

## **CHAPTER 5: OIP ACHATINELLA SPECIES MANAGEMENT**

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The OIP stabilization plan for *Achatinella* outlines protection measures for each Geographic Unit (GU). GUs were designated based on closest geographic groupings with an emphasis on representing the entire range of the taxon in management. The term GU is used as a surrogate for genetically defined ESUs for *A. mustelina* in the MIP. CO1 analyses were conducted for Koolau *Achatinella*. These studies showed that there is less genetic variation between *A. sowerbyana* and *A. livida* than there is between any ESUs of *A. mustelina*. The reason for this relates to the comparative ages of the lineages, as well as of the Waianae and Koolau Mountains, and therefore shorter potential timeframe for genetic variation to develop for Koolau taxa (pers. comm. B. Holland 2010). In addition, a species such as *A. mustelina* with a comparatively much larger geographic range has further opportunities for genetic structure to develop among populations, due to the evolutionary effects of isolation by distance. Thus, the GU approach to managing Koolau *Achatinella* is conservative and a good starting point. That said, for some of the geographic nodes of Koolau *Achatinella*, there are no known extant populations and thus protection and management may not be possible. This will be determined only after extensive surveys are conducted within these GUs. In order to reach stability for Koolau *Achatinella*, OANRP must attain the goals below for each taxon.

### **OIP Long Term Goals:**

- Manage extant population units (PUs) and additional reintroduction PUs, up to a total of six PUs within the action area to encompass the known geographical range of the species.
- Achieve at least 300 snails in each GU
- Maintain captive populations of each species
- Control all threats at each managed field location
- Tier 2 stabilization priority

### **5.1 ACHATINELLA STABILIZATION OVERVIEW**

Most GUs are far from the stated OIP stability goals. The situation for Koolau *Achatinella* is less than optimistic at this point in time. There are only two large populations (>300 snails) known for any of these taxa, one for *A. byronii/decipiens* from the North Kaukonahua area and the other for *A. sowerbyana* in Opaepa. *A. bulimoides*, *A. lila* and *A. livida* only remain as a few small populations.

In March 2010, representatives of the OANRP, State DOFAW and USFWS met to discuss the possibility of obtaining funding for an Oahu Snail Extinction Prevention Program (OSEP) and produced a spreadsheet of specific priority projects and from this generated an associated staff time and cost. This detailed list is being used by DOFAW and USFWS to seek funding for staff positions similar to those of the Oahu Plant Extinction Prevention Program. The agencies listed above would form the Oahu Rare Snail Working Group (ORSWG) which would guide OSEP staff regarding these conservation actions for Koolau *Achatinella*. Leveraging assistance from other conservation partners, OANRP could justify promoting important Tier 2, snail-related fence projects such as the North Kaukonahua MU enclosure. Partnerships are essential if the conservation community is to succeed in reversing the downward trend of Koolau *Achatinella*.

#### **5.1.1 Captive Propagation**

In this year's data there are some dramatic declines in lab populations, even for taxa with previously stable or increasing trends (See Koolau *Achatinella* Captive Propagation Table below). Despite fastidious care, controlled conditions, and frequent monitoring at the UH Tree Snail Lab, decline continues without clear cause. An example of this is the decline observed for *A. lila* from 2009 to 2010. The decrease is mainly due to mortality in adult size class snails, and reasons for this are not clear at the present time. There is no evidence of pathogenic involvement, and in fact pathogens tend to impact juveniles more

severely than adults. Adult *Achatinella* in captivity tend not to survive for more than a year or so, and one possibility for this is nutritional factors. UH lab staff are currently addressing this issue by culturing additional species of leaf fungus and trying to improve the situation in the near future. OANRP will convene a meeting of the captive propagation subcommittee to determine how this situation will play out for OANRP in meeting OIP *Achatinella* stability goals.

