



Managing Jamaica's queen conch resources

Karl Aiken^{a,*}, Andre Kong^a, Stephen Smikle^b,
Richard Appeldoorn^c, George Warner^d

^aDepartment of Life Sciences, University of the West Indies, Mona, Jamaica

^bFisheries Division, Ministry of Agriculture, Kingston

^cDepartment of Marine Sciences, University of Puerto Rico, Mayaguez, Puerto Rico

^dCentre for Marine Sciences, University of the West Indies, Mona

Abstract

Jamaica's industrial fishery for queen conch (*Strombus gigas*) has produced a substantial amount of much-needed foreign exchange and for at least 10 years has been the most valuable component of all commercial marine fisheries activities. Since its inception in 1990 it has grown tremendously and may now be at some risk of collapse, due to problems including, among other factors, overfishing, poor enforcement, foreign poaching and under-reporting of catches. This paper examines and analyzes the problems relating to management of the conch fishery and speculates on its future. The main problems are overfishing by licensed fishers who take more than permitted, and serious poaching by industrial vessels mainly from Honduras, which exploit poor high seas enforcement by Jamaican authorities. For nearly two years the official fishery was closed due to legal issues. During closures, considerable foreign poaching occurred. The paper suggests that increased roles for the coast guard, continued quota reductions, and the Convention on International Trade in Endangered Species of Flora and Fauna (CITES), could be the best options for sustainability.

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1. Introduction

The queen conch, *Strombus gigas*, is a valuable marine mollusc that is harvested in the coastal waters of many Caribbean countries and is the focus of directed fisheries, wherever it occurs. Throughout their range, their fisheries are typified by overfishing, as the species is sedentary and thus very susceptible to over-collecting [1]. In a market which in 1992 was

*Corresponding author. Tel.: +876 927 1202; fax: +876 977 1075.

E-mail addresses: karl.aiken@uwimona.edu.jm, kaaiken@uwimona.edu.jm (K. Aiken).

worth US\$60 million annually, Jamaican queen conch exports rose such that in that year it was the leading exporter [2]. The main fishing ground is a large adjacent oceanic plateau called Pedro Bank (Fig. 1) which, due to its proximity (160 km) to Kingston, is readily exploitable.

2. History and development

Prior to 1988 all activities were limited to small-scale free diving collection from around the island shelf. Exports were less than 50 t annually. These island shelf stocks have since virtually disappeared. In 1988, investors became aware of stocks of queen conch on part of Pedro Bank. An industrial fishery quickly developed and exports rose dramatically by 1990 [3]. The fishery since 1990 has been based on scuba and hookah-equipped divers who collect conch in depths to nearly 30 m. The industrial conch fleet comprises approximately 11 decked vessels ranging from 20 to 30 m in length operating on Pedro Bank, the main fishing ground. Fig. 2 shows changes in exports as the fishery developed. It shows relatively consistent, large levels of exports between 1993 and 1998/1989. In particular it shows that exports have fallen since 1999. Overall, CITES data showed that Jamaica was the largest exporter of queen conch meat exporting a total of 7500 t between 1993 and 1999. This accounted for 46% of all queen conch recorded in international trade in that period [4]. In 1996, nearly 2000 t of product was exported from Jamaica.

The industrial fishery is but one part of the three categories of conch fishers operating on Pedro Bank. The other two are the free divers operating from Pedro Cays-based canoes, and free divers who come from the south coast of Jamaica. Industrial fishers utilize decked vessels with an average of 10 divers, on trips that last an average of 2 weeks. These larger vessels act as “mother” ships to a number of smaller dinghies or dories that take teams of divers to adjacent seas floor areas known to have conch. The industrial divers exploit queen conch for transport to Kingston for processing. Complete details of conch fishing are given in a previous review [1].

One of the reported problems with industrial fishing methods is that conch meat is removed and the shells are left on sea floor. This practice makes it more difficult for inspectors to check the state of maturity of fished conch, which are often taken when juvenile or immature. The presence of empty shells is believed to drive away remaining conch. It is reported that large portions of the bank are now covered with empty shells resulting from 10 years of industrial fishing. The reasons for this apparent avoidance reaction by queen conch are unclear, but may be related to chemical stimuli resulting from trapped body parts decaying inside the shells.

