

# **Status of the Queen Conch *Strombus gigas* Stocks, Management and Trade in the Caribbean: A CITES Review**

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## **ABSTRACT**

The Queen conch *Strombus gigas*, a large marine gastropod, is found in the territorial waters of 36 countries and territories in the Caribbean region. Over the past decades, intensive fishing has led to population declines resulting in the total or temporary closure of the fishery in a number of locations. Since November 1992, the species has been included in Appendix II of CITES. In 2002, concerns about levels of illegal trade led to a 'Review of Significant Trade' in queen conch by TRAFFIC on behalf of the CITES. For this review, data on commercial fisheries landings, CITES trade data, stock status, and management measures were compiled with the assistance of CITES and fisheries authorities, and regional experts.

Available information suggests that the majority of conch populations have continued to decline since the species was listed in CITES. Between 1993 and 1998, the total annual *landings* of (unprocessed) conch meat ranged between 6,534 and 7,370 metric tons (t); in 2001 the landings had fallen to 3,169 t. Most landings were reported from the Dominican Republic, Jamaica, and Honduras. From 1992 to 2001, total *exports* were 21,649 t of (processed) meat. The largest exporters are Jamaica and Honduras, followed by the Turks and Caicos Islands, the Bahamas, the Dominican Republic, Colombia, and Belize. Seventy-eight per cent of all queen conch meat in international trade is imported by the US.

In response to the declines, the majority of range States have imposed measures for the management and conservation of the conch fisheries. However in several countries, such efforts are undermined by insufficient stock, landings, and trade data. There is also evidence of increased levels of illegal harvesting and trade including that by vessels in waters under other State's jurisdictions. Localized exploitation of deeper stocks and juveniles, the shift to remote harvesting areas, and low population densities suggest that some populations are depleted and local fishery collapses are possible. Of particular concern are the high exports reported from countries where only sparse information on stocks is available, where management is weak, and where available information suggest that significant portions of conch are fished in waters of neighboring countries. It is hoped that the CITES review process will assist range States in addressing these issues and support their efforts in ensuring that the harvest and trade in Queen conch is sustainable.

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KEY WORDS: Queen conch, *Strombus gigas*, international trade, CITES

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## Estado del Stock del Caracol Reina (*Strombus gigas*), Manejo y Comercio en el Caribe: Una Revisión de CITES

El caracol reina del Caribe, *Strombus gigas*, se encuentra a todo lo largo del Caribe. Durante las últimas décadas, la pesca intensiva ha llevado a declinaciones de la población que causaron el cierre total o temporal de la pesquería en varias localidades. La especie fue incluida en 1992 en el Apéndice II del Convenio sobre Comercio Internacional de Especies Amenazadas de Fauna y Flora Silvestres (CITES) y desde entonces todo el comercio internacional de caracol reina del Caribe está controlado. En 2002, se encomendó a TRAFFIC emprender una revisión de la condición biológica y de comercio del caracol reina del Caribe en nombre de CITES y con dicho propósito se compilaron datos de desembarco de pesquerías comerciales, datos de comercio de CITES, de la condición de los planteles y de las medidas de manejo.

La información disponible sugiere que la mayor parte de las poblaciones de caracol reina del Caribe ha continuado declinando desde que la especie se incluyó en CITES. Entre 1993 y 1998, los desembarcos anuales totales de carne (no procesada) de esta especie, osciló entre 6.534 y 7.370 toneladas métricas (t); para 2001 los desembarcos se habían reducido a 3.169 t. La mayor parte de los desembarcos fueron reportados de la República Dominicana, Jamaica y Honduras. Desde 1992 hasta 2001, las exportaciones totales de todos los Estados exportadores fue de 21.649 t de carne (procesada), 2.345.868 conchas, 143 t de conchas, 407.140 especímenes vivos, y 342 t de especímenes vivos. Los principales exportadores de carne de caracol reina del Caribe son Jamaica y Honduras, seguidos de las islas Turks y Caicos, Bahamas, la República Dominicana, Colombia y Belice. Los EE.UU. importaron 78% de toda la carne de caracol reina del Caribe del comercio internacional.

