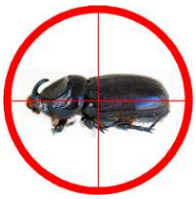
Research in Support of the Guam Coconut Rhinoceros Beetle Eradication Project



CRB Mitigation for Conservation of Rare Snails and Butterflies at Haputo Beach

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1 Introduction

This note is in response to concerns about maintenance of the limestone forest habitat at Haputo Beach which is home to endemic partulid snails and a nymphalid butterfly, *Hypolimnas octocula marianensis*, which are candidates for the endangered species list.

The limestone forest habitat at Haputo Beach and elsewhere on Guam, is under attack by invasive species including ungulates, brown treesnake, snails and slugs, greenhouse frogs, and many species of herbivorous insects. The endangered snails and butterfly and their host plants require a microhabitat characterized by high humidity and shade. This microhabitat could be rapidly lost at Haputo and elsewhere because the two most populous trees in Guam's forest [Donnegan et al.(2004)Donnegan, Butler, Grabowiecki, Hiserote, and Limtiaco], the cycad, *Cycas micronesica* and the coconut palm, *Cocos nucifera*, are under severe attack by recently arrived insect herbivores, the Asian cycad scale, *Aulacaspis yasumatsui* and the coconut rhinoceros beetle, *Oryctes rhinoceros*. *Cycas micronesica* is endemic in Micronesia, having evolved here, whereas the coconut palm is native, having arrived before man [Athens and Ward(2004)].

*Revised February 26, 2014
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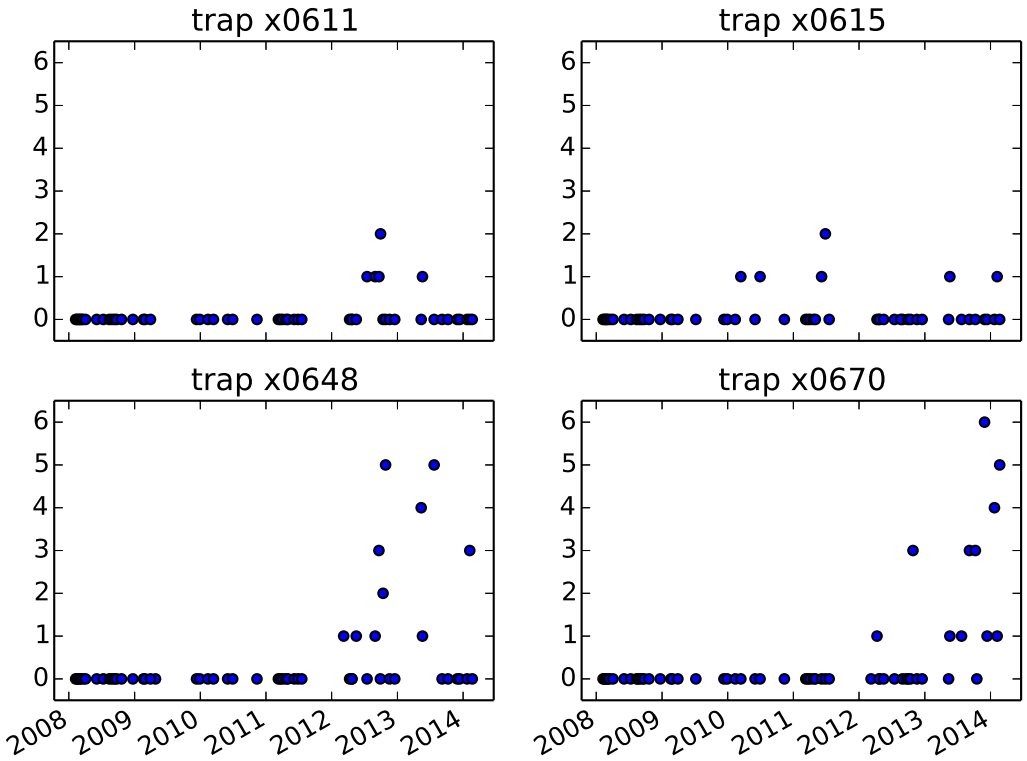

Figure 1: Coconut rhinoceros beetle adults caught in pheromone traps at Haputo Beach.

2 Trapping record

Four CRB pheromone traps were deployed at Haputo Beach in February 2008 and these have been visited and maintained by Navy biologists. Click here to see an interactive map. [Note: the GPS coordinates for the Haputo traps seem to be imprecise. I would appreciate it if someone could provide corrected positions.]

The first beetle was trapped in March 2010 and the trap catch has trended upwards since then (2008: 0, 2009: 0, 2010: 2, 2011: 3, 2012: 22, 2013: 27). To date in 2014 (February 26), 14 beetles have been trapped (Fig. 1)

3 Barrel traps for adult population suppression

The Guam CRB Project has developed barrel traps which trap 13X as many beetles as standard pheromone traps (Click here for details.). These barrel traps are essentially artificial breeding sites

baited with oryctalure pheromone, CRB infested decaying coconut material, and a solar powered light emitting diode (UVLED). Replacement of the existing four pheromone traps at Haputo with four barrel traps may suppress the local population and reduced damage by capturing a high proportion of adults. Barrel traps will be visited and maintained as per the existing schedule for the current pheromone traps, approximately biweekly.

