

The Role Livelihood Outcomes and Strategies Play in the Adaptive Co-management of the Sea Urchin Fisheries in Barbados and St. Lucia

El Papel de las Estrategias de Subsistencia y los Resultados del Juego en la Cogestión Adaptativa de la Pesca del Erizo de Mar en Barbados y Santa Lucía

Les Stratégies de Subsistance Rôle et les Résultats Jouer dans la Co-Gestion Adaptative de la Pêche de l'Oursin à La Barbade et à Sainte-Lucie

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ABSTRACT

The sea urchin fisheries of Barbados and St Lucia have provided supplemental income for families living in coastal communities for many years. These fisheries have also shaped the social history and influenced the culture of communities that traditionally take part in harvesting and related activities. In recent times, low abundance of sea urchins has resulted in legislated multi-year closures of the fisheries. In Barbados the last open season occurred in 2004, while St. Lucia had only a three-day open season in 2009 after being closed for the prior four years. These closures suggest that current regulatory management measures are not producing results that sustain livelihoods in the fishery. The adoption of an adaptive co-management (ACM) approach which empowers resource users and other stakeholders to manage their resources and protect their livelihood may provide a solution. Implementing such an arrangement requires commitment to a long term institution building process. It is likely to encounter many challenges. Assessing the feasibility of implementing this innovative approach to management is part of doctoral research in five sea urchin harvesting communities in Barbados and St. Lucia. Livelihoods analyses were conducted in Silver Sands and Consett Bay in Barbados and Anse Ger, Laborie and Vieux Fort in St. Lucia. In each community a short questionnaire was administered at the household level to investigate assets, vulnerabilities, institutions, livelihood strategies and outcomes. This paper presents preliminary findings and suggests how livelihood strategies and outcomes can develop and sustain conditions that favour successful ACM.

KEY WORDS: Livelihoods, adaptive co-management, sea urchin fisheries, Barbados, St. Lucia

INTRODUCTION

In Barbados and St. Lucia there are small-scale, culturally important fisheries for the white sea urchin (*Tripneustes ventricosus*) commonly referred to as 'sea egg'. These fisheries provide supplemental income for persons living in coastal communities when they are not employed in the seasonal (November to June) pelagic fisheries. Residents of coastal communities become involved in the fishery because of their love for the sea and because of family members who pass down ecological knowledge and instructions for mastering harvesting and processing skills. During an open season for sea urchins, processing groups work on the beach front creating an atmosphere for information exchange, social interaction, and economic activity. During the last open season in Barbados in 2004 the price for a two litre container filled with roe, the volume taken from about 120 sea urchins, fetched a price of US\$60 (Allan Bradshaw, Personal communication). In 2009, St Lucian sea egg vendors sold roe by the pound for the price of US\$11, and charged US\$6 for the traditional 'coucou' (Figure 1b) (Xystus Clerice, Personal communication 2009).

The preparation for the fishery also provides employment. In Barbados persons specialize in knitting sea egg nets which are sold for an average price of \$25 per net (Steven Bourne, Personal communication 2009). Other preparations in Barbados, which previously employed the skills of persons involved in the fishery but did not directly generate income included folding the sea grape leaves into cones for the traditional marketing method (see Figure 1a). In addition, the agave flower stalk is dried and used as a floating maypole from which sea egg nets or bags are suspended. In St. Lucia preparations involve constructing traditional rafts called 'dories' or 'shaloop' in Creole (Pena et al. 2010) which were made from banana stalks in the past and most recently constructed using wood from breadfruit trees (Figure 1d) (Thaddeus Simeon, Personal communication 2009).

Over the years, fishing has evolved from using traditional gear and methods such as the floating maypole (Figure 1c) to nets attached to buoys. The traditional rafts in St. Lucia have been replaced by motorized boats (pirogues) (Figure 1d) allowing more efficient methods of harvesting. In Barbados, the maypole has been replaced by motorized day boats and ice boats (Figure 1d). The sedentary nature of sea urchins makes them vulnerable to overexploitation, and increasingly efficient harvesting equipment has contributed to reducing resource populations.