A major problem is under-reporting of catches by licensed fishers. The problem is, by its nature, a difficult one to identify and thus to resolve. The under-reporting of catches is thought to be a long-standing one and is thought to be considerable. This is not new in industrial fisheries in Lesser Developed countries and was identified as one of the secondary reasons for the collapse of the Peruvian anchoveta fishery [5].

Meat for export is landed from freezer and ice hold equipped vessels is put ashore on ice. The product is defrosted and then processed usually to 60% (i.e. 40% body weight trimmed and discarded) by teams of women under closely monitored, hygienic conditions at a number of locations mainly in Kingston. The processed meat is placed in 15 m freezer trailers and shipped overseas from Kingston. The major destination for queen conch export is the United States. In the mid-1990s, the main market for a number of years was

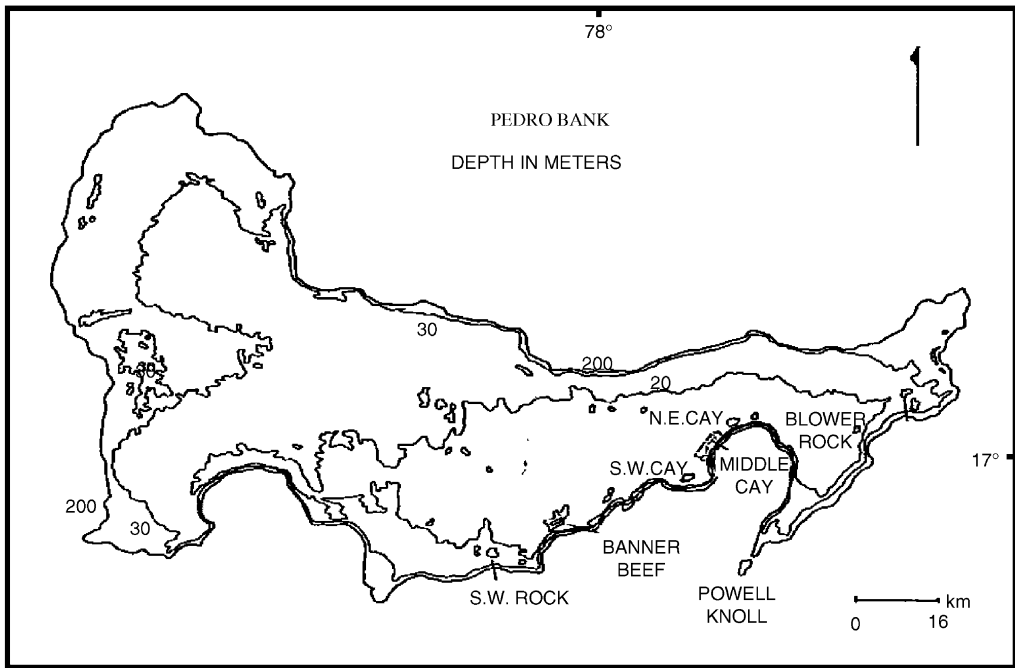
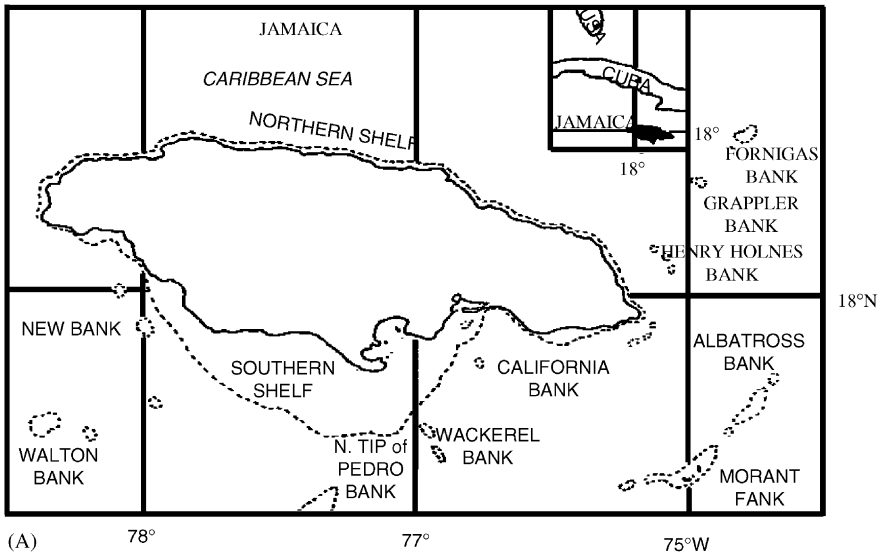


