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F/SER29:AJS

AUG 6 2014

MEMORANDUM FOR: David Bernhart
Assistant Regional Administrator, Protected Resources Division

FROM: Phil Steele
Assistant Regional Administrator, Sustainable Fisheries Division

SUBJECT: Sustainable Fisheries Review and Input on the Draft Queen Conch 12-month Listing Determination

Earlier this year, the Sustainable Fisheries Division (SFD) and the Southeast Fisheries Science Center provided the Protected Resources Division (PRD) with queen conch abundance estimates, a meta-analysis of factors affecting the status and health of queen conch, and mapping of queen conch densities and oceanographic currents for evaluating dispersal and recruitment of queen conch. This information was incorporated into the draft queen conch 12-month listing determination. During review of this document, PRD staff requested additional input and review from SFD. In particular, SFD was asked to more thoroughly review and discuss the adequacy of regulatory mechanisms for queen conch, evaluate the utility of overall abundance estimates for queen conch, further discuss and summarize trends in queen conch density, and evaluate trends in landings in relation to the sustainability of queen conch.

In conducting this secondary review, SFD staff reviewed and evaluated trends in landings, densities, and catch rates either on a Caribbean-wide basis or by country when available. Life history characteristics were also considered, such as minimum densities for mating success, and regulations were evaluated with regard to their ability to sustain queen conch harvest. Data were then compiled and a queen conch 'sustainability' index was created.

The attached report summarizes SFD's response to PRD's comments on the draft listing determination. If you have any questions regarding this response please contact Andy Strelcheck on my staff at 727-824-5374.

cc: F/SE – Crabtree, Croom
F/SER29 – Strelcheck
F/SER31 – Hoffman, Bolden, Horn

Sustainable Fisheries Input on Draft Queen Conch 12-month Finding
July 18, 2014

Background

The Office of Protected Resources requested additional input from the Sustainable Fisheries Division (SFD) on the draft queen conch 12-month determination. Previously, SF and the Southeast Fisheries Science Center (SEFSC) had provided queen conch abundance estimates, a meta-analysis of factors affecting the status and health of queen conch, and mapping of queen conch densities and oceanographic currents for evaluating dispersal and recruitment of queen conch. During review, the Office of Protected Resources provided several comments pertaining to the 12-month determination, which SF was asked to further review and consider. Below is a brief synopsis of the major comments SF was asked to consider and respond to:

- Estimates of abundance should not be produced due to data limitations and model assumptions. The overall abundance of queen conch is not really a relevant factor; rather, conch densities are the key factor. There is no discussion of trends in density or abundance despite the status report providing numerous sources of information.
- The adequacy of regulatory mechanisms should be more thoroughly discussed. The draft determination simply provides a list of regulations. Additionally, there is limited discussion of poaching and illegal trade in the document.
- The determination does not discuss that many fisheries in the Caribbean catch juvenile conch, which would lead to growth overfishing.
- The assertion of sustained fishing is not consistent with Food and Agriculture Organization (FAO) landings data, which indicates a 50% decline in landings has occurred since the mid-1990s. Additionally, although landing stabilized from 2007-2011, they were at reduced levels relative to the peak in the mid-1990s.

In conducting a secondary review in response to the above comments, SF focused on factors affecting the 'sustainability' of queen conch. Typically, population assessments are used to assess sustainability by comparing fishing mortality rates and abundances/biomasses to established reference points. In this instance, a Caribbean wide assessment was not available for evaluating the status, health, and sustainability of queen conch. Instead, SF reviewed and evaluated trends in landings, densities, and catch rates (i.e., catch per unit effort) either on a Caribbean-wide basis or by country when available. Additionally, life history characteristics were also considered, such as minimum densities for mating success. Literature was searched to determine the composition of juveniles versus adults in queen conch catches. Lastly, regulations were evaluated with regard to their ability to prevent overharvest, including the amount of poaching and illegal harvest that may be occurring. Data were then compiled and a queen conch 'sustainability' index was created.

This report does not attempt to reach a conclusion on the sustainability of queen conch. Rather, it is intended to provide an overall review of data available for consideration in the 12-month queen conch determination and is provided to the Protected Resources Division for their formal consideration.

Landings Trends

Queen conch landings by country from the Food and Agriculture Organization (FAO) were available from 1950 through 2011 (Calusa Horn, pers. comm.) for the Caribbean. A total of 30 countries had reported and/or estimated queen conch landings during this time. Only two countries had landings for all 62 years in the time series. In many instances, landings were estimated by the FAO when a country did not report landings and for some countries landings were not reported or estimated (Figure 1). Estimated landings typically represented a small portion of the total annual landings (<5%). Figure 2 summarizes landings data available for each country from 1980 through 2011 (note: landings prior to 1980 are not shown). There was a rapid increase in landings from the mid-1980s through the mid-1990s, after which landings declined.

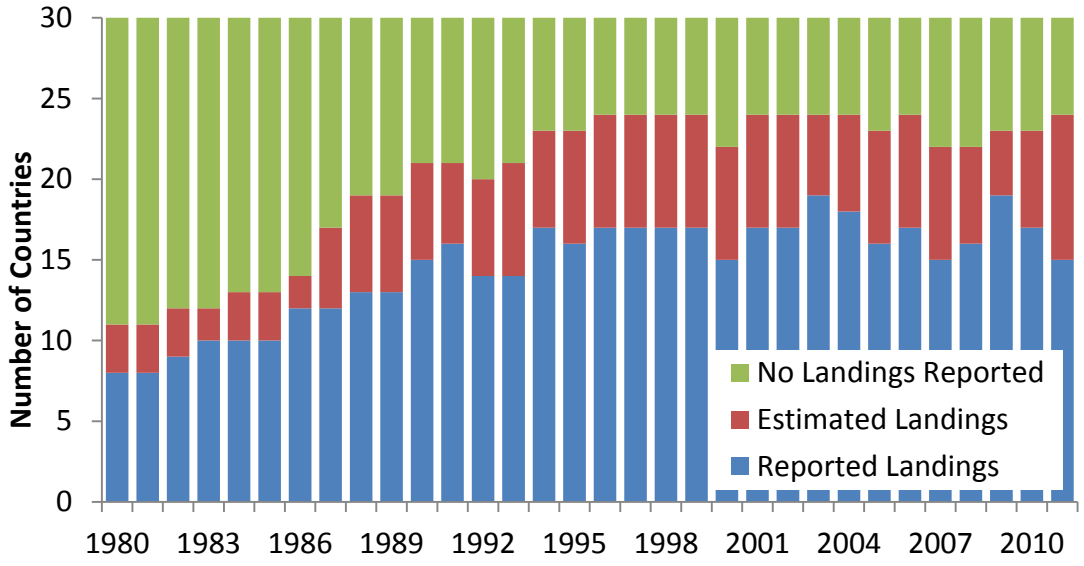

Figure 1. Number of countries with reported, estimated, and no reported queen conch landings, 1980-2011.

