CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

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Nineteenth meeting of the Animals Committee
Geneva (Switzerland), 18-21 A 2003

Review of Significant Trade in specimens of Appendix-II species
(Resolution Conf. 12.8 and Decision 12.75)

PROGRESS ON THE IMPLEMENTATION OF THE REVIEW OF SIGNIFICANT TRADE (PHASES IV AND V)

1. This document has been prepared by the Secretariat.

Strombus gigas

2. *Strombus gigas* (queen conch) was first selected for the Review of Significant Trade in 1995. However, owing to continuing concern regarding the implementation of Article IV, the species was selected at the 17th meeting of the Animals Committee (AC17, Hanoi, July-August 2001) to be reviewed again during Phase V.

3. The Annex to this document consists of a report of the Review of Significant Trade in specimens of *Strombus gigas* that has been prepared by a consultant, TRAFFIC Europe in cooperation with IUCN, under contract to the CITES Secretariat.

4. The draft report was sent to all range States for comment and, where appropriate, additional information. Comments on the draft report received from range States by 30 June 2003 have been incorporated into the review in the Annex to this document where appropriate. Additionally, a workshop was organized by the Caribbean Fisheries Management Council, funded by the United States of America, from 11 to 12 June 2003 in Montego Bay, Jamaica. The *International Queen Conch Initiative* and CITES workshop, (Strombus gigas *Significant Trade Review*), brought together fisheries and Management Authorities from the range States, the Caribbean Fisheries Resource Mechanism (CFRM), the Food and Agriculture Organization, other experts, the CITES Secretariat and TRAFFIC Europe, to discuss the draft report, provide additional information, and formulate a number of recommendations related to both the Review of Significant Trade and wider capacity-building issues.

5. In accordance with Resolution Conf. 12.8 on the Review of Significant Trade in specimens of Appendix-II species and taking into consideration all the information referred to in paragraph 4, the Secretariat and the consultant shall summarize the conclusions about the effects of international trade on *Strombus gigas*, and provisionally divide the range States of *Strombus gigas* into three categories, i.e. 'of urgent concern', 'of possible concern', or 'of least concern' with regard to the implementation of the provisions of Article IV paragraphs 2 (a), 3 or 6 (a) of the Convention. The proposed categorization will be transmitted to the range States and the members of the Animals Committee before the 19th meeting of the Animals Committee. This will include an indication of

the problems that were identified in the course of the review as not related to the implementation of Article IV paragraph 2 (a), 3 or 6 (a), and of the range States concerned.

Implementation of the Review of Significant Trade for species selected in Phase IV

6. The Secretariat will provide an oral summary of the status of the Review of Significant Trade for all the taxa that have been selected for review since the 11th meeting of the Conference of the Parties. This concerns the species listed below.

Species	**Species report document number**
Moschus spp.	Doc. AC.16.7.4
Naja naja spp.	Doc. AC.16.7.3
Testudinata	
Cuora amboinensis	AC18 Doc. 7.1
Cuora flavomarginata	AC18 Doc. 7.1
Cuora galbinifrons	AC18 Doc. 7.1
Lissemys punctata	AC18 Doc. 7.1
Pyxis planicauda	AC18 Doc. 7.1
Acipenseriformes	
Acipenser baerii	Doc. AC.16.7.2
Acipenser fulvescens	Doc. AC.16.7.2
Acipenser gueldenstaedtii	Doc. AC.16.7.2
Acipenser nudiventris	Doc. AC.16.7.2
Acipenser oxyrinchus	AC18 Doc. 7.1
Acipenser persicus	AC18 Doc. 7.1
Acipenser ruthenus	Doc. AC.16.7.2
Acipenser schrencki	Doc. AC.16.7.2
Acipenser stellatus	Doc. AC.16.7.2
Acipenser transmontanus	AC18 Doc. 7.1
Huso dauricus	Doc. AC.16.7.2
Huso huso	Doc. AC.16.7.2
Polyodon spathula	Doc. AC.16.7.2
Scaphirhynchus platorynchus	AC18 Doc. 7.1

Strombus gigas Linnaeus, 1758

Queen Conch
Lambi, Strombe géant
Caracol reina

Order: MESOGASTROPODA

Family: STROMBIDAE

SUMMARY AND CONCLUSION

Queen Conch *Strombus gigas* is distributed throughout the Caribbean, from Florida (US) to the northern coast of Latin America, and the species is found in the territorial waters[1] of at least 36 countries and dependent territories. They primarily inhabit sandy seafloors in clean, shallow waters, but also occur in depths of up to 100 m. The species has been included in Appendix II of CITES since November 1992 and although it was classified as Commercially Threatened in the 1994 IUCN Red List of Threatened Animals (Groombridge, 1993), it is not currently classified as threatened by IUCN (IUCN, 2002).

S. gigas has been harvested for food for centuries, however, a large commercial fishery has developed only in the last few decades, mainly in response to the increased international demand for the meat. Today, the species is one of the most important fishery resources in the Caribbean and the wholesale value of the annual landings has been estimated to be USD 60 million. The shells are also used and traded as curio and tourist souvenirs, but are largely considered a by-product of the meat trade.

Over the past few decades, intensive fishing pressure has led to population declines, stock collapses and consequently the total or temporary closure of the fishery in a number of locations, for example in Bermuda (GB), Cuba, Colombia, Florida (US), Mexico, the Netherlands Antilles (NL), the Virgin Islands (US) and Venezuela. Available information suggests that the majority of *S. gigas* populations have continued to decline since the species was listed in the Appendices, and in some areas, population densities are so low that recruitment failure is a risk to local fisheries (e.g. in parts of Belize, Colombia, the Dominican Republic, Haiti, Honduras, Panama, Puerto Rico (US) and the Virgin Islands (US)). Overfishing for domestic and international trade is the primary factor for these population declines, although habitat degradation may also be a factor, especially with regard to the loss of important nursery habitats, such as shallow water seagrass meadows close to the shore. Due to the depletion of shallow water stocks, fishing efforts have shifted from near-shore to offshore areas (e.g. in Colombia, Dominican Republic, Mexico). The use of scuba and hookah gear (compressor diving) has become widespread and as near-shore areas are increasingly overfished, former deep-water refugia (> 20 m) have also become subject to intense exploitation (e.g. in parts of the Bahamas, Haiti, Dominican Republic). Among the few larger areas that still maintain relatively stable populations are, for example, the Bahamian archipelago, the Pedro Bank in Jamaica, and the banks in the Turks and Caicos Islands. 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 Haiti and Honduras. In addition, low adult densities are reported from fishing grounds of some of the larger exporting countries, for example, Belize and the Dominican Republic.

Between 1993 and 1998, the total annual landings of Queen Conch meat ranged between 6,519,711 and 7,369,314 kilograms (kg). Since then, annual landings have fallen and were 5,554,114 kg in 1999, 4,598,004 kg in 2000 and 3,131,599 kg in 2001. The largest landings have been reported from the Dominican Republic, Jamaica and Honduras, with each country declaring annual landings of around 1,000,000 kg of meat. Other important producers are the Bahamas and the Turks and Caicos Islands, annually landing up to 680,000 kg and 964,597 kg of unprocessed meat respectively. The majority of these landings are destined for export, but in some countries, local consumption can also be significant

[1] Most range States claim 12 nautical miles (nm) as territorial sea, with the exception of Nicaragua and Panama, that claim a territorial sea of 200 nm, and the Dominican Republic, that has set claims to a territorial sea of six nm. With the exception of Nicaragua and Panama, all Queen Conch range States have established a 200 nm exclusive economic zone (EEZ).

and even greatly exceed exports, e.g. in the Bahamas and the Dominican Republic. Based on CITES trade data, a total of 21,649,306 kg of meat were exported (net exports) in the ten-year period of 1992 to 2001. In addition, 2,345,868 shells, 142,778 kg of shells, 407,140 live specimens and 341,777 kg of live specimens have been reported as exports by CITES Parties. The largest exporters of Queen Conch meat are Jamaica and Honduras, followed by the Turks and Caicos Islands (GB), 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 [including Puerto Rico and the Virgin Islands (US)], followed by France (including Guadeloupe and Martinique) which imported 19% of all meat reported in international trade between 1992 and 2001.

Non-standarized or insufficient monitoring and reporting of landings, together with insufficient information on the weight of meat yields (soft tissue) per specimen upon landing (unprocessed) and in trade (processed), make the monitoring of landings and trade volumes difficult. There is evidence of increased levels of illegal harvesting and international trade from various fishing grounds in the region, including illegal harvesting by vessels in waters under the jurisdiction of other States. Therefore, considerable amounts of meat entering international trade may in fact have been obtained in contravention with existing fisheries regulations, and illegally.

With the exception of Haiti and the Turks and Caicos Islands (GB), all Queen Conch range States are Parties to CITES, and all Queen Conch range States have imposed some regulations relating to the management and/or conservation of the Queen Conch fisheries, except for Barbados, Dominica, Guatemala, Montserrat (GB), Panama and Trinidad and Tobago. The most common measures include minimum size restrictions (minimum shell length, lip thickness and tissue weight), closed seasons, closed areas or no-take zones, harvest bulk restrictions (quotas or daily bag limits) and gear restrictions. For example, harvest and/or export quotas are used by the Bahamas, Colombia, Cuba, Jamaica, Mexico, Nicaragua and the Turks and Caicos Islands (GB); daily bag limits are used in the Cayman Islands (GB), Puerto Rico (US) and the Virgin Islands (US). However, enforcement is poor in some countries and regulations are often ignored.

The exploitation of deeper stocks, the shift in local harvesting areas and low population densities reported from several countries indicates that several populations are overfished and that there is a potential for local fishery collapses. Of concern are also the high exports reported from countries where only little information on the stocks is available (e.g. Honduras), or where available information suggest that population are depleted and overfished (e.g. Belize, Dominican Republic). There is also evidence of unreported international trade, primarily between countries or dependent territories in the region.

Table A4 in the Annex of this report provides an overview of the Queen Conch fishery (relative importance of the fishery, uses, fleet and main gear used), the annual landing and export figures since the early 1990s and information about the status of the stocks per range State.

DISTRIBUTION AND POPULATION

Strombus gigas is one of the seven species of the family *Strombidae* that occur in the Western Atlantic Ocean. Queen Conch is known by various names throughout its range, including: Botuto or Guarura (Venezuela); Cambombia (Panama); Cambute (Costa Rica); Caracol abulon (Guatemala); Caracol gigante (Honduras); Caracol pala (Colombia); Caracol rosado (Mexico); Carrucho (Puerto Rico); Cobo (Cuba); and Lambi (Hispaniola and French Antilles). It is easily distinguished from other strombid species by its large size (up to 30 cm shell length and 3 kg in weight) and its deep pink coloured aperture (Randall, 1964). The species is distributed throughout the tropical north-western Atlantic including Bermuda (GB), the Florida Keys (US), 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 the following 36 countries and dependent territories in the Wider Caribbean (based on Anon., 1996a):

Anguilla (GB)	Bermuda (GB)	Cuba
Antigua and Barbuda	Brazil	Dominica
Aruba (NL)	British Virgin Islands (GB)	Dominican Republic
Bahamas	Cayman Islands (GB)	Grenada
Barbados	Colombia	Guadeloupe (FR)
Belize	Costa Rica	Guatemala

Haiti	Nicaragua	Trinidad and Tobago
Honduras	Panama	Turks and Caicos Islands (GB)
Jamaica	Puerto Rico (US)	United States of America
Martinique (FR)	Saint Kitts and Nevis	Venezuela
Mexico	Saint Lucia	Virgin Islands (US)
Montserrat (GB)	Saint Vincent and the Grenadines	
Netherlands Antilles (NL)		

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 (e.g. Bermuda, Cuba, Florida (US), Mexico, St. Thomas and St. John in the Virgin Islands (US), Venezuela) and the populations of several countries are considered depleted due to overexploitation. According to Tewfik (*in litt.* 2002), there are only a few unexploited populations or areas within the species' range (i.e. deep water stocks, stocks in protected areas, etc.). 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., 1996a; Mulliken, 1996; Anon., 1999). Overexploitation is reported to have changed local distribution and abundance (Tewfik, *in litt.* 2002).

Several countries have undertaken stock assessments and abundance surveys and collected morphological and fisheries dependent data (Catch and Effort data) (see also Conservation Measures). However, stock assessment remains difficult due to certain aspects of the species biology such its unusual growth pattern and its large change in natural mortality with age (Anon., 1999; see Ecology and Biology). Moreover, Queen Conch stocks are patchy in their distribution even within the appropriate habitats, and this patchiness adds to the difficulties in their assessment.

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 (see Table A1 in Annex). In fact, adult densities in several range States are now at such low densities where reproduction failure may be a risk due to the so-called 'Allee-effect' (Stoner and Ray-Culp, 2000; see Ecology and Habitat). 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 (see Table A1 in Annex). Some of these locations host potentially very important populations, such as the Queen Conch stock at Pedro Bank in Jamaica, that is considered one of the largest stocks within the species range (Aiken *et al.*, 1999) and one of the most important Queen Conch producing areas in the region (Stoner, 1997).

The species' range is considered a mixed meta-population with constant genetic flow between populations (Mitton *et al.*, 1989; Morales and Lopez, 2002), with the exception of Bermuda (GB). The majority of Queen Conch populations are considered to be interdependent for recruitment at some spatial and temporal scale, due to the dispersal of the planktonic larvae (Stoner, 1997). Therefore the species has been considered a shared resource for the Caribbean region (Anon., 1999; Stoner, 1997). However, it is evident that the magnitude and frequency of the recruitment varies among areas, depending on oceanographic currents and other factors. For example, after a temporal fisheries closure in the early 1980s the Cuban Queen Conch population recovered relatively rapidly (Munoz *et al.*, 1987), whereas populations in other areas, for example in Florida and Bermuda, recovered slowly, even after more than a decade of a total fishing ban (Posada and Appeldoorn, 1994). Speed of recovery is therefore assumed to be related to the dependence on and availability of recruiting larvae from other populations including distant "source populations" located upstream (Stoner, 1997). However, local recruitment and larvae retention within a certain stock are also considered important factors (Stoner, 1997), for example it is likely that Queen Conch populations in Florida were self-sustaining, when adult densities where high. Initially, recruitment appeared to depend largely on spawning populations elsewhere, for example in Belize and Mexico, that have been considered to have important spawning stocks (Stoner, 1997), however, Florida is now experiencing increases in population densities and abundance (Thomas and Gabel, *in litt.* 2003). Other important Queen Conch producing areas are for example the Pedro Bank in Jamaica, sites in Cuba and possibly the Windward Islands, e.g. the

Grenadines that are located at the eastern fringe of the species range with an east-to-west circulation of surface waters through the Caribbean Sea.

Anguilla (GB): The status of the local Queen Conch stocks is insufficiently known (Anon., 1998).

Antigua and Barbuda: The species is historically known from the western shelf of Antigua, but may also be distributed on the central and northern shelf (Tewfik, *in litt.* 2002). Continued harvesting has resulted in the depletion of *S. gigas* in the shallow water habitats of the southern portions of the shelf (Horsford and Lovell, 2002); harvest has shifted to deep-water populations. In 1999, abundance surveys were conducted in the main commercial fishing ground and a morphometric analysis of two stocks was undertaken at the western shelf of Antigua (Tewfik *et al.*, 2001; Horsford, 1999). The abundance survey revealed overall densities of 17.2 ind./ha with juveniles making up almost 80% of the surveyed population. The overall adult density was extremely low (3 ind./ha), indicating consistent and high fishing pressure. The estimates of the exploitable biomass of adult meat weight were 32,000 kg for the study area (Tewfik *et al.*, 2001). However, as this abundance survey was restricted to a heavily fished location, the results can not be extrapolated to other areas (Horsford, *in litt.* 2003).

Aruba (NL): The species is considered rare (Anon., 1998).

Bahamas: The large Bahamian archipelago provides important habitat for Queen Conch populations (Tewfik, *in litt.* 2002). The *S. gigas* populations around the Bahamas have been considered generally stable (Philipps, *in litt.* 2002). However, localised areas close to human population centres appear to be overfished and local depletions have been noted (Appeldoorn, 1994a; Tewfik, *in prep.*). For example, surveys undertaken in the mid-1990s found mean adult densities around Lee Stocking Islands of 1.67 ind./ha in shallow waters (< 5 m) and 41.2 ind./ha in deeper waters (> 5 m) (Stoner and Ray, 1996). In contrast, surveys undertaken in protected waters found higher adult densities of 50.2 ind./ha in shallow water (< 5 m) and 111 ind./ha in deeper waters (> 5 m) (see Table A1 in Annex). Based on these results, Gascoigne (2002) concluded that local shallow waters stocks in unprotected areas were overfished, while deep-water stocks are approaching a status of overfishing. Landings of juveniles occurs and are reported to be significant at certain sites (Tewfik, *in prep.*). In 1999, a weight-based stock assessment was undertaken for the Grand Bahama Island to determine the total Queen Conch abundance and biomass (Ehrhardt, 1999). The total *S. gigas* biomass was calculated at over 881,000 kg of Queen Conch meat and the authors concluded that the stocks of the Grand Bahama Islands are not fully exploited (Anon., 1999).

Barbados: The populations of *S. gigas* around Barbados are patchily distributed off the northwest and southwest of the island, and some populations are known to be present in deep water (30-50 m) along the west coast. There is currently no information on the population status, however, anecdotal information suggests that local populations are typically much smaller that those of other countries in the region, possibly due to the lack of suitable shallow water habitats (Anon., 2001c).

Belize: Queen Conch populations have been considered to be overfished and have shown evidence of severe declines (Appeldoorn, 1994a). This trend appears to have continued and the species is reported to have become scarce as progressively smaller individuals are being harvested despite national size restrictions (Anon., 1999; Anon., 2002a; Marin, *in prep.*; Tewfik, *in prep.*). In 1996, the Belize Fisheries Department conducted visual surveys in shallow waters of up to 70 ft (21.3 m) in commercially important fishing grounds (Appeldoorn and Rolke, 1996); deeper water populations (> 70ft) were not surveyed. The surveys found that the shallow water population is dominated by juveniles greater than 10 cm (70%) and only a few adults were observed; it was suggested that the population is seriously overexploited and in danger of stock collapse due to spawning failure. It was further assumed that recruitment to the surveyed area might largely depend on spawning stocks located in protected areas (Marin, *in prep.*). However, Azueta (*in litt.*, 2003) notes that the deep water stocks consist largely of adults and are considered an important refugia. The Maximum Sustainable Yield of the legal size population (> 18 cm) was calculated to be around 190,000 kg (Appeldoorn and Rolke, 1996). Stock assessments undertaken in 1999 based on available catch and effort data from 1996 to 1998 estimated the Total Maximum Sustainable Yield at 284,398 kg per year, however, this figure was considered a very unreliable estimate and it was concluded that the Queen Conch stocks are overexploited (Anon., 1999). It was further noted that juveniles were increasingly targeted and that larger individuals are depleted.

Bermuda (GB): Bermuda lays at the edge of the Queen Conch range and the population is considered geographically isolated and possibly genetically distinct from populations elsewhere (Mitton *et al.*, 1989). Loss of habitats has impacted populations, which have been considered depleted since the early

1990s (Glazer, 1991). Mean densities have been estimated between 0.5 to 2.9 ind./ha (Berg *et al.*, 1992b). The Queen Conch fishery in Bermuda has been closed since 1978 as a result of low population counts (Barnes, *in litt.* 2001).

Brazil: The species is known to occur in Brazil, but little is known about the population status and distribution in Brazilian waters. *S. gigas* is not commercially fished in Brazil (Anon., 1998).

British Virgin Islands (GB): There is currently insufficient information to determine the status of *S. gigas* populations in the British Virgin Islands. No abundance or population surveys have been undertaken in recent years (Eristhee, *in litt.* 2001).

Cayman Islands (GB): Annual stock assessments of shallow water populations have been undertaken since 1988 in Grand Cayman and Little Cayman, but only areas that are fished and that have large enough densities to support fishing in the future have been surveyed. Deep-water populations have not been surveyed as the use of scuba or similar gear to harvest Queen Conch is prohibited (it is assumed that only the shallow water stocks are affected by fishing). The survey results show that Queen Conch populations have decreased in both islands: in Grand Cayman the average density fell from approx. 260 ind./ha in 1988 to around 70 ind./ha in 2000; in Little Cayman the average density dropped from 220 ind./ha in 1988 to approximately 100 ind./ha in 2000 (Bothwell, *in litt.* 2002).

Colombia: In the early 1970s, the main commercial fishing areas for Queen Conch were the San Bernardo Archipelago and Islas del Rosario (close to Cartagena). However, these areas were closed in 1977 after substantial overfishing had occurred and consequently fishermen had turned to new areas, mainly in the San Andrés and Providencia Archipelago (Mora, 1994). Nowadays, most fishing takes place at the Peninsula de la Guajira and in the Archipelago San Andrés and Providencia (González, 2002). Several studies including morphological studies and abundance surveys have been conducted in the early 1990s in main fishing areas in the San Andrés and Providencia Archipelago (i.e. Ospina et al., 1996; Chiquillo et al., 1997; Gallo, 1997). Surveys undertaken in 1993 and 1994, found at a depth range of 1.5-5 m, adult densities of 160 ind./ha at Quitasueño, 410 ind./ha at Roncador, 500 ind./ha at Serrana and 70 ind./ha at Albuquerque (Ospina et al., 1997). Ospina et al. (1997) also found that harvest rates reported from the different banks in the San Andrés and Providencia Archipelago had decreased from 1991 to 1994, despite increased fishing efforts. The most recent abundance surveys undertaken in 1999 at the four banks revealed significantly lower mean densities: at Quitasueño bank densities were 2.4 ind./ha despite a fishing ban and mean densities at Roncador were 33.7 ind./ha (Valderrama and Hernández, 2000). Ongoing illegal fishing activities at Quitasueño are seen as one of the reasons for the low densities recorded at this bank and overfishing is seen as a reason for the low densities observed at Roncador. Densities at Serrana bank were 317.5 ind./ha, and therefore also lower in comparison to the results of Ospina et al. (1997), but considerably higher than at the other banks. It was estimated that 80% of the total Queen Conch biomass calculated for the area are found in the Serrana bank (Valderrama and Hernández, 2000).

Costa Rica: The populations of *S. gigas* are reported to be declining around Costa Rica, but only very limited information is available (Mora, *in litt.* 2001).

Cuba: Queen Conch occurs around the Cuban shelf, with the keys and reefs of the northern and southern shelf of the island providing important habitat for the species. In the past, indiscriminate collection has resulted in significant population declines at many sites around Cuba and the fishery was closed between 1978 to 1982, and again in 1998. In the 1980s, densities were reported to be low (5 ind./ha) and in decline (Ferrer and Alcolado, 1994) and some populations along the northern shore were considered depleted (Glazer, 1991). The populations along the southern shelf were considered stable, but fully exploited (Appeldoorn, 1994a). In 1999, a study to evaluate population abundance and structure in the most important fishing areas was initiated (Formoso, 2001). Preliminary results found densities of 0.2 – 0.35 ind./m^2 with around 80% of individuals being adults (Formoso, 2001).

Dominica: Due to unsound harvesting practises and lack of regulation Queen Conch populations in Dominica were considered over-exploited and are now depleted (Fisheries Division of Dominica, 2002). According to Guiste (*in litt.* 2002) there is no commercial Queen Conch fishery in Dominica and the species is only fished opportunistically. Random measurements of shell length and meat weight indicate that the majority of harvested individuals are below the legal minimum size and are hence juveniles. There is no information on the population status, the extent of Queen Conch habitat and biological or fishery dependent data (Catch and Effort data) (Fisheries Division of Dominica, 2002) and populations are currently not monitored (Fisheries Division of Dominica, *in litt.* 2001).

Dominican Republic: The Queen Conch populations in the Dominican Republic are reported to be declining and are considered seriously over-fished in the main fishing areas within the territorial waters of the country, i.e. in the south- western area around the Jaragua National Park and in the south-eastern area around the Parque Nacional del Este (Delgado *et al.*, 1999; Posada *et al.*, 2000). Delgado *et al.* (1999) reported a three-fold decline in adult density (4.5 ind./ha in 1996 and 1.6 ind./ha in 1997) and a ten-fold decline in juvenile densities (283 ind./ha in 1996 and 22.5 ind./ha in 1997) between 1996 and 1997 in the Parque Nacional del Este located at the south-eastern part of the country. This marked decline was directly linked to high fishing pressure in the park. A recent survey conducted in 2000 in the same area found juvenile densities of 14.4 ind./ha and adult densities of 0.6 ind./ha (Torres and Sullivan-Sealey, 2001). Surveys in the insular shelf of the Jaragua National Park in the south-western part of the country noted that 88.9% of the individuals dominating shallow waters were juveniles (Posada *et al.*, 2000). Juvenile densities in this area were 53.0 ind./ha and the mean adult densities were 4.6 ind./ha, which indicates high fishing pressure and according to Tejada (1996) the majority of Queen Conch landed in the Dominican Republic in the Mid-1990s came from this area. No information is available from other Queen Conch fishing grounds such as the north-western fishing grounds around Monte Christi, or from the offshore banks i.e. Banco de Plata and Banco de Navidad (Torres, *in litt.* 2002). Tewfik (*in litt.* 2002) notes that populations at the north coast are also largely depleted.

Grenada: Nowadays the greatest fishing efforts are in the northern parts of the island shelf and in the Grenada Grenadines, as populations in the southern parts of the shelf appear to be overfished and to consist mainly of juveniles (Anon., 1999; Tewfik, *in prep.*). Although biological and catch and effort data were collected in 1997 and 1998, additional data collection is still required before a reliable stock assessment would be possible (Anon., 1999).

Guadeloupe (FR): According to Legendre (*in litt.* 2002) there is only very little information on the status of Queen Conch populations in Guadeloupe. A recent study on the different habitat types found in the waters around Guadeloupe provided some information about the species potential distribution, however no information on the species abundance and population densities is currently available (Legendre, *in litt.* 2002). The population has been affected by overexploitation, is unable to meet the high local demand for the meat, and harvest levels have decreased in the past (Frenkiel, 2002).

Guatemala: *S. gigas* is found along the Atlantic coast of Guatemala and is fished for subsistence and for local restaurants. Little is known about the species distribution and population status in Guatemala and no abundance studies have been carried out (Sánchez and Lara, *in litt.* 2001).

Haiti: The majority of the Queen Conch populations of Haiti are considered to be largely depleted and over-exploited (Glazer, 1991; Mulliken, 1996), however the most recent population data dates back to surveys undertaken in 1995 (Wood, 1995). Wood (1995) reported that populations around the Gonaves Islands, Les Arcadines Islands and Les Cayemites Islands were seriously over-fished. Subadult densities at Gonaves Island and Les Arcadines Islands in 1995 were 10.7 ind./ha, and there were no adults; around Cayemites Island no *S. gigas* was found. The high levels of juvenile harvesting, the need to harvest at greater depths and the difficulties of fishers to find adult Queen Conch were seen as clear evidence of over-fishing. On the Rochelois Bank, low adult densities of 15 ind./ha were found. Higher densities of 160 ind./ha were only found off the western end of the southern peninsular close to Dame Marie where fishing is restricted to local fishermen (Wood, 1995).

Honduras: Information on Queen Conch populations in Honduras is limited to a single stock assessment study undertaken in 1996 in the Cayos Cochinos, located on the northern coast (Tewfik *et al.*, 1998). The Cayos Cochinos were declared a Biological Reserve in 1993 and since then harvest of Queen Conch has been prohibited. The study found low densities of 7.3 ind./ha for both, juveniles and adults, which was thought to be caused by intensive exploitation during previous decades. The Cayos Cochinos have never been targeted by the 'industrial' Queen Conch fishery and was mainly used by artisanal fishers (Morales, *in litt.* 2003). There is no population information for the banks that are used by the commercial Queen Conch fishery (Pineda, *in litt.* 2001).

