National Environment and Planning Agency

FISHERIES DIVISION
MINISTRY OF AGRICULTURE

QUEEN CONCH FISHERY MANAGEMENT PLAN
(Final draft)

By,

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Executive Summary

Reef fisheries in Jamaica are valuable resources that have been traditionally exploited by coastal communities and so are deeply attached to the island's culture and important in the provision of income and food security for thousands of families. The queen conch (*Lobatus* (=*Strombus*) *gigas*) is a species that occupies several benthic reef associated habitats throughout its life and is considered the country's most important fishery. This is because conch is being exploited at industrial and artisanal levels and expected to contribute to the local economy, with a value of more than $US 3 million every year.

The conch fishery and its management regime have been continuously transformed towards maintaining its sustainability, building a process that resulted in a good understanding of its natural population dynamics, and in the development and implementation of a system and capacity that determine: a) An adequate extraction rate; b) A set of criteria to distribute this potential production among licensed fishers; and c) The use of high standards to determine the legality and health condition of all of the conch commodities in the international markets.

With limited resources, the Jamaican authorities face tremendous challenges, given that the fishery is based on a species with a complex life cycle, that lives in distant and oceanic grounds (more than 70km from main home ports), which are wide spread over the Jamaica Exclusive Economic Zone, is captured by thousands of fishers, and where managers need to enforce numerous regulations, be vigilant on the strict health and market conditions, and battle well-structured networks of illegal fishing. However, these issues are slowly being addressed, while at the same time developing a process that increases stakeholder participation and collaboration.

The progressive success of queen conch management in Jamaica is unique in the Wider Caribbean and has demonstrated that overcoming excessive exploitation rates is possible if based on a focused and long-term determination, on good scientific information, and on applying measures to achieve stable production, with maximum quality standards. However, the process still needs improvements to fill gaps in data on catch and effort monitoring, collection of better bio-ecological data, determinations of climate change impacts on the natural conch populations, and to better counteract illegal fishing including action at national and international forums.

The fishery and its management are also unique in the sense that conch exporters are funding most of the fishery management and studies across this and other fisheries, and this continuous effort has resulted in the formation of a well-trained scientific cadre for field surveys, data analysis and the translation of results to management action. The management staff is increasingly capable of exploring ways to improve transparency in government actions. Slowly but steadily, an increasing number of fishers and other stakeholders are taking part in the decision-making process and are exploring ways to increase fishery earnings, for instance by developing new value-added conch products.

The document presented here updates the 1994 preliminary queen conch fishery management plan by integrating information about the evolving process Jamaica utilizes for the management of this precious resource. Therefore, it compiles historical fishery dependent and independent data, integrates the available oceanographic and biological information, and identifies the challenges of the fishery in the bio-ecological, social, economic and institutional dimensions.

With this information, the plan proposes goals and objectives that are consistent with the national fishery and environmental policies, and presents a total of 22 measures for the improvement of the queen conch fishery in accordance with the ecosystem approach to management. Proposed measures were prioritized by the different stakeholder groups (industry, agencies, scientists, managers) in this fishery.

The plan at this stage needs to follow formal revision process under Jamaican laws that proceeds legal adoption, and this process should open doors for securing the necessary resources and strategies envisioned for its implementation. For that to happen, review, revision and implementation of the plan need to occur within the context of national public and private initiatives and to build international support coupling the national efforts with the regional actions recently approved within the Western Central Atlantic Fishery Commission (WECAFC) leadership.

The sustained efforts of Fisheries Division, Veterinary Services Department and NEPA (National and Environmental and Planning Agency) in the process of updating the Jamaica queen conch fisheries management plan, and the promotion of broad stakeholder participation illustrates how the collaborative inter-institutional and multi-disciplinary strategy is contributing in the process of applying the ecosystem approach to traditional fishery management.

Acronyms

BSJ	Bureau of Standards Jamaica
CARICOM	Caribbean Community
C-CAM	Caribbean Coastal Area Management Foundation
CFMC	Caribbean Fisheries Management Council
CFNI	Caribbean Food and Nutrition Institute
CFRAMP	Caricom Fisheries Resource Assessment and Management Programme
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPUE	Catch per Unit of Fishing Effort
CRFM	Caribbean Regional Fisheries Mechanism
DAN	Dive Accident Insurance Program
EEZ	Exclusive Economic Zone
EFJ	Environmental Foundation of Jamaica
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FDMF	Fisheries Development Management Fund
HS	Harmonized Commodity Description and Coding System
IOJ	Institute of Jamaica
IUU	Illegal, Unreported and Unregulated fishing
JCF	Jamaica Constabulary Force
JCAJamaican Customs Agency	
JDF-CG	Jamaica Defense Force Coast Guard Service
JET	Jamaica Environment Trust
JFCU	Jamaica Fisherman's Cooperative Union
MOJ	Ministry of Justice
MoAF	Ministry of Agriculture and Fisheries
MICAF	Ministry of Industry, Commerce, Agriculture and Fisheries
MOU	Memorandum of Understanding
MSY	Maximum Sustainable Yield
NCOCZM	National Council on Ocean and Coastal Zone Management
NDF	Non-Detriment Findings
NEPA	National Environmental and Planning Agency
NOAA	National Oceanographic and Atmospheric Administration
NTAC	National Total Allowable Catch
NGO	Non-Governmental Organization
OSPESCA	Central American Fisheries and Aquaculture Organization
PBPA	Portland Bight Protected Area
PCJ	Petroleum Corporation of Jamaica
PIOJ	Planning Institute of Jamaica
SFCA	Special Fisheries Conservation Area
STATIN	Statistical Institute of Jamaica
TAJ	Tax Administration Jamaica
TEF	Tourism Enhancement Fund
TNC	The Nature Conservancy
TRN	Transportation Reference Number
UDC	Urban Development Corporation
UNEP/CEP	United Nations Environment Program, Caribbean Regional Office
UWI	University of the West Indies
VMS	Vessel Monitoring System
VSD	Veterinary Services Division
WECAFC	Western Central Atlantic Fishery Commission

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ANNEXES

SECTION I. DIAGNOSTIC OVERVIEW

1. Introduction

The queen conch has been fished in Jamaica for centuries, and conch is recognized as its most valuable marine resource. This fishery involves thousands of people, generates several millions of US dollars in earnings, and provides food security for coastal communities and many visitors.

This traditional fishery expanded up to an industrial scale at the beginning of the 1990´s when the resource on Pedro Bank was targeted by commercial fishing companies. It was at this time, and in response to the high capture rates reported, that interest in managing the conch fishery developed. By the end of the 1990´s, several government organizations, led by the Fisheries Division and with the assistance of the CFRAMP a regional fisheries programme, drafted a preliminary queen conch fishery management plan. Although this process did not initially result in a gazetted document, it originated the implementation of strategies and protocols among government organizations towards increasing the sustainability of the queen conch fishery.

To promote the development of national strategies to manage and protect conch resources, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) added queen conch to its Appendix II. In Jamaica, this convention entered into force on July 22, 1997. The application of this convention resulted in the creation of special protocols to certify the legality and sustainability of the trade, as well as the identification and strengthening of the Jamaican CITES management and scientific authorities.

Over time, the marine fishery sector in Jamaica has been able to work collaboratively, overcoming challenges in the fishery, building trust and progressively implementing institutional agreements. However, the process still needs adjustments in order to increase transparency, counteract illegal fishing from neighboring countries, enhance strategies for better sustainability, and integrate co-management strategies.

As a consequence, updating the preliminary queen conch fishery management plan became a priority for the National and Environmental and Planning Agency (NEPA), Fisheries Division and Jamaica's Scientific Authority. In order to maintain a healthy fishery and to promote the use of Ecosystem Based Management tools, the process was developed following a: i) High stakeholder participatory strategy; ii) Compilation of recent and historical data, technical reports, and scientific recommendations; and iii) integration of ecosystem approaches in fisheries management concepts.

The development of the queen conch fishery management plan provides an excellent opportunity to support Jamaica's national policies and regulations regarding economic development, industry performance, and the fishery and conservation management needed to reduce fishermen poverty and safeguard food safety and security.

In updating the national queen conch fishery management plan, the guidelines recommended in the CFMC/WECAFC/OSPESCA/CRFM/CITES Draft Regional Queen Conch Fisheries

Management and Conservation Plan were also reviewed. This draft plan was regionally adopted in session sixteen of the Western Central Atlantic Fishery Commission (WECAFC) meeting held in July 2016.