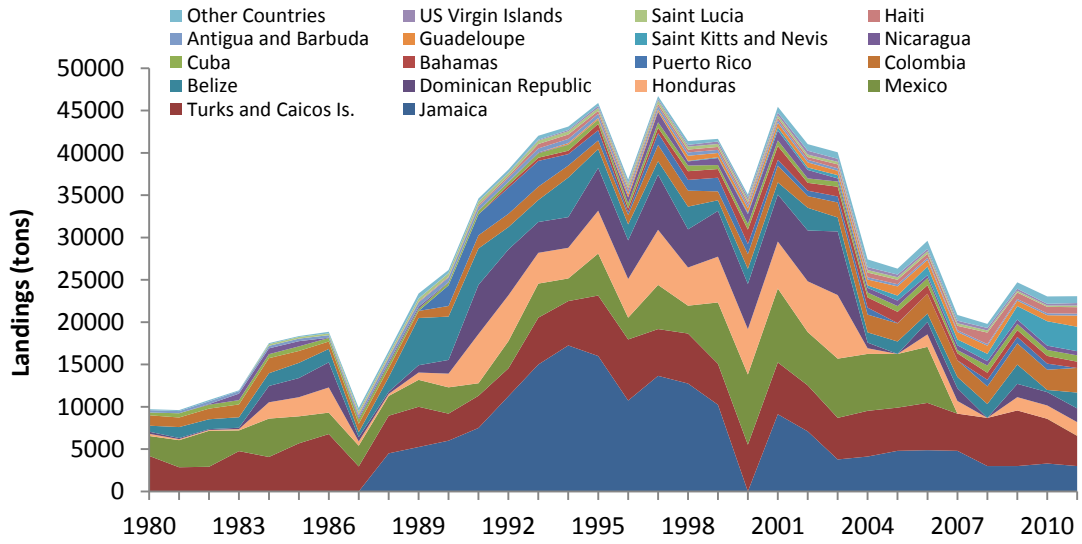

Figure 2. FAO queen conch landings by Caribbean country, 1980-2011.

As noted in the reviewer comments, there was a 50% decline in landings from the mid-1990s through 2011. However, this decline as well as the increase in landings leading up to the peak is confounded by several factors. First and foremost, improvements in data reporting have occurred over time. Between 1980 to 1990, the number of countries reporting landings increased from 8 to 15, including several countries with major amounts of landings such as Jamaica, Columbia, and Puerto Rico. By the early 2000s, 19 countries were reporting landings and landings for 6-7 other countries were being estimated by the FAO (Figure 1). Although an increase in landings is apparent, this increase may not have been as substantial if landings were being reported by more countries leading up to the peak in landings.

The number of countries with reported or estimated landings reached a maximum of 24 in 1996 and has remained fairly constant since. Based solely on available landings, there was a 47% decline in landings from the peak observed in 1995 (40,835 tons) through 2011 (21,448 tons). However, this decline is confounded by several regulatory measures, as well as non-reporting. For instance, there are no reported or estimated landings for Mexico during 2006-2011, yet prior to that time Mexico was averaging over 6,000 tons of annual landings. The reason for Mexico not reporting landings has yet to be determined, but it is not due to a full moratorium on harvest as Mexico did not close Chinchirro Bank until 2012 (Aldana Aranda GCFInet communication). Closures off the Yucutan and Quintana Roo were implemented in the late-1980s and early 1990s (CITES 2012).

Jamaica accounted for the largest amount of landings of any country during 1980-2011 (22%), but overharvest led to more restrictive management and implementation of harvest quotas. Harvest off Jamaica was unregulated until 1994 (Murray et al. 2012). In 1994, the first harvest quotas were implemented. Jamaica began conducting scientific surveys and setting total allowable catches based on conch abundances (Murray et al. 2012). This led to considerably lower landings and fishing effort after the mid-1990s in response to more sustainable and scientifically based harvest practices.

Similarly, following the Caribbean-wide peak in landings in the mid-1990s, two other countries saw major declines in landings. Landings from Honduras decreased in 2003 due to a moratorium on harvest imposed by the government in response to the Conservation on International Trade in Endangered Species (CITES) concerns regarding the lack of information, high amount of exports, lack of landings records, illegal activity, and low population densities. Harvest and trade resumed in 2006, but only for conch collected through scientific surveys. Total allowable catch levels are considerably lower now than peak Honduran landings.

CITES also suspended exports from the Dominican Republic in 2003 due to high landings and a lack of current stock information (CITES 2006). Exports were suspended from 2003 through 2012, during which time the fishery existed mostly for tourism and domestic consumption (Torres and Sullivan Sealy 2002b; FAO report 2012).

If landings from Jamaica, Mexico, the Dominican Republic, and Honduras are excluded from Figure 2 due to confounding regulatory changes and missing landings, then the cumulative trend in landings looks very different for the remaining countries (Figure 3). In fact there is a very

stable trend in landings from 1993 forward which also corresponds well with improvements in data reporting (see Figure 1).

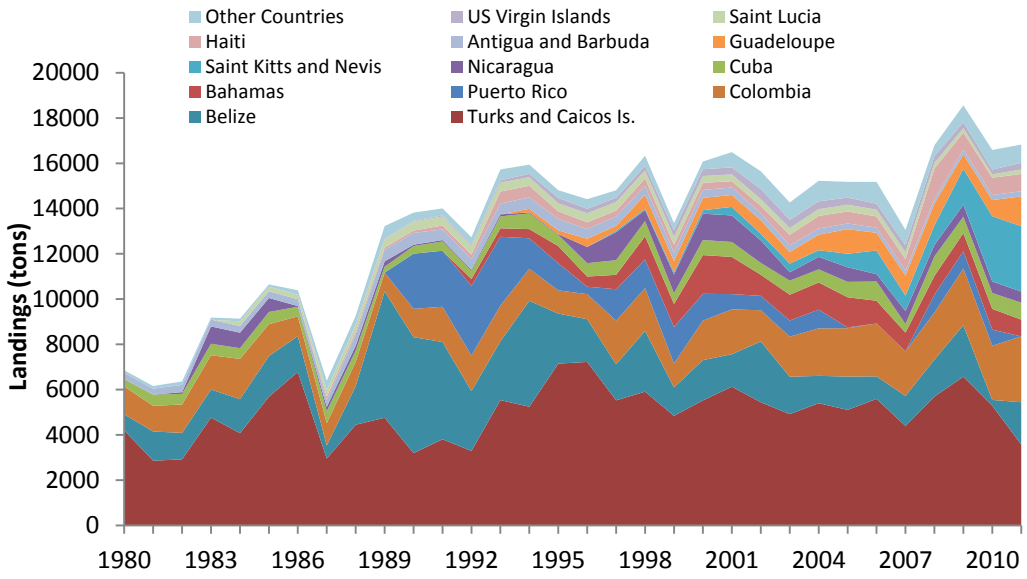

Figure 3. FAO queen conch landings by Caribbean country, 1980-2011. Landings from Jamaica, Mexico, the Dominican Republic, and Honduras were excluded due to major changes in regulations and missing landings.

There were also other regulatory changes that affected trends in landings from other countries, but none as significant as those observed for Jamaica, Honduras, Mexico, and the Dominican Republic. The above is not intended to assess the sustainability of queen conch, but merely point out that landings should be interpreted with caution and should be used with other sources of data to assess trends in population abundance, as reporting levels and regulations confound overall trends in landings. Regardless of improvements in reporting and confounding regulations, landings alone may not be a useful indicator of stock health. Landings can increase, decrease, or remain stable for numerous reasons that do not necessarily reflect stock abundance or 'sustainability'. For instance landings may be increasing because of increasing effort, but such harvest rates may not be sustainable. Similarly, hyper-stability may occur in which fishermen over time expend more effort to catch the same amount of conch. If this occurs, then catch per unit effort may decline while landings remain stable, leading to reduced population abundance. Lastly, landings may decline due to more sustainable harvesting practices, economic factors, or reduced stock abundance, but any declines should be carefully evaluated against fishery survey data and fishery-dependent data - catch per unit effort (CPUE) to determine the root cause of the decline.

Although it may be informative to note there has been a large decline in landings in the last few decades, any reference to this decline in the 12-month determination should be accompanied with a discussion of the data caveats described above.