The following table summarizes the captive propagation status for each Koolau *Achatinella* taxon. *A. byronii* are listed as *A. decipiens* as of 2009. Although both *A. byronii* and *A. decipiens* are listed as endangered species, the UH lab geneticists have never been able to identify two separate species.

#### Koolau *Achatinella* Captive Propagation Data (2007-2010)

	August 2007	August 2008	August 2009	August 2010
Taxon	juv/sub/adult total	juv/sub/adult total	Juv/sub/adult total	Juv/sub/adult total
<i>A. lila</i>	215/246/8 470	151/372/21 544	175/363/118 656	129/287/0 416
<i>A. sowerbyana</i>	4/14/3 21	8/14/3 25	7/13/5 25	2/10/4 16
<i>A. livida</i>	50/66/6 122	28/75/5 108	17/51/17 85	2/44/8 54
<i>A. byronii/A. decipiens</i>	5/14/9 28	6/17/7 30	3/17/5 25	1/5/0 6
<i>A. apexfulva</i>	3/4/1 8	2/0/0 2	0/2/0 2	0/2/0 2
<i>A. bulimoides</i>	21/4/9 34	24/15/4 43	18/22/3 43	4/19/9 32

#### 5.1.2 Genetic Issues

OANRP continue to assist *Achatinella* researchers, David Sischo and Dr. Holland in making genetic collections from field sites. Results are pending from these collections and will be presented and discussed at the 2011 IT by David Sischo. Details about samples made this year are presented within the taxon section bullets.

During the 2009 reporting period, OANRP collected 10 tissue samples for genetic analysis from each of three *A. lila* sites along the Punaluu cliffs. These samples were analyzed in combination with 23 additional samples obtained from the Tree Snail Conservation Lab at UH Manoa, to compare the *A. lila* lab population which was established in 1997, with seven adult snails from the Poamoho cliffs. The results of the haplotype analysis were presented at the 2010 Snail IT meeting. Results showed that all lab snails sampled thus far matched Poamoho haplotypes. These data will have important implications

relevant to the Koolau reintroduction strategy. A discussion of how these results may affect management is included in the reintroduction discussion in Section 5.1.4.

### 5.1.3 Monitoring

The following monitoring proposal was presented in the 2009 year-end report. Monitoring snail populations in the Koolau Mountains can be a destructive undertaking. In the past, intensive monitoring has resulted in extensive trampling of habitat. In order to avoid negative impacts like this, OANRP propose to monitor these fragile sites only every three years. At sites where the habitat is not very susceptible to trampling (ex: sites along trails), OANRP have proposed annual monitoring. Trampling and habitat destruction are also concerns with establishing ground shell plots (GSPs) and thus they have not been established at many Koolau snail sites. Also, very few Koolau *Achatinella* sites have the areas of high population density required for placement of GSPs. The bold text in the table below indicates the monitoring that OANRP successfully completed during the 2010 reporting period. The proposed monitoring plan is ambitious and not surprisingly, OANRP was only able to conduct six of twenty-six proposed Koolau monitoring activities. One reason for the shortfall is that extensive staff time was spent coordinating and conducting work related to the *A. mustelina* KAL-A predator enclosure; therefore, less of the Rare Snail Conservation Specialist's time was available for Koolau work. This shortfall is added support for partnering with other conservation agencies to accomplish rare snail work. Inadequate attention is given to these critically endangered *Achatinella* species. Because they are all tier 2 and 3 taxa for OANRP, work with Koolau snails is done as a lower priority than tier 1 *Achatinella mustelina* work. The proposed annual monitoring may not be realistic for these sites. Planned monitoring should be staggered to avoid trying to conduct work at all sites within a given year.