Actualmente la mayor parte de los Estados del área de distribución del caracol reina del Caribe han impuesto medidas para el manejo de las pesquerías de caracol reina del Caribe y su comercio. Sin embargo, tales esfuerzos son a menudo debilitados por insuficientes datos de manejo y de vigilancia de los desembarcos y de los niveles de comercio. También existen evidencias de niveles significativos de cosecha y de comercio ilegales que incluyen embarcaciones en aguas bajo la jurisdicción de otros Estados. La explotación localizada de planteles de aguas más profundas y de juveniles, un desplazamiento hacia áreas de cosecha mas remotas, y las bajas densidades poblacionales sugieren de que varias poblaciones están diezmadadas. Son de particular preocupación las altas exportaciones reportadas desde aquellos países en que hay una escasa información disponible sobre la condición de los planteles. Se confía de que el proceso de revisión de CITES ayudará a los Estados del área de distribución en sus esfuerzos para asegurar que la cosecha y comercio de caracol reina del Caribe sea sustentable.

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PALABRAS CLAVES: Caracol reina del Caribe, *Strombus gigas*, comercio internacional, CITES

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## INTRODUCTION

An economic and cultural symbol of the wider Caribbean, the queen conch *Strombus gigas* has supported subsistence, artisanal and more recently, important commercial fisheries throughout much of its range (Siddall 1984). The species has been valued as a protein source and has been exploited for hundreds of years. However, it is only during the last century that commercial exploitation has become such an important source of income (Brownell and Stevely 1981). Nowadays, the queen conch fishery has become one of the most important fishery product both with regard to annual landings and as a source for economic income in some Caribbean countries. In Jamaica for example, the annual queen conch landings for the year 1998 were estimated to be worth around US\$ 15 - 20 million, making it Jamaica's economically most valuable fishery and creating employment for around 3,000 people, especially in the processing and packaging sector (Anon. 2000). The total economic value of Queen conch taken from the Caribbean region has been estimated at US\$ 60 million in the mid-1990s (Chakalall and Cochrane 1996), however, this would be considerably higher if the employment created was taken into account.

*S. gigas* is currently harvested commercially in approximately 25 countries and dependent territories throughout the Caribbean region (Theile 2001). The main product of *S. gigas* in international trade is the meat, which is mostly traded frozen. Other products such as shells, shell carvings and pearls, are also traded in considerable quantities but are largely considered by-products of the meat fishery and are rarely the result of a direct harvest (e.g. Chakalall and Cochrane 1996, Mulliken 1996). The majority of the meat harvested in exported, however domestic consumption is high in a number of islands (e.g. Bahamas, Cayman Islands, Dominican Republic, Guadeloupe, Martinique, Netherlands Antilles, Puerto Rico, etc.).

Queen conch are particularly vulnerable to overfishing because of their slow growth, their occurrence in shallow waters, their late maturation, and their tendency to aggregate in shallow waters for spawning. The shallow water populations have often been the most depleted due to their accessibility, however, the introduction of commercial interests and modern dive gear such as scuba and hookah has led to the deep-water populations being harvested in recent years (Mulliken 1996, Anon. 1999).

The species that was listed in Appendix II of the Convention on International Trade in Endangered Species of Fauna and Flora (CITES) in 1992, following concerns over the increasing exploitation of the species in the 1980s and early 1990s. CITES was established in 1973 with the aim of ensuring that trade in wild animals and plants is conducted in a non-detrimental manner and is not threatening the survival of the species in the wild. To date (November 2003) 164 States (in the following referred to as Parties) have joined the Convention, including most queen conch ranges States and territories (except

for Anguilla, Haiti and the Turks and Caicos Islands, see Table 1). Many countries in the Caribbean region still face difficulties in the implementation and enforcement of CITES and some lack adequate legislation to fully implement the provisions of the Convention (Anon., 2002b).

Since the listing of queen conch in CITES, international trade in all specimens of the species (including meat, shells, trimmings and manufactured products) requires the prior issuance of a CITES export permit. According to Article IV of CITES no export permits should be issued unless the designated Scientific Authority of the exporting State has determined that the export will not be detrimental to the survival of the species.

Following concerns about high volumes of Queen conch meat recorded in international trade and reports suggesting that considerable amounts are harvested illegally, TRAFFIC, the wildlife trade monitoring network, was commissioned to undertake a review on the biological, management and trade status of the species pursuant to CITES Resolution Conf. 12.8 'Review of Significant Trade in specimens of Appendix-II species'. The main purpose of this 'Review of Significant Trade' was to assess whether or not exporting countries adequately implement Article IV of CITES, i.e. making accurate determinations that exports will not be detrimental to the survival of the species (also referred to as 'non-detriment finding').

