the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly is currently envisioned as follows: viable populations of each species will persist in protected and managed habitat throughout 90 percent of the species' historical range on their islands of origin. Furthermore, threats to the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly, primarily habitat loss and degradation and predation by nonnative species, will be sufficiently abated to ensure the high probability of survival for each species for at least 100 years.

C. INITIAL ACTION PLAN

The goal of the initial phase of recovery is to arrest and reverse the general population declines and increase occupied range of the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly. The primary objectives of the initial phase of recovery include:

1. Protect habitat and control threats
 - 1.1. Identify and survey remaining extant populations for the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly species and the habitat in which they occur
 - 1.2. Identify areas necessary for recovery, including critical habitat, and develop emphasis areas and management units
 - 1.3. Ensure long-term protection of habitat
 - 1.3.1. Identify threats to the habitat within management units
 - 1.3.2. Within identified management units, construct and maintain fencing to prevent ungulate disturbance
 - 1.3.3. Control habitat-modifying invasive nonnative plant species

- 1.3.4. Develop and implement a program to control or eliminate nonnative predators (ants, backswimmers, fish, and bullfrogs)
- 1.3.5. Protect management units from human disturbance as necessary
- 1.3.6. Control and manage purposeful and accidental introduction of potential predators
- 1.3.7. Control other threats as appropriate
- 1.3.8. Work with the State of Hawaii and private parties to maintain sufficient instream flow in critical reaches, or restore flow to reaches in which addition breeding habitat may be practically reclaimed
- 1.4. Monitor success of management actions and use results to adapt management actions
- 1.5. Identify and implement permanent or minimum instream flow standards for aquatic ecosystems within the historical and current range
2. Conduct research and monitoring necessary to guide recovery planning for both damselfly species
 - 2.1. Conduct basic research on environmental requirements associated with the reproductive biology of both species and the naiad life history stage of the flying earwig Hawaiian damselfly
 - 2.2. Develop and implement a detailed monitoring plan for each species and its preferred habitat
3. Develop and implement a detailed monitoring plan to assess the levels of currently known threats and identify potential threats to the species or their habitat
4. Investigate need for and feasibility of damselfly translocations into unoccupied historical habitat
5. Develop and initiate a public information program for the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly
6. Refine downlisting and delisting criteria at both the species and ecosystem level as necessary to validate recovery objectives

These objectives will be accomplished by using the full range of protection tools available (*e.g.*, critical habitat identification and determination, section 7 consultations, incidental take permits, partnerships, etc.) and will be based on our current understanding of the ecological requirements of these species and what is needed to fully protect their

habitats. Heightened public awareness through information and incentive programs may play a role in generating voluntary protection actions (*e.g.*, grants for habitat restoration and protection, Safe Harbor Agreements, etc.).

D. RECOVERY ACTIONS

The recovery effort should build upon ongoing conservation and monitoring efforts described above. Specific actions that should be undertaken early in the process include the following:

- Stabilize and protect all remaining extant populations of the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly.
- Identify highest priority management units and initiate control of ecosystem-modifying threats, such as ungulates, invasive nonnative plant species, and stream diversions, as soon as possible.
- Increase outreach effort and coordination with State agencies and private landowners regarding Hawaiian damselfly conservation. Promote opportunities to assist in the recovery of these species through Habitat Conservation Plans, Safe Harbor Agreements, and through various conservation partnerships funded by State and Federal agencies and private organizations.

III. Preplanning Decisions

A. PLANNING APPROACH

A recovery plan for the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly will be prepared pursuant to section 4(f) of the Endangered Species Act. Plan preparation will be conducted by the Pacific Islands Fish and Wildlife Office as described in section III.C below.

We do not believe the appointment of a recovery team for these species is necessary at this time. Our lead biologist will coordinate recovery efforts within an informal network of experts and involved parties. Periodically, meetings among these parties may be convened with the purpose of sharing information and ideas about advancing the recovery of the Hawaiian damselflies. Plans for stakeholder involvement are addressed below.

B. INFORMATION MANAGEMENT

All information relevant to the recovery of the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly will be housed in the Pacific Islands Fish and Wildlife

Office's administrative files. Our lead biologist will be responsible for maintaining a full administrative record for the recovery planning and implementation process for the species.