#### Proposed monitoring schedule for Koolau *Achatinella*

Taxon Name	GU	Pop Ref Site Code (s)	Current accurate GU Total Snails	Monitoring Method	Frequency	Method specifics	Notes
<b>Achbul</b>	<b>A</b>	<b>KLO-A</b>	<b>5</b>	<b>Population counts</b>	<b>Annually</b>	<b>night</b>	<b>Current numbers critically low</b>
<b>Achbyr/dec</b>	<b>A</b>	<b>SBE-B through SBE-E</b>	<b>6</b>	<b>Population counts</b>	<b>Every 3 years</b>	<b>night</b>	<b>Survey all four sites in combined trip</b>
Achbyr/dec	B	KLO-D Puu Pauao	16	Population Count	Every 3 years	night	
<b>Achbyr/dec</b>	<b>C</b>	<b>KLO-B, KLO-C and KLO-F</b>	<b>259</b>	<b>Population Count</b>	<b>Every 3 years</b>	<b>night</b>	
Achbyr/dec	D	KLO-H, KLO-I	7	Population Count	Every 3 years	night	Current numbers critically low
Achbyr/dec	E	KLO-E North Kaukonahua	445	Population Count-sweep	Every 3 years	night	Concerned about creating trails that pigs follow
Achbyr/dec	E	KLO-E North Kaukonahua	445	Ground shell plots	annually		Not baited. Concerned about frequent visits impacting habitat so annual visits, not quarterly
Achlil	A	KLO-B North of Poamoho Trail	15	Population Count	Every 3 years	night	Only known site in GU

Taxon Name	GU	Pop Ref Site Code (s)	Current accurate GU Total Snails	Monitoring Method	Frequency	Method specifics	Notes
Achlil	B	KLO-C and KLO-F	11	Population Count	Every 3 years	night	
Achlil	C	KLO-D and KLO-E	66	Population Count	Every 3 years	night	
Achliv	A	KLO-A Crispa	86	Population Count	annually	night	
<b>Achliv</b>	<b>A</b>	<b>KLO-A Crispa</b>	<b>86</b>	<b>Ground Shell</b>	<b>annually</b>		<b>Rat control on going</b>
Achliv	B	KLO-B Northern	9	Population count	annually	night	Rat control on going
<b>Achliv</b>	<b>C</b>	<b>KLO-C Radio and PAP-A</b>	<b>18</b>	<b>Population count</b>	<b>annually</b>	<b>night</b>	<b>Rat control on going</b>
Achsow	A	No extant sites known	0	Survey			Priority for survey
Achsow	B	KLO-K Bloody Finger	28	Population Count	annually	night	Only extant site known, need surveys
Achsow	B	KLO-P Kawaiiki	1	Survey			Last observed in 1997 requires more survey
Achsow	C	KLO-J Hypalon	220	CMR entire site	every 3 years	Paint pen, 2 days	Pay close attention to site impacts. Can do more frequently if incidental observations show decline
Achsow	C	KLO-L 290	43	Population count	annually	night	Noted impacts from monitoring, focus on largest site in GU (KLO-J)
Achsow	C	KLO-M Shaka	47	Population count	annually	night	Noted impacts from monitoring, focus on largest site in GU (KLO-J)
<b>Achsow</b>	<b>D</b>	<b>KLO-C North of Poamoho Summit</b>	<b>177</b>	<b>Population count-sweep</b>	<b>annually</b>	night	
Achsow	D	KLO-FF South of Poamoho Summit	19	Population count	annually	night	
Achsow	D	KLO-GG Poamoho Trail upper 1/3	77	Population count-sweep	annually	night	Does not require helicopter to access
Achsow	E	KLO-A Poamoho Pond	35	Population count	annually	night	
Achsow	F	KLO-AA Little Italy	2	Survey	Every 3 years	Night	Priority on finding more snails w/in GU
Achsow	G	KLO-S, T, V	5	Survey	annually		Priority on finding more

Taxon Name	GU	Pop Ref Site Code (s)	Current accurate GU Total Snails	Monitoring Method	Frequency	Method specifics	Notes
							snails in GU