This paper summarizes some of the results of the review prepared by TRAFFIC. The full report was submitted to the 19<sup>th</sup> meeting of the CITES Animals Committee as AC19 Doc. 8.3 (Rev. 1) and can be downloaded from the CITES website at [www.cites.org/eng/ctte/AC/19/E19-08-03.pdf](http://www.cites.org/eng/ctte/AC/19/E19-08-03.pdf).

The information for the review was collected between 2001 and 2003 from scientific literature, unpublished reports, trade statistics reported by CITES Parties and through country visits and questionnaires and interviews with more than 150 governmental officials, scientists and other fisheries experts throughout the region. Prior to the submission of the report to the CITES Animals Committee a draft version of the review was circulated to all range States for review and comments. In addition, a two-day consultation meeting for queen conch range States was held in June 2003 where representatives were given the opportunity to comment on the draft report and to provide additional information. The meeting also agreed on a set of draft recommendations relating, among others, to CITES implementation, regional co-operation and law enforcement effectiveness. The final report was then presented to the CITES Animals Committee in August 2003.

**Table 1.** Queen conch range States, their membership in CITES and main use of Queen conch at national level.

Country / Territory	CITES Party	Use of Queen conch
Antigua and Barbuda	Oct-97	Domestic and export
Aruba (NL)	Mar-95	Harvest prohibited
Bahamas	Sep-79	Domestic and export
Barbados	Mar-93	Only occasionally fished, no export
Belize	Sep-81	Mainly export
Brazil	Aug-75	No harvest
Colombia	Nov-81	Mainly export
Costa Rica	Sep-75	Harvest prohibited
Cuba	Jul-90	Domestic and export
Dominica	Nov-95	Domestic and some export
Dominican Republic	Mar-87	Domestic and export
France (incl. Guadeloupe and Martinique)	Aug-78	Major importer and consumer, small local fishery
Grenada	Nov-99	Domestic and some exports
Guatemala	Feb-80	Only occasionally fished, no export
Haiti	Non-Party	Domestic and export (mostly shells)
Honduras	Jun-85	Mainly export
Jamaica	Jul-97	Mainly export
Mexico	Sep-91	Domestic, no exports
Netherlands Antilles (NL)	Jul-99	Mainly imports (unreported)
Nicaragua	Nov-77	Mainly export
Panama	Nov-78	Mainly domestic
Saint Kitts and Nevis	May-94	Mainly export
Saint Lucia	Mar-83	Domestic and export
Saint Vincent and the Grenadines	Feb-89	Domestic and export
Trinidad and Tobago	Apr-84	Domestic and export
United Kingdom (incl. Bermuda, British Virgin Islands, Cayman Islands and Montserrat)	Aug-76	Bermuda: Harvest prohibited Montserrat: only occasionally fished BVI and CI: only small fishery, no export, but imports (unreported)
Anguilla	Non-Party	Domestic, no exports
Turks and Caicos Isl.	Non-Party	Mainly for export
US (incl. Florida, Puerto Rico US Virgin Islands)	Aug-75	Major importer and consumer
Venezuela	Jan-78	Harvest prohibited

\*= date indicates month and year of the range States' accession to CITES

## POPULATION STATUS

*S. gigas* is distributed throughout the tropical north-western Atlantic including Bermuda, the Florida Keys, the Greater and Lesser Antilles and the Caribbean coasts of Central and South America south to Brazil and ranges into the Gulf of Mexico (Brownell and Stevely 1981). The known distribution of *S. gigas* includes the territorial waters of 36 countries and dependent territories in the Wider Caribbean (Anon., 1996).

Over the past decades, intensive fishing has led to population depletions, stock collapses and consequently national or local closures of the fishery in a number of locations. The review indicates that the populations of several countries are considered depleted due to overexploitation and that there are only a few unexploited populations or areas within the species' range (i.e. deep water stocks or stocks in protected areas). Due to the depletion of shallow water stocks, fishing efforts have shifted from near-shore to offshore areas. The use of scuba and hookah gear (compressor diving) has also become widespread and has allowed divers to exploit deepwater refugia. Nowadays, several stocks show clear signs of overexploitation, for example large landings of juveniles or fishing efforts shifting to the deeper areas of the stock (>20m) (Appeldoorn 1994a, Anon. 1996, Mulliken 1996, Anon., 1999). Overexploitation is reported to have changed local distribution and abundance in some areas (Tewfik, in lit. 2002).

