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A HISTORY OF CHANGE AND REORGANIZATION: THE PELAGIC LONGLINE FISHERY IN GOUYAVE, GRENADA

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ABSTRACT This paper traces the history of the pelagic surface longline fishery in Gouyave, Grenada, noting 4 major periods of change from pre-1985 to 2004. Reconstructed from document reviews, newspaper articles, oral history, and key informant interviews 1) the pre-1985 period was the time when the longline was introduced and popularized by the Cubans, 2) the period of institutionalization and technology development (1986–1990) corresponded to the strengthening of institutional arrangements and the initial improvements in technology, 3) the Coastal Fisheries Development Project (CFDP) of 1991–1999 was the period of international donor support and further technology change in longline construction, and finally 4) the 2000–2004 period marked innovation, training and fish quality control for export markets. The main point of the paper is that fisheries management is about the management of change. Fishery managers need to learn to deal, not only with technology change, but also with surprise and variability related to biophysical change (e.g., hurricanes), change in markets, and other external drivers such as international policies. Key considerations for managers to deal successfully with change include: learning from experience, capacity building, and the need to engage cooperatively with fishers and communities, the private sector, and non-governmental organizations.

RESUMEN Este documento relata la historia de la industria pesquera del palangre de superficie para la captura de los pelágicos basada en Gouyave, Grenada, señalando 4 periodos principales de cambio entre 1985 hasta 2004. Elaborada mediante la revisión de documentos, artículos de periódico, relatos orales y entrevistas de los informantes claves: 1) el periodo anterior a 1985 cuando el palangre fue introducido y popularizado por los Cubanos, 2) el periodo de la institucionalización y desarrollo de la tecnología (1986–1990) correspondiente al fortalecimiento institucional y los inicios en el mejoramiento tecnológico, 3) el Proyecto de Desarrollo de la Pesca Costera (CFDP) de 1991–1999 fue el periodo de la apoyo internacional por parte de los donantes y un mayor cambio en la tecnología fabricación de los palangres, y finalmente 4) el periodo del 2000–2004 que marca la innovación, el entrenamiento y el control de calidad del pescado para los mercados de la exportación. El punto principal de este trabajo es si el manejo de las pesquerías tiene que ver con el cambio en su manejo. Los gerentes pesqueros necesitan aprender a manejarse no solo con cambios en la tecnología sino también con la sorpresa y la variabilidad relacionadas a cambios biofísicos (ej. huracanes), cambios en los mercados, y otras fuentes externas tales como políticas internacionales. Consideraciones claves para que los gerentes se puedan manejar exitosamente, incluido los cambios: aprendiendo de la experiencia, capacidad institucional, y la necesidad de comprometerse de manera conjunta con los pescadores y las comunidades, el sector privado y las organizaciones no gubernamentales.

INTRODUCTION

A fishery often undergoes changes in response to various factors: biological (e.g., resource availability), economic (e.g., market demand), and political (e.g., changes in resource management policies). Many of these changes are unpredictable and/or beyond the capabilities of the resource manager, as discussed, for example, by Charles (2001) who refers to the 'illusion of certainty' and the 'fallacy of controllability' in fisheries management. Even though the conventional philosophy of management is based on a tradition that assumes predictability and control, our ability to actually predict ecosystem behavior and resource use trajectories are limited, and models based on equilibrium thinking often do not work (Wilson 2006).

Marine ecosystems on which fisheries are based are complex adaptive systems characterized by constant change and multiple equilibria (Levin 1999; Gunderson and Holling 2002). They are subject to natural disturbances (e.g., hurricanes), changes originating from within the system, and to external drivers created by human actions, as increasingly recognized by global studies such as the Millennium Ecosystem Assessment (MA 2005). If fisheries are complex systems, then fishery problems need to be treated as a complex system problem. As such, management processes cannot follow blueprints; rather, they should be adaptive and flexible, able to deal with uncertainty and surprise, involve partnerships to deal with issues at different levels of organization, and build capacity to adapt to change (Berkes et al. 2001).