Abundance Estimates

During review of the Draft Queen Conch 12-month determination, the following comment was made during review by Protected Resources staff: *Estimates of abundance should not be produced due to data limitations and model assumptions. The overall abundance of queen conch is not really a relevant factor; rather, conch densities are the key factor.*

SERO SF staff and SEFSC assessment staff disagree with the above comment and believe estimates of queen conch abundance are relevant and should be considered in the 12-month determination in conjunction with density data. NMFS' own guidance for conducting status reviews under the Endangered Species Act (ESA) (May 24, 2013), as adapted from McElhany et al. (2000), emphasizes the need to conduct an extinction risk analysis in terms of a population's abundance and trends (as well as other factors). Abundance data can be used in conjunction with density estimates to ascertain population trends and conch sustainability. The abundance estimate produced by the SEFSC is based on published literature and government reports and uses the best available scientific information. The estimate represents a minimum estimate of queen conch in the Caribbean since biomass and abundance estimates were only available for some, but not all Caribbean countries. Additionally, abundance estimates could only be extrapolated to a fraction of the range of conch in many areas because the surveys were not conducted over the entire range. Despite being a minimum estimate, population abundance is estimated to be very large at 170,000,000 adult queen conch. Although only a point-estimate for abundance is provided and there is no long term trend in overall Caribbean-wide queen conch abundance, high standing stock abundance (even if reduced from historical levels) can provide useful information for assessing how threats may affect queen conch in the foreseeable future. Abundance estimates by country, as summarized in the SEFSC's memo, provide a way to evaluate the status of queen conch throughout discrete parts of its geographic range. This is particularly important in considering whether or not queen conch are threatened since a threatened listing indicates they would become endangered within the foreseeable future throughout <u>all or a significant portion</u> of their geographic range.

Assessing 'Sustainability'

As noted in the Queen Conch Status Report, the minimum threshold density to ensure sustainability has been found to be a 50 conch/ha minimum cross shelf density (Stoner and Ray-Culp 2000) and 185 conch/ha intra-aggregation density (Glazer 2008). In 2012, the report from the queen conch expert workshop recommended that a median or mean density of 100 adult conch/ha (or higher) should be used (QCEWR 2012). At density levels less than the critical threshold, mating will not occur at the frequency needed to sustain the stock which can lead to a populations collapse (Stoner and Ray-Culp 2000); this is known as an allee effect.

Density data from the top queen conch producing countries were reviewed from published reports and documents. Information was compared to minimum threshold densities noted above. Density estimates were available from a variety of sources. Some were very limited in temporal or geographic scope while others were longer-term surveys that occurred over wide areas. There were also many studies providing density estimates both within and outside of marine reserves.

No attempt was made to evaluate the adequacy or comprehensiveness of these surveys, including how representative they were in geographic scope. Density estimates from smaller spatial surveys may not be fully representative of a country's conch population, especially if surveys are conducted in areas of lesser or greater fishing pressure. In comparison, surveys that are repeated every few years and are conducted over wide-geographic areas are likely to provide a more representative density of the overall conch population.

Regulations and regulatory compliance were also reviewed to determine their adequacy in sustaining harvest. For instance, limits on harvest were evaluated relative to the size at 50% maturity. There are several different methods for measuring conch at maturity, including shell length, flared lip thickness, and meat weight. Sizes at maturity also vary by region/country. For instance, Stoner et al. (2012) estimated ~50% of male conch were mature by 210 mm (shell length) and 24 mm (shell thickness) and 50% of female queen conch were mature by 206 mm (shell length) and 26.2 mm (shell thickness). Off the San Andres Archipelago, Avila-Poveda and Baquiero-Cardenas (2006) estimated ~50% of male conch were mature by 234 mm (shell length) and 13 mm (shell thickness) and 50% of female queen conch were mature by 249 mm (shell length) and 17.5 mm (shell thickness). Similarly, regulatory mechanisms for limiting fishing effort (e.g., prohibition on self-contained underwater breathing apparatus [SCUBA], etc.) and protecting conch through seasonal and spatial closures were also examined.

Since the 12-month finding must examine queen conch on a Caribbean-wide basis, 'sustainability' was first assessed by country (see Appendix 1). A sustainability index was then developed to assess the overall 'sustainability' of queen conch by the top producing Caribbean countries. Eleven countries were included in the analysis (see Appendix 1). These countries represented 92.4% of the Caribbean queen conch landings between 1980-2011 and 91.6% of the landings between 2000-2011. Index results were weighted by recent country landings (2000-2011; Table 1). Weighting factors were developed for each country by dividing the country's average 2000-2011 landings or possible queen conch habitat (acres) by the total landings or acreage for all 11 countries during the same time period. The maximum score for the index is 20. Sustainability factors considered in the analysis are summarized in Table 2.

It should be noted that the sustainability factors and scores summarized in Table 2 are intended only to serve as general guidance. Other sustainability factors could also be considered (e.g., larval connectivity) and scoring could be modified in many ways for index estimation. Density estimates received 50% of the total score (scale of 0 to 10) given limitations on reproductive mating occur at low densities (Stoner et al. 2012) and could negatively affect stock sustainability unless there is recruitment from other countries. Management factors and regulatory compliance received the remaining 50% of the score (scale of 0-2 for four management factors and 0-2 for illegal harvest/poaching). Scores closer to the maximum 20 score indicate greater Caribbean-wide sustainability of queen conch. Scores closer to zero indicate unsustainable harvest practices. A score near 10 would indicate harvest practices that may be sustainable for some countries and unsustainable for other countries. In addition to an overall Caribbean-wide index value, the index also assigned index values for each country. Scores were assigned based on review of available data and literature (see Appendix 1).

Overall, across all 11 countries the index score was 8.55 out of 20 when weighted by landings (Table 3) and 8.90 out of 20 when weighted by acreage (Table 4). This indicates lower densities and/or unsustainable harvest and management practices are occurring in some, but not all countries. Cuba, Honduras, Jamaica, and Columbia received the highest scores due to a combination of sustainable management practices coupled with moderate to high densities of queen conch. Mexico, Puerto Rico and the Dominican Republic received the lowest scores primarily due to a lack of regulations and low densities of queen conch. It was noteworthy that 9 of the 11 countries had at least some surveys reporting queen conch densities in excess of the minimum 56 conch/ha mating threshold and 4 countries reporting densities in excess of 100 conch/ha. Additionally, despite densities well below minimum mating thresholds fisheries still persist in Puerto Rico and the Dominican Republic. This could be due to a variety of reasons including harvest of juveniles and fishing for conch in deeper water (although prohibited off Puerto Rico in federal waters). However, it could also be due to recruitment of conch from other source populations in the Caribbean, allowing fisheries to persist in countries that have overharvested conch to low adult density levels. For more information on each countries landings, regulations, regulatory compliance (illegal harvest and poaching), and density estimates see Appendix 1.

Table 1. Weighting factors for the Queen Conch Sustainability Index

Country	**Average Landings (2000-2011) mt**	**Weighting Factor (landings)**	**Acres of Possible Habitat**	**Weighting Factor (acreage)**
Turks and Caicos Islands	5,301	0.2205	425,448	0.006
Jamaica	4,241	0.1764	2,156,728	0.029
Mexico	4,167	0.1733	6,570,484	0.088
Honduras	2,735	0.1137	7,456,695	0.100
Belize	2,108	0.0877	2,147,505	0.029
Dominican Republic	1,550	0.0645	1,277,592	0.017
Puerto Rico	1,090	0.0453	825,233	0.011
Nicaragua	1,005	0.0418	11,218,276	0.151
Bahamas	666	0.0277	24,637,913	0.332
Cuba	653	0.0272	14,223,300	0.191
Colombia	528	0.0220	3,348,287	0.045

Table 2. Sustainability factors and scores used for the Queen Conch Sustainability Index.