### 5.1.4 Reintroduction

During the 2009 reporting period, OANRP visited the proposed predator enclosure at Poamoho Summit with KS land managers and they support the project. They plan to include permission to construct the proposed enclosure in the pending 20-year license agreement. This protected site would be used to reintroduce snails from the *A. lila* captive population. OANRP would also like to translocate some wild *Achatinella* from nearby sites into the enclosure for protection, but per IT recommendations, will do so only after it is determined safe for them to share an enclosure with the lab reared *A. lila*. Genetics showed that this lab population is inbred. This does not automatically mean that these snails are not fit. At the 2010 meeting, the IT recommended conducting the reintroduction with captive *A. lila* first and monitoring closely for any signs of inbreeding depression. These results can then inform other projects within the predator enclosure. In addition, OANRP will be conservative regarding our approach to the potential for pathogen introduction. Although the Rare Snail reintroduction guidelines developed in 2007 were never officially adopted by the USFWS, OANRP plan to follow the sanitation precautions outlined in the document.

### 5.1.5 Threats

General threat updates for *Achatinella* are covered in the MIP Snail Chapter. *E. rosea* and rats are considered ubiquitous at all Koolau *Achatinella*. Rat control is currently being conducted at the most accessible snail locations and regular access to these sites is via helicopters. Weather often interferes with regular OANRP rat control visits. Rat control at unprotected sites is necessary for the conservation of these *Achatinella* taxa and has been included in the OSEP project list. Jackson's chameleons have not been observed in the northern Koolau Mountains by OANRP staff.

### 5.1.6 Threat Control Development

Threat control development updates are covered in the MIP Snail Chapter.

### 5.1.7 Research

All research projects discussed in the MIP Snail Chapter also apply to Koolau *Achatinella*. Results specific to Koolau taxa will be discussed within the taxa updates to follow.

## 5.2 GU UPDATES

The following section contains brief updates for each of the Koolau *Achatinella* taxa. There are no separate updates per GU, as with *A. mustelina* ESUs, because there fewer extant individuals to discuss.

### 5.2.1 *Achatinella curta*, *Achatinella leucorapphe*, *Achatinella apexfulva*

#### Major Highlights/Issues Year 3

- There are no known extant live snails of these taxa. One survey was conducted at the last known location of *A. apexfulva* on August 17, 2010, but no live snails were found. *A. curta* and *A. leucorapphe* were last identified live in the field in 1989.
- The current status of *A. apexfulva* in captivity is not promising. The two immature snails remaining in the lab are the only two known to remain in the world. There are no known *A. curta* or *A. leucorapphe* in the lab.

### Plans for Year 4

- OANRP will conduct surveys next year for each of these taxa and will request assistance from partner agencies in these survey efforts.

### 5.2.2 *Achatinella bulimoides*

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina

#### *Achatinella bulimoides*

GU: A		Poamoho Cliffs									
KLO-A	Manage for stability	5	2010/07/28	5	0	0	0	No	No	No	No
Poamoho Cliffs											
GU Total:		5		5	0	0	0				

#### Size Class Definitions

SizeClass	DefSizeClass
Large	>15 mm
Medium	7-15 mm
Small	<7 mm

 = Threat to Taxon at Population Reference Site

No Shading = Absence of threat to Taxon at Population Reference Site

Yes=Threat is being controlled at PopRefSite

No=Threat is not being controlled at PopRefSite

Partial=Threat is being partially controlled at PopRefSite

Table shows the number of snails, size classes, and threats to the snails in the ESU sites. Yes = threat is being controlled; In some cases the threat may be present but not actively preying on *A. mustelina*.

### Major Highlights/Issues Year 3

- Laboratory populations of *A. bulimoides* have declined from 43 to 32 since last year.
- A license agreement was obtained from Kamehameha Schools for access to Punaluu.
- Surveys were performed July 27-29, 2010 in Punaluu and a total of five *A. bulimoides* were counted.

### Plans for Year 4

- OANRP will conduct surveys next year for this taxon and will request assistance from partner agencies in these efforts. Previous to this only two had been seen in 2006.