Jamaica: The Pedro Bank, a large submarine offshore bank in the southwest of Jamaica, has the largest and most important Queen Conch populations in the Western Caribbean. Populations at Pedro Bank were largely untouched by commercial fisheries until the late 1980s and the Jamaican Queen Conch fishery was mostly restricted along the island shelf (Aiken *et al.*, 1999). However, by the early 1990s a large-scale fishery had developed and annual landings of more than 3,000,000 kg of Queen Conch meat were recorded from Pedro Bank (Mahon *et al.*, 1992) raising concerns that populations might be depleted in the near future unless landings were brought within sustainable levels

(Appeldoorn, 1995). Abundance surveys at Pedro Bank were conducted in 1991, 1994, 1997 and 2002 (Aiken *et al.*, 1992; Appeldoorn, 1995; Tewfik and Appeldoorn, 1998; Smikle and Appeldoorn, 2002). The 1994 surveys showed that mean densities at Pedro Bank were 10-100 times higher than in most other areas in the Caribbean that are subject to fishing. Average densities were 89 ind./ha in the 1-10 m zone, 204 ind./ha in the 10-20 m zone and 277 ind./ha in the 20-30 m zone (Appeldoorn, 1995). The majority of the individuals were adults (73 - 82% per 10m stratum). The 1997 survey noted increased mean densities with 316 ind./ha in the 1-10 m zone and 513 ind./ha in the 10-20 m zone (the 20-30 m zone was not surveyed). However, a significant decrease in the number of adults and 'stoned conch' (= very old specimens with eroded shell) was observed, particularly in the 10-20 m zone where most of the fishing occurs (adults: 64 ind./ha in 1994 to 32 ind./ha in 1997; stoned conch: 88 ind./ha in 1994 to 16 ind./ha in 1997) (Tewfik and Appeldoorn, 1998). The 2002 survey found higher mean adult densities in the 10-20 m depth zone than in the 1997 survey (136 ind./ha) but juvenile recruitment was lower than in the 1997 survey, but larger than in the 1994 survey (Smikle and Appeldoorn, 2002). The increased abundance of adults is seen as a result of the growth of the large juvenile recruitment of 1997, or as a consequence of the reduced fishing pressure that occurred since 1999. A second phase of the 2002 abundance survey was planned to take place in late 2002/early 2003 and will be used as the basis for the establishment of a Total Allowable Catch (TAC) for the 2003/04 fishing season (Kong, *in litt.* 2002).

Martinique (FR): Queen Conch is traditionally fished in Martinique, but the high domestic consumption has depleted local populations and created a market for Queen Conch meat harvested from other parts of the Caribbean (Mulliken, 1996). Surveys of the Queen Conch populations of Martinique conducted between 1986 and 1987 revealed that shallow water populations were seriously overfished and locally depleted, and that the majority of the harvest had been sustained by juveniles (Rathier and Battaglya, 1994). Deepwater populations were considered to be in a better state than inshore populations, due to the prohibition on the use of scuba (Appeldoorn, 1994a). No further population studies have been undertaken and the current status of the populations is unknown (Doray and Reynal, 2001).

Mexico: Historically, Queen Conch was fished in the Yucatan Peninsula, from Ciudad del Carmen, Campeche to Chetumal, Quintana Roo, but and the fishery has been most active in the states of Quintana Roo and Yucatan (Anon., 1999). Declines of shellfish (including *S. gigas*) have led to the closure of the fishery off the Yucatan Peninsula including the Alacranes reef in 1989. In 1994 a permanent fishing ban was established for all areas in the State of Yucatan after population surveys found that populations are too low to sustain commercial fishing (Pérez and Cervera, 1994; Anon., 1999) and this fishing ban is still in place. Population surveys undertaken at the Alcranes Reef in recent years found densities of 60 ind./ha and 84 ind./ha (Pérez and Aldana, 1998; Pérez and Aldana, 2000). The coast of Quintana Roo is divided into three main fishing areas (North, Central and the South Zones). The most productive zones were the North and South Zones. In the South Zone, Queen Conch were usually found in shallow waters that allowed access by free diving. Depth at the North and Central Zones averaged 20-30m and therefore scuba and hookah prevailed. Nowadays, Queen Conch are generally found at depths of 30 m or more, except for Chinchorro Bank where some shallow water stocks remain (Anon., 1999). In Quintana Roo the fishery was closed from 1990 to 1996, except for the Chinchorro Bank. Today, the only legal harvesting areas in Quintana Roo are the Chinchorro Bank (in the South Zone) and the Cozumel Bank (in the Central Zone) (Aldana *et al.*, *in litt.* 2002). Fishing is subject to a harvest quota (see Conservation measures). After the six year fishing ban, populations surveys at Cozumel have shown signs of recovery and densities have started to increase (Basurto et al., 1996). Significant numbers of Queen Conch are still fished illegally in areas closed for fishing, such as the Alacranes reef, or areas that are subject to a quota such as Cozumel and Chinchorro Bank (Aldana *et al., in litt.* 2002). Despite the fishing bans and regulations in place some stocks are not reported to be recovering as expected (Basurto and Reguero, *in litt.* 2001). It is not clear whether this slow population recovery is due to low population densities that have fallen below a critical point where recovery is still possible or caused by reported high levels of poaching (Aldana *et al.*, *in litt.* 2002).

Montserrat (GB): In the early 1960s important Queen Conch nursery habitats were lost due to road construction and from the mid-1960s, stocks showed signs of decline due to overexploitation (Jeffers, 1996). A study undertaken in 1980 concluded that populations were 'threatened' (Jeffers, 1996). According to O'Garro (*in litt.* 2001) there is currently no information available on the abundance and status of *S. gigas* in the island's waters.

Netherlands Antilles (NL): The Netherlands Antilles consist of 5 islands: Curacao and Bonaire off the coast of Venezuela, and St. Maarten, St. Eustatius and Saba at the northern end of the Lesser Antilles island arc. Queen Conch stocks are considered severely depleted in the Leeward Islands, Curacao and Bonaire (van Buurt, 2001). In Curacao adult Queen Conch are reported to be extremely rare, and surveys conducted in 1999 in Bonaire found 111 individuals in a 51,000 m^2 sampling area (equivalent to 21.8 ind./ha), with the majority of these comprising juveniles (van Buurt, 2001). Both the populations of Bonaire and Curacao have been affected by illegal fishing that is seen as the principal cause for the observed declines (van Buurt, 2001). In the Windward Islands, stocks in the inshore areas around the islands of St. Maarten and Saba are also said to be entirely depleted (Anon., 1996a), but some Queen Conch are still caught around the island of St. Eustatius for local consumption (van Buurt, 2001). The Saba Bank, located 3–5 km southwest of the island of Saba and 25 km west of St. Eustatius, is the only area remaining in the Netherlands Antilles, which may still have considerable numbers of Queen Conch (van Buurt, 2001). The Bank has a surface area of 2,200 km^2 of which the largest part is between 20-50m depth and is considered to be an potentially important source of Queen Conch larvae to islands located downstream, such as Saba, St Maarten and the Greater Antilles (Dilrosun, 2000). However, during seven dives undertaken at the eastern side of the Bank in 1996 no Queen Conch was found, even though fishermen indicated that the dived area used to have high densities of Queen Conch (Meesters et al., 1996). Surveys are required to assess the population status. Funds to undertake such work and to identify nursery areas for Queen Conch are currently being sought by the Ministry of Agriculture and Fisheries (van Buurt, *in litt.* 2002).

Nicaragua: Until recently there has been very little information about the status and distribution of the Queen Conch populations in Nicaragua, but abundance surveys and stock assessments were initiated in 2002 and preliminary results are expected in 2003 (Morales, *in litt.* 2002).

Panama: Visual surveys undertaken in 2000 in the Boca del Toro archipelago revealed that the stocks there are overfished and found at extremely low overall densities of 1.4 ind./ha (adults approximately 0.2 ind./ha). These densities are among the lowest reported from the Caribbean region (Tewfik and Guzman, *in prep.*). The long-term overexploitation of the species in the Bocas de Toro archipelago is seen as the major cause of these low densities and concerns are being raised about the local recruitment and rebuilding capacity of the depleted populations if fishing is not subject to strict regulations or even temporary fishing bans (Tewfik and Guzman, *in prep.*).

Puerto Rico (US): The most important fishing areas in Puerto Rico are on the southwest, south and east coasts (Valle-Esquivel, 2002), with the populations around the islands being considered to be depleted and overfished since the mid-1990s (Appeldoorn, 1994a). Abundance studies undertaken in the late 1980s found mean densities of 8.1 ind./ha in the La Parguera area (Torres Rosado, 1987). Surveys undertaken in 1996 found densities of 7.4 ind./ha on the East Coast and 8.48 ind./ha on the West Coast (Mateo *et al.*, 1998). A recent analysis of commercial landing statistics and of catch and effort data for the years 1983 to 2001 found that fishing effort levels have sharply increased while catch rates have declined, suggesting that the Queen Conch stocks are likley undergoing overfishing and in decline (Valle-Esquivel, 2002a). Based on the 2001 report on the status of the US fisheries (Anon., 2001e) the Secretary of Commerce determined that the Queen Conch stocks in the US Caribbean EEZ have been subject to 'overfishing' (= harvest rate was above a prescribed threshold) and that stocks are 'overfished' (= the stock size was below a prescribed threshold), as defined under the Sustainable Fisheries Act of 1996. The Caribbean Fisheries Management Council is currently preparing a recovery plan for the Queen Conch in the US Caribbean federal waters and the primary recommendation under this plan is a total closure of the fishery in EEZ of the US Caribbean waters (Rolon, *in litt.* 2002).

Saint Kitts and Nevis: There are defined Queen Conch populations around the entire coast of the two islands at various depths, which are considered overfished, especially on the western side of the islands (Anon., 1999). Since the 1980s scuba gear has been increasingly used to access stocks in deeper and more distant waters (Wilkins, 1996). There are indications that depleted stocks are beginning to recover in near-shore areas, possibly caused by a reduction in fishing efforts that occurred after the closure of the French market for Queen Conch meat from Saint Kitts and Nevis due to EU Food Sanitary Regulations imposed in 1997 (Anon., 1999). In addition, Nevis appears to be a regional settlement area for Queen Conch larvae (Anon., 1999). In Saint Kitts, there is evidence of population decline in certain areas, thought to be mainly due to habitat degradation, dredging and hurricanes (Simmonds, *in litt.* 2002). To date, no abundance survey has been carried out (Simmonds, *in litt.* 2002).

Saint Lucia: Although Queen Conch is thought to be distributed around the island, only two significant populations have been identified: one in the north and one in the south, with the former considered to have been more heavily exploited than the latter (Nichols and Jennings-Clark, 1994). Near-shore populations have been over exploited and thus most fishermen now target stocks in deeper waters using scuba gear (Anon., 1999). Few surveys had been undertaken until 1996 when a two-year study was conducted to collect morphometric data (shell length, lip thickness and meat weights of harvested specimens) (Anon., 1999). It was observed that the majority of the Queen Conch harvested, had a lip thickness of 21-23 mm and a shell length between 24-25 cm. No visual abundance surveys have been conducted in Saint Lucia to date.

Saint Vincent and the Grenadines: Data on Queen Conch populations in the Saint Vincent and the Grenadines are limited (Anon., *in prep.* b). The Fisheries Division collects catch data from local markets to assess overall harvest. A plan to collect catch and effort data as well as biological data are available but has not been implemented (Anon., *in prep.* b).

Trinidad and Tobago: Trinidad has a depleted and small population of *S. gigas* (Glazer, 1991). Tobago's population has also been depleted, but remains larger than the Trinidad population (Anon., 1996a).

Turks and Caicos Islands (GB): The majority of the Queen Conch stocks are found on the south-western and eastern edges of the Caicos Bank. The stocks are generally considered to be stable, although intensively fished and possibly overfished in certain areas (Ninnes, 1994; Fenton *et al.*, 1997). In addition harvests are reported to have has shifted to more distant and deeper waters in recent years, suggesting that some stocks are declining (Wilkinson, 2002). The Turks and Caicos Islands have one of the longest catch-effort time series data, which date back to 1977 (Medley and Ninnes, 1995). Between 2000 and 2001, the Department of Environment and Coastal Resources conducted visual stock assessment surveys in the main fishing area on the Caicos Bank in order to validate the findings of the dynamic biomass model which is used to set yearly quotas (Clerveaux, *in litt.* 2002). The Turks Bank was also surveyed. Density estimates for the Turks Bank were 47.8 ind./ha for small and medium juveniles, 20.5 ind./ha for large juveniles and sub-adults, and 73.1 ind./ha for adults; for the Caicos Bank densities were 170.4 ind./ha for small and medium juveniles, 87.5 ind./ha for large juveniles and sub-adults, and 204 ind./ha for adults (Clerveaux and Danylchuk, *in press*). The density of 204 ind./ha for young adults and old adults found at Caicos Bank (= size of the fished population) was used to calculate the total biomass available for harvesting in this area, which resulted in a total of 3,703,000 kg of meat (using an average meat weight of 152g per landed individual) (Clerveaux and Danylchuk, *in press*). Based on the density of large juveniles and subadults (87.5 ind./ha) at the Caicos Bank it was estimated that around 714,000 kg will recruit into the fishery in the year 2002. Based on the results of this survey it was concluded that current management measures are maintaining stock size, and although Queen Conch populations are intensively fished, they are considered stable (Clerveaux, *in litt.* 2002). Medley and Ninnes (1995) assumed that unexploited 'deep-water' stocks exist that contribute to recruitment of the fished stocks in shallower waters and several deep-water sites (> 20 m depth) have recently been identified south of the Caicos Islands within the Admiral Cockburn Land Sea Park (Clerveaux, *in litt.* 2002). Preliminary estimates of densities in this park provided densities of 400 ind./ha for old adults, 150 ind./ha for young adults, 100 ind./ha for subadults, 100 ind./ha for large juveniles and 30 ind./ha for medium sized juveniles.

United States of America: The species occurs in the waters of Florida, but is also known to range into the waters of Georgia, South Carolina and Texas, with a small spawning population known from the coastal waters of Texas (in the Flowers Gardens Bank National Marine Sanctuary) (Thomas and Gabel, in litt. 2003). In the Florida Keys, adult Queen Conch are distributed in two different zones: near-shore in shallow water and offshore adjacent to the reef tract. The species once constituted a significant recreational fishery in south Florida and a moderate commercial fishery that supplied shells to the local curio markets (Glazer and Berg, 1994). Throughout the 1960s and 1970s the local population declined dramatically due to overfishing. In 1985, all harvest of *S. gigas* was banned in Florida State waters and in 1986 the ban was extended to adjacent federal waters. Until recently, the population has shown only small signs of recovery. In 1992, the population estimate for adult Queen Conch spawning stock in the entire Florida Keys island chain was approximately 5,800 individuals (Glazer and Berg, 1994); however, in 2002, this estimate had grown to 31,000 individuals at a density of 800 ind./ha. There has been little change in density estimates since 1999 when off-shore populations became self-sustaining (Thomas and Gabel, *in litt.* 2003). Hawtoff *et al. (*1998) had suggested that *S. gigas* populations in the Florida Keys depend largely upon recruitment transported from other areas in the Caribbean Sea, such as Belize, Cuba and Mexico. However, recent studies undertaken in the Exuma

Cays in the Bahamas have shown that failure of populations to recover could also partly result from low local spawning stock densities that are reduced below a critical threshold (< 56 ind./ha) for reproduction (Stoner and Ray-Culp, 2000). It has been assumed that the lack of recovery in Florida was a result of the low adult densities that were observed since the early 1990s that did not allow reproduction. Therefore it is suggested that the local spawning stock is a critical source of larvae supplying populations in south Florida (Glazer, 2001). Based on research that demonstrated that the nearshore population never reproduces, but that reproduction regularly occurs in the offshore population (Glazer and Quintero, 1998), a transplantation project (= relocating specimens from one location a another location) was initiated in 2001 with the aim of enhancing the stocks in the Florida Keys (Glazer and Delgado, 2002).

Venezuela: With the exception of 1999, the entire Venezuelan Queen Conch fishery has been closed since 1991. Before this closure, 90% of the Queen Conch harvested in Venezuela came from Los Roques, Las Aves and Los Testigos Archipelago. Population studies in the 1980s determined that the Queen Conch populations around Los Roques were severely overfished in non-protected areas (Laughlin *et al.*, 1985). Following these surveys, the Los Roques Archipelago was closed in 1985 and in 1991 the Government adopted a total closure for Venezuela. After the total closure, illegal fishing was reported to be ongoing and harvests to be comprised mainly of juveniles (Rodríguez and Posada, 1994). Since the ban, only small signs of recovery have been noted, which is largely attributed to continuing high levels of illegal fishing that takes place around Los Roques and other offshore islands (Arnal, *in litt.* 2002). Surveys undertaken in 1999 in Los Roques found adult Queen Conch in 42 of the 44 sites that were randomly selected and the total density estimate in the archipelago was 18.8 ind./ha. Mean juvenile density for the archipelago was very low and estimated to be around 0.82 ind./ha (Schweizer and Posada, 2000).

Virgin Islands (US): In the past two decades local inshore populations of the Virgin Islands (US) became depleted (Anon., 1999). In the early 1980s densities were reported to range from 2-10 ind./ha (Wood and Olsen, 1983). In St. Thomas and St. John, over-fishing led to a five-year moratorium between 1987-1992. When the ban was lifted, no new management measures were in place, and the resource was depleted again in a short time (Anon., 1999). New management measures were adopted in 1994. Abundance surveys were conducted at five year intervals in 1981, 1985, 1990, 1996 and 2001 (Wood and Olsen, 1983; Boulon, 1985; Friedlander *et al.*, 1994; Friedlander, 1996; Gordon, *in prep.*). In 1999, the fishery was considered to be fully exploited and shell lengths and lip frequency values indicated that increasingly smaller individuals were harvested each year (Anon., 1999). Mean densities of adult Queen Conch were lower for St John in 2001 compared to previous surveys; for St Thomas a decline in juvenile density was observed in 2001 (in 1996: 31 ind./ha; in 2001: 1.88 ind./ha); and for St Croix adult densities were relatively stable (around 26-27 ind./ha) (Gordon, *in litt.* 2002). Based on shell sizes at fishermen's landing sites, more than 60% of *S. gigas* harvested in St Croix are undersized (less than 23 cm in length and with lip thickness of less than 9.5 mm) (Kojis, *in litt.* 2001). A recent analysis of commercial landing statistics and catch and effort data for the Virgin Islands (US) found a decrease in landings and much higher effort levels, particularly in St Croix (Valle-Esquivel, 2002a). Based on the 2001 report on the status of the US fisheries (Anon., 2001e) the Secretary of Commerce determined that the Queen Conch stocks in the US Caribbean EEZ have been subject to 'overfishing' (= harvest rate was above a prescribed threshold) and that stocks are 'overfished' (= the stock size was below a prescribed threshold) as defined under the Sustainable Fisheries Act of 1996. The Caribbean Fisheries Management Council is currently preparing a recovery plan for the Queen Conch in the US Caribbean waters and the primary recommendation under this plan is a total closure of the fishery (Rolon, *in litt.* 2002).

ECOLOGY AND HABITAT

The Queen Conch is generally found in clean waters and primarily inhabits sandy or rubble sea floors that support the growth of seagrass and algae (Randall, 1964; Stoner and Waite, 1990). However, they are also encountered in rocky habitats and on coral reefs. Whilst they occur in a wide spectrum of depths of up to more than 100 m, adults are typically found in depths of 10 to 30 m, and densities decrease significantly below 30 m due to light limitations for algae and plant growth. Research has shown that Queen Conch actively select among their habitats, with juveniles being more selective than adults, and are dependent on certain habitat requirements (Sandt and Stoner, 1993). The most productive nurseries occur in shallow (5-6 m deep) seagrass meadows (Stoner, 1997). Juveniles exhibit a strong preference for intermediate densities of seagrass, whereas adults show less habitat specificity (Stoner and Waite, 1990).

Queen Conch have a maximum longevity of 20 to 30 years (Anon., 1999) and sexual maturity in both sexes is reached at approximately five years (Appeldoorn 1994a). Reproduction generally occurs in the warmer months, however, in some areas it can continue throughout the year (Blakesley, 1977; Brownell, 1977). Fertilisation is internal and initial copulation may occur several weeks prior to spawning (D'Asaro, 1965). Stoner and Ray-Culp (2000) found that mating in *S. gigas* populations in the Exuma Cays did not occur when adult densities fell below 56 ind./ha and that spawning did not occur where densities were below 48 ind./ha. The authors attributed this to the so-called "Allee effect", where negative rates of per capita population growth occur below critical population levels. For the Queen Conch, the lack of reproduction in low-density populations was related primarily to the lack of encounters between female and males. Stoner and Ray-Culp (2000) found that reproduction increased proportionally with density levels (due to increased likeliness of encounters) and remained stable near densities of 200 ind./ha. This highlights the importance of maintaining stock density above this critical level to prevent recruitment failure (Anon., 1999).

Females may spawn several times during the reproductive season (Stoner *et al.*, 1996), often producing in excess of 400,000 eggs each time (Davis *et al.*, 1984). There is evidence of a relationship between fecundity and age (measured by lip thickness), indicating that fecundity increases with age (Anon. 1999). However, this relationship cannot be extended to older ages where lip growths ceases. The pelagic larvae hatch five to six days after spawning (D'Asaro, 1965) and drift in the currents of the upper water layers during the first weeks of their lives before they descend and start their benthic lifestyle. The larval development is greatly influenced by temperature and the supply of phytoplankton (Brownell and Stevely, 1981; Stoner, 1997). Larval exchange may occur up to distances of 900 km during the first three weeks (Davis *et al.*, 1993), but is generally in the range of tens to hundreds of kilometres within sub-regions (Anon., 1999). Depending on the conditions, larvae can settle to benthic habitats 17 to 22 days after hatching, but may remain in the plankton for up to two months (Posada and Appeldoorn, 1994; Stoner, 1997). The metamorphosis of the larvae usually starts within five days of settlement, after which the animals are about 0.2 cm in length and start to develop their shell. Metamorphosis depends among others on the presence of the appropriate stimulus which appear to be certain algae foods associated with the substratum and particular characteristics of the sediment (Davis and Stoner, 1994). Laboratory experiments have shown that larvae will loose the ability to metamorphose after around six days if the appropriate habitat conditions are not found (Davis and Stoner, 1994).

Young Queen Conch (< one year) remain buried for most of the time, possibly to avoid predation, but begin to emerge at shell length of 5-10 cm. Juveniles can suffer high mortality from predation (up to 63%) (Alcolado, 1976). Queen Conch is known to be eaten by around 130 marine species (Hesse, *in litt.* 2002), including several mollusc species, crustaceans such as Spiny Lobster, various species of sharks and snappers, Nassau Grouper, and Loggerhead Turtle (Randall, 1964; Jory and Iversen, 1983). Natural mortality rates decrease exponentially with age until the onset of sexual maturity (Appeldoorn, 1988a) but can vary widely due to season, habitat and other factors (Stoner and Glazer, 1998). Mortality is thought to be low once the animal has sexually matured and thickened the shell (Anon., 1999).

Juveniles tend to aggregate regularly over large areas (> 100 ha) in dense groups of 0.2-2 ind./m^2, possibly to reduce predation and disperse natural mortality (Stoner and Ray, 1993). These aggregations are common in areas with significant tidal circulation, shallow depth, high algae productivity and moderate or dense seagrass coverage and may contain 100,000 individuals (Stoner and Waite, 1990; Stoner *et al.*, 1996). The most productive nursery habitats appear to be determined by complex interactions of physical oceanographic features, seagrass and algae communities and larval recruitment and play a crucial role in ensuring population stability (Stoner, 1997). There are two migrations that occur in Queen Conch, the first is a movement of larger juveniles into deeper waters, the second one is an annual movement that is observed in adults which migrate into shallower water during spawning (Anon., 1999). The migration into shallow water for spawning coupled with the necessary aggregation results in greater vulnerability to fishing.

The most unusual aspect of the Queen Conch biology is its determinate shell growth: once the animal starts producing its typical large flared shell lip, the shell does not continue to increase in length and growth occurs only by thickening of the shell, especially of the flared lip. Estimates for mean shell length range from 7.6 to 10.8 cm for a one-year old animal, 12.6 to 17.0 cm for a two-years old animal, and 18.0 to 20.5 cm at the end of three-years (Alcolado, 1976; Berg, 1976; Brownell, 1977; Appeldoorn, 1990). The shell length of an adult Queen Conch can progressively decrease with age due to bioerosion of the shell.

The flaring of the lip starts at an age of approximately two to four years and lasts for approximately seven to ten months, or longer (Glazer and Berg, 1992). During this stage the young individuals are considered sub-adults (i.e. individuals that have begun flaring a shell lip but have not yet reached sexual maturity). The linear growths of the shell and the flaring of the lip may occur simultaneously for some time before the adult shell length is reached and the growth in shell length ceases. Sexual maturity usually occurs when the animal is about four to five years old, but only when the flared lip has thickened to approximately 0.5 cm (Appeldoorn, 1988b; Berg and Olsen, 1989; Chiquillo *et al.* 1997). There are often differences in shell size and shape at the onset of sexual maturity of various Queen Conch populations, depending on habitat quality, food and water depth (Randall, 1964; Alcolado, 1976), and faster growth is often coupled with earlier maturation (Alcolado, 1976) and this again can be site specific (Martin-Mora *et al.*, 1995).

Queen Conch play an important ecological role in marine benthic communities, feeding principally upon dead or detritus remains of seagrasses, seagrass epiphytes, and macroalgae, as well as significant amounts of sand (Randall, 1964; Hensen, 1984) and thereby greatly affecting the benthic community structure of seagrass meadows. Experimental studies in the Exuma Cays in the Bahamas found that Queen Conch grazing has an important effect on regulating the abundance of seagrass detritus and on the overall structure of the macrofauna communities (Stoner *et al.*, 1995). The loss or substantial decrease of *S. gigas* is therefore likely to result in significant community changes and trophic cascades that will negatively affect the productivity and future recruitment of the species as well as other ecologically and economic important fisheries resources (e.g. Spiny Lobster *Panulirus argus*) (Tewfik and Guzman, *in prep.*).

THREATS TO SURVIVAL

The principal threat to Queen Conch populations in the wider Caribbean is overfishing, followed by habitat degradation. An economic and cultural symbol of the wider Caribbean, the Queen Conch has supported subsistence, artisanal and more recently, important commercial fisheries throughout much of its range (Siddall, 1984). Queen Conch have been valued as a protein source in many native diets and have been exploited as a food source for hundreds of years. However, it is only during the last century that commercial exploitation has become such an important source of income to many of the range States (Brownell and Stevely, 1981). *S. gigas* is currently harvested commercially in approximately 25 countries and dependent territories throughout the Caribbean region (Theile, 2001). In some Caribbean countries, the Queen Conch fishery is only second after the Spiny Lobster fishery in terms of economic importance (e.g. in the Bahamas, Belize, Turks and Caicos Islands (GB)). In other countries, the Queen Conch fishery has become the most important fishery product both with regard to annual landings and as a source for economic income. In Jamaica for example, the annual Queen Conch landings for the year 1998 were estimated to be worth around USD 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., 2000a). The total economic value of Queen Conch taken from the Caribbean region has been estimated at USD 60 million in the mid-1990s (Chakalall and Cochrane, 1996), however, this would be considerably higher if the employment created was taken into account.

The species is primarily harvested for its meat; secondary uses include the sale of shells to tourists and recreational fisheries. The consumption of *S. gigas* was formally a key dietary source of protein for many coastal peoples, but the increase in market value and decrease in stocks has led to a reduction in local consumption and increased export and tourist consumption (Appeldoorn, 1994a). Queen Conch are particularly vulnerable to overfishing because of their slow growth, their occurrence in shallow waters, their late maturation and the 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.

The Queen Conch fisheries are not believed to threaten the survival of the species, but it is likely that many populations will continue to decline and that the fishery ultimately becomes economically unviable. A recent study has shown that Queen Conch reproduction fails at low densities (Stoner and Ray-Culp, 2000) and this largely affects recovery once populations are depleted. Both Florida (US) and Bermuda (GB) have implemented bans on fishing, yet the populations have not recovered as expected (Appeldoorn and Rodríguez, 1994). This suggests that even with high fecundity, resilience of exploited populations may not be sufficient to re-establish healthy populations.

