PROJECT REPORTING FORM

CONTACT
Elizabeth Moore
JNCC
TEL: 00 (44) 7890 012207 mailto:elizabeth.moore@jncc.gov.uk
www.jncc.gov.uk

COUNTRY: Cayman Islands

PROJECT TITLE: Lionfish (*Pterois volitans* Linnaeus) **Density, Distribution and Effectiveness of control efforts-Cayman Islands**

REPORTER: Croy McCoy

ACKNOWLEDGEMENTS:
Matt Cottam
Christopher McCoy
Bradley Johnson
James Gibbs
Rhiannon Meir
Erbin Tibbetts

Keith Neil
Robert Walton
Southern Cross Club
Brac Reef Beach Resort
Little Cayman Beach resort

SURVEY TEAM
Croy McCoy (DoE)
Laura Richardson (Intern)
Monique Grol (Intern)
Paul Chin (DoE)

DATA COMPILATION
Laura Richardson

FUNDING
JNCC funding:£8,500.00
Darwin Inititive:£4,924.22

PROJECT DESCRIPTION:

Overall, the project was successful with lionfish density and mobile invertebrate community structure estimated around all three islands during the set survey period (January-March 2011).

PROBLEMS and RESOLUTION

1. Adverse weather conditions restricted access to some sites during the survey, particularly during visits to the sister islands, Little Cayman and Cayman Brac as those islands have no leeward sides. As such, feasibility of statistical data analysis was compromised by an insufficient level of replication in some aspects in the study. Due to time restrictions, it was not possible to resolve this issue for this study, though experiences gained this year have inspired the design of a robust survey design including sufficient base-line sample replication within a 'worst case' time frame for subsequent studies. For these reasons, surveying during the Summer months would be more appropriate. Additionally, surveyors whom swam along the transect line counting other species of fish possibly interfered by scaring Lionfish off the line. Further follow up studies will eliminate this issue by allowing a longer delay time between surveyors along transect lines.

2. For the purposes of temporal comparison with lionfish density data acquired in the same survey period (January - March) in 2009 at all three islands, this study was carried out using the methodology for estimating density as the Fish Biomass study. At each site, three 50 x 1 m belt transects were positioned centrally on top of reef spurs (in the case of deeper reefs, c.60-80 ft depth) or along constant reef parallel to the shore (for shallow reefs, c. 20-40 ft depth) in order to reduce variance associated with habitat heterogeneity (variable rugosity and/or substrate type). Within their native range, Indo-Pacific lionfish are typically found on coral reefs and rocky outcrops from shallow waters (less than 1 m) to 100 m (Schultz 1986, Whitfield et al. 2007), with adult diets reported to consist of a wide variety of reef dwelling organisms, namely smaller fishes, shrimps and crabs (Fishelson 1975, Sano et al. 1984). Whilst there have been notably few studies on localised reef habitat preferences to date, the majority of lionfish observed in this study were found under coral overhangs, beside larger reef structures, or in caves or large crevices. A study by Fishelson (1997) described lionfish in the Red Sea as occupying the 'reef shadows' during the day. This local-scale distribution may be due to the potential structural refuge provided to reef fishes by high rugosity or structural complexity (Hixon and Beets 1993, Beukers and Jones 1997). Micro-habitat selection may also be in part due to predation behaviour during active diurnal feeding by adult lionfish. Recent observations in the Bahamas noted that selected lionfish prey (mostly small fish) were often herded into a confined space by the lionfish

with their pectoral fins spread widely to trap the prey (Côté and Maljkovic 2010) Given this, it is possible that whilst survey swims included thorough searches of caves, crevices and overhangs where present within the 50 x 1 m belt, transects along the highest and most consistent areas of reef may not have served to provide a true estimate of lionfish abundance, since areas of greater structural complexity may provide more suitable habitat. Recent studies by REEF in the region have however recorded lionfish in "almost all habitat types including artificial sites, canals, deep reefs, shallow reefs, small ledges and sand bottom" (www.reef.org 07/04/11).