Fig. 1. Map of Jamaica showing insular shelf to 200 m, proximal bank and the major conch fishing ground, Pedro Bank, to southwest.

France through Martinique. In 2000, 47% of the island’s queen conch went to France and 53% to the USA [4]. The main reason for this shift was said to be price changes. Prices have fluctuated between US\$2.50 and a high of \$8.00/kg between 1993 and 2002 [4]. Prices

in the 1993/1994 fishing season were so low that the US Virgins Islands conch fishery was forced to close, as it could not compete with the cheaper Jamaican product. Between the 1997/98 and the 1999/2000 fishing season the average international price for conch was

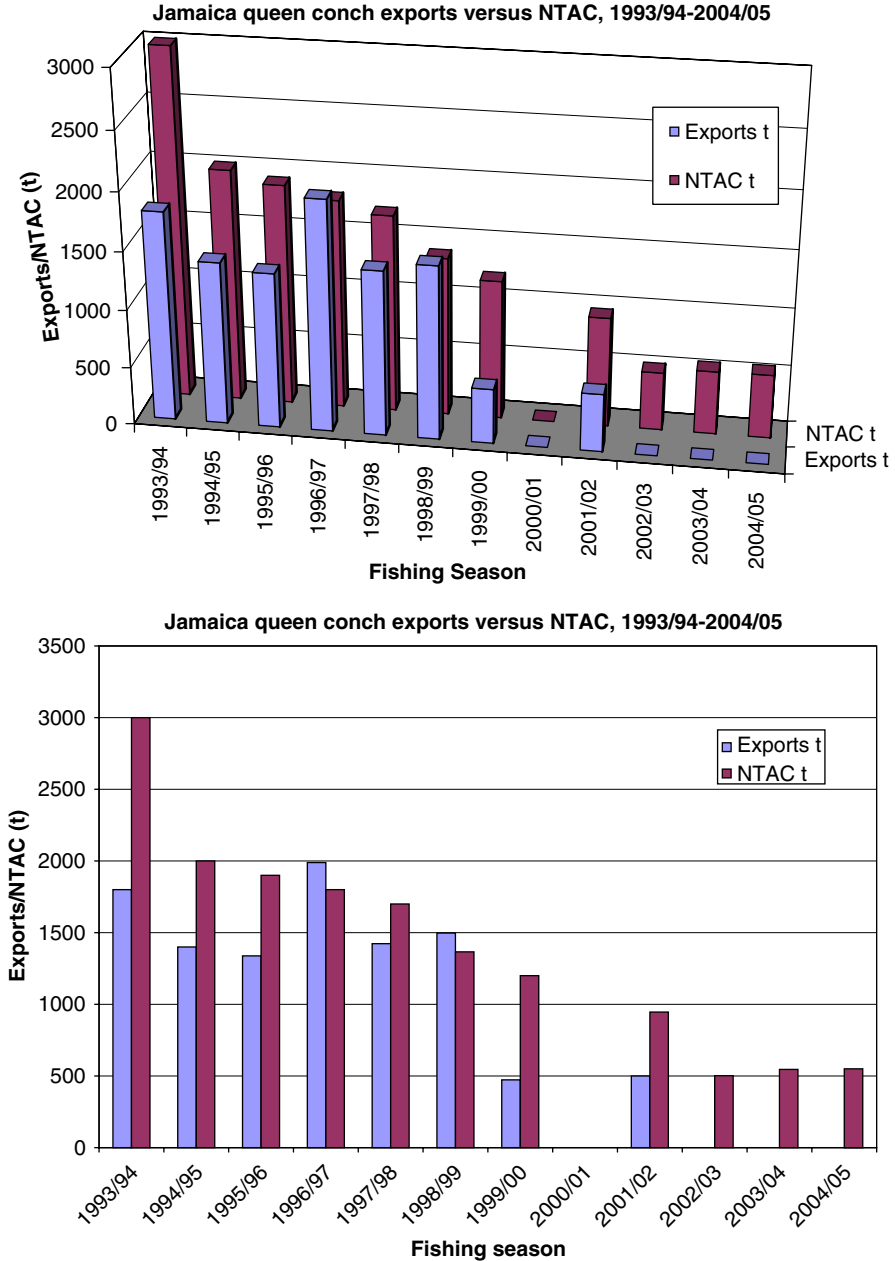


Fig. 2. Queen conch exports versus NTAC, 1993/94–2001/02.

Conch Season	NTAC t	Exports t	1993 2004	Season	Exports t	NTAC t
1993/94	3,000	1800		1993/94	1800	3,000
1994/95	2000	1400		1994/95	1400	2000
1995/96	1900	1338		1995/96	1338	1900
1996/97	1800	1989		1996/97	1989	1800
1997/98	1700	1423		1997/98	1423	1700
1998/99	1366	1497		1998/99	1497	1366
1999/00	1200	473		1999/00	473	1200
2000/01	0	0		2000/01	0	0
2001/02	946	500		2001/02	500	946
2002/03	502	0		2002/03	0	502
2003/04	546	0		2003/04	0	546
2004/05	550	0		2004/05	0	550

Fig. 2. (Continued)

US\$6.29/kg [4]. Jamaican exporters thus earned an average of US\$8 million/year in that period. Since that time earnings have been greatly reduced due to closure of the fishery.