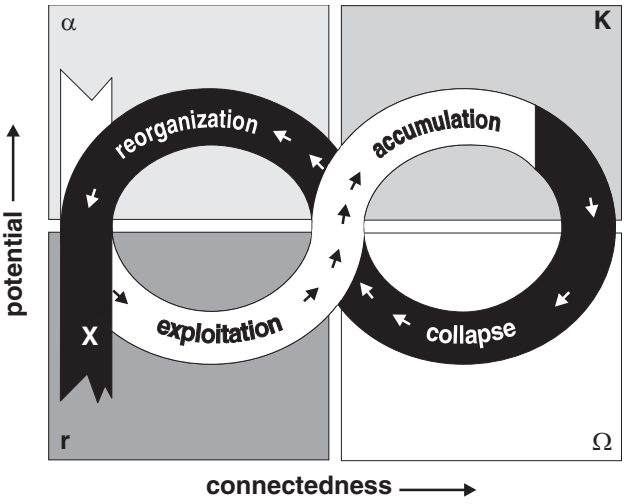

Figure 1. The adaptive renewal cycle. The cycle reflects changes in 2 properties: y-axis, the potential that is inherent in the accumulated resources and structure; x-axis, the degree of connectedness among controlling variables. The exit (marked with an X) from the cycle indicated at the left of the figure suggests, in a stylized way, the stage where the potential can be leaked away and where a shift is most likely into a less productive and organized system. The shaded part of the cycle is termed the 'backloop' and concerns the release and reorganization phases (modified from Holling 2001, Gunderson and Holling 2002). Terms of the adaptive cycle are: exploitation (r) period; accumulation (K) period (termed conservation phase by Holling 2001); collapse (Ω) period (termed release in Holling 2001) and reorganization (∝) period called the 'back loop'.

In this paper we use the resilience approach and the idea of adaptive renewal cycles to analyze the change in a Caribbean fishery. As proposed by Holling (2001), the heuristic model of the adaptive renewal cycle consists of 4 phases (Figure 1). It starts with an exploitation (r) phase, followed by accumulation (termed conservation phase K, by Holling 2001). This 'front loop' is followed by a collapse (termed release phase Ω) and reorganization (∝) period, called the 'back loop.' The front-loop coincides roughly with the period of growth and development of a fishery. The back-loop, often neglected in resource management, is usually triggered by a disturbance and tends to occur over a short time period. The adaptive renewal cycle can provide insights into the response of fisheries to environmental, social, and economic change, as illustrated by cases in Florida (Gunderson et al. 2002) and southern Brazil (Seixas and Berkes 2003).

As we show with our Caribbean fishery case, the back-loop raises important considerations in resource management (Berkes et al. 2003). The back-loop is a time for both crisis and renewal, and provides a fertile environment for experimentation. It is often this 'window of opportunity' created by collapse and reorganization that shapes the subsequent developments in a resource system (Holling 2001, Gunderson and Holling 2002). In approaching the phenomenon of change in a complex world, the resource manager needs to consider a range of factors—ecological, social, technological, and other (Plummer and Armitage 2007). Hence our unit of analysis in this paper is not the ecological system by itself or the social system by itself, but the fishery as an integrated social-ecological system (Berkes and Folke 1998).

The objective of this paper is to analyze how the pelagic surface longline fishery in Gouyave, Grenada, deals with change. We use the Holling adaptive renewal cycle to examine change as technological, social, and institutional innovation in what we assess to be 4 cycles in the Gouyave fishery. The paper highlights changes in behavior, activities, and knowledge in maintaining a viable fishery by conserving sufficient memory (information, knowledge and experience) to allow for innovation, learning, and reorganization. We conclude by drawing lessons from the case and finding 3 characteristics of managing change.

