

**Coconut Crab (*Birgus Latro*) Survey on  
Diego Garcia**

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## INTRODUCTION

The Coconut or Robber Crab (*Birgus latro*) has a wide distribution ranging from Eastern Africa, through the Indian Ocean islands to the Pacific Ocean islands. It is the largest terrestrial invertebrate in the world. Due to its large size, ease of collection and palatable flesh, the coconut crab is often overharvested when it occurs in the vicinity of human habitation. The population on Diego Garcia is protected by British law and no legal harvest takes place. Previous reports mention that crabs are numerous on Diego Garcia, but this study is the first time that crab population density and demographic data have been collected on the island.

## METHODS

Diego Garcia was visited in July 2003 and again in March 2004. A different survey method was used for each trip.

### July 2003

Two areas were surveyed (Figure 1). Area 1 was located approximately 1000 meters past the Donkey gate leading towards the eastern arm of the atoll. This is at the bottom of the “U shaped” atoll on the inhabited side of the island. Area 2 was located on the Minni Minni conservation area on the eastern arm or uninhabited side of the island.

The sampling method was as follows. Wedges (~3 cm diameter) were cut into whole coconuts that had fallen off the tree but still had juice and had not yet sprouted. The coconut was wired to a tree at roughly breast height during the day and coconut/vanilla extract was sprinkled onto the coconut. This was one bait station. The scent from the extract and the coconut juice attracts the crabs and since the coconut is wired to the tree the crab cannot carry it away. The crabs will stay on the coconut and can be easily captured at night. Twenty of these bait stations (spaced every 20 meters) were set up and checked at night for two consecutive nights. Crabs captured on the first night were marked with yellow fingernail polish so that the same animal was not recorded again on the second night. Crabs on the ground at and between bait stations were also collected, marked and measured.

Crabs were measured for thoracic length, weighed and sexed. The crabs were processed and released at the point of capture.

Abundance was expressed as the catch per unit of effort (CPUE). Catch per unit of effort was defined as number of crabs captured per trapping night with one trap/bait station set for one night equal to one trapping night. For this study each area had 40 trap nights (20 traps/bait stations set for 2 nights).

## March 2004

These surveys focused on the Minni Minni conservation area.

Four, 30 meter x 30 meter, quadrats were located with a pseudorandom methodology (quadrats were located off of the existing road at a pre-chosen compass bearing. The distance, in meters, from the road was determined using a random number table). Two plots were in Coconut forest and two were in *Pisonia/Ficus* dominant forest. Each plot was searched at night and all crabs within the plot were counted. Crabs in 2 plots and one half of another were measured for thoracic length and sexed. Due to time constraints not all crabs could be measured and sexed.

In addition to the quadrat sampling, a 1000 meter transect was walked and the distances from the transect centerline to all crabs seen were recorded. The hip chain thread (used to measure the length of the transect) was left up, at ~chest height, and was used as the centerline for all distance measurements. The transect was slowly walked and both sides were monitored. This was done for analyses with the computer program DISTANCE. The transect went through coconut forest and *Pisonia/Ficus* forest but the transect length for each habitat type was not recorded.

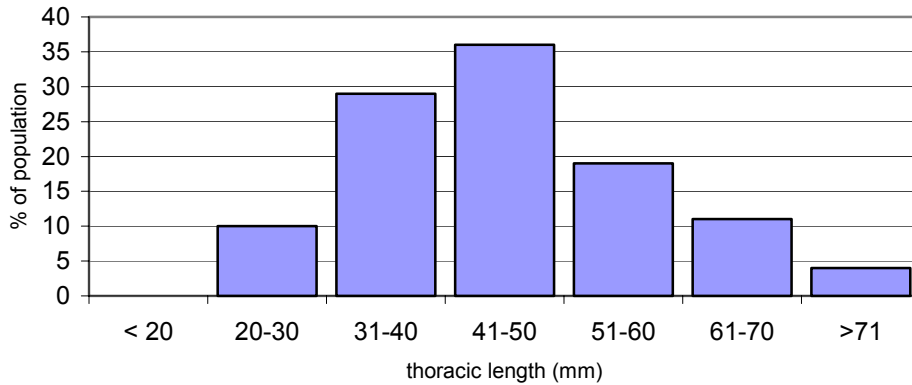
## RESULTS

### Population Demographics

Chart 1 shows the histogram for crabs measured from the Minni Minni Conservation Area (Both 2003 and 2004 surveys combined). Chart 2 shows those crabs measured from the bottom of the island for the transect (2003 survey) between the Donkey Gate and the GEODS gate (the inhabited side of the island). Chart 3 combines the measurements from all the surveys. As a comparison, chart 4 shows the population profile from Guam (Haputo Conservation Area, NCTAMS, Guam). The Guam sample is representative of an over-harvested population. The comparisons on charts 1-4 are based on thoracic length.

