The Whelk (*Cittarium pica*) Fishery of Saint Lucia: Description and Contribution to the Fisheries Sector

La Pesquería de Buccino de Santa Lucía: Descripción y Contribución al Sector Pesquero

La Pêche au Buccin de Sante-Lucie: Description et Contribution au Secteur des Pêches

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ABSTRACT

The West Indian topshell or "whelk", *Cittarium pica*, is a marine gastropod found only in the western central Atlantic. It inhabits intertidal and shallow subtidal areas of rocky shores and has been widely exploited throughout its range since prehistoric times. Although whelk populations have declined, they remain important to many small-scale fishers across the region. In Saint Lucia, the whelk known as "bwigo" has cultural and economic importance but the local fishery remains unregulated, unmonitored, and undocumented. This research seeks to fill some of the knowledge gaps and thereby provide stakeholders with information that is important for making management choices. Data were collected via consultations with key informants; by conducting an interview survey with a large subset of the whelk fishers; and through observation, measurement and participation in whelk harvesting trips. A total of 108 part-time whelk fishers were recorded from 11 communities around the island. Typically Saint Lucian whelk fishers are young males with at least a primary school education, and a multi-occupational livelihood strategy. All harvest whelks on a part-time basis, most engage in other fisheries, whilst many also have additional employment outside the fishing industry. No whelk fisher relies entirely on income derived from whelk fishing, but 60% state that whelk contribute to more than a quarter of their annual earnings. Whelks are harvested by hand from rocks along the shoreline, in the surf zone and in the subtidal areas down to 3 m by free-divers. Some harvest sites are accessed by boat, but the majority are reached on foot and by swimming from the shoreline. Harvesting frequency is strongly dependent on sea conditions and water clarity and therefore highly variable. All fishers give away a part of their catch, most also keep some for personal consumption and the remainder is sold for local consumption. A majority of whelk fishers reported observing negative changes in size and abundance of whelks over the last decade, and made suggestions for management action.

KEY WORDS: Whelk (*Cittarium pica*) fishery; management; Saint Lucia

INTRODUCTION

The West Indian topshell or "whelk", *Cittarium pica*, is a marine gastropod found only in the western central Atlantic and occurring commonly in the intertidal and shallow subtidal areas of rocky shores (Randall 1964, Leal 2002, Robertson 2003). Like the queen conch, whelk was probably one of the most abundant large gastropods in the Caribbean and of considerable importance to pre-historic human settlers (Keegan et al. 2003, Blick 2012). Also like conch, the whelk is considered one of the most commercially important large gastropods in the Caribbean (Flores and Talarico 1981, cited by Bell 1996), has suffered declines across the region in response to overexploitation (Randall 1964, Debrot 1990, Leal 2002, Toller and Gordon 2005, DaCosta-Cottam et al. 2009) and is now a protected species in Bermuda after its reintroduction there (Sartwell et al. undated). Unlike conch however, whelk is not listed under CITES, and the status and dynamics of their fisheries are poorly documented across much of the species' range, with little or no attention being given to sustainable management of this resource regionally (Bell 1996, Jimenez 2006).

Whelk remains traditionally and culturally important in many countries today for livelihood support, as a subsistence high protein food source, as a bait species, for its apparent medicinal and aphrodisiac properties, and for use in the jewellery and curio trade (e.g. Robertson 2003, Schmidt et al. 2002, Toller and Gordon 2005, DaCosta-Cottam et al. 2009, Oxenford et al. 2007, Rosique et al. 2008, George et al. 2010). It has also been highlighted as a species with good potential for aquaculture (Bell 1996, Lovatelli and Sarkis 2011).

