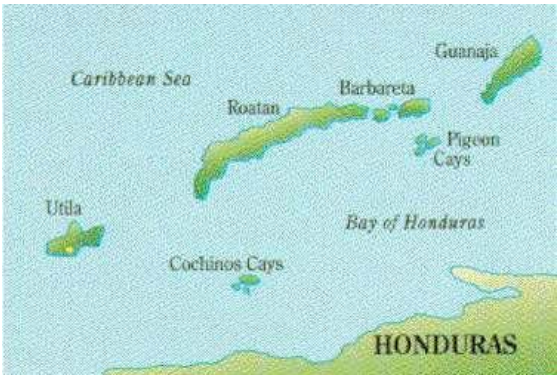
Thirty five miles off the northern coast of Honduras, wedged between the small islands of Utila and Guanaja sits Roatan. Collectively they are known as the Bay Islands, and are located along the largest barrier reef in the western hemisphere. A political coup rages on in Honduras, yet this small archipelago, known worldwide for its pristine coral reefs and clear blue waters could not have looked more inviting as my plane descended toward Roatan's lone airport, in early August last summer. Thirty seven miles in length and five miles wide, the largest of the bay islands, Roatan's infrastructure is geared towards accommodating keen divers from across the globe. However within a few hours of touching down I soon discovered the island is much more than a tourist hub. Culturally and visually very colourful the island is awash with different sights and sounds. Originally Roatan was populated by the Garifuna, an English speaking ethnic group of mixed ancestry, descendents of Carib and Arawak Indians as well as African slaves. However within the last ten years an influx of Spanish speaking Honduran migrants has diversified, and in some instances, segregated the culture of Roatan further.



A map of the Bay Islands, Honduras. members.virtualtourist.com

Unfortunately, change on land is also being mirrored below the surface of the water, as native marine animal residents feel the strain of a booming population. One such animal is *Strombus gigas*. For thousands of years the Queen Conch has been a popular food source across the Caribbean, including the Garifuna people of Roatan. Firmly engrained in their culture, Queen Conch were accessible and valuable sources of protein, whilst the shells were used as tools, musical instruments or ceremonial items. However as the population of the Caribbean grew and fishing techniques were honed, *Strombus gigas* became increasingly endangered. Exploitation continued until 1992 where the Queen Conch was listed in Appendix II of the Convention of International Trade in Endangered Species (CITES). Despite the legislation this species remains extremely threatened, and a new approach to management must be considered.


The Reef House Resort and its shallow water enclosure. The mesh fencing provides refuge for many different marine species including hundreds of Queen Conch.

After a few days of exploring, getting to grips with the islands bustling West End and meeting with some of the locals, I made my way by taxi-boat to the Reef House Resort. There I would meet with Professor Stephen Dunbar, of Loma Linda

University, California. The Canadian born, jet-setting professor uses the Reef House as a base for his various projects around Roatan. His research in the area stretches from the conservation of the highly endangered Hawksbill and Green turtles, to the behaviour of hermit crabs. Upon my arrival Steve tells me that I shall be focusing on conch conservation, and, more specifically, *Strombus gigas*, the Queen Conch. Studying Marine Biology at Newcastle University gave me a little insight in what to expect when working with the animal, but little did I know that over the next few days I would become a relative expert in the field. In comparison to terrestrial molluscs, *Strombus gigas* is huge. The spiralled shell encases and protects the animals flesh, which includes a muscled foot used in locomotion. The foot ends in a hard, hooked shaped operculum, the shape of which matches that of the aperture opening, in order to prevent access to predators.

A juvenile Queen Conch is dwarfed by a mature adult. The dark operculum can just be seen extruding from the juvenile's aperture opening.

As I familiarised myself with the Reef House, I could not help but notice the dozens of now empty shells dotted around the resort, often gaping holes in the calcareous shell. Excavated and discarded by locals, and now used as decoration, the shells also served as a stark reminder of the Queen Conchs dire circumstances. It dawned on me how simply the lumbering giants could be caught and extracted, simply with the use of a hammer or rock. Not only is it the Queen Conch's lack of speed that leaves it vulnerable to the effects of overfishing, but also its reproductive cycle. Males internally fertilise the females over a period of a few months each year. As fertilisation requires contact between individuals, mating is density-dependent, making it increasingly difficult for a population of Queen Conch to replenish its numbers as fishing pressure increases.