**Chart 1.**

**Size Classes of Coconut Crabs on Diego Garcia,  
Minni Minni Conservation Area**

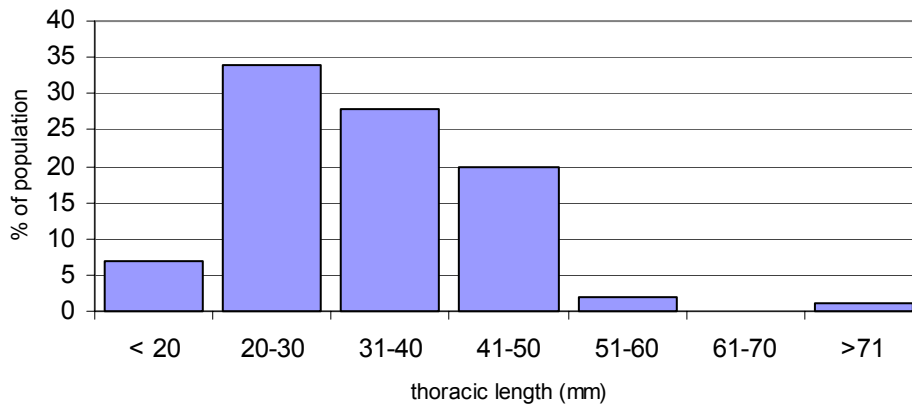


The sex ratio was slightly skewed towards males. One hundred and seventeen crabs (60%) of the 194 total were male and 77 (40%) were female. (charts 5 and 6).

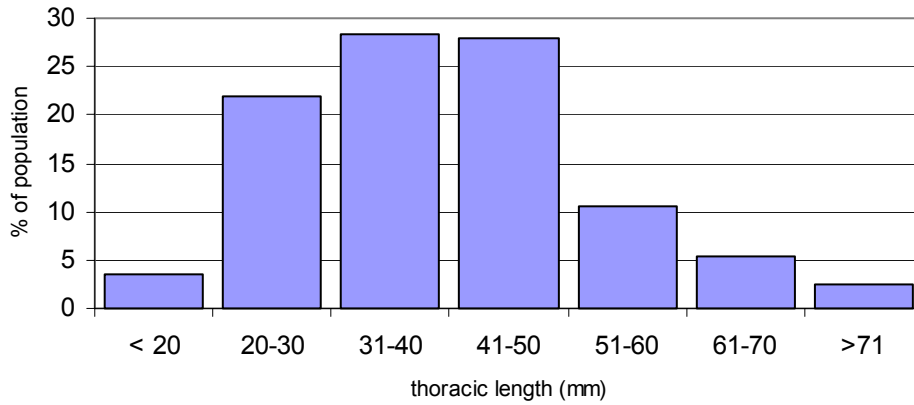
The crabs in the Minni Minni conservation area were significantly larger on average (t test,  $p < 0.0001$ ) than those on the inhabited side. See charts 5 and 6 and table 1 for comparison of the average (with 95% confidence intervals) thoracic lengths and weights between the Minni Minni Conservation Area, the southern tip (inhabited side) of the island and the Guam sample.

**Chart 2.**

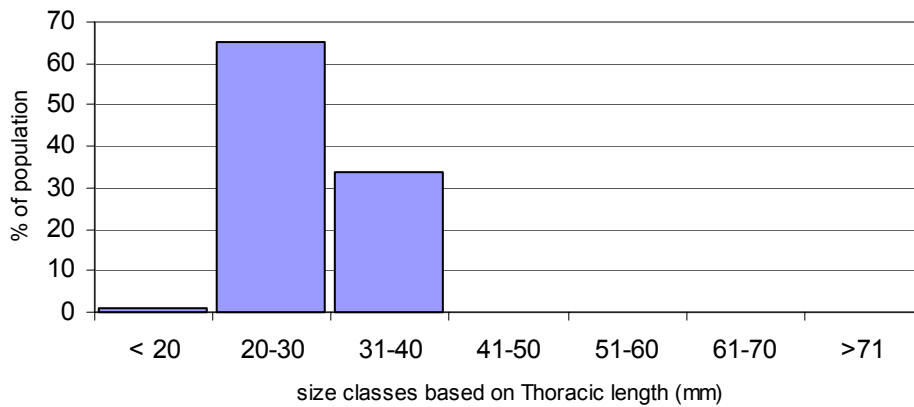
**Size of Classes of Coconut Crabs on Diego  
Garcia, Southern Tip of the Island**



