

5-YEAR REVIEW

Short Form Summary

Species Reviewed: Pacific Hawaiian damselfly (*Megalagrion pacificum*)

Current Classification: Endangered

FR Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews for 77 Species in Oregon, Washington, Idaho, and Hawai‘i. Federal Register 86 (120):33726–33728.

Lead Region/Field Office: Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewer(s):

Charmian Dang, Fish and Wildlife Biologist, PIFWO

John Vetter, Animal Recovery Coordinator, PIFWO

Methodology used to complete this 5-year review: This review was conducted by staff of the PIFWO of the U.S. Fish and Wildlife Service (USFWS), beginning on May 18, 2023. The review was based on a review of current, available information since the last 5-year review for the Pacific Hawaiian damselfly (*Megalagrion pacificum*) (USFWS 2018, entire). The evaluation by Charmian Dang, Fish and Wildlife Biologist, was reviewed by John Vetter, the Animal Recovery Coordinator, and the acting Recovery Team Manager.

Background:

For information regarding the species’ listing history and other facts, please refer to the USFWS Environmental Conservation Online System database for threatened and endangered species at <http://ecos.fws.gov/ecp/species/6119>.

Review Analysis:

Please refer to the Recovery outline for two Hawaiian damselflies (USFWS 2011, entire), the Species Report for the Pacific Hawaiian Damselfly (USFWS 2022a, entire), the Recovery plan for 50 Hawaiian Archipelago Species (USFWS 2022b, entire) and the previous 5-year review for the Pacific Hawaiian damselfly published on September 19, 2018 (available at <http://ecos.fws.gov/ecp/species/6119>) for a complete review of the species’ status, threats, and management efforts. No new threats or no new information regarding the species biological status have come to light since listing to warrant a change in the Federal listing status of the Pacific Hawaiian damselfly as endangered.

Historically, Pacific Hawaiian damselflies were noted on all Hawaiian islands except Kaho‘olawe and Ni‘ihau (Polhemus and Asquith 1996; USFWS 2010; USFWS 2011). The Pacific Hawaiian damselfly is now believed to be limited to 30 populations: 20 on Maui, nine on Moloka‘i, and one on the island of Hawai‘i (Polhemus and Haines 2020, pp. 10, 12, 14–15; Polhemus 2022, p. 23; USFWS 2022a, p. 3). Currently, there is no quantitative estimate of the size of the extant populations of the Pacific Hawaiian

damsselfy available (USFWS 2022a, p. 24). However, many populations of the Pacific Hawaiian damsselfy are thought to be relatively small in size (< 100 individuals) (USFWS 2022a, p. 18). The Pacific Hawaiian damsselfy is believed to be extirpated from O‘ahu, Kaua‘i, and Lāna‘i. In 1998, it was believed it was extirpated from the island of Hawai‘i, but one population was discovered in a small stream on the island (Englund 1998, pp. 15–16; USFWS 2010, p. 35992).

New status information:

On Moloka‘i, the Pacific Hawaiian damsselfy is found in at least nine streams and may possibly be extant in other unsurveyed streams on the north coast that have not been invaded by nonnative fish (Polhemus and Haines 2020, pp. 10, 12, 14–15; USFWS 2022a, p. 24). The Pacific Hawaiian damsselfy was observed in Pelekunu Valley and Wailua Valley in January of 2020 (Polhemus and Haines 2020, pp. 10, 12, 14–15). Habitats utilized by the Pacific Hawaiian damsselfy may be seasonal in more dynamic aquatic systems. For example, based on three surveys in 1991, 1995, and 2020 in Pelekunu Valley on Moloka‘i, the Pacific Hawaiian damsselfy exploit different habitats opportunistically as conditions permit (Polhemus and Haines 2020, p. 17; USFWS 2022a, p. 24). In dry summer months, when the old kalo fields dry out and large scouring floods are infrequent, the Pacific Hawaiian damsselfy may breed in the terminal pond and seepage-fed side channels along the lower course of the main stream channel (Polhemus and Haines 2020, p. 17; USFWS 2022a, p. 24). However, during the winter, when the old kalo fields become partially flooded and marsh-like, the Pacific Hawaiian damsselfy appears to move back into this area, possibly to avoid impacts from high impact stream flooding (Polhemus and Haines 2020, p. 17; USFWS 2022a, p. 24). It is also possible that individuals seen along the stream channel during the summer months are spillover from the larger core breeding populations in the old kalo fields that persist throughout the year (Polhemus and Haines 2020, p. 17; USFWS 2022a, p. 24).