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Figure 1. Traditional features of the sea egg fishery: (a) Traditional Marketing of sea eggs using sea grape leaves (Barbados) (b) Traditional marketing of sea eggs in St. Lucia (c) Maypole (agave flower stalk) with a net attached (d) Traditional raft called a Dory (Photo credits (a) E. Fitzpatrick (b) S. Cox (c) G. Franklin (d) S. Cox (e) C. Parker)

boats (Figure 1d). The sedentary nature of sea urchins makes them vulnerable to overexploitation, and increasingly efficient harvesting equipment has contributed to reducing resource populations.

METHODS

Five communities were selected in Barbados and St. Lucia to be studied based on their traditional involvement in the sea egg fishery, and the past to present participation of divers in the annual in-water population surveys. These communities were Silver Sands and Consett Bay in Barbados, and Anse Ger, Laborie and Bruceville, (in Vieux Fort) in St. Lucia.

The graduate research undertaken primarily employed ethnographic methods including participant observation and key informant interviewing. For the livelihood aspect of the research, a key informant was identified and selected based on their involvement in population surveys, vast traditional knowledge and on the advice of senior fisheries officials. The informant was consulted to provide background information about the community, provide a brief history, and highlight environmental and physical infrastructural changes.

Consultations used various approaches, including informal and semi-structured interviews, community walks

-through and participant observation of day-to-day activities. The walk-through involved the informant pointing out sea egg landing and selling points, households where sea egg divers and breakers resided and other key places of interest related to the sea egg fishery. In addition, the informant would introduce the researcher to sea egg divers during these consultations. During the last open season (29th September– 1st October, 2009) in St. Lucia the researcher accompanied three groups of divers on their harvesting trips to observe diving practices, sea urchin fishing grounds and fishing ranges.

In order to delineate the boundary within which a livelihood analysis would take place, a Google Earth image of the area was printed and used as a tool to assist the informants in outlining what they defined as their sea egg community inclusive of traditional landing and selling points. To test the validity of the boundary a list of divers who operated from that location during the most recent open season was provided by the key informant. The boundary was considered valid if seventy-five percent or over of the sea egg divers listed actually resided within the boundary. In the communities of Silver Sands and Laborie where more than 30 divers resided, the original boundary had to be adjusted through consultations with the key informant to ensure that the majority of divers lived within the

boundary. After the adjustment the informants and researcher re-validated the boundaries (see Figure 3) taking into account limitations of time and resources. No Google Earth image was used for the community of Anse Ger because it is obscured in available Google Earth images by a large amount of cloud cover. In this case, the boundary was delineated during a community walk-through while simultaneously counting houses.

After the boundary was delineated, houses within the boundary were counted while walking or driving through the community using a clicker counter. Forty percent of the houses counted were surveyed to stay within a reasonable budget for data collection and ensure sufficient statistical power (see Figure 4).

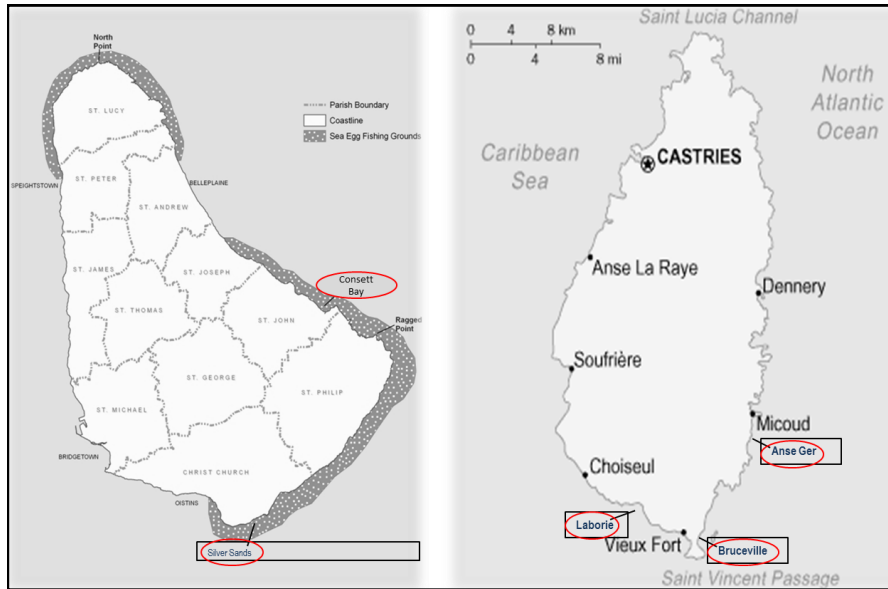


Figure 2. Location of the five communities under study in Barbados and St. Lucia.



