*Discussion*

This study was successful in tracking CRB to cryptic breeding sites at two locations on the island of Guam. The two areas where CRB were tracked differed both in topography and vegetation and the effective location of tagged beetles in these different environments shows promise for the applicability of this technique in the varied habitats were CRB infestations may occur. Out of 33 released CRB, a total of 19 were retrieved either as an individual or as a fallen radio transmitter resulting in a 58% retrieval rate. This comparatively high retrieval rate required an input of approximately 1 hour per CRB immediately after release and at least the same amount of time on the following day. The tracking of CRB to an approximate location during the night followed by a more precise pinpointing during the daytime proved to greatly facilitate the retrieval of released CRB.

**ANECTDOTAL LOCATIONS**

Although a majority of the released CRB were successfully tracked to discrete locations, 14 CRB were lost presumably due to out-of-range flights. Interestingly, those CRB that flew out of range had statistically significantly lower percent emergence weights than those that stayed within the detection range of the radio devices, suggesting that lighter CRB fly longer distances. State average %EW. Although the distance flown by retrieved CRB had no statistically significant correlations with percent emergence weight, distance flown by all 33 CRB, lost and found, would most likely correlate with percent emergence weight if the distance of the lost CRB were to be determined. This observation raises the ability to minimize the loss of CRB while radio tracking. Prior to release, CRB must be fed to above 70 percent of their emergence weight to ensure that the individuals will remain within the detection radius.

Moreover, percent emergence weight of released CRB had a strong association with the microhabitats in which tagged CRB were found. Of the 19 retrieved CRB, 11 landed arboreal microhabitats whereas 8 landed in soil-associated microhabitats. The CRB that landed in the arboreal microhabitats had a statistically significantly lower percent emergence weight than those CRB that landed on soil-associated microhabitats, 74.43% compared to 82.73% respectively. It has been noted that adult CRB spend their time either feeding on the crown of palms or breeding in either soil or compost piles (Zelazny 1975). As CRB alternate between these microhabitats, individuals fluctuate in their percent emergence weight making it possible to determine the behavioral pattern that CRB will engage in by noting their percent emergence weight (Source). CRB at a higher percentage of their emergence weight will very likely refrain from further feeding and fly in search of breeding sites whereas CRB at a lower percentage of their emergence weight will likely forage in search for food. Therefore, it is not coincidental that the CRB that landed in ground microhabitats, associated with breeding, had statistically significantly higher percentage emergence weights than those that landed in palm crowns, associated with feeding sites. This characteristic of the CRB life cycle makes this tracking method specific and controllable. In order to have CRB fly directly to breeding sites, the individuals must be fed to above 80 percent of their emergence weight. In doing so, monitoring and eradication teams can ensure that the released CRB will not lead them to feeding sites rather than breeding sites and will increase the effectiveness of CRB control methods. It is reasonable to hypothesize that heavier CRB landed on lower microhabitats due to the comparative inability to reach higher altitudes than the ones reached by lighter CRB. However, all of the released CRB flew several meters vertically into the air before displacing horizontally. If heavier CRB experienced a hindered vertical displacement in comparison to lighter CRB, then takeoff would have notably different between these two groups. Since hindered vertical displacement was not observed during CRB takeoff, it is reasonable to conclude that the difference in landing microhabitats was most likely due to the percent emergence weight of released CRB.

The use of radio telemetry to monitor flying species is generally constrained by the weight of radio transmitters (Robinson *et al.* 2009, Cochran *et al.* 2004, Thorup *et al.* 2007). This limitation is especially true when monitoring flying insects since a small increase in weight may severely hinder flight behavior (Source). In recent years, though, the gradual miniaturization of transmitters has circumvented this obstacle allowing for more precise monitoring of flying insects (Sato Maharbiz 2010). One of the factors determining the feasibility of this study was whether or not adult CRB could fly undisturbedly with the attached radio transmitters. Adult CRB are excellent fliers and can exert force much larger than their body weight when fighting and boring, so it was reasonable to expect that the miniature radio transmitters would have little to no effect on CRB flight capability. As expected, the flight capability of CRB was seemingly unaffected by the extra weight of radio transmitters. Each radio transmitter amounted to between 5.04% and 9.72% of the CRB weight at the time of release, and there was no correlation between the increased percentage weight and the single flight distance of CRB indicating that CRB could fly carry the extra burden of the radio transmitters. Note about whether it went over 100% It is also important to note that the 14 CRB were lost did present not statistically significant differences in the radio transmitter percentage weights compared to the CRB that stayed in range. These observations are consistent with other studies monitoring members of the Scarabaeidae family which found that radio transmitters did not noticeably affect beetle flight capabilities (Beaudoin-Ollivier 2003, McCollough 2006, Rink and Sinsch 2007). Also, the duration of commercially available radio transmitters (10-14 days) is appropriate for this type of CRB monitoring. However, the battery life of the transmitters must guide monitoring protocol timelines. CRB should be pinpointed to a final location within 2-3 days after initial release to prevent the loss of CRB due to battery drainage.

Another important factor to consider is the distance over which CRB can be monitored. Radio telemetry monitoring typically covers only short to medium displacement distances usually limiting the applications of the technology (Robinson *et al.*2009). The radio devices employed in this study had an effective range of localization that varied with topological conditions. In this study, the range of detection was appropriate for monitoring since the overall CRB flight distance from release sites to landing sites ranged from 52.8 meters to 564.6 meters. This range also roughly delineates a radius for breeding site discovery from released CRB; the detector CRB must be released no further than approximately 500 meters from breeding sites. This might present difficulties for eradication teams since the breeding sites in question occur in cryptic locations presumably unknown to those searching for them. The relatively short detection radius of the radio devices obligates teams to close in on the cryptic sites through other investigative means. In order to effectively estimate possible locations of CRB breeding site, visual monitoring of damage and trapping should assess the presence of CRB populations. Once visual monitoring and trapping indicates the existence of CRB in a particular location, the detector CRB would be released in the vicinity to pinpoint the exact location of the breeding sites. Stats about monitoring and visual in Guam and HI This combination of monitoring methods would ease the control and eradication of CRB, and since traps and visual monitoring are already widespread, it would not be complicated to craft an integrated strategic plan.

**COMPARATIVE TO OTHER METHODS**