On Maui, the Pacific Hawaiian damsselfy is currently known from 20 streams (Polhemus 2022, p. 23; USFWS 2022a, p. 24). While the Pacific Hawaiian damsselfy is no longer found along the entire reaches of some Maui streams, they are still found in restricted areas where steep terrain prevents access by nonnative fish, which inhabit the degraded, lower stream reaches (Polhemus and Asquith 1996, p. 13; Englund et al. 2007, p. 215; USFWS 2022a, p. 24). In April of 2022, six streams (Kailua, Makanali, Puohokamao, Kopiliula, ‘Ula‘ino, and Mokulehua) were surveyed for native damsselfies for the Hāna Highway Bridge Improvements project. The Pacific Hawaiian damsselfy during the two-day survey. A small population was found at ‘Ula‘ino Stream where three individuals were observed. A second previously unknown population was observed at Kawaihapapa Stream, one mile to the west of ‘Ula‘ino, indicating that Pacific Hawaiian damsselfy may be more prevalent in the streams east of Nāhiku than was previously realized (Polhemus 2022, p. 23).

A survey of the one population on the island of Hawai‘i has not been completed since 1998 (USFWS 2018, pp. 6–7).

New threats:

A threat to the Pacific Hawaiian damselfly is the ongoing destruction and degradation of wetland and lowland stream habitat by nonnative animals, particularly feral pigs (*Sus scrofa*) (Polhemus and Asquith 1996, p. 22; Erickson and Puttock 2006, p. 42; USFWS 2022a, p. 13). Animals such as feral pigs, goats (*Capra hircus*), axis deer (*Axis axis*), black-tailed deer (*Odocoileus hemionus*), and cattle (*Bos taurus*) were introduced either by the early Hawaiians around 400 A.D. or more recently by European settlers for food and/or commercial ranching activities (Tomich 1986, pp. 120–121; USFWS 2022a, p. 13). Feral pigs threaten the existence of the Pacific Hawaiian damselfly by trampling the forest floor, thereby encouraging the establishment of nonnative plants, and by removing vegetation by wallowing in moist depressions (Stone 1985, p. 263; Cuddihy and Stone 1990, p. 65; USFWS 2022a, p. 13). In nitrogen-pool soils, feral pig excrement increases nutrient availability, enhancing establishment of nonnative weeds that are more adapted to richer soils than are native plants (Cuddihy and Stone 1990, p. 65; USFWS 2022a, p. 13). Rooting by feral pigs was observed to be related to the search for earthworms, with rooting depths averaging 8 inch (20 centimeters), and rooting was found to greatly disrupt the leaf litter and topsoil layers, and contribute to erosion and changes in ground topography (Diong 1982, pp. 150, 160–167; USFWS 2022a, p. 13). In addition, Mountainspring (1986, p. 98) surmised that rooting by feral pigs depresses insect populations that rely on ground litter for reproduction; this could impact prey availability for damselflies (Foote 2008, in litt., entire; Polhemus 2008, p. 48; USFWS 2022a, p. 13). Feral pigs are often managed as game animals for public hunting (The Nature Conservancy 2014, p. 12; USFWS 2022a, p. 13). In contrast to a total eradication program, this action makes it more likely that feral pigs will continue to exist in Hawai'i, and thus likely that feral pigs will continue to destroy and degrade habitat of the Pacific Hawaiian damselfly (USFWS 2022a, p. 13).