STUDY AREA AND METHODS

Study area

Grenada is an island in the Eastern Caribbean, between 11º00' and 12º30' north latitude, with a total area of 311 km^2 (Figure 2). The town of Gouyave, in the parish of St. John's, is located on the west coast of the island about 19 km north of St. George's town. The estimated population in Gouyave is 2,100 about 2% of the national population. Of the estimated 2,200 fishers in Grenada, over 300 operate from Gouyave, and most of these (82%) are involved in longline fishing. These fishers operate 100 active longline fishing vessels of 3 types. The first, open pirogues, are semi-decked, wooden, 5–7 m in length, powered by a single 15–40 HP outboard engine, and equipped for multiple-purpose fishing. The second, cabin pirogues, made from wood and/or fiberglass are 7–9 m in length, powered by two 40–75 HP outboard engines, and equipped for longline fishing. Third, launchers, made from wood and fiberglass are 9–15 m in length, powered by a 130–300 HP inboard diesel or gas engine, and equipped for overnight fishing. Longline fishers target pelagic species including yellowfin tuna (*Thunnus albacares*), white marlin (*Tetrapturus albidus*), blue marlin (*Makaira nigricans*), common dolphinfish (*Coryphaena hippurus*), sailfish (*Istiophorus albicans*), swordfish (*Xiphias gladius*), wahoo (*Acanthocybium solandri*), bigeye tuna (*Thunnus obesus*), and blackfin tuna (*Thunnus atlanticus*).

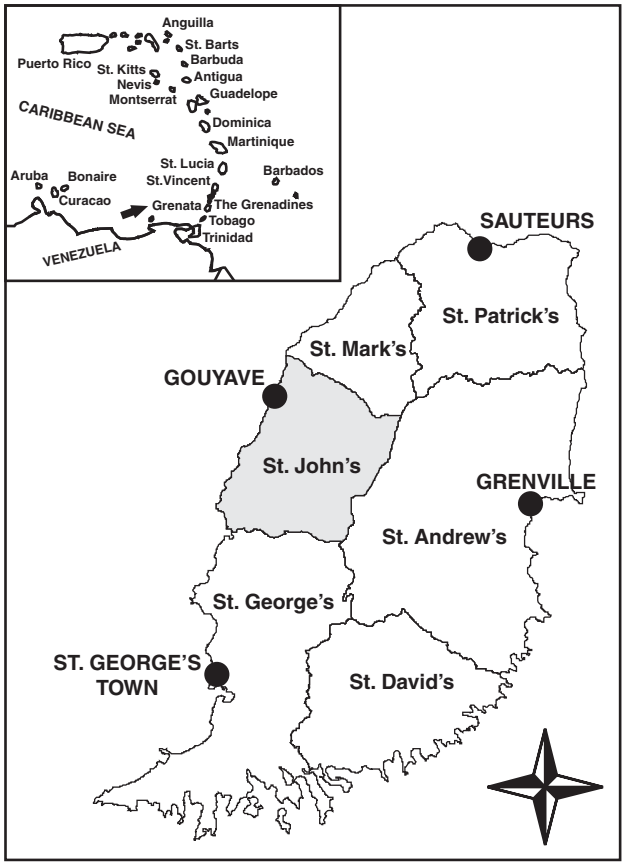

Figure 2. The study area of Grenada and the Eastern Caribbean.

Methods

The history of the surface longline (or simply longline) fishery was reconstructed and documented through literature/document review, newspaper review, oral history, and key informant interviews. Literature and documents were gathered from government correspondents, libraries, and newspaper articles dating back to the 1980s and were provided by Osmond Small, the former President of the St. John's Fishermen Association. An oral history technique was used to gather information on the history of fishing in Gouyave. Twelve key individuals provided detailed information on the history of the longline fishery, marketing, and roles and activities of the Fisheries Division. Research findings from the literature and document reviews were supplemented with oral history and interviews to check for consistency. Following Hurricane Ivan which destroyed the island's infrastructure in September 2004, the researcher returned to the island in April 2005 to gather information on how the fishery reorganized after the crisis. This was accomplished with semi-structured interviews conducted with community members, fishers, the Grenada Community Development Agency (GRENCODA; a local non-governmental organization), and staff of the Fisheries Division.