Factors that affect the size of a population can be divided into density-dependent and density independent factors. Density independent factors will affect a population to the same degree, regardless of its size. In contrast, the affects of density-dependent factors increase or decrease as the population size changes. In this instance, as the population decreases due to overfishing, the rate of mating also decreases, relative to the population.

Whilst Steve prepared the equipment for the day ahead, I was shown around the resort by co-owner and manager Mike Pack. It soon became apparent why Steve used the resort as the base of his operations. Situated right on the coast, the Reef House has set up a large enclosed area of shallows. A variety of reef fish call the enclosure their home and an area of mesh fencing means the pool is an open system allowing fresh input from the sea. As a consequence the pool acts as a nursery area for many marine species, including octopi and brittle stars. The enclosure also allows for some close encounters with

endangered turtles. Working in coordination with Honduran organisation ProTECTOR, rescued turtles are tagged, quarantined and then released into the wild. The same enclosure is also the centre of Steve's work with Queen Conch, an area I would become very familiar with over the next few days.

After a liberal application of sunscreen- temperatures in the excess of 30°C, plus the seas reflective qualities means one can never be too careful- I was ready to start work. My task was to round up every Queen Conch in the enclosure. Systematically I would measure the length, width and lip thickness of the individual. Then applying pressure to the conch's operculum, I would squeeze, pushing the conch inwards. Although it sounds brutal, Steve assured me it caused the animals no discomfort and was to remove excess water from inside the shell in order to produce an accurate weight on the scales.

Steve shows me how to measure the lip thickness of a conch using a pair of small and accurate callipers.

All data was entered into Steve's database, allowing for future comparisons. When the data was recorded each conch was assigned a number, which was carved using a dremel tool into the shell. If any individuals removed from the enclosure already possessed a number then, their information was still recorded to see how that individual had grown over the years. Processing an individual conch took approximately fifteen minutes, and as the first day ended carving numbers into forty tough calcareous shells was already taking its toll.

After measuring the dimensions and weighing the conch, the process is finished by assigning each conch a number, carving it into the individual's shell.

As dusk fell and I returned home through the mangroves, I passed a local man who worked as a dive boat captain for a local resort. He had spent the day fishing with his nephew, and as I peered into his dory to view his catch, I could clearly make out at least four mature Queen Conch, in a bag by his feet. Although I voiced my opinion, there was nothing that I could do, and I knew this man fully intended to eat the endangered conch, probably using the same recipe his family had been using for generations. I returned home feeling a little disheartened. Over the next four days as I measured, weighed and carved through nearly two hundred conch, I had a chance to contemplate the future effects of our work. I was relishing the chance to be part of the scientific process, and though I could not argue that the work being carried out by Steve and myself was a worthy

cause; I began to wonder whether the Queen Conch were beyond saving. Since the CITES convention listed the species as endangered in 1992, trade in Queen Conch has continued. When Jamaica reduced its catch quotas in 1999, Honduras took advantage of this gap in the market almost doubling the amount of conch it exported, from 750 to 1,330 metric tonnes in 2001. Eventually however, as a result of continued pressure from organisations such as CITES, in 2003 Honduras announced it would suspend all Queen Conch exports. Whether the regulations are being adhered to is another matter, especially as reports of Honduran conch dealers approaching officials in other countries in an attempt to 'greenwash' there stock for international trade, completely undermine the legislation.

A much larger pair of callipers is used to measure the length and width of each conch.