OUTCOMES

1. A total of 55 deep and shallow coral reef terrace sites (approx. depth 60-80 ft and 25-40 ft, respectively) were surveyed around Grand Cayman (figure 3), Cayman Brac (figure 1) and Little Cayman (figure 1) between 19.01.2011 and 03.03.2011. On average, 15 minutes was spent on each transect to standardize survey effort. In total between >80 hours was spent estimating counts and length of lionfish during the survey, in addition to >120 Scuba dives, including the buddy safety diver. At each site, abundance of lionfish was assessed along three 50 x 1 m belt transects, covering a total survey area of 8250 m^2.
2. During the survey, a total of 21 lionfish were recorded in just 19 out of 165 surveyed belt transects on deep and shallow reef terraces around all islands (Table 1).

3. Size of fish (measured as total length, from tip of the snout to the tip of the caudal fin), estimated in 5 cm increments) ranged from 10 to 40 cm, with an average size of 24.52 cm (± 3.84 2 SE) overall. For sizes by island, see Table 1.

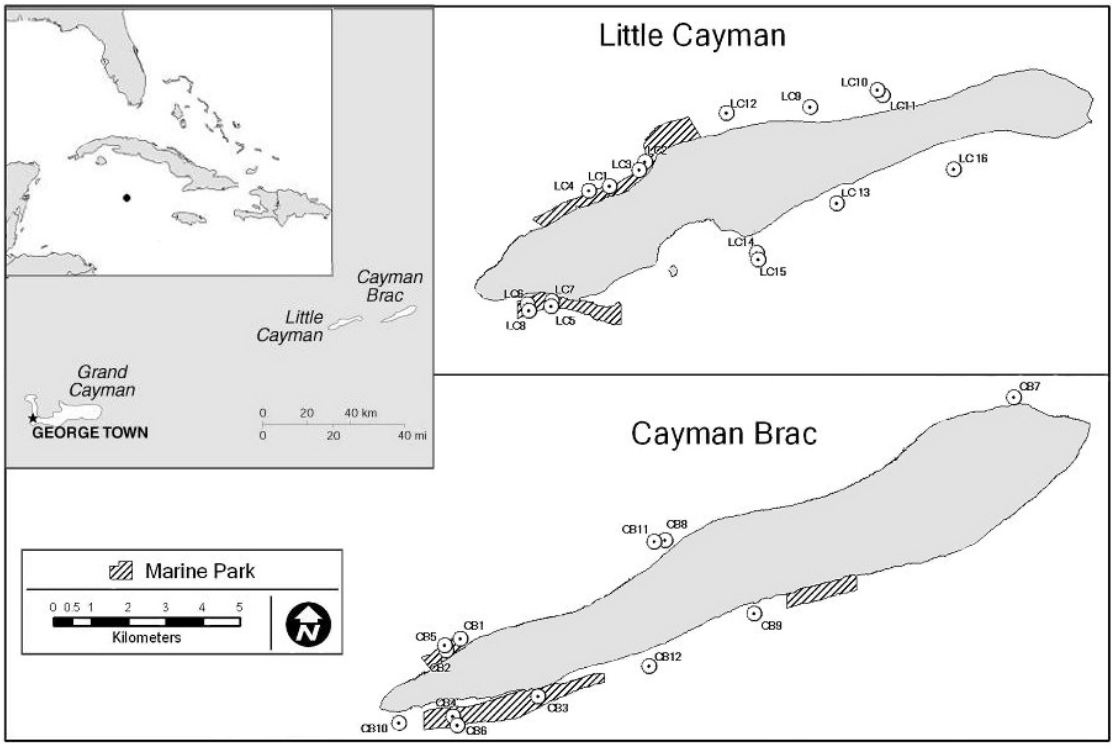

Figure 1. Map showing location of Cayman Islands and study sites in Little Cayman (n=16) and Cayman Brac (n=12).

4. Department of the Environment with the help of the JNCC is actively encouraging the removal of local lionfish populations from all three islands which is centered mainly within the MPAs (Marine Protected Areas) and is currently issuing culling licenses (with and without spears) to local SCUBA diving companies and Caymanian residents (Table 1). It is assumed that extraction of lionfish populations is currently highest within the established MPAs as the majority of dives are carried out within these areas

(Tratalos and Austin 2001). Data in figure 4 shows that control efforts in Grand Cayman and Little Cayman are effective, with recorded numbers of lionfish lower within the MPAs, where removal effort is highest. However that is not the case in Cayman Brac, where Lionfish abundance is highest within its MPAs. Additionally, overall Lionfish density is highest in Little Cayman (figure 5), with Grand Cayman and Cayman Brac exhibiting quite similar results (figure 5). Due to restricted sampling in this study, it has not been possible to statistically compare populations within the reserves compared to outside, though it is recommended for future studies that not only is sampling potential maximized but that additional correlative analysis considering the relationship between lionfish abundance and removal effort and catch data obtained from licensed dive companies be included.