Overfishing is undoubtedly the major cause of Queen Conch decline although habitat degradation due to siltation, other forms of pollution, and the use of dynamite and other destructive gears such as bottom nets certainly has an important role to play in the decline of populations. This is especially true for the juvenile Queen Conch, which requires undisturbed nursery sites in which they can develop. Many of these sites are close to the coast and suffer from human activities such as development and pollution. Such disturbance is likely to cause mortality and reduce the recruitment of juveniles, which in turn reduces the growth of the overall population. The growth in the human population has also led to greater deforestation and erosion of soils, which has led to an increase in sedimentation on the reef and water turbidity. There are also concerns about the effects of water pollution on Queen Conch (Glazer and Quintero, 1998). This is especially true for heavy metals and pesticides which leach through the soil into water sources and ultimately end in the sea (Appeldoorn and Rodríguez, 1994).

DOMESTIC USE

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. 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 (FR), Martinique (FR), Netherlands Antilles (NL)) (Mulliken, 1996). Prices for Queen Conch meat at local markets generally vary between USD 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 USD 11 per kg for locally harvested meat and up to USD 20/kg for imported meat (Gourbeyre, *in litt.* 2001). The import value of Queen Conch meat imported into the US ranged from USD 4.5-5.8 per kg (average USD 4.9 per kg) in the years 1995 to 2002 (NMFS, 2002).

In many countries that have a significant commercial Queen Conch fishery (such as the Bahamas, Belize, Dominican Republic, Honduras, Jamaica, etc.), it is common practice to extract the meat directly underwater or on the fishing boat and to discard the shells at sea or near the landing sites. The empty shells are often sold on local markets as tourist souvenirs or marine curios, and therefore they are largely considered a by-product of the Queen Conch fishery (Wood, 1995). In some areas, e.g. Cuba, Jamaica, Puerto Rico (US) and elsewhere, the shells are crushed in large numbers for gravel in driveways and streets; additionally, there is demand for the shells in the aquarium trade as ornaments in fresh and salt water tanks (Ikenson, 2002). Tour operators in some countries (e.g. Cayman Islands) include the collection of Queen Conch as part of their tour. Prices for shells at local markets can vary between USD 5-15 or more, depending on the size and quality of the shell and whether they have been processed in any way e.g. polished or painted (Theile, 2001).

Available information on harvest and landing statistics of Queen Conch meat by country/dependency is provided in Table 1. For comparison capture statistics for Strombid conchs as reported by range States to the Food and Agriculture Organisation (FAO) are included in Table A5 in the Annex. It should be noted that the meat weights included in Table 1 may refer to different levels of meat processing (see International Trade) and may therefore not necessarily be comparable between countries/dependencies. In addition, landing figures are often only estimate, 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 54,940,005 kg of *S. gigas* meat has been reported as landings between 1993 and 2001. Until 1998, annual landings remained relatively stable and ranged between 6,519,711 and 7,369,314 kg. Since 1999 annual landings have decreased steadily from 5,554,114 kg in 1999, to 4,598,004 kg in 2000 and 3,169,809 kg in 2001 (Note: landing figures for 2001 are incomplete). This decrease is primarily attributed to the sharp drop in Queen Conch meat landings in Jamaica, which used to be one of the largest producers of Queen Conch meat until 2000, when landings plummeted to zero due to a temporary closure of the fishery (see International Trade). The largest landings have been reported from the Dominican Republic (totalling 16,730,500 kg), followed by Jamaica (13,788,000 kg). No landing figures are available for Honduras and the figures in Table 1, totalling 7,746,218 kg, refer to reported exports only; consequently actual landings of Honduras are likely to be considerably higher.

Based on the assumption that the meat of an adult Queen Conch weighs roughly around 140 g upon landing (and after some basic cleaning; see International Trade), it is estimated that the annual landings of Queen Conch for the whole Caribbean region in the mid-1990s (ranging from 6,500,000 to 7,400,000 kg annually in the years 1993-1998, see Table 1) were equivalent to around 46 to 53 million individuals harvested per year.

Table 1. Reported landings (kg) of Queen Conch meat in range States for 1993 to 2001

Range State	1993	1994	1995	1996	1997	1998	1999	2000	#2001	Total	Source
Antigua and Barbuda		69,000	45,600	38,800	35,000	44,700	46,000	42,000	37,000	358,100	1, 2
Bahamas			493,000	589,680	635,040	680,400	453,600	668,000		3,519,720	3
Belize	192,000	149,000	165,000	138,080	257,264	209,042	178,215	234,670	262,889	1,786,160	4, 5
British Virgin Islands					5,200	5,530	4,890	6,155		21,775	6
Colombia	227,900	240,300	206,700	107,143	100,132	155,816	199,043	104,134		1,341,168	7, 8
Cuba *			55,000		141,000			19,950	28,910	244,860	22, 23
Dominican Republic	2,600,000	1,857,000	2,209,800	1,957,400	1,573,100	2,668,700	1,242,500	1,400,000	1,222,000	16,730,500	9, 24
Grenada	26,000									26,000	10
Haiti			55,000	70,000						125,000	10
Honduras (export)	450,000	858,000	832,300	737,102	965,652	636,252	746,854	931,531	1,328,118	13,338,518	11
Jamaica**	3,000,000	2,051,000	1,950,000	1,900,000	1,821,000	1,700,000	1,366,000			13,788,000	10
Mexico	45,000	45,000	45,000	42,000	42,000	42,000	42,000	42,000		345,000	12, 13
Montserrat			500	3,000						3,500	24
Nicaragua					16,783	19,051	24,948	65,318		126,100	14
Panama		372,000		5,000		116,000				493,000	10
Puerto Rico	74,658	77,476	97,175	108,781	108,238	118,347	97,090	127,582	112,569	921,916	15
Saint Kitts and Nevis			28,844	48,723	29,141	81,186	66,900	72,604	70,300	397,698	
Saint Lucia		20,000	34,000	28,000	26,000	29,000	34,000	40,000	41,400	252,400	18
Saint Vincent and the Grenadines		36,741	7,722	12,431	8,183	20,763	6,822	6,900	38,210	137,772	19
Turks and Caicos Islands***	737,866	953,875	964,597	736,801	787,698	645,433	736,616	816,986		6,379,872	10
Virgin Islands (US)	15,890	16,223	11,504	11,972	35,233	30,916	8,890	35,205	28,413	194,246	21, 15
Total	7,369,314	6,745,615	7,201,742	6,534,913	6,586,664	7,203,136	5,254,368	4,613,035	3,169,809	54,678,596	

Notes: landing figures refer to different levels of processed meat which significantly influence the weight reported (up to 50% or more). For countries where no landing data were available, the reported export volumes are included (e.g. Honduras); #Data for 2001 are largely incomplete

* = refers to processed meat = approx. 7% of live weight; ** = refers to 50% cleaned meat; *** = refers to unprocessed Queen Conch meat; 1 = Horsford and Lovell, 2002; 2 = Horsford, *in litt.* 2002; 3 = Deleveaux and Philipps, *in litt.* 2001 and 2002; 4 = Marin, *in litt.* 2001; 5 = Villanueva, *in litt.* 2001; 6 = Eristhee, *in litt.* 2001; 7 = Perez, 1996; 8 = Andrade and Vaca, *in litt.* 2001; 9 = Díaz, *in litt.* 2001; 10 = Tewfik, in prep.; 11 = for 1993 to 1995: Morales, 1996; for 1996 to 2001: UNEP-WCMC, 2002; 12 = Villarreal Rios, 1996; 13 = Basurto, *in litt.* 2001; 14 = Martinez, *in litt.* 2001; 15 = Valle-Esquivel, 2002; 16 = S. Heyliger, Fisheries Department of Saint Kitts, *in litt.* July 2003; 17 = Department of Fisheries of Nevis, *in litt.* 2001 and 2002; 18 = Joseph, in prep.; 19 = Fisheries Division of Saint Vincent and the Grenadines, in prep.; 20 = Clerveaux, *in litt.* 2001; 21 = Uwate, *in litt.* 2001; 22 = Alvarez, *in litt.* 2002; 23 = Formoso, 2002; Nolasco, *in litt.* 2002; 24 = Jeffers, 1996

Anguilla (GB): *S. gigas* is harvested only for local consumption in Anguilla and according to the government, no data are available on harvest volumes (Anon., 1998).

Antigua and Barbuda: The Queen Conch is the second most valuable commercial fishery species in Antigua and Barbuda. In Antigua, Queen Conch is marketed mainly to hotels and restaurants. The fishery plays a less important role in Barbuda where it is mostly used for subsistence (Horsford, *in litt.* in litt. 2002). Historically, the southern side of the shelf was the main fishing ground, but in recent years harvest also takes place between Antigua and Barbuda and in the northeastern side of the shelf. It is estimated that around ten vessels target Queen Conch commercially. Most of them are small boats 21-30 feet (≈6.4 - 9.1 m) in length (Horsford and Lovell, 2002). Most Queen Conch is harvested using scuba gear. Between 1993 and 2001, landings ranged from 37,000 kg to 69,000 kg (see Table 1) (Horsford, *in litt.* in litt. 2002).

Aruba (NL): The harvest of *S. gigas* is prohibited in Aruba (Anon., 1998). Queen Conch meat is popular in Aruba, but local harvests would not be sufficient to supply local demand (De Cuba, *in litt.* in litt. 2002), which would suggest that Queen Conch meat is imported from elsewhere. However, no trade in Queen Conch meat involving Aruba has been reported in the CITES trade data (see International Trade).

Bahamas: The main fishing areas for Queen Conch in the Bahamas are Little Bahama Bank and the Berry and Andros Island area located on the Great Bahama Bank. The majority of Queen Conch (60-70%) is harvested during the closed season for lobster (1 April to 31 July) (Braynen, in prep). Hookah is the main gear used for harvesting *S. gigas* and there is widespread illegal use of hookah gear during the closed season for lobster (Philipps, *in litt.* 2002). According to Philipps (*in litt.* 2002) annual Queen Conch meat landings have increased over the past few decades from 222,000 kg in 1979 to 668,000 kg in 2000 (see Table 1). However, it should be noted that the statistics are incomplete, as it does not account for *S. gigas* taken in the recreational or subsistence fishery or fished illegally by foreign vessels in the Bahamian waters (Braynen, *in prep.*). The majority of the meat is consumed locally and only around 20% is exported, mostly to the US (Braynen, *in prep.*). Illegal harvesting by foreign vessels (e.g. under the registry of the Dominican Republic), especially in the southern Bahamas is reported to have been ongoing for years and is causing serious concerns amongst officials of the national fishing agency (Deleveaux, *in litt.* June 2001).

Barbados: Although a very small number of fishers may target Queen Conch on some fishing trips in Barbados, the species is mainly taken opportunistically for their shells which are sold as curio on the local market; the meat is generally used as subsistence or sold privately (Parker, *in litt.* in litt. 2001). There are no regularly recorded landing statistics available, but Parker (*in litt.* in litt. 2001) estimates that around 100 individuals are taken per year.

Belize: The Queen Conch fishery is the second largest capture fishery in Belize, earning about 3.3 million Belize Dollars per year (≈ USD 1.7 million) from the exports of around 212,000 kg of processed meat and 11,000 kg of shells (Anon., 1999). For decades, Belize was known as the world's largest Queen Conch meat exporter, exporting more than 500,000 kg per year (Perez, 1996). Today, annual landings have not recovered to historical levels and have ranged between 149,000 kg to 262,889 kg from 1992 to 2001; they increased in recent years (Marin, *in litt.* in litt. 2001; Villaneuva, *in litt.* in litt. 2002) (see Table 1). [An abundance survey undertaken in 1996 concluded that the Maximum Sustainable Yield of the legal size (> 18 cm) Queen Conch population was around 190,000 kg; see Distribution and Population.] The landing data are considered to be an underestimation of the actual levels of harvests, as it does not take into account sales at local markets and *S. gigas* that is taken illegally (Anon., 1999). According to data provided by the Fisheries Department of Belize, the majority of the meat harvest is exported (Marin, *in litt.* in litt. 2001), but levels of local consumption are not known. Queen Conch is mainly caught along the fore-reef and the inner lagoons of the Barrier reef and from the three adjacent atolls Turneffe, Glovers and Light House Reef (Villanueva, *in litt.* in litt. 2002). It is fished exclusively by free-diving from small canoes that deliver their daily harvest to traditional sailing ships of about 10 m.

Bermuda (GB): *S. gigas* is protected in Bermuda and the harvest of Queen Conch has been prohibited through the Fisheries (Protected Species) Order since 1978 (Barnes, *in litt.* in litt. 2002).

Brazil: Queen Conch is not commercially exploited in Brazil and is only incidentally taken by fishers targeting shrimps (Anon., 1998).

British Virgin Islands (GB): Estimated annual landings of Queen Conch meat in the British Virgin Islands range from 4,890-6,155 kg for the years 1997 to 2000 (see Table 1). A proportion of the landings

consists of Queen Conch fished in the waters of the Virgin Islands (US). The meat is destined for local consumption (Eristhee, *in litt.* 2001).

Cayman Islands (GB): The Cayman Islands are considered a significant consumer of Queen Conch meat, with demand largely exceeding the island's supply and foreign imports make up the major proportion of the Queen Conch meat consumed (Bothwell, *in litt.* 2003). According to the Cayman Island Department of Environment, there is only a very limited artisanal fishery for *S. gigas* in the Cayman Islands. It is estimated that less than 100 people harvest Queen Conch for consumptive purposes as part of their commercial fishing activity. No harvest statistics are kept, as the domestic fishery is not considered commercially important. An unknown quantity of Queen Conch is taken in a recreational fishery (Cayman Island Department of Environment, *in litt.* 2001).

Colombia: The most important areas for the Queen Conch fishery in Colombia are the San Andrés Archipelago, Providencia and Santa Catalina Archipelago, i.e. Quitasueño, Serrana, Serranilla and Roncador, located off the eastern coast of Nicaragua (Valderrama and Hernández, 2000), and there is a artisanal fishery at the Peninsula de la Guajira (González, 2002). Fishing at Quitasueño, Serranilla and Roncador is currently prohibited (Vaca, *in litt.* 2002). The majority of the Queen Conch meat is destined for export. Local consumption is small and estimated to be around 5% of the total landings (Gallo-Nieto, *in litt.* 2002; Vaca, *in litt.* 2002). Based on landing statistics from San Andrés and Providencia, the Queen Conch fishery peaked in 1988 at about 800,000 kg of meat and has since fallen due to overfishing and local depletion (Mora, 1994). According to González (2002), the observed decreasing trend in harvest levels over the last 30 years may suggests that the fishery is close to collapse. Landing figures for the years 1996 to 2000 provided by the CITES Management Authority of Colombia range from approximately 100,132 to 199,043 kg (Vaca, *in litt.* 2002) (see Table 1).

Costa Rica: *Strombus galeatus,* which occurs in the Pacific, is more commonly fished and traded in Costa Rica than *S. gigas*, because the harvest of the latter is prohibited in Costa Rica (Mora, *in litt.* 2001).

Cuba: Harvest of Queen Conch in Cuba is mainly by free diving from small boats. Currently the harvest is restricted to six areas and fishing is allowed and managed through a quota system. Unlike many other countries the Queen Conch is primarily landed alive in its shell and landing figures are recorded as total animal weight (Anon., 1999). The processed or "cleaned meat" is approximately 7% of animal total weight (Formoso, 2001). High landings of 2,353,000 kg were recorded in 1977 (Muñoz *et al.*, 1987). Since then landings have decreased drastically. In 2000 and 2001 the harvest quota was 800,000 kg live weight corresponding to approximately 50,400 kg of processed Queen Conch meat (Formoso, 2001). However, the annual quota was not met in 2000 and 2001, and the actual harvest was less in both years: 285,000 kg live weight (32,800 kg processed meat) in 2000 and 413,000 kg live weight (41,300 kg processed meat) in 2001 (Alvarez, *in litt.* 2002). Based on recent abundance surveys it was suggested that the annual harvest quota could be increased to around 1,250,000 kg of live weight or 88,000 kg processed meat (Formoso, 2002). According to Alvarez (*in litt.* 2002) the difference between annual harvest and exports (approximately 10,000 kg in 2000 and 15,000 kg in 2001; see International Trade) is consumed domestically as food. *S. gigas* has been used in considerable quantities as bait in the Cuban finfishery (Appeldoorn, 1994a; Anon., 1999), however the importance of this use and the volumes currently involved are not well understood, and according to Alvarez (*in litt.* 2002) Queen Conch is no longer used for bait in Cuba.

Dominica: Queen Conch is one of the least harvested fishery resources in Dominica. Fishing takes place mainly off the northwest coast by free divers. Most meat is sold locally to restaurants and hotels while the shells are sold to tourists and cruise ship passengers (Fisheries Division of Dominica, 2002). There are no landing statistics and hence harvest volumes are not known (Fisheries Division of Dominica, *in litt.* 2001). According to Appeldoorn (1994b) 5,000 kg were harvested annually in the early 1990s.

Dominican Republic: The main fishing areas in the Dominican Republic are in the south-western part of the country around the Jaragua National Park, the south-eastern area around the Parque Nacional del Este and at Silver Banks, which lies 90 km north of the island (Delgado *et al.*, 1999; Posada *et al.*, 2000; Torres, *in litt.* 2002). According to figures provided by the Fisheries Department (Díaz, *in litt.* 2001), the Dominican Republic landed between 1,100,000 and 2,600,000 kg of Queen Conch meat per year in recent years, which are among the highest landing figures for the entire region (Table 1). According to the State Secretariat for Coastal and Marine Resources, the majority of the harvest originates from fishing grounds in the north (Monte Christi and the offshore bank Banco Plata) and the south-east (around Pedernales) (Nolasco, pers. comm.*pers. comm.* 2001). Based on the results of

recent population surveys in the southern part of the country, it is highly unlikely that the reported landings are harvested exclusively from the waters of the Dominican Republic. For example, Torres (*in litt.*, 2002) notes that current densities of the Queen Conch populations in the southern part of the country would not be able to meet the demand of the domestic market. Also, a number of Dominican vessels have been intercepted in foreign waters, and it has therefore been suggested that a considerable portion of the Queen Conch landings of the Dominican Republic originate from other nation's waters, such as the Pedro Banks in Jamaica, Mouchoir Banks and Caicos Banks in the Turks and Caicos Islands and the Bahamas Banks (Clerveaux, *in litt.* 2002; Deleveaux, *in litt.* 2001; Kong, *in litt.* 2001). For example, between October 2001 and April 2002, approximately 68 individuals from the Dominican Republic were arrested for illegally fishing in the waters of the Turks and Caicos Islands and over 40 vessels were confiscated (Clerveaux, *in litt.* 2002).

Grenada: The Queen Conch is harvested commercially on the island shelf of Grenada and of the Grenada Grenadines. In recent years, *S. gigas* has been harvested mainly using scuba gear. Around 50 boats are involved in the commercial Queen Conch fishery. According to surveys of the Fisheries Division a large majority of the harvest consists of juveniles. Currently no landing statistics are available (Isaac, *in prep.*). Grenada has traditionally been a supplier of Queen Conch meat to Trinidad; however, the meat is also consumed locally, especially in the tourist industry (Anon., 1999).

Guadeloupe (FR): Guadeloupe is considered to be of the largest consumers of Queen Conch meat in the region importing between 300,000 to 400,000 kg of Queen Conch meat per year in the mid 1990s (Anon., 1996a). Due to EU Food Sanitary Regulations, no imports of Queen Conch meat were allowed from July 1997 to December 2001. Due to these import restrictions, prices for Queen Conch meat in Guadeloupe increased greatly to USD 13/kg in 2001. Local harvests have considerably decreased in recent years due to stock depletions and over exploitation, but there are no official landing figures (Legendre, *in litt.* in litt. 2001).

Guatemala: Queen Conch is not an important commercial fishery product in Guatemala. It is mainly fished for subsistence, to supply the meat to local restaurants or to sell the shells to tourists (Sánchez and Lara, *in litt.* 2001).

Haiti: Haiti is traditionally one of the largest consumers of Queen Conch meat in the region. It imported dried Queen Conch meat from Turks and Caicos Islands in the early 1900s in considerable quantities (Brownell and Stevely, 1981). Queen Conch have been heavily fished in Haitian waters and domestic demand has also exceeded local supplies for decades (Wood, 1995). *S. gigas* meat is still popular throughout the country and most landings are consumed locally. Fishing is carried out mostly from small boats and by the use of hookah and free diving. Landings in 1995 and 1996 ranged from 55,000 to 70,000 kg respectively; no recent information on landings is available (see Table 1). In 1995, a survey revealed that harvests consisted largely of juveniles (Wood, 1995).

Honduras: Honduras has a large commercial Queen Conch fishery and based on the export volumes of processed Queen Conch meat, the country has among the highest landings in the region. However, no specific landing figures are currently available and therefore all estimates are based on export data only (around 1,328,118 kg in 2001, see International Trade). As this greatly influences the total meat weight (as all meat exported is processed), harvest volumes are likely to be considerably higher (possibly up to 50%, depending on the processing grades of exported meat). Levels of domestic consumption are not known. It is believed that the majority (> 95%) of the Queen Conch meat landed in Honduras is destined for export (Morales, *in litt.* 2001). According to Morales (*in litt.* 2003) Queen Conch is fished in several banks, including the banks of Rosalinda, Thunder Knoll, Media Luna, Gorda, Arrecife Lagarto, Cayos Vivorillos, and the banks of Misteriosa and El Rosario close to the martime border to the Cayman Islands (UK). However, information from other countries suggests that Honduran vessels are also fishing illegally Queen Conch in waters under the jurisdiction of other states. In 2002, three Honduran vessels were caught by Jamaican authorities for fishing illegally Queen Conch at Pedro Bank (Anon., 2002d; Anon., 2002f, Kong, *in litt.* 2002). However, the actual numbers of foreign vessels fishing at Pedro bank is most likely higher, as up to six Honduran vessels have been observed daily during abundance surveys undertaken in May in the same year (Kong, *in litt.* 2002; see Illegal trade).

Jamaica: The Queen Conch fishery of Jamaica has an estimated value of USD 15-20 million and is its most important fishery resource (Anon., 2000b). In recent years annual landings have dropped by a third from 3,000,000 kg of meat in 1993 to around 1,000,000 kg in 1999. No harvest was allowed in 2000 due to several court cases between Queen Conch exporters and the Jamaican government about

the use of quotas (Anon., 2001f; Anon., 2002e). In 2001, the fishery was reopened for a short period and again in 2002 harvest was not allowed due to another court injunction and a delay in the collection of population data (Kong, *in litt.* 2002). Approximately 95% of the total landings originate from the Pedro Banks and are destined for export. Landings from the Jamaican island shelf are not regularly recorded, but it is estimated that less than 5% of the total annual landings originate from the island shelf (Smikle, 1997). In the early 1990s, the Queen Conch fishery at Pedro Bank developed into a large-scale commercial fishery, with diver-equipped vessels averaging 24 m in length. These vessels serve as "mother" vessels that remain at the bank for several weeks and house up to 20 divers that operate from small boats (Aiken *et al.*, 1999). "Packer boats" receive and transport the Queen Conch meat from the fishing grounds to the processing plants. Queen Conch is primarily harvested by using scuba and hookah gear, but some free diving is used at the island shelf and in the artisanal fishery zones around the Pedro Cays. The Queen Conch fishery at Pedro Bank is governed by a quota system (see International Trade).

Martinique (FR): Martinique is considered one of the largest markets of Queen Conch meat in the region consuming around 300,000 to 400,000 kg of meat per year, all of which is imported (Rathier and Battaglya, 1994). Current levels of domestic consumption are not known, but are reported to have been as high as 900,000 kg in the mid-1990s (French Customs Service, *in litt.* 2001). Due to EU Food Sanitary Regulations no imports of Queen Conch meat were allowed between July 1997 and December 2001, however, anecdotal information suggests that Queen Conch meat was imported illegally from other islands in the region during that period (Anon., *in prep.* b). Due to the import restrictions prices for Queen Conch meat increased drastically and were USD 13 per kg in 2001 (Doray and Reynal, 2001). Little is known about the status of the Queen Conch fishery in Martinique and most information is restricted to two studies undertaken in the late 1980s (Gobert, 1989; Rathier, 1994). In 1987, Martinique produced 26,900 kg of *S. gigas* meat, most of which was taken by free diving. The majority (more than 90%) of Queen Conch caught by free diving were juveniles. The recreational fishery's production has been estimated in 1987 between 2,000 and 3,000 kg (Rathier and Battagyla, 1994). The previously marginal use of bottom nets to fish *S. gigas* has increased in recent years (Doray and Reynal, 2001).

Mexico: The Mexican 'Conch' fishery targets not only *S. gigas* but also some 20 different mollusc species (Basurto and Reguero, *in litt.* 2001). Several of the historically important fishing areas for Queen Conch have been closed due to stock depletions and over-fishing. The legal harvest of Queen Conch is currently restricted to Chinchorro and Cozumel (Anon., 2001d). An indefinite closure of the Queen Conch fishery has been proposed recently for the entire Quintana Roo State, based on concerns raised by local fishermen (Padilla *et al.*, 2002). This would effectively mean a total closure of the legal Queen Conch fishery in Mexico. Estimated annual landings were around 42,000 kg between 1996 and 2000 (see Table 1), which is only 12% of the highest historical landings recorded in the mid 1970s (INP, 2000). However, Alvarez-Romero (*in litt.* 2003) notes that in the mid-1970s some Queen Conch landed in Mexico originated from Belize. All Queen Conch meat harvested in Mexico is consumed nationally (see International Trade), it is assumed that all landed Queen Conch meat is consumed at nationally and used to supply demand in the states of Quintana Roo and Veracruz (INP, 2000)..

Montserrat (GB): Since 1996, only very limited harvest of Queen Conch has been taken place in Montserrat since local populations can no longer supply local demand by restaurants and tourist (O'Garro, *in litt.* 2001). Populations have been severely affected by overexploitation (Jeffers, 1996), but no further information is currently available (O'Garro, *in litt.* 2002).

Netherlands Antilles (NL): In the past Queen Conch were heavily fished at Saba Bank, mostly by foreign vessels (van Buurt, 2001). The Saba Bank was considered a refuge for foreign fishing as no regulations were in place until the early Nineties, when a Extended Fisheries Zone, which included parts of the Saba Bank, was declared (Dilrosum, 2000). Since the mid-1990s, the coast guards started to patrol the Bank and expelled several foreign vessels that were illegally fishing on the bank. No exact catch figures are known, but it is suspected that the Queen Conch populations at the Bank were severely overfished (Dilrosun, 2000; van Buurt, 2001). Nowadays, fishing on the bank is only allowed for Antillean boats in possession of a fishing permit, however Queen Conch are fished only occasionally by local fishers, and there are no landing statistics (van Buurt, *in litt.* 2002). Queen Conch is still caught around the island of St. Eustatius for local consumption. Some fishing, also occurs around the waters of Bonaire and possibly Curacao, but populations are depleted and can no longer sustain a commercial fishery (van Buurt, 2001).

Nicaragua: Until the Mid-1990s, Queen Conch was not a popular catch and was normally harvested occasionally by fishermen targeting lobster. Following an attempt to diversify national fisheries, landings of Queen Conch meat have increased steadily in recent years from 16,783 kg in 1997 to 65,318 kg in 2000 (Martinez, *in litt.* 2001). The majority of Queen Conch is harvested by vessels targeting lobster. Since 1998, Nicaragua has set export quotas for Queen Conch, which were around 20,000 kg of meat in 1998, 1999 and 2000, but increased in 2001 to around 40,000 kg (see International Trade). Queen Conch is harvested mostly for export, but is also consumed locally.

Panama: Queen Conch is harvested both for commercial use and for subsistence. Only limited data are available on Queen Conch landings in Panama. According to Tewfik and Guzman (*in prep.*), a total of 116,000 kg of meat (possibly including meat of the Milk Conch *Strombus costatus*) was landed in 1998. As no exports of *S. gigas* are reported from Panama (see International Trade), it is assumed that all landed Queen Conch meat is consumed at nationally.