5.2.3 *Achatinella byronii/decipiens*

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina
<b>Achatinella byronii / decipiens</b>											
<b>GU: A East Range</b>											
SBE-A	Manage for stability	0	2006/06/26	0	0	0	0	No	No	No	No
Middle Waikakalaua-South Kaukonahua dividing ridge											
SBE-B	Manage for stability	1	2001/02/26	1	0	0	0	No	No	No	No
South Kaukonahua stream											
SBE-C	Manage for stability	1	2001/02/26	1	0	0	0	No	No	No	No
East Waikakalaua-South Kaukonahua dividing ridge											
SBE-D	Manage for stability	1	2002/05/01	1	0	0	0	No	No	No	No
West Waikakalaua-South Kaukonahua dividing ridge											
SBE-E	Manage for stability	3	1997/09/25	1	1	1	0	No	No	No	No
North branch of South Kaukonahua											
<b>GU Total:</b>		6		4	1	1	0				
<b>GU: B Puu Pauao</b>											
KLO-D	Manage for stability	16	2006/08/22	15	1	0	0	No	No	No	No
Puu Pauao											
<b>GU Total:</b>		16		15	1	0	0				
<b>GU: C Poamoho</b>											
KLO-A	Manage for stability	0	2004/12/01	0	0	0	0	No	No	No	No
South of Poamoho Trail											
KLO-B	Manage for stability	23	2006/04/18	18	3	2	0	No	No	No	No
Poamoho Cabin											
KLO-C	Manage for stability	1	2001/06/13	0	0	0	1	No	No	No	No
South of Poamoho Cabin											
KLO-F	Manage for stability	235	2010/07/28	162	62	11	0	No	No	Partial	No
North of Poamoho Trail											
KLO-G	Manage for stability	0	2007/08/31	0	0	0	0	No	No	No	No
Poamoho trail 1800 ft at A. apexfulva site											
<b>GU Total:</b>		259		180	65	13	1				

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina
<b>GU: D Punaluu cliffs</b>											
KLO-H	Manage for stability	2	2006/05/04	2	0	0	0	No	No	No	No
Windward cliffs opposite Peahinaia summit LZ											
KLO-I	Manage for stability	5	2009/04/06	5	0	0	0	No	No	No	No
East of 290											
<b>GU Total:</b>		7		7	0	0	0				
<b>GU: E North Kaukonahua</b>											
KLO-E	Manage for stability	445	2009/08/31	355	50	40	0	No	No	No	No
North Kaukonahua											
<b>GU Total:</b>		445		355	50	40	0				

**Size Class Definitions**

SizeClass	DefSizeClass
Large	>15 mm
Medium	7-15 mm
Small	<7 mm

 = Threat to Taxon at Population Reference Site

No Shading = Absence of threat to Taxon at Population Reference Site

Yes=Threat is being controlled at PopRefSite

No=Threat is not being controlled at PopRefSite

Partial=Threat is being partially controlled at PopRefSite

Table shows the number of snails, size classes, and threats to the snails in the ESU sites. Yes = threat is being controlled; In some cases the threat may be present but not actively preying on *A. mustelina*.

**Major Highlights/Issues Year 3**

- A total of 235 *A. byronii/decipiens* were counted in Punaluu July 27-29, 2010. It is likely that this number would be higher if the entire site were surveyed.
- GU-E meets the 300+ snail goal.

**Plans for Year 4**

- OANRP will conduct night surveys over the next year at all sites with <30 remaining individuals that were not monitored during the 2010 reporting period. Assistance will be requested from partner agencies in these survey efforts.
- OANRP will develop a North Kaukonahua fence project proposal for the ORSWG to use in seeking funding.