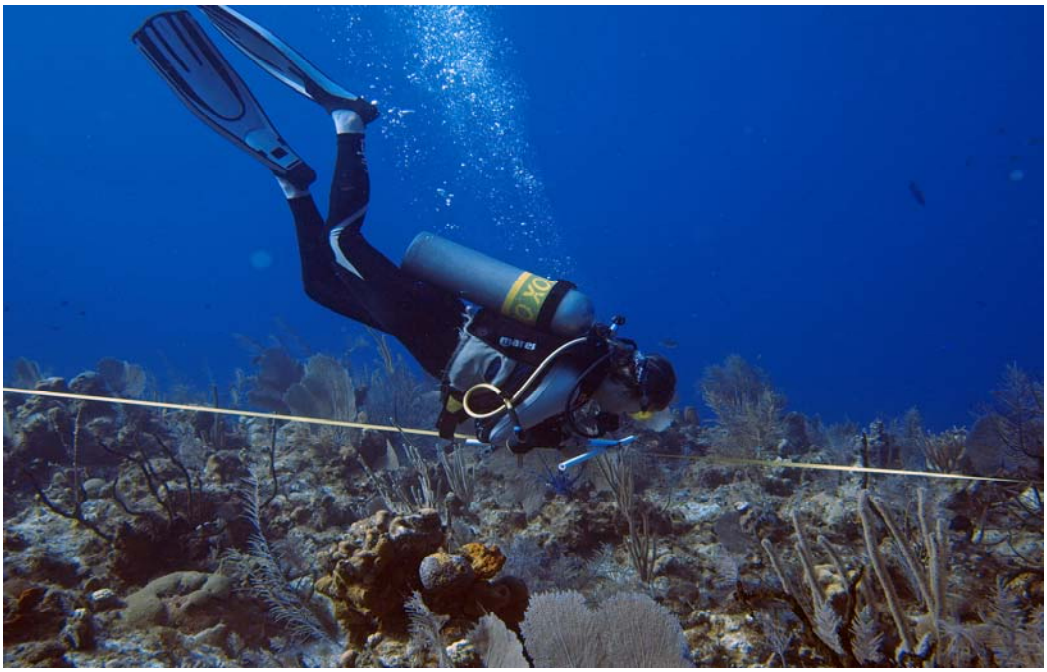

Figure 2. Intern L. Richardson conducting Lionfish surveys within the Bloody Bay / Jackson Point Marine Park, Little Cayman.