2. Description of the Resource

The queen conch is a large marine gastropod of the Strombidae family formally recognized by the scientific name of *Lobatus gigas*, but more commonly known by its former scientific name of *Strombus gigas*. Another current synonym is *Eustrombus gigas*. Resolution of nomenclature issues awaits more detailed studies. Queen conch is distributed across the wider Caribbean[1], with Bermuda at the northern-most edge of the species' distribution, Panama at the south-western and Barbados at the eastern edge.

The fishery is conducted mainly to extract the meat (foot muscle), which is cleaned to various degrees depending on consumer preferences. Additional products of the fishery consist of conch shells and the conch pearls utilized in the tourism and jewelry industries. Just recently, new value added products from this fishery appear to be developing for the conch. For instance, the operculum is often grounded into powder which is used in oriental medicine and as an ingredient in the preparation of incense, and the trimmings are used for burgers and conch chowders, and sometimes for the pet food industry.

Figure 1. Products of the queen conch fishery in Jamaica.
Photos courtesy of Fishery Division

[1] Anguilla, Antigua & Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Brazil, British Virgin Islands, Cayman Islands, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Grenada, Guadeloupe, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Netherlands Antilles, Nicaragua, Panama, Puerto Rico, Saint Kitts & Nevis, Saint Lucia, Saint Vincent and The Grenadines, Trinidad & Tobago, Turks & Caicos Islands, United States of America, United States Virgin Islands, Venezuela.

Queen conch has two life stages. The first one is as a free swimming organism living in the plankton community for around 20-30 days, a period that can be delayed up to 60 days (Mianmanus 1988; Davis et al. 1990; Rodriguez Gil 1995; Brito et al. 2006). This molluscan larval stage, known as the veliger, remains planktonic until it settles to the substratum and undergoes metamorphosis to become a small juvenile. At this moment, the organism begins its life associated to the seafloor, becoming part of the benthic community. During this stage, the species can live for approximately 40 years, but because of intense fishing pressure across its distribution, it may not live for more than five years. During its benthic life, the queen conch utilizes several habitats through ontogeny, searching for appropriate feeding or spawning areas. They live associated to coral reef environments, where they slowly move across hard bottom habitats, seagrass beds and sand plains or rubble bottoms with some algal growth.

Early juveniles (< 10cm siphonal length (SL)) are usually buried in unconsolidated sediments, emerging at night to feed. Their shell grows in concert with their body, becoming hard and thick. Older juveniles emerge and reside on top of the substratum. Queen conch reach sexual maturity at an age of about three and a half to four years (Egan 1985; Appeldoorn 1988; Appeldoorn et al. 1997; Stoner and Sandt 1992; de Jesus-Navarrete and Aldana-Aranda 2000; Stoner et al. 2012). At that age, their shell averages approximately 22 cm siphonal length (SL), but this size varies greatly and is dependent on environmental conditions. The increase in shell length stops at the onset of the flared lip and as the animal begins to mature, when growth is diverted to the formation of a flared shell lip. Therefore, the formation of a flared lip alone does not necessarily indicate sexual maturation. Recent studies have found that sexual maturity in queen conch does not occur until the shell flared lip thickness reaches 8 to 26 mm (Egan 1985; Posada et al. 1997, Ávila-Poveda and Baqueiro-Cárdenas 2009; Stoner et al. 2012) and this variability may in part be site specific owing to environmental and density conditions.

Some tissue growth continues after maturation. Modelling the relationship between lip-thickness and tissue weight indicates that 95% of the adult growth occurs by age 6, or approximately 3 years after the onset of lip formation (Posada et al. 1997). However, as conch age and the shell thickens, internal space decreases, which eventually leads to a decline in the tissue weight of very old conch. It is not clear if this leads to a decline in fecundity, as reduced space could be offset by higher egg density within the egg mass, greater egg quality or an increased rate of egg mass deposition. However, conditions being equal, total fecundity is largely determined by size, which is fixed at the time of lip formation.

Variations in queen conch growth can be attributed either to genetic (heritable traits) or phenotypic (physiologic response to local conditions) factors. Currently, there is no consensus regarding the proportion that each factor influences queen conch growth at the population level. While patchy larval settlement may lead to distinct genetic populations, environmental conditions in different areas are clearly associated with significant variations in growth and morphology. In heavily fished sites, large queen conch disappear rapidly leading to the dominance of smaller individuals, thereby potentially influencing the overall growth pattern of the population (Borrell 2013).

Independently of conch growth and morphology differences, a mature male conch is recognized by the formation of a verge, while females develop an egg groove. Conch have internal fertilization, and mating appears to be affected by population densities and water temperature.

The depth is another factor affecting reproduction success, because spawning will be site specific; too intense fishing in shallow areas by free diving may also lead to elimination of the adult reproductive population in certain places.

In the Bahamas, Stoner and Ray-Culp (2000) reported that queen conch reproduction was negligible at densities below 50 adults/ha, succumbing to the Allee effect (Odum 1953). Indeed, the probability of successful reproduction varies in different locations and depends on the level of fishing pressure and how density is measured relative to total shelf area. Following the Queen Conch Expert Workshop, held in May 2012 in Miami, Florida, a conch population density of 100 adults/ha (2.47 adults/acre) recommended in accordance with the precautionary principle in fisheries management. Considering these biological characteristics, multiple indicators (e.g., density, size structure) are needed to assess conch population health, and corresponding multiple regulations may be required in order to maximize reproduction and sustainability.

Water temperature is a key factor controlling gametogenesis (Aldana et al. 2014). In warmer years, actual spawning can occur year round, while in other years it can be rather seasonal (Randall 1964; Laughlin and Weil 1984; Stoner et al. 1992; Appeldoorn 1997). With recent temperature increases, it has been suggested that peak spawning may be expanding from July to September (Aldana et al. 2014) and into October (Appeldoorn et al. 2011).

3. Ecologic Role

Queen conch is a herbivore/detritivore, feeding primarily on algae/epiphytes/detritus as adult, and in large numbers can, therefore, have a major influence upon benthic productivity processes (Stoner 1989 a, b). For example, young individuals feed on seagrass remains, seagrass epiphytes and macro-algae, which may influence the composition of seagrass beds (Randall 1964; Stoner et al. 1994).

Queen conch play an important role in shallow marine trophic dynamics as they form part of the regular diet of an array of predators, such as the true tulip snail (*Fasciolaria tulipa*), apple murex (*Murex pomun* or *Phyllonotus pomum*), and other carnivorous species like octopus (*Octupus* spp), spiny lobster (*Panulirus argus*), queen triggerfish (*Balistes vetula*), spotted eagle ray (*Aerobatus narinari*), tiger shark (*Galeocerdo cuvier*), nurse shark (*Ginglymostoma cirratum*) and Atlantic loggerhead turtle (*Caretta caretta*) (Jory and Iversen 1983; Iversen et al 1986; Cervigón et al. 1992).

4. Abundance of the Resource

Estimates of queen conch population abundance and population size in Jamaica (Pedro Bank) are derived from visual surveys. After over 20 years of such surveys, Jamaica has become a country with vast experience and trained personnel, resulting in capacity, a track record of basing conch fishery management decisions on scientific data, and the development of a robust system to assure recurrent funds to sustain this strategy.

Surveys are conducted using a stratified random sampling protocol, with three different depth strata (0-10m, 10-20m, and 20-30m), and classifying individual conch into six different stages (age/size groups). To date, six scientific expeditions have been conducted, every three to five years, as follows: 1994, 1997, 2002, 2007, 2011 and 2015 (Tables 1-2). With time, surveys have increased the number of sites and expanded the area covered, exploring the entire bank up to the 30m in depth, while following safe diving and scientific protocols.

Based on this information, it is clear that the conch abundance on Pedro Bank has not only remained high but also has increased from previous lows in response to management actions. Mature conch are found throughout the bank, with production supported by recruitment of juveniles, which are also found in high densities and fairly evenly distributed (Morris 2016). To prove the occurrence of successful conch reproduction, scientific divers noted conch pairing and mating, and egg masses have been observed on the substrate during several expeditions. As long as larval survival and settlement occurs regularly (every 1-3 years) and juvenile survivorship remains at current levels, the population should be able to sustain high rates of exploitation (Tewfik and Appeldoorn 1998).