In 1999, 2000 and into 2002 there were prolonged legal battles between the Government of Jamaica and one or more of the commercial conch fishers. This was based on the matter of the alleged biased awarding of conch fishing licenses. These legal matters resulted in the conch fishing season not being opened for nearly 2 years, for the first time in the history of the industry. The closure of the fishery and the previously known poor high seas enforcement, resulted in the arrival of foreign poaching vessels which fished intensively on Pedro Bank.

Changes in exports have occurred in the closed seasons when no exports were reported. Considerable poaching by Honduran and Dominican Republic vessels was known to have taken place in closed season 2000/2001 and for part of the 2001/2002 season. The seasons actually did not open in those years due to a lawsuit related to the national queen conch fishery between the government and certain licensees. It is of considerable interest to note that landings in Honduras and the Dominican Republic rose significantly in exactly those years [4]. Though unsubstantiated, this could likely suggest that these increases probably originated in illegally removed Jamaican conch, as this is the largest nearby available stock, and fishing vessels from those countries were observed and photographed on Pedro Bank.

3. Management

There are several regulations relating to conch that manage the number of fishers licensed to dive for, process and export conch meat. The Fisheries Division of the Ministry of Agriculture has implemented a scheme since 1995, whereby regulations require all investors in conch fishing to apply for licenses to fish. Further, each season, only a limited number of licenses are issued. Table 1 shows how licenses are issued.