Puerto Rico (US): Primary Queen Conch fishing grounds in Puerto Rico are at the west coast of the island. In the early 1980s, annual landings were around 200,000 kg, but have since fallen considerably (Valle-Esquivel, 2002a). Between, 1993 and 2001 landings ranged from 74,972 kg in 1993 to 112,569 kg in 2001, with the largest landings recorded in the last two years (see Table 1). Fluctuating landings, a sharp increases in effort and a declining trend in catch rates over the last 20 years suggest that overfishing of the Queen Conch stocks occurs (Valle-Esquivel, 2002a). All landings are destined for local markets. As local demand is high the majority of Queen Conch meat consumed in Puerto Rico is imported (Anon., 1999) (see International Trade).

Saint Kitts and Nevis: Queen Conch is mainly fished using Scuba gear. There are approximately eight vessels in sizes from 16-29 feet (4.8-6m) that are full time involved in the Queen Conch fishery, another five vessels are involved in fishing Queen Conch on a part time basis. Most Queen Conch is taken around the island of Nevis and from the North eastern waters of Saint Kitts to the western Channel between Saint Kitts and Saint Eustatius (Netherlands Antilles). The diving depth is over 100 feet (30m) and bottom times may exceed 30 minutes. Normally, no decompression stops are made. The total estimated landings for both islands ranged between 28,844 to 70,300 kg a year between 1995 and 2001 (see Table 1) (Heyliger, *in litt*., 2003). Approximately 15-25% of the landings in Saint Kitts are destined for local consumption, with the remainder being exported (Anon., 1999; Simmonds, *in litt.* 2002). In Nevis, between 66-95% of the annual Queen Conch meat landings is exported. Preliminary analysis of catch and effort data from Nevis suggested that there is potential for higher yields, and an interim maximum catch of 68,000 kg was recommended as a precautionary approach (Anon., 1999).

Saint Lucia: Queen Conch is fished within various areas including off Cas en Bas, Esperance, Grand Anse, Gros Islet, Mennard and Marisule in the north; Vieux Fort and Caille Bleu in the south; and Dennery on the east coast. Queen Conch is landed at three main sites: Gros Islet in the north, Vieux Fort and Laborie in the south (Joseph, 2003). However, small-scale fishing takes also place from coastal villages along the southwestern coast. Queen Conch is now mainly harvested at deeper depths (20-50 m) with the use of scuba gear (Anon., 2001g). Bottom nets are also still in use and free diving occurs along the west and south-west coast. The majority of Queen Conch is landed whole (live) and then stored in wire-meshed cages in shallow waters until sold (Joseph, *in prep.*). Landings in recent years (1994-2001) ranged from 20,000 to 41,400 kg of Queen Conch unprocessed meat (see Table 1). Queen Conch meat is consumed locally but there is also a strong demand for the meat in neighbouring islands (especially Martinique), and in the early 1990s, more than 50% of the total landings was exported (Joseph, *in prep.*). Subsistence exploitation in shallower waters occurs but the extent is unknown (Joseph, *in prep.*). Concerns have been raised about illegal fishing activities by French vessels from the neighbouring island of Martinique (FR) (Nichols and Jennings-Clark, 1994), and about illegal exports of Queen Conch meat to Martinique (Anon., 2001g).

Saint Vincent and the Grenadines: Queen Conch meat has been an important protein source in the diet of many Grenadines inhabitants. In more recent times, however, the Queen Conch fishery has gained importance as an commercial activity (Isaacs, *in litt.* 2003). Queen Conch in Saint Vincent and the Grenadines is primarily fished during the closed season for lobster (1 May to 31 August), but there are also a number of specialised free-divers who target the species all year around and operate mostly around the islands of Mustique, Union and Bequia (Anon., *in prep* b). Some divers have started using scuba gear to reach deeper waters. Landings between 1994 and 2001 ranged from 6,822 to 38,210 kg of Queen Conch meat (only viscera removed) (see Table 1). In recent years (2001 and 2002) Queen Conch landings increased from 6,900 kg in 2000 to 38,210 kg in 2001 and 35,856 kg in 2002.

Interestingly, this increase is caused by the EU's ban of imports of fishery products from Saint Vincent and the Grenadines due to EU Food Sanitary Regulations, closing the traditional markets of Martinique and Guadeloupe. However, this closure resulted in new marketing perspectives and now a larger quantities of Queen Conch meat are landed and exported to a wider range of countries, including neighbouring islands such as Anguilla, Barbados, Saint Lucia and Trinidad (Cordice, 2003). Therefore, Queen Conch harvest is thought to be heavily influenced by market forces and demand, rather then abundance of stocks (Isaacs, *in litt.* 2003). The average value of the Queen Conch landings between 1995 and 2002 were approximately USD 76,000 per year. The Queen Conch meat is consumed locally but around 70% are exported. In 2002, Queen Conch products constituted 8.3% of the annual fisheries products landings, however exported Queen Conch products made up 35% of the total fish exports value. Generally, Queen Conch is landed in its shell and fishermen remove the viscera prior to selling and export. There are a small number of small-scale food processing plants that utilise Queen Conch meat in other food products such as conch samosas and soup that contains Queen Conch meat; these products are sold locally, but are also exported (Cordice, 2003).

Trinidad and Tobago: According to Sturm (Anon., 1996a), populations of *S. gigas* in Trinidad and Tobago are heavily overfished, but are reportedly only used for the domestic markets in the form of meat and shells. Harvests are apparently insufficient to meet the local demand for meat, which is therefore imported from other countries (Anon., 1996a).

Turks and Caicos Islands (GB): Queen Conch is economically the second most important commercial fishery in the Turks and Caicos Islands (Fenton et al., 1997). The Caicos Bank is the primary fishing ground for Queen Conch and the species is harvested by free diving in waters usually less than 10 m deep (Medley and Ninnes, 1999). Following a peak in commercial harvest of Queen Conch in 1980 (approximately 1,150,000 kg unprocessed meat), harvest levels have declined (Clerveaux and Danylchuk, in prep.). In the 1980s, annual landings of Queen Conch (unprocessed) meat were around 400,000 to 600,000 kg (Medley and Ninnes, 1995). In the 1990s, the harvest levels had increased to 600,000 to 800,000 kg per year (see Table 1). The majority of Queen Conch meat landed in the Turks and Caicos Islands is destined for export and it is estimated that less than 5% or around 45,260 kg of unprocessed meat are consumed locally (Clerveaux, *in litt.* in litt. 2002).

United States of America: The US is the largest consumer of Queen Conch meat; but since harvest of Queen Conch in the federal waters was banned in 1986, all Queen Conch meat consumed locally is now imported (see International Trade).

Venezuela: Venezuela used to be an important producer of Queen Conch meat (landing 360,000 kg in 1988), but due to unsustainable fishing practices the populations declined in the 1980s and in 1991 the harvest of Queen Conch had been prohibited. However, illegal harvesting and poaching is reported to be ongoing and is seen as the major cause for the lack of recovery around the Los Roques Archipelago and other important fishing areas (Arnal, *in litt.* 2002). Queen Conch meat has not been a popular food item in Venezuela and traditionally, most Queen Conch meat was destined for export to supply demand in Martinique, Bonaire and Curacao (Appeldoorn, 1994a). Today, the illegal harvest is still mainly driven by the demand in nearby islands, e.g. Bonaire and Martinique (Posada, *in litt.* 2001). There have been considerations to reopen the Queen Conch fishery following political pressure from fishermen and the industry and this has raised concern given the lack of information regarding the population status of the species (Schweizer and Posada, 2000).

Virgin Islands (US): The Queen Conch fishery in the Virgin Islands (US) is mostly concentrated around St Croix (over 90% of the landings) (Valle-Esquivel, 2002b). Commercial fishing is most common in offshore waters of 5-26 m depth, but recreational fishing still occurs in the shallow embayments where the species has been severely depleted from prior commercial use (Valle-Esquivel, 2002a). According to Gordon (*in litt.* 2002) all major populations are harvested. Reported landings for the years 1996 to 2001 were between 402 and 2,170 kg of Queen Conch meat landed at St Thomas and St John (combined), and between 11,312 and 33,137 kg landed at St. Croix (Kojis, *in litt.* 2001; Valle-Esquivel, 2002). There is an ongoing harvest of juveniles and current management and enforcement measures are not effective in controlling this illegal offtake (Gordon, *in litt.* 2002). All Queen Conch meat harvested is destined for local consumption (Anon., 1996a).

INTERNATIONAL TRADE

The main product of *S. gigas* in international trade is the meat, which is now mostly traded frozen. Some meat may also be exported fresh, stored on ice or dried. Other products of the Queen Conch such as shells, shell carvings and pearls, are also traded in considerable quantities. Such products 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).

Meat weight and processing grades

Prior to export Queen Conch meat is processed to varying degrees, which can, depending on the processing grade, result in a reduction of the original tissue weight by 50% or more. In some countries specific terms are used to describe the different processing levels. These are however not yet standardised. In Jamaica for example, "100% cleaned" refers to meat where most parts (e.g. claw, viscera, head and eyes, mantle) have been removed and only the pure white muscle ('fillet') remains. In the Turks and Caicos Islands the processing procedure is very similar to Jamaica and only the pure white meat is exported. This is referred to as "40% clean" which refers to meat where only 40% of the original tissue weight remains after processing. The level of processing and tissue loss is a critical factor for example in calculating quotas and in recording and monitoring harvest and export volumes: 5,000 kg of unprocessed Queen Conch meat can for example be equivalent to more than 30-35,000 harvested adult individuals, whereas 5,000 kg of processed meat would be equal to more than 50,000 individuals. However, the tissue weight of an adult Queen Conch can vary from region to region depending for example on the age of the individual and spatial differences (see Ecology and Habitats). Therefore it is crucial that countries determine the mean tissue weight of unprocessed meats and establish conversion factors that allows for conversion of the weight of processed Queen Conch meat to the actual volume of harvested Queen Conch. In addition, meat grades (e.g. percentage loss of edible soft tissue) would need to be standardised and specified on shipments to allow effective recording and monitoring of international trade (Tewfik, *in litt.* 2002).

Several countries, especially those using quotas to manage their Queen Conch fishery, have established conversion factors that allow conversion of the weight of declared exports of Queen Conch meat to the number of animals harvested. For example, Table 2 shows the mean tissue weights and corresponding conversion factors for the different processing grades used in the Jamaican Queen Conch Fishery. These figures have been obtained from samples taken for the different processing grades. Jamaica sets a quota for total allowable catch per year and then converts the declared export volumes back to the actual harvest volume using standardised conversion factors and the declared meat grade per shipment (Smikle, 1997).

Table 2. Meat grades, tissue loss, mean tissue weight and conversion factors for Queen Conch processing used in Jamaica

Processing grade	Tissue loss	% of Tissue loss	No. ind./kg	Mean tissue weight	Conversion Factor
Unprocessed	None, animal removed from shell	N/A	6.1	165g/meat	0.85
50% Cleaned	Removal of claw and viscera	0	7.2	140g/meat	1.00
65% Cleaned	All the above plus head and parts of mantle	11.3	8.0	126g/meat	1.11
85% Cleaned	All of the above plus verge, remaining mantle and parts of skin	28.2	9.2	109g/meat	1.28
100% Cleaned ("fillet")	Only pure white muscle remains	42.9	10.2	98g/meat	1.43

Note: Only 50% grade has been verified by field sampling (N = 2,718, M:F ratio 1:1.2) and is used as base unit; "unprocessed" grade simply refers to total tissue removed from shell; (Source: Tewfik, 1996; Smikle, 1997)

International Trade in Queen Conch

The international trade in Queen Conch products involves a significant number of countries and dependent territories: in total, more than 90 States and territories were recorded in CITES trade statistics as being involved in the international trade of Queen Conch products between 1992 and 2001, as (re-)exporter or as importer (UNEP-WCMC, 2002). Data for net trade, reported by CITES Parties in their annual reports for the years 1992 to 2001, were provided by UNEP-WCMC and is in the following referred to as CITES trade data. 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, two Queen Conch range States are not yet a Party to CITES (Haiti, Turks and Caicos Islands) while others have only recently acceded to the Convention, e.g. Aruba (in 1995), 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.

Table 3 provides an overview of net exports[2] of the different specimens of Queen Conch reported in the CITES trade statistics for 1992 to 2001. 2000 is the most recent year with relatively complete trade data are available. The main specimens of Queen Conch in trade are meat, shells, live specimens and bodies. Unfortunately, some Parties reported trade in specimens of *S. gigas* without providing a weight unit resulting in records of '1,000 meat", or in meat exports expressed in number of boxes or cases (see Table 3). Such entries have been excluded from further analysis and only entries recorded in kilograms (kg) or pounds (lbs) have been considered for further analysis (see Table 4) (lbs have been converted into kg using a conversion factor of 1 lb = 0.4536 kg).

International trade in Queen Conch meat and shells

The main specimens of Queen Conch reported in trade are Queen Conch meat and shells. A brief overview of the volumes and trends in international trade in these two specimens and information on trade involving the various ranges States is provided below.

Queen Conch meat

Table 4 summarises the net exports of Queen Conch meat from 1992 to 2001 per exporting State. Based on this data a total of 21,649,306 kg of Queen Conch meat was exported between 1992 and 2001 (Note: data for 2001 is partly incomplete and no trade in meat has been reported in 1992). Based on the assumption that the weight of one processed 'meat' of an adult Queen Conch reported in international trade is approximately 70-120 g, 21,649,306 kg would be equivalent to 180 to 309 million individuals traded between 1992 and 2001, or an average of 20 to 34 million animals in international trade per year. 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. The total annual trade volumes ranged from 363,421 kg exported in 1993 to a maximum of 3,517,518 kg of meat exported in 1996. In the late 1990s (1998-2000), exports have decreased slightly from 2,685,478 kg and 2,817,647 kg in 1998 and 1999 to 2,090,810 kg in 2000, but have again increased in 2001 and were 3,087,856 kg. The decrease in export in the late 1990s is mainly due to the lack of exports from Jamaica, following a national lawsuit that had 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, see further below). Since 2000, meat exports from a number of other countries have increased, most notably from Honduras, the Turks and Caicos Islands, the Dominican Republic, Belize and the Bahamas.

The US and France are the largest importers of Queen Conch meat; 97% of all meat reported in international trade between 1992 and 2001 has been imported by these two Parties (Table 5). The US [including Puerto Rico and the Virgin Islands (US)] is the largest importer of Queen Conch meat, importing a total of 16,302,645 kg, or 78% of all Queen Conch meat reported in international trade in the ten-year period. Trade involving Puerto Rico and the Virgin Islands (US), the two US dependencies in the Caribbean region, is normally not reported separately from trade to and from mainland US in the CITES annual reports as it is considered internal (Field, *in litt.* in litt. 2001). France (including the two Overseas Departments Guadeloupe and Martinique) is the second largest importer of Queen Conch meat, importing 3,501,299 kg of meat or 19% of all meat traded between 1993 and 2001. However, the majority of these imports took place between 1994 and 1997, because due to EU Sanitary Food Regulations, no imports of Queen Conch meat were allowed between July 1997 and late 2001.

Queen Conch shells

Queen Conch shells are largely considered a by-product of the meat trade. Nevertheless, considerable quantities are exported mostly for decorative purposes and as tourist souvenirs. CITES Parties report trade in Queen Conch shells in kg or in number of specimens, making it difficult to assess the total volume of shells traded internationally. Based on CITES trade data, a total of 2,345,868 individual shells and 142,778 kg of shells have been reported in trade between 1992 and 2001 (Table 3). Haiti, a non-Party, is by far the largest exporter of Queen Conch shells, exporting 1,529,798 shells (79% of total exports) and 47,872 kg of shells (33% of total exports). Other important exporting States of Queen Conch shells are the Bahamas, Turks and Caicos Islands, Honduras and Mexico. The US is the largest

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[2] Net exports represent the total volume of Queen Conch meat exported from a range State minus the volume imported, based on the export and import data reported by CITES Parties in their annual reports.

importer of Queen Conch shells. In total, 1,648,024 shells (70% of total trade) and 122,447 kg of shells (86% of total trade) were imported by the US from 1992 to 2001. The Member States of the European Union (EU) are the second largest importer of *S. gigas* shells, importing in total 493,153 shells and 8,239 kg of shells between 1992 and 2001; 59% of the shells imported by the EU were destined for Spain.

Anguilla (GB): The only trade in *S. gigas* reported in the CITES trade data involving Anguilla refers to three shells that have been seized by New Zealand in 2000 which originated from Anguilla (UNEP-WCMC, 2002).

Antigua and Barbuda: Antigua and Barbuda became Party to CITES in 1997. Since 1999, Antigua and Barbuda have been affected by a recommendation of the CITES Standing Committee that Parties suspend imports of specimens of *S. gigas* originating from Antigua and Barbuda. Before this, up to 20% of the total landings (around 500 to 4,000 kg of meat from 1990 and 1996) were exported, primarily to the French Antilles (Horsford and Lovell, 2002). Antigua and Barbuda joined CITES in 1997 and the only international trade in Queen Conch specimens from Antigua and Barbuda recorded in the CITES trade data refers to an import of six shells by the US and the seizure of two shells by New Zealand which originated in Antigua and Barbuda.

Aruba (NL): Although demand for Queen Conch meat in Aruba is said to be considerable (De Cuba, in litt., 2002), no imports of Queen Conch meat have ever been recorded by Aruba or the Netherlands respectively in the CITES trade data. In 1998, Jamaica reported the export of 10,000 kg of Queen Conch meat to Aruba, but this was not reported by Aruba (UNEP-WCMC, 2002).

Bahamas: According to the CITES trade data, the Bahamas is the fourth largest exporter of Queen Conch meat exporting more than 1,445,557 kg between 1993 and 2001 (see Table 4 and 6). The US was the main destination for meat exports from the Bahamas, importing more than 95% of the total exports. Export figures provided by the Department of Fisheries of the Bahamas differ to that reported in the CITES annual reports (see Table 6), which is likely to be due to differences in the time period used for reporting (calendar year versus seasonal/fishing year). Since 1996, the Bahamas established annual export quotas but communicated these to the CITES Secretariat only in 1997 and 1998. The export quota for Queen Conch meat has been increased in recent years from 136,080 kg in 2000 to 308,448 kg 2001 and 2002 (Philipps, *in litt.* in litt. 2002; Gittens, *in litt.* in litt. 2003). However, exports remained well below the set quota and according to the Fisheries Department, only 164,115 kg were exported in 2001 (Philipps, *in litt.* in litt. 2002). However, based on the CITES trade data 219,787 kg were exported in 2001, which may be likely to be due to reporting differences between the Departments responsible for Fisheries and the one responsible for CITES matters (Philipps, *in litt.* in litt. 2002). In 2003, the export quota was decreased to 136,000 kg, which is a reduction by more than 50% compared to the quota of the previous year (Gittens, *in litt.* in litt. 2003).

Table 6. Comparison of Queen Conch meat exports (kg) reported by the Bahamian Department of Fisheries (BDF) and in the CITES trade data for 1993 to 2001

	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total
Total harvest (kg)			493,000	589,680	635,040	680,400	453,600	668,000		3,519,720
National Export quota				201,836	204,120	204,120	158,760	136,080	308,448	1,213,364
Meat exports reported by BDF	217,000	356,000	126,000	166,000	165,000	92,000	91,000	118,000	164,115	1,495,115
Meat exports reported to CITES	293,099	88,984	99,332	202,031	94,236	175,941	142,954	129,193	219,787	1,445,557

(Source: UNEP-WCMC, 2002; CITES Notification *No. 980, 1998/36, 1999/21, 2000/053 and 2001/041*; Braynen, 2001; Deleveaux, *in litt.,* 2001, Philipps, *in litt.* 2002; Gittens, *in litt.* 2003)

Table 3. Global net exports of *Strombus gigas* specimens as reported by CITES Parties between 1992 and 2001

Specimen	Unit	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total
Meat	kg		363,421	1,115,447	2,666,018	3,517,518	3,305,111	2,685,478	2,817,647	2,090,810	3,090,219	21,649,306
Meat	No			20,856	226,000	455	11,468	102,543		130,348		491,670
Meat	Boxes					49						49
Meat	Cases				151	18					400	569
Shells	No	3,000	364,961	59,188	252,417	232,785	191,663	263,211	268,782	342,760	370,101	2,345,868
Shells	kg	866		31,626	10,301	35,726	29,862	1,161	20,480	8,263	5,359	142,778
Live	No			16,641	87,956	108,848	97,991	36,439	41,992	9,836	7,437	407,140
Live	kg				64,687	135,380	23,668	24,767	54,111	27,091	12,073	341,777
Bodies	No		282,172		32,530		101	1	2		9,580	324,386
Bodies	kg								10,000			10,000
Pearls	No						323	441	295	803	823	2,685
Pearls	g								130		959	1,089
Skeletons	g									7,125		7,125
Skin/leather	No			2,254		24,662						26,916
Soup	No						1					1
Carvings	No	20,345	3,718	372	43,033	4,480	20,467	15	58	28	29,254	101,425
Specimens	g							166		300		466
Specimens	No				800			28		22		850
Unspecified	No				3,364			12				3,376
Extract	No										1	1

(Source: UNEP-WCMC, 2002)

Table 4. Global net exports of *Strombus gigas* meat (kg) between 1992 and 2001 as recorded in the UNEP-WCMC CITES trade Database.

Exporter	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total	% of Total
Jamaica			808,347	1,337,803	1,989,560	1,423,309	1,468,055	1,125,849	18,797	287,854	**8,459,574**	39
Honduras				459,238	737,102	965,652	636,252	746,854	931,531	1,328,118	**5,804,747**	27
Turks and Caicos Islands		9,440	96,918	481,750	367,198	294,219	67,805	205,297	287,816	256,971	**2,067,414**	10
Dominican Republic			32,210	134,941	33,081	101,897	58,641	276,009	338,561	552,163	**1,527,503**	7
Bahamas		293,099	88,984	99,332	202,031	94,236	175,941	142,954	129,193	219,787	**1,445,557**	7
Colombia				106,061	63,688	153,538	155,826	196,044	110,208	90,512	**875,877**	4
Belize				26,129	80,169	70,896	111,133	111,548	190,974	254,893	**845,742**	4
Haiti				34	17,043	159,494				1,091	**177,662**	< 1
Nicaragua						7,023	6,750	9,897	20,000	41,153	**84,823**	< 1
Netherlands Antilles			61,236								**61,236**	< 1
French Antilles		59,082									**59,082**	< 1
Cuba					7,000				9,994	40,000	**56,994**	< 1
Saint Vincent and the Grenadines		1,800	12,590	7,780	3,200	9,517	145	2,274	9,583	1,471	**48,360**	< 1
Saint Lucia			15,000		1,200	6,000					**22,200**	< 1
Trinidad and Tobago					5,670	1,249			23	1,588	**8,530**	< 1
Venezuela							4,930				**4,930**	< 1
Costa Rica						4,309					**4,309**	< 1
Dominica					2,500						**2,500**	< 1
Saint Kitts and Nevis					2,181						**2,181**	< 1
Bermuda								836			**836**	< 1
Brazil			25								**25**	< 1
Virgin Islands (US)				4							**4**	< 1
Grenada										1	**1**	< 1
Caribbean (unspecified)			137							12,127	**12,264**	< 1
Non-range States				12,946	5,895	13,772		85	44,130	2,490	**76,828**	1
Total		**363,421**	**1,115,447**	**2,666,018**	**3,517,518**	**3,305,111**	**2,685,478**	**2,817,647**	**2,090,810**	**3,087,856**	**21,649,306**	100

*(Source: UNEP-WCMC, 2002); Note: due to different processing grades of Queen Conch meat, export volumes can be equivalent to different volumes of specimens taken from the wild; No trade in Queen Conch meat was reported in 1992. Meat reported in other units e.g. boxes or cases, or in number of specimens is not included. *refers to exports or re-exports of Strombus gigas meat reported in kg from the following non-range States: Belgium, Canada, China, El Salvador, Netherlands, Solomon Islands and Turkey*

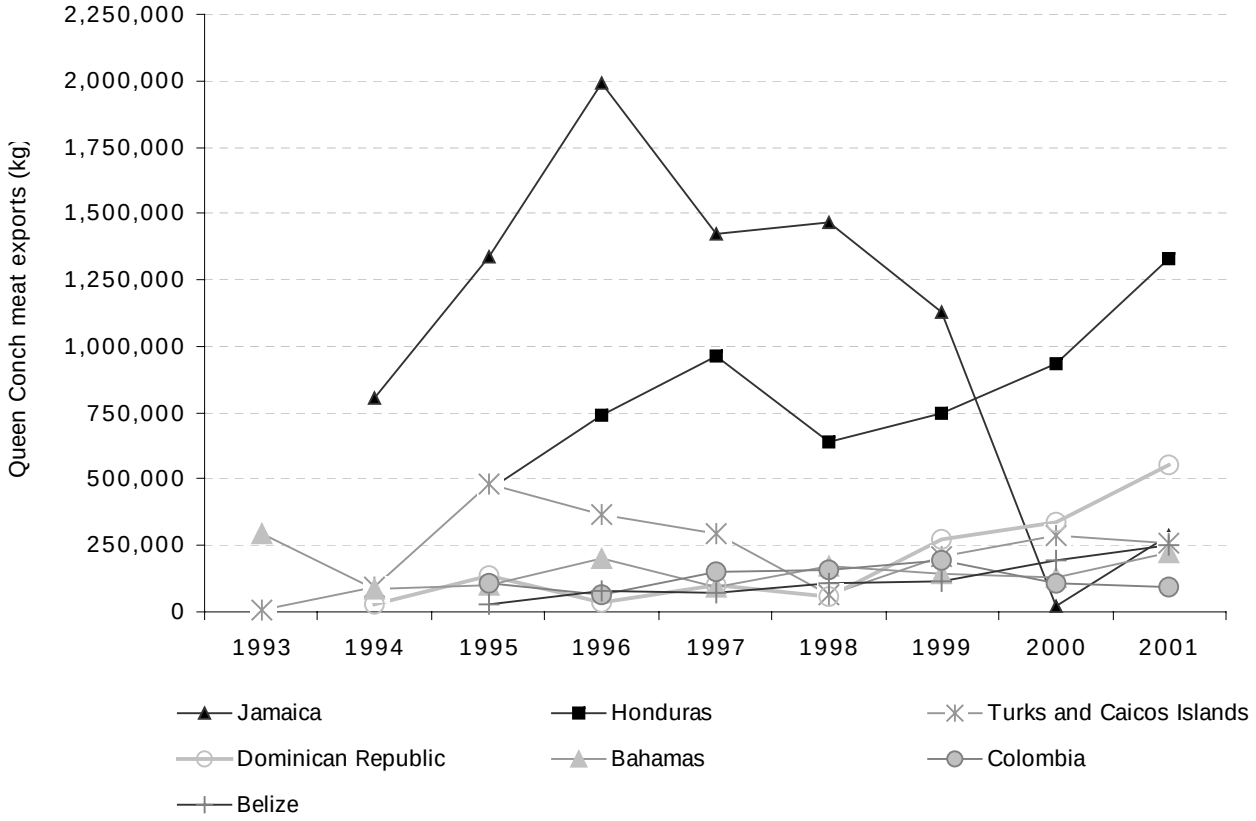

Figure 1: Annual net exports of Queen Conch meat (kg) between 1993 and 2001 illustrated for the seven largest exporters. (Source: UNEP-WCMC, 2002)

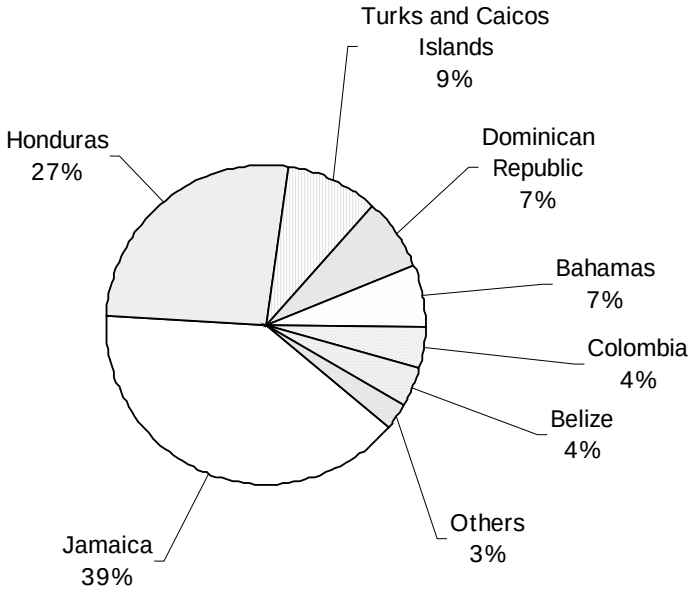

Figure 2. Percentage per exporting State. Total Queen Conch meat export between 1993 and 2001: 21,649,306 kg. (Source: WCMC-UNEP, 2003)

Table 5. Net imports of Queen Conch meat (kg) reported between 1992 and 2001

Exporter	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total	% of Total
US	*293,097*	*197,434*	*1,743,660*	*2,249,353*	*2,365,595*	*2,177,318*	*2,397,437*	*2,028,358*	*2,786,308*	***16,238,560***	***75***
Puerto Rico					*44,001*	*279,685*	*317,199*			***640,885***	***3***
Subtotal US	293,097	197,434	1,743,660	2,249,353	2,409,596	2,457,003	2,714,636	2,028,358	2,786,308	**16,302,645**	**78**
France	*11,235*	*805,322*	*908,534*	*1,245,652*	*107,436*					***2,364,624***	***14***
Martinique		*61,236*		*13,200*	*547,313*		*60,000*			***681,749***	***3***
Guadeloupe					*213,432*				*241,494*	***454,926***	***2***
Subtotal France	11,235	866,558	908,534	1,258,852	868,181		60,000		241,494	**3,501,299**	**19**
Netherlands Antilles			10,896		678	7,491	10,920	25,689	250	**55,924**	**< 1**
Netherlands		95		2,268	2,385	10,896			13,000	**28,644**	**< 1**
Aruba						10,000				**10,000**	**< 1**
Mexico			2,928		13,608	18,640			15,000	**50,176**	**< 1**
Haiti								9,453	10,000	**19,453**	**< 1**
Saint Lucia								7,539		**7,539**	**< 1**
Barbados						5,557	454			**6,011**	**< 1**
British Virgin Islands						5,227				**5,227**	**< 1**
Trinidad and Tobago						45	2,274	1,862		**4,181**	**< 1**
Honduras								1,700		**1,700**	**< 1**
Other States *	59,089	51,360		7,045	10,663	170,619	29,363	16,209	21,804	**366,152**	**2**
Total	**363,421**	**1,115,447**	**2,666,018**	**3,517,518**	**3,305,111**	**2,685,478**	**2,817,647**	**2,090,810**	**3,087,856**	**21,649,306**	**100**

*(Source: UNEP-WCMC, 2002) * includes: Canada, Japan, Peru, Spain, Hong Kong, Taiwan and Ireland (in order of importance)*
Note: No trade in Queen Conch meat was reported in 1992. Meat reported in other units e.g. boxes or cases, or in number of specimens is not included.