Surveys have identified nursery areas, particularly along the southeastern edge of the bank. In fact, in 2015, 1994 and 1997 the areas with the highest juvenile abundance has been less than 20 m depth in suitable habitats (macroalgae, sand and seagrass) (Morris 2016, Appeldoorn 1995, Tewfik and Appeldoorn 1998). However, in 2011, the 0-10m stratum had the highest abundance of juveniles, while the 20-30m stratum was highest for mature conch. The spatial and temporal variability in the abundance of the various conch age/size classes within Pedro Bank is complex, and with more sites and more surveys a better understanding of the changes in the conch abundances is now becoming possible.

There is no information to characterize the abundance of the conch population in other areas such as the south-end of the insular shelf, or smaller oceanic banks such as Morant, Albatros, Blossom,Walton, Formigas, or Mackerel, which are also subjected to unknown levels of queen conch fishing.

Table 1. Summary of the queen conch surveys on Pedro Bank, Jamaica conducted by the Fisheries Division.

Year	Dates/ month	No. Sites	Total sampling area (m2)	Mean total density (ind/ha)	Population size (Millions ind.)	Total Exploited Biomass (MT)
2015	Oct	80	87,400	394	239.8	10,383.35
2011	Nov-Dec	81	100,400	99/185	221.5	12,231.98
2007	Jan and Nov	45	60,000	521	70,45	7,421.78
2002	May 5-14 & Dec 6-9	45/47	25,560	138	129.6	15305.85
1997	Mid Nov	22	20,400	263/88	115.1	12203.27
1994		22		225/167		13325.48

*Data taken from Appeldoorn 1995, Tewfik and Appeldoorn 1998, Smikle 2009, Smikle and Appelddorn 2003, Ministry of Agriculture, Fisheries Division 2013, and 2017

Table 2. Detailed conch density (ind/ha) by depth strata and sizes classes obtained from surveys on Pedro Bank, Jamaica conducted by the Fisheries Division.

Year / Depth strata	Age / size class						
	Small juvenile	Medium juvenile	Large juvenile	Sub - adults	Adults	Stone	Grand total
0-10m							
2015	48	92	33	48	65	28	316
2011	0	8	0	7	20	53	89
2007	8/27	7/28	10/20	12/33	77/195	44/125	159/436
1997	111	64	53	59	111	17	408
1994	0	8	0	7	20	53	89
10-20m							
2015	36	45	32	35	150	63	361
2011	101	70	36	23	68	18	317
2007	3/14	14/7	2/7	7/4	39/18	31/21	95/72
2002	79	50	22	6	33	77	267/
1997	285	141	11	29	32	16	513
1994	17	20	2	13	64	88	204
20-30m							
2015	23	18	22	43	61	48	217
2011	102	110	41	6	55	56	385
2007	9/9	7/3	21/4	20/9	65/18	27/18	145/61
2002	24	60	82	20	65	24	276
1997							
1994	12	44	1	16	29	174	277

*Data taken from Appeldoorn 1995, Tewfik and Appeldoorn 1998, Smikle 2009, Smikle and Appelddorn 2003, Ministry of Agriculture, Fisheries Division 2013, and Morris et. al., 2017

5. Vulnerability of the Resource

Queen conch are very sensitive to habitat conditions and require good water quality (Sanders 1984, Glazer and Quintero 1998), with juveniles and spawning adults otherwise broad spectrum of sediments, rubble and hard bottom used. As a slow moving benthic organism, the queen conch is subject to any drastic changes in habitat quality, which may affect connectivity, conch morphology, growth, reproduction or survival (Kowalik et al. 2007, Glazer et al. 2008). Changes in strength and direction of ocean currents, due to climate change or alterations of the coastal zone could affect the important processes regulating dispersal and recruitment.

Changes in water quality due to anthropogenic impacts (e.g., sewage discharge, runoff from coastal/industrial development or agriculture) could be significant on the main island shelf. However, Pedro Bank, being a remote area and having a diverse mosaic of habitats (Baldwin 2015), suffers fewer impacts from land-based sources of pollution. Live coral cover on reefs surrounding the Pedro Cays, the country's most significant reefs, has been estimated at 16%, relatively higher than that reported for Jamaica's north coast (11%) (Kramer 2006). In general, the Pedro Bank marine ecosystems are in relatively good condition, with low levels of recent coral mortality, few diseases and low to moderate macroalgae cover (Barret 2006, Bruckner 2012).

There are two small oceanic cays on Pedro Bank with permanent or seasonal residents who, accordingly to Baldwin (2015), come from all the parishes of Jamaica except St. Ann, but mainly from the southern parishes of Westmoreland, St. Elizabeth, Clarendon and St. Catherine (the closest to the Pedro Bank). These residents are predominantly male fishers. However, the number of people living on the bank has increased substantially since the 1950s. Currently, it is estimated that these residents total around 300-350, despite anecdotal evidence suggesting that at one time there were over 1,500 residents (Espeut 2006). The Fisheries Division indicated that over 600 Pedro Cay permits were issued for 2011 (Isaacs 2012). Information from interviews with fishers indicated that the numbers of persons living on Middle Cay increased to well over 500 during the conch season, but that the population on NE Cay had not increased since the hurricanes of 2004 and 2005, as fishers had not been able to recover financially (Baldwin 2015).

Cay residents face major challenges given difficulties such as accessing fresh water, combating roaches, bed bugs, rats and mosquitoes, having inadequate access to sanitary facilities (which are either inadequate or non-existent) and poorly erected housing (Rhynie et al. 2014). It is perhaps these conditions that resulted in the poor water quality in the surrounding shallow marine environment, where high concentrations of nitrates and phosphates have been determined. In addition, piles of conch shells occupy portions of the north-eastern and south-western beaches (Hay 2006).

In deeper sites on the bank, the marine environments such as seagrass beds, coral reefs, macroalgae and sand habitats (all used by conch through ontogeny), have better water quality, but they are also affected by localized disturbances. Examples of these impacts include cyanobacterial blooms and macroalgal overgrowth on corals observed by scientific divers during conch expeditions (Steven Smikle, personal communication) and other field work recently done on the bank (Baldwin 2015).

The potential effects of climate change were considered to be high in the recent marine spatial planning study. The vulnerability of the queen conch to climate change includes, for instance:

- Increase in storms and hurricanes can negatively affect queen conch production by impacting recruitment and disturbing juvenile and adult queen conch grounds.
- Increases in seawater temperatures have direct implications for queen conch reproduction and may lead to cyanobacterial overgrowth on feeding grounds.
- Decreases in pH in the ocean have negative consequences for queen conch shell formation because its shell is made out of aragonite, a substance that can dissolve in

acidic environments. This would cause a greater proportion of energy to allocate toward shell formation and my result in weaker shells, which would enhance vulnerability to predators. Impacts are expected to be most severe during larval development.

In addition to the above mentioned vulnerability factors, Baldwin (2015) reported the risk of initiating oil exploration and production, which appears to be high. Companies are currently far advanced in their exploratory evaluation in licensed blocks on the Pedro Bank. The Petroleum Corporation of Jamaica (PCJ) has entered into Production Sharing Agreements with the licensed companies, which include a variety of environmental protection measures such as contingency and emergency response plans and compensation schemes. Direct impacts to the queen conch natural populations from these human activities are as yet not well known and need to be studied.

Queen conch populations are subjected to high levels of fishing and thus vulnerable to over-exploitation. However, given the healthy condition of the conch essential habitats and the high abundance of their natural population on Pedro Bank, measured for more than 20 years, along with improvements to the fishery management system, the stock does not appear to be suffering from overfishing. But considering the unknown and suspected significant levels of poaching and other illegal fishing practices, thought to be conducted mostly by foreign vessels, it is possible that these illegal activities represent a significant socio-economic loss to local fishers

6. Description of the Fishery

6.1. Fisheries Management Units

Jamaica is located in the western Caribbean (18° 15' N and 77° 30' W) and is comprised by the main island and a number of associated nearshore and offshore cays, shoals and banks. The main island is around 10,991km^2 (http://www.jtbonline.org/tourism_jamaica/pages/resortareas.aspx). Jamaica's southern insular shelf extends approximately 25km from shore, while the northern coast has only a narrow shelf of 1.6 km before dropping to a depth of more than 300 m (Munro 1983) (Figure 2).

