

*Achatinella apexfulva*  
(*O`ahu Tree Snail*)

**5-Year Review  
Summary and Evaluation**

**U.S. Fish and Wildlife Service  
Pacific Islands Fish and Wildlife Office  
Honolulu, Hawai`i**

# 5-YEAR REVIEW

Species reviewed: *Achatinella apexfulva* (O'ahu tree snail)

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**5-YEAR REVIEW**  
***Achatinella apexfulva* / O`ahu Tree Snail**

**1.0 GENERAL INFORMATION**

**1.1 Reviewers**

**Lead Regional Office:**

Region 1, Endangered Species Program, Division of Recovery Jesse D'Elia,  
(503) 231-2071

**Lead Field Office:**

Pacific Islands Fish and Wildlife Office, Loyal Mehrhoff, Field Supervisor,  
(808) 792-9400

**Cooperating Field Office(s):**

N/A

**Cooperating Regional Office(s):**

N/A

**1.2 Methodology used to complete the review:**

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office of the U.S. Fish and Wildlife Service (USFWS), beginning on August 7, 2009. The review was based on the final rule to list the Hawaiian (O`ahu) tree snails genus *Achatinella* and the Recovery Plan for the O`ahu Tree Snails of the Genus *Achatinella* (USFWS 1981, 1992), as well as a review of current available information. The Hawaiian Tree Snail Lab provided an initial draft of portions of the review and recommendations for conservation actions needed prior to the next five-year review. The draft 5-year review was then reviewed by the Recovery Program Leader and the Assistant Field Supervisor for Endangered Species before submission to the Field Supervisor for approval.

**1.3 Background:**

**1.3.1 FR Notice citation announcing initiation of this review:**

[USFWS] U.S. Fish and Wildlife Service. 2009. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 103 species in Hawaii. Federal Register 74(49):11130-11133.

### 1.3.2 Listing history

#### Original Listing

**FR notice:** [USFWS] U.S. Fish and Wildlife Service. 1981. Endangered and Threatened Wildlife and Plants; Listing the Hawaiian (O`ahu) Tree Snails of the Genus *Achatinella*, as Endangered Species. Federal Register 8(46):3178-3182.

**Date listed:** February 12, 1981

**Entity listed:** Genus

**Classification:** Endangered

#### Revised Listing, if applicable

**FR notice:** N/A

**Date listed:** N/A

**Entity listed:** N/A

**Classification:** N/A

### 1.3.3 Associated rulemakings:

Critical Habitat was not designated for the Hawaiian (O`ahu) tree snails genus *Achatinella* in 1981 when it was listed because it would make these animals more vulnerable to collection.

### 1.3.4 Review History:

Species status review [FY2010 Recovery Data Call (August 2010)]: Declining

#### **Recovery achieved:**

1 (0-25%) [FY2010 Recovery Data Call - August 2010]

### 1.3.5 Species' Recovery Priority Number at start of this 5-year review:

2

### 1.3.6 Current Recovery Plan or Outline

**Name of plan:** Recovery Plan for the Oahu Tree Snails of the Genus *Achatinella*

**Date issued:** June 20, 1992

**Dates of previous revisions, if applicable:** N/A

## 2.0 REVIEW ANALYSIS

### 2.1 Application of the 1996 Distinct Population Segment (DPS) policy

#### 2.1.1 Is the species under review a vertebrate?

       *Yes*  
  X   *No*

**2.1.2 Is the species under review listed as a DPS?**

*Yes*  
 *No*

**2.1.3 Was the DPS listed prior to 1996?**

*Yes*  
 *No*

**2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?**

*Yes*  
 *No*

**2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?**

*Yes*  
 *No*

**2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?**

*Yes*  
 *No*

## **2.2 Recovery Criteria**

**2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?**

*Yes*  
 *No*

**2.2.2 Adequacy of recovery criteria.**

**2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?**

*Yes*  
 *No*

**2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery?**

*Yes*  
 *No*

**2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:**

The recovery plan states “the status of most Hawaiian tree snails is so poorly known that no downlisting or delisting objective can be established at this time. Eventually, through the development of populations in nature that are robust and free of the twin threats of predation and habitat destruction, steps should be taken to downlist the Hawaiian tree snails (or individual species) to Threatened.”

These criteria have not been met. The population of *Achatinella apexfulva* is not robust with only one wild individual observed in the past 6 years and only two individuals in captive propagation (Hadfield 2010). The threats of predation and habitat destruction are largely unmanaged.

