Determination of the Queen Conch *Lobatus (Eustrombus) gigas* Home-range

Determinación del Habitat Hogareño del Caracol Rosa *Lobatus (Eustrombus) gigas*

Détermination du Domaine Vital du Lambi *Lobatus (Eustrombus) gigas*

CHLOÉ GOULIÉ[1,2]* and DALILA ALDANA-ARANDA[1]
[1]*Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional, Km. 6 Antigua carretera a Progreso, 97310 Mérida, Yucatan, México.*
[2] *Faculté des sciences, Université des Antilles et de la Guyane, 97159 Pointe-à-pitre cedex, Guadeloupe.*
*chloe.goulie@gmail.com.

ABSTRACT

The recreational park of Xel Há has been demonstrated as a beneficial marine reserve for the population of the overfished queen conch. While several long-term movement studies of conches have been conducted, only one drew conclusions on daily displacements and habitat use. The aim of the present study was to determine the home-range used by *Lobatus gigas,* in function of conch weight, in order to define size of reserves and mariculture enclosures. To reach this goal, 300 individuals were marked, weighed and measured. During one hour their position was recorded every ten minutes, so as to then measure distances and angles of the convex polygon formed to determine the conch speed and area. A total of 221 individuals were followed with average speed of 1.75 ± 2.25 m/h and average area of 0.44 ± 2.25 m². Conch weight did not influence area and speed.

KEY WORDS: *Lobatus gigas*, *Strombus gigas*, queen conch, home-range, displacements, marine reserves

INTRODUCTION

Marine Protected Areas (MPAs) have been created in order to *protect structure, integrity and stability of ecosystems* functioning as a refuge from fishing pressure. Benefits from MPAs as size and abundance increase in species have been largely demonstrated in reserves and adjacent areas. Recent studies focused on reserves dimensions so as to protect properly species in function of their circadian, seasonal and ontogenetic displacements. For sedentary mollusks as *Lobatus gigas,* site fidelity necessarily impact the home-range required by this species. So, species vulnerability to death due to fishing depends on localization of this home-range related to reserves frontiers. Moreover, *L. gigas* larviculture *ex situ* is effective for restocking programs respecting optimal conditions for larval development. Mariculture to produce marketable adults in enclosures could be feasible with adequate dimensions according to the home-range of *L. gigas.* Several studies have been conducted based on long-term displacements, home-range, and migrations of *L. gigas* in function of annual cycles, reproductive seasons, age and sex, site and physicochemical variables along Caribbean. However, only one study drew conclusions on short-term home-range in function of age, circadian cycle and two seasons in Xel Há (Noguez Nuñez and Aldana Aranda 2014a). Purcell and Kirby (2006) developed an individual based model demonstrating the relation between speed and weight of sea cucumbers in order to define the size of capture exclusion zones. Others also studied the tides influence on displacements of sea cucumbers (Graham and Battaglene 2004).

Consequently, the aim of the present study was to determine the short-term home-range used by *L. gigas,* in function of their weight, at Xel Há Park.

MATERIAL AND METHODS

Study Site

The Xel-Há inlet is located in the west cost of the Yucatán peninsula in the Mexican Caribbean between parallels 20° 30' and 20°00' north latitude and meridians 87°30' and 87°00' west longitude (Figure 1). This site with a superficial of 10 ha and depth of 0.5 to 4 m is characterized by a mix of salted water and groundwater from the calcareous cavities called cénotes, flowing into the Caribbean sea. This is constituted of a mouth of 50 m large, a lagoon of 0.7 km and two annexes inlets north and south.

The climate is described as sub-humid with a season called *nortes* from November to February, a dry season from Marsh to May and rainy season from June to October. The *nortes* season is characterized by sporadic rains and fresh winds from the north responsible of a cooler climate. The tidal regime of the Caribbean sea of Mexican cost is semi-diurnal. The Xel Há Park is qualified as a sanctuary for *L. gigas* containing abundance and density superior to that recommended due to the absence of extractive activity.

The present study was conduct in the mouth zone (Figure 1) defined by Peel et al. (2011) as a particular zone of migration for *L. gigas* because it is composed of sand bottom with patches of sea grass beds (*Thalassia* sp. and *Halodule* sp.), rocks covering of macro-algae and a few corals.