For the purposes of conch fishery management, three different units can be identified: 1) Pedro Bank, supporting around 75-85% of the landings; 2) the Jamaica southern insular shelf, supporting an unknown production, but suspected to represent approximately 10%; and 3) other smaller proximal or oceanic banks such as Morant, Walton, Blossom, New and Formigas, among others.

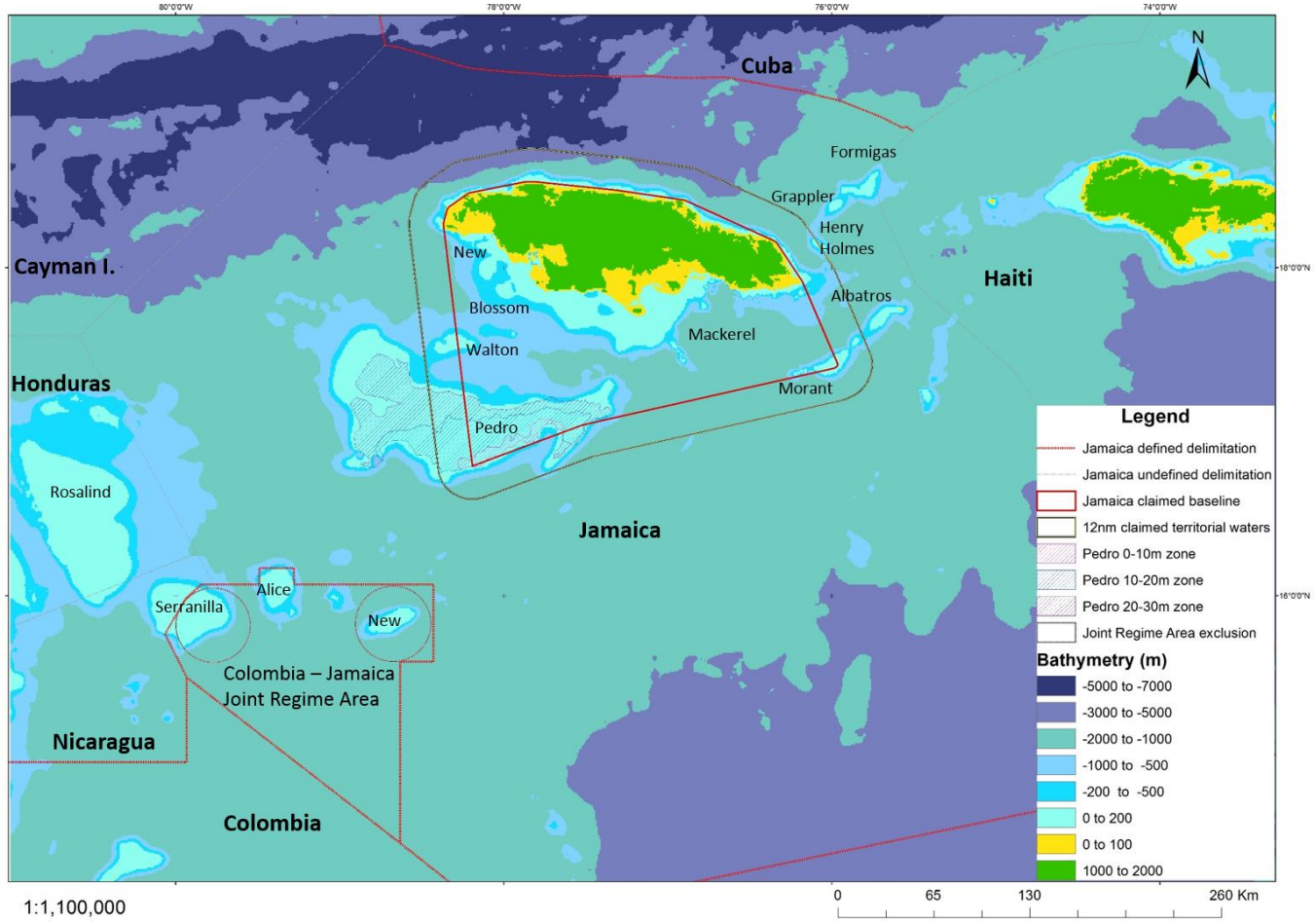

Figure 2. Location of the Jamaica EEZ within the southwestern Caribbean. The queen conch lives in depths between 0-200m in depth, mainly on Pedro Bank and the main island insular shelf.

Note that EEZ boundaries with Haiti, the Cayman Islands, Honduras and Nicaragua have not yet be formally designated. Bathymetric information taken from GEBCO available at http://www.marineregions.org/eezdetails.php?eez_id=166

According to measurements collected by the NOAA Buoy 42057 (16.752°N, 81.550°W, around 275 km from the Pedro Bank west end) the mean sea surface temperature between 2012 and 2015 varied from 25.6 to 29.4°C, with higher values seen August-October (Figure 3). This graph also illustrates an increasing trend both in minimum and maximum sea surface water temperatures. Average sea surface temperature measured four decades ago mentioned an overall value of 27°C (Dolan 1972). Dolan also determined a tidal range of 0.33 m, and a mean salinity of 35.2 – 35.8 ppm, which is presumed to be slightly higher in shallow water areas.

Figure 3. Sea surface temperature (°C) measured at NOAA Buoy 42057 between 2012-2015.

Red line indicates temperature trend (+5°C/yr) over the period, arbitrarily aligned with minimum annual temperatures.
Data taken from http://www.ndbc.noaa.gov/station_page.php?station=42057

Jamaica lies in the path of the predominant surface circulation with a generalized westward flow called the Caribbean current, a circulation pattern that exhibits much temporal and spatial variability due to the formation of meso-scale eddies (Andrade and Barton 2000). In particular, in the central Caribbean such eddies are frequent and generally produced southwest of the Dominican Republic (Oey et al. 2003), mostly during July-October, with maximum curl associated to the Northeast Trade Winds (Andrade and Barton 2000). Anticyclonic and cyclonic eddy formation, propagation and dissipation can be modified by the complex bathymetry and geography present in the region. In fact, Richardson (2005) using NOAA drifter data illustrated cyclonic and anticyclone looping trajectories in this region, with mean velocities of 0.5m/s and highest speed of 1m/s (Figure 4). Other drifters had swirls around 0.3 m/s at a diameter of 100km.

The presence of these eddies and the complex circulation patterns appear to favor larval self-recruitment in some areas. Indeed, self-recruitment (within a country) dominates lobster larval recruitment, for example, in the Bahamas, Cuba, Nicaragua, and Venezuela, while other areas, e.g. Cayman Islands, Colombia, Honduras, Jamaica, Panama, and Puerto Rico, depend largely on larval subsidies from outside their borders, contributing to the genetic diversity (Gutierrez et

al. 2012). However, the scale of dispersal, given the long larval life of lobsters, is large and exchange among areas can still be significant. Gutierrez et al. (2012) also found that lobster spawning from the Cayman Islands may benefit lobster population in Jamaica (57%) and Dominican Republic-Haiti (21%). Nevertheless, the processes in Jamaica affecting the dynamics of the queen conch larval dispersal, with a reduced larval duration, may be quite different. Spatial population structure is currently being analyzed using genetic techniques (Karl Aiken and Mona Webber, personal communication)