**2.3 Updated Information and Current Species Status**

**2.3.1 Biology and Habitat**

**2.3.1.1 New information on the species’ biology and life history:**

There is no new information on the biology and life history of *Achatinella apexfulva*.

**2.3.1.2 Abundance, population trends (e.g., increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:**

*Achatinella apexfulva* is so rare in the wild (US Army 2009) that it was presumed extinct in the field (Holland and Hadfield 2004). In 1998, one population of *A. apexfulva* was identified on the Paomaho Trail, in the Ko’olau Mountains on the island of O’ahu. The most recent sighting of live *A. apexfulva* in the field was on February 16, 2005; only one adult was found and it was taken to the Hawaiian Tree Snail Conservation Captive-Propagation Lab located on the University of Hawai’i at Mānoa campus (US Army 2009).

**2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):**

Analyses of mitochondrial sequence data from 16S and cytochrome c oxidase subunit I (COI) revealed that *Achatinella apexfulva*, *Achatinella livida*, *Achatinella mustelina*, and *Achatinella sowerbyana* are in the same monophyletic clade (Thacker and Hadfield 2000; Holland and Hadfield 2002). Additionally, according to mitochondrial DNA-sequence analysis,

*A. apexfulva*, *A. livida*, and *A. sowerbyana* were grouped together into the same subgenus (Holland and Hadfield 2002).

According to COI-sequence analyses of all extant *Achatinella* spp., *A. apexfulva* is most closely related to *A. concavospira*, making the two species sister taxa. This is interesting, because these two species are found on different mountain ranges, *A. apexfulva* in the Ko`olau Mountains and *A. concavospira* in the Wai`anae Mountains (Holland and Hadfield 2004).

#### **2.3.1.4 Taxonomic classification or changes in nomenclature:**

There has been no change to the taxonomic classification or nomenclature of *Achatinella apexfulva*.

#### **2.3.1.5 Spatial distribution, trends in spatial distribution (e.g., increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g., corrections to the historical range, change in distribution of the species' within its historic range, etc.):**

There is no new information on the spatial distribution or historic range of *Achatinella apexfulva*.

#### **2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):**

The tree-snail habitat present in the north Ko`olau summit area is in good condition. The area is characterized by tall native vegetation, but invasive grasses are present. Tree snails found in this location, live on native trees (M. Hadfield, University of Hawai`i, pers. comm. 2010).

#### **2.3.1.7 Other:**

None

### **2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)**

#### **2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:**

Habitat degradation is a major threat to *Achatinella* spp.; however, the degree of habitat degradation varies within the historical range of each species. The tree-snail habitat within the historical range of *Achatinella apexfulva* continues to be threatened by the spreading of invasive plants into higher elevations by feral pigs (*Sus scrofa*), feral goats (*Capra hircus*), hunting, and hiking. Tree-snail host plants are threatened by

invasions from *Psidium cattleianum* (strawberry guava), *Grevillea robusta* (silk oak), *Schinus terebinthifolius* (christmas berry), *Lantana camara*, *Clidemia hirta* (USFWS 1992), *Leucaena leucocephala* (koa haole), and *Miconia calvescens* (Weed Risk Assessments for Hawai`i and Pacific Islands 20011). Invasive plant species compete with host plant species for space and resources. Feral pigs trample host plant species and spread the seeds of invasive plant species (USFWS 1992). The population of *A. apexfulva* located along the Poamoho Trail, that has been monitored by the Army Natural Resource Section (ANRS) since 1998, is not managed for weed control and no ungulate fence is present to keep feral pigs away (US Army 2009).

The majority of the historical range of *A. apexfulva* lies within the US Army's Kawaihoa Training Area and Schofield Barracks East Range, (USFWS 1992; USFWS 2003). Tree-snail species are threatened directly and indirectly by training activities. Food disposed of during military troop activities leads to an increase in the size of rat populations. Seeds of non-native plants may be spread along the trails used by the Military via transportation on boots, vehicles, equipment, or clothing. Dismounted troop movement in forested areas may result in the trampling of host plants and possibly tree snails. Discarded cigarettes, Military vehicles and other equipment used during training activities can be potential sources of fire ignition (USFWS 2003).

#### **2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:**

Illegal shell collecting is a continuing threat to the species.