Sustainability Factor	**Sustainability Score**
Regulations (Min Shell Length or Meat Weight)	0 = unknown or no size/weight/lip thickness limit; 1 = size/weight/lip thickness limit below 50% maturity; 2 = size/weight/lip thickness above 50% maturity
Regulations (Quota Limits/TACs; effort restrictions)	0 = no limits; 1 = quotas set, but surveys infrequent; 2 = TACs set based on recent, period scientific surveys.
Regulations (Closed Season/MPAs)	0 = no closure or MPAs; 1 = short seasonal closure and/or few MPAs which prohibit harvest; 2 = lengthy seasonal closure and/or extensive network of MPAs which prohibit conch harvest
Regulations (SCUBA/Hookah)	0 = SCUBA/Hookah allowed; 1 = SCUBA prohibited, Hookah allowed; 2 = SCUBA and Hookah prohibited
Illegal harvest, poaching , and enforcement	0 = unknown or high illegal harvest/poaching; 1 = moderate illegal harvest/poaching; 2 = low illegal harvest/poaching and high enforcement
Densities	0 = densities below 56 adult conch/ha; 2.5 = densities between 56-100 adult conch/ha; 5 = densities between 101-200 adult conch/ha; 7.5 = densities between 200-500 adult conch/ha; 10 = densities >500 adult conch/ha.

Table 3. Queen conch sustainability index scores by country and the total weighted score. Score was weighted by landings.

Country	Weighting Factor	Minimum Size/Lip/Weight	TAC/ quota	Closures/ MPAs	SCUBA/ Hookah	Poaching/ Illegal Take	Densities	Weighted Score	Max Score	% of Max
Cuba	0.027	1	2	2	2	1	10	0.49	0.54	90%
Jamaica	0.176	1	2	2	1	1	5	2.12	3.53	60%
Honduras[1]	0.114	1	2	2	0	1	5	1.25	2.27	55%
Colombia[2]	0.022	1	2	2	2	1	2.5	0.23	0.44	53%
Belize[1]	0.088	1	2	2	1	1	2.5	0.83	1.75	48%
Turks & Caicos	0.221	1	2	2	2	0	2.5	2.09	4.41	48%
Nicaragua	0.042	1	0	1	0	0	6.25	0.34	0.84	41%
Bahamas[2]	0.028	0	0	1	1	0	2.5	0.12	0.55	23%
Mexico[2]	0.173	1	0	2	0	0	1.25	0.74	3.47	21%
P.R.	0.045	2	0	1	0	0	0	0.14	0.91	15%
Dom. Rep.	0.065	2	0	1	0	0	0	0.19	1.29	15%
Total	**1.000**							8.55	20.00	43%

[1] It is unknown whether densities for Honduras and Belize include only adults or both adults and juveniles. Honduras density estimates ranged from 93-248; therefore, a score of 5 was assigned to account for the range in density estimates. Additionally, a score of 1 was assigned to Honduras for minimum size. Although there is no minimum size Regaldo (2012) indicates all conch harvested are mature.

[2] Densities for Columbia ranged from < 50 conch/ha to >100 conch/ha. A density score of 2.5 was assigned to account for these different density estimates. Densities for Nicaragua ranged from 176-267. A score of 6.25 was assigned to account for these differences. Densities for Mexico ranged from 23-96 conch/ha. A score of 1.25 was assigned to account for these differences.

Table 4. Queen conch sustainability index scores by country and the total weighted score. Score was weighted by potential queen conch acreage.

Country	Weighting Factor	Minimum Size/Lip/Weight	TAC/ quota	Closures/ MPAs	SCUBA/ Hookah	Poaching/ Illegal Take	Densities	Weighted Score	Max Score	% of Max
Cuba	0.191	1	2	2	2	1	10	3.45	3.83	90%
Jamaica	0.029	1	2	2	1	1	5	0.35	0.58	60%
Honduras[1]	0.100	1	2	2	0	1	5	1.10	2.01	55%
Colombia[2]	0.045	1	2	2	2	1	2.5	0.47	0.90	53%
Belize[1]	0.029	1	2	2	1	1	2.5	0.27	0.58	48%
Turks & Caicos	0.006	1	2	2	2	0	2.5	0.05	0.11	48%
Nicaragua	0.151	1	0	1	0	0	6.25	1.25	3.02	41%
Bahamas[2]	0.332	0	0	1	1	0	2.5	1.49	6.63	23%
Mexico[2]	0.088	1	0	2	0	0	1.25	0.38	1.77	21%
P.R.	0.011	2	0	1	0	0	0	0.03	0.22	15%
Dom. Rep.	0.017	2	0	1	0	0	0	0.05	0.34	15%
Total	**1.000**							8.90	20.00	45%

[1] It is unknown whether densities for Honduras and Belize include only adults or both adults and juveniles. Honduras density estimates ranged from 93-248; therefore, a score of 5 was assigned to account for the range in density estimates. Additionally, a score of 1 was assigned to Honduras for minimum size. Although there is no minimum size Regaldo (2012) indicates all conch harvested are mature.

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APPENDIX 1

Jamaica

Landings - Jamaica accounted for 22% of queen conch landings from 1980-2011 (Ranked #1) and 16% of the landings from 2000-2011 (Ranked #2). Jamaican landings peaked in 1994, declined through 2007, and have remained stable at ~3000 mt since 2008. Landings post-1994 have been based on annual total allowable catch (TAC) limits.

Management Regulations - The fishery is managed using annual TACs and individual fishing quotas (Aiken et al. 2006; Kong 1997). TACs are set based on scientific surveys of the queen conch population on the Pedro Bank (Murray et al. 2012). Individual quotas are associated with licenses to ensure the TAC is not exceeded (Aiken et al. 2006). There is a closure from July 31 through February 1 each year. Conch harvest is prohibited within the South West Cay Special Fisheries Conservation Area and within a 2 km radios around Bird Key/Southwest Key on Pedro Bank. SCUBA is prohibited.

Illegal Fishing - In 1997, the Jamaica Defense Force established an offshore base to try to combat poaching (Aiken et al. 1997). A high amount of poaching occurred in 2000/2001 when the Jamaican fishery was closed (NMFS 2014a). High levels of poaching were estimated for most years (CITES 2003), and the 2001 TAC was reduced by 22% to account for poaching. More recent information on poaching and illegal harvest is limited. Jamaica's Defense Force Coast Guard has caught numerous Honduran vessels illegal poaching conch on Pedro Banch in recent years (http://www.jamaicaobserver.com/news/Lobster-poachers-rob-Ja-of-US-132m_8941558, http://jamaica-gleaner.com/gleaner/20101013/lead/lead3.html). Jamaican queen conch losses due to poaching were at one time estimated at 400 MT. However, due to the intervention of the CITES, poaching for conch has reduced significantly (http://www.jamaicaobserver.com/news/Lobster-poachers-rob-Ja-of-US-132m_8941558). Given the abundance surveys mentioned below, as well as individual quotas issued to licenses, any illegal take is directly accounted for when setting overall TACs based on scientific survey abundances.