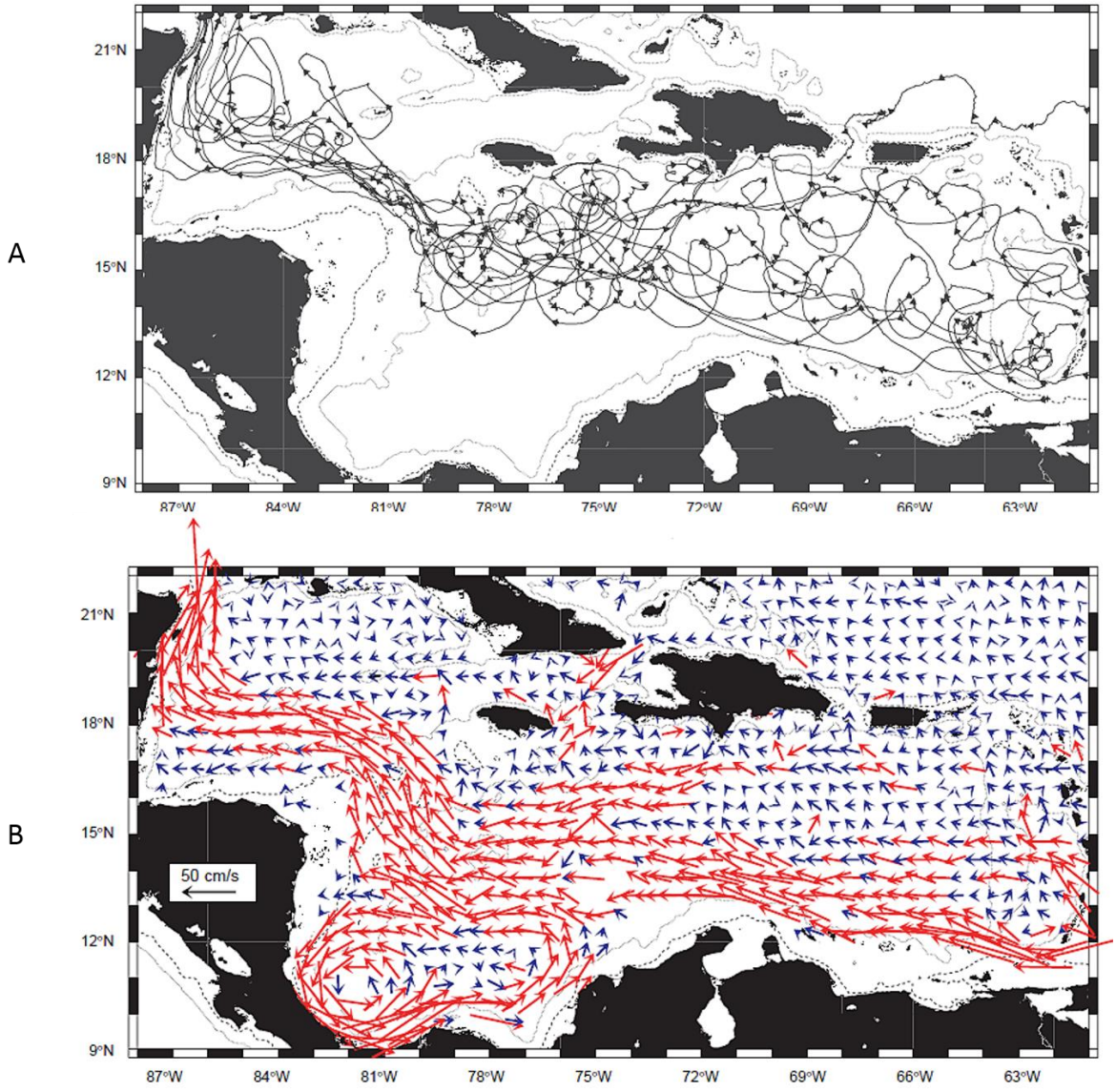

Figure 4. Synoptic circulation patterns around Jamaica estimated from NOAA drifter programs: Looping trajectories entering from the Eastern Caribbean. B. Mean current velocity calculated by grouping 6 hourly velocity values.

Taken from Richardson (2005).

Pedro Bank (16°42'- 17°39'N and 77°19''79°02'W) is a large bank (8,040 km^2) with its closest point approximately 70 km southwest of Jamaica. It has a mean depth of 24.5m, but also has a complex bathymetry. According to Dolan (1972) the bank consists of a) shallow reefs with irregular profiles; b) more regular profile reefs; c) sandy bottom with frequent isolated patch reefs; and d) carbonate, biogenic and detritus sand blanket, which comprises two-thirds of the bank. Recent preliminary mapping efforts illustrate the complexity and spatial distribution of the reef habitats (Figure 5, Table 3) and in addition report seagrass beds and macroalgal habitats (Bruckner 2012, Baldwin 2015), although these are thought to be overrepresented. The bank is among the country's most valuable marine resources generating income and serving many stakeholders, yet it is estimated to have a potential for income generation (Baldwin *et al.* 2014).

In contrast, the southern section of the Jamaica insular shelf is wide (maximum of 24 km), less than 40 m in depth and comprises a total area of 3,208 km^2. Although based on old and incomplete data, the preliminary habitat map in Figure 6 shows the area possess mangroves, coral reefs (hard and soft corals), dead elkhorn reefs, seagrasses, mud, sand, clay silt, limestone bedrock and limestone platform (Table 3). These habitats support many commercially important marine resources such as conch, lobster and finfish (Clemetson 1994), as well as provide a number of other ecosystem goods and services for the coastal communities (CARICOM 2000, Waite et al. 2011).

There is almost no information on the third fishery management unit, which includes other banks across the Jamaica archipelago, with the exception of some information from Morant Bank. This bank, located approximately 64km southeast of Jamaica (17°24'N 75°59'W), is a coralline bank averaging 20-40m in depth, which drops sharply to great depth (Munro 1983). The area within the 200m contour is approximately 170km^2 and supports a small population (60-80) of mostly artisanal fishers, who exploit reef resources there and on the adjacent banks, despite the fact that by 1996, the Fisheries Division had issued only 12 fishing licenses to fish there (Pears and Sary 1997). It is believed that the fishery on the bank (mainly reef fish) developed late (mid 1960´s) and peaked in 1988, until the category 5 Hurricane Gilbert hit the area and caused extensive damage and economic losses (Pears and Sary 1997). Since then, fishing effort has been slowly building up. According to Pears and Sary (1997), there is not much information for these bank coral habitats, but their location in the upstream dominant circulation pattern is believed to serve as potential "seed" areas. They also reported foreign industrial vessels fishing for queen conch, similar to the ones observed on Pedro Bank. Jamaican fishers usually stay in the area for a period of 3-4 months and return to the main island for a period of 2 months; however there are people that fish in the area for only a few weeks at a time.

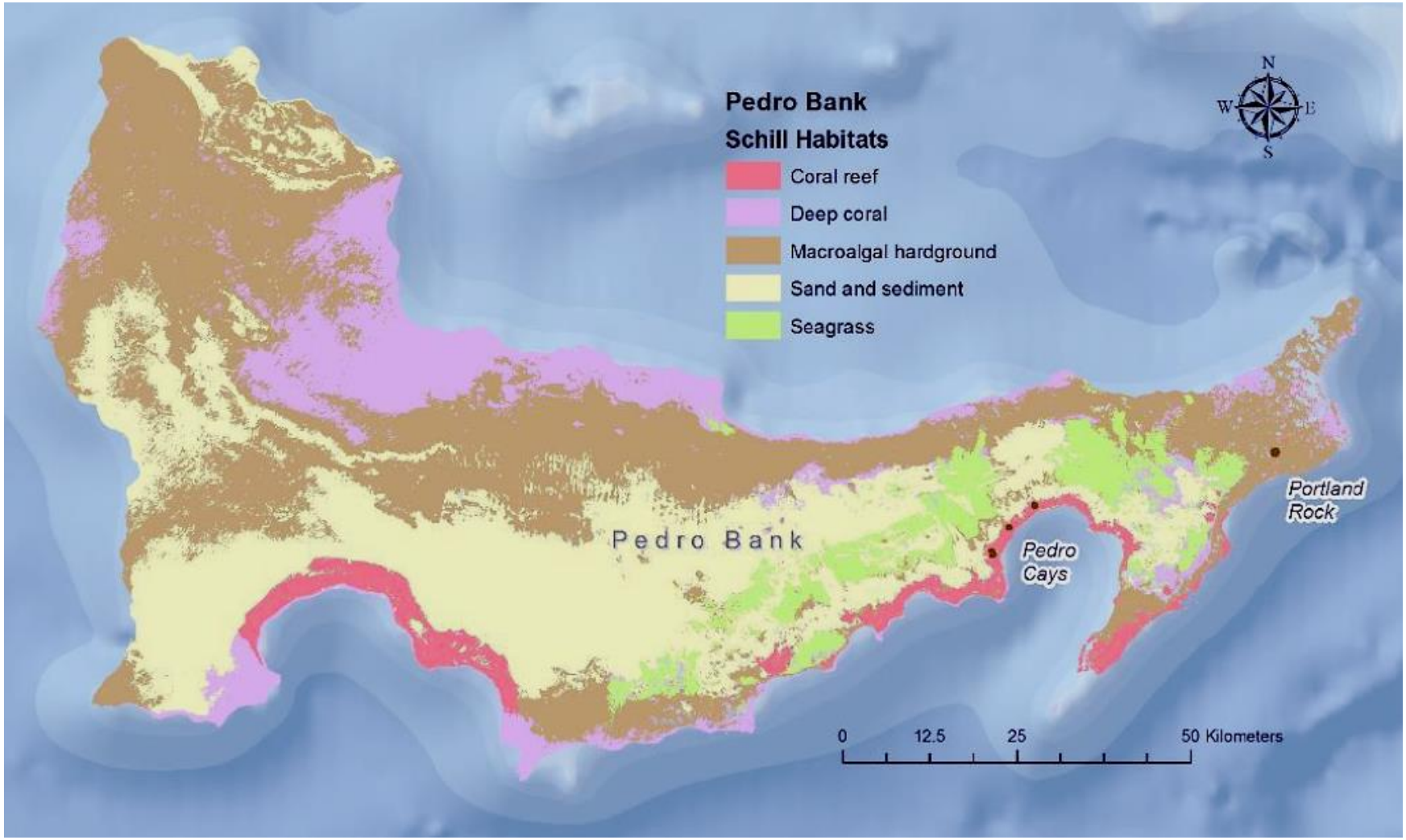

Figure 5. Preliminary broad scale habitat map of Pedro Bank of the ≤30m depth zone.
Taken from Baldwin 2015.