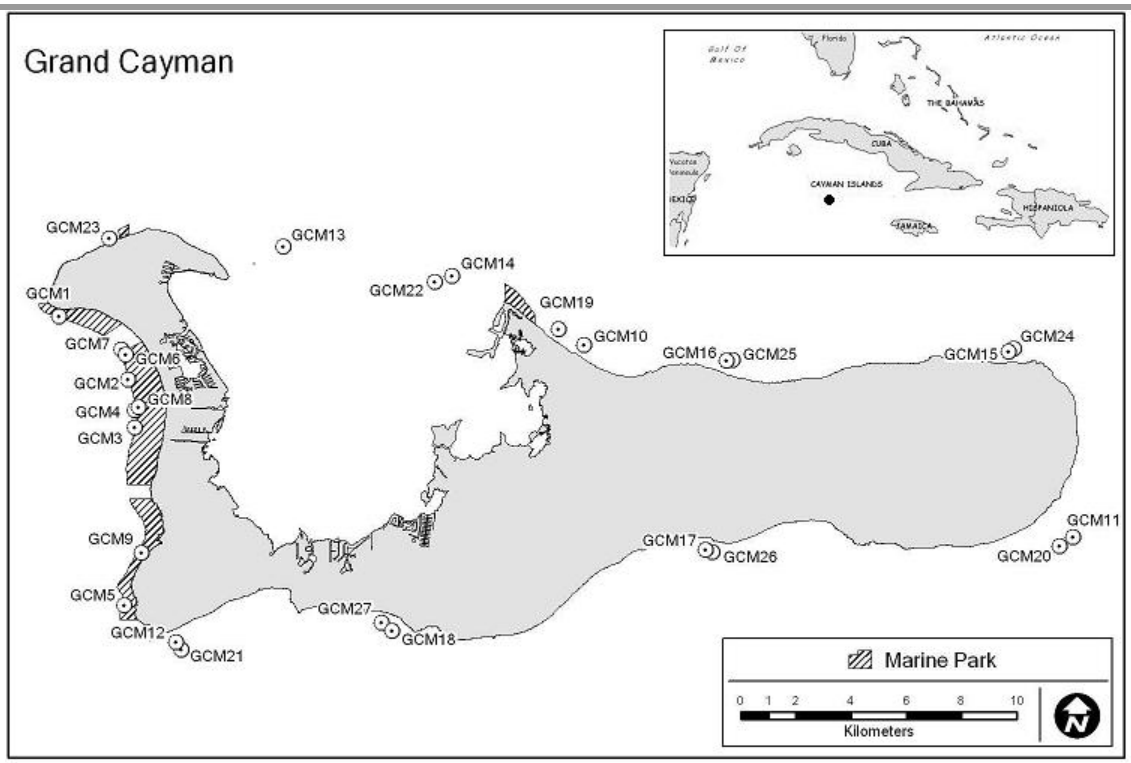

Figure 3. Map of Grand Cayman showing study sites (n=27)

Table 1. Characteristics of surveyed lionfish populations and removal effort on each of the Cayman Islands.

	Grand Cayman	Cayman Brac	Little Cayman
Total lionfish abundance	6	3	12
Mean lionfish density (ind/m²)	0.001	0.002	0.005
Size range (cm)	15-25	10-40	25-35
Average size (cm) ± 2 SE	25.83±5.75	25.83±5.75	30.00±5.77
No. of current issued licenses for lionfish culling with pole spears (resident spearing program not yet started in Grand Cayman or Little Cayman)	99 dive company staff	6 dive company staff, 23 residents	29 dive company staff
Estimated no. of current issued licenses for lionfish culling (without spears)	600	10 (*most licensees now licensed to use pole spears)	10

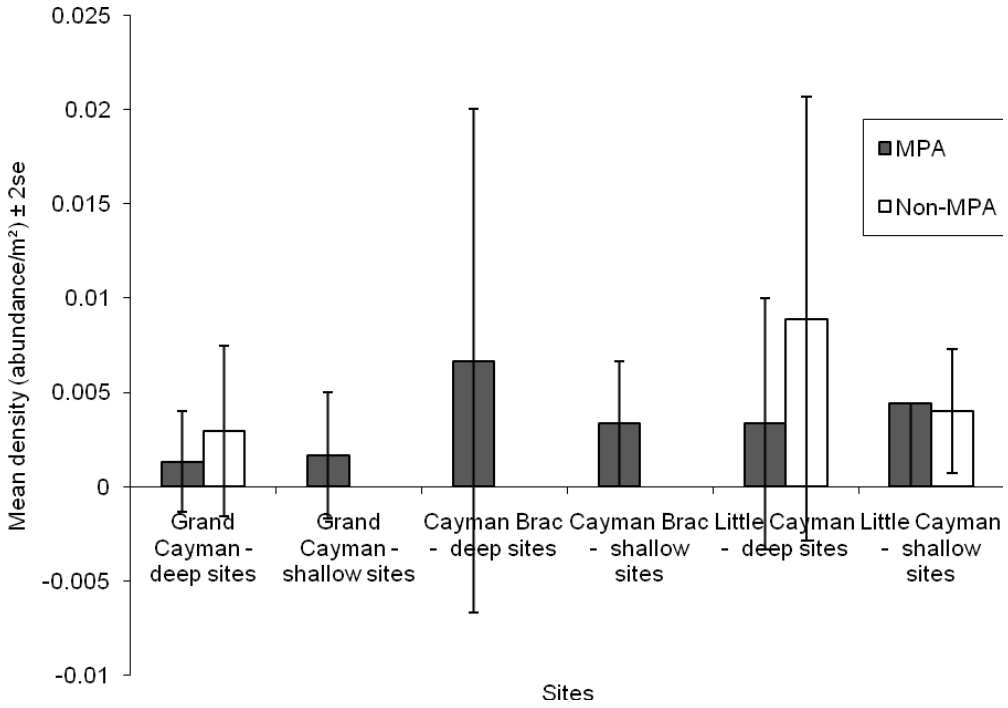

Figure 4. Lionfish density (abundance/m²) ± 2 SE at each island showing Inside MPA vs. outside MPA. Grand Cayman n=27, Little Cayman n=16, Cayman Brac n=12

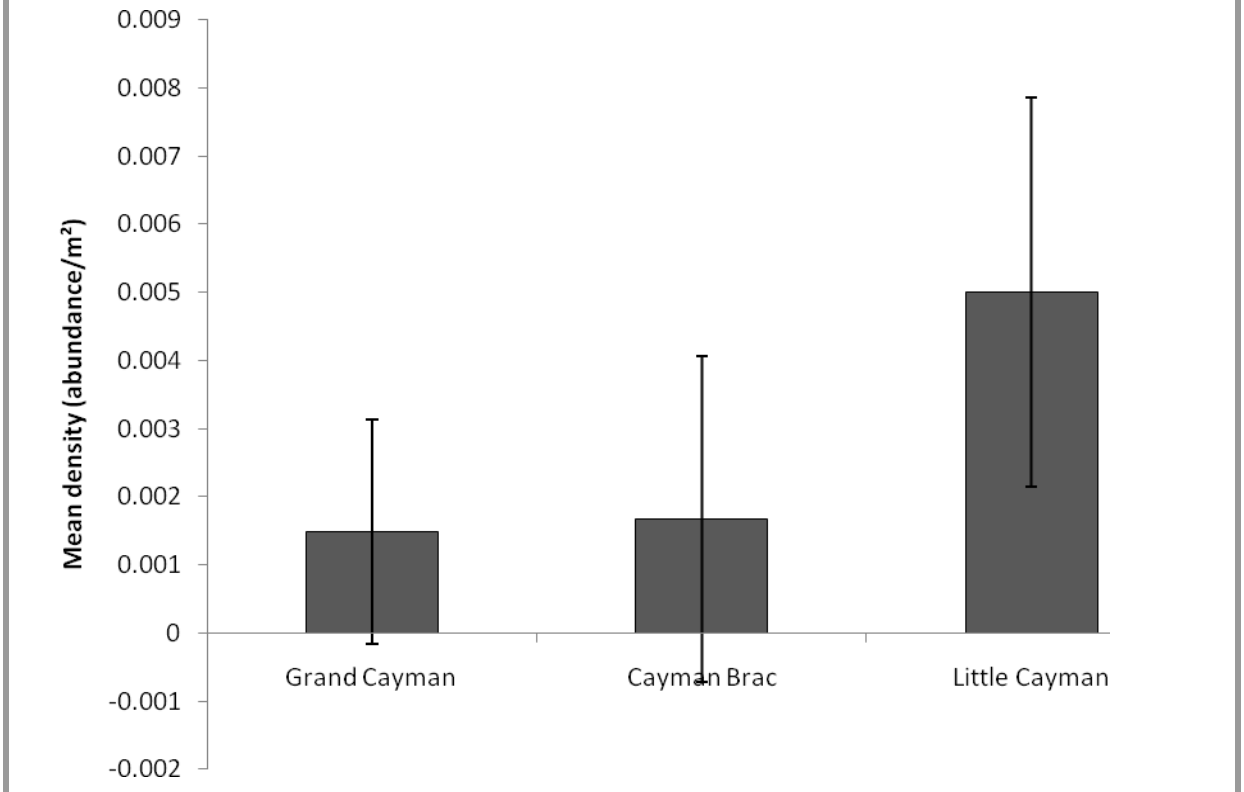

Figure 5. Lionfish density (abundance/m²) ± 2 SE at each island (Grand Cayman n=27, Little Cayman n=16, Cayman Brac n=12)

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OUTPUTS:

ACTIVITY	ACTUAL OUTCOME	COMMENTS
1	Use grant funds to cover inter-island travel and subsistence of volunteers during this project.	Completed
2	In-water surveys of lionfish around all three Cayman Islands (recording abundance and size).	Completed
3	Progress made towards developing the *National Lionfish Action Plan for the Cayman Islands*.	Completed
4	Develop and implement monitoring programme for the invasive Red Lionfish, ***Pterois volitans***, to determine their abundance, distribution and effectiveness of current control efforts.	**Completed**