Densities/Catch-per-unit-effort - Five conch abundance surveys have been completed since 1994, with the most recent survey conducted in 2011. Catch per unit effort (kgs/diver hr) declined from 40 kg/diver hr in 1994 to 18 kg/diver hr in 1998, but has since increased to 37 kgs/diver hr in 2012 (Murray et al. 2012). In 2011, mean densities for the exploitable biomass (inclusive of size classes > 200 mm in shell length) averaged 185 conch/ha, while mean densities of all size classes averaged 370 conch/ha (Murray et al. 2012). Biomass of Jamaican queen conch was estimated to decline from 13,325 mt in 1994 to a low of 7,421 mt in 2007. Since 2007, biomass has increased to 12,213 mt and densities have increased, especially between 10-30 m (WECAFC 2012). Overall adult densities of conch are above the recommended 100 conch/ha threshold for maintaining mating success.

Turks and Caicos

Landings – The Turks and Caicos Islands accounted for 20% of the Caribbean-wide landings from 1980-2011 (Ranked #2) and 20% of Caribbean-wide landings from 2000-2011 (Rank #1). Landings were stable from 1980-2011 at ~5000 mt but have recently declined following hurricanes in 2008 (Wood 2012; Haughton 2012; DEMA 2012).

Management Regulations - Regulatory measures include a minimum shell length of 18 cm, or a meat weight of no less than 225 g (NMFS 2014a). All conch must have a flared lip to be landed. The uses of SCUBA and hookah gears are prohibited and there is a closed season to exports from July 15 through October 15 (NMFS 2014a) although conch can still be fished and consumed locally. The minimum length limit is below the size at 50% maturity. Since 1994, there has been a quota system in place and there are 35 protected areas encompassing almost 1/3 of the Turks and Caicos area. From 2004-2011, quotas ranged from 1.5 to 1.6 million pounds (Note: unit of measure was inferred from presentation given at QCWG meeting in 2012). In 2012, the quota was reduced to 800,000 pounds.

The Admiral Cockburn Land and Sea National Park prohibits fishing. This 480 acre (1180 hectares) protected area includes a small portion of the south coast of South Caicos and the small cays of Long Cay, Six Hill Cays and Middleton Cay. East Harbor Lobster and Conch Reserve is a no-take fishing reserve off of south Caicos.

Illegal Fishing – According to a report presented by the Turks and Caicos government at the Queen Conch Working Group meeting in 2012, the Turks and Caicos is threatened by large-scale poaching operations from neighboring Hispaniola. To combat illegal poaching, the Turks and Caicos recently installed a radar station, which resulted in the apprehension of a poaching vessel in 2012. The radar station allows all vessels entering territorial waters to be monitored for suspicious activity. There is a small percentage of illegal fishing by local fishers (QCWG 2012 - TCI presentation). There are numerous enforcement issues in the Turks and Caicos, including a lack of financial resources for boat repairs and gas, and a loss of personnel (QCWG 2012 – TCI presentation).

Densities/Catch-per-unit-effort – The most recent published survey of queen conch densities was in 2000. The study by Grabowski and Tewfik (2000) indicated adult conch densities of 149 conch/ha outside a marine protected area and conch densities of 575 conch/ha inside an MPA. Juvenile densities were >400 conch/ha inside and outside the MPAs. More recent conch visual survey data indicates densities less than 100 conch adults/ha (K. Wood, pers. comm. to C. Horn, June 27, 2014). The Turks and Caicos is currently contemplating an export closure for 2014 that would continue after October 15 (K. Wood, pers. comm. to Calusa Horn, June 27, 2014). Currently, no exports are allowed from July 15 to October 15. Trends in CPUE were stable from the mid-1990s through 2006, then increased to a peak in 2008, before precipitously falling thereafter. CPUE in 2010-2011 was approximately ½ of the CPUE observed during the stable period from 1993 through 2006. The decline in CPUE and landings is attributed in part to Hurricanes Ike and Hannah.

Mexico

Landings – Mexico accounted for 15% of the landings from 1980-2011 (Ranked #2) and 16% of landings from 2000-2011 (Rank #3). Landings were fairly stable from 1980 through the late 1990s, then increased rapidly in 1999 and averaged ~6,000-7,000 mt until 2006. No landings after 2006 were reported to the FAO.

Management Regulations – The Queen Conch Status Review provides limited information on Mexican regulations. There is a minimum size limit for Mexican queen conch of 20 cm (Thiele 2001). SCUBA and hookah are not prohibited. Temporary and permanent fishery closures have been imposed throughout Mexico over time. In November 2012, the entire fishery in Chinchorro Bank was closed and will remain closed until February 2017 (Aldana Aranda GCFInet communication).

Illegal Fishing – Based on unpublished data, De Jesús-Navarrete estimated illegal harvest was similar to the amount of conch caught legally. As noted by CITES (2012), illegal fishing of queen conch at both the Chinchorro and the Cozumel Banks and at Alacranes reef were thought to be significant factors preventing recovery of queen conch populations.

Densities/Catch-per-unit-effort – Jesus-Navarrete and Valencia-Hernandez (2013) published the most recent data on queen conch densities off Chinchirro Bank, Mexico. The study was conducted in the Banko Chinchirro Biosphere Reserve. Adult queen conch densities ranged from 23 conch/ha in July 2009 to 96 conch/ha in November 2009. These density estimates were considerably less than those observed by Chavez (1990) and DeJesus-Navarrete et al. (2003) between 1990 to 1997 in the same area. Adult densities were greater than 10,000 conch in 1990 (Chavez 1990) and ranged from 300-800 adult conch/ha in 1992 (DeJesus-Navarrete et al. 2003). By 1997, adult conch densities had dropped to between 0-100 conch/ha.

Honduras

Landings – From the early 1990s through 2003, Honduran landings average >5,300 mt per year. In 2003. There was a moratorium on conch fishing declared by the Honduran government from 2003 to 2006 in response to CITES' concerns regarding the lack of information, high amount of exports, lack of landings records, illegal activity, and low population densities. Since 2006 (excluding 2008), landings have averaged >1,500 mt live weight.

Management Regulations - The Honduran government established regulations in 1997 that prohibited required queen conch have a minimum shell length of 22 cm (NMFS 2014a). These regulatory measures no longer appear to be in place because they are under a moratorium and only collect conch for scientific research. Regalado (2012) noted that "there are no size limits to the conch landed due to the fact that only mature queen conch are found in the existing fishing grounds in Honduras." Vessels that harvest queen conch are required to be licensed and authorized by the Honduras government (CITES 2012). The commercial fishery has been closed since 2003. Since 2006, export quotas have been set at 210,000kg/annually for meat that is taken during scientific surveys (CITES 2012; Regalado 2012). Only 4 of the 12 industrial fishing vessels are licensed to fish for conch. Observers are onboard vessels to quantify the catch. Vessels must land at an authorized processing plant. The processing plant must submit a bill of sale to the Directorate of Fisheries. Vessels are also tracked using satellites while at sea (Regalado 2012).

The Cayos Cochinos were declared a Biological Reserve in 1993 and since then harvest of queen conch was been prohibited (AC19 Doc 8.3, 2003). A study undertaken in 1996 in the Cayos Cochinos, located on the northern coast, found low densities of 7.3ind./ha for both, juveniles and adults, which was thought to be caused by intensive exploitation during previous decades (CITES 2012).

Illegal Fishing – In the early 2000s there was evidence that significant portions of queen conch meat landed in and exported from Honduras had been fished illegally in waters under the jurisdiction of neighboring states and territories (Queen Conch Status Review 2014). In particular, concerns were raised about the 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). There was also a moratorium on conch fishing declared by the Honduran government from 2003 to 2006 in response to CITES' concerns regarding the lack of information, high amount of exports, lack of landings records, illegal activity, and low population densities. More recent information on poaching and illegal harvest is limited. Honduran vessels have been caught poaching in Jamaican waters (http://jamaica-gleaner.com/gleaner/20101013/lead/lead3.html and http://www.jamaicaobserver.com/news/Lobster-poachers-rob-Ja-of-US-132m_8941558). However, if poaching and illegal harvest is significantly affecting queen conch abundance than that would be reflected in the research surveys described below.