#### **2.3.2.3 Disease or predation:**

*Achatinella apexfulva* is threatened by predation from the rosy wolf snail (*Euglandina rosea*) and rats (*Rattus exulans*, *Rattus rattus*, and *Rattus norvegicus*) (USFWS 1992; Hadfield *et al.* 1993; Hadfield and Saufler 2009). *E. rosea* preys on all sizes of snails. Predation by *E. rosea* can result in the extirpation of a snail population in less than one year. When *E. rosea* preys on snails, the shell is left clean and undamaged. Rats prey on larger snails. When rats prey on snails, the shells are crushed (Hadfield *et al.* 1993).

The Jackson's chameleon (*Chamaeleo jacksonii*) has recently been documented as a predator of *Achatinella* spp. and may pose a major threat to their existence. Jackson's chameleons are found in the Ko`olau and Wai`anae Mountains (Holland *et al.* 2009); however, their impact on *Achatinella* spp. is not well documented.

The terrestrial snail *Gonaxis kibweziensis* was introduced around O`ahu to control *Achatina fulica* or African Snail. *Gonaxis kibweziensis* have been observed preying on *Achatina* egg clutches and juvenile under the length of 35mm and unidentified native terrestrial snails (Davis and Butler 1964). Carnivorous snails introduced to control other introduced snails pose a significant threat to *Achatinella* spp. Although released at various elevations around O`ahu (Davis and Butler 1964), they are mainly found in the lowland (B. Holland, University of Hawai`i, pers. comm. 2011a). In April 2011, this species was found in the back of Kuliouou Valley on O`ahu at 2,200 feet elevation (N. Yuen, Biological Consultant, pers. comm. 2011b; Hawaiianforest.com 2011).

The terrestrial snail *Oxychilus alliarius*, and the terrestrial flatworm *Geoplana septemlineata*, which reportedly eats snails (USFWS 1992) may threaten *Achatinella* spp.; however, predation on *Achatinella* spp. by *G. septemlineata* and *O. alliarius* has not been observed (USFWS 1992).

Additionally, the flatworm *Platydemis manokwari* is a known predator of land and arboreal snails on many Pacific islands (Hopper and Smith 1992; Sugiura 2009). *Platydemis manokwari* is known to occur on O`ahu from low elevations up to Mount Ka`ala in the Wai`anae Mountains (US Army 2008) and in the Ko`olau Mountains (B. Holland, University of Hawai`i, pers. comm. 2011b); however, predation by *P. manokwari* on *Achatinella* spp. has not been documented. There are no known diseases that threaten *Achatinella* spp. (USFWS 1992). It is unknown what impacts skinks and birds may have on *Achatinella* spp. (B. Holland, University of Hawai`i, pers. comm. 2011a).

#### **2.3.2.4 Inadequacy of existing regulatory mechanisms:**

None.

#### **2.3.2.5 Other natural or manmade factors affecting its continued existence:**

Species like *A. apexfulva* that are endemic to small portions of a single island are inherently more vulnerable to extinction than widespread species because of the higher risks posed to a few populations and individuals by random demographic fluctuations, localized catastrophes such as hurricanes, landslides, flooding, and disease outbreaks, and climate change effects such as lowland predators moving to higher elevations.

Conservation measures for this species include captive propagation and genetic research. Individuals of *Achatinella apexfulva* have been maintained in the Hawaiian Tree Snail Conservation Captive-Propagation

Lab at the University of Hawai'i at Mānoa since 1994. In July 1994, four *A. apexfulva* (two adults and two subadults) were brought into the facility. In July 1998, one more adult was added to the captive population. In March 2001, two more adults were added. In February 2005, one more adult was added (Hadfield 2010). All individuals of *A. apexfulva* were collected from Poamoho Trail. The population trend of *A. apexfulva* in the lab is one of decline due to low reproductive output and mortality (Hadfield 2010).

Tree snails are brought into the captive-propagation facility because they are highly endangered in the field. Conditions in the lab duplicate conditions in the field, as much as possible. Environmental data were gathered from field sites in order to reproduce similar conditions in the lab. The temperature (average between 16° C and 20° C), humidity, rainfall, day length (12 hours), and substratum (native host-tree species) found in the field, are reproduced as best as possible in the environmental chambers in which the captive-reared snails live. The snails are provided with leafy branches of *Metrosideros polymorpha*. The epiphytic black mold *Cladosporium* sp, which is the snails' food source, is propagated in the lab and added as an additional food source. Most of the species in the facility initially experience an adaptation period, in which there is very low reproductive output. In some species, the adaptation period is followed by an increase in reproductive output and population size (Hadfield *et al.* 2004).