RESULTS

We traced the history of the pelagic fishery based on 4 time periods (Figure 3). The first, the pre-1985, was the period when the Cuban longline technique was introduced. The second, institutionalization and technology development during 1986–1990, was the period of strengthening institutional arrangements and the initial improvement in longline fishing technology. The third, the Coastal Fisheries Development Project (CFDP) between 1991 and 1999, was a period of further donor support and technological changes in line construction. Finally, the period from 2000–2004 was a time of technological innovation.

Pre-1985 period

Traditionally, fishers in Gouyave used the '3-line' fishing (handline technique) to catch pelagic fish. By the early 1970s, observations of the effectiveness of the longline techniques used by illegal vessels led fishers to design and experiment with this gear (Grant and Baldeo 2006). In 1979, the People's Revolutionary Government (PRG) embarked on a number of projects to improve fishing. They established the Grenada Fisheries Training School in True Blue St. George's with technical assistance from the Government of Cuba, where students were trained in pelagic fishing techniques (longline, pole and line, gillnet) and gear construction. The Grenada Fisheries Company was also established to improve the harvesting of fish for domestic consumption. The company had a Fish Processing Plant to smoke, fillet, and salt fish for local and export markets and a National Fisheries Company to store and market wholesale and retail fish (J. St. Louis, per. comm., Fisheries Division, St. George's, 2003). To support local fisheries, the government encouraged the development of fishermen cooperatives (Sandford and Vigilant 1984).

The fishery grew steadily between 1980 and 1981 as production at the Fish Processing Plant increased from 18 kg/day to 1,588 kg/day, due mainly to the production of canned tuna and flyingfish in tomato sauce for the export market and fillets and smoked fish for the local market (Aberdeen 1982). By 1982, the fishery started showing signs of stress as problems with poor organization and management left the National Fisheries Company unable to cover expenses. Likewise, a world recession in 1980–1982 also reduced the demand for Grenadian goods (Aberdeen 1982, Sandford and Vigilant 1984).

In 1983, the United States (USA) invaded Grenada and in the process some fishing infrastructure (boats, agro-industry) were destroyed. Gouyave fishers who were attending the Fisheries Training School and working at