Surveys undertaken in the 1970s reported adult densities of several hundred or even more than a thousand individuals per hectare (ind./ha), for example Alcolado (1976) observed 1,582 ind./ha at a site in Cuba in 1972, Hesse (1979) reported 255 ind./ha in the Turks and Caicos Islands in 1974, and Weil and Laughlin (1984) reported densities of 1,886 ind./ha in unfished locations and 160 ind./ha in fished areas in Los Roques, Venezuela, in 1981. Nowadays, densities are considerably lower in most areas (Table 2). In fact, relatively high adult densities are only reported from a few locations, for example Cuba, the Pedro Bank in Jamaica, the Serrana Bank in Colombia and from the Caicos Bank in the Turks and Caicos. Adult densities in most of the other range States are now at such low densities where reproduction failure may be a risk due to the so-called 'Allee-effect': recent research indicates that mating in queen conch does not occur when densities were below 56 ind./ha and no spawning below densities of 48 ind./ha (Stoner and Ray-Culp 2000). In a number of countries, the status of local queen conch populations is either poorly known or not known at all including important exporting countries such as Honduras. In addition, low adult densities are reported from fishing grounds of some of the larger exporting countries, for example, Bahamas, Belize, Colombia and the Dominican Republic.

**Table 2.** Mean densities of *Strombus gigas* determined by visual surveys in selected range States

Location	Ind./ha	Notes	Source
Antigua and Barbuda	13.5	Juveniles, 2001	Tewfik <i>et al.</i> , 2001
	3.7	Adults (lip > 4 mm), 2001	Tewfik <i>et al.</i> , 2001
Bahamas	1.67	Unprotected Bank (<5 m), adults, 1996	Stoner and Ray, 1996
	41.2	Unprotected Bank (>5 m), adults, 1996	Stoner and Ray, 1996
Belize	14.3	Sub-adults (<15 cm), 1996	Appeldoorn and Rolke, 1996
	14.9	Adults (>15 cm), 1996	Appeldoorn and Rolke, 1996
Cayman Islands	70	Grand Cayman, 2000	Bothwell, <i>in litt.</i> 2002
	100	Little Cayman, 2000	Bothwell, <i>in litt.</i> 2002
Colombia	317.5	Serrana Bank, 1999	Valderrama and Hernández, 2000
	22.1	Serranilla Bank, 1999	Valderrama and Hernández, 2000
	33.7	Roncador Bank, 1999	Valderrama and Hernández, 2000
	2.4	Quitassueño Bank, 1999	Valderrama and Hernández, 2000
Dominican Republic	14.4	Juveniles (Parque del Este), 2001	Torres and Sullivan Sealey, 2001
	0.6	Adults (Parque del Este), 2001	Torres and Sullivan Sealey, 2001
	53	Juvenile (Parque Jaragua), 1999	Posada <i>et al.</i> , 1999
	4.6	Adults (Parque Jaragua), 1999	Posada <i>et al.</i> , 1999
Haiti	10.7	Juveniles (Gonaves Island), 1995	Wood, 1995
	0	Adults (Gonaves Island), 1995	Wood, 1995
	15	Adults (Rochelios Bank), 1995	Wood, 1995
	160	Western end, 1995	Wood, 1995
Honduras	7.3	Cayos Cochinos (protected), Adults, 1998	Tewfik <i>et al.</i> , 1998
Jamaica	136	Subadults and adults (10-20 m), Pedro Bank, 2002	Smikie and Appeldoorn, 2002
Mexico	84	Alcranes Reef, 1999	Pérez and Aldana, 2000
Netherlands Antilles	20.2	Bonaire, overall density, 1999	van Buurt, 2001
Panama	1.4	Bocas del Toro (0-10 m), 2000	Tewfik and Guzman, <i>in prep.</i>
Turks and Caicos Isl.	87.5	Caicos Bank, large juveniles and subadults, 2002	Clerveaux, <i>in litt.</i> 2002
	204	Caicos Bank, adults, 2002	Clerveaux, <i>in litt.</i> 2002
	44.8	Turks Bank, large juveniles and subadults, 2002	Clerveaux, <i>in litt.</i> 2002
	182.7	Turks Bank, adults, 2002	Clerveaux, <i>in litt.</i> 2002