**Chart 3.**  
**Size Classes of All Crabs Measured on Diego Garcia**

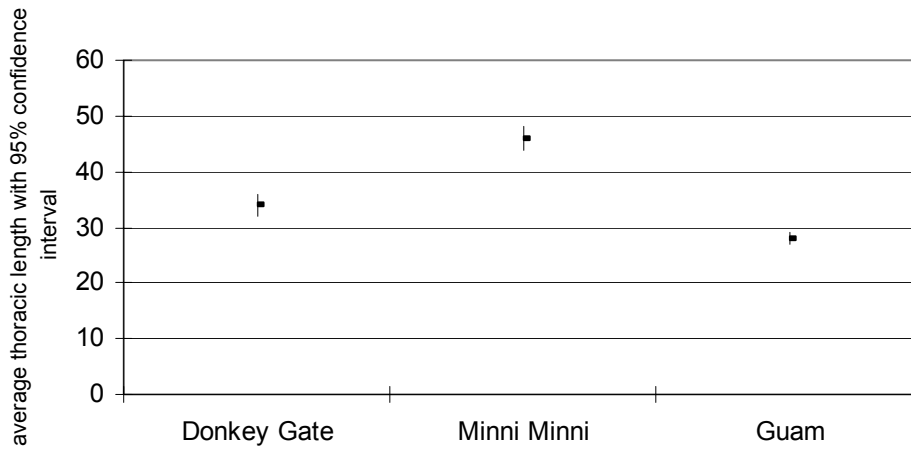


**Chart 4.**  
**Size Classes of Crabs from Haputo Conservation Area, Guam**



**Chart 5.**

**Average Thoracic Length for Coconut Crabs on Diego Garcia and Guam**



**Chart 6.**

**Average Weight for Diego Garcia and Guam Coconut Crabs**

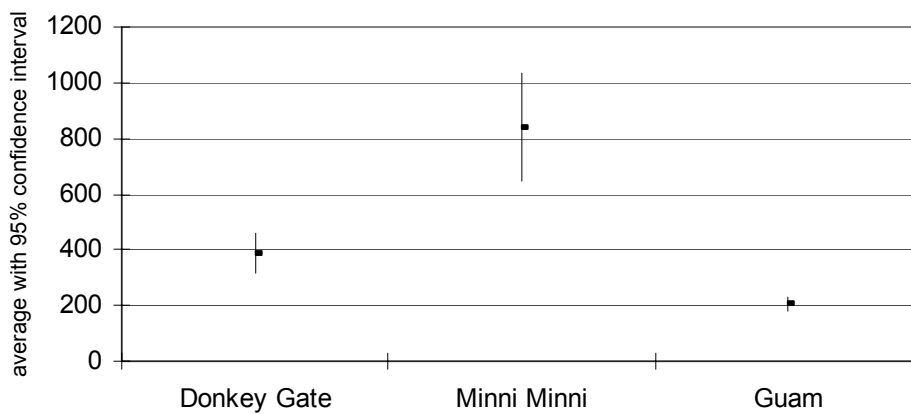


Table 1.

	Minni Minni Conservation Area	Southern tip of Diego Garcia, inhabited side	Total for Diego Garcia	Guam, Haputo Conservation Area, NCTAMS
Overall, average weight, gms, with 95% confidence interval	844 649-1038	389 315-463	571 475-668	206 180-231
Overall average Thoracic length, mm, with 95% confidence interval	46 44-48	34 31-37	38 36-40	28 27-29
Male: average weight, gms, with 95% confidence interval	988 722-1255	421 398-534	667 523-810	222 191-254
Male: average thoracic length, mm, with 95% confidence interval	48 45-52	34 31-37	42 40-45	29 27-30
Female: average weight, gms, with 95% confidence interval	530 392-668	347 274-421	406 335-477	151 122-179
Female: average thoracic length, mm, with 95% confidence interval	42 40-45	33 31-35	38 36-40	25 24-27