Barbados: Since 1999, Barbados has been affected by a recommendation of the CITES Standing Committee that Parties suspend imports of specimens of *S. gigas* originating from Barbados. According to CITES trade data Barbados exported a total of 24 shells between 1997 and 2000. In addition, Barbados imported a total of around 6,000 kg of Queen Conch meat from Belize in 1998 and 1999.

Belize: During the past few decades, Belize was known as the largest Queen Conch meat exporter world-wide exporting more than 500,000 kg per year (Perez, 1996). Based on CITES trade data, Belize exported from 1995 to 2000 a total of 845,742 kg of Queen Conch meat (Table 4), of which almost all (>99.9%) went to the US. Exports have increased in recent years and were 190,974 kg in 2000 and 254,893 kg in 2001. However, based on data received from the Belize Fisheries Department (Villanueva, *in litt.* 2002) higher volumes of Queen Conch meat have been exported (see Table 7). Based on the data in Table 7, a total of 1,470,199 kg of Queen Conch meat was exported during the same time period. In addition, the Belize Fisheries Department also reported the export of 23,593 shells in 1998 which is not recorded in the CITES trade data. According to Villanueva (*in litt.* 2002), the Fisheries Department sets export quotas that are assigned to individual fisheries co-operatives, but no further information has been received.

Table 7. Comparison between the exports of Queen Conch meat and other specimens reported by the Fisheries Department of Belize (FD BZ) and in the CITES trade data.

	1995	1996	1997	1998	1999	2000	2001	Total
Exports (CITES)								
Meat (kg)	26,129	80,169	70,896	111,133	111,548	190,974	254,893	845,742
Live (No)		5,171						5,171
Shells (kg)		4,536						4,536
Shells (No)			6	2	22	5		35
Exports (FD BZ)								
Meat (kg)	165,023	138,368	257,800	209,477	178,586	235,159	285,786	1,470,199
Trimmings (kg)				3,955		4,136	7,159	15,250
Shells (No)				23,593				23,593
Live (No)							1,125	1,125

(Source: UNEP-WCMC, 2002; Marin, in litt. 2001; Villanueva, in litt. 2002)

Bermuda (GB): The harvest of Queen Conch in Bermuda has been prohibited since 1978 and hence exports of Queen Conch meat harvested in Bermuda is not allowed. However, in 1999 the US reported the import of 836 kg of Queen Conch meat originating from Bermuda (UNEP-WCMC, 2002). Based on the CITES trade data, the only other Queen Conch specimens reported in trade involving Bermuda are eight shells exported in 1997 to the US and one shell seized by New Zealand in the same year.

Brazil: The only recorded trade in Queen Conch specimens involving Brazil is the export of 25 kg of Queen Conch meat to Martinique reported in the CITES annual report of Brazil in 1994 (UNEP-WCMC, 2002).

British Virgin Islands (GB): None of the Queen Conch meat harvested in the British Virgin Islands is exported as it is all destined for domestic consumption (Eristhee, *in litt.* 2002). Consequently, no exports are recorded in the CITES trade data for 1992 to 2001. However, according to the Fisheries Department of Saint Kitts and Nevis (Anon., 2003a) Queen Conch meat was exported to the British Virgin Islands, but no meat imports have been reported to CITES. In 1998, the US re-exported 5,227 kg of Queen Conch meat to the British Virgin Islands of unknown origin (UNEP-WCMC, 2002). Fifteen shells and one hundred live specimens were recorded as being exported between 1996 and 1998, the majority destined to the US. Based on reports by the Virgin Islands (US) considerable amounts of Queen Conch landed in the Virgin Islands (US) have been fished in the British Virgin Islands (Eristhee, *in litt.* 2002).

Cayman Islands (GB): According to the Department of Environment of the Cayman Islands (Bothwell, *in litt.* 2002) Queen Conch meat is imported by the Cayman Islands from various countries to supply the demand by the local tourist and restaurant sector. However, there is currently no accurate mechanism to control and monitor trade in Queen Conch specimens and hence trade levels, especially imports, are not known (Bothwell, *in litt.* 2002). No exports or imports of Queen Conch meat are recorded in the CITES trade data involving the Cayman Islands and the only import of Queen Conch meat reported by the

United Kingdom between 1992 and 2001 refers to 450 'meat' (no weight unit) that were imported in 1996 from Jamaica. Queen Conch shells are exported as tourist souvenirs, but export levels are not accurately monitored (Bothwell, *in litt.* 2002). Based on the CITES trade data for 1992 to 1999, 108 shells were recorded as being exported from the Cayman Islands. In 1999, the Cayman Islands imported 910 shells originating from Haiti and re-exported by the US (UNEP-WCMC, 2002). There is also a small trade in worked *S. gigas* shell products and pearls as tourist souvenirs, however, most of these are thought to be re-exports of worked items imported from other countries for re-sale to tourists (Bothwell, *in litt.* 2002).

Colombia: According to the CITES trade data, Colombia exported a total of 875,877 kg of Queen Conch meat between 1995 and 2001 (see Table 4; no trade was reported between 1992 and 1994). The US is the most important market for Queen Conch meat from Colombia, which imported more than 87% of all meat exports between 1995 and 2001. Since the early 1990s, Colombia establishes annual export quotas for Queen Conch meat (see Table 8), which have been communicated to the CITES Secretariat since 1997. These quotas have two components and are based on annual harvests fished under a harvest quota for the actual fishing year (January-June) and on Queen Conch meat that was fished between November and December of the previous year but had not been exported before 31 December (Vaca, *in litt.* 2002). Between 1996 and 1999, the annual export quotas increased steadily from 203,000 kg in 1996 to 391,395 kg in 1999. In the following two years the quota was reduced to 293,839 kg in 2000 and 126,000 kg in 2001. The export quota for Queen Conch meat in 2002 was 148,000 kg and according to the CITES Management Authority of Colombia 80,413 kg of Queen Conch meat were exported in 2002 (Gutierrez, *in litt.* 2003). Based on the CITES trade data, the actual exports have remained well below the set annual quotas and in most years were less than 50% (e.g. in 1995, 1996, 1998 and 2000) (Table 8).

Table 8. Comparison of reported net exports of Queen Conch meat (kg) from Colombia with the national export quota.

	1995	1996	1997	1998	1999	2000	2001	2002	2003
CITES export quota for meat *	258,963	203,000	285,000	364,776	391,395**	293,839	126,000	158,000	148,000
Export reported by CITES *	106,061	63,688	153,538	155,826	196,044	110,208	90,512	80,413***	

* includes *S. gigas* meat not exported under the export quota of the previous year, ** based on CITES Notification 1999/68 the export quota for meat was 482,923 kg, *** based on exports reported by Colombia, F. De P. Gutierrez, *in litt.* 2003, *(Source: UNEP-WCMC, 2002; Vaca, in litt., 2001 and 2002; CITES Notification No. 980, 1998/36, 1999/21, 2000/053 and 2001/041).*

Costa Rica: The only trade in Queen Conch involving Costa Rica recorded in the CITES trade data refers to an import of 4,309 kg of Queen Conch meat from Costa Rica to the US in 1997 (UNEP-WCMC, 2002).

Cuba: Exports of Queen Conch meat from Cuba are recorded in the CITES trade data for the years 1996, 2000 and 2001. The 7,000 kg of meat reported in 1996 refer to a seizure made by Spain. In 2000 and 2001, Cuba exported 9,994 kg per year to Haiti. In 2001, Cuba reported an export of 15,000 kg of Queen Conch meat to Mexico, however Mexico reported an import of 30,000 kg of Queen Conch meat from Cuba (UNEP-WCMC, 2002). In addition, 140 Queen Conch shells have been reported as exports from Cuba in the CITES trade data for 1992 to 2001.

Dominica: Since 1999, Dominica has been affected by a recommendation of the CITES Standing Committee that Parties suspend imports of specimens of *S. gigas* originating from Dominica. In 1996, the US reported the import of 2,500 kg of Queen Conch meat originating from Dominica. The only other trade reported in CITES trade data involving Dominica data included two *S. gigas* shells and one live specimen (UNEP-WCMC, 2002).

Dominican Republic: Based on the CITES trade data the Dominican Republic exported a total of 975,340 kg of Queen Conch meat between 1994 and 2000 (no exports reported in 1992 and 1993). The US is the major destination of *S. gigas* meat from the Dominican Republic, importing more than 80% of all *S. gigas* exported between 1994 and 2000. In the first years after the CITES Appendix II listing, exports from the Dominican Republic were between 30,000 kg in 1993 and 155,000 kg in 1995. In recent years, the recorded exports increased five-fold: from 58,641 kg in 1998 to 338,561 kg in 2000, making the Dominican Republic the third largest exporter of Queen Conch meat in 2000.

According to the CITES Management Authority of the Dominican Republic 358,693 kg of meat were exported in 2001 (Hernández, *in litt.* 2002). However, the United States reported the import of 552,163 kg of Queen Conch meat from the Dominican Republic in its 2001 CITES annual report (UNEP-WCMC, 2002). There have been concerns that significant portions of Queen Conch meat exported from the Dominican Republic may in fact originate from the waters of foreign countries e.g. in the Bahamas, Jamaica or the Turks and Caicos Islands and therefore has been fished illegally (Clerveaux, *in litt.* 2002; Deleveaux, *in litt.* 2001; Kong, *pers. comm.* 2002). For example, between October 2001 and April 2002, approximately 68 individuals from the Dominican Republic were arrested for illegal fishing in the waters of the Turks and Caicos Islands and over 40 vessels were confiscated (Clerveaux, *in litt.* 2002).

Grenada: Grenada has traditionally been a supplier of Queen Conch meat to Trinidad, but Queen Conch meat is also consumed locally (Anon., 1999). However, the only recorded trade involving Grenada in the CITES trade data involved a small number of shells (>50 specimens) and 1 kg of Queen Conch meat imported by the US in 2001. In 1996, Trinidad and Tobago reported the re-export of 5,000 lbs (≈ 2,268 kg) of Queen Conch meat originating from Grenada to the Netherlands (UNEP-WCMC, 2002).

Guadeloupe (FR): The French Department of Guadeloupe (including St Martin and St Barthelemy) is considered as one of the largest consumers of Queen Conch meat in the region (Mulliken, 1996), with local demand largely prevailing over national supplies (Legendre, *in litt.* 2002). Due to the depletion of local Queen Conch stocks most of the Queen Conch consumed in Guadeloupe, St Martin and St Barthelemy has been imported from other countries in the region and Jamaica is considered one of the most important supplier of Queen Conch meat to the French Departments of Martinique and Guadeloupe. Imports by Guadeloupe are not reported separately in the CITES annual reports and are normally reported as imports by 'France' which makes it difficult to determine the final market (however, in cases where annual reports were compiled directly by UNEP-WCMC were the imports by Guadeloupe recorded separately). Based on information received from the CITES trade data and from Guadeloupe (Legendre, *in litt.* 2002), imports of *S. gigas* meat into Guadeloupe ranged between 122,400 kg in 1995 and 213,432 kg in 1997, all of which were exported by Jamaica (see Table 9). Between July 1997 and December 2001, no Queen Conch meat could be imported into the European Union (EU) due to EU Food Sanitary Regulations, and according to Legendre (*in litt.* 2002) no Queen Conch meat was imported into Guadeloupe during that period. In 2001, imports from a number of Jamaican exporters were allowed again and CITES trade data indicate the import of 241,494 kg of Queen Conch meat (Legendre, *in litt.* 2002).

Table 9. Net imports of *Strombus gigas* meat (kg) by Guadeloupe and France between 1993 and 2001 as reported in the CITES trade data

	1994	1995	1996	1997	1998	1999	2000	2001	Total
France	866,533	908,533	1,245,652	107,468	-	-	-		3,128,186
Guadeloupe		122,400	151,094	213,432	-	-	-	241,494	728,420
Martinique	61,261		13,200	547,313	-	60,000	-		681,774
Total	927,794	1,030,933	1,409,946	868,213	0	60,000	0	241,494	4,538,380

(Source: UNEP-WCMC, 2002)

Guatemala: No trade in *S. gigas* involving Guatemala was recorded in the CITES trade data for 1992 to 2001 (UNEP-WCMC, 2002).

Haiti: Haiti, a non-Party, is the largest exporter of Queen Conch shells according to CITES trade data, exporting 1,518,099 shells and 42,504 kg of shells between 1993 and 2001, which accounts for more than 77% of all shells recorded in trade in numbers of specimens and 31% of the shells recorded in kg (see Table 3). Queen Conch meat exports from Haiti were only reported by importing Parties in the CITES trade data between 1995 and 1997. An analysis of the Queen Conch shell imports of the United Kingdom between 1997 and 2000 revealed that significant numbers of shells (approximately 30% of all 71,860 imported shells) originate from immature Queen Conch, of which harvest is illegal according to Haitian regulations (UK CITES Scientific Authority, unpubl.). Consequently, the EU Member States restricted the import of shells originating from Haiti and since November 2000 they allow only the import of shells with a shell length of more then 23 cm (Anon., 2001g). According to the CITES trade data, 76% (10,004 shells) of all Queen Conch shells seized between 1993 and 1999 originated from Haiti (Theile, 2001). Haiti is an important consumer of Queen Conch meat and local demand is likely to be higher than national harvests (Wood, 1995). However, Queen Conch meat

imports were only recorded in the CITES trade data for 2000 and 2001, when Haiti imported a total of 20,000 kg of Queen Conch meat from Cuba (UNEP-WCMC, 2002).

Honduras: Since 1998, exports of Queen Conch meat from Honduras have increased significantly (from 636,252 kg in 1998 to 1,328,118 kg in 2001) and since 2000 Honduras has become the largest exporter of Queen Conch meat. The majority of Queen Conch meat exported from Honduras is imported by the US. The high and increasing exports by Honduras are cause for serious concerns considering the limited information that is available on the population status of the species in Honduran waters, and taking into account information that confirms that Honduran vessels illegally harvest Queen Conch in other nation waters. There is evidence that significant portions of Queen Conch meat landed in and exported from Honduras have been fished illegally in waters under the jurisdiction of neighbouring States, for example in Jamaica (see Illegal Trade). Concerns were also raised about the recent increase in Queen Conch meat exports from Honduras that coincided with the period when the Jamaican fishery at Pedro Bank was closed (2000-2001 and 2002), which has led to an increase in poaching at the Bank by foreign vessels (including Honduran vessels) after the closure (Kong, pers. comm. 2002).

Jamaica: Jamaica is one of the largest exporters of Queen Conch meat. In total 8,414,214 kg of Queen Conch meat were exported by Jamaica between 1993 and 2001, accounting for 41% of all Queen Conch meat recorded in international trade during this nine-year period. No exports by Jamaica were reported by CITES Parties in 1993 (Jamaica joined CITES in 1998), but figures of the National Statistical Bureau of Jamaica (STATIN) indicate that exports were around 1,800,000 kg in 1993 and 1,400,000 kg in 1994 (Kong, *in litt.*, 2001). Almost all Queen Conch meat exported from Jamaica originates from the offshore Pedro Bank (Aiken *et al.*, 1999). Since 1993, the Queen Conch fishery at Pedro Bank is managed through a quota system that has been revised and refined several times to better adapt it to the characteristics of the fishery and to respond to population surveys undertaken in 1995, 1997 and 2002. The quotas are set as equivalents to the weight of "50% cleaned" Queen Conch meat (see Table 10) and apply only to meat exports harvested at Pedro Bank. Queen Conch meat harvested at the island shelf is not allowed for export and is destined for local consumption (Kong, *in litt.*, 2001).

Table 10. Comparison of reported exports of Queen Conch meat (kg) by Jamaica (per calendar year) and the export quota set per fishing season

	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00*	2000/01*	2001/02*	2002/03*
National Export quota	3,000,000	2,000,000	1,900,000	1,800,000	1,700,000	1,366,000	1,216,000	-	946,000	500,000
Calendar year		1994	1995	1996	1997	1998	1999	2000	2001	2002
Meat exports (kg) as recorded in the CITES trade data		808,347	1,337,803	1,989,560	1,423,309	1,468,055	1,125,849	18,797	287,854	

* the Queen Conch fishery was closed in August 1999 and not reopened until September 2001; in 2002 the opening of the fishing season for 2002/03 was delayed and in November it was decided not to re-open before further stock assessment work was concluded. Hence, no fishing took place under the 2002/03 quota (Anon., 2001b; Kong, *in litt.* 2002; UNEP-WCMC, 2002)

Since 1993, the quota has been steadily reduced from initially 3,000,000 kg in the 1993/1994 fishing season down to 946,000 kg in 2001. In August 1999 the Queen Conch fishery at Pedro Bank was closed due to a law suit by Queen Conch exporters against the government, in an attempt to prevent the establishment of further management measures i.e. the continued reduction of quotas and the introduction of a fishing season (Anon, 2001f). The fishery was reopened in May 2001 after the imposition of new regulations and laws. Based on preliminary surveys undertaken in May 2002, the MSY (Maximum Sustainable Yield) for 2002 was estimated to be 800,000 to 900,000 kg (Smikle and Appeldoorn, 2002). The Fisheries Division estimated that around 300,000 kg of meat is lost annually to poachers and consequently a quota of 500,000 kg was set for the 2002/2003 fishing season (1 August 2002 to 31 May 2003) (Kong, *in litt.* 2002). However, the opening of the 2002/2003 Queen Conch fishing season was again delayed due to another court injunction (Anon., 2002e; Anon., 2002f) and in November, before quotas were allocated and fishing had taken place, the Queen Conch fishing season for 2002 had again been closed to facilitate another abundance survey (Anon., 2002g). Before 1997, Jamaica exported between 60% to 90% of all Queen Conch meat exports to the French Departments of Guadeloupe and Martinique. However, due to stricter EU Food Sanitary Regulations no exports of Queen Conch meat from Jamaica were allowed into the EU between July 1997 and December 2000, and hence

in 1998 and 1999 more than 99% of the Jamaican exports were destined to the US. In January 2003, Jamaica notified the CITES Secretariat that the export quota for 2003 is 500,000 kg of Queen Conch meat (Strong, *in litt.* 2002).

Martinique (FR): The French Department of Martinique is considered as one of the largest consumers of Queen Conch meat in the region (Mulliken, 1996) and local demand outweighs harvest volumes several times. Due to the depletion of local Queen Conch stocks, most of the Queen Conch consumed in Martinique is imported from other countries in the region and Jamaica is one of the most important exporter of Queen Conch meat to the French Departments. Cuba is allegedly another important supplier, however no imports from Cuba have been reported and anecdotal information suggests that Queen Conch meat has been imported to Martinique unreported (French Customs Service, *in litt.* 2001). Due to CITES reporting practices of France, i.e. trade involving Martinique is normally reported as France and not separately which makes it difficult to assess how much Queen Conch meat was actually imported by Martinique. However, in cases where such information is available, for example Martinique was reported as importer by an exporting nation, this information is included in the CITES annual trade data (Table 11). The DIREN of Martinique (Bertome, *in litt.* 2002) provided some more detailed import figures. The majority (> 90%) of these imports came from Jamaica. Queen Conch meat was also imported from Saint Lucia, Saint Vincent and the Grenadines and Colombia. Similar to Guadeloupe, exports of Queen Conch meat to Martinique have not been allowed between July 1997 and December 2001 due to EU Food Sanitary Regulations and consequently no imports have been reported by the DIREN. However, in 1999 the Dominican Republic reported the export of 60,000 kg to Martinique in its CITES annual report, although that import of these specimens was not confirmed in the annual report of France (UNEP-WCMC, 2002). In addition, there have been reports about an increased illegal trade in Queen Conch meat from Saint Lucia to Martinique since the import ban caused by the EU Food Sanitary Regulations (Jospeh, *in prep.;* Rambally and Pierre-Nathoniel, *in litt.* 2001).

Table 11. Net imports of *Strombus gigas* meat (kg) by France and Martinique as reported in the CITES trade data and by the DIREN (Directions régionales de l'environnement) of Martinique

	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total
France	11,235	805,297	908,533	1,245,652	107,468	-	-	-		2,364,624
Martinique		61,236		13,200	547,313	-	60,000	-		681,774
Total	11,235	866,558	908,533	1,258,852	654,781		60,000			3,046,398
DIREN MQ	52,503	838,131	644,452	617,173	434,698	-	-			2,586,957

(Source: UNEP-WCMC, 2002, Bertome, *in litt.* 2002)

Mexico: Queen Conch meat harvested in Mexico is mostly consumed locally and only shells are occasionally exported. Consequently, no exports of Queen Conch meat are recorded in the CITES trade data for Mexico, but more than 12,000 kg of shells and more than 32,000 shells have been exported between 1992 and 1999 (UNEP-WCMC, 2002). Between 1992 and 2001, Mexico imported a total of 65,176 kg of Queen Conch meat (see Table 5) originating from the Dominican Republic, Jamaica and Cuba.

Montserrat (GB): According to the Ministry of Agriculture (O'Garro, *in litt.* 2002) small amounts of around 100 kg of Queen Conch meat originating from Antigua are imported annually by local restaurants. There is also information that Queen Conch meat has been imported from Nevis on a regular basis in recent years, as demand in Montserrat exceeds the local supply (Jeffers, 1996). However the only trade in Queen Conch meat involving the United Kingdom refers to an import of 450 kg reported as export by Jamaica in 1996 and no other trade in Queen Conch meat involving the United Kingdom, including Montserrat, has been reported (UNEP-WCMC, 2002).

Netherlands Antilles (NL): The Netherlands Antilles are considered to be an important consumer of Queen Conch meat in the region (Anon., 1996a). According to the CITES trade data for 1992 to 2001 the Netherlands Antilles imported 55,924 kg of Queen Conch meat, of which the majority (85%) was imported from Colombia. In addition 26,393 kg were reported as exports to the Netherlands. All of this was recorded as exports by the exporting country and no imports of Queen Conch meat were recorded by the Netherlands Antilles. The Netherlands reported only the import of 1,861 kg of Queen Conch meat. The only reported export involved 61,236 kg of meat to Martinique in 1994 (UNEP-WCMC, 2002). In 1994, the US confiscated a shipment of 113,363 kg of Queen Conch meat originating from the Netherlands Antilles that has been re-exported via Jamaica. No other trade data involving the Netherlands Antilles has been reported. In the past, Queen Conch meat has been illegally imported into

the Netherlands Antilles, mostly into Bonaire and Curacao from Venezuela and possibly other countries. Some illegal trade still occurs today (van Buurt, 2001).

Nicaragua: Meat exports from Nicaragua were only reported in the CITES trade data for the years 1997 to 2000 and ranged from 6,750 kg in 1998 to 20,000 kg in 2000. Since 1998, Nicaragua established an export quota for Queen Conch meat, which has been communicated to the CITES Secretariat and was 19,958 kg of Queen Conch meat in 1998, 1999 and 2000. The quota was increased in 2001 to 45,359 kg of meat for the years 2001, 2002 and 2003 respectively (CITES Notification No 2001/041, 2002/032 and CITES website, January 2003). All Queen Conch meat exports from Nicaragua went exclusively to the US (UNEP-WCMC, 2002).

Panama: The only international trade in *S. gigas* recorded as involving Panama refers to one shell that was confiscated in New Zealand.

Puerto Rico (US): Puerto Rico is an important consumer of Queen Conch meat. International trade in *S. gigas* involving Puerto Rico is normally not reported separately from trade involving mainland US in the CITES annual reports of the US (Caldwell, *in litt.* 2001), which makes it difficult to quantify trade involving the island. However, information on trade via the different ports of entry (including Puerto Rico) is available through the relevant import documents. From 1998 to 2002, imports of Queen Conch into Puerto Rico or the Virgin Islands (US) had to be processed by CITES law enforcement agents in Miami. This required either routing shipments into Miami as the first port of entry, or physically bringing inspectors from Miami to Puerto Rico or the Virgin Islands (US) to process CITES paperwork and inspect shipments. Since, 2002, law enforcement personnel have been stationed full-time in San Juan, Puerto Rico, for inspecting and clearing wildlife imports into the US Caribbean territories (Thomas and Gabel, *in litt.* 2003). . Imports of Queen Conch meat into Puerto Rico have only been reported separately from the US data in 1997, 1998 and 1999 and totalled 640,886 kg for these three years (UNEP-WCMC, 2002).

Saint Kitts and Nevis: According to Simmonds (*in litt.* 2002), more than 75% of the annual Queen Conch meat landings of Saint Kitts, which is equivalent to 17,000 to 23,000 kg, are exported and the rest is used for local consumption. In addition, shells and pearls are also occasionally exported or sold to tourist. Similarly, the majority (up to 95%) of the annual Queen Conch meat landings from Nevis are said to be exported (Anon, *in prep.*) (equivalent to 35,000 to 45,000 kg). However, Saint Kitts and Nevis reported in their annual report to CITES for the years 1996 to 1999 a total of only 5,909 kg of *S. gigas* meat [Note: this information refers to exports from Saint Kitts only (Heyliger, *in litt.* 2003); because information on the export destination was not provided the data could not be included in the CITES trade database] (Caldwell, *in litt.* 2002). The only other CITES recorded exports from Saint Kitts and Nevis referred to 84 *S. gigas* shells exported between 1997 and 1998. Based on data received from the Department of Fisheries of Nevis around 170,000 kg of Queen Conch were exported between 1996 and 2001 (Department of Fisheries of Nevis, *in litt.* 2001 and May 2002).