Figure 3. Boundaries delineated in four out of the five communities surveyed. Top row from left: Silver Sands and Consett Bay (Barbados). Bottom row from left: Laborie and Vieux Fort (St. Lucia).

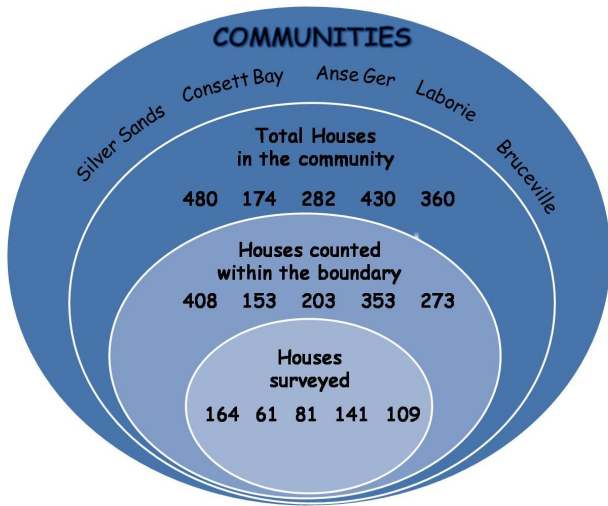


Figure 4. Stacked venn diagram illustrating the sampling frame used for livelihood analysis.

A survey instrument was designed to investigate livelihood vulnerabilities, strategies, and outcomes and assess assets. This survey was administered at the household level using a random starting point with interval sampling. Every other house on the street was sampled wherever possible. In some areas, houses did not conform to the ideal street arrangement, in this case houses were chosen at random. In addition to the informants' advice, there were some helpful community members, referred to as 'Gatekeepers', who assisted by providing information on what time residents were going to be available. In addition to the answers from the prepared questions, some residents provided information about their experiences in the fishery, which were noted. Additional notes were also taken from observation of features missed in the community walk-through to assist with the description of the community's involvement with the sea egg fishery.

Livelihood analyses in the five study communities were conducted over a period of thirteen months. Questionnaires were administered to households between the hours of 4:00 - 6:30 pm during week days, and late morning and early afternoon on Sundays. These times were chosen based on the advice of key informants and gate keepers as to the availability of community residents. Figure 5 below illustrates the field days in the various communities.

In Barbados, one field assistant was hired to accompany the researcher in each community. In St. Lucia, the researcher enlisted the help of a team of three teachers to assist with data collection and the translation of native Creole to English.

RESULTS

The five communities surveyed showed relatively high percentages of involvement in the sea urchin fisheries of Barbados and St. Lucia (see Table 1). Bruceville had the highest percentage of household (HH) involvement when