### 5.2.4 *Achatinella lila*

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina
<b>Achatinella lila</b>											
<b>GU: A Poamoho Summit</b>											
KLO-A	Manage for stability	0	2004-12-01	0	0	0	0	No	No	No	No
South of Poamoho Trail											
KLO-B	Manage for stability	15	2008-08-12	12	2	1	0	No	No	Yes	No
North of Poamoho Trail											
GU Total:		15		12	2	1	0				
<b>GU: B Peahinaia Summit</b>											
KLO-C	Manage for stability	2	2006-05-03	1	1	0	0	Partial	Yes	Yes	No
Peahinaia Summit											
KLO-F	Manage for stability	9	2006-05-04	8	1	0	0	No	No	No	No
Below Peahinaia Summit on windward side											
GU Total:		11		9	2	0	0				
<b>GU: C Opaepala-Punaluu Summit</b>											
KLO-D	Manage for stability	3	2005-05-03	1	1	1	0	No	No	No	No
Notch Site, Opaepala Fence											
KLO-E	Manage for stability	42	2006-05-03	32	8	2	0	No	No	No	No
Windward side below Sanpur outplanting											
KLO-G	Manage for stability	21	2007-04-02	18	3	0	0	No	No	No	No
East of 290											
GU Total:		66		51	12	3	0				
<b>Size Class Definitions</b>				<div style="display: flex; align-items: center;"> <div style="width: 15px; height: 15px; background-color: #cccccc; margin-right: 5px;"></div> = Threat to Taxon at Population Reference Site            No Shading = Absence of threat to Taxon at Population Reference Site            Yes=Threat is being controlled at PopRefSite            No=Threat is not being controlled at PopRefSite            Partial=Threat is being partially controlled at PopRefSite         </div>							
<u>SizeClass</u>	<u>DefSizeClass</u>										
Large	>15 mm										
Medium	7-15 mm										
Small	<7 mm										

Table shows the number of snails, size classes, and threats to the snails in the ESU sites. Yes = threat is being controlled; In some cases the threat may be present but not actively preying on *A. mustelina*.

#### Major Highlights/Issues Year 3

- Rat control was maintained at KLO-C and KLO-B as weather allowed.
- A three-year license agreement was obtained from KS for conservation work on their lands. It includes permission to work in Punaluu. A 20-year license is pending which will include permission to construct predator enclosure fencing.

#### Plans for Year 4

- OANRP will conduct night surveys over the next year at all sites with <30 remaining individuals and will request assistance from partner agencies in these survey efforts.
- Rat control will be maintained twice per quarter at KLO-B and KLO-C.
- Construct snail enclosure near Poamoho Trail Summit. It will primarily serve *A. lila*, but also be available for other species found in Punaluu.

### 5.2.5 *Achatinella livida*

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina
<b>Achatinella livida</b>											
<b>GU: A Crispa Rock</b>											
KLO-A	Manage for stability	86	2009-04-28	56	13	17	0	No	No	Yes	No
Crispa Rock											
GU Total:		86		56	13	17	0				
<b>GU: B Northern</b>											
KLO-B	Manage for stability	9	2009-04-27	6	2	1	0	No	No	Yes	No
Northern											
GU Total:		9		6	2	1	0				
<b>GU: C Radio</b>											
KLO-C	Manage for stability	6	2010-08-10	2	4	0	0	No	No	Yes	No
Radio											
PAP-A	Manage for stability	31	2010-08-10	17	12	2	0	No	No	No	No
Windward side of radio											
GU Total:		37		19	16	2	0				

#### Size Class Definitions

SizeClass	DefSizeClass
Large	>15 mm
Medium	7-15 mm
Small	<7 mm

 = Threat to Taxon at Population Reference Site

No Shading = Absence of threat to Taxon at Population Reference Site

Yes=Threat is being controlled at PopRefSite

No=Threat is not being controlled at PopRefSite

Partial=Threat is being partially controlled at PopRefSite

Table shows the number of snails, size classes, and threats to the snails in the ESU sites. Yes = threat is being controlled; In some cases the threat may be present but not actively preying on *A. mustelina*.