**Table 2 continued.** Mean densities of *Strombus gigas* determined by visual surveys in selected range States

Location	Ind./ha	Notes	Source
	1.5	Florida, 1990	Berg and Glazer, 1995
	8.1	Puerto Rico, Southwest, 1985/86	Torres-Rosado, 1987
	8.5	Puerto Rico, West, 1995	Mateo <i>et al.</i> , 1998
	7.4	Puerto Rico, East, 1996	Mateo <i>et al.</i> , 1998
	27.4	St Croix, Adults, 2001	Gordon, <i>in litt.</i> 2002
	12.3	St. Thomas/St. John, 1990	Friedlander <i>et al.</i> , 1994
	1.88	St Thomas, Juveniles, 2001	Gordon, <i>in litt.</i> 2002
Venezuela	18.8	Los Roques, overall density	Schweizer and Posada, 2000
	0.82	Los Roques, Juveniles	Schweizer and Posada, 2000

#### DOMESTIC USE AND LANDING VOLUMES

Data on the levels of Queen conch meat consumed domestically are lacking for most countries. Where available, it suggests that levels of domestic consumption is high in some areas including the Dominican Republic, the French Antilles and Haiti, whereas in others, most of the Queen conch harvest is destined for export (Table 1). In some countries or dependent territories domestic demand has exceeded local supplies and the majority of the meat needs to be imported (e.g. Guadeloupe, Martinique, Netherlands Antilles) (Mulliken 1996). Prices for Queen conch meat at local markets generally vary between US\$ 3 - 8 per kg (Theile 2001). However, prices can be considerably higher, e.g. in the French Antilles (Martinique and Guadeloupe) where retail prices at local markets are US\$ 11 per kg for locally harvested meat and up to US\$ 20 per kg for imported meat (Gourbeyre *in litt.* 2001). The import value of Queen conch meat imported into the US ranged from US\$ 4.5 - 5.8 per kg (average US\$ 4.9 per kg) in the years 1995 to 2002 (NMFS 2002).

Available information on harvest and landing statistics of queen conch meat (fresh, excluding shell) by country/dependency is provided in Table 3. It should be noted that the meat weights included in Table 3 may refer to different levels of meat processing, including meat that has been 'cleaned' prior to landing, and may therefore not necessarily be comparable between countries/dependencies. In addition, landing figures are often only estimates, especially in countries where landings are not well monitored and therefore these figures may be an under- or overestimate of the real volumes of landed queen conch meat.

Based on these figures, a minimum of 54,680 t of *S. gigas* meat has been reported as landings between 1993 and 2001. Until 1998, annual landings remained relatively stable ranged around 7,000 t per year. Since 1999, landings have decreased and were 3,150 t in 2001. However, the overall harvest is likely to be significantly larger due to the high levels of illegal and unreported fishing (see below). The largest landings have been reported from the Dominican Republic, followed by Jamaica, Honduras, the Turks and Caicos Islands,



Bahamas, Belize and Colombia. The majority of these landings are exported, but in some countries such as the Bahamas and the Dominican Republic a significant portion of the harvest is consumed locally.

Until 1999, Jamaica used to be the largest producer and exporter of Queen conch meat. Most of the meat originated from the Jamaican Pedro Banks, a large submarine bank that lays south-west of the island and is considered to host one of the largest and most important queen conch stocks in the region. In the early 1990s annual landings from the Pedro Bank were as high as 3,000 t, however, from 1994 onwards the allowable catch and export volumes were decreased, in response to stock assessments and the implementation of a management plan that introduced the use of annual catch and export quotas. Due to the significant levels of poaching at Pedro Bank, the quota for 2003 was decreased to 500 t, although stock assessments undertaken earlier this year estimated the total allowable catch of 900 t.

#### INTERNATIONAL TRADE

Table 4 provides an overview of net exports of Queen conch meat between for 1992 to 2001 per exporting State based on trade reported by CITES Parties. Due to incomplete reporting or failure to submit annual reports, these data only provide an indication of actual trade levels. This applies in particular to trade reported in the years 1993 and 1994, i.e. the first two years after the inclusion of the species in CITES Appendix II. Moreover, three Queen conch range States are not yet a Party to CITES (Anguilla, Haiti and the Turks and Caicos Islands) while others have only recently acceded to the Convention, such as Jamaica (in 1997), Grenada (in 1999) and the Netherlands Antilles (in 1999). Comprehensive trade data from these countries, especially for the early 1990s, is therefore lacking.