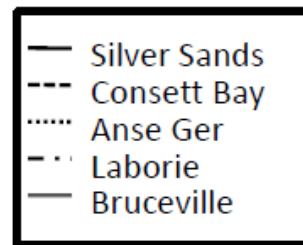
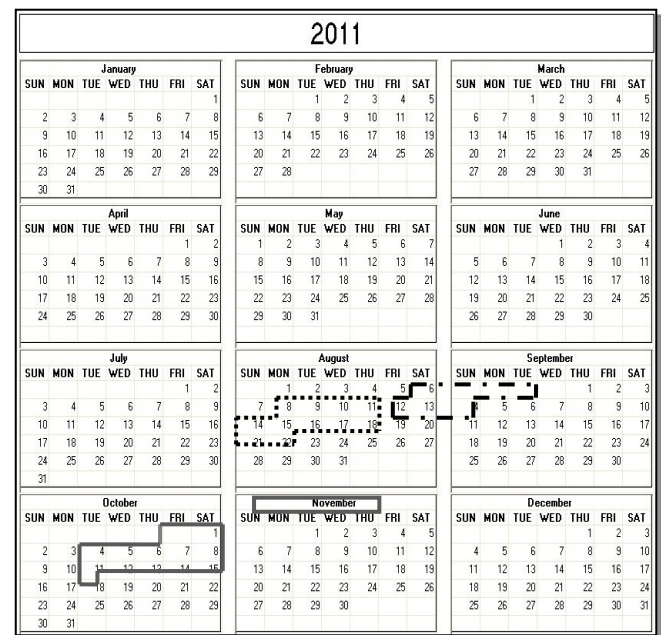
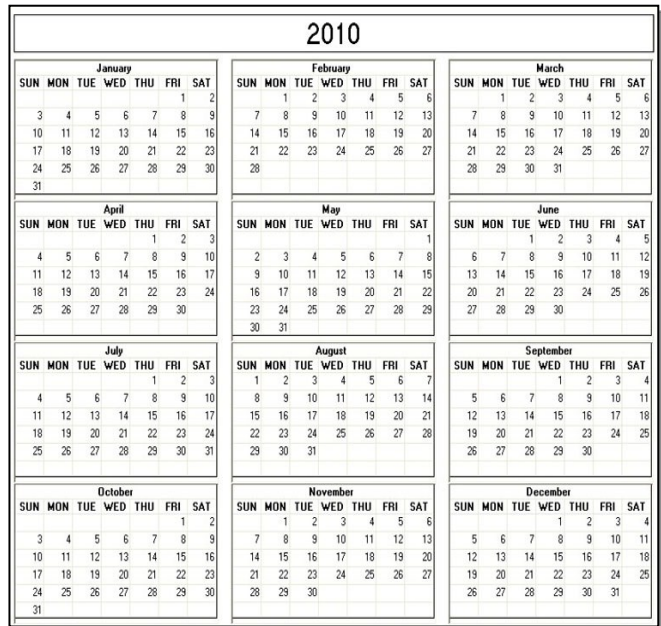


Figure 5. Calendar illustrating time period of field days in the five study communities.

compared to the other communities. The percentage sea urchin fishery involvement of households within the bounded areas was higher in St. Lucia than in Barbados.

Individuals who took part in the sea urchin fisheries of Barbados and St. Lucia identify themselves as performing the roles listed in Table 2. A sea egg diver harvests urchins by free diving and 'picking' them up from the sea bottom. A breaker processes the urchins by cracking them open using a spoon, removing the unwanted parts then scoops out the roe. Vendors sell the roe by the pound in St. Lucia or in 16 oz., 1 litre, or 2 litre containers in Barbados. They also prepare the sea urchin roe in traditional ways (cou-cou or sea egg with grape leaf), then sell to customers.

Some persons specialize in one particular role while others perform different roles to optimize profits. Table 3 shows the average weekly income that individuals can make based on their role in the fishery during the last open season for each country. The last open season in Barbados occurred in 2004 and lasted two weeks. In St. Lucia, the last open season was in 2009, and its duration was only for

three days. Those persons who perform all three roles can make on average US\$978 in Barbados and US\$519 in St. Lucia. With a maximum reported income of US \$2,500 (Barbados) and US \$1,852 (St. Lucia).

In the absence of an open season sea egg divers, breakers and vendors are compelled to find alternative income earning activities. Individuals who take part in the urchin fisheries under study usually have more than one income earning activity. Based on the results of the survey, it was found that in Silver Sands the percentage of individuals was 40 %, Consett Bay (38.5%), Anse Ger (43%), Laborie (27 %) and Bruceville (20%). Figure 6 shows the livelihood activities which those involved in the sea urchin fisheries ranked as most important to them since 2005. The percentage of persons who rank a job in the fishing industry as most important never exceeded 48% in any community. This shows that persons who are not employed in the fishing industry take part in the sea urchin fishery. It may also suggest that persons may be entering other fields due to the multi-year closures of the sea urchin fisheries under study.