Densities/Catch-per-unit-effort – A research plan was approved in December 2005, which established a protocol for conducting scientific research surveys. Surveys were conducted in 2006, 2007, 2009, 2010, 2011, and 2012. A total of 453 random sampling stations were deployed in the most important fishing grounds (Regalado 2012). On average 20,385 diving

sites swept by individual divers are sampled annually, each corresponding to 2,094 square meters swept by each diver (Regalado 2012). As per the agreement and approval of the conch research program in 2005, the CITES authorized Honduras to export up to 210 metric tons of conch produced annually from research surveys. The funds obtained from such fishing activity are used to fund the project. From 2009 through 2011, conch densities at Rosalind, Oneida, and Gorda banks have ranged from 93-248 conch/ha (Regalado 2012). It is unclear whether these density estimates include juvenile conch. If these densities represent adult conch, then all densities were at or near the 100 conch/ha threshold for mating success and sustainability. The average standing stock size of Honduran queen conch during 2009-2011 was 21,143 mt, which is 100X greater than the 210 mt research survey quota (Regalado 2012).

Dominican Republic

Landings – Dominican Republic landings peaked in 1989 at greater than 5,000 mt, but have since declined to less than 2,000 mt annually. The Dominican Republic accounted for 8% of the queen conch landings between 1980-2011 (Ranked #5) and 6% of the queen conch landings between 2000-2011 (Ranked #6).

Management Regulations – The Dominican Republic set minimum shell size of 25 cm for harvest in 1986. There is a closed season from July 1-October 31 each year, and some closed areas, but no other fishing restrictions. SCUBA and Hookah are allowed. CITES suspended trade exports in 2003 and the moratorium continued through 2012 (NMFS 2014a).

Illegal Fishing – The closed season and closed areas were not effective due to insufficient enforcement (AC19 Doc 8.3, 2003). Dominican vessels have frequently been caught poaching in other states fishing grounds (NMFS 2014a).

Densities/Catch-per-unit-effort – Numerous surveys were conducted in the 1990s and early 2000s, but no queen conch surveys have been conducted in the last decade based on review of the literature. All of the surveys came to similar conclusions and indicated the queen conch fishery was unhealthy. Juvenile and adult densities were observed to decline, only high percentages of juveniles were seen in shallow waters, reproduction was threatened by low densities, and fishing was moving to different areas. In Jaragua National Park, the age structure in shallow water reflected high fishing pressure with a high percentage of juveniles and low percentage of adults. The density of adults found in deeper waters (53 conch/ha) was just at the level needed for successful reproduction (Posada et al. 1999). Low numbers of juvenile conch were found in the historic fishing areas. In the Parque Nacional del Este, the main fishing area in the southeast Dominican Republic, adult mean densities had decreased from 4.5 conch/ha in 1996 to 0.62 conch/ha in 2000 (Torres and Sullivan Sealy 2002a). Juvenile densities also decreased from 283 conch/ha in 1996 to 14.4 conch/ha in 2000 (Torres and Sullivan Sealy 2002a).

Belize

Landings – Belize accounted for 6% of the queen conch landings between 1980-2011 (Ranked #6) and 8% of the queen conch landings between 2000-2011 (Ranked #5). Landings from Belize averaged ~1,000 mt from 1980 through the late 1990s, but have been increasing since then to a high of 2,908 mt in 2011.

Management Regulations – Regulations include a minimum weight limit of 85 gram (market clean weight), 7 inch minimum shell length (17.8 cm), July 1-Sept 30 closed season, and prohibition on SCUBA (NMFS 2014a). Belize has established a network of 9 multiple use, marine reserves positioned along Belize Barrier Reef and 2 offshore atolls (Capture Fisheries Unit, Belize, 2013). The queen conch fishery in Belize is open access, but a limited entry system is being proposed for introduction by fishing year 2015 (Capture Fisheries Unit, Belize, 2013). Since 2004, the Belize government has employed a national conch quota system. The quota is allocated to fishery cooperatives on a monthly basis (Azueta 2012). The TAC estimates obtained from the bi-annual conch surveys are used to establish the National Conch Quotas every two years. The quotas are distributed among the four fishermen cooperatives and once a fishermen cooperative quota is filled then that cooperative ceases to accept conch meat from fishers. When the NCQ is filled then the fishery is closed, even if the official fishing season has not expired (QCWG 2012 – Belize report).

The conservation effectiveness of marine protected areas is of substantial dispute (Chan et al. 2013). In the Belize Barrier Reef, there are several zones with increasing human activity and harvesting of overexploited species. Marine protected areas are designed to protect endangered species and increase the population size of exploited species.

Illegal Fishing – The amount of unreported catch is believed to be small as 90% of the catch is delivered to fishery cooperatives (Azueta 2012). In recent years there has been close cooperation between the BFD and Belize Coast Guard and illegal conch fishing has declined significantly in southern Belize (QCWG 2012 – Belize report). The Belize government acknowledged that there is limited poaching by Belizean fishermen but there is no large-scale poaching by foreigners (QCWG 2012 – Belize report). Recently, the European Union issued a ban on imports from any fish caught on Belize vessels, due to the country's inability to stem illegal fishing (Nielsen, 2014).

Densities/Catch-per-unit-effort – Conch surveys were conducted in 2006, 2008, 2010, and 2012. Surveys in 2006 and 2008 indicated ~100 conch/ha (Gongora 2012). In 2010 and 2012, more than 325 conch/ha were reported (Gongora 2012). Data presented at the 2012 Queen Conch Working Group Meeting indicated 72% of the sampled population in 2012 was considered sub-legal conchs and 28% was considered legal (adult conchs). This equates to a mean density of adults of 94 conch/ha (28% times 337 conch/ha). The average length of conch caught in the fishery was 134 mm in 2008, compared with 153 mm in 2012. These average lengths are well below the size at 50% maturity, and indicative of juveniles being harvested. The average lengths are also below the 7 inch minimum size limit (178 mm).

Chan et al. (2013) compared queen conch densities inside and outside a Belize conservation zone. Densities of juvenile and adult conches in the conservation zone were substantially higher (2000 and 288 individuals/ha, respectively) than in the general use zone (529 juveniles and 58 adults/ha). The shell length of adult individuals ranged from 14.4 to 18.5 cm in the conservation zone and from 14.6 to 18.1 cm in the general use zone.

Columbia

Landings – Landings were first reported in the late 1980s and quickly increased to 3,000 mt. Landings peaked in 1992 and then quickly declined. Between 2008-2010, landings average slightly less than 800 mt per year. Landings were not reported to the FAO in 2007 or 2010. Overall, Columbia accounted for 3% of the queen conch landings from 1980-2011 (Ranked #7) and 2% of the queen conch landings from 2000-2011 (Ranked #12).

Management Regulations – Columbian queen conch are currently managed with a TAC, closed areas (i.e., San Bernardo, Rosario, and Queena), closed season June 1 - October 31, a minimum size limit (100 g cleaned meat; 225 g uncleaned meat), and individual commercial permits with quota distribution (QCWG 2012 – Columbia presentation). SCUBA and Hookah are also prohibited. Based on Stoner et al. (2012), a soft tissue weight of 225 g corresponds to a queen conch shell length of 193 mm, which is slightly less than the length at 50% maturity. In 2008, the TAC was allocated between two atolls (Serrana and Rancador) with most TAC allocated to Serrana. There were also reductions in industrial fishing and time at sea following the reopening of the fishery in 2008 and increases in artisanal fishing (Prada et al. 2008).