Based on this data a total of 21,649 t of Queen conch meat was exported between 1993 and 2001. Jamaica, Honduras, the Turks and Caicos Islands, the Dominican Republic, the Bahamas, Colombia and Belize are the largest exporters of Queen conch meat, combined responsible for 98 % of the total recorded exports. In the late 1990s (1998 - 2000), exports have decreased slightly from 2,818 t in 1999 to 2,091 t in 2000, but have again increased in 2001 to 3,088 t. The decrease in export in the late 1990s is mainly due to the lack of exports from Jamaica, following a national lawsuit that suspended the national Queen conch fishery, and consequently all exports from Jamaica, for almost two years (from August 1999 to May 2001, and again in 2002). At the same time, meat exports from a number of other countries have increased, most notably from the Dominican Republic and Honduras.

The majority of the 21,649 t (78 %) exported between 1993 and 2001, was imported by the USA (including Puerto Rico and the US Virgin Islands), the largest importer and consumer of Queen conch meat. The EU, in particular the two French Overseas Departments of Martinique and Guadeloupe, is considered to be the second largest importer of Queen conch meat; 19% of the Queen conch exported between 1992 and 2001 were imported by these two islands. Due to EU Sanitary Food Regulations, imports of Queen conch meat to the EU were not allowed between July 1997 and late 2001, and after that only certain

producers have been authorized to export to the EU again (Theile 2001). Others, such as the Cayman Islands and the Netherlands Antilles are also considered important consumers of Queen Conch, however no imports of meat have been reported, which has raised questions about the legality of these imports (Mulliken 1996).

**Table 3.** Reported landings (metric tons) of Queen conch meat\* in the most important producing countries for 1993 to 2001

Range State	1993	1994	1995	1996	1997	1998	1999	2000	2001 <sup>3</sup>	Total	% of Total
Dominican Republic	2,600	1,857	2,210	1,957	1,573	2,689	1,243	1,400	1,222	16,731	31
Jamaica <sup>1</sup>	3,000	2,051	1,950	1,900	1,821	1,700	1,366			13,788	25
Honduras (export)	450	858	832	737	966	636	747	932	1,328	7,486	14
Turks and Caicos Isl. <sup>2</sup>	738	954	965	737	788	645	737	817		6,381	12
Bahamas			493	590	635	680	454	668		3,520	6
Belize	192	149	165	138	257	209	178	235	263	1,786	3
Colombia	228	240	207	107	100	156	199	104		1,341	2
Other countries	162	636	382	368	446	508	331	458	356	3,647	7
<b>Total</b>	<b>7,370</b>	<b>6,745</b>	<b>7,204</b>	<b>6,534</b>	<b>6,586</b>	<b>7,203</b>	<b>5,255</b>	<b>4,614</b>	<b>3,169</b>	<b>54,690</b>	<b>100</b>

Fresh, without shell, however landing figures refer to different levels of processed meat which significantly influence the weight reported (up to 50% or more). 1 = refers to 50% cleaned meat; 2 = refers to unprocessed Queen conch meat; 3 = Data for 2001 are largely incomplete. Source: Information compiled during the CITES Review of Significant Trade in *Strombus gigas*. See Document AC19 Doc. 8.3 (Rev. 1), [www.cites.org](http://www.cites.org)

### ILLEGAL FISHING AND TRADE IN QUEEN CONCH

Over the past decade increasing concerns have been raised about the alleged high levels of illegally harvested and traded Queen conch meat (e.g. Mulliken 1996, Chakalall and Cochrane 1996, Anon. 2001).

Illegal trade across international borders occurs often due to lack of knowledge, awareness and poor enforcement of CITES provisions and other regulations in exporting and importing countries. However, intentional and concealed illegal trade, especially in the form of illegal fishing by vessels in foreign territorial waters and subsequent illegal import and landing of the product in the vessel's home port, appears widespread and seriously undermines the management and conservation of *S. gigas* resources. There are concerns that considerable amounts of queen conch meat entering international trade may in fact have been obtained in contravention with existing fisheries regulations, or from waters under the jurisdiction of other countries. Recent information suggests, for example, large-scale poaching by foreign vessels on the offshore banks of Jamaica, especially on the Pedro Banks, and several foreign fishing vessels have been apprehended by the Jamaican Defence Force Coast Guards and brought before court (Anon. 2001b, Anon. 2002c, Anon. 2002d, Kong, in litt. 2002). A significant number of these vessels originate from neighboring countries and some of these vessels misuse their license to harvest lobster and illegally fish for queen conch (Kong, in litt. 2002). Since the exports of Jamaica decreased, export levels of some of the neighboring countries, in particular Honduras and the Dominican Republic, have increased continuously and have almost doubled in the three years from 1999 to 2001 (from 750 t in 1999 to 1,330 t in 2001 for Honduras and from 280 t in 1999 to 560 t in 2001 for the Dominican Republic) (see Table 4). Due to the stock status in these countries, there have been concerns that considerable amounts of the conch meat exported may in fact have been obtained from waters under the jurisdiction of other countries, including Jamaica.