The fishery up to 1992 was essentially unmanaged. Very rapid expansion of the fishery on Pedro Bank in that year caused serious concern for the sustainability of the fishery [6] and resulted in the Fisheries Division (FD), in conjunction with CARICOM Fisheries

Table 1
Conch license issue procedures and criteria

Regulatory measure	Conditions applying	Comments
NTAC (divided into individual/business quotas)	NTAC based on scuba assessment of density of conch on Pedro Bank	Assessments take place approx. every 3 years
Conch fishing licenses issued by Fisheries Division	Applicant must show ability to harvest product	Quota accompanies license to fish
	Applicant must be registered fisher with license	All licenses issued must not exceed NTAC
	Applicant must have one or more vessel(s)	Individual quotas are transferable
	NTAC falls by 100 t annually since 1995/96 season	

Resources Assessment and Management Programme (CFRAMP) drafting a Management Plan for conch [7]. The plan is based on a system of quotas, called the National Total Allowable Catch, (NTAC). The NTAC levels are set at the beginning of each conch fishing season (normally in November) by the FD. These are set in kg and is in equivalents of “50% cleaned meat”. The NTAC is an important management tool that is based on the estimation of the total allowable sustainable yield of conch on Pedro Bank [8]. The total allowable yield is based on visual surveys of the abundance of conch stocks.

The NTAC was adjusted each year based on (i) a 1995 agreement to reduce the annual catch by 100 t each year to 1000 t by the year 2000, and (ii) the tri-annual abundance (assessment) surveys of Pedro Bank stock. The Plan has been modified several times since its introduction in order to accommodate new developments. The most recent plan has a ban on the processing and sale of conch during the annual close season and requires the declaration and inspection of all stored conch meat. Table 2 lists a number of management developments since 1999.

Enforcement has historically been one of the weak points of the conch industry in Jamaica. Generally, marine fisheries enforcement has been poor with the exception of spiny lobster and to some degree, conch resources. Funding for conch fishery enforcement by the Fisheries Division has been lacking, coupled with longstanding personnel shortage. The industry is aware of these deficiencies. Additionally, the Jamaica Defense Force (JDF) coast guard arm suffers from inadequate patrol vessel numbers and is responsible for a maritime area several times the size of the island. Significantly, poachers are known to be aware of this particular problem.

S. gigas was listed in Appendix II of CITES in 1992 and affects all forms of the species ranging from live animals, their meat and by-products thereof [4]. The CITES a major international conservation treaty, has proven to be one of the most useful regulations which most of the participants in the conch trade in Jamaica both know and respect. The main reason for this relates to a 1993 incident in which a leading exporter’s product was seized in the US because the CITES documentation had not been completed prior to departure from Jamaica. The entire shipment became unsuitable for sale by the time the matter was resolved. No further documentation problems have re-occurred since that time. Several CITES meetings outside the island, particularly since 2000, have also made it clear to managers that the fishery is being closely scrutinized by international groups.

Table 2
Recent management developments in the conch fishery since 1999

New measures	Expected benefits
Distribution of NTAC between small number of qualified companies (2001)	Closer monitoring of industrial fishery
Prohibition of processing and sale of conch during closed season	Reduction in demand for conch
Queen conch from island shelf not allowed for export or processing	Retention of mainland artisanal conch catch for local demand
Declaration of conch in storage	Establishment of quantities of product
Inspection of conch by Fisheries Division, Veterinary Service or NEPA	Verification of stored quantities and sources
New Licenses for industrial vessels, crews and divers	Improved data on fishing effort and catches
Aquaculture Inland and Marine Product and By-product Act of 1999	Improved management of hygienic and quality control standards in processing plants
Endangered Species Act (Protection, Conservation and Regulation of Trade) 2000	Streamlining of trade in conch, establishment of individual export quotas, and procedures for application for quotas

NEPA = National Environmental & Planning Agency.

Significantly, senior CITES personnel have privately suggested to one of the authors (KAA) that continued poor Jamaican enforcement could result in the collapse of the stock, and CITES would then be forced to place the queen conch, *S. gigas*, on the endangered list and in Appendix 1, wherein no trade would be allowed. This would, of course, result in the end of the export-oriented commercial fishery in Jamaica and in all other places in the western hemisphere where fishing occurs. Oversight reports by, and contact with personnel from Traffic Europe have also helped in the continued management of the queen conch fishery.