Table 1. Percentage of houses involved in the fishery.

Country	Community	Houses counted	Houses surveyed	% Households involved in fishery
Barbados	Silver Sands	408	164	32 %
	Consett Bay	153	61	52 %
St. Lucia	Anse Ger	203	81	36 %
	Laborie Village	353	141	54 %
	Bruceville	273	109	61 %

Table 2. Roles individuals play in the sea urchin fisheries and the percentage of persons surveyed who are involved.

Community Role	BARBADOS			ST. LUCIA	
	Silver Sands	Consett Bay	Anse Ger	Laborie Village	Bruceville, Vieux Fort
Diver	15	13	26	38	33
Diver/Breaker	13	2	8	36	21
Diver/Breaker/Vendor	11	7	-	29	7
Breaker	20	14	13	32	33
Breaker/Vendor	8	-	-	1	1
Vendor	-	2	-	2	1
TOTAL	67	38	47	138	96
% of individuals involved out of all fishery HH	40 %	49 %	46 %	67 %	58 %

Table 3. Comparison of average weekly income (US dollars) across the five study communities during the last open season.

Community Role	BARBADOS ¹			ST. LUCIA ²	
	Silver Sands	Consett Bay	Anse Ger	Laborie Village	Bruceville, Vieux Fort
Diver	\$ 600.00	\$ 600.00	\$ 296.00	\$ 370.00	\$ 556.00
Breaker	\$ 250.00	\$ 300.00	\$ 175.00	\$ 185.00	\$ 222.00
Vendor	-	\$ 500.00	-	-	-

¹Last open season (2004)

²Last open season (2009)

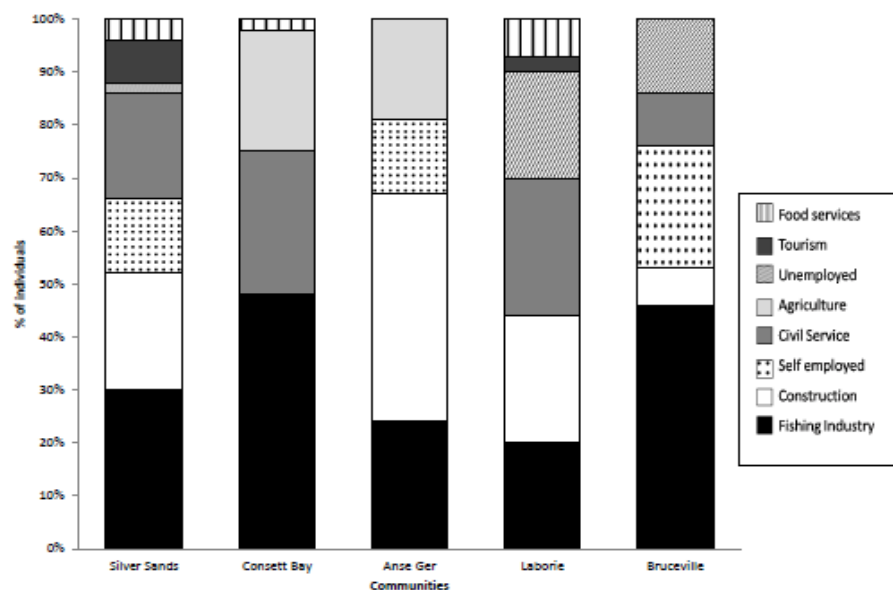


Figure 6. Bar graph showing the livelihood activities which those involved in the sea urchin fisheries ranked as most important since 2005.

DISCUSSION

There are several initial determinants of livelihood strategies. A person may be born, socialised, and apprenticed into an inherited livelihood and may in turn create a new household or households in the same way of life (Chambers and Conway 1991). This is the case of those persons involved in the sea urchin fisheries in Barbados and St. Lucia. The culture of diving and processing is passed down through generations. Due to circumstances largely determined by the social, economic and ecological environment in which the fisheries are positioned, individuals may have to improvise livelihoods.