Illegal Fishing – Prada et al. (2008) noted that illegal commercial fishing was occurring in National Parks along the Rosario and San Bernardo Archipelagos. They also noted that recovery of queen conch in the San Andres Archipelago was attributable to a three year closure as well as reductions in illegal fishing from neighboring countries during the closure. In May 2010, the Columbian Navy detained a Jamaican fishing vessel for illegal poaching in Columbian waters (http://colombiareports.co/colombia-detains-jamaican-boat-for-illegal-fishing/).

Densities/Catch-per-unit-effort – Visual surveys are conducted every three years (Prada et al. 2008). The most recent published survey was conducted by Prada et al. (2008). Queen conch densities declined along the San Andres Archipelago until 2003 when the fishery was closed for three years. In 2007, Prada et al. (2008) conducted surveys, which indicated recovery in the northern atolls. The recovery was attributed to the 3-year closure and ban on exports from Honduras, Dominican Republic, and Haiti (Prada et al. 2008). Conch populations did not recover in the central and southern atolls due to continued artisanal fishing. Adult densities were >100 conch/ha off Roncador and Serrana, but less than 40 conch/ha off Quintsueno, and less than 10 conch/ha off more southerly atolls. Ballesteros *et al.* (2005), Garcia *et al*. (2005), and Gomez *et al*. (2005) estimated adult queen conch densities along the Rosario and San Bernardo Archipelagos at 1.3-12.8 conch/ha. These archipelagos were declared as National Parks in the 1970s and 1980s, but subsistence fishing is still allowed and illegal fishing activity continues to occur. Prada et al. (2008) estimated the San Andres Archipelago population size at 10.7 individuals weighing 1,674 metric tons. No estimates of population size or biomass were available for the Rosario and San Bernardo Archipelagos. More recent surveys conducted off Serrana indicated adult queen conch densities were > 123 conch/ha (QCWG 2012 – Columbia presentation).

Puerto Rico

Landings – Landings from Puerto Rico are available from the FAO since the early 1990s. Landings records prior to the 1990s summarized by Appeldorn (1991) indicate an increase in landings in the late-1970s and early-1980s corresponding to increased fishing effort and the use of SCUBA. This increase in landings was then followed by a rapid decline in landings through the mid-1980s. During 1980-2011, Puerto Rico accounted for 2% of the Caribbean-wide queen conch landings according to FAO statistics (Ranked #8). During 2000-2011, Puerto Rico accounted for 4.2% of the Caribbean-wide landings (Ranked #7). Landings peaked in 2000 at 1,710 mt and have since declined. Since 2007, landings have been stable and have averaged >800 mt annually.

Management Regulations – Puerto Rico has a 22.9 cm shell length minimum size limit and a 9.5 mm flared lip thickness, although conch are not required to be landed in the shell. The fishery is closed from August 1-October 31 in state waters and closed year-round in federal waters. SCUBA and Hookah are prohibited in federal waters. The minimum size limit is slightly above the size at 50% maturity.

Illegal Fishing – There is limited information on illegal fishing and poaching of queen conch off Puerto Rico. In Amendment 2 to the Caribbean Council's Queen Conch Fishery Management Plan it is noted that there are many commercial fishers without commercial fishing licenses (Daniel Matos). The amendment also indicates that fishers do not report their real catches because then they would have to report their real income (Victor Padilla, comm. fisherman). During the 148th Caribbean Council meeting it was noted that fishermen commonly catch conch during the seasonal closure. During the same meeting it was also discussed that the federal annual catch limit (ACL = 0 in federal waters) for Puerto Rico was exceeded but the catch comes from state waters because federal waters are closed to harvest.

Densities/Catch-per-unit-effort – The most recent survey was conducted in 2006 (Jimenez 2007) and consisted of a total of 99 stations located along the east, south, and west coasts of Puerto Rico. Queen conch were found in 81 of the 99 sampled stations. Densities per habitat type ranged from 5.5 to 73.8 conch/ha. Density on the west coast increased to 19 conch/ha, and the average density was 31.6 conch/ha. As in other previous surveys, most of the individuals observed were juveniles (Jimenez 2007). As of 2006, the queen conch population in Puerto Rico appeared to be at a healthier state than what was observed in previous visual surveys (Marshak et al. 2006). The overall densities estimates per coast indicated the east coast had a higher density (12.0) than the south (8.7) and the west (8.8) (Jimenez 2007). The overall stock is still considered to be overfished and density is considered to be below the recommended reproductive threshold of 100 adult conch/ha (or higher) to avoid recruitment failure (Report of the QCWG 2012).

Bahamas

Landings – Bahamian landings have been fairly stable since the early-1990s, averaging >640 mt annually since 1994. The Bahamas accounted for 2.2% of the Caribbean-wide landings during 1980-2011 (Ranked #9) and 2.5% of the Caribbean-wide landings during 2000-2011 (Ranked #10).

Management Regulations – There is no minimum shell length or weight for Bahamian conch. SCUBA is prohibited. Hookah is allowed, but only by permit from August 1-March 31. The Bahamas does have numerous marine protected areas and reserves throughout the country and an export quota system. The Exuma Cays Land and Sea Park (112,640 acres) is a no take reserve created in 1958. Fishing for conch within the parks boundaries is prohibited.

Illegal Fishing – A recent report on illegal, unreported and unregulated fishing in the Bahamas pointed out that as many as 65 fishing vessels could be operating from Dominican Republic ports, taking Bahamian conch, grouper and other fin fish in large quantities. It was pointed out that each of these vessels could land over 70,000 pounds of catch per trip (L. Smith; Tribune242.com article; March 20, 2013; http://www.tribune242.com/news/2013/mar/20/tough-call-bahamian-conch-danger/). While the use of SCUBA is curtailed, considerable effort goes into restricting the use of compressors during the summer months (April through July) and enforcing the permit requirements (Gitten and Braynen 2012).

Taleaue-McManus and Hazell (Proc.11th International Coral Reef Symposium) reported that "the fisheries monitoring system in the Bahamas did not document 86% of the estimated total conch catch based on consumption and trade statistics." Additionally, NOAA law enforcement agents and Florida Fish and Wildlife officers completed an investigation of a fishermen for violating the Lacey Act. The fisherman returned from the Bahamas with 338 queen conch and other species in violation of Bahamian and Florida laws.

Densities/Catch-per-unit-effort – Stoner et al. (2011, 2012), Stoner and Davis (2010), Stoner et al. (2009) and Stoner (2010) have published numerous recent studies of queen conch density in the Bahamas. Recent studies have assessed status queen conch populations at Andros Island, Berry Islands, Exuma Cays, Jumento Cays, and Ragged Islands. Surveys conducted in the Exuma Cays, Bahamas, in 1991 showed that the density of adult queen conch in the shallow bank habitat at the Exuma Cays Land and Sea Park (ECLSP) (> 50 adults/ha2) was 17 times higher than in a fished area near Lee Stocking Island (LSI). When identical surveys were repeated in 2011, it was discovered that the density of conch in the bank habitat of LSI had increased slightly, but numbers in shelf habitat had declined 91%, to densities below capacity to support reproduction. At ECLSP, bank densities declined by 69% to just 16 adults/ha. Adult densities near LSI were all less than 10 adult conch/ha in 2011, while adult densities near Warderick Wells ranged from 16-144 adults/ha.