Regional management has played a minor role in the management of conch fishing in Jamaica. The San Juan Agreement of 1996 has had little effect on trade. More importantly has been the compliance with CITES, an international treaty.

The conch industry has been involved in funding of most of the abundance surveys since 1994 when the first survey was done. Surveys have been carried out in 1997, 2000 and in 2002. All have resulted in estimates of stock size and of recommendation on quota levels. The most recent survey is, at the time of writing (early 2003), still being completed. The previous survey had found that the mean size of the conch harvest had fallen slightly since the survey before it. Table 3 lists the estimates of stock and the quotas resulting from them.

Before the surveys, the first assessments of Jamaican conch stocks were based on literature research, interviews and a series of workshops held in 1992 that were organized by the Fisheries Division and the CARICOM Fisheries Resources Assessment & Management Programme (CFRAMP). At that time it was assumed that stocks were like that of other countries then harvesting conch. Subsequent diver surveys revealed that actual stock on Pedro Bank was larger than first estimated and was one of the largest then in existence.

One of the signs of cooperation between the industry and the managers was the involvement in the earlier surveys of government divers and vessels operated by major fishers. The 2002, survey was funded by an ENGO (the Environmental Foundation of

Table 3
Queen conch abundance surveys and resultant NTAC estimates

Survey year	Sustainable yield estimate (t year ⁻¹)	Resulting NTAC (t year ⁻¹)	Stock status	Survey funding by industry	Reference
1994	1608	1500	Good	Yes	[9]
1997	1366	1366	Good	Yes	[9]
2000	946	946	Declining slightly	Yes	[10]
2002	800–900	504.3	Stable	No (ENGO)	[11]

Jamaica) and its administration was assisted by the UWI, Life Sciences Department. The shift away from the industry's funding was due mainly to the protracted legal battle between the government and one or more licensees between 2000 and 2002.

Since 1999 more than 10 vessels have been caught illegally fishing for conch on Pedro Bank by the Coast Guard. If we consider that only a small fraction of the offenders are apprehended, only then is the possible scale of poaching appreciated. One recent conservative estimate, based on reliable sources was that in the (closed) 2000/2001 season, the estimated poaching catch was probably as great as or more than the previous NTAC. Even if only partly correct, the deleterious effect on the stock is likely to be serious. From January to March 2003, two conch poaching vessels were seized by the Coast Guard on Pedro Bank. Successful prosecutions were unfortunately followed by release of poaching vessels, suggesting that more stringent fines and forfeitures need to be considered by authorities to produce real disincentives to poachers.

4. Recommendations for sustainable conch fishing

Some of the problems mentioned previously and suggested solutions are set out in Table 4.

One new suggestion for the sustainability of the fishery is training of divers to remove shells from the substrate. These shells have some value as tourist curios and could be cleaned on land for that purpose. Unfortunately, the attractive, pink, shiny interior of the shell deteriorates quickly in the sea after death, so only fresh shells could be used for sale to tourists. Empty shells are used in all other range states [4]. Shell use is considered as very limited in Jamaica. If the unit value of each large shell is taken as a mean of US\$5.00 [4], then this represents a significant potential resource. Shells are exempted from CITES export control under provisions of local regulations from the National Environment Protection Agency (NEPA).

Government support is vital for the continued existence of the fishery. Of particular importance is the role of the GOJ in continued funding of the Fisheries Division, and the JDF Coast Guard (see Table 4). Significantly increased funding seems, unfortunately, unlikely in the near future based on previous sluggish national economic performance. However, CFRAMP, in conjunction with the Fisheries Division, could continue to organize conch management workshops to review and modify regulations for conch both in Jamaica and regionally.