Small-scale whelk fisheries have been described in a number of countries including the Bahamas (Debrot 1990), the US Virgin Islands (Randall 1964, Toller and Gordon 2005), Puerto Rico (Jimenez 2006), Costa Rica (Schmidt et al. 2002) and have been mentioned in the Cayman Islands (DaCosta-Cottam et al. 2009), the Dominican Republic (Herrera et al. 2011) and Colombia (Rosique et al. 2008), but remain completely undocumented in most. In Saint Lucia, whelk, known in the local creole language as "bwigo", is considered an important coastal resource (Walker 2005, Gardner 2009). However, information on the whelk fishery is largely anecdotal despite its great historical importance and significant cultural heritage value in Saint Lucia (Hofman and Hoogland 2009). Fishery management efforts on the island to date have been largely geared towards the main fisheries resources (Joseph 2001). The current fisheries data collection system does not collect landings data on whelks (considered a minor fishery) and the register of fishers kept by the Department of Fisheries (DOF) does not include whelk fishers. As such, the status of the whelk fishery in Saint Lucia remains unknown and essential baseline information for appropriate decision making is largely non-existent.

The overall goal of this study was to document, for the first time, the extent, importance and nature of the whelk fishery in Saint Lucia and thereby provide a basis for informed management decisions for the sustainable use of the whelk resource.

METHODOLOGY

Primary data on the fishery and whelk resource were collected over three months (July – September 2012) through consultations with key informants (fishery extension officers and data collectors of the DOF and members of fishers' co-operatives); by conducting a standard interview survey of a large subsample of whelk fishers; and by accompanying whelk fishers on harvesting trips.

Well known whelk fishers were identified by key informants and subsequently other whelk fishers were found by a 'snowball' sampling method using referrals from the first fisher interviewees, and by scoping coastal communities. The standard interview instrument contained questions on fisher demographics, whelk harvesting areas, harvesting methodology, frequency and length of harvesting trips, quantity and use of the catch, marketing arrangements, and importance of the resource to their livelihood. Whelk fishers were also asked whether they had observed any changes in the whelk population over time and to what they attributed these changes, and their opinions were sought on a variety of other management issues.

Additional information was gathered informally through conversation and observation whilst accompanying whelk fishers on harvesting trips. Geospatial locations recorded by handheld GPS receiver, and qualitative visual observations made during harvesting trips with fishers were used to validate fishers' maps, names of harvesting areas and other habitat attributes given during interviews.

Biological data on size of whelks were collected in an *ad hoc* manner from any whelks seen landed during the research period. Shell width (diameter) was measured using a veneer calliper to the nearest 1 mm as described by Debrot (1990).

Microsoft Excel was used for data entry, manipulation and preliminary statistical analysis. Further statistical analyses were performed as required using the IBM Statistical Package for Social Sciences (SPSS) version 19. GPS position data and harvesting area delimitations indicated by fishers were created and displayed using ArcGIS and ArcMap 10 software. Geospatial shapefiles and aerial photographs for map generation were obtained from the Ministry of Physical Development, Housing and Urban Renewal, Government of Saint Lucia.

RESULTS

Whelk Fisher Demographics

A total of 108 whelk fishers from 11 major coastal communities were identified, and 75 (69%) of them were interviewed from 10 communities around the island between July 8 and September 26, 2012 (Figure 1). The greatest numbers of whelk fishers are found along the exposed windward coast of the island in the communities of Dennery (33 whelk fishers) and Anse Ger (17 whelk fishers) (Figure 1). Ninety-seven percent of the whelk fishers interviewed (n = 75 respondents) are male, and all have attained at least a primary school education, with 40% having also completed secondary school (Table 1). Generally, whelk fishers are relatively young with an average age of 32 years (range: 13 – 64 yr) and around 19% of them are teenagers. Mean age of whelk fishers differs among communities (ANOVA: $F = 4.836$; $df = 9, 65$; $p < 0.001$), with whelk fishers from Soufriere and Laborie being significantly younger than those from Canaries.