Habitat poisoning is a potential threat to the Pacific Hawaiian damselfly. Exposure to pesticide contamination can cause acute and chronic poisoning and lead to the mortality of non-target aquatic organisms (Gulliya et al. 2021, p. 10134; USFWS 2022a, pp. 14–15). Pesticides applied to the aquatic environment during collection of Tahitian prawns (*Macrobrachium lar*) can poison and cause mortality to all aquatic life (HDLNR 2018a, entire; HDLNR 2020a, entire; USFWS 2022a, pp. 14–15). In one stream where pesticide was used for Tahitian prawn collection, anecdotal evidence indicates that the orangeblack Hawaiian damselfly (*Megalagrion xanthomelas*) has not been documented since pesticide application (Magnacca 2022, in litt., entire; USFWS 2022a, pp. 14–15). Hawaiian damselfly larvae and eggs can be exposed to pesticide contaminated water through direct contact. In addition, secondary poisoning can occur to Hawaiian damselfly adults and larvae through bioaccumulation by the consumption of contaminated prey (USFWS 2022a, pp. 14–15).

A predatory, freshwater invertebrate, *Hydra vulgaris*, is a newly identified threat to Hawaiian damselflies. Water studies by State of Hawai'i Department of Land and Natural Resources Division of Forestry and Wildlife Hawai'i Invertebrate Program have shown *Hydra* is a threat to the orangeblack Hawaiian damselfly population located at Tripler Army Medical Center. This common aquarium system pest appears to be preying on

damsselfly naiads in addition to their other prey that includes *Moina* and *Culex* larvae (Haines 2022, in litt., entire; USFWS 2022a, pp. 15–16).

Management actions:

One of the primary threats to the Pacific Hawaiian damsselfly is the 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, the State of Hawai‘i’s Aquatic Invasive Species program works to control, manage, and prevent introduced aquatic pests (HDLNR 2020b, entire; USFWS 2022a, p. 19). Work from this program includes various methods of nonnative fish removal including dewatering, netting and trapping, electrofishing, and other biocontrol methods (Tavares 2009, p. 2; USFWS 2022a, p. 19).

The State of Hawai‘i also considers all natural flowing surface waters (e.g., streams, springs, seeps) as State property (Hawai‘i Revised Statutes 174c 1987). The primary federal regulatory mechanisms that may play a role in the survival and recovery of these damsselfies 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 ESA (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; 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. However, there are no known conservation efforts or agreements specifically for the Pacific Hawaiian damsselfly (USFWS 2022a, pp. 19–20).

In June of 2018, the State of Hawai‘i Commission on Water Resource Management ordered the full restoration of flows to 10 streams in Maui and ordered no or limited diversions, for seven streams in the east Maui watershed (HDLNR 2018b, entire; USFWS 2022a, p. 20). The Commission’s decision will return free flowing water, with no upstream diversions, to the following streams: Hanehoi, Honopū, Huelo, Kualani, Makapipi, ‘Ohi‘a (Waiianui), Palauhulu, Pi‘ina‘au, Wailuanui, and Waiokamilo. The majority of these 10 streams have been diverted for over 100 years. The Commission’s decision also orders East Wailua Iki, Honomanū, Kopiliula, Waikamoī, Punalau/Kōlea, Waiohue, and West Wailua Iki streams to have limited or no water diversions in order to foster improved habitat for native fish and other stream animals. The two exceptions are Waiohue and West Wailua Iki streams, which are to remain undiverted so that total flow is restored as habitat reference streams and important estuaries (USFWS 2022a, p. 20).

Table 1. Status and trends of the Pacific Hawaiian damselfly from listing through current 5-year review.