The population of *A. apexfulva* that has been monitored by the ANRS since 1998 is not managed to control predators; a predator-exclosure fence is not present and no rat-control efforts are underway (US Army 2009).

Climate change may also pose a threat to this species. However, current climate change analyses in the Pacific Islands lack sufficient spatial resolution to make predictions on impacts to this species. The Pacific Islands Climate Change Cooperative (PICCC) has currently funded climate modeling that will help resolve these spatial limitations. We anticipate high spatial resolution climate outputs by 2013.

## 2.4 Synthesis

In the 1992 recovery plan for the O'ahu tree snails of the genus *Achatinella*, *Achatinella apexfulva* was classified as having the status of extant, but uncommon. *A. apexfulva* was historically located on the leeward slopes of the northern Ko'olau Mountains. The area within the historical range where there have been recent sightings of *A. apexfulva* lies within the U.S. Army's Training Area.

The U.S. Army has been surveying for *A. apexfulva* since 1998 and have found very few live snails in the wild. The most recent field sighting was in February 2005; a single live snail was found on Poamoho Trail and removed to the Hawaiian Tree Snail Conservation Captive Propagation laboratory. The Army Natural Resource Staff (ANRS) has surveyed for *A. apexfulva*, because portions of its historical range lie within the US Army's lands, where there are current populations of other species of *Achatinella*. The ANRS staff has conducted seven surveys of the area where this population was found between 1998 and 2007. The most recent survey of this population was conducted on August 31, 2007; no live *A. apexfulva* were found.

The Hawaiian Tree Snail Conservation Captive Propagation Lab located on the grounds of the University of Hawai'i at Mānoa campus has maintained individuals of *A. apexfulva* since 1994. The lab population of *A. apexfulva* has decreased overtime due to low reproductive output and mortality. In January 2010, there were two live *A. apexfulva* in the facility (Hadfield 2010).

The degree of habitat degradation varies within the historical range of the O'ahu tree snails. The presence and abundance of invasive plant species, feral pigs and goats result in habitat degradation and loss. Tree-snail host plants are threatened by invasions from invasive plants. Feral pigs and goats; hunting activities, and hiking activities threaten tree-snail host plants by trampling them.

Tree-snail habitat and snails located within US Army Training Areas can be threatened directly and indirectly by Military training activities. Food disposed of during military troop activities leads to an increase in the size of rat populations. Seeds of non-native plants may be spread along the trails used by the Military via transportation on boots, equipment, or clothing. Dismounted troop movement in forested areas may result in the trampling of host plants and possibly tree snails. Discarded cigarettes, Military vehicles and other equipment used during training activities can be potential sources of fire ignition.

Predation by *Euglandina rosea* and rats are major threats to *A. apexfulva*. The Jackson's chameleon has recently been documented as a predator of *Achatinella* spp. and may pose a major threat to their existence. The terrestrial flatworm *Geoplana septemlineata* and the terrestrial snail *Oxychilus alliarius* and *Gonaxis kibweziensis* may threaten *Achatinella* spp. The flatworm *Platydemis manokwari* is a predator of arboreal snails on many Pacific islands and does occur on O'ahu. It is unknown what impacts skinks and birds may have on *Achatinella* spp. (B. Holland, University of Hawai'i, pers. comm. 2011a).

Species like *A. apexfulva* that are endemic to small portions of a single island are inherently more vulnerable to extinction than widespread species because of the higher risks posed to a few populations and individuals by random demographic fluctuations, localized catastrophes such as hurricanes, landslides, flooding, and disease outbreaks, and climate change effects such as lowland predators moving to higher elevations.

Due to extremely limited numbers of individuals observed in the wild, an extremely limited historical spatial distribution, and the absence of management actions to mitigate threats to this species, it is recommended that *A. apexfulva* remain classified as endangered.