4 Sanitation

When the barrel traps are deployed, a search for CRB breeding sites in the lower Haputo Basin will be performed. Breeding site material, along with all CRB life stages, will be removed and placed in the barrel traps. This sanitation serves two purposes, it provides material for the barrel traps, plus it reduces competition between the barrel traps (artificial breeding sites) and natural breeding sites.

5 Coconut tree health monitoring

Response to the suggested mitigation methods (trapping and sanitation) will be measured by monitoring coconut tree health. Thirty easily accessible palms along the length of the beach will be selected and tagged for monitoring. When traps are visited, the biologist will observe the crown of each monitored palm with binoculars to determine whether or not any of the four youngest fronds have been damaged as evidenced by v-shaped cuts. If there is a spear, this is considered to be the youngest frond. Each observation will be recorded as Y if any of the four youngest fronds are damaged, or N otherwise.

References

[Athens and Ward(2004)] J. Stephen Athens and Jerome V. Ward. *Holocene vegetation, savanna origins and human settlement of Guam.* Records of th australian museum, supplement 29 edition, 2004. URL http://australianmuseum.net.au/Uploads/Journals/17986/1398_complete.pdf.

[Donnegan et al.(2004)Donnegan, Butler, Grabowiecki, Hiserote, and Limtiaco] Joseph A. Donnegan, Sara L. Butler, Walter Grabowiecki, Bruce A. Hiserote, and David Limtiaco. Guam's forest resources, 2002. (PNW-RB-243):32 p., 2004 2004. URL http://www.fs.fed.us/pnw/pubs/pnw_rb243.pdf.

Listing 1: HaputoTrapCatch.py

```
import MySQLdb as db
from operator import itemgetter
import datetime as dt
import matplotlib.pyplot as plt
import matplotlib.dates as mdates

def getData(trap_id):
    con = db.connect('mysql.guaminsects.net','readonlyguest','mangilao'
        ,'oryctes')
    cur = con.cursor(db.cursors.DictCursor)
    sql = "SELECT visit_date, male_count+female_count+unsexed_count AS
        adultsTrapped"
    sql = sql + " FROM trap_visit"
    sql = sql + " WHERE trap_id = '" + trap_id + "'"
    cur.execute (sql)
    rows = cur.fetchall()
    return rows

trap_id = ['x0611', 'x0615', 'x0648', 'x0670']
placement = [221, 222, 223, 224]
plt.figure(1)
plt.gca().xaxis.set_major_formatter(mdates.DateFormatter('%m/%d/%Y'))
plt.gca().xaxis.set_major_locator(mdates.YearLocator())
for i in range(len(trap_id)):
    rows = getData(trap_id[i])
    x = map(itemgetter('visit_date'), rows)
    y = map(itemgetter('adultsTrapped'), rows)
    plt.subplot(placement[i])
    plt.scatter(x, y)
    plt.ylim(-0.5, 6.5)
    plt.gcf().autofmt_xdate()
    plt.title('trap ' + trap_id[i])
plt.show()
```

Listing 2: HaputoKML.py

```
import MySQLdb as db
import simplekml

sqlFile = open('trapCatch.sql','r')
sql = sqlFile.read()
print sql

con = db.connect('mysql.guaminsects.net','readonlyguest','mangilao','
    oryctes')
cur = con.cursor(db.cursors.DictCursor)
cur.execute (sql)
rows = cur.fetchall()
print rows

kml = simplekml.Kml()
for row in rows:
    name = row['trap_id'] + ' ' + str(row['adultsTrappedPerDay']) + '
        beetles per day'
    kml.newpoint(name=name, coords=[(row['longitude'], row['latitude'])
        ])
kml.save('Haputo.kml')
print 'Open Haputo.kml in GoogleEarth'
```

Listing 3: Haputo.kml

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2" xmlns:gx="http://www.google
    .com/kml/ext/2.2">
    <Document id="feat_1">
        <Placemark id="feat_2">
            <name>x0611 0.0027  beetles per day</name>
            <Point id="geom_0">
                <coordinates>144.83154,13.576572,0.0</coordinates>
            </Point>
        </Placemark>
        <Placemark id="feat_3">
            <name>x0615 0.0032  beetles per day</name>
            <Point id="geom_1">
                <coordinates>144.83154,13.57749,0.0</coordinates>
            </Point>
        </Placemark>
        <Placemark id="feat_4">
            <name>X0648 0.0118  beetles per day</name>
            <Point id="geom_2">
                <coordinates>144.8317,13.57875,0.0</coordinates>
            </Point>
        </Placemark>
        <Placemark id="feat_5">
            <name>X0670 0.0109  beetles per day</name>
            <Point id="geom_3">
                <coordinates>144.82883,13.57546,0.0</coordinates>
            </Point>
        </Placemark>
    </Document>
</kml>
```