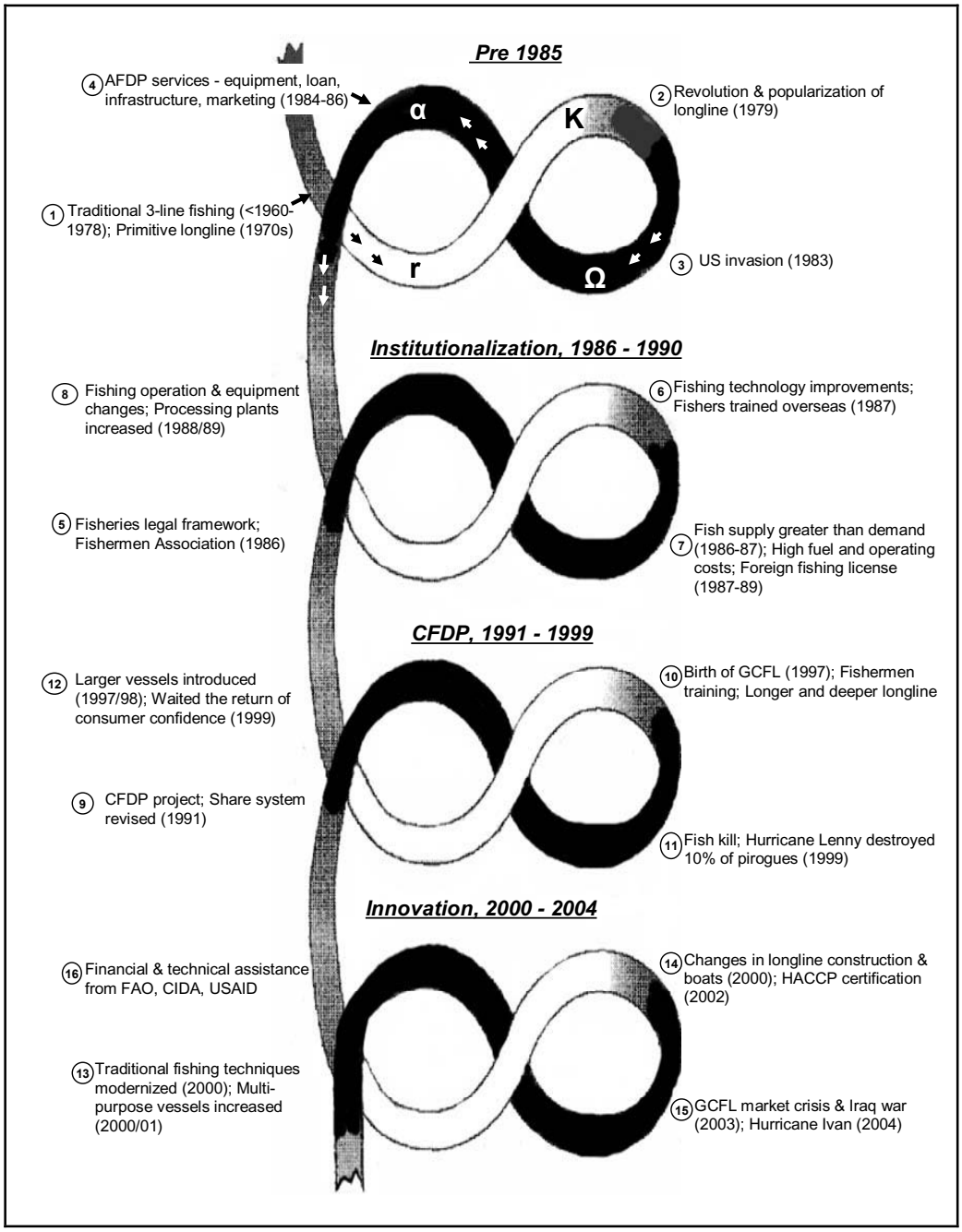

Figure 3. Timeline for the development of the longline fishery as represented by successive iterations of the modified adaptive cycle. The fours found in the pre-1985 panel are defined in the Figure 1 caption.

the Fish Processing Plant returned to their communities to shape the local development of the longline fishery (J. St. Louis, pers. comm., Fisheries Division, St. George's, 2003).

The Artisanal Fisheries Development Project (AFDP; 1983–1985) that helped reorganize the fishery was funded by the World Bank International Fund for Agricultural Development (US$2.7 million) and the Venezuelan Investment Fund (US$1 million), together with a counterpart contribution by the Government of Grenada (WECAFC 1985). The objectives were to develop infrastructure and improve technical and support services. Program activities included: selling imported fishing gear and equipment; operating a machine shop to service and repair engines; organizing a fish market program to distribute processed fish to buyers in Grenada; improving infrastructure to land, clean, weigh, and sell fish; improving data collection

system to handle vessel data and monitor gas rebates and duty free concessions; and introducing a line of credit for fishers, vendors, and boat builders.

Institutionalization and technology development 1986–1990

In 1986, the most comprehensive fisheries legislation to date (the Fisheries Act #15 of 1986), was enacted. With this Act and the Fisheries Regulation #9 of 1987, the Chief Fisheries Officer was able to organize a Fisheries Division. That same year, staff at the AFDP administrative office were transferred to the Fisheries Division. By 1988, the Fisheries Division was a fully functioning body with administration, biology, technology, aquaculture, extension services, and statistics units to provide services in licensing, concessions, enforcement, and data and information systems. By the end of 1990, the Fisheries Division was in local communities talking with fishers, dealing with conflicts, providing training in fishing technology and navigation to further developing the fisheries (J. Finlay, per. comm., former Chief Fisheries Officer, St. George's, 2003).