CITES support and external monitoring is thought to be important in the future of the fishery. The influence of CITES is real and considerable within and among the business

Table 4
Summary of problems identified and suggested measures for sustainable conch fishing

Problem identified	Suggested solution	Implementing organization
Overfishing	Improved enforcement of NTAC and inspection of catch	Fisheries Division
Poaching	(a) Improved Pedro bank surveillance (b) Warning of offending countries	JDF Coast Guard Ministry of Foreign Affairs
Under-reporting of catches	Improved monitoring of landings and processors	Fisheries Division
Discarding of shells on sea floor	Training of divers	Fisheries Division/dive organizations
Prolonged legal wrangling with GOJ	Speeding up of legal resolutions	Government of Jamaica (Attorney General's Office).
Release of poaching vessels	Mandatory forfeiture of vessels and equipment	Coast Guard/Judiciary
Lack of control over landing of immature specimens	Maturity regulation requiring only sexually mature specimens to be landed	Fisheries Division (will require major change in fishing, as shells must be landed to assess maturity)
Exploitation of deeper conch	Protection of selected deep (>30 m) areas of Pedro Bank to form spawning stock refugia	Fisheries Division, Coast Guard

GOJ = Government of Jamaica.

community involved in conch fishing. It is hoped that CITES will remain a dominant force in enforcement. With continued world population growth, it is also predicted that market demand for conch will at least remain large, and will likely increase in the not too distant future.

5. Summary

An examination of the major developments and problems relating to the queen conch fishery of Jamaica since the 1999 paper by Aiken et al. showed that poor enforcement continues to be the major problem, along with mostly uncontrolled poaching. Generally, despite efforts to maintain quotas and properly regulate the fishery, management has therefore not been very effective, especially since the year 2000. The continued modification (reduction) of the NTAC in response to each successive assessment is however, one major positive sign. Improved monitoring of Pedro Bank is important, as is another biological study of the conch resources. Use of high-quality shells for tourism purposes is seen as one way to optimize existing resources. We suggest that the queen conch industrial fishery of Jamaica will only survive if the management measures discussed are quickly implemented in an integrated programme of truly sustainable fishing. CITES is suggested as being a major player in effective observation of regulations.

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References

- [1] Aiken KA, Kong GA, Smikle S, Mahon R, Appeldoorn R. The queen conch fishery on Pedro Bank, Jamaica: discovery, development, management. *Ocean & Coastal Management* 1999;42:1069–81.
- [2] Chakallal B, Cochrane KL. The queen conch fishery in the Caribbean—an approach to responsible management. Presented at International Meeting on Queen Conch Fishery, Puerto Rico, 29–31 July 1996. 18pp.
- [3] Smikle S. Conch and lobster fisheries of Jamaica. Lobster & Conch Subproject Specification Workshop, Kingston. November 1995. CARICOM Fisheries Research Doc. no. 19, Belize, 1997. p. 46–55.
- [4] Thiele S. Queen conch fisheries and their management in the Caribbean. Traffic Europe, 2001. 73pp. + 10 annexes.
- [5] Tsukayama I, Pauly D, editors. The Peruvian anchoveta and its upwelling ecosystem: three decades of change. Peru, Germany, Philippines: IMARPE, GTZ, ICLARM; 1987. 351pp.
- [6] Mahon R, Kong A, Aiken K. A preliminary assessment of the conch fishery on the shelf and banks off the south coast of Jamaica. CARICOM Fishery Research Document 1992; No. 8.
- [7] Fisheries Division. Proposal for the allocation of quotas for the conch industry. Unpublished Report, Ministry of Agriculture, Jamaica, 1994. 6pp.
- [8] Appeldoorn RS. Stock abundance and potential yield of the queen conch of Pedro Bank. Jamaica: University of Puerto Rico/Fisheries Division; 1995. 10pp.
- [9] Tewfik A, Appeldoorn R. The 1997 queen conch (*Strombus gigas*) abundance survey and potential yield estimates for Pedro Bank, Jamaica. Jamaica: Fisheries Division; 1998. 39pp.
- [10] Smikle S, Appeldoorn R. The 2002 estimates of abundance and potential yield for the Pedro Bank queen conch population. Fisheries Division, Ministry of Agriculture, 2002. 38pp.
- [11] Smikle S, Appeldoorn R. The 2003 estimates of abundance for the Pedro Bank queen conch population. Fisheries Division, Ministry of Agriculture, 2003. 20pp.