Saint Lucia: From 1993 to 1999, exports of Queen Conch from Saint Lucia were destined to Martinique (FR). These exports were permitted only as whole animals and after careful examination of the product by the Department of Fisheries and the presentation of the relevant CITES documents. Individuals were allowed to make no more than one export trip per month and export no more than 300 conch. Export permits were also required for the export of Queen Conch shells (Polius, *in litt.* 2003). Between February 1999 and March 2002, Saint Lucia had been affected by a recommendation of the CITES Standing Committee that Parties suspend imports of specimens of *S. gigas* originating from Saint Lucia. This recommendation was withdrawn at the 46th meeting of the CITES Standing Committee in March 2002. According to CITES trade data for 1992 to 2000, 22,200 kg of Queen Conch meat, 37,395 kg of live specimens and 93,600 live specimens were reported as exports from Saint Lucia. All these exports were destined for France and presumably went to Martinique. No exports of live specimens or of Queen Conch meat were reported for 1999 and 2000; however, small numbers of shells (< 10) were exported in 1999, 2000 and 2001 (UNEP-WCMC, 2002). Since the withdrawal of the Standing Committee recommendations in May 2002, no authorised export in Queen Conch to Martinique has taken place (Polius, *in litt.* 2003). In 2001, Saint Lucia imported 4,994 kg of Queen Conch meat from Saint Vincent and the Grenadines. The temporary closure of the EU market for Queen Conch products imported from Saint Lucia due to EU Food Sanitary Regulations in 1998 and the Standing Committee recommendations, are reported to have resulted in a significant illegal trade of Queen Conch meat between Saint Lucia and Martinique (Joseph, *in prep.*).

Saint Vincent and the Grenadines: According to CITES trade data for 1992 to 2001, 48,360 kg of Queen Conch meat and 2,000 kg of live specimens were reported as being exported from Saint Vincent and the Grenadines. Until 1997, the vast majority of exports went to 'France' or Martinique; in recent years the majority is reportedly exported to Saint Lucia and Trinidad and Tobago (UNEP-WCMC, 2002). According to Isaacs (in litt., 2003) Anguilla is also an important destination. This recent shift in import markets is due to a EU ban on fishery products from Saint Vincent and the Grenadines due to EU Food Sanitary Regulations. At the same time meat exports are reported to have increased sharply and were 35,751 kg in 2001 and 34,128 kg in 2002 (see Domestic use). Meat exports are usually as fresh meat (stored on ice) (Anon., *in prep.* b). Some of the meat destined for export is directly sold by fishermen to yachts at sea and may go unrecorded (Ryan, 1997).

United States of America: The United States, including the territories of Puerto Rico and Virgin Islands (US), are the largest importer and consumer of Queen Conch meat. Miami is the most important port of entry for Queen Conch meat from the region. As mentioned earlier, between 1998 and 2002, imports of Queen Conch destined into Puerto Rico or the Virgin Islands (US) had to be processed by CITES law enforcement agents in Miami (Thomas and Gabel, *in litt.* 2003). According to the CITES trade data the US imported a total of 16,238,580 kg of Queen Conch meat between 1993 and 2001. However, due to discrepancies in reporting between importing and exporting countries the actual imports may be lower (see Table 12). Based on the import data reported by the US a total of 12,204,919 kg of Queen Conch meat were imported between 1993 and 2001. 32% of the 12,204,919 kg were imported from Honduras, followed with 27% from Jamaica, 15% from the Turks and Caicos Islands (GB), 8 % from the Dominican Republic and around 7% from Belize. Most of the meat imported by the US is consumed domestically (in mainland US and the territories of Puerto Rico and the Virgin Islands (US)) and based on the figures recorded in the CITES trade data only a relatively small amount (48,716 kg) of the imported meat was re-exported between 1993 and 2001 (see Table 12).

Table 12. Queen Conch meat imports (kg) of the United States according to the CITES trade data.

	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total
CITES net imports (reported by importer and exporter)	293,097	197,434	1,743,660	2,249,353	2,365,595	2,177,318	2,397,437	2,028,358	2,786,308	16,238,560
CITES import data (reported by the US only)	5	113,773	1,423,709	1,749,757	1,996,920	1,294,594	1,590,010	1,822,963	2,213,188	12,204,919
Re-exports (reported by the US)			601		9,072	29,400	7,943	1,700		48716

Source: UNEP-WCMC, 2003)

Besides the Queen Conch meat the United States import also larger quantities of shells and live animals; for example, between 1992 and 2001 the US imported 1,572,255 shells (67% of the total net trade), 114,172 kg of shells (80% of total trade), 293,874 live Queen Conch (72% of total trade), 301,984 kg of live Queen Conch (88% of total trade) and 99,546 Queen Conch carvings (98% of total trade) (UNEP-WCMC, 2003).

Trinidad and Tobago: Since February 1999, Trinidad and Tobago has been affected by a recommendation of the CITES Standing Committee to suspend imports of specimens of *S. gigas* originating from Trinidad and Tobago. In 1996 and 1997, Trinidad and Tobago exported 5,670 kg and 32 kg of Queen Conch meat respectively. In 2000, 23 kg of meat was reported as export to the US and in 2001 a total of 1,588 kg originating from Saint Vincent and the Grenadines were re-exported to the US (UNEP-WCMC, 2002).

Turks and Caicos Islands (GB): According to the CITES trade data the Turks and Caicos Islands, a non-Party, is the third largest exporter of Queen Conch meat, exporting more than 1,800,000 kg, or around 10% of the total exports of Queen Conch meat, between 1993 and 2001. Most of the Queen Conch meat from the Turks and Caicos is exported as "40% cleaned meat", which refers to meat where only 40% of the original tissue weight of the animal is left after processing (Clerveaux, *in litt.* 2001). Parts of the remaining 60% may be used as 'trimmings', which are sold locally as bait for the lobster trap fishery. According to Clerveaux (*in litt.* 2002) the trade data recorded in the CITES trade data, does not correspond to exports recorded by the Department of Environment and Coastal Resources (DECR). The

discrepancy may be due to CITES reporting of trade per calendar year and DECR reporting per fishing season (16 October to 14 July) rather than calendar years (Clerveaux, *in litt.* 2001) (Table 13 and 14). The DECR sets a national harvest quota for wild harvested Queen Conch meat, which includes a proportion for both export and domestic consumption (see Conservation measures). The harvest quota refers to unprocessed meat of wild origin and was in recent years around 700,000 to 750,000 kg (1,600,000 – 1,660,000 lbs), which is equivalent to approximately 290,000 kg of processed meat.

Table 13. National harvest quota of wild harvested Queen Conch meat from the Turks and Caicos Islands (kg) for unprocessed (unproc.) and processed (proc. = 40%) meat (further divided into national export quota and local consumption) per fishing season (Oct.-July) in comparison with actual harvest levels reported by the Department of Environmental and Coastal Resources (DECR)

	1995/1996		1996/1997		1997/1998		1998/1999		1999/2000		2000/2001	
	Unproc.	Proc.	unproc.	Proc.	unproc.	proc.	Unproc.	Proc.	Unproc.	Proc.	Unproc.	proc.
National Harvest quota	725,760	290,304	725,760	290,304	725,760	290,304	725,760	290,304	725,760	290,304	700,971	280,388
National Export quota	680,400	272,160	680,400	272,160	680,400	272,160	680,400	272,160	680,400	272,160	675,676	270,270
Local consumption	45,360	18,144	45,360	18,144	45,360	18,144	45,360	18,144	45,360	18,144	25,296	10,118
Actual harvest (DECR)	964,596	385,838	736,801	294,720	781,425	312,570	640,310	256,124	730,770	292,308	810,502	324,201

(Source: Clerveaux, *in litt.* 2001; UNEP-WCMC, 2002)

Table 14. Exports of Queen Conch (kg) meat recorded in the CITES trade data.

	1995	1996	1997	1998	1999	2000
Exports (CITES)	481,750	367,198	294,219	67,805	205,297	287,816

Fuente: UNEP-WCMC, 2002.

In recent years the Turks and Caicos Islands have communicated export quotas for different specimens of Queen Conch to the CITES Secretariat (see Table 15). These referred to specimens of wild harvested Queen Conch and to 'ranched' Queen Conch, the latter originating from the Caicos Conch Farm in Providenciales (see Captive Breeding). Quotas were established for meat, live animals, trimmings, shells, and pieces of shells. There are some differences between the export quotas communicated by the CITES Secretariat and the ones set by the DECR (see Table 13 and 15) which may be caused by a confusion between kg and metric tonnes, as well as decimal places (Clerveaux, *in litt.* 2002). Table 16 shows the actual exports of Queen Conch specimens exported by the Caicos Conch Farm for the years 1999 to 2001 (Hesse, *in litt.* 2002).

Table 15. Export quotas communicated by the CITES Secretariat for different Queen Conch specimens for the Turks and Caicos Islands for the years 1997 to 1999 (CITES Notification No.s 980, 1998/36 and 1999/21). (Note: no quota were communicated to the CITES Secretariat for the years 2000-2003)

Specimens	1997		1998		1999	
	wild	ranched	wild	ranched	wild	ranched
Meat (kg)	45,359*	453,590*	272,155	4,536	272,160	3,629
Dried meat (kg)	454		907		907	
Trimmings (kg)	136,077	272,154	435,448			
Shells (kg)	22,679	22,679	22,679	22,679		
Shells (No)					50,000	50,000
live (kg)		22,679		181,436		136,080
Pieces of shell (kg)					435,456	

*according to the DECR the export quota for wild meat for 1997 was 272,160 kg and 4,536 kg for ranched meat, (Source: CITES Notification No.s 980, 1998/36 and 1999/21)

Table 16. Exports of 'captive reared' Queen Conch specimens from the Caicos Conch Farm between 1999 to 2001.

Year	1999	2000	2001
Meat (kg)	1,026	3,489	2,848
Live (kg)	6,169	1,795	1,324
Shell (No.)	880	4,530	7,235

(Source: Hesse, *in litt.* 2002)

Venezuela: The harvest and export of specimens of Queen Conch has been prohibited since 1991. Despite this prohibition, the US reported the import of 4,930 kg of Queen Conch meat and 24 shells from Venezuela in 1998 (UNEP-WCMC, 2002). Illegal fishing and poaching by foreign vessels, mainly in Las Aves and Los Testigos Archipelago, is reported to be ongoing (Solórzona and Lagarde, 2001). The meat is sold to restaurants, but is also sold directly at sea to foreign vessels that bring the meat to neighbouring islands e.g. Bonaire, Curacao and Martinique (Appeldoorn, 1994a; Solórzona, pers. comm. 2001).

Virgin Islands (US): International trade in *S. gigas* involving the Virgin Islands (US) is normally not reported separately from trade involving mainland US in the CITES annual reports of the US, which makes it difficult to quantify trade involving these islands. The only trade recorded in the CITES trade data involving the Virgin Islands (US) referred to 4 kg of Queen Conch meat that were seized by the US in 1995. No imports have been recorded (UNEP-WCMC, 2002).

Illegal harvest of and trade in *Strombus gigas*

Over the past decade increasing concerns have been raised about the alleged high levels of illegally harvested and traded Queen Conch products, especially Queen Conch meat (e.g. Mulliken, 1996; Chakalall and Cochrane, 1996, Anon., 2001b) and reports have documented that harvest of and international trade in Queen Conch meat is often conducted in contravention of national regulations and CITES provisions (e.g. Mulliken, 1996).

Illegal trade across international borders continues often due to lack of knowledge, awareness and poor enforcement of CITES provisions in Queen Conch range States, as well as in importing countries. However, intentional and concealed illegal trade, especially in the form of illegal fishing by vessels in foreign territorial or EEZ 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. Recent information suggests 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., 2002d; Anon., 2002e; Kong, *in litt.* 2002). The majority of these vessels originate from Honduras and the Dominican Republic; some of these vessels misuse their licence to harvest lobster and illegally fish for Queen Conch (Kong, *in litt.* 2002). In response to the alleged high level of poaching at Pedro Bank, the TAC for the 2001 season was reduced by 22% (Anon., 2001b) and by almost 40% in 2002 as a 'precautionary measure' (Kong, *in litt.* 2002). Information from other range States suggests that the problem 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 Dominican Republic registry have been arrested with large quantities of Queen Conch meat. Attempts have been made to have the Royal Bahamian Defence Force to strengthen its patrols, especially in the southern Bahamas. In the Turks and Caicos Islands, 68 individuals from the Dominican Republic were arrested for illegal fishing and over 40 vessels were confiscated between October 2001 and April 2002 alone (Clerveaux, *in litt.* 2002). 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 USD 50,000 was imposed and Queen Conch meat on board was confiscated (Vaca, in litt., 2001). Belize reported significant poaching activities by fishers of neighbouring countries during most parts of the year (Marin, 2001). Venezuela reported 'unknown levels' of poaching at Los Roques, based on observations of local fishers (Solórzona, pers. comm., 2001). Illegal fishing by foreign vessels is also reported from the British Virgin Islands (Eristhee, in litt. 2002), Nicaragua (Marenco, pers. comm. 2002), Saint Lucia (Joseph, in prep.), Saint Vincent and the Grenadines (Anon., in prep. b) and the Virgin Islands (US) (Kojis, in litt, 2001).

In other cases, vessels harvest Queen Conch products illegally in their own territorial waters and sell the product directly at sea, for example to vessels of foreign registry which land the product in their home ports as domestic catch (e.g. French Customs Service, *in litt.* 2001; Anon., in prep.b). At the national level, illegal fishing and trade occurs in a variety of forms, for example as harvest of juveniles or undersized individuals (e.g. in Antigua and Barbuda: Horsford and Lovell, 2002; Bahamas: Tewfik, in prep.; Belize: Tewfik, in prep.; Dominican Republic: Delgado et al. 1998; Grenada: Crafton, in prep.; etc.), harvest of Queen Conch in closed areas or during closed seasons (e.g. Belize: Anon., 2002a; Dominican Republic: Torres, *in litt.* 2002; Mexico: Aldana et al., *in litt.* 2002; Venezuela: Posada, *in litt.* 2001), harvest in excess of quotas or daily harvest limits (e.g. Cayman Islands: Bothwell, *in litt.* 2002; Mexico: Aldana et al., *in litt.* 2002) or harvest using prohibited or restricted gear, e.g. scuba or hookah (for example in the Bahamas: Philipps, *in litt.* 2002).

Based on CITES trade statistics, a total of 156,792 kg of Queen Conch meat, 13,433 shells, 213 carvings and one "body" of *S. gigas* were reported as being seized or confiscated by CITES Parties between 1993 and 2001 (UNEP-WCMC, 2002). The majority of seizures and confiscations were reported by the US and by Member States of the EU. It should be noted that this information is not considered comprehensive or complete, because many countries do not report seizures and confiscations in their annual reports, or do so inconsistently.

CONSERVATION MEASURES

At the international level

With the exception of Haiti and the Turks and Caicos Islands, all Queen Conch range States are Parties to CITES; however, some countries have ratified the treaty only recently, such as Grenada and the Netherlands Antilles (see Table A2 in Annex). Many countries in the Caribbean sub-region still face difficulties in the implementation and enforcement of CITES and some lack adequate legislation to fully implement the provisions of the Convention and were consequently classified into Category 3 of the National Legislation Project (NLP) of CITES (see Table A2 in Annex) (Anon., 2002c).

Strombus gigas is listed in Annex III of the SPAW Protocol (Protocol concerning Specially Protected Areas and Wildlife) of the Cartagena Convention. The SPAW Protocol was adopted in 1990, but only recently entered into force (in April 2002). The listing requires Parties to "adopt adequate measures to ensure the protection and recovery of the species", "to regulate the use of the species" and to "formulate, adopt and implement plans for their management and use" (Article 11(1)(c) of the Protocol). Twenty-four 24 Queen Conch range States have ratified the Cartagena Convention, but to date only ten have ratified the SPAW Protocol (see Table A2 in Annex). Over the past 15 years, several organisations and institutions have undertaken efforts to develop effective management strategies for *Strombus gigas* and have been active in the promotion of a regional management approach for the species. For example, the Caribbean Fishery Management Council (CFMC) organised several bilateral, sub-regional and regional meetings concerning the conservation of Queen Conch and the sustainable management of its fishery. In 1996, the First International Queen Conch Conference was held in Puerto Rico to discuss Queen Conch biology and research and to establish a basis for a regional management approach. The conference led to the formal establishment of the "International Queen Conch Initiative" and to the adoption of the "Declaration of San Juan" which laid out a framework for more effective collaboration between range States regarding the promotion and development of a regional management regime. A second declaration pertaining to the need to strengthen regional co-operation in managing the Queen Conch fisheries, the "Declaration of San Andrés", was adopted at the Regional Fisheries Forum of the south-western Caribbean held in Colombia in 1997. Following the conference in 1996, several other regional or bilateral meetings were organised to discuss available information on the status of Queen Conch stocks and to address specific issues such as illegal fishing and poaching. In July 2001, the Second International Queen Conch Conference was held in the Dominican Republic and brought together 22 Queen Conch range States as well as numerous observers from intergovernmental and non-governmental organisations. The Third International Queen Conch Conference is planned for 2004.

The "Lobster and Conch Resource Assessment Unit" (RAU) of the of the Fisheries Resource Assessment and Management Programme of the Caribbean Community (CFRAMP) undertook various activities relevant to the conservation and management of Queen Conch, including assessment studies in Antigua and Barbuda and Belize; capacity building, training and technical assistance; the organisation of two Lobster and Conch workshops (1995 and 2001); and the collection of biological and other fisheries related data in all seven Member States (Grant, in press). In July 2001, the "Lobster and

Conch Terminal workshop" was held in the Dominican Republic to determine future priorities and needs for conch and lobster assessments and management in the region.

With the aim of harmonising fisheries regulations among its members, the Organisation of the Eastern Caribbean States (OECS) recommended in the early 1990s that its members implement certain management measures for the Queen Conch fishery. These included a minimum shell length and meat weight restriction, allowing only the harvest of specimens with a flared lip and establishing closed seasons or areas. Seven of the 9 OECS members have implemented all or some of these measures, with the exception of Anguilla and Montserrat.

At the national level

Since the 1980s several Queen Conch range States started to impose species-specific regulations and management measures for the Queen Conch fishery, and most range States have now implemented some form of management for the fishery (see Table A3 in Annex). The most common management measures include different minimum size restrictions (shell length or meat weight), temporal or geographical closures of the fishery, gear and vessel restrictions (e.g. prohibition of scuba gear), bulk harvest restrictions (quotas or daily bag limits) and limited entry measures. However, the effectiveness of these measures is largely dependent on adequate knowledge of the stock status (size, distribution, abundance, etc.), other biological and morphometric criteria (location of nurseries and spawning sites, time of the spawning period, shell growth and maturity, etc.) and country-specific characteristics of the fishery. For example, the imposition of a minimum shell length restriction for *S. gigas* does not 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 (≈ 25 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 in countries where 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 seen as 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 A3 in Annex). However, these closures are not always harmonised 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 neighbouring 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, which greatly facilitates the enforcement of closed seasons (for example in the Dominican Republic or Jamaica).

A number of Queen Conch range States have established harvest and/or export quotas to control total fishing effort. Annual (or seasonal) harvest quotas for *S. gigas* are used in Cuba, Jamaica, Mexico, Turks and Caicos Islands, and daily catch limits are in use in the Cayman Islands, Puerto Rico, Saint Lucia and the Virgin Islands (US). Annual harvest quotas are often used in combination with export quotas (e.g. in Jamaica and the Turks and Caicos). Other countries have established export quotas to regulate and control export volumes (the Bahamas, Colombia, Nicaragua), however, these do not necessarily influence fishing effort especially in countries where local consumption is high (e.g. the Bahamas).

Anguilla (GB): Anguilla is not a Party to CITES. There are currently no management measures in place to regulate the harvest of Queen Conch in Anguilla.

Antigua and Barbuda: Management regulations: The Fisheries Act (1983) and the Fisheries Regulations (1990) form the primary legislative bases for managing the Queen Conch fishery in Antigua and Barbuda. The Fisheries Act No. 14 of 1983 requires all fishing vessels to be licensed. The Fisheries Regulation No. 10 of 1990 prohibits the harvest of Queen Conch with a shell length of less than 18 cm or of shells that do not have a flared lip, however, there is no requirement regarding lip thickness. Only animals weighing more than 225 g (after the removal of the digestive glands) can be harvested. The Fisheries Regulation also makes provisions for the establishment of a closed season. However, none has been established (Horsford and Lovell, in prep.). In 1996, a data collection programme was initiated, which included the collection of catch and effort data as well as biological data (mean shell length, tissue weight, etc.) (Horsford and Lovell, 2002).

Aruba (NL): Aruba does not permit the capture of *S. gigas*. Occasional export permits are issued to local inhabitants exporting shells for personal use (Anon., 1996a). In addition to the export permit, an import permit is required before a shipment can be imported into Aruba.

Bahamas: Management regulations: The Department of Fisheries is responsible for the management of *S. gigas* under the Fisheries Resources (Jurisdiction and Conservation) Act of 1977 (Anon., 1998). In 1995, an export quota system for Queen Conch was established and quotas were allocated to selected licensed processing facilities (Anon., 1998). Braynen (in prep.) states that this measure has helped to control the amount of Queen Conch meat exported, but that it has failed to stem the rising levels of recorded Queen Conch landings, as the demand is mainly driven by domestic consumption. Annual export quotas were communicated to the CITES Secretariat in 1997 and 1998 only (204,115 kg of Queen Conch meat per year) although national export quotas were also set for the following years. In 2003, the export quota was reduced from 308,448 kg to 136,080 kg which is a decrease by more than 50% (see International Trade). The Bahamas prohibited the use of scuba. The use of hookah for harvesting Queen Conch is allowed, but only during the open season for spiny lobster (1 August to 31 March). However, there is a widespread illegal use of hookah during the closed season for lobster and according to the Fisheries Department, most Queen Conch is harvested by the use of hookah gear during the closed lobster season (Philipps, *in litt.* 2002). Further management regulations included in the Fisheries Regulations of 1986 prohibit the harvest, possession and sale of Queen Conch shells without a well-formed flaring lip, the export of Queen Conch specimens without a licence, and sets a limit for non-commercial exports of 10 lbs per person (≈ 4.5 kg). Queen Conch fishing is prohibited for example, in the Exuma Sea and Land Park (45,584 ha) which is the first marine protected area in the Caribbean. In the mid-1990s, the Government of the Bahamas started to develop a system of fisheries reserves and in 2000, declared the first five reserves that will be part of a nation-wide, integrated network of no-take marine reserves that are designed to protect flagship species such as the Nassau Grouper, Queen Conch and the Spiny Lobster. The first five reserves are the Berry Islands, Andros Islands, Bimini Islands, South Eleuthera Islands and the Exumas Islands and they are scheduled to be completed by October 2003 (Anon., 2003b).

Data collection and monitoring: Daily landing forms are used to collect catch and effort statistics from vessels at landing sites in Abaco, Grand Bahamas and New Providence. In addition, all licensed processing facilities are required to submit Monthly Purchase reports that details species, source and cost of all purchases (Anon., 1999). However, due to the dispersed state of the Bahamian islands, the available data is geographically not complete (Anon., 1999).

Barbados: The current Fisheries Management Plan of Barbados for the period of 2001-2003 includes an implementation plan for Queen Conch that considers amongst others the licensing of harvesters and vendors, the establishment of a closed season, the imposition of minimum shell size and/or lip thickness, and the establishment of total, individual or area allowable catch quotas (Anon., 2001c). However, these measures still need to be established (Parker, *in litt.* 2001). No fishing of Queen Conch has been allowed in the Folkstone Marine Park since 1988 (Oxenford, *in litt.* 2001).

Belize: Management regulations: In 1977, Belize established through the Statutory Instrument No. 70 (Fisheries Regulation), a closed season from 1 July to 30 September and imposed a minimum legal shell size of 7 inches (18 cm) and a minimum meat weight of 3 oz (85 g) for 'market clean meat'. The use of scuba and hookah to harvest *S. gigas* is prohibited. Queen Conch harvest is prohibited in certain areas of Port Honduras and Laughing Bird National Park, in the Hol Chan and Glovers Reef Marine Reserve, and in the Half Moon Cay and the Blue Moon Monument (Marin, *in litt.* 2001). Belize has undertaken studies to establish the relationship between the weight of landed and processed meat ('fillet Conch') (Villanueva, *in litt.* 2002). The studies showed that around 30% of meat is lost during processing, and it was established that landed meat should not weigh less than 113 g in order to produce the minimum legal weight of 85 g of processed meat (Villanueva, *in litt.* 2002).

Data collection and monitoring: Catch and effort data, and information on abundance and distribution have been collected for several years. Queen Conch is landed primarily at the co-operatives and catch and effort data is taken from purchase slips that include information on area fished, duration of trip, name of the boat and crew members, type of vessel, type and weight of product fished (Anon., 1999). Morphometric data was collected in 1996, 1997 and 1998. However, according to Villanueva (*in litt.* 2002) there is currently no biological information to assign annual harvest levels.

Bermuda (GB): *S. gigas* is protected in Bermuda and the harvest of Queen Conch has been prohibited through the Fisheries (Protected Species) Order since 1978.

British Virgin Islands (GB): Management regulations: The use of scuba to harvest Queen Conch is prohibited, but there are currently no further management regulations for the Queen Conch fishery in place. Several measures have been proposed and are under consideration. These include for example the establishment of a legal minimum shell size of 7 inches (18 cm) or a meat weight of 2.2 lbs (≈1kg), the establishment of a closed season from 1 December to 31 March and the establishment of protected areas for Queen Conch (Eristhee, *in litt.* 2001).

Cayman Islands (GB): Management regulations: The Marine Conservation Law and Regulation of 1978 included several management measures for the Queen Conch fishery such as daily bag limits. This law was amended in February 2002 to include an annual closed season from May to October and reduced catch and purchase limits. The daily bag limit has been reduced from fifteen to five Queen Conch per person, or ten per boat (whichever is least); the purchase of more than five Queen Conch per day is not allowed (Bothwell, *in litt.* 2002). The use of scuba to harvest Queen Conch is prohibited. The Endangered Species Protection and Propagation Law (1978), which implements CITES in the Cayman Islands does not cover *S. gigas*. New legislation to implement CITES that would also cover *S. gigas* is currently in parliament and is expected to be decided upon in 2003.

Colombia: Management regulations: Since the early 1990s, Colombia has established annual harvest and export quotas for Queen Conch specimens (see International Trade) and currently harvest is only allowed at the Serrana Bank and the Peninsula de la Guajira. Quotas are established annually and are based on stock abundance survey. The most recent surveys were undertaken in 1999 (Valderrama and Hernández, 2000; Vaca, *in litt.* . 2002). Following the 1999 surveys, the harvest of Queen Conch at Serranilla and Roncador Bank was closed and the 2001 export quota was reduced by almost 50% from 293,839 kg in 2000 to 126,000 kg in 2001. However, in 2002 the quota has increased slightly to 158,000 kg (De Paula Gutierrez, *in litt.* 2002) and was set at 148,000 kg for 2003. The annual harvest quota is allocated to different fishing areas and was 96,000 kg for Serrana and 30,000 kg for the Peninsula de la Guajira in 2001 (Vaca, *in litt.* 2002). Colombia has also prohibited the use of scuba and hookah to harvest Queen Conch, and the harvest of Queen Conch with a shell length of less than 22 cm and a lip thickness of 7 mm, or for animals with a meat weight less than 225 g uncleaned meat or 100 g

cleaned meat. A closed season for the fishery from 1 July to 31 October has also been established. In 2001, however, the fishery was closed between September and December (De Paula Gutierrez, *in litt.* 2002). The government also limits the number of vessels that are licensed to harvest Queen Conch (Vaca, *in litt.* 2001) and currently no new vessels will be allowed into the fishery (De Paula Gutierrez, *in litt.* 2002).

Data collection and monitoring: Catch and effort data is compiled by the National Fishery and Aquaculture Institute and the Co-operation for the Sustainable Use of San Andrés, Providencia and Santa Catalina (Anon., 1998).

Costa Rica: The harvest and export of *S. gigas* is prohibited in Costa Rica (Mora, *in litt.* 2002), however, subsistence fishing occurs illegally in small quantities for domestic consumption (Anon., 1996a).