Date	No. Adult Wild Individuals	Downlisting Criteria Identified in Recovery Plan	Downlisting Criteria Completed?
2010 (listing)	Unknown	No recovery plan developed yet.	N/A
2011 (recovery outline)	Unknown	Recovery outline developed.	No
2018 (5-year review)	Unknown	Recovery outline developed	No
2022 (species report)	Unknown	Recovery outline developed.	No
2022 (recovery plan)	Unknown; around 30 populations	1. Existing populations of each damselfly species are identified and stabilized. Each of the three damselfly species should be represented by at least 10 populations geographically distributed in their respective habitats among islands where they have been historically observed. Populations should be well distributed on an island such that an island population is unlikely to be extirpated by a catastrophic event. For each population, a population index based on repeated surveys with consistent methodology must indicate stable to increasing indices over at least 5 consecutive years immediately prior to downlisting being considered for the species.	No
		2. Habitats at each population site in <i>Downlisting Criterion 1</i> provide sufficient breeding habitat to support the damselflies, and measures are in place to protect the sites from ungulates, fire, and other forms of degradation in perpetuity.	No
		3. For each population site in <i>Downlisting Criterion 1</i> , threats from predation, competition, and invasive species have been monitored for the 5 most recent years, and results based on at least	No

		3 years of the most recent data indicate that (a) nonnative predators are absent, or (b) that predation and competition are occurring at a level that will not result in significant long-term effects on damselfly population indices. All major threats to individual damselflies and habitat are managed, and measures are in place to prevent the introduction of new nonnative predators, competitors, or disease to the populations in <i>Downlisting Criterion 1</i> . Monitoring and management plans are completed and implemented for each damselfly species.	
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Table 2. Threats to the Pacific Hawaiian damselfly and ongoing conservation efforts.

Threat	Listing Factor	Current Status	Conservation/Management Efforts
Agriculture/urban development	A	Ongoing	Agriculture and urban development continue to pose a threat to the Pacific Hawaiian damselfly habitat through encroachment and modification of water resources.
Stream alteration	A	Ongoing	Removal and reduction of stream flow diversion has been ordered on 17 streams in east Maui. Ongoing and extensive stream diversion and channelization continue to degrade the quantity and quality of the Pacific Hawaiian damselfly habitat elsewhere on Maui and Hawai'i islands.
Habitat modification by pigs	A	Ongoing	Ongoing habitat destruction and degradation caused by feral pigs in riparian habitat promote the establishment and spread of nonnative plants.
Habitat modification by nonnative plants	A	Ongoing	Nonnative plants that turn marshes into meadowlands and modify the riparian community lower or destroyed the capability of the habitat to support viable populations of the Pacific Hawaiian damselfly.

Habitat poisoning	A	Ongoing	Exposure to pesticide contamination can cause acute and chronic poisoning and lead to the mortality of all life stages of the Pacific Hawaiian damselfly.
Stochastic events	A	Ongoing	The extreme reduction in range and dispersed populations put the Pacific Hawaiian damselfly at risk of extirpation.
Climate change	A	Ongoing	Climate change is expected to affect water levels in streams. Reduced genetic diversity of the remaining population may limit the ability of the Pacific Hawaiian damselfly to adapt.
Predation	C	Ongoing	Nonnative fish, backswimmers, ants, <i>Hydra vulgaris</i> , and bullfrogs pose a threat to the Pacific Hawaiian damselfly throughout their habitat.
Inadequate habitat protection	D	Ongoing	The State of Hawai'i considers all natural flowing surface water (streams, springs, and seeps) as State property (Hawai'i Revised Statutes 174c 1987). However, the State's Water Commission has not consistently enforced State Water Code regulations to protect the Pacific Hawaiian damselfly stream habitat. Recent ordering of stream flow restoration in the east Maui watershed may provide an increase in the amount of habitat available to the Pacific Hawaiian damselfly if the water returns were to be implemented carefully to prevent the spread of nonnative fish species upstream.
Limited populations	E	Ongoing	The Pacific Hawaiian damselfly is restricted to one population on Hawai'i island, at least nine streams on Moloka'i, and 20 streams on Maui with an unknown population estimate at each stream location. The species appears to have low representation and resiliency and low to moderate redundancy.
Competition for food resources	E	Ongoing	Coqui frog would compete with the Pacific Hawaiian damselfly for food

			resources should the frog become established in the species habitat.
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Syntheses:

The Pacific Hawaiian damselfly, *Megalagrion pacificum*, is an endangered invertebrate that was once found across the Hawaiian archipelago. This species is now believed to be limited to 30 populations: 20 on Maui, nine on Moloka‘i, and one on the island of Hawai‘i (Polhemus and Haines 2020, pp. 10, 12, 14–15; Polhemus 2022, p. 23; USFWS 2022a, p. 3). There is no quantitative estimate of population size, although many populations of the Pacific Hawaiian damselfly are thought to be relatively small in size (< 100 individuals) (USFWS 2022a, p. 18).

Downlisting and delisting objectives are provided in Recovery Plan for 50 Hawaiian Archipelago Species (USFWS 2022b, p. xi). To be downlisted, at least 10 populations with stable population indices must exist; suitable habitats supporting at least 10 populations with stable population indices are protected; and habitat and threats are managed, monitoring and management plans are completed and implemented, and measures are in place to prevent the introduction of new threats. To be delisted, 10 years of systematic surveys must indicate significant increases in population indices and distribution of the 10 populations; suitable habitats supporting the 10 years of systematic surveys indicating significant increases in population indices and distribution of the 10 populations are protected; and habitat and threats are managed, monitoring of population status and threats are ongoing, and measures are in place to prevent the introduction of new threats.

The key threats to the Pacific Hawaiian damselfly are agriculture and urban development that encroach and modify water resources, stream diversion and channelization that continues to degrade the quantity and quality of the species habitat, modification of the species habitat by pigs and nonnative plants, habitat poisoning by pesticide contamination, nonnative predatory fishes, backswimmers, ant species, coqui frogs, bullfrogs, and *Hydra vulgaris*, climate change, catastrophic events such as hurricane, landslides or drought, and lack of population representation, resiliency, and redundancy due to its apparent low population count. Currently, existing regulations are inadequate to protect the Pacific Hawaiian damselfly from introduction of nonnative species and to maintain their aquatic and riparian habitat. Currently, these threats are not managed. Therefore, the Pacific Hawaiian damselfly continues to meet the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Develop and implement a detailed monitoring plan for *Megalagrion pacificum* and its preferred habitat.
- Conduct targeted surveys for *Megalagrion pacificum* to determine the distribution of the species.
- Based on survey results, stabilize and protect extant populations of *Megalagrion pacificum* and implement the recovery plan.

- Identify the primary habitat features and characteristics necessary for *Megalagrion pacificum* recovery.
- Identify and evaluate the primary biological characteristics necessary for *Megalagrion pacificum* recovery.
- Maintain and protect the habitat of *Megalagrion pacificum*.
- Refine and calibrate the indices for invertebrate communities that are used for monitoring programs to improve stream habitat.
- Eliminate or manage nonnative predators of *Megalagrion pacificum*.
- Survey, document, and manage threats to *Megalagrion pacificum*.
- Once habitat requirements are understood, translocate *Megalagrion pacificum* to other suitable sites.

References:

See previous 5-year review and recovery plan for additional references.

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U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW on the Pacific Hawaiian damselfly
(*Megalagrion pacificum*)

Pre-1996 DPS listing still considered a listable entity? ___N/A___

Recommendation resulting from the 5-year review:

- Delisting
- Reclassify from Endangered to Threatened status
- Reclassify from Threatened to Endangered status
- No Change in listing status

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