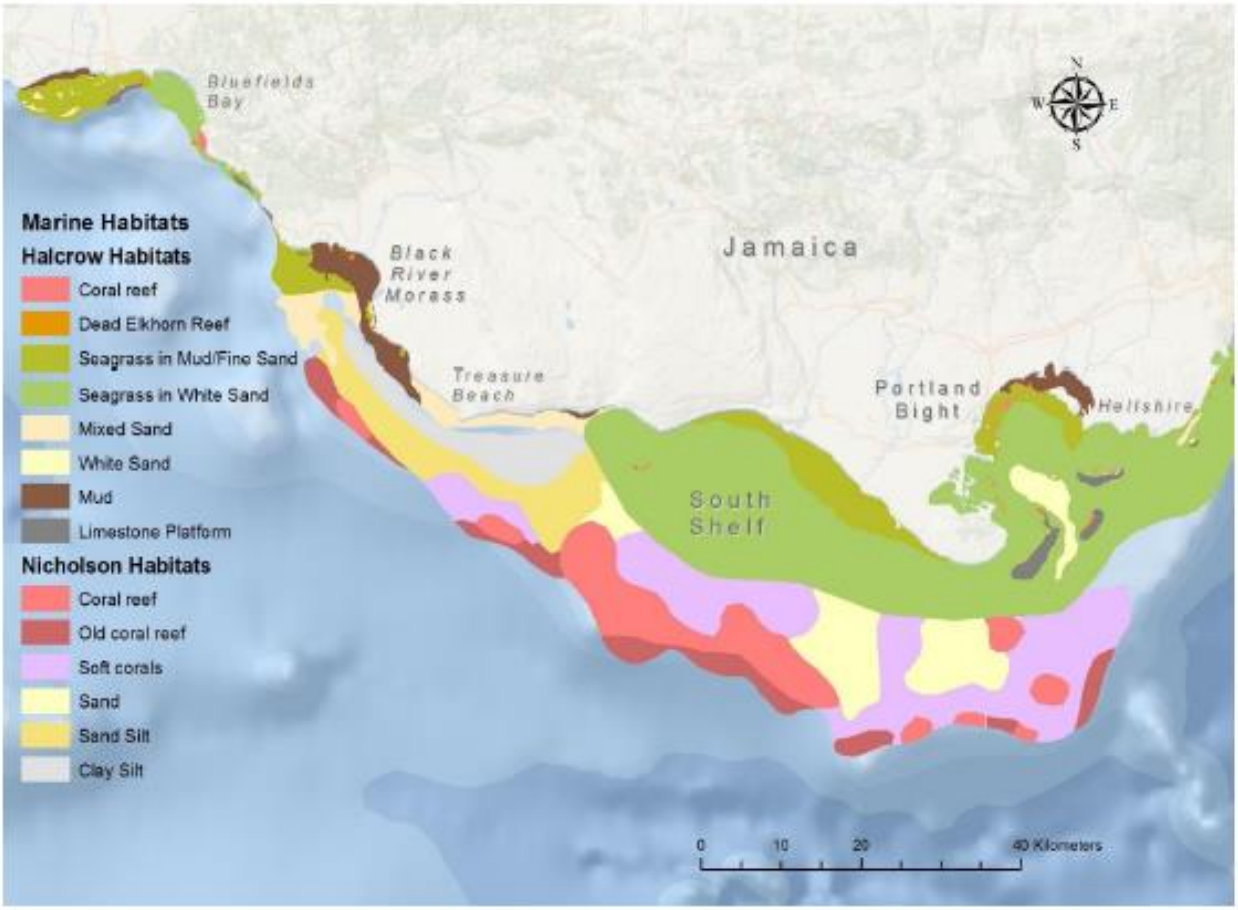

Figure 6. Preliminary broad scale habitat map of Jamaica south end insular shelf.

Taken from Baldwin 2015, based on Nicholson 1983, Halcrow 1998.

Table 3. Preliminary estimates of the extent of benthic habitats on Pedro Bank within the ≤30m depth zone.

Habitat	Pedro Bank	South insular shelf
	Area (km^2)	Area (km^2)
Coral reef	1,388	807
Macroalgae	3,139	
Sand	2,590	506
Mud		80
Seagrass	474	1,219
Limestone		48

Taken from Nicholson 1982, Halcrow 1998, Baldwin 2014.

6.2. Description of the Conch Production

The queen conch fishery started mostly around the southern section of the country's insular shelf and progressively moved to Pedro Bank following the establishment of fishing camps on the Pedro cays in the 1960s (Baldwin and Mahon 2015). At that time the fishery was small-scale, based on free-diving and conducted mainly in shallow waters adjacent to the Pedro Cays. By the late 1980s, the fishing industry became aware of the high conch abundance in the central plains of Pedro Bank, which were located in deeper waters, and this required that conch exploitation be conducted from primarily larger commercial diving vessels using scuba and hookah (Grant et al. 2001). By 1992, Jamaica had become the largest queen conch producer in the Caribbean (Aiken and Kong 2000). This rapid expansion of the fishing effort to supply mostly international markets (from approximately 50MT in exports in mid 1980´s to 2,132MT in 1995), highlighted the high risk of overfishing the conch resource (Aiken et al. 1999) and the need for management of the fishery.

Around 1991, the Fisheries Division, in conjunction with CFRAMP, estimated a maximum sustainable yield (MSY) of 800MT of conch meat, excluding the western and deeper part of Pedro Bank, and generated a preliminary conch management plan aimed at sustaining the fishery. In 1994 surveys, estimates from 830 to 1800 MT MSY were obtained using 5 different models/approaches of the conch population on Pedro Bank (Tewfik 1996), and final recommendation of MSY was set at 535 MT (Appeldoorn 1995), resulting in significantly reduced conch production. During the last five years production has been approximately 500MT of 50% cleaned meat annually (Fisheries Division database). Accordingly to the Fisheries Division, by 2012 conch fishing extended across the entire bank, up to a maximum of 30 m. A historical perspective of the conch production in Jamaica is presented in Table 4.

Despite the gaps in Table 4, the uncertainty of the total meat conch production is even higher given the various processing grades of the conch meat (Table 5), which are not specified, particularly for the beginning of the fishery, but were assumed to be 100% clean. The processing of this commodity has evolved with time, as the conch meat reach new markets.

Table 4. Annual queen conch production and exports in Jamaica 1993-2015.

Year	Industrial Landings (MT)*	VSD verified (MT)	NTAC (MT)	NEPA conch exports (MT)**	CITES Conch exported (MT)***	Value of exports ($ millions USD) ****
2015	483.5	450.7	500	450		
2014	393.77		400	500	412	
2013	424.93		500	500	339	
2012	378.56		550	500	415	
2011			350	400	383	
2010			420	420	382	2.73
2009	325.81	399,9	400	400	429	2.60

2008			400	400	392	2.60
2007			640	600	434	3.90
2006			650	650	615	3.88
2005			640	600	536	3.87/4.7***
2004			550	550	528	3.43/1.2***
2003	504		505	500	393	2.56/2.7***
2002	946		946		306	1.98/6.9***
2001	946		946	946	297	3.35/6***
2000					9	
1999	1,366		1,366	1,216	474	4.52/10***
1998	1,700		1,700	1,700	788	6.19/12.5***
1997	1,937/1,821		1,821	1,800	1,423	7.30/13.4***
1996	1,432		1,900	1,900	1,999	10.5***
1995	2,132		1,900	1,500	1,554	

*: Based on data from STATIN 2007, Industrial landings from Anonym 2001 for 1993-1996, Smikle 2010, Murray 2011, Murray et al. 2012, Morris 2014, Murray 2015.
**: NEPA's National Export Queen Conch Records.
***: Exports quantities from CITES online database Cites trade database.
****: Exports value from CITES online database Cites trade database.