At the next available opportunity I decided to ask Steve what he believed his work at the Reef House resort could achieve for the endangered Queen Conch. He explained that he viewed his work with the conch on Roatan as the first steps in establishing a cheap and simple mechanism for raising conch that does not rely on laboratory based conservation. Roatan simply does not have the facilities to establish a more scientific method of conch rearing, however the potential of these simple enclosures is huge. Conch juveniles naturally occupy clear shallow waters, less than 10 meters in depth. They feed on tiny photosynthetic algae such as diatoms as well as seaweeds and sea grass, all of which are regularly brought in on the tide, or naturally grow in shallow waters. Consequently conch enclosures require little or no maintenance. In the long run, Steve hopes that hundreds of these small, natural conch farms can be established across the Bay islands. It was at that point I realised why the work I had been doing for Steve was completely necessary. Recording the enclosed conch data was essential to scientifically prove that this method of conch rearing actually works, and would have to occur, at the very least, year on year. However, even now it is clear that much more preliminary work needs to be done before successful conch farms can become a reality.

During my brief stint working at the Reef House I had heard stories of, either unaware or very bold locals, simply wading into the Reef House enclosure and helping themselves to the conch. Although fairly isolated incidents, these examples highlight the juxtaposed differences in culture present on the island of Roatan. Conservation is still a very 'western' principle and understandably a very foreign concept to many islanders. In order for conservation of conch to take off on the island an effort to educate the locals in its basic principles needs to take place. When I asked any local about the abundance of conch most replied that their numbers have obviously declined. However it is still clearly a case of making ends meet for the

people of Roatan. As an Englishman, sometimes it is easy to forget that these people are surviving in a third world country. When a Queen Conch can provide a meal for the family or be sold to buy gas for the dory, then I imagine conservation is rarely considered. The task at hand is to show the locals that creating their own simple farm may benefit them directly within a few years of establishment, and perhaps even give their children a much improved standard of living. A more difficult task, once the farm is established, would be to persuade the farmers to throw some of the individuals back into the ocean every year, an act to seed the open population. Magnified across several hundred farms the effects could have a very positive impact on the 'wild' population.

I celebrate at the end of the fifth day, as all Queen Conch in the enclosure have been recorded.

Needless to say, to get the ball rolling would require at the least awareness of, if not direct financial influence from, western tourists. Thousands of tourists visit Roatan each year, meaning the potential audience for public awareness is huge. Steve admits that public awareness is an issue, for both locals and tourists alike, but he is lacking in funding to get an awareness campaign off the ground. A survey of guests staying at the Reef House resort was started to find out how many people actually knew what CITES was, what kinds of animals were protected and if they tended to shop for souvenirs with the environment and protected species in mind. Most guests did not know what CITES was, but many tried to be aware of animal product souvenirs. Unsurprisingly, most visitors were unaware that the Queen Conch was protected at all, and that it is illegal for them to transport the shells out of the country.

As I said goodbye to Steve on my final day of working with the Queen Conch, he asked if there was any chance of myself or any other marine biology student I knew, returning the following year. While I have not ruled out the possibility of a return trip, it is clear that Steve is searching for regular help with his conch conservation. His demands as a university professor, his distance from Roatan and his various projects when he is on the island, means Steve is unable to spend the time he would like on conch conservation at the Reef House. Preferably, this admirable but daunting task requires a semi-annual count of the enclosure. Once this preliminary work is a proven success, and when funding is available for it to be replicated, the first conch farms will require months of work and dedication to encourage local people to set up their own farms. Steve cannot supply sufficient time and energy on his own. For this project to really take off a more permanent position on Roatan needs to be fulfilled, to build on the fantastic foundations set by Professor Stephen Dunbar. With more help there is no reason why this simple solution could not greatly improve the abundance of *Strombus gigas* across Roatan.

Waiting in Roatan airports single departure lounge, despite the power-cut induced gloom in which I sat, I felt decidedly optimistic. Undoubtedly the Queen Conch conservation process would be a long one, for various social, political and financial reasons. However, Steve's goal is certainly obtainable, once a degree of recognition brings more support to the cause. I hope what little awareness this article provides may make a difference in aiding Steve to accomplish his work. Long live the Queen!

Heyes, Timothy, 2009. Conch Research Report from Reef House Resort Study 2009. Newcastle University, U.K.

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