During this period, fishers launched the St. John's Fishermen Association (SJFA) in Gouyave with a US$100,000 loan from the Humanistisch Instituut Voor Ontwikkelings Samenwerking (HIVOS) through the Agency for Rural Transformation. This loan financed the building of a gas station to sell marine fuel, a tackle shop to sell fishing equipment, and a meeting room for fishers (O. Small, pers. comm., former president of the SJFA, Gouyave 2003). The objectives of the SJFA were to retail fishing tackle and equipment, to process and market fish, to improve the quality and output of fish products, to assist members in seeking financial assistance, and to make recommendations to government on matters relating to the fishery (SJFA 1986). The success of the SJFA led to the formation of the National Fishermen Association in 1990, an umbrella organization which worked towards improved conditions for fishers (O. Small, pers. comm., Gouyave 2003).

Capacity building included longline training provided by the Fisheries Division and overseas fishing training in Japan, Korea, and Canada to help fishers apply new knowledge to existing technology. Subsequently, twisted monofilament line was replaced with single monofilament line, and a box used for the deployment of longline was replaced with reels (Samlalsingh et al. 1999, Grant and Baldeo 2006).

Problems came with improvements in longline technology. First, these improvements resulted in the growth of the fishery; a 73% increase in pelagic fish landing in 1986 over 1984 figures (Fisheries Division landings statistics). Landings were so large that Gouyave fish market could not store excess fish; thus, fishers were forced to bury some of the catch. Second, high fuel prices increased operating costs (pirogues with two 75 HP engines consumed 38 liters of fuel per trip) which forced fishers to think about alternative boat and engine options (R. Gill, pers. comm., fisher, Gouyave, 2003). Third, the government granted fishing licenses to foreign operators with advanced skills and expertise who marketed their catch outside of Grenada and evaded the government's fee of EC$0.25 (1 US$ = 2.71 EC$) per kg of fish caught (Grenada Guardian, 2 December 1988).

To deal with excess fish, the government, fishers, and the private sector found options to increase fish sales and reduce operating expenses. In Gouyave, the NORDOM Seafoods Ltd. processing plant became operational and focused on the export of pelagic fish to the USA (N. Simon, pers. comm., NORDOM Seafoods Ltd., Gouyave, 2003). In St. George's, the AFDP processing plant and the Caribbean Seafoods Ltd. (a privately owned company) processed fish for local and export markets (Weidner et al. 2001). The solution to high operating costs was to replace the 75 HP engines with more efficient 40 HP ones (R. Gill, pers. comm., fisher, Gouyave 2003). The problem of foreign operators was solved when the National Fishermen Association launched a series of protests to pressure the government to stop issuing foreign licenses (Informer, 20 January 1989).

The Coastal Fisheries Development Project (CFDP) 1991–1999

The fishery entered another period with larger boats, modern longline equipment, loans to fishers, and improved infrastructure with support from the Coastal Fisheries Development Project (CFDP). The CFDP was a grant aid cooperation project between the Governments of Grenada and Japan valued at US$4.68 million. The project aimed to introduce large-size fishing vessels to exploit offshore resources and to consolidate support services by improving the fishery environment and distribution facilities. The government received eight 11 m longline fishing vessels, accessory supplies and longline material, 4 vehicles for extension including 2 insulated trucks for transporting fish, and tools and equipment for gear repair facilities. Gouyave benefited from this project with the construction of a fishermen's centre with a small jetty, block ice and plate ice-making machine, cold storage facilities, lockers, and other equipment (J. Finlay, pers. comm., former Chief Fisheries Officer, St. George's, 2003).

During this period the foundation for future growth was laid. First, the goal of Gouyave fishers was to fish further offshore with minimum capital and operational expenses. They considered Japanese longline vessels too expensive to own and maintain, hence designed an economical offshore vessel (or launcher) with an inboard diesel engine. The prototype was built in the USA, and by 1997 a 12 m vessel with sleeping quarters, specific to Gouyave needs, was fully operational (N. Simon, pers. comm., NORDOM Seafoods Ltd., Gouyave 2003).