Information from other range States suggests that the problem of poaching and illegal trade is widespread. The Department of Fisheries of the Bahamas, for example, reported ongoing poaching activities, especially during the summer (Deleveaux, in litt. 2001). In the past, several vessels with foreign registry have been arrested with large quantities of Queen conch meat. In the Turks and Caicos Islands, 68 foreign individuals were arrested for illegal fishing and over 40 vessels were confiscated between October 2001 and April 2002 alone (Clerveaux in litt. 2002). There are also reports that sustainable volumes of Queen conch meat are fished and transported outside the Haitian waters, predominately, to the French islands of Guadeloupe and Martinique, French Customs Service in litt. 2001). The CITES Management Authority of Colombia reported poaching by foreign vessels in their territorial waters, especially in San Andrés Archipelago (INPA 2001). In 1995, a foreign vessel was caught in Colombian territorial waters and a fine of US\$ 50,000 was imposed and queen conch meat on board was confiscated (Vaca in litt. 2001). Belize reported significant poaching activities by fishers of neighboring countries during most parts of the year (Marin 2001). Venezuela reported

Table 5. Overview of most important management measures adopted by Queen conch range States\*.

Country/Territory	Lip size	Meat weight	Shell length	Gear restriction	Closed season	Closed areas	Harvest quota	Export quota
Antigua and Barbuda	*	*	*	*	*	*	*	*
Bahamas	*	*	*	*	*	*	*	*
Belize	*	*	*	*	*	*	*	*
British Virgin Islands	*	*	*	*	*	*	*	*
Cayman Islands	*	*	*	*	*	*	*	*
Colombia	*	*	*	*	*	*	*	*
Cuba	*	*	*	*	*	*	*	*
Dominican Republic	*	*	*	*	*	*	*	*
Grenada	*	*	*	*	*	*	*	*
Guadeloupe	*	*	*	*	*	*	*	*
Haiti	*	*	*	*	*	*	*	*
Honduras	*	*	*	*	*	*	*	*
Jamaica	*	*	*	*	*	*	*	*
Martinique	*	*	*	*	*	*	*	*
Mexico	*	*	*	*	*	*	*	*
Netherlands Antilles	*	*	*	*	*	*	*	*
Nicaragua	*	*	*	*	*	*	*	*
Puerto Rico (federal waters)	*	*	*	*	*	*	*	*
Saint Kitts and Nevis	*	*	*	*	*	*	*	*
Saint Lucia	*	*	*	*	*	*	*	*
Saint Vincent and the Grenadines	*	*	*	*	*	*	*	*
Turks and Caicos Islands	*	*	*	*	*	*	*	*
US Virgin Island	*	*	*	*	*	*	*	*

\* Countries and territories not included in this Table have either no species-specific regulations in place (Anguilla, Barbados, Dominica, Guatemala, Montserrat, Panama and Trinidad and Tobago) or have banned the harvest of Queen conch (Aruba, Bermuda, US - Florida and Venezuela). For further details see CITES Review of Significant Trade in *Strombus gigas*. Document AC19 Doc. 8.3 (Rev. 1). [www.cites.org](http://www.cites.org)

The most common measure used to regulate the queen conch fishery are minimum size restrictions in the form of shell size restrictions or meat weights, that are used by many countries to prevent the harvest of immature individuals. However, the imposition of a minimum shell length restriction alone does not necessarily prevent the harvest of immature individuals, unless it is implemented in combination with a lip thickness requirement. This is because sexual maturity only occurs when the shell lip has started to flare and has reached a thickness of approximately 5 mm (Appeldoorn, 1988b), and this may occur as much as one year after the start of the lip formation. Therefore, even animals that have a shell length of an adult specimen ( $\approx 20$  cm), but do not yet have a flared lip, may still be sexually immature. The imposition of shell length limits can also result in a selective pressure on local stocks due to the fact that the size of individuals can vary from one area to another, and that females are generally slightly larger than males (Appeldoorn 1994b). Shell size requirements can also be difficult to enforce, because in many countries the shells are often discarded directly at sea and only the meat is landed.