### 3.0 RESULTS

#### 3.1 Recommended Classification:

Downlist to Threatened

Uplist to Endangered

Delist

*Extinction*

*Recovery*

*Original data for classification in error*

**No change is needed**

#### 3.2 New Recovery Priority Number: N/A

**Brief Rationale:** N/A

#### 3.3 Listing and Reclassification Priority Number: N/A

**Reclassification (from Threatened to Endangered) Priority Number:** \_\_\_\_\_

**Reclassification (from Endangered to Threatened) Priority Number:** \_\_\_\_\_

**Delisting (regardless of current classification) Priority Number:** \_\_\_\_\_

**Brief Rationale:** N/A

### 4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Identify the actions to take when *Achatinella abbreviata* is found in the wild.
- Routinely survey and monitor areas with existing populations of *Achatinella. apexfulva*.
- Survey areas with suitable habitat, within the historical range of *A. apexfulva*.
- Continue and possibly expand captive-propagation efforts with the intended goals of increasing the population size in a predator-free environment and eventually reintroducing captive-reared *A. apexfulva* into the wild (Recovery Action 12 and 13).
- Develop reintroduction plans for future releases into predator free sites in the wild.
- Identify suitable habitat sites that may serve as potential reintroduction sites for captive-reared *A. apexfulva* (Recovery Action 51).
- Identify suitable habitat within the historical range of *A. apexfulva* to construct predator proof enclosures where snails found in the wild could be moved into.

- Survey and monitor the presence and abundance of *Euglandina rosea*, rats, *Geoplana septemlineata*, *Platydemis manokwari*, *Oxychilus alliarius*, and Jackson's Chameleons within the specie's historical range (Recovery Actions 311, 313, and 315).
- Assess the impacts of *Euglandina rosea*, rats, *Geoplana septemlineata*, *Platydemis manokwari*, *Oxychilus alliarius*, and Jackson's Chameleons on *Achatinella* spp.
- Assess the impact of feral pigs and other ungulates on tree-snail habitat.
- Collect anecdotal information on other potential predators of *Achatinella* spp. such as *Gonaxis kibweziensis*, skinks, and birds.
- Design and implement more effective predator elimination techniques within the historical range of *A. apexfulva* (Recovery Actions 31 and 312).
- Control feral ungulates within the historic range of *Achatinella* spp.
- Remove invasive plant species responsible for habitat degradation (Recovery Action 3274).

## 5.0 REFERENCES

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## **PERSONAL AND WRITTEN COMMUNICATIONS**

- Costello, Vince. 2011. Army Natural Resource Staff, Directorate of Public Works, Natural Resources Division, Schofield Barracks, Hawai'i. E-mail to Joy Browning, U.S. Fish and Wildlife Service, dated May 2, 2011. Subject: 5-year Review Questions.
- Hadfield, Michael. 2011. Kewalo Marine Laboratory, University of Hawai'i, Mānoa, Honolulu, Hawai'i. Email to Joy Browning, U.S. Fish and Wildlife Service, dated \_\_\_\_\_. Subject \_\_\_\_\_.

- Holland, Brenden. 2011a. Department of Zoology, University of Hawaii at Manoa, Honolulu, Hawaii. Telephone Conversation Record to Joy Browning U.S. Fish and Wildlife Service, dated April 14, 2011. Subject: *Gonaxis kibweziensis*
- Holland, Brenden. 2011b. Department of Zoology, University of Hawai'i at Mānoa, Honolulu, Hawai'i. Electronic message regarding *Platydemis manokwari*. Received by Joy Browning, U.S. Fish and Wildlife Service. Dated July 8, 2011.
- Miller, Stephen. 2011. U.S. Fish and Wildlife Service, Honolulu, Hawaii. E-mail to Joy Browning, U.S. Fish and Wildlife Service, dated April 14, 2011. Subject: O`ahu Tree Snail Survey and *Gonaxis kibweziensis*
- Yuen, Nathan. 2011. Biological Consultant, Honolulu, Hawaii. E-mail to Joy Browning, U.S. Fish and Wildlife Service, dated April 13, 2011. Subject: O`ahu Tree Snail Surveys and *Gonaxis kibweziensis*.

**Signature Page**  
**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW of *Achatinella apexfulva***

**Current Classification:**           E          

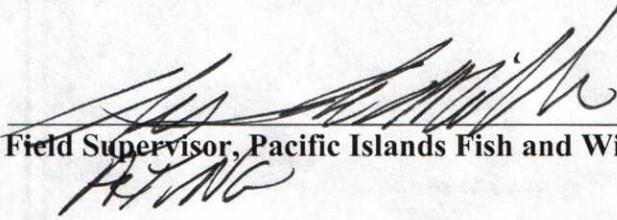
**Recommendation resulting from the 5-Year Review:**

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

**Appropriate Listing/Reclassification Priority Number, if applicable:** \_\_\_\_\_

**Review Conducted By:**

Joy Hiromasa Browning, Fish and Wildlife Biologist  
Jess Newton, Endangered Species Recovery Program Leader  
Assistant Field Supervisor for Endangered Species

Approved  Date 8/2/11  
Field Supervisor, Pacific Islands Fish and Wildlife Office