Second, boat owners further reduced operating costs by changing the share system. Traditionally, income from fish sales was divided into 3 parts: one for the boat and 2 for crew. The boat's share included all expenses and the owner's share. But with high operating expenses, many boat owners could not make a profit. With the new share system, expenses were deducted first and the remainder divided in two, one part for the boat and one part for crew (R. Gill, pers. comm., fisher, Gouyave, 2003).

Finally, continuous capacity building was critical to the survival of the fishery. With an increase in offshore fishing, the Fisheries Division provided captaincy training for Gouyave fishers. Such training included fisheries conservation and laws, safety at sea, navigation, Global Positioning System education, and seamanship and boat handling. Also, as longline technology developed, the Fisheries Division provided technical assistance in collaboration with regional and international organizations.

Improved fishing vessels and equipment, access to fishing loans, capacity building, and a thriving export market resulted in the growth of the fishery. Boat size increased from 7 m in 1979 to 12 m by 1997, and longlines were built longer and deeper, from 46 hooks in 1983 to over 250 in the late 1990s. Landings from the longline fishery peaked between 1993 and 1995 at 474,000 kg. To deal with increased landings, the AFDP processing plant was transformed to the Grenada Commercial Fisheries Limited (GCFL) in 1997. The company processed fish fillets, steaks, and salted shark for local and export markets. They also purchased fish directly from Gouyave fishers and transported it by insulated trucks to St. George's (Weidner et al. 2001).

In late 1999, the fishery in Gouyave declined due to a series of events. Extreme storm surges, a direct result of category 4 Hurricane Lenny hit the west coast of Grenada in November 1999. The storm surge was accompanied by dangerous waves and flooding of 3–5 m above normal tides (McConney 2003) which damaged coastal roads, homes, and the jetty. In Gouyave, fishing boats and equipment were destroyed, including 10% of the cabin pirogue fleet. The estimated cost to local fishers and vendors was US$189,557 (Jessamy and Turner 2003). Also in 1999, a fish kill in the southeastern Caribbean caused by the bacterial agent *Streptococcus iniae* and poor water quality resulted in significant death to demersal reef fish (Ferguson et al. 2000, Willoughby et al. 2002) which led to a decline in fish consumption. Thus, by the end of this period landings were down to 100,000 kg (Fisheries Division fish landings data).

To reorganize, the government and other organizations provided financial assistance to fishers. In 1999–2000 GRENCODA applied to the Canadian International Development Agency (CIDA) and received grants of US$15,000 to help rebuild the fishery in Gouyave (GRENCODA 2000). Many fishers used the financial assistance from the government and GRENCODA to re-invest in open pirogues. They evaluated distance traveled, economic return, safety of the vessel, and capital investment of open versus cabin pirogues and decided open pirogues were more economical (C. Richards, pers. comm., Gouyave fish market, 2003).

Innovation 2000–2004

Storm surges, rough seas, decline in fish catches, increasing numbers of fishers, and indebtedness to the bank were factors that forced fishers to change fishing operations and strategies once again. Business practices changed from boat owner/investor dominated operations, to crew members purchasing boats to become a new class of owner/captain. The 6-month fishery was extended to a year as fishers diversified their activities by altering existing longline technology and modernizing traditional fishing techniques. One such innovative technique was the modified longline specifically constructed to catch blackfin tuna (Grant and Baldeo 2006).

Overnight, offshore fishing, diversification, modernized techniques along with further technological innovations increased fish catch in Gouyave to over 500,000 kg in 2001. To further increase fish export to regional and international markets (particularly Europe), Fisheries Division and Ministry of Health developed a program to ensure that all fish products met European Union and other fish health safety standards. The agencies enacted legislation to ensure Hazard Analysis and Critical Control Point (HACCP) and Sanitation Standards and Operating Procedure (SSOP) standards at processing plants, trained 350 individuals in fish processing standards, and set up a testing laboratory (J. St. Louis, pers. comm., Fisheries Division and F. Balwant, pers. comm., Ministry of Health, St. George's, 2003). By 2002 all 5 fish processing plants in Grenada received HACCP compliance status, and 2 were certified to export fish to the European Union.