Table 5: Processing grades and tissue loss of Queen Conch in the Jamaican processing industry.

Processing grade	Tissue loss	Weight tissue (g)	% Tissue lost	Jamaican factor
Unprocessed ("dirty conch")	None; animal simply removed from shell	142.5	N/A	0.85
50% cleaned	Removal of the operculum (" claw") and viscera (" bag")	121.3	0	1
65% cleaned ("semi-fillet")	All of the above plus "head (eyes, stalks and proboscis) and parts	108.9	11.3	1.113
85% cleaned	All of the above plus verge, mantle and part of the skin	96.7	28.21	1.2821
100% cleaned ("fillet")	Only the pure white meat remains	72.1	42.86	1.4286

From Tewfik 1996 and Smikle 1997.

In Jamaica, conch production for local consumption is supplied mostly (usually >80%) from the artisanal fishery. Unfortunately, the available data in this regard are scarce. While many people during interviews recognized that local production is low compared to Pedro Bank, they

also thought that it can be much higher than government authorities are reporting, a view shared by Fisheries Division. According to the a survey of the local market conducted in 2015 the Fisheries Division, reported that 10-13 MT was supplied by the artisanal fishers for the period 2010-2015(Table 6).

It is believed that a significant production of queen conch in Jamaica is being funneled through illegal fishing channels, but data to estimate the approximate quantity of the illegal conch extraction are not available.

Table 6. Estimated quantity (kg) and value ($JAM) of locally consumed conch from different conch suppliers.

Year	Quantity contributed by different suppliers (kg)				Total (kg)	Value ($ Million JAM)
	Mixed	No quota	Quota	Not Stated		
2010	149	5,350	488	544	6,531	7.5
2011	208	8,194	1,114	544	10,061	8.2
2012	459	8,737	864	544	10,604	9.8
2013	479	9,441	596	544	11,060	10.3
2014	1,067	10,625	865	544	13,102	13.4
2015*	763	6,155	689	544	8,151	12.4

Data provided by Fisheries Division and Murray 2015
*: Data do not cover the entire year.

6.3. Description of the Fishing Effort

6.3.1. Industrial Fishing

Legal industrial conch operations occur exclusively on Pedro Bank. According to data provided by Fisheries Division, in 2015 a total of 11 industrial companies, i.e., conch quota holders, (including three that entered to the fishery in 2014), 10 larger vessels and 342 fishers operated in the queen conch fishery (Table 7). Some of these companies bring foreign divers (mostly Hondurans or Dominicans), but there are others that rely on the production of Jamaica artisanal fishers, usually resident on Pedro Cays, that are contracted to fish for licensed harvesters.

Harvesters licensed to fish conch at the industrial level employ a large vessel that works in conjunction with smaller boats from which the actual fishing for conch is pursued. Generally, an industrial fishing trip can extend for approximately 1-10 days. In a season, each larger vessel conducts 3 to 8 fishing trips. There are three types of vessels employed in the conch fishery*[2]. Jamaican industrial vessels are typically 20-25 m in length and 30-38 TRN storage capacity and

[2] *Note: the Aquaculture, Inland and Marine Product and By-Product Act and the Fishing Industry Act define vessel types differently.

support approximately 10 small canoes. Canoes are 8-10 m in length and each carries 1 or 2 boat drivers and crew and 2 to 3 divers, mostly using hookah (Figure 7). It is estimated that canoes fish in an area 2 to 10 km from the vessel. Canoes carry their catch to the vessel every 3-4 hours depending on level of catch. In contrast, some canoes fish in association with carrier vessels, which are smaller (9-12 m) and used to transport conch from the canoes directly to processing plants on the Jamaican mainland within 8 hours. Some larger vessels serve as mother vessels for smaller dories, with all divers living aboard the mother vessel and the mother vessel being able to transport all divers and dories to various locations on Pedro Bank. Dories fish within a radius of up to 15 km away from the mother vessel.

The product on the small boats is usually100% dirty meat (only the shell is separated). Only one company generally has the operculum removed at sea. The conch meat is stored in plastic containers with ice. Once the smaller boats reach the larger vessel, the product is weighed, stored in long plastic bags (capacity for 50 lb.), blast frozen and kept in a freezer (at -18^{o}C or below). Carrier vessels maintain conch meat chilled at -4 to -6 ^{o}C for the trip back to the mainland.

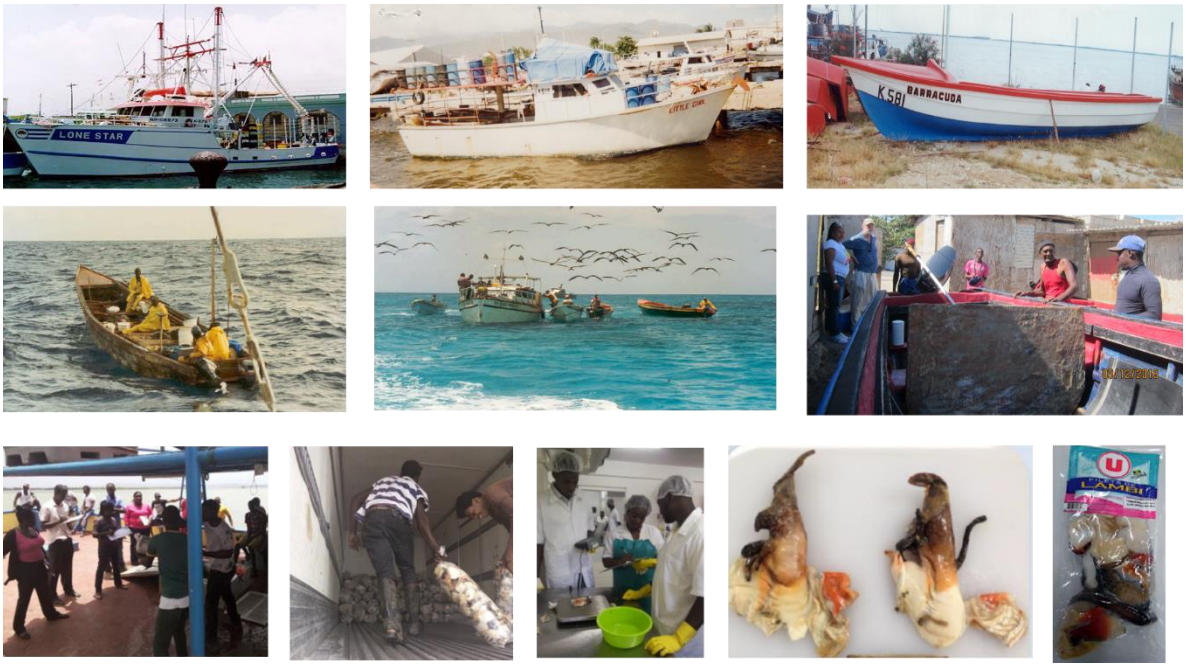

Figure 7. Pictures illustrating characteristics of the conch fishing effort

Photos courtesy of Fisheries Division.

Table 7. Characteristics of fishing effort of the conch industrial fleet on Pedro Bank.