Whelk Harvesting and Landing Areas

Whelks are harvested all around the coast of Saint Lucia, although the exposed, windward, eastern and northern coastlines are the most heavily used areas (Figure 1). In general, whelk fishers tend to use the coastal areas close to the communities in which they live, although fishers from Anse Ger, Dennery, and Micoud located on the east coast and Castries on the west coast also use sites along the north coast of the island. Most intertidal areas comprising reef, rock or boulders are target areas for whelks, especially where they are exposed to high wave energy. Whelks are harvested from shoreline rocks in the splash zone and from subtidal, nearshore areas down to 3 m deep.

The majority (63%, n = 75 respondents) of whelk fishers do not use formal fish landing sites recognised by the DOF, but bring in their catch anywhere along the shore close to their harvesting sites. Fishers who do use recognised landing sites for whelks (37%) tend to be those who use a boat for harvesting (Figure 1).

Whelk Fishing Practices

Fishers free dive, wade or climb on rocks to harvest whelks. The majority (77%, n = 75 respondents) reported using all three methods to harvest whelks, although not necessarily all on the same harvesting trip. Free divers use a mask and snorkel, and either fins, shoes or go barefoot. Whelk fishers access the harvesting sites from the shoreline by boat or using some other floating devise. The shoreline is the predominant means of access (with 49% using shoreline access exclusively), while 17% access the sites only through the use of a boat (motorised fibreglass pirogue). Only 5% of the respondents use all three means of access to the whelk harvesting sites. The community of Dennery is the largest group to use boats for whelk harvesting. Although 53% of the whelk fishers sometimes harvest whelks alone, almost 90% of them stated that they usually harvest whelks as a group, ranging in size from 2 – 16 persons. The most frequent group size, as indicated by

45% of the respondents, is 4 - 6 partners. Fishers normally carry a device to prise the whelks from crevices (e.g. a stick, a steel rod made into a hook, a screw driver, cutlass or knife) and a porous bag (e.g. used chicken feed sack, onion or flour bag) to hold the whelks as they are harvested. In some instances, stones and rocks are lifted and rolled over to retrieve whelks from underneath. Whelk fishing takes place during the day and sometimes at night using battery operated torch lights or kerosene lamps.

The frequency of whelk harvesting trips was observed to be highly variable, perhaps occurring every day for a while and then not at all for days or weeks at a time. The majority of whelk fishers (97%, n = 75 respondents) stated that harvesting frequency was strongly dependent upon calm sea conditions and clear water, although a variety of other factors were mentioned, including moon phase and tidal condition. The 'best months' for whelk harvesting were stated to be March through to December with July to September being considered the peak harvesting months because the sea is generally calmest during this summer period.

Although fishing practices are generally similar among whelk fishers from the different communities, a number of interesting differences were observed. For example, the Dennery fishers, who usually harvest by boat, undertake dives in sections, commonly known as 'innings' or 'endings' which can range from 15 to 45 minutes depending on the sea conditions and the abundance of whelks. After each 'innings' they move as a group to another section. Dennery fishers also wear a pair of tights into which they stuff whelks whilst harvesting, only transferring them to bags once onboard the boat.