### Major Highlights/Issues Year 3

- A comprehensive night survey was conducted at KLO-C, including a survey for the predatory flatworm, *Platydemus manokwari*. No *P. manokwari* were detected but staff did confirm the presence of *Oxychilus alliarius*, the garlic snail, which could explain the observed decline in *A. livida* over the last six years.
- Rat control continues at three of four *A. livida* sites on a 6-8 week basis as the weather allows.
- The GSP at KLO-A was monitored and no rat predation was detected.
- OANRP initiated rat monitoring via tracking tunnels. Data will be used to determine how to best configure and possibly intensify rat control efforts. Data may also be used to correlate rat activity levels with any observed predation.

### Plans for Year 4

- OANRP will continue to maintain rat control and read the GSP. Rat tracking tunnels will be run once per quarter to establish a baseline of rat activity for guiding management.
- Surveys will be conducted at KLO-A and KLO-B.
- Continue plans for the Koloa MU fence project after a license agreement is obtained from Hawaii Reserves to protect the KLO-B snail habitat from further pig damage.

### 5.2.6 *Achatinella sowerbyana*

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk.	Ungulate	Weed	Rat	Euglandina
<b>Achatinella sowerbyana</b>											
<b>GU: A Kawainui Ridge</b>											
KLO-Q Pinch ridge	Manage for stability	0	2007-05-15	0	0	0	0	No	No	No	No
KLO-R Freckled-Toothed Ridge	Manage for stability	0	2007-05-15	0	0	0	0	No	No	No	No
<b>GU Total:</b>		0		0	0	0	0				
<b>GU: B Kawaiiki Ridge</b>											
KLO-K Bloody finger	Manage for stability	28	2009-01-05	16	6	6	0	No	No	No	No
KLO-P Ptelid gulch upstream from the Ptelid	Manage for stability	1	1997-08-06	1	0	0	0	No	No	No	No
<b>GU Total:</b>		29		17	6	6	0				

\*This long table has been formatted to keep population reference sites within one GU together. In order to maximize use of space the bullets for this taxon are included between the status tables.

#### Major Highlights/Issues Year 3

- Maintained rat control at KLO-C, KLO-D, KLO-J, KLO-L, KLO-M, KLO-N, and KLO-O.
- Eighteen genetic samples were collected from KLO-K and KLO-L to facilitate *A. livida* versus *A. sowerbyana* analyses. Results are still pending.
- OANRP collected 10 samples from KLO-NN (Helemano drainage) that may be used to determine ESUs for *A. sowerbyana* by comparing to samples already collected from other sites.

#### Plans for Year 4

- OANRP will continue to maintain ongoing rat control efforts.
- OANRP will obtain genetics results from any outstanding collections.
- OANRP will continue to visit sites proposed in the monitoring schedule table in 5.1.3.

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina
<b>GU: C Opaepula-Helemano</b>											
KLO-BB	Manage for stability	3	2004/07/21	2	0	1	0	Yes	Yes	No	No
Below Peahinaia trail in Helemano											
KLO-CC	Manage for stability	1	2004/07/21	0	1	0	0	Yes	No	No	No
Helemano southwest of KLO-12 transect											
KLO-D	Manage for stability	6	1997/09/04	0	0	0	6	Yes	Yes	Yes	No
Peahinaia Summit											
KLO-DD	Manage for stability	1	2004/07/21	0	1	0	0	Yes	No	No	No
Helemano Southwest of KLO-12 transect, middle site.											
KLO-E	Manage for stability	1	1998/05/28	0	0	0	1	Yes	Yes	No	No
Cyrvir, photopoint pole Peahinaia trail											
KLO-EE	Manage for stability	1	2004/07/21	0	1	0	0	Yes	No	No	No
Helemano Southwest of KLO 12 transect, eastern site.											
KLO-F	Manage for stability	5	2006/07/18	2	3	0	0	Yes	No	No	No
Peahinaia trail pulcherima like snails											
KLO-G	Manage for stability	0	2009/09/09	0	0	0	0	Yes	No	No	No
South ridge of Helemano fenceline											
KLO-H	Manage for stability	2	1997/06/06	1	0	1	0	Yes	Yes	No	No
Ilex spot near palm grass site at sta 260 KLO-12											
KLO-HH	Manage for stability	5	2004/12/01	4	1	0	0	Yes	Yes	No	No
West Helemano, below Palm grass site											
KLO-I	Manage for stability	1	2003/08/27	1	0	0	0	Yes	Yes	No	No
Above goose wing											
KLO-II	Manage for stability	1	2004/12/01	1	0	0	0	Yes	No	No	No
West Helemano, above stream 30m, below large flat ridge											
KLO-J	Manage for stability	220	2008/08/11	105	90	25	0	Yes	Yes	Yes	No
Hypalon											
KLO-KK	Manage for stability	2	2006/05/02	1	0	1	0	Yes	Yes	No	No
Second ridge off Peahinaia trail											
KLO-L	Manage for stability	43	2008/09/16	17	16	10	0	Yes	Yes	Yes	No
Sta 290 on summit trail along Peahinaia fence											