## Population Densities/Abundance

The two coconut forest plots had 34 and 27 crabs respectively. The *Pisonia/Ficus* plots had 14 and 9 crabs. The average for the coconut plots was 30.5 crabs and for the *Pisonia/Ficus* plots 11.5. The average for all 4 plots together was 21. These extrapolate to densities of 339 crabs/ha with a 95% confidence interval of 263-415 for coconut forest and 128 crabs/ha with a 95% confidence interval of 73-182 for *Pisonia/Ficus* forest. The overall density (average for the 4 plots) is 233 crabs/ha with a 95% confidence interval of 107-358.

A total of 100 crabs were detected on the 1000 meter transect. The distance methodology produced an estimate of 227 crabs/ha with a 95% confidence interval of 169-304.

The coconut bait station transect in the Donkey Gate area had 84 crabs with a catch rate of 2.10 crabs/trap night (#crabs/trap nights) and the bait station transect at the Minni Minni area had 71 crabs with a catch rate of 1.78 crabs/trap night. The difference in catch rates was not statistically significant (Mann-Whitney test  $p=0.54$ ). Similar bait station transects on Guam had a catch rate of 0.41 crabs/trap night.

## Discussion

Due to the isolation of Diego Garcia and the restricted access, the Minni Minni conservation area is one of the few places in the world with an essentially, unharvested coconut crab population. Overall densities on Diego Garcia appear to be some of the highest recorded for this species

Data on an unharvested crab population is rare, but Chauvet and Kadiri-Jan (1999) reported a density of 190 crabs per hectare on the uninhabited Taiaro atoll in French Polynesia. By contrast, the densities of harvested populations have been reported at 27.5 per hectare on Lifou (Loyalty Islands, New Caledonia) (Kadiri-Jan 1995) and 9 crabs per hectare at the Haputo conservation area on Guam (USFWS 2001).

There appears to be differences between the conservation area population and that on the inhabited side of the island. On the inhabited side, the average crab size is smaller due to a lack of larger crabs. A best guess as to why there is this difference would be occasional harvest (albeit illegal) by people. Due to time constraints it was not possible to estimate the crab densities for this side (the inhabited side) of the island. The abundance sampling (catch rates for the coconut bait stations) had similar catch rates for both sides of the island but the precision of this method is unknown. It is very conceivable that two areas with similar catch rates could have significantly different population densities. Absolute densities on the non-conservation side of the island need to be established.

Quadrat and distance methods produced very similar density estimates (227/ha and 233/ha). The distance method produced a tighter confidence interval. How much of each forest type on the distance transect was not recorded. For the quadrat sampling it was exactly 50% of each. The crabs were readily detectable and the measurements were easy to make.



## **Recommendations**

We recommend systematic monitoring of the crab populations on Diego Garcia, on both the conservation area and the inhabited side of the island. Monitoring can be accomplished by existing environmental staff. A Navy biologist can provide the initial training and survey design. The method should be either the distance methodology or quadrat sampling. In either case crab thoracic length, weight and sex should be recorded in addition to the counts. The demographic and density data will give an exact picture of population changes over time. These surveys should be performed on both the conservation area and the inhabited side of the island.



## References

Chauvet, C. and T. Kadiri-Jan. 1999. Assessment of an unexploited population of coconut crabs, *Birgus latro* (Lenni', 1767) on Taiaro atoll (Tuamotu archipelago, French Polynesia). *Coral Reefs* (1999) 18:297-299.

Kadiri-Jan T. 1995. Biology and population dynamic of the coconut crab (*Birgus latro*) in Loyalty island. New Caledonia. Theses of Universite' Francaise du Pacifique New Caledonia: 155pp.

USFWS. 2001. Assessment of the coconut crab (*Birgus Latro*) population on the Naval computer and telecommunications master station. Prepared for: Department of the Navy, Environmental Section, Commander U.S. Naval Forces, Marianas. Prepared by: U.S. Fish and Wildlife Service, Guam National Wildlife Refuge, Dededo Guam.



**Legend**

- Coconut Crab Transects
- Coconut Crab Quadrats



0 0.5 1 2 Kilometers

0 0.3 0.6 1.2 Miles

**Figure 1. Coconut Crab Quadrat and Transect Lines**

Diego Garcia

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