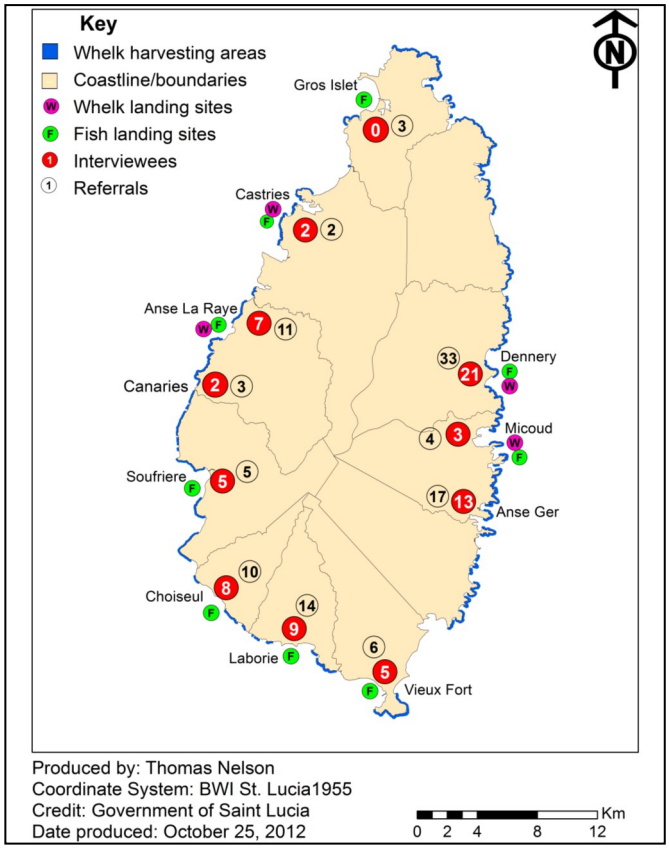

Figure 1. Map of Saint Lucia displaying the distribution of all known whelk fishers (referrals) and those interviewed (interviewees) in each community, the location of whelk harvesting areas and official fish landing sites around the coast at which whelk are landed.

Table 1. Summary of demographic information on whelk fishers from coastal communities around Saint Lucia, based on interviews conducted from July – September 2012.

Community	Total referred[1] Fishers	Total interviewed fishers	Gender		Highest education		Fisher type		Mean age (yr)	Mean time as whelk fisher (yr)
			Male	Female	1°	2°	Not for profit	Small scale commercial		
Anse Ger	17	13	13	0	11	2	0	13	43	20
Anse La Raye	11	7	7	0	2	5	1	6	34	17
Canaries	3	2	2	0	2	0	0	2	52	33
Castries	2	2	2	0	2	0	0	2	46	29
Choiseul	10	8	7	1	5	3	3	5	27	11
Dennery	33	21	21	0	12	9	0	21	28	11
Gros Islet	3	0	-	-	-	-	-	-	-	-
Laborie	14	9	8	1	3	6	1	8	22	11
Micoud	4	3	3	0	3	0	0	3	41	27
Soufriere	5	5	5	0	3	2	0	5	21	10
Vieux Fort	6	5	5	0	2	3	0	5	29	7
Total	**108**	**75**	**73**	**2**	**45**	**30**	**5**	**70**	**-**	-

[1] Indicates the total number of fishers identified (referred) by key informants and other whelk fishers

Catch and Effort

Overall, the average stated number of whelks harvested by each fisher per trip was 161 (SD = 107, n = 75 respondents). This was validated by an observed mean catch rate per fisher per trip of 166 whelks (SD = 90, n = 49 fisher harvesting trips across five communities) between July 9 and September 30, 2012. The duration of a harvesting trip, defined as the total time spent at sea (not just the time spent diving for, or catching whelks) varies from < 1 hour to > 6 hours.

Interviewed fishers were unable to estimate the average frequency of whelk harvesting trips made per week or per month, and therefore it is not possible to extrapolate catch per trip to annual landings of whelk in Saint Lucia. However, field observations at five communities recorded a total of 8,118 whelks being captured in 251 man hours by 19 fishers. This translates into an observed mean catch rate of 33 (SD = 19) whelks per fisher per hour of harvesting trip (Table 2).

Biological Data

Landed whelks ranged in shell width from 22 – 100 mm with an overall mean of 56 mm (n = 709). However, the catch appears to comprise two or more cohorts; one young cohort ranging from 22 – 38 mm in shell width and the other a more diffuse one, probably comprising several older year groups from 40 – 100 mm (Figure 2).