Cuba: Management regulations: The Cuban Queen Conch fishery was closed between 1978 and 1982 due to the depletion of the stock. In 1982 the fishery re-opened under a system that established separate harvest quotas for each of the four fishing zones. The annual quota for all areas was 555,000 kg in 1982, and 780,000 kg in 1984 and then reduced to 200,000 kg in 1986 (total animal weight, cleaned meat weight is 7% of total animal weight). In 1998, the Queen Conch fishery was closed, and reopened in 1999 after the initiation of a stock abundance study and the establishment of an annual harvest quota of 800,000 kg (total animal weight equivalent to 50,400 kg cleaned, processed weight). There is currently a proposal to increase the annual quota to 1,250,000 kg (total weight equivalent to 88,000 kg cleaned, processed weight) (Formoso, 2002). In 1990, Cuba imposed a minimum shell size limit of 20 cm. The use of scuba and hookah is prohibited in Cuba, and since 2001, there is a closed season from 1 May to 30 September. Queen Conch has also been harvested for bait for the finfish fishery in Cuba, however, it is not clear whether the regulation in place also applies to the harvest of Queen Conch for bait (Anon., 1999).

Dominica: There are currently no specific regulations for the management of the Queen Conch fishery in Dominica (Fisheries Division of Dominica, *in litt.* 2001), however, some measures such as minimum shell length and meat weight, prohibition of scuba gear, are used as a policy (Fisheries Division of Dominica, 2002).

Dominican Republic: Management regulations: In 1986, the Dominican Republic established a minimum shell size limit of 25 cm through Decree 312. Following population studies in the mid-1990s, a closed season from 1 July to 31 October was established by the Presidential Decree No. 269-99 in 1999. The sale and export of Queen Conch meat during the closed season is also prohibited. Decree No. 269-99 also prohibits the fishing of Queen Conch in the south-west of the Island Beata and in the Canal Catuano. Currently the Dominican Republic does not set quotas for the annual harvest or export of Queen Conch specimens (Nolasco and Hamilton, *in litt.* 2002).

Data collection and monitoring: Information on catch and effort is limited (Tewfik, in prep.). Existing regulations such as the minimum shell size requirement or the closed fishing season are said to be ineffective due to insufficient enforcement in certain parts of the country (Torres, *in litt.* . 2002).

Grenada: Management regulations: According to the Fisheries (Amendment) Regulations *S. gigas* may not be landed with a shell size of less than 18 cm or a minimum meat weight of 225 g. In addition, all harvested Queen Conch must have a fully flared lip (Isaac, in prep.).

Data collection and monitoring: Biological and Catch and Effort data was collected in 1997 and 1998 with the assistance of CFRAMP. However, basic data collection is still required before a reliable stock assessment is possible (Anon., 1999).

Guadeloupe (FR): Management regulations: Order No. 94-77 sets out the provisions governing the marine coastal fishing in Guadeloupe. Article 14 prohibits the harvest and sale of *S. gigas* without a well-formed lip or a cleaned meat weight greater than 250 g (excluding the digestive gland). The use of scuba and hookah is prohibited, and since 1998 there has been an annual closed season from 1 April to 31 August (Legendre, *in litt.* 2001). In addition, the taking of Queen Conch in recreational fishery is prohibited (Frenkiel, *in litt.* 2003). In August 2002, these regulations were amended by Arrete No. 2002/1249 that introduces different regulations between Guadeloupe and Saint-Martin (the French part of the island of Saint Martin). In Saint-Martin the closed season is remains from 1 April to 31 August; in Guadeloupe (the other islands except for Saint-Martin) the closed season was extended and is now from 1 January to 30 September for shallow waters (up to 25m) and from 1 February to 30 September for deeper waters. The sale of Queen Conch meat is forbidden between 1 February to 30 September and meat harvested in

Saint-Martin cannot be sold in Guadeloupe during this period. To date landings of Queen Conch are not monitored and no official landing statistics for the species are available. Illegal fishing during the closed season occurs commonly and juvenile Queen Conch are regularly sold at local markets, suggesting that enforcement of the existing regulations is problematic (Frenkiel, 2002).

Haiti: Management regulations: Haiti is not a Party to CITES. Regulations in Haiti prohibit the harvest of shells without a well-formed lip and the use of scuba and hookah (Tewfik, in prep.). In 1997, plans existed to set a temporary fishing ban on the Queen Conch fishery in Haiti (Anon., 1998), but this was not implemented. Overall, enforcement of existing fishing regulations is very poor to non-existent due to low law enforcement capacities and consequently illegal fishing practices such as harvest of undersized Queen Conch or harvesting with hookah gear is common (Wilkinson, 2002).

Data collection and monitoring: There are no basic data collection systems in place and information on the biological status as well as fishery related information such as catch and effort data is very limited (Tewfik, in prep.).

Honduras: Management regulations: Honduras established closed seasons for the Conch fishery in 1993. The months of the season may change annually based on studies and communications with the fishing sector (Morales, *in litt.* 2001). In 2001, fishing of *S. gigas* was prohibited between 1 June and 30 September. Resolution 030-59 of 1995 prohibits the harvest of Queen Conch with a shell length of less than 22 cm, and the use of scuba and hookah to harvest Queen Conch has not been allowed since 1997. All vessels harvesting Queen Conch must be licensed and authorised; in 2003 a total of 14 vessels were allowed to harvest Queen Conch (Morales, *in litt.* 2003). The harvest of Queen Conch in the Cayos Cochinos and in the Marine Reserve of Sandy Bay is prohibited (Pineda, *in litt.* 2001; Morales, *in litt.* 2003). Plans to establish a quota system for the harvest and export of Queen Conch exist for some years (Anon., 1998), but have not yet been implemented.

Jamaica: Management regulations: Since 1993 the Jamaican Queen Conch fishery has been regulated under a quota system (National Total Allowable Catch or NTAC). The current NTAC for *S. gigas* applies exclusively to Queen Conch resources at Pedro Bank as a specially designated Fishery Management Area. As all Queen Conch meat harvested at Pedro Banks is destined for export, the NTAC is considered as both a catch and export quota (Anon., 2001b). In order to convert the weight of exports of processed *S. gigas* meat to the weight of Queen Conch catch quota the Jamaican Fisheries Division established, in co-operation with the Queen Conch industry, specific conversion factors (see International Trade). The Fishing Industry Act 1975 and the Fishing Industry Regulation of 1976 are the two pieces of primary fishery legislation. Other important legislation is the Aquaculture Inland and Marine Product and By-Product Act 1999 administered by the Veterinary Services Division. This focuses on the processing regime and regulates the sanitary conditions of marine products for export. The Endangered Species Act (Protection, Conservation and Regulation of Trade) 2000, and relevant Regulations are used to implement and enforce the provisions of CITES, and are administered by the Natural Resources Conservation Authority. Within the framework of the Endangered Species Act of 2000, individual export quotas for the export of Queen Conch meat are only issued in conjunction with individual allowable catch quotas that are issued under the Fishing industry Act (Anon., 2001b). All fishers and vessels harvesting Queen Conch in Jamaica must be licensed. Only the harvest of Queen Conch with a minimum size limit of 22 cm and a well-formed lip or a minimum weight for "market clean meat" of 84 g is allowed and the fishery is normally closed each year for four months (Aiken et al., 1999). These measures apply to the Queen Conch fishery as a whole and therefore also affect fishermen at the island shelf. However, the quota system applies only to the Queen Conch fishery at Pedro Bank. The Management Plan for 2001-2002 sets out additional measures, which include the prohibition to process and sell Queen Conch meat during the annual closed season. All Queen Conch meat in storage needs to be declared before the start of the annual closed season. It also includes provisions that allow for the inspection of Queen Conch meat in possession at any time through the Veterinary Service, the Fisheries Division or the NRCA (Anon., 2001b).

Data collection and monitoring: Catch and effort data is collected from the larger industrial vessels that operate at Pedro Bank, who have to submit specific data collection forms to the Fisheries Division after each fishing trip. No catch and effort data is collected from the artisanal fishers that harvest Queen Conch along the island shelf (Anon., 2001b). Biological data (meat weight) has been collected from processing plants (Smikle, 1997). Four visual surveys have been undertaken at Pedro Bank (see Population).

Martinique (FR): Management regulations: The use of scuba to harvest Queen Conch has been prohibited since 1992. In 1999, Regulation No. 994296 was passed that prohibited the harvest of Queen Conch with a shell length of less than 22 cm and of shells without a flared lip whose meat weight is less than 250 g (without digestive gland) (Doray and Reynal, 2001). The recreational harvest of Queen Conch is restricted to three animals per person and day; there is no closed season (Frenkiel, *in litt.* 2003).

Mexico: Management regulations: The Queen Conch fishery has been closed in the State of Yucatan since 1989, and nowadays the legal Queen Conch fishery in Mexico is restricted to two banks located in the Quintana Roo State: Banco Chinchorro and Banco de Cozumel (Anon., 2001d). The regulation NOM-013-PESC-1994 establishes a minimum shell size of 20 com and a closed season from 1 May to 31 October each year (INP, 2000). In 1996, harvest quotas were established for Cozumel and Chinchorro Bank and were 30,000 kg and 12,000 kg respectively (INP, 2000). The quotas are distributed among licensed fishing teams which have to represent a monthly report to the authorities (Alvarez-Romero, *in litt.* 2003). Aldana et al. (in litt., 2002) note that the establishment of harvest quotas for Cozumel and Chinchorro Bank have prevented further declines, but have not helped to recover the population to their original size; illegal fishing of Queen Conch at both banks and at Alacranes reef is thought to be a significant factor that prevents the recovery of the resource.

Montserrat (GB): Management regulations: In 1996, a management plan was drafted which included the restriction of scuba gear to harvest Queen Conch, the establishment of a minimum meat weight, the establishment of a closed season, and a restriction of the numbers of person allowed to harvest Queen Conch (Jeffers, 1999).

Netherlands Antilles (NL): Management regulations: In 1993, the Netherlands Antilles declared a 200 nautical mile Extended Fisheries Zone (EFZ), which placed two thirds of the Saba Bank within the jurisdiction of the Netherlands Antilles. The remaining third falls within the jurisdiction of the Saban territorial waters (Dilrosun, 2000). The Saba Bank is the only area remaining in the Netherlands Antilles which may still have some considerable numbers of Queen Conch (van Buurt, 2001). In 1992, the National Fisheries Decree came into effect, which regulates fishing activities in the Netherlands Antilles territorial waters and the EFZ. A national decree adopted under this law imposed a minimum legal shell length of 18 cm, or a minimum meat weight of 225 g (van Buurt, 2001). The use of hookah is prohibited by the Saba Island fishery ordinance, and will in future also be prohibited under the Central governments fisheries regulations. In 1991, Bonaire renewed their Marine Environment Ordinance and under the new regulation a permit is required to fish Queen Conch (Anon., 1996a; van Buurt, *in litt.* 2002). A similar system is in place in St Eustatius, however, no regulation for the Queen Conch fishery exists in St. Maarten and in Curacao (van Buurt, 1996; van Buurt, *in litt.* 2002).

Nicaragua: Management regulations: In 1998, Nicaragua established a national export quota for Queen Conch meat. The quota was 20,000 kg (44,000 lbs) in the years 1998, 1999 and 2000, but was increased to 45,359 kg (100,000 lbs) in 2001, 2002 and 2003 (CITES Notification No.s 1998/36, 1999/24, 2000/053, 2001/041). Since scientific information regarding the local population size and distribution is currently not available, the quotas are based on basic information such as historical off-take and export volumes (Morales, *in litt.* 2002). There are currently no other regulations in place (Martinez, *in litt.* 2001). Stock assessment surveys have been initiated in 2001 and the results of these surveys will be used to calculate harvest and export quotas and to establish relevant management measures for the Queen Conch fishery in Nicaragua (CIPA, 2001).

Panama: Management regulations: According to Guzman (*in litt.* 2002) there are currently no regulations for the harvest of Queen Conch in place in Panama. Based on the results of a recent population survey in the Boca del Toro archipelago (Tewfik and Guzman, in prep.) the government is considering the imposition of a five year fishing ban for Queen Conch (Tewfik, *in litt.* 2002).

Puerto Rico (US): Management regulations: The Queen Conch fishery in the EEZ of Puerto Rico is managed through the federal Caribbean Fisheries Management Council (CFMC) (Thomas and Gabel, *in litt.* 2003). In 1996, the existing regulations for the federal waters were amended with the introduction of a Fishery Management Plan for the Queen Conch fishery (Anon., 1996b). Part 622 of the Federal Register lays out the specific regulations which prohibit the harvest, possession and landing of Queen Conch with a shell length of less than 9 inches (23 cm) or less than 3/8 inch (9.5 mm) lip thickness. The use of hookah to harvest Queen Conch is prohibited. It requires that all Queen Conch must be landed attached to the shell and establishes a closed season from 1 July through 30 September. In addition, harvest for recreational purposes is limited to 3 Queen Conch per person and day, or 12 Queen Conch per boat. Licensed commercial fishers may land 150 Queen Conch per day for the first year, 100 for the

second year and 75 for the third year. In the state waters (up to 9 nm) the Department of Natural and Environmental Resources has established a closed season from 1 July to 30 September and a permitting system that licenses all commercial harvesters of *S. gigas* in Puerto Rico (Thomas and Gabel, *in litt.* 2003). Proposed regulations include the 9 inch total length and 3/8 inch lip thickness, harvest quotas and prohibition of hookah (Lilyestrom, *in litt.* 2003).

Data collection and monitoring: Mandatory reporting for commercial fisheries, including Queen Conch, was established in the late 1970s documenting total landings, catch and effort data, including information on landings per trip, gear type and fishing ground (Anon., 1999; Valle-Esquivel, 2002).

Saint Kitts and Nevis: Management regulations: The Fisheries Regulation No. 11 of 1995 on Queen Conch prohibits the harvest, sale and purchase of 'immature' Queen Conch with a shell length of less than 18 cm, or individuals without a flared lip, or with a meat weight of less than 225 g (after removal of the digestive gland) (Simmonds, *in litt.* 2002). There also is a requirement to obtain a permit for the use of scuba or hookah for fishing Queen Conch. The Fisheries Regulation also provides for the imposition of a closed season, but none has yet been established. The imposition of a lip thickness restriction and a ban or restriction on the use scuba gears is being considered, but have not yet been implemented (Anon., in prep.a).

Data collection and monitoring: Some biological data on lip thickness, meat weight, shell length and samples of the catch, i.e. the number of Queen Conch within the catch samples, has been collected. However, the Fisheries Division has experienced difficulties in collecting this information, mainly because fishermen were unwilling to provide shells, which are normally not landed (Anon., 1999). Before this, catch data was collected from monthly export forms and effort data was collected from interview with fishermen, both since 1979 (Anon., 1999).

Saint Lucia: Management regulations: In 1987, the Department of Fisheries introduced legislation relevant to the Queen Conch fishery in Saint Lucia under the Fisheries (Turtle, Lobster and Fish Protection) Regulation No. 67. New fisheries regulations were imposed in 1994 through the Fisheries Act No. 9. These comprise a minimum size limit of 18 cm shell length and a minimum weight of 1 kg total animal weight or 280 g for meat (after the removal of the digestive gland). In addition, all Queen Conch harvested must have a flared lip. The policy of the Department of Fisheries also requires all Queen Conch to be landed whole (live) in the shell. However, enforcement focuses only on the flared lip requirement due to the ease of enforcement and implementation in the field (Joseph, in prep.). There also is a provision for a closed season, but none have been established. The use of scuba for fishing is regulated by law and only a certain number of divers are authorised to use scuba gear and those who are require a licence by the Fisheries Division. Additional licences are required for fishing vessels and all fishers need to be registered. Prior to the CITES Standing Committee decision to suspend imports of *S. gigas* from Saint Lucia, vessels were required to export Queen Conch as whole animals. Individuals were allowed to make no more than one export trip per month and export no more than 300 Queen Conch per consignment (Rambally and Pierre-Nathoniel, *in litt.* 2001).

Data collection and monitoring: Data collection programmes have been implemented since 1979, but have been significantly improved with the assistance of CFRAMP (Joseph, in press). A Queen Conch biological data collection initiative commenced in 1996 and ran for a period of two years. A detailed analysis of this data has not yet been completed, although some preliminary assessments have been conducted. There is a need for improved baseline information on the stocks to set quotas or allowable catch levels and to effectively monitor catches (Rambally and Pierre-Nathoniel, *in litt.* 2001).

Saint Vincent and the Grenadines: Management regulations: The Statutory Rules and Orders Act 1986, Part IV section 18 prohibits the possession of Queen Conch with a shell length of less than 7 inches (18 cm) or without a flared lip, or with a total meat weight of less than 8 oz (225 g). The legislation also provides for the Ministry of Agriculture and Fisheries to close the Queen Conch fishery for a season (Isaacs, *in litt.* 2003). Other measures such as a restriction or ban on the use of scuba gear and the establishment of export quotas and a limited entry system are under consideration, but have not yet been implemented (Anon., in prep.b; Isaacs, *in litt.* 2003).

Data collection and monitoring: A specific catch and effort collection programme has not been implemented for the Conch fishery, but the Fisheries Division collects catch data from local markets (Anon., in prep.b). An implementation plan to collect catch and effort data as well as biological data is available but is not yet implemented (Murphy, pers. comm. 2001).

Turks and Caicos Islands (GB): Management regulations: The Turks and Caicos Islands are not a Party to CITES. Since 1995, the Queen Conch fishery in the Turks and Caicos Islands has been managed through a system of harvest and export quotas that are set per fishing season. A national quota is set for landings and subsequently for exports, taking into account the loss in tissue weight and amounts consumed locally. The national harvest quota for the fishing season 1999/2000 was 725,760 kg of unprocessed meat, which is equivalent to 290,304 kg of processed meat. The quota is further divided into export and national consumption, with the majority being exported (see International Trade). The harvest quotas are calculated yearly based on catch per unit effort data, periodic stock assessments and mathematical models to calculate Total Allowable Catch (Clerveaux, *in litt.* 2002). The quotas are allocated to the processing plants on a quarterly basis, with each plants receiving individual shares (Bennett and Clerveaux, 2001). The introduction of the quota system to manage the national Queen Conch fishery led to a "race to fish" phenomena, leading to a sharp increase in fishing effort ("man-days") and landings. Due to the introduction of additional management measures the fishing effort has reduced but is still higher that in the early 1990s. Measures included the prohibition of the harvest of undersized individuals with a shell length of less than 7 inches (18 cm) or with a meat weight of less than 8 oz (225 g). All Queen Conch landed must also have a flared lip (Clerveaux, *in litt.* . 2001). Since 2000, a closed season has been established from 15 July to 15 October. Fishing of Queen Conch is prohibited in the Admiral Cockburn Land and Sea National Park and in the East Harbour Conch and Lobster Reserve (both in South Caicos). The overall fishing efforts under the current national annual harvest quota (= 725,760 kg of unprocessed meat) are considered to be maintaining the stock size at sustainable levels (Anon., 1999). However, the Department of Environment and Coastal Resources is considering conducting a bio-economical study of the stock, which would suggest a change in the management strategy and be based on Maximum Economical Yield instead of Maximum Sustainable Yield (Clerveaux, *in litt.* 2002).

Data collection and monitoring: The Turks and Caicos Islands have one of the longest catch-effort time series data, which date back to 1974 (Medley and Ninnes, 1995). Catch data are collected through a system of processing plant pay slip receipts, which record pounds of meat per boat day. Additional data such as number of fishermen per boat are also recorded. In 2001 the Department of Environment and Coastal Resources conducted visual surveys of the Queen Conch populations around the Caicos and Turks Banks (see Population).

United States of America: Management regulations: In 1975, the commercial Queen Conch fishery was closed in Florida due to over-fishing. This ban was extended to the recreational fishery in 1985 in state waters (through the Florida Administrative Code, Chapter 68b-16003), and in 1986 in contiguous federal waters for those vessels registered in Florida (Florida Administrative Code, Chapter 68b-16.005). In 1990, the species' status was up-graded to 'protected species' and a 'species of special concern' (Glazer and Berg, 1994). In 1986, the State of Florida began a research programme designed to monitor the recovery of the Queen Conch stock and to determine how to rehabilitate the depleted population (Glazer, 2001). The studies showed that the stocks recovered more slowly than anticipated and found that only few larvae originating from other upstream populations outside the waters of Florida's were entering the Florida Keys. Hence, it was determined that more effort was needed to increase the local spawning stock in order to rehabilitate the south Florida Conch population (Glazer, 2001).

Venezuela: Management regulations: The Queen Conch fishery is currently closed in Venezuela. The Los Roques Archipelago was closed to the Queen Conch fisheries in 1985, and in 1991 the Government adopted a total closure for Venezuela for a three-year period. In 1994, the total closure was extended until 1999, following little signs of recovery. After the total closure, the fishing activity was reported to be ongoing and harvests were mainly of juveniles (Rodríguez and Posada, 1994). Despite the lack of supporting signs of the local Queen Conch populations recovering, a management plan that included provisions for a harvest quota of 200,000 kg 'cleaned' meat was developed and promoted in 1999 but was never realised and the fishery remained closed (Solórzona and Lagarde, 2001). The government imposed a closed season (1 July to 30 September), prohibited the harvest of undersized individuals (minimum of 20 cm shell length and 5 mm lip thickness, or 220 g minimum meat weight), prohibited the use of scuba and hookah and required all Queen Conch fishermen to be licensed. In 2000, the government passed a new regulation and the fishery was closed again.

Virgin Islands (US): Management regulations: The local Queen Conch fishery in coastal waters of the Virgin Islands (US) (up to nine nautical miles) are regulated by the Department of Planning and Natural Resources following recommendations from the local Fisheries Advisory Committees and the Division of Fish and Wildlife. The Caribbean Fisheries Management Council (CFMC) regulates Queen Conch fisheries in the federal waters, i.e. from nine nautical miles to the edge of the US Exclusive Economic

Zone or 200 nautical miles. Local Queen Conch regulations were first established in 1984 for St Croix and consisted of a closed season from 1 July to 30 September, a minimum shell size limit of 23 cm (9 inches) and a minimum meat weight of 2 animals per pound uncleaned meat or 3 animals per pound cleaned meat. A continued decline in landings for St Thomas and St John led to a five-year moratorium on harvest from February 1988 to December 1992. In 1994, unified rules and regulations for St Croix, St Thomas and St John were implemented. These included a closed season from 1 July to 30 september, the requirement that all Queen Conch had to be landed live and in shell. In 1996, the Government of the Virgin Islands (US) has adopted all of the Queen Conch regulations specified in the federal management plan administered by the CFMC, so that there is no discrepancy in local and federal regulations (withy the exception for recretaional harevst). These include a closed season from 1 July to 30 September, the requirement that all Queen Conch had to be landed live and in shell, a minimum size limit of 23 cm (9 inches) for the shell length or a lip thickness of at least 9.5 mm (3/8 inch), a commercial harvest limit of 150 individuals per day and per licensed fisherman, recreational/ personal catch limit of 6 individuals per person per day or 24 per day per boat, and the prohibition of the sale of undersized shells. Due to the lack of enforcement presence at landing sites, most fishermen do not land Queen Conch in their shells, which makes enforcement of the shell size limits impossible (Anon., 1999).

Data collection and monitoring: Commercial landing data provide information per trip, gear used, area fished, hours and catch and have to be submitted on a monthly basis (Anon., 1999). Stock assessments are being undertaken every five years; the most recent was conducted in 2001 and the next one is planned for 2006 (Gordon, *in litt*. 2002; see Population).

CAPTIVE BREEDING

Queen Conch mariculture

The drastic decline in Queen Conch stocks throughout the species range has promoted efforts to investigate the potential of mariculture techniques. Over the past 20 years extensive research has been carried out by several private and public institutions into methods of cultivation, the potential of Queen Conch aquaculture to reduce fishing pressure on wild populations and the prospect of stock enhancement (e.g. Davis *et al*., 1984; Creswell, 1994; Reed, 1994; Stoner and Davis, 1994; Weil and Laughlin, 1994; Iversen and Jory, 1997; Delgado *et al*., 2000; Ray-Culp *et al*., 1999; Davis, 2000; Glazer, 2001). This research has shown that *S. gigas* can be cultivated and hatchery techniques are now well established and has significantly contributed to the understanding of Queen Conch biology and ecology.

In the past, the survival of hatchery-reared juveniles released in the wild has created difficulties (Coulston *et al.*, 1989, Dalton, 1994; Iversen and Jory, 1997, Glazer, 2001). Major obstacles to Queen Conch mariculture and restocking efforts has been the inability to generate a consistent hatchery production of a large number of juveniles, and the high mortality of juveniles released in the field, primarily due to predation (Ray *et al.*, 1994; Iversen and Jory, 1997). Other difficulties encountered have been the slow growth rate, lighter shell structures and the decreased predator avoidance behaviour observed in hatchery-reared conch (Iversen and Jory, 1997; Posada *et al.*, 2000; Glazer, 2001). Queen Conch that were conditioned to predators in hatcheries had higher survival rates in hatchery conditions when exposed to foraging predators (Delgado *et al.*, 2002). It has been shown that older and hence larger hatchery reared Queen Conch are more likely to survive in the wild (Glazer and Delgado, 1999), however, rearing Queen Conch to larger sizes has considerable cost implications (Iversen and Jory, 1997; Glazer and Delgado, 1999).

However, in the past decade, increased knowledge has become available regarding the early lifecycle of juvenile Queen Conch, larvae development and metamorphosis, feeding behaviour and response to predators, and this has led to significant improvements in the survival rates of hatchery released individuals and their potential to restock wild populations. Stock restoration and enhancement programmes are therefore a focus of research by several private and public research institutions and are seen as an important aspect in restoring depleted Queen Conch populations (Iversen and Jory, 1997; Posada *et al.*, 2000; Glazer, 2001). Nevertheless, restoration programmes for example in Florida, continue to focus on transplantation of wild Queen Conch as a method to increase spawning stock (Glazer, 2001). There have also been concerns about the use of farmed Queen Conch for restocking programmes, in particular with regard to the genetic structure of various Queen Conch populations (e.g. Bothwell, *in litt.* 2002).

To date, the only economically profitable establishment is the Caicos Conch Farm in Providenciales, Turks and Caicos Islands. Research into the cultivation of *S. gigas* at the Conch Farm has been under development since 1984 and in total USD 9 million have been invested. In addition to pursuing commercial viability of Queen Conch production for human consumption, the farm has also begun a program to release hatchery-produced juveniles to the wild to augment local populations (Hesse, *in litt.* 2002). Today, the Caicos Conch Farm has about 3.5 million Queen Conch at various developmental stages in its inventory. One million individuals are kept offshore in 80 acres of fenced 'pasture' on the Caicos Bank to keep predators away and around two million individuals are kept in onshore nursery ponds on the farm itself. The ponds are used to grow the animals from 2-16 cm over a period of 24 months. Since 2001, the farm has produced 1.5 million individuals per year.

The traditional Queen Conch market has been for adult animals (> 16 cm shell length) which are consumed as food. A secondary consumer market exists based on sale of the shells of adult Queen Conch, although this market is often filled as a by-product of individuals harvested for food. Novel markets for Queen Conch products are also beginning to emerge as a result of developing aquaculture programs. There is a demand by the marine aquarium trade for small (2.5 cm) tank-sized animals. There is also an effort to expand a niche market for 'ocean escargot' which are animals of approximately 6 cm shell length.