Low queen conch densities observed at Andros Island suggest that queen conch fishing is no longer viable there, with the exception of Grassy Creek Cays (Stoner and Davis 2010). The high numbers of queen conch at Grassy Creek were mostly samba conch (85% of total population, 97% of adults). When data from Grassy Creek (117 conch/ha) were removed from the analysis,

overall adult density was 3 conch/ha for Andros Island with only 15% of the sites having total densities greater than 100 conch/ha.

In fishing areas around the Berry Islands queen conch populations are characterized as low density, with low mating frequency, having a high percentage of juveniles, and by the loss of historical nursery grounds (Stoner et al. 2009). Most queen conch (98% adults; 96% of subadults) are located in the southern section of the Berry Islands Bank. Sites to the north and west of the Berry Islands had low conch densities of 4 adults/ha and 8 subadults/ha with 50-75% of the sites having no conch. Conch were found at a small percentage of locations at densities high enough for successful reproduction; 7.8% of the sites > 50 conch/ha and 5.2% of the sites > 100 conch/ha) (Stoner et al. 2009).

There have been no recent visual surveys around Eleuthra; the last visual survey was conducted in 2003 (Clark et al. 2005). The 2003 (Clark et al. 2005) survey found that 30% of the harvest consisted of juveniles. Densities ranged from 0 to 3,255 individuals/ha with a mean density of 993 conch/ha (Clark et al. 2005).

In 2013, surveys on queen conch density, abundance and population structure were conducted in the Jumento Cays and Ragged Islands. Surveys were conducted in the shallow areas where commercial fishing occurs between Water Cay in the north and Little Ragged Island to the south. Average adult (flared-lip) density over the Jumento Cays and Ragged Islands was 122 conch/ha (Stoner et al. 2013), slightly higher than those observed in previous surveys conducted at the Grassy Cays (Andros Island) and the Berry Islands (Stoner et al. 2013). Within the survey area, queen conch density generally decreased from north to south, with Stoner et al. (2013) reporting queen conch densities that ranged from a high of 168 adults/ha near Flamingo Cay to just 10/ha in the southern sector encompassing Raccoon Cay to Little Ragged Island. Density of 3-year-old conch (i.e., “sub adults” or “rollers”) was relatively low, averaging 14.8/ha in the island chain (Stoner et al. 2013). The number of mating pairs observed in 176 survey lines throughout the study area revealed that most mating occurred at “adult” densities > 85/ha (Stoner et al. 2013) corresponding closely with other areas in the Bahamas considered as “lightly fished” and within the range recommended by conch experts for fishery management to achieve minimum densities of 100 adults/ha. (Table 4) (Stoner et al. 2013).

Cuba

Landings – Cuban landings have been highly variable over time. During the 1990s, landings exceeded 1,000 mt in several years. In 2003, there was a large decrease in landings. Since 2003, landings have been stable averaging ~500 mt per year. Cuba accounted for 1.8% of the Caribbean-wide landings during 1980-2011 (Ranked #10) and 2.5% of the Caribbean-wide landings during 2000-2011 (Ranked #11).

Management Regulations – The queen conch fishery in Cuba is currently managed under a catch-quota system. There is a 20 cm minimum shell length and 5 mm lip thickness (Thiele 2001). Fishery quotas are established by "zones" and set according to population assessments and monitoring (NMFS 2014a). SCUBA and Hookah are prohibited in Cuba. There is no minimum shell length limit, but there is a 10 mm flared lip thickness regulation. There is also a closed season from May 1-Sept 30 (NMFS 2014a). Fishing in protected areas is prohibited. There is a national system of protected areas in addition to areas Under Special Regime for Use and Protection (Fisheries Reserves) which together protect more than 26% of the Cuban insular shelf (isobath 200 m). Lemus and Loranzo 2012

Illegal Fishing – Regulations require a lip thickness of greater than 10 mm, but the regulations do not require that animal be landed in shell, so it is difficult to determine whether or not the minimum size requirements are adhered to by the fishery. Currently, there are only 6 active fishing zones, as 2 zones were closed for not complying with regulatory requirements and 1 was declared a protected area where harvest is prohibited (Lemus and Lorenzo 2012).

Densities/Catch-per-unit-effort – Queen conch densities within the Jardines de la Reina National Park were estimated to be 1,108 conch/ha (Formoso et al. 2007). Cara De La Hera et al. (2013) observed relatively high queen conch density during surveys in the National Park Desembarco del Granma (a reef lagoon in eastern Cabo Cruz, Cuba). Queen conch densities were evaluated in 2009-2010, at 3 different areas (Farito, Guafe and Laguna within the national park) during rainy, dry, and cold-front periods. The highest densities were observed during the dry season (1395 conch/ha) and the lowest during the rainy season (647 conch/ha). The highest density reported (Cala De La Hera et al. 2011) was at Farito (1,723 conch/ha) and the lowest at Guafe (511 conch/ha). Laguna showed a very similar density to Farito (1,271 conch/ha).

Nicaragua

Landings – Landings from Nicaragua were first reported to FAO in 1997. Landings have increased since 1997 from 64 mt to >2,800 mt in 2010-2011. Nicaragua accounted for 1.5% of the Caribbean-wide landings during 1980-2011 (Ranked #11) and 3.8% of the Caribbean-wide landings during 2000-2011 (Ranked #8).

Management Regulations – There is a June 1-Sept 30th closed season and 20 cm minimum shell length (NMFS 2014a). There is also a minimum flared lip thickness of 9.5 mm and there are no prohibitions on SCUBA or Hookah.

Illegal Fishing – Limited information on illegal trade and poaching is available for Nicaragua. Queen conch stocks off Nicaragua suffer from poaching by foreign vessels (Theile 2001). More recent information on poaching and illegal harvest is limited. In April 2010, Nicaraguan authorities detained Colombia fishermen for illegally fishing in Nicaragua waters. The Colombian authorities assert that the vessel was "illegally" detained in Colombia waters. There is a "long-running" dispute between Colombia and Nicaragua over maritime rights (http://colombiareports.co/colombian-air-force-to-pick-up-detained-fishermen-in-nicaragua).

Densities/Catch-per-unit-effort – In April, July and November 2009, research surveys were conducted on three scientific fishing cruises. A total of 123 fishing stations were surveyed. The first cruise was held at coordinates ranging from 12 º 23 '00" to 13 º 58' 00" north latitude and from 82 º 14 '00" to 83 º 18' 00" west longitude. In a depth range of 40 to 89 ft and densities were obtained 176 ind / ha (adult snails) per hectare. The second monitoring was conducted at coordinates ranging from 14 º 07 '00" to 14 º 59' 00" north latitude and from 82 º 12 '00" to 83 º 05' 00" W and the average density obtained was 267 ind / ha (adult snails). The third cruise was conducted in the coordinates range from 15 º 00 '00" to 15 º 59' 00" north latitude and from 81 ° 46 '00" to 83 º 05' 00" west longitude yielding a density average of 190 ind / ha (adult snails). In two of the 123 stations surveyed during the three monitoring found an abundance of juveniles (pre-recruits) with densities equivalent to 1,715 individuals per hectare.

The three sampling cruises achieved a total of 1,157 adult individuals and found that 90.5% had an average size or siphonal length of 200 mm with a mode of 230 mm being the confidence limits at 95% for both sexes ± 2.7. Lip thickness separated by sex resulted in an arithmetic average for females and males of 17 and 20 mm

References

All literature cited in this report are referenced in the 2014 Queen Conch Status Report (NMFS, 2014a). A comprehensive list of those references can be found therein.