There was a significant difference in mean whelk size landed among the five communities (ANOVA: F = 179.560; df = 4, 704; $p < 0.001$) with whelks from the leeward south and west coast communities of Vieux Fort and Soufriere respectively being significantly smaller than elsewhere and comprising mainly the younger cohort, whilst those landed at Dennery were significantly larger than in any other community and comprising almost exclusively the older cohorts.

Table 2. Number of whelks captured, hours spent on harvesting trips and mean CPUE (as number of whelks per fisher per hour) for 19 whelk fishers observed over 49 harvesting trips shown for each of five communities around

Community	no. whelks	Harvesting time (hr)	CPUE (whelks / fisher / hr)	
			Mean	SD
Anse Ger	2759	73	38	23
Anse La Raye	115	11	11	3
Dennery	4635	157	30	12
Soufriere	189	5	38	-
Vieux Fort	420	5	84	-
Grand Total	**8118**	**251**	**33**	**19**

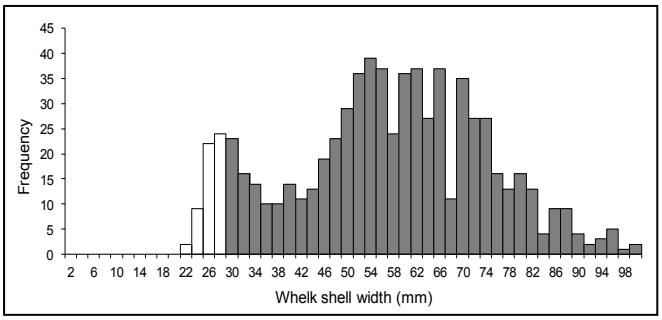

Figure 2. Size frequency distribution of whelks landed by fishers from five communities in Saint Lucia between July 28 – September 12, 2012 (n = 709 whelks). White bars represent immature whelks and shaded bars represent mature whelks based on a shell size at first sexual maturity of 29 mm as reported by Schmidt et al. (2002).

Post Harvest Practises and Landed Value

All of the interviewed whelk fishers stated that they give away part of their harvest. Almost all (99%, n = 75 respondents) also keep some for personal consumption and 24% of fishers also utilise some of their whelk as bait to catch a variety of other fish species. Most fishers (93%) sell at least a part of their catch, doing so directly from the roadside to locals for personal consumption, as well as to food vendors and/or to hotels and restaurants. All whelks are sold whole and unprocessed by the fishers, and are typically cooked whole and eaten directly from the shell by consumers. Generally, whelks are sold at EC$ 5.00 (US$ 1.84) per 'heap'. A heap usually comprises 3 – 5 whelks but may contain up to 20 if the whelks are small. One processor occasionally purchases whelks inclusive of the shell at EC$ 4.00/lb (US$ 0.84/kg).

Importance to Livelihoods

All whelk fishers harvest whelks on a part-time basis. No whelk fisher depends entirely on whelk harvesting for their livelihood, although the majority (60%, n = 75 respondents) reported that whelk sales account for more than a quarter of their annual income and 11% reported that whelks are responsible for more than 75% of their annual income.

Although fishers were unable to estimate how many whelk harvesting trips they make a year, from the observed average catch rate over the July – September study period, a whelk fisher can make an average of around EC$207 (US$76) per harvesting trip or EC$30.58 (US$11.24) an hour (Figure 3).

Most whelk fishers (89%, n = 75 respondents) also catch and sell other species on whelk harvesting trips, with crab, lobster and octopus being the most frequently reported. The majority of whelk fishers (88%) are also involved in a number of other types of fishing activities, with trolling, spearfishing, net fishing, trap fishing and FAD fishing (fishing around fixed fish attracting devices) being the most frequently mentioned. Furthermore, 63% of whelk fishers interviewed said that their fishing income