However, a series of events caused the fishery to decline again. In January 2003, GCFL experienced economic hardship and by March (the peak month for pelagic landings) fishers had to reduce fishing. Later that year, the war in Iraq caused overseas buyers to reduce fish prices. September 7, 2004 Hurricane Ivan caused damage to boats, equipment, engines, fishing gear, safety equipment, communication facilities, seines, and fishing infrastructure valued at over US$2,115,000 (Government of Grenada 2004).

Reorganizing after the hurricane, the community spent the first 3 days replacing roofs, clearing roads, and removing debris then later focused on the fisheries sector. Compared to the rest of Grenada, the fishery in Gouyave received little damage to fishing vessels because past experiences with storm surges and tropical storms had taught fishers how to secure their equipment. However, low quantities of bait, rough seas, and strong currents hindered longline fishing activities. As soon as roads were cleared and air transportation resumed, NORDOM Seafoods Ltd. exported the first batch of fish a month after Hurricane Ivan. By November 2004, the Fisheries Division was able to secure financial and technical assistance for short- and medium-term support to rebuild the fisheries. The Government, the Food and Agriculture Organization of the United Nations (FAO), and CIDA provided finances to refurbish, expand, and upgrade the Gouyave Fish Market; the FAO/CIDA gave special assistance to repair boats, replace engines and equipment; the FAO provided financial and technical support for a 24 hr ship-to-shore communication system; the USAID financed small grants to assist in the recovery and business reactivation; and GRENCODA/USAID provided financial assistance to replace engines and equipment (Government of Grenada 2004). National fish exports resumed 2 months later and by March 2005 the country was exporting up to 60% of fish landed (N. Simon, pers. comm., NORDOM Seafoods Ltd., Gouyave, 2005). Finally, the Agency for Reconstruction and Development (ARD) was established by the government as a monitoring and coordinating body to facilitate and implement long-term recovery and rebuilding processes following Hurricane Ivan.

CONCLUSIONS

The ability to deal with change, maintain options, and take advantage of 'windows of opportunity' in a resilience sense (Holling 2001, Gunderson and Holling 2002) is crucially important to the success of any fishery. The Gouyave case demonstrates how the pelagic longline fishery dealt with biophysical changes (including hurricanes and storms) and social changes related to technology (boats and gears), fishing activities (bait use, marketing), and management (policies, legislation).

We used the heuristics of the adaptive renewal cycle (exploitation, accumulation, collapse, and reorganization) to examine social-ecological change and identified 3 characteristics of managing change. First, managing change involves learning from experimentation and accumulated experience by building and conserving memory (information, knowledge) to allow for innovation, reorganization, and growth. Second, managing change also requires continuous capacity building; as the fishery evolved, new skills are required. Finally, managing for change depends not only on governments but the interactions of the fishers, the private sector, non-governmental organizations, and community members working together, with each providing specific strengths and roles.

Fisheries management and development is challenged by the complexities and uncertainties of social-ecological systems. Unpredictable changes include not only hurricanes but also military interventions, and the market demand may be further impacted by fish quality regulations and distant wars. Finally, changes such as those related to international regulations (Singh-Renton et al. 2003) are also in the 'unpredictable' category from a small island nation point of view.

Thus, the manager is limited in the scope of management-as-control. Rather, it appears that the role of the fishery managers is to guide the fishery to evolve in response to various drivers by encouraging learning and facilitating capacity building to take advantage of numerous 'windows of opportunity' (Berkes et al. 2003, Wilson 2006). Likewise, managers can guide partnerships by encouraging fishers, the private sector, government, non-governmental organizations, and community members to work together, as each has a role to play in a more comprehensive approach to fisheries management. This kind of approach is part of managing for change, and likely requires a skill set different than that for predictability and control.

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