The closure of the sea urchin fisheries for a number of years has contributed to the loss of supplemental income of sea egg divers, breakers and vendors. The sea urchin fishery is very lucrative, during an open season an individual can make a substantial profit due to low investment costs. In the absence of this supplemental income, those usually involved in the sea egg fishery find alternative income earning activities to support their families. Persons who are already engaged in the fishing industry exploit reef fishes, jacks, red snappers, conch, lobster and reef octopus (commonly called sea cat in Barbados and chatou in St. Lucia). Other individuals employ income earning activities in the construction industry, while others settle for just one main income earning activity.

While some persons have chosen to employ alternative income earning activities, others have created an illegal limited entry, high priced sea egg fishery

(Christopher Parker Personal communication). In Barbados, the black market price for a 2 litre container is US\$100 (Steven Bourne Personal communication) and in St. Lucia US\$22 per pound (Adrian Kisna Personal communication). Those divers willing to risk being arrested by the authorities and pay fines or serve time in prison take part in illegal harvesting. Poachers have adapted their fishing gear to facilitate the quick release of nets attached to buoys to avoid being caught by the enforcement authorities (Steven Bourne Personal communication). In addition, they have also created a warning system where spouses of the divers and other community members make signals (waving of a towel) to alert divers that the law enforcement authorities are approaching (Emelda Bourne Personal communication).

The occurrence of poaching threatens the sustainability of livelihoods in the sea urchin fisheries under study. Having a sustainable livelihood involves securing the ownership of or access to, resources and income-earning activities including reserves and assets to offset risk, ease shocks, and prepare for unforeseen events. Sustainable livelihoods provide opportunities for the next generation and contribute net benefits to other livelihoods at the local level in the short and long term (Chambers and Conway 1991).

The adoption of an ACM approach which empowers resource users and other stakeholders to manage their resources can lead to sustainable livelihoods. An ACM approach is a long term management structure that permits stakeholders to share management responsibility within a

specific system of natural resources, by taking part in a dynamic, on-going, self-organized process of learning by doing. This process tests and revises institutional arrangements and ecological knowledge (Ruitenbeek and Cartier 2001, Folke et al. 2002). An ACM approach can be tailored to specific places and situations, and supported by and working, with various organizations at different scales (Olsson et al. 2004).

Employing an ACM approach can support sustainable livelihoods by creating partnerships with stakeholders and encouraging actors to create reasonably clear property rights to the resources of concern. ACM represents a potential innovation in natural resource governance under conditions of change, uncertainty and complexity (Plummer and Armitage 2007). This novel approach to management promotes the provision of training, capacity building and resources for stakeholders which can create other livelihood opportunities. In the case of the fisheries under study, where some individuals who were settling for just one income earning activity, they can be trained or taught a new skill so that they can employ another way of earning income.

Facilitating the exchange of traditional knowledge between stakeholders and the sharing of different knowledge systems and sources can influence the belief systems of illegal harvesters. If these illegal harvesters clearly understand the serious consequences that their actions will cause, then they will be influenced to adhere to the laws which are there to protect fisheries and by extension ensure its sustainability.

What role can livelihood strategies and outcomes play in ACM of the sea urchin fisheries in Barbados and St. Lucia? Those individuals who developed positive livelihood strategies have recognized that the resource is in a crisis. Their choice to pursue other income earning activities allows the resource to recover. Their willingness to facilitate change, which is demonstrated by their actions, is the foundation needed to implement ACM. Resource users should be able to identify with a management strategy that encourages learning by doing in a situation of uncertainty because of its similarity to their way of life. Experimenting with new strategies and learning from mistakes is all a part of survival. Similarly, ACM emphasizes the need to test and revise actions as a part of the learning process.

The livelihood strategies and outcomes of individuals involved the sea urchin fisheries in Barbados and St. Lucia is integral in enabling the conditions that will facilitate successful ACM. Illegal harvesting, which is a negative livelihood strategy, is one of the greatest challenges of implementing an ACM approach. Having an adaptable portfolio of management measures and providing training and capacity building may contribute to a solution and the provision of sustainable livelihood opportunities for future generations.

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