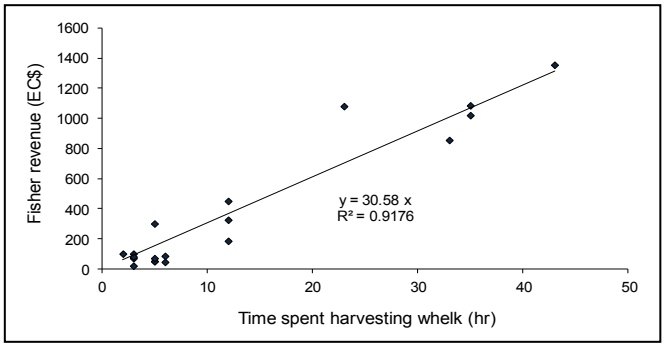

Figure 3. Gross revenue generated versus number of hours spent harvesting by 19 whelk fishers over 49 trips from five communities in Saint Lucia observed during the period July – September 2012.

was supplemented by income from activities outside the fishing industry, particularly construction work and farming. It was clear also from observation that whelk fishing is not only economically important, but plays a significant role in the wider community, adding to subsistence food security, building comradeship and strengthening social networks.

Perceptions on Management Issues

The majority (79%, n = 75 respondents) of whelk fishers reported having observed changes in the number (density) of whelks at their harvest sites. Of these, 86% (n = 59 respondents) stated that they now see fewer or far fewer whelks than previously, while 14% reported that more whelks are currently being observed. Most (68%, n = 75 respondents) whelk fishers also reported having observed changes in the sizes of whelks, with 80% of them (n = 51 respondents) claiming that whelks are now smaller or much smaller than previously; although, 20% reported bigger or much bigger whelks being observed nowadays. These reported changes were observed by most fishers over a 1 – 5 year time period, although some stated observing the changes over the last decade.

Whelk fishers believed that fishing pressure was the most prominent cause of the negative changes in whelk size and abundance, particularly:

i) Overharvesting of juveniles off shoreline rocks,
ii) Too many whelk fishers in the fishery, and
iii) Fishing too often at the same sites.

The drivers of heavy fishing pressure were believed to be an increased market demand for whelks and the deteriorating socio-economic status of many fishers. Other suggested causes included:

i) Natural disasters such as hurricanes and tropical storms causing high mortality in whelks and destruction of their habitats,
ii) Predators such as octopus, and
iii) Poor water quality and climate change.

Of the few whelk fishers who observed positive changes in whelk size and abundance, most were unable to offer any explanation for the changes. However, fewer fishers targeting whelks and improved natural environmental conditions were given as reasons by two fishers for increases in the numbers and sizes of whelks they had observed.

In response to an open ended question about what management action, if any, should be taken, interviewed fishers (n = 75 respondents) made a total of 85 suggestions. The most frequent (32% of suggestions) was to institute a minimum size limit to protect juveniles and to ensure that a breeding stock is maintained. A further 20% called for a limited harvest period to reduce the harvest pressure and protect spawning stock during the reproductive period. Capacity building for whelk harvesters and consumers through education and training, building a sense of ownership, empowerment, and provision of incentives were also suggested by 11% of the fishers. Some fishers even suggested the implementation of a moratorium on whelk harvesting for a period of time (6 months – 2 years) to allow the whelk population to recover, the establishment of area closures or marine reserves to maintain a breeding stock, and improvements in habitats through habitat restoration and mitigation of land based sources of pollution.

Traditional Beliefs

There are several traditional beliefs or myths about whelks and whelk fishing that were shared by whelk fishers whilst interacting with them during the three month survey period. These form part of the traditional lore and cultural value of this fishery. One common belief among whelk fishers is that once whelk is being harvested, the sea gets rough. This phenomenon is believed to worsen if fishers shout out the word "bwigo" during harvesting. Consequently, the creole word "wosh" meaning stones is used among fishers during whelk harvesting to refer to whelks. Whelk is also believed to have certain medicinal and demonic healing properties; amongst them is its apparent effectiveness in treating certain speech defects, asthma and carbuncles, as well as being able to ward off witchcraft curses.