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina
KLO-LL East of 290	Manage for stability	3	2007-04-02	3	0	0	0	No	No	No	No
KLO-M Shaka	Manage for stability	47	2008-09-17	30	11	6	0	Yes	Yes	Yes	No
KLO-N Lizard-back ridge	Manage for stability	1	2005-01-05	1	0	0	0	Yes	Yes	Yes	No
KLO-O Close to shelter just above waterfall in Opaepala fence	Manage for stability	3	2002-01-01	3	0	0	0	Yes	Yes	Yes	No
KLO-U Rich Ridge	Manage for stability	22	1997-12-11	0	0	0	22	No	No	No	No
KLO-Y KST and Shelter ridge junction	Manage for stability	1	2001-10-18	1	0	0	0	No	No	No	No
KLO-Z Peahinaia south side of goose-head ridge	Manage for stability	1	2003-08-27	0	0	0	1	Yes	Yes	No	No
GU Total:		370		172	124	44	30				
<b>GU: D Poamoho Summit &amp; Trail</b>											
KLO-C North of Poamoho Summit	Manage for stability	242	2009-01-01	0	0	0	242	No	No	Yes	No
KLO-GG Poamoho trail upper 1/3	Manage for stability	77	2008-05-05	63	9	5	0	No	No	No	No
GU Total:		319		63	9	5	242				
<b>GU: E Poamoho Pond</b>											
KLO-A Poamoho Pond	Manage for stability	35	2008-08-23	25	6	4	0	No	No	No	No
GU Total:		35		25	6	4	0				
<b>GU: F Poamoho-North Kaukonahua Ridge</b>											
KLO-AA Little Italy	Manage for stability	2	2004-05-19	2	0	0	0	No	No	No	No
GU Total:		2		2	0	0	0				

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina
<b>GU: G Lower Peahinaia</b>											
KLO-S Puu Roberto	Manage for stability	0	2008-10-07	0	0	0	0	No	No	No	No
KLO-T Near Frog Pond	Manage for stability	0	1996-08-31	0	0	0	0	No	No	No	No
KLO-V Lower Peahinaia trail Hes arb site	Manage for stability	5	1999-12-13	0	0	0	5	No	No	No	No
<b>GU Total:</b>		5		0	0	0	5				

**Size Class Definitions**

SizeClass	DefSizeClass
Large	>15 mm
Medium	7-15 mm
Small	<7 mm

= Threat to Taxon at Population Reference Site  
 No Shading = Absence of threat to Taxon at Population Reference Site  
 Yes=Threat is being controlled at PopRefSite  
 No=Threat is not being controlled at PopRefSite  
 Partial=Threat is being partially controlled at PopRefSite

Table shows the number of snails, size classes, and threats to the snails in the ESU sites. Yes = threat is being controlled; In some cases the threat may be present but not actively preying on *A. mustelina*.