Gear restrictions, for example banning the use of scuba and thereby limiting the legal harvest of Queen conch to free diving or hookah, are an important and effective management tool for reproductive stocks as it helps to preserve deep-water populations and important spawning stock refugia (Appeldoorn 1997, Stoner 1997). A total prohibition of these two types of gear seems not only to effectively limit the areas (depths) that can be fished and to effectively reduce the overall fishing pressure, but would also help to prevent the serious health risks that are associated with unsafe diving practices using these gear types (Espeut 1997). However, the ban of scuba has also shown negative effects because it may increase the fishing pressure on shallow water stocks and potentially leads to the increased exploitation of juvenile Queen conch in shallower waters (Appeldoorn 1997). Moreover, in several areas, queen conch populations have been reduced to the point where only deep-water populations remain (e.g. Puerto Rico) and a total prohibition of scuba and/or hookah would be likely to end the fishery (Espeut 1997, Stoner in litt. 2002, Tewfik in prep.).

Closed areas in the form of "no take zones" or Marine Protected Areas (MPA) are seen as one of the most important management tools to protect Queen conch populations (Anon. 1999, Appeldoorn 1994b, Stoner 1997, Marin in prep.). MPAs allow maintenance of spawning stock size at high densities and provide a refuge for older specimens which are known to be more reproductive than younger adults (Anon. 1999). Comparative studies in protected and unprotected areas, for example in the Bahamas or the Turks and Caicos Islands, have shown that densities and stock sizes are significantly higher in protected areas. For example, the Exuma Land and Sea Park in the Bahamas was found to support 31 times greater concentrations of queen conch than areas outside the park (Stoner and Ray 1996). Moreover protected areas can be an important source of larvae and new recruits to exploited areas ('spillover effect') (Stoner 1997). Evidence that MPAs are working is also demonstrated by studies from the Turks and Caicos Islands, where queen conch densities in the East Harbor Lobster and Conch Reserve in South Caicos

were almost twice as high as in similar habitats outside the reserve (Wilkinson 2002). However, the effectiveness of these management measures is dependent on the identification of critical spawning sites and nursery grounds. Critical nursery sites are often found near-shore and are therefore particularly vulnerable to habitat degradation and other human impacts. Some areas may depend largely on recruitment from faraway stocks (through larval drift) and hence depend on the protection of spawning sites in other regions; therefore, larval transport, retention and physical oceanography must also be considered (Stoner 1997).

Seasonal closures to protect the stock during the most reproductively active months are in place in several range States (see Table 5). However, these closures are not always harmonized at regional or sub-regional level, which may undermine their enforcement, because queen conch taken illegally in one country during a closed season could be landed legally in a neighboring country. In several States, seasonal harvest closures are supplemented with a seasonal ban on processing, trade, and exports of queen conch meat during the closed season (for example in the Dominican Republic or Jamaica), which greatly facilitates the enforcement of closed seasons.

In recent years, several range States made use of harvest and or export quotas to manage and control the total fishing effort. Annual (or seasonal) harvest and/or export quotas for *S. gigas* are used in the Bahamas, Colombia, Cuba, Jamaica, Mexico, Nicaragua, Turks and Caicos Islands, and daily catch limits are in use in the Cayman Islands, Puerto Rico, Saint Lucia and the US Virgin Islands. Annual harvest quotas are often used in combination with export quotas. Most of these range States consider quotas as an effective tool that enabled them to better control off-take and to monitor exports of Queen Conch products. The inclusion of *S. gigas* in Appendix II of CITES and the resulting need to issue export permits was not only instrumental in the decisions to employ export quotas but also facilitated the control and monitoring of export quotas (Braynen 2001, Anon. 2001b).

#### OUTCOME OF THE CITES REVIEW OF SIGNIFICANT TRADE AND THE WAY FORWARD

Following the requirements of CITES Resolution Conf. 12.8, the Animals Committee categorized the Dominican Republic, Haiti and Honduras as countries of 'urgent concern' at its 19th meeting held in August 2003. The recommendations by the Animals Committee for these three countries included a voluntary suspension of all commercial fishing (except for legal harvest in their own national waters) and exports for six months in order to designate future fishing areas and undertake stock assessments that can serve as a basis for the establishment of a management plan that includes catch and export quotas. Following these recommendations, the Dominican Republic and Honduras suspended exports of Queen conch in September 2003. Haiti, a non-Party to CITES, did not respond to the recommendations.

This temporary suspension of international trade in Queen conch has significant consequences for the countries, especially for the many hundreds of people involved in the fishery. However, after years of reports about increas-

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