DISCUSSION

The whelk fishery, considered a minor fishery in Saint Lucia, nevertheless has an estimated fishing capacity of 108 fishers (predominantly male) distributed right around the island among 11 coastal communities, and it contributes significantly to the multi-occupational livelihood strategies of most, accounting for more than a quarter of the annual incomes of 60% of the fishers. The fishery also has traditional and cultural value and contributes to the wellbeing of the communities in which whelk fishers reside, adding to food security and strengthening social

networks; attributes which are often over looked in fisheries management (Armitage et al. 2008). Furthermore, the fishery is conducted mainly in the summer months, coinciding with the 'off season' for the important oceanic pelagic fishery in Saint Lucia (Sanderson 1995, DOF 2012), thereby increasing the significance of the whelk fishery in terms of employment opportunity for fishers and in helping to meet market demand for seafood during this period.

Most of the people involved in the whelk fishery are low income earners and whelk harvesting is part of a diversified livelihood strategy, with additional sources of income being derived from several alternative occupations within and outside the fishing industry. This multi-occupational strategy is typical of small scale artisanal fishers (e.g. Berkes et al. 2001, Staskiewicz and Mahon 2007) and of many other coastal marine resource users in the Caribbean (e.g. Cooke et al. 2007), and corroborates the idea that such small scale fisheries are both socially and ecologically complex systems that need to be considered together in management efforts (Berkes and Folke 1998).

The small-scale, semi-commercial/subsistence nature of the whelk fishery and the artisanal fishing methods and practices of Saint Lucian whelk fishers are very similar to those described for other whelk fisheries in the region (Schmidt et al. 2002, Toller and Gordon 2005, Jimenez 2006, Osorno Arango et al. 2009). Likewise, there is also an awareness amongst fishers in Saint Lucia, as in the other whelk fisheries described, of the impacts of heavy fishing on the vulnerable whelk resource and the need for some form of fisheries management. One contrast however, is the current lack of any whelk-specific regulations or management measures in Saint Lucia, although there are plans to implement measures that would lead towards the conservation and sustainable management and use of whelks on the island, including enactment of the revised fisheries legislation to control whelk harvesting.

Typically, management measures for whelk fisheries across the Caribbean include one or more of the following regulations: a minimum legal size; a closed season aimed at protecting reproductive whelk; a personal bag limit; and restricted or no take areas (Table 3). However, we are unaware of any comprehensive species-specific management plans for whelk fisheries, although the Cayman Islands has a Species Action Plan for the conservation of whelk under their National Biodiversity Strategy and Action Plan (DaCosta-Cottam et al. 2009).

Notably, Saint Lucian whelk fishers thought that some management action should be implemented in their own fishery; the most frequently suggested measures being a minimum harvest size and a closed season to protect breeding adults, as seen for other whelk fisheries in the region. However, it is clear that if such measures were to be adopted, careful consideration would need to be given to selecting an appropriate minimum size and closed season, and how a size restriction might be enforced.

Whilst the majority of the current catch is above the smallest minimum legal size suggested for Costa Rica (40 mm shell diameter, Schmidt et al. 2002), those used elsewhere (62 – 63.5 mm, Table 3) would have a significant impact on current landings in Saint Lucia (Figure 2). Some thought should also be given to the notion of a maximum legal size to protect the most valuable (fecund) larger shells (see Vermeij 2012). Furthermore, the stated 'best months' for whelk fishing in Saint Lucia fall in the summer period, when whelks are believed to be reproductively active at least in the northern Caribbean (Robertson 2003, Bahamas: Debrot 1990, Bell 1992; Puerto Rico: Randall 1964), although there is some suggestion of all year activity in Los Roques (Castell 1987, cited in Bell 1996). The current regulated closed seasons for whelk vary considerably among countries (Table 3). This illustrates the importance of further biological research to determine the reproductive season, and size at first maturity for whelk in Saint Lucia, such that stakeholders can make informed choices.