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Annex

Table A1. Mean densities of *Strombus gigas* determined by visual surveys in various range States
[Note: recent research undertaken in the Exuma Sea and Land Park, Bahamas, indicates that mating did not occur when densities were below 56 ind./ha and no spawning was observed at densities below 48 ind./ha (Stoner and Ray-Culp, 2000)]

Location	Notes	Ind./ha	Source
Anguilla (GB)	No information		
Antigua and Barbuda	Juveniles	13.5	Tewfik *et al.*, 2001
	Adults (lip > 4 mm)	3.7	Tewfik *et al.*, 2001
Aruba (NL)	No information		
Bahamas			
Little Bahama Bank	1983/84	28.5	Smith and van Neirop, 1984
Great Bahama Bank	Unprotected Bank (1983/84)	20.8	Smith and van Neirop, 1984
	Protected Park (< 5 m), adults	50.2	Stoner and Ray, 1996
	Protected Park (> 5 m), adults	111	Stoner and Ray, 1996
	Unprotected Bank (< 5 m), adults	1.67	Stoner and Ray, 1996
	Unprotected Bank (> 5 m), adults	41.2	Stoner and Ray, 1996
Barbados	No information		
Belize	Sublegal (< 15 cm)	14.3	Appeldoorn and Rolke, 1996
	Legal (> 15 cm)	14.9	Appeldoorn and Rolke, 1996
Bermuda	1988	0.52	Berg *et al.*, 1992a
	1989	2.94	Berg *et al.*, 1992b
Brazil	No information		
British Virgin Islands (GB)	No information		
Cayman Islands (GB)	Grand Cayman (2000)	70	Bothwell, *in litt.* 2002
	Little Cayman	100	Bothwell, *in litt.* 2002
Colombia	Quitasueño Bank (1993/94), adult densities at 1.5-5m zone	160	Ospina *et al.*, 1997
	Roncador Bank (1993/94), adult densities at 1.5-5m zone	410	Ospina *et al.*, 1997
	Serrana (1993/94), adult densities at 1.5-5m zone	500	Ospina *et al.*, 1997
	Albuquerque (1993/94), adult densities at 1.5-5m zone	70	Ospina *et al.*, 1997
	Serrana Bank (1999)	317.5	Valderrama and Hernández, 2000
	Serranilla Bank (1999)	22.1	Valderrama and Hernández, 2000
	Roncador Bank (1999)	33.7	Valderrama and Hernández, 2000
	Quitasueño Bank (1999)	2.4	Valderrama and Hernández, 2000
Costa Rica	No information		
Dominica	No information		
Dominican Republic	Juveniles (Parque del Este) (1996)	283	Delgado, 1999
	Adults (Parque del Este) (1996)	4.5	Delgado, 1999
	Juveniles (Parque del Este) (1997)	22.5	Delgado, 1999
	Adults (Parque del Este) (1997)	1.6	Delgado, 1999
	Juveniles (Parque del Este)	14.4	Torres and Sullivan Sealey, 2001
	Adults (Parque del Este)	0.6	Torres and Sullivan Sealey, 2001

Location	Notes	Ind./ha	Source
	Juvenile (Parque Jaragua)	53	Posada *et al.*, 2000
	Adults (Parque Jaragua)	4.6	Posada *et al.*, 2000
Grenada	No information		
Guadeloupe (FR)	No information		
Guatemala	No information		
Haiti	Juveniles (Gonaves Island)	10.7	Wood, 1995
	Adults (Gonaves Island)	0	Wood, 1995
	Rochelios Bank (adults)	15	Wood, 1995
	Western end	160	Wood, 1995
Honduras	Cayos Cochinos (protected), Adults	7.3	Tewfik *et al.*, 1998
	Cayos Cochinos (protected), Juveniles	7.3	Tewfik *et al.*, 1998
Jamaica			
Pedro Bank (1994)	All age classes (0-10 m)	89	Appeldoorn, 1995
	All age classes (10-20 m)	145	Appeldoorn, 1995
	All age classes (20-30 m)	277	Appeldoorn, 1995
Pedro Bank (1997)	Juveniles (Artisanal Zone)	221	Tewfik and Appeldoorn, 1998
	Adults (Artisanal Zone)	93	Tewfik and Appeldoorn, 1998
	Juveniles (10-20 m)	466	Tewfik and Appeldoorn, 1998
	Adults (10-20 m)	48	Tewfik and Appeldoorn, 1998
Pedro Bank (2002)	Subadults and adults (10-20 m)	136	Smikle and Appeldoorn, 2002
Morant Bank (1996)	Juveniles (0-10 m)	482.1	Stephens, 1997
	Adults (0-10 m)	10.9	Stephens, 1997
	Juveniles (10-20 m)	59.9	Stephens, 1997
	Adults (10-20 m)	101.1	Stephens, 1997
	Juveniles (20-30 m)	31.8	Stephens, 1997
	Adults (20-30 m)	214.5	Stephens, 1997
Martinique (FR)	No information		
Mexico	Cozumel (1989)	70	Cruz, 1989
	Cozumel (1989)	20	Quijano--Fernandez, 1988
	Cozumel (1995, after closure)	820	Basurto *et al.*, 1996
	Alacranes Reef (1997)	47	Rios Lara, 1998
	Alcranes Reef (1997)	60	Pérez and Aldana, 1998
	Alcranes Reef (1999)	84	Pérez and Aldana, 2000
Montserrat (GB)	No information		
Netherlands Antilles (NL)	Bonaire, overall density (1999)	20.2	van Buurt, 2001
Nicaragua	No information		
Panama	Bocas del Toro (0-10 m)	1.4	Tewfik and Guzman, in prep.
Puerto Rico (US)	Southwest (1985/86)	8.1	Torres-Rosado, 1987
	West (1995)	8.5	Mateo *et al.*, 1998
	East (1996)	7.4	Mateo *et al.*, 1998
Saint Kitts and Nevis	No information		
Saint Lucia	No information		
Saint Vincent and the Grenadines	No information		
Trinidad and Tobago	No information		
Turks and Caicos (GB)	Caicos Bank, small + medium juveniles	170.4	Clerveaux, *in litt.* 2002
	Caicos Bank, large juveniles + subadults	87.5	Clerveaux, *in litt.* 2002

Location	Notes	Ind./ha	Source
	Caicos Bank, adults	204	Clerveaux, *in litt.* 2002
	Turks Bank, small + medium juveniles	47.8	Clerveaux, *in litt.* 2002
	Turks Bank, large juveniles + subadults	44.8	Clerveaux, *in litt.* 2002
	Turks Bank, adults	182.7	Clerveaux, *in litt.* 2002
US (Florida)	1987-88	2.4	Berg and Glazer, 1995
	1990	1.5	Berg and Glazer, 1995
Venezuela	Los Roques (overall density)	18.8	Schweizer and Posada, 2000
	Los Roques (Juveniles)	0.82	Schweizer and Posada, 2000
Virgin Islands (US)	St. Croix (Adults) (1981)	26.1	Wood and Olsen, 1983
	St Croix (Adults) (2001)	27.4	Gordon, *in litt.* 2002
	St. Thomas/St. John (1981)	9.7	Wood and Olsen, 1983
	St. Thomas/St. John (1990)	12.3	Friedlander *et al.*, 1994
	St Thomas (Juveniles) (1996)	31	Gordon, *in litt.* 2002
	St Thomas (Juveniles) (2001)	1.88	Gordon, *in litt.* 2002

Table A2. Membership of Queen Conch range States in Multilateral Environmental Agreements and other international or regional organisations.

Country / dependency	CITES	Category of	Cartagena Convention		SPAW Protocol		CFRAMP [5]	OECS[4]	Member of
	Party *	NLP**	Signature	Ratified	Signature	Ratified	member		FAO
Anguilla (GB)	non-Party							X	
Antigua and Barbuda (1)	Oct-97	3		X	X		X	X	X
Aruba (NL)	Mar-95								
Bahamas	Sep-79	3							X
Barbados (1)	Mar-93	3	X	X	X	X	X		X
Belize	Sep-81	3		X			X		X
Bermuda (GB)	Oct-76								
Brazil	Aug-75	Under review							X
British Virgin Islands (GB)	Oct-76							X	
Cayman Islands (GB)	Oct-76								
Colombia	Nov-81	1		X	X	X			X
Costa Rica	Sep-75	1		X					X
Cuba	Jul-90	1		X	X	X			X
Dominica (1)	Nov-95	3		X			X	X	X
Dominican Republic	Mar-87	3		X		X			X
France	Aug-78	1	X	X [3]	X	X			X
Guadeloupe (FR)	Aug-78								
Grenada	Nov-99	3	X	X			X	X	X
Guatemala	Feb-80	1	X	X	X				X
Haiti	non-Party								X
Honduras	Jun-85	2	X						X
Jamaica	Jul-97	Under review	X	X	X		X		X
Martinique (FR)	Aug-78								
Mexico	Sep-91	1	X	X	X				X

Country / dependency	CITES Party *	Category of NLP**	Cartagena Convention		SPAW Protocol		CFRAMP [5] member	OECS[4]	Member of FAO
			Signature	Ratified	Signature	Ratified			
Montserrat	Oct-76						X	X	
Netherlands	Apr-84	1	X [1]	X [1]	X	X			X
Netherlands Antilles (NL)	Jul-99								
Nicaragua	Nov-77	1	X	X					X
Panama	Nov-78	2	X	X	X	X			X
Puerto Rico (US)	Jul-75			X					X
Saint Kitts and Nevis	May-94	2					X	X	X
Saint Lucia	Mar-83	2	X	X	X	X	X	X	X
Saint Vincent and the Grenadines	Feb-89	2		X	X	X	X	X	X
Trinidad and Tobago (1)	Apr-84	2		X	X	X	X		X
Turks and Caicos Islands (GB)	non-Party								
United Kingdom	Aug-76	1	X [2]	X [2]	X				X
United States of America	Jul-75	1	X	X	X				X
Virgin Islands (US)	Aug-75			X					X
Venezuela	Jan-78	2	X	X	X	X			X

Notes: * = date indicates month and year of the range States' accession to CITES; ** = National Legislation Project of CITES, based on Doc. 28 presented at CoP12, November 2002; Category 1 = legislation is believed to meet the requirement for the implementation of CITES, Category 2 = legislation is believed not to meet all requirements ..., Category 3 = legislation that is believed not to meet the requirements...; (1) = imports of *Strombus gigas* originating from this country are currently suspended through a recommendation of the Standing Committee (CITES Notification No. 1999/20), [1] = on behalf of the Netherlands Antilles and Aruba, [2] = on behalf of the Cayman Islands, Turks and Caicos Islands and the British Virgin Islands, [3] = on behalf of Martinique and Guadeloupe, [4] = Organization of Eastern Caribbean States, [5] = Caribbean Community Fisheries Resources Assessment and Management Program

Table A3. Overview of some management measures adopted by Queen Conch range States (see chapter Conservation measures for more details).

Country/	Size restriction with regard to the minimum:			Closed	Gear	Closed	Harvest quota/ daily	Export Quota
Territory	Lip size	Meat weight	Shell length	season	restriction	areas	bag limit (meat in kg)	(meat in kg)
Anguilla	Currently no regulations							
Antigua and Barbuda	Presence of flared lip (no measure)	225 g (excluding viscera)	180 mm	Considered but not yet implemented				
Aruba (NL)	Harvest banned							
Bahamas	Presence of well formed lip (no measure)				Scuba prohibited, hookah only allowed during open lobster season (Aug-March)	Exuma Land and Sea Park, North Bimini, Berry Islands, South Eleuthera, Exuma Cays, Northern Abaco Cays		1999: 158,760 kg 2000: 136,080 kg 2001: 285,768 kg
Barbados	Currently no regulations, but some measure under consideration					Folkstone Marine Park		
Belize		85 g (3 oz) for 'cleaned meat'	(18 cm) 7 inch	1 Jul - 30 Sep	Scuba and hookah prohibited	Port Honduras and Laughing Bird NP, Hol Chan and Glovers Reef Marine Reserve, Half Moon Cay, Blue Moon Monument		
Bermuda (GB)	Harvest banned since 1978							
British Virgin Islands (GB)			(18 cm = 7 inch proposed)	(1 Dec - 21 May, proposed, not yet implemented)	Scuba prohibited	(proposed)		
Cayman Islands (GB)				May - October	Scuba prohibited	Several (Marine Park and Replenishment and Environmental Zones)	Daily bag limit of five Queen Conch per person, or ten per boat (whichever is least)	
Colombia	7 mm	'Cleaned' meat : 100 g, 'uncleaned' meat: 225 g	24 cm	1 July - 31 Oct	Scuba and hookah prohibited	Quitasueño, Serranilla and Roncador Bank	based upon export quota	1999: 391,395 kg* 2000: 293,839 kg 2001: 126,000 kg 2002: 158,000 kg 2003: 148,000 kg

Country/	Size restriction with regard to the minimum:			Closed	Gear	Closed	Harvest quota/ daily	Export Quota
Territory	Lip size	Meat weight	Shell length	season	restriction	areas	bag limit (meat in kg)	(meat in kg)
Cuba	5 mm		20 cm	1 May - 30 Sep	Scuba and hookah prohibited	Several	2001: 798,000 kg live weight = 50,400 kg cleaned weight	Based on harvest quota
Dominica	No regulations currently in place, but some measures i.e. minimum shell length/meat weight and prohibition of scuba used as policy							
Dominican Republic	Well formed lip		25 cm	1 July - 31 Oct		Canal Catuano, Islas Saona, Punta Aljibe y Balaju in the Nacional Parque del Este, Islas Beata y Trudille in the Nacional Parque Jaragua		
Grenada	Well formed lip	225 g (excluding viscera)	180 mm	Considered but not yet implemented				
Guadeloupe (FR)	Well formed lip	250 g (excluding viscera		1 Apr - 31 Aug	Scuba and hookah prohibited	Grand Cul-de-Sac Marin in Saint Barthelemy, Petite Terre in Saint Martin		
Guatemala	No regulations currently in place							
Haiti	Well formed lip				Scuba and hookah prohibited			
Honduras			22 cm	1 June - 15 Sep	Scuba and hookah prohibited	Cayos Cochinos, Sandy Bay (Isla Roatan)		
Jamaica		84 g (market clean)	22 cm	1 Aug - 30 Nov	Prohibition of scuba under consideration	Morant Bank, Formigas Bank, Grappler Bank, Henry Holmes Bank and Albatross Bank	Based on export quota	1999: 1,216,000 kg 2000: fishery closed 2001: 946,000 kg 2002: set at 502,450 kg but no fishing took place 2003: 500,000 kg
Martinique (FR)	Formed lip	250 g (excluding viscera)	22 cm	1 April - 31 August	Scuba prohibited			

Country/	Size restriction with regard to the minimum:			Closed	Gear	Closed	Harvest quota/ daily	Export Quota
Territory	Lip size	Meat weight	Shell length	season	restriction	areas	bag limit (meat in kg)	(meat in kg)
Mexico			20 cm	1 May - 31 October		Harvest only allowed at Chinchorro and Cozumel Bank	2002: 30,000 kg for Chinchorro Bank and 12,000kg for Cozumel Bank	
Montserrat (GB)	No regulations currently in place, but Management Plan under preparation							
Netherlands Antilles (NL)		225 g	18 cm		Hookah prohibited in Saba			
Nicaragua						Reserva Cayos Miskitos Franja Costera		1999: 20,000 kg 2000: 20,000 kg 2001-03: 45,359 kg
Panama	No regulations currently in place							
Puerto Rico (US) (local waters)				1 Jul - 30 Sep				
Puerto Rico (US) (federal waters)	9.5 mm (3/8 inch)		23 cm (9 inches)	1 Jul - 30 Sep	Hookah prohibited		3 conch/person/day or 12 conch/boat/day for recreational purpose; 150 conch/person/day for commercial fishers; all Queen Conch must be landed in shell	
Saint Kitts and Nevis	Well formed lip	225 g (excluding viscera)	180 mm	considered but not yet implemented				
Saint Lucia	Well formed lip	Must be landed in shell: 1000 g total weight (incl. shell), 280 g meat	18 cm	considered but not yet implemented				
Saint Vincent and the Grenadines	Well formed lip	225 g (excluding viscera)	18 cm	Provisions to close the fishery for a season provided for in Fisheries Act	Prohibition on the use of scuba under consideration	'conservation area s' are designated within legislation		
Trinidad and Tobago	No regulations currently in place							

Country/	Size restriction with regard to the minimum:			Closed	Gear	Closed	Harvest quota/ daily	Export Quota
Territory	Lip size	Meat weight	Shell length	season	restriction	areas	bag limit (meat in kg)	(meat in kg)
Turks and Caicos Islands (GB)	Well formed lip	225 g (8 oz)	18 cm (7 inch)	15 July - 15 Oct	Scuba and hookah prohibited	Admiral Cockburn Land and Sea NP, Esat Harbour Conch and Lobster Reserve	Processed meat: 1999/2000: 290,304 kg 2000/2001: 280,388 kg	Processed meat: 1999/2000: 272,160 kg 2000/2001: 270,270 kg
US (Florida)	Harvest banned since 1986							
US Virgin Island	9.5 mm (3/8 inch)	All conch must be landed in shell	23 cm (9 inches)	1 July - 30 Sep	Hookah prohibited	St John National Park, Buck Island National Monument, Virgin Island Coral Reef National Monument, Cas Cay/ Mangrove Lagoon Marine Reserve, St James Marine Reserve	150 conch/person/day for commercial fishers and 6 conch/person/day or 24 conch/boat/day for recreational fishers	
Venezuela (harvest banned from 1991 onwards)	5 mm	220 g	20 cm	1 Jul - 30 Sep	Scuba and hookah prohibited			

* = Jamaican conch fishery was closed in 2000, re-opened in June 2001 and again closed in 2002

"Lip size" refers to restrictions on the lip thickness (minimum thickness of the lip in mm) or simply the presence of a flared or well formed lip; "Shell length" refers to the shell length measured from the tip of the spire to the end of the siphonal canal.

Table A4. Overview of status of Queen Conch fisheries and resources per range State. Harvest volumes are based on reported landings of Queen Conch meat (see Table 1) in metric tonnes (mt). Export figures are based on trade reported in CITES trade data in mt (see Table 4).

Country/ territory	Use	Fleet and gear	Annual landings in the 1990s and trend		Annual exports in the 1990s and trend		Overall stock status
Anguilla (GB)	Local consumption, no exports		Unknown		None reported		No information
Antigua and Barbuda	Local consumption, tourist and restaurants and export to the region	Large (13m) fibreglass boats and smaller (7m) canoes, Mainly Scuba	35-69 mt	+/- stable	0.5-4 mt (not reported in CITES data)	Standing Committee recommendation in place since 1999	Some areas overfished and local depletions in shallow waters; low overall density (17.2 ind./ha) and adult densities very low (3 ind./ha), considerable harvest of juveniles
Aruba (NL)	Harvest prohibited				None reported		No information
Bahamas	Domestic consumption and export	Small boats; Free-diving, hookah and 'conch hooks'	453-680 mt	Fluctuating	89-293 mt	Fluctuating	Overall stock status considered stable, but local depletions and low densities noted in some areas, signs of overfishing, harvest of juveniles and unknown levels of poaching
Barbados	Domestic and some tourist use (mainly shells), no meat exports	Small boats; Free-diving		Small scale only; levels unknown	None reported	Standing Committee recommendation in place since 1999	Stock status largely unknown but stocks thought to be smaller than in neighbouring islands
Belize	Mainly for export	Sailing boats (10m) and small canoes; Free-diving, up to 20m	138-257 mt (>500 mt in 1970s)	Fluctuating, increase since 1999	26-255 mt	Increasing	Stocks considered overfished and continues to decline, harvest is targeting mainly juveniles, adults are considered depleted, unknown level of poaching by foreigners
Bermuda (GB)	Harvest prohibited				0.8 mt in 1999 only		Stocks considered overfished and despite harvest ban only slow recovery
Brazil	No fishery		Unknown		25 kg in 1994		No information
British Virgin Islands (GB)	Domestic consumption and tourists, some (unreported) meat imports	Mainly scuba	4.8-6.2 mt	+/- stable	No exports reported		Insufficient information to determine status, local stocks possibly overfished
Cayman Islands (GB)	Domestic, tourist, restaurants and recreational, significant (unreported) meat imports	Small boats	Unknown		No exports reported		Stocks considered overfished and declines in fishing areas

Country/ territory	Use	Fleet and gear	Annual landings in the 1990s and trend		Annual exports in the 1990s and trend		Overall stock status
Colombia	Mostly export	Larger boats; Free-diving	100-240 mt (800 mt in 1988)	Decreased	64-196 mt	Fluctuating	Most traditional fishing areas now overfished, some with very low densities (< 3 ind./ha); harvest restricted to one bank with relatively high densities (> 300 ind./ha)
Costa Rica	Harvest prohibited		Unknown		4 mt in 1998		No information
Cuba	Domestic, export and possibly used as bait	Small boats, Free-diving, Catch is landed live in shell	20-163 mt	Decreased	7-40 mt	Increasing	Historical declines with northern population depleted and southern shelf fully exploited, recent info suggest population recovery
Dominica	Domestic and tourist; some regional exports	Small boats; Free-diving and bottom nets	5 mt in early 1990s	Insufficient data	2.5 mt in 1996	Standing Committee recommendation in place since 1999	Stocks overfished in the past and now considered depleted, insufficient information to determine status
Dominican Republic	Domestic and export	Some larger steel vessels (20m) plus small boats; Free-diving and hookah	1,145-2,668 mt	Decreased	32-339 mt	Increasing	Stocks of main fishing grounds on the island shelf severely depleted, significant declines in adult densities (in some areas < 1 ind./ha), harvest largely juveniles, insufficient data from offshore banks
Grenada	Domestic	Small boats, Free diving and scuba at depth up to 50m	26 mt in 1993	Insufficient data	No exports reported		Insufficient information to determine stock status, traditional fishing areas overfished and harvest mainly juveniles
Guadeloupe (FR)	Domestic consumption, meat imports	Free-diving	Unknown		No exports reported	Important importer	Insufficient information available, stocks considered depleted and over-exploited, especially in shallow waters
Guatemala	No fishery, occasional harvest for subsistence		Unknown		No exports reported		Only very small population, status not known
Haiti	Mainly for domestic consumption; shells are exported	Small boats; Free-diving	55-70 mt	Insufficient data	34-159 mt	Exports reported only in 1995, 1996 and 1997	Populations in most fishing grounds over-fished; densities in several fishing areas very low; harvest of juveniles, no recent information available
Honduras	Mainly export	Large industrial vessels and auxiliary boats	636-1,328 mt	Increased	459-1,328 mt	Increasing	Insufficient info on stock status, illegal fishing in foreign waters

Country/ territory	Use	Fleet and gear	Annual landings in the 1990s and trend		Annual exports in the 1990s and trend		Overall stock status
Jamaica	Mainly export	Large industrial vessels (20-30m) and auxiliary boats; Scuba, hookah, free-diving	1,366-3,000 mt	Decreased	19-1,989 mt	Decreasing	Pedro Bank: overall population status +/- stable, but unknown and possibly significant level of illegal fishing by foreign vessels; status of inshore populations unknown
Martinique (FR)	Mainly domestic, meat imports	Small boats; Free-diving and bottom nets	20-30 mt in 1990	Insufficient data	No exports reported	Important importer	Shallow water populations overfished; harvest largely juveniles, stock population status not sufficiently known
Mexico	Domestic consumption, meat also imported	Small boats (5-8m); approximately 38 boats and 115-130 fishermen at Chinchorro and 15 boats and 45-55 fishermen at Cozumel Scuba and free-diving	42 mt (>300 mt in 1970s)	+/- stable	No exports reported		Several areas affected by over-exploitation, inshore populations considered depleted, to date fishing is allowed only at two banks, some signs of recovery noted in certain areas after six year fishing ban, however illegal fishing is of concern and still presents major problem
Montserrat (GB)	Only subsistence fishing		Unknown		No exports reported		Stocks overfished, no recent information available
Netherlands Antilles (NL)	Domestic consumption, also some (unreported) imports		Unknown		61mt in 1994	Exports only reported in 1994	Stocks overfished and depleted in most areas including Saba Bank, some areas close to stock collapse; depletions caused by over-fishing in Curacao, and more severely in Bonaire, but no recent population surveys
Nicaragua	Mainly export	Scuba	17-65 mt	Increased	6.8-41mt	Increasing	No population data available, but surveys and population study initiated in 2001
Panama	Mainly domestic	Free-diving	up to 372 mt	Insufficient information	No exports reported		Very low densities in Bocas del Toro (1.4 ind./ha), status in other areas not well known, but stock considered overfished, temporary fishing ban under consideration
Puerto Rico (US)	Domestic, additional meat imports	Scuba, free-diving	75-128 mt	Fluctuating	No exports reported	All harvest is consumed locally	Stocks depleted and overfished, low densities in most areas, temporary fishing ban under consideration

Country/ territory	Use	Fleet and gear	Annual landings in the 1990s and trend		Annual exports in the 1990s and trend		Overall stock status
Saint Kitts and Nevis	Mostly export	Small boats (5-7m); Scuba, free-diving	20-90 mt	Fluctuating	6 mt	Data not included in CITES annual report data due to insufficient reporting	Some areas (shallow waters) over-exploited, but harvest is still mostly mature animals; overall insufficient info to determine stock status
Saint Lucia	Domestic and export, some imports	Small boats (8m); Scuba, free-diving and bottom nets	20-40 mt	Increased	1.2-15 mt	Standing Committee recommendation between 1999 and 2002	Near shore stocks overexploited and therefore deep water stocks are increasingly targeted; but harvest is still mostly mature animals, no stock assessment undertaken
Saint Vincent and the Grenadines	Domestic and export	Small boats (6m); Scuba and hookah	7-37 mt	Decreased	0.1-12.6 mt	Fluctuating, recently increasing due to increased demand	Over-exploitation of stocks in shallower waters noted but no assessment conducted. Information extrapolated from anecdotal information.
Trinidad and Tobago	Domestic, some regional imports/re-exports from Saint Vincent and the Grenadines and Grenada	Small boats	Unknown		1-6 mt	Standing Committee recommendation in place since 1999	Populations considered small, no further information available
Turks and Caicos Islands (GB)	Mostly export	Small boats; Free-diving	736-964 mt	+/- stable	9-482 mt	Fluctuating	Overall population +/- stable, but localised signs of overfishing; unknown level of poaching
Virgin Islands (US)	Domestic, additional meat imports	Small boats; Scuba	9-35 mt	Fluctuating	4 kg in 1995	All harvest is consumed locally	Populations depleted with low densities, illegal harvest of juveniles, populations considered overfished and temporary fishing ban under consideration,
Venezuela	Before fishing ban: mostly export to Bonaire, Curacao, Martinique	Small boats; Free-diving	Harvest banned (up to 360 mt in 1988)		5 mt in 1998		Population largely affected by over-exploitation in the 1980s; harvest banned since 1991; some recovery; illegal harvest and trade (both national and international e.g. to Netherlands Antilles)

Source: Based on literature and reports referenced in the text and on Appeldoorn, 1994b; Chakalall and Cochrane, 1996; Tewfik, in press, and Theile, 2001

A5. Capture production of Strombid conchs in metric tones reported by FAO for the Atlantic West Central (no capture reported from other areas).

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Anguilla	11	5	18	8	9	5	10	10	10	10	10	10
Antigua and Barbuda	104	175	201	70	69	46	39	35	45	46	42	37
Bahamas	335	409	358	527	693	494	589	648	670	472	667	661
Belize	1,254	1,557	1,571	1,137	1,413	1,026	1,105	1,926	1,891	1,051	1,745	1,980
British Virgin Islands (GB)	.	.	.	.	32	43	54	8	9	8	6	6
Cuba	61	63	51	90	47	32	717	1,234	487	831	830	830
Dominican Republic	5,120	4,300	2,640	2,600	4,680	2,210	1,889	1,594	2,683	1,257	1,778	1,437
Grenada	8	15	< 0.5	11	1	2	6	1	24	6	< 0.5	2
Guadeloupe (FR)	520	470	470	480	500	500	430	470	550	580	550	550
Haiti	400	400	350	400	380	350	400	380	350	300	300	300
Honduras	216	775	722	485	402	410	490	2,987	500	44	832	.
Jamaica	800	1,000	1,500	2,000	2,300	2,133	2,850	1,821	1,700	1,366	< 0.5	.
Mexico	3,105	1,478	3,218	4,023	2,670	4,963	2,566	5,218	3,293	7,243	8,295	8,730
Netherlands Antilles (NL)	10	10	5	5	5	5	5	5	5	5	5	5
Nicaragua	-	-	-	-	-	-	-	-	162	209	555	956
Puerto Rico (US)	.	.	308	375	405	758	450	638	1,025	1,025	1,710	1,643
Saint Kitts and Nevis	.	.	.	.	21	29	49	38	140	91	76	75
Saint Lucia	4	6	8	10	13	15	15	25	28	25	40	41
Saint Vincent and the Grenadines	.	.	.	.	32	30	25	10	21	7	7	37
Turks and Caicos Islands (GB)	426	507	439	738	699	695	647	650	788	770	770	770
Virgin Islands (US)	24	32	30	25	20	15	10	5	5	1	1	1
Venezuela	35	27										

(Source: FAO Fishstat, 2003)