Year	No. of licensed companies	No. of mother vessels	No. licensed fishers	Mean No. effective Days fishing	No. conch/lb.	Starting month	Closing month
2015	11	10	342		3.38	April	Aug
2014	11	7	274		2.76	April	Aug
2013	8	5	65			April	Sep
2012		7	240		2.76	Jun	Aug
2011			265				
2010			267		2.76	Jul	Aug
2009		7	180			Jun	Aug
2008		6	194				
2007		6	202				
2006		6	99				
2005		6	101				
2004		6	91				
2003		6	94				
2002		6	103				
2001		6					
2000							
1999		10					
1998		10					
1997		15			3.25		
1996		15					
1995	13	16					
1994	12	13					
1993		7					
1992		9					
1991							
1990							

Data taken from Morris 2011, Murray 2012, Fisheries Division internal reports. Data for 1997 taken from Aiken et al. 1999

6.3.2. Artisanal Fishing

The artisanal fishery in Jamaica is multi-species and multi-gear, yet in harvesting queen conch it operates in a similar way to the industrial fishery in that conch are harvested by divers from canoes, sometimes by free diving but most frequently using scuba tanks or hookah. Artisanal fishers use small boats ranging from 4-14m in length (Aiken and Kong 2000), with the smaller

ones made of wood and the larger constructed of fiberglass. Smaller boats fish the southern section of the insular shelf, while the larger ones travel to Pedro and other outer banks. Oswald (1963) reported that around 1956, the government subsidized the mechanization of the artisanal fishing fleet, which resulted in increased production because they were able to fish in new offshore banks (Lingard et al 2012).

Interviews conducted during this process indicated that a typical artisanal conch fishing trip can land approximately 95 lb. (43kg) per day, and it is sold at 50% clean. At Port Henderson, fishermen mentioned that a daily fishing trip can consist of one boat driver and up to seven divers. From the approximate total of 70-100 active divers just in that area, maybe only 10% are conch divers, because of the extra work needed for processing the meat to the 50% clean stage. Usually, each diver uses around four tanks per day at a cost of $JAM 400 each. However, other fishers and local traders stated that conch fishing is a good business because the cost of cleaning the conch is not high, and when in season, this product can get fair prices despite the fact that fish is the preferred consumer product in Jamaica. In the perception of local fishermen, the abundance of conch is decreasing compared to abundances seen 10-20 years ago.

The artisanal catch is either carried ashore by licensed carrier boats to the fishing terminal in Kingston Harbour, among other places, or by the fishers themselves, usually along Jamaica's south coast, for example, at Whitehouse (Westmoreland) and Rocky Point (Clarendon) with respect to the Pedro Bank, and Rocky Point (St. Thomas) with respect to the Morant Bank. The carrier boats also transport ice, food and water to the cays for the fishers based there. The Coast Guard provides emergency transportation services for people living at the Pedro Cays by helicopter.

There are no data on the production of queen conch pearls and shells, but some information of its international and national trade is presented below, in the trade section.

6.4. Fishing Indicators

A common indicator to determine the efficiency of the industrial fleet is by calculating the abundance index of Catch per Unit of Fishing Effort (CPUE), preferably using standardized fishing effort. Available data from Fisheries Division and other researchers show that CPUE varies but appears to average around 36.8 kg/diver*hour during the last decade. In comparison, a lower mean CPUE was calculated for 1994-1998 averaging 25.6 kg/diver*hour (Table 8).

Table 8. Historical variation of the CPUE in the queen conch fishery at Pedro Bank.

Year	Mean CPUE (kg/diver*hour)	Max CPUE (kg/diver*hour)	Min CPUE (kg/diver*hour)
2015	37.74	96.77	20.86
2014	37.22	48.16	22.18
2013	30	33.49	20.95
2012	37.03	65.49	23.81
2011	33.88	-	-
2010	41.08	70.05	27.67
2009	38.45	-	22.68
2008	35	-	-
2007	-	-	-
2006	-	-	-
2005	-	-	-
2004	-	-	-
2003	-	-	-
2002	26	-	-
2001	-	-	-
2000	-	-	-
1999	-	-	-
1998	18	-	-
1997	16	-	-
1996	22	-	-
1995	32	-	-
1994	40	-	-
1993	-	-	-

Data taken from Fisheries Division.

6.5. Description of the Processing

The conch meat harvested by the industrial fishery is usually kept unprocessed (dirty conch), meaning fishers do not remove at sea any part of the conch besides the shell. The shell is left on the seafloor. The meat is kept on ice at a 1:1 conch to ice ratio. Only one company removes the operculum at sea.

When the conch meat reaches the industrial vessel, the product is weighed, washed, blast frozen and stored in a freezer, using tubular plastic bags. Each mother vessel can store large quantities of product (30-38MT or 66,000-84,000 lbs.), and each canoe or dory receives a receipt detailing the conch meat production by diver (Murray 2015).

At the main landing sites (four or five) in mainland Jamaica, the conch meat is inspected by the Fisheries Division and the Veterinary Services Department (VSD). Using color coded plastic tags, the VSD identifies samples taken from each mother vessel and subsequently conducts health analysis, measuring a set of food safety standards and bio-toxins. These samples are taken to certify that the product satisfies the national regulatory requirements for export. Jamaica is the only country in the region that has been certified to trade conch with the European Union markets. As part of the certification process, the VSD laboratories also measure water quality parameters where the industrial fishing is operating on Pedro Bank. Water samples are taken with the support of the Fisheries Division and the JDF Coast Guard, since the VSD does not have the means for this expensive sampling protocol. The EU publishes on the internet the name of the vessels and processing plants licensed to export products to the EU (https://webgate.ec.europa.eu/sanco/traces/output/non_eu_listsPerCountry_en.htm#).

Under an MOU from the Ministry of Health, the VSD also inspects and certifies the larger boats and processing plants (4-5 facilities). In 2015, there were seven certified processing plants: B & D Trawling Ltd, Rainforest Seafoods, Coles Seafood and More, Everything Seafoods, Knights Commodity Trading Company Ltd. Ton Rick Enterprises and Water Wheel Estate. The processing plants belonging to Rainforest Seafoods and B&D Trawling are the largest and quite frequently are used to process conch meat for those companies not having or not wanting to utilize their own processing facility for conch meat. During the conch season, the VSD issues export health certificates and licenses, one for each shipment or export. The Fisheries Division requires every person (including processors, supermarkets, hotels, etc.) to declare the amount of conch in their facilities in preparation for the beginning of the close season. Conch declarations as well as other data and information are used by the Fisheries Division to issue catch certificates for the export of conch to the EU markets. However, these data are not organized in a data base.

To maintain state of the art facilities, the VSD renovated their entire laboratory in 2000 in order to meet the EU requirements at an approximate cost of $JA 50 million (~$US 400,000). The cost to operate their laboratories can be up to $JA 60 million per year. Financial support to cover a large portion of these investments came from external sources. Support from the Fisheries Management Development Fund is used to cover at-sea monitoring.

Once at the processing plant, if not processed immediately, the product is maintained frozen, being stored at -20°C in a freezer room in trays of 115lb with some water added to maintain good meat quality. Once processing begins, the conch meat is cleaned from dirty meat to usually 50% cleaned meat (removing the operculum and viscera), and sometimes to 65% cleaned (accounts for approximately 7-10% of conch meat processed) or more (Table 5, Figure 8). In the past, some conch meat was processed to 85% cleaned, losing around 25 - 30% of the initial weight or 100% cleaned, and losing up to 50% of the initial weight.

Figure 8. Example of the 50% conch cleaned meat.
Pictures from Murray (2015), Fisheries Division

The processing of conch meat begins with the removal of the meat from the freezer room for thawing, it is then washed and sent to the processing line (Figure 9). At all times, the conch is kept in ice and water while being processed. The conch meat is weighed at three different points across the processing line. The product is then washed and packaged. To complete the conch processing, the processing plant requires additional seasonal employees (Murray 2015).

Producers reported that after processing, 14-16% of the total initial weight can be attributed to the presence of sand, slime and other debris material, meaning that around 84-86% of the total unprocessed (dirty) weight remains after processing to the 50% cleaned meat stage. Preliminary findings (Murray, pers comm) however suggests that after the first wash (which gets rid of slime and other debris) there was an increase in the overall weight gain ranging from 6 to 9% whilst at times a loss of 0.22-3.3% was also experienced. At the end of the process however, when trimmings and other debris were removed, losses ranged from 0.48-8% whilst a considerable portion of the sample gained weight from 9-15% after processing to the 50% cleaned meat stage. For the 65% cleaned meat, 15%-20% weight is lost by the end of processing. It is possible then that the conch meat is absorbing water gradually as it is being processed thereby replenishing fluids loss due to slime. Further investigation on cellular activity is therefore required to determine exactly what occurs from the harvesting of conch to the final stages of processing (Murray, pers comm). The conch is exported as frozen conch meat packages, taken in refrigerated containers from the Kingston commercial port facility.