Sampling and Displacements Monitoring

A total of 300 individuals were marked, measured (shell length and lip thickness) with a Vernier of 0.1 mm precision and weighed with a balance of 0.1 g precision. Individuals were then categorized in classes of weight in order to compare a minimum of 30 individuals.

During one hour, the position of each individual was recorded every ten minutes with stakes. Then, distances, angles and orientation of conch were measured with a meter tape, protractor and compass. Area was determined by drawing convex polygons formed and Speed was calculated according to the distance traveled in one hour. Monitoring was done during hours of movement between 10 am and 4 pm (Noguez Nuñez and Aldana Aranda 2014b).

Statistical Analysis

Results of area and speed in function of weight, were statistically tested with scatter plots coupled with non parametric Spearman correlation using *Infostat 2012*.

RESULTS

Population

A total of 221 individuals (weight 40 - 4,000 g, shell length 70 - 245 mm and lip thickness 1 - 32 mm) were followed from 3rd to 28th February 2015 with a majority of 85 individuals between 1,400 and 1,800 g and 170 and 215 mm.

Weight Influences

Conch showed an average of speed was 1.75 ± 2.25 m/h and of area was 0.44 ± 2.25 m². No significant negative correlations of both area and speed (respectively r = -0.02 and -0.01 and p = 0.84 and 0.89) were observed with conch weight (Figures 2 A and D).

DISCUSSION

Purcell and Kirby (2006) demonstrated a positive and linear correlation between speed and weight of a sea cucumber juvenile and adult population in a seagrass bed of Colombia. In the present study, the population observed was homogeneous and essentially composed of individuals bigger than 1400g. Only three categories were identified without significant difference for their displacements.

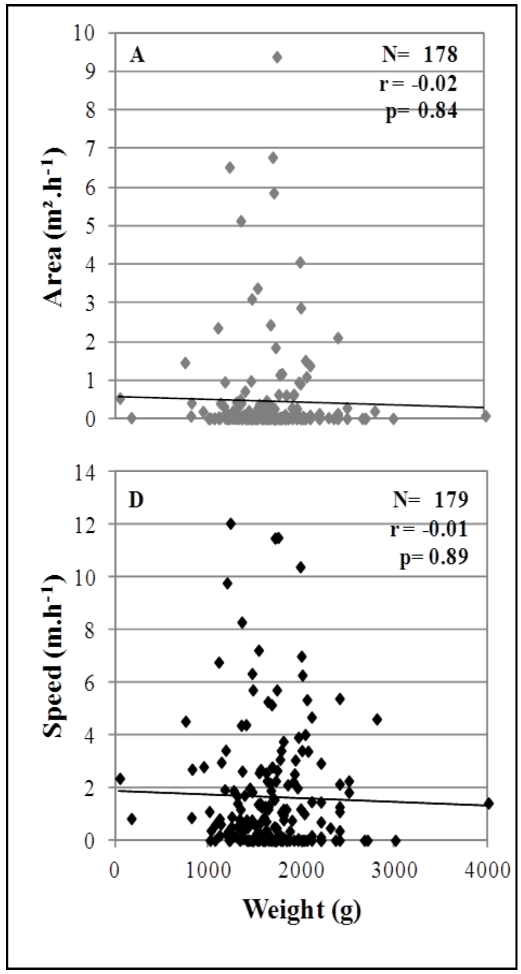

Figure 2. Scatterplots of area and speed en function of weight (A and D), N: number of individuals tested, r : spearman coefficient and p : value of correlation test for a risk of 5%.