C. RECOVERY PLAN SCHEDULE

The Pacific Islands Fish and Wildlife Office will initiate recovery planning for these Hawaiian damselfly species in the context of a series of upcoming ecosystem-based recovery plans. These recovery plans, which will complement several forthcoming listing rules, are projected to cover a broad suite of listed species on each of the main Hawaiian islands, beginning with a Kauai species (island-wide) recovery plan that is currently in preparation.

The Oahu species recovery plan (including multiple listed plant and animal species on Oahu) will address restoration of extirpated populations of the Pacific Hawaiian damselfly. Currently a listing rule for multiple Oahu species is projected to be published in 2012, and the Oahu species (island-wide) recovery plan is projected to be published as a draft in 2013 and finalized in 2014.

The Maui Nui species recovery plan (including multiple listed plant and animal species on Maui, Molokai, and Lanai) will address the flying earwig Hawaiian damselfly population on Maui and the Pacific Hawaiian damselfly populations on Maui, Molokai, and Lanai. Currently a listing rule for multiple Maui Nui species is projected to be finalized in 2012, and the Maui Nui species (islands-wide) recovery plan is projected to be published as a draft in 2015 and finalized in 2016.

Subsequently, the Big Island species recovery plan (including multiple listed plant and animal species on the island of Hawaii) will address recovery of Pacific Hawaiian damselfly populations, as well as restoration of extirpated populations of the flying earwig Hawaiian damselfly, on the island of Hawaii. We currently project that the Big Island species (island-wide) recovery plan will be published as a draft in 2016 and finalized in 2017.

An integrated range-wide analysis of recovery needs for the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly will be included in the Multi-island Species recovery plan. This recovery plan will be prepared after a Multi-island Species listing rule is finalized, which is expected to occur in 2015. We currently project that the draft Multi-island Species recovery plan will be published in 2017 and finalized in 2018.

D. STAKEHOLDER INVOLVEMENT

Key stakeholders:

- State of Hawaii, Department of Land and Natural Resources, Division of Aquatic Resources

- State of Hawaii, Commission on Water Resource Management
- State of Hawaii, Department of Agriculture, Division of Quarantine
- U.S. Natural Resource Conservation Service
- U.S. Forest Service
- Kalaupapa National Historical Park
- Hawaiian Commercial and Sugar Company

E. STAKEHOLDER INVOLVEMENT STRATEGY

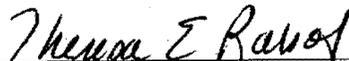
The implementation of recovery actions generally requires the participation of a broad range of partners, including other Federal agencies, States, local jurisdictions, nongovernmental organizations, businesses, and private landowners. Examples of recovery actions include habitat restoration (*e.g.* restoration of vegetation), research, captive propagation and reintroduction, and outreach and information. Because many of the current and historical populations of the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly occur or occurred on non-Federal lands, recovery of these species cannot be accomplished solely on Federal lands. To achieve recovery of these species requires cooperative conservation efforts with State and local governments as well as private landowners. We anticipate identifying these non-Federal landowners and coordinating with them to determine their ability and willingness to assist in recovery actions for the two Hawaiian damselflies.

Stakeholders will be invited to participate in meetings as warranted, and will be given an opportunity to review and comment on drafts of the recovery plans prior to their finalization. Stakeholders will also be invited to contribute directly in developing and implementing recovery strategies and actions.

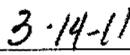
A mailing list of stakeholders will be maintained and the Pacific Islands Fish and Wildlife Office will attempt to foster open and ongoing communications with all interested parties. Field biologists working with the two Hawaiian damselflies and other natural resource issues in the Hawaiian Islands will aim to develop strong one-on-one working relationships with interested parties over time to achieve the collaborative recovery of the flying earwig Hawaiian damselfly and Pacific Hawaiian damselfly.

Approved:

Acting



Regional Director, Region 1
U.S. Fish and Wildlife Service



Date

Citation

U.S. Fish and Wildlife Service. 2011. Recovery Outline for Two Hawaiian Damselflies. Portland, Oregon. 19 pp.

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