The unpredictable locations and erratic frequency of whelk landings all around the island make formal monitoring of the fishery very difficult and possibly would be more costly than the value of the landings. Given the nature of the fishery, a community-based or co-management arrangement is likely to be more feasible and more appropriate than a top down government-focussed approach with formal monitoring and control. Other features of the fishery that will increase the likelihood of a community-based approach being successful include the relatively high fidelity of fishers to harvesting areas, the location of harvest sites close to fishers' own communities, and the fact that whelk fishers normally harvest together in

Table 3. Example of regulations for harvesting whelk, *Cittarium pica*.

Country	Regulation	Source
Puerto Rico	Minimum size (63.5 mm) Marine reserves	Jimenez (2006) DRNA (2007)
United States Virgin Islands (USVI)	Minimum size (62 mm) Closed season (Apr. 1 – Sept. 30) Bag limit (1 gal/person/day)	Toller and Gordon (2005)
Cayman Islands	Closed season (May 1 – Oct. 31) Bag limit (2.5 gal/person/day) Fishing license required for non-nationals	DaCosta-Cottam (2009)
Belize	Minimum size limit (62 mm) Closed season (Oct 1 – Jan 1) Fishing license required Shell & meat export license	Government of Belize (2006)
Bermuda	Fully protected	Sartwell et al. (n.d.)
British Virgin Islands (BVI)	Minimum size (62 mm) Closed season (Aug 15 – Oct 31) Fishing license required	Government of the British Virgin Islands (2012)

groups with a common purpose (Pomeroy and Berkes 1997). Furthermore the groups were observed to already have some established "codes of conduct" for responsible fishing, including their own 'restraint' against harvesting small whelks, and not returning to the same area without ensuring some time for 'recovery' of the whelk population.

Another feature in favour of a management approach requiring high participation by stakeholders is the relatively young age of whelk fishers compared with many of the other small scale fisheries in neighbouring Caribbean islands (e.g. Gill et al. 2007, Arthurton and McDonald 2010, Georges et al. 2010, Maraj et al. 2011), and the fact that all have completed formal education up to primary level and many to secondary level. Such a young cadre of literate whelk fishers may not be able to provide a historical perspective, or information on the past status of the whelk fishery; however, such attributes provide an opportunity for training and capacity building to help inform and empower fishers to lead community-based management initiatives towards sustainable whelk use and management practises in Saint Lucia. Furthermore, a majority of the whelk fishers have already observed negative changes in whelk size and abundance over recent years and shown a good understanding of likely proximate and root causes; and the need for a broader approach to management that protects not only the whelks but their habitats and by extension the watersheds draining into these nearshore areas.

Although co-management is not a panacea for all problems in small-scale, artisanal fisheries, it can be viewed as a logical approach to continuous problem-solving through the creation of essential stakeholder partnerships to address the many challenges associated with the management of complex social-ecological systems (Carlsson and Berkes 2005). Furthermore, Saint Lucia has already demonstrated a willingness to devolve power and engage in meaningful co-management of its coastal marine resources with projects involving participatory planning and community-based management of coral reefs, sea urchins, sea moss and mangroves (e.g. Smith and Berkes 1991, Sandersen 1995, Reynard 2001).

CONCLUSION

This study provides the first formal description of the small scale whelk fishery in Saint Lucia and highlights the importance, extent, and characteristics of this minor fishery and its contribution to, and links within, the local fisheries sector. It has filled some significant knowledge gaps and highlights aspects of this fishery that would make it suitable as a candidate for some form of community-based stewardship set within a broader framework of integrated coastal area management. The study also highlights the need for further biological study to determine the local reproductive season and size at sexual maturity to assist fishers and other stakeholders in planning appropriate management measures. There is also a need for catch and effort monitoring if the actual volume and economic value of whelk landings is to be determined, which might be important to justify proposed management expenses.

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