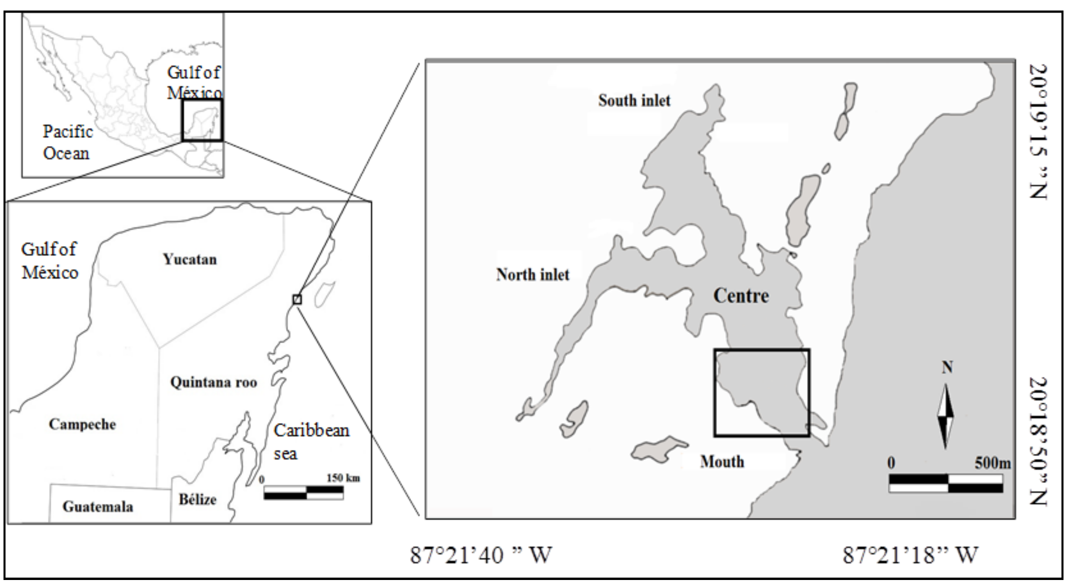

Figure 1. Study site location at Xel Ha Park, México.

These results highlight that weight does not affect area and speed of individuals. On the contrary, the lightest individual of sea cucumber does not move more rapidly than the heaviest.

CONCLUSION

Weight had no influence on *L. gigas* displacements. Moreover, it could be interesting to make a feasibility study of mariculture *in situ* of *L. gigas* respecting the optimal conditions and enclosures sizes described by aquaculture and home-range studies.

AKNOWLEDGMENT

We thank CINVESTAV-Mérida and grant SEP-CONACYT, N° 181329, "El Caracol rosado como indicador de Cambio Climático en el Caribe: Acidificación Oceánica y Calentamiento. Thanks Xel-Ha's Executive Director Elizabeth Lugo, Elba Lopez Castro and all the Xel-Ha staff for the unconditional support and unlimited access during our work.

LITERATURE CITED

GLAZER, R.A., G.A. DELGADO, and J.A. KIDNEY. 2003. Estimating queen conch (*Strombus gigas*) home ranges using acoustic telemetry: Implications for the design of marine fishery reserves. *Gulf and Caribbean Research* **14**(2):79-89.

GRAHAM, J.C. and S.C. BATTAGLENE. 2004. Periodic movement and sheltering behaviour of *Actinopyga mauritiana* (Holothuroidea: Aspidochirotidae) in Solomon Islands. *SPC Beche-de-mer Information Bulletin* **19**:23-31.

HESSE, K.O., 1979. Movement and migration of the queen conch, *Strombus gigas*, in the Turks and Caicos Islands. Bulletin *of Marine Science* **29**(3):303-311.

NOGUEZ NÚÑEZ, M.N. and D. ALDANA ARANDA. 2014a. ¿ Cómo es el Comportamiento del Caracol rosa *Strombus gigas* y cómo Utiliza su Hábitat? *Proceedings of the Gulf and Caribbean Fisheries Institute* 66:454-457.

NOGUEZ NUÑEZ, M.N. and D. ALDANA ARANDA. 2014b. Eco-etología básica del caracol rosa *Strombus gigas* (Mesogastropoda: Strombidae), en Xel-Há, Yucatán, Caribe Mexicano. *Revista de Biología Tropical* **62**:215-222.

PEEL, J.R., R. SÁENZ, E. MAY, J. MONTERO, and D. ALDANA ARANDA. 2011. Importance of a Marine Protected Area in the Mexican Caribbean for the Conservation of the Endangered Species Queen Conch, Strombus. *Proceedings of the Gulf and Caribbean Fisheries Institute* **63**:448-456.

PURCELL, S.W. and D.S. KIRBY. 2006. Restocking the sea cucumber Holothuria scabra: Sizing no-take zones through individual-based movement modelling. *Fisheries Research* **80**(1):53-61.

STONER, A.W. and V.J. SANDT. 1992. Population structure, seasonal movements and feeding of queen conch, Strombus gigas, in deep-water habitats of the Bahamas. *Bulletin of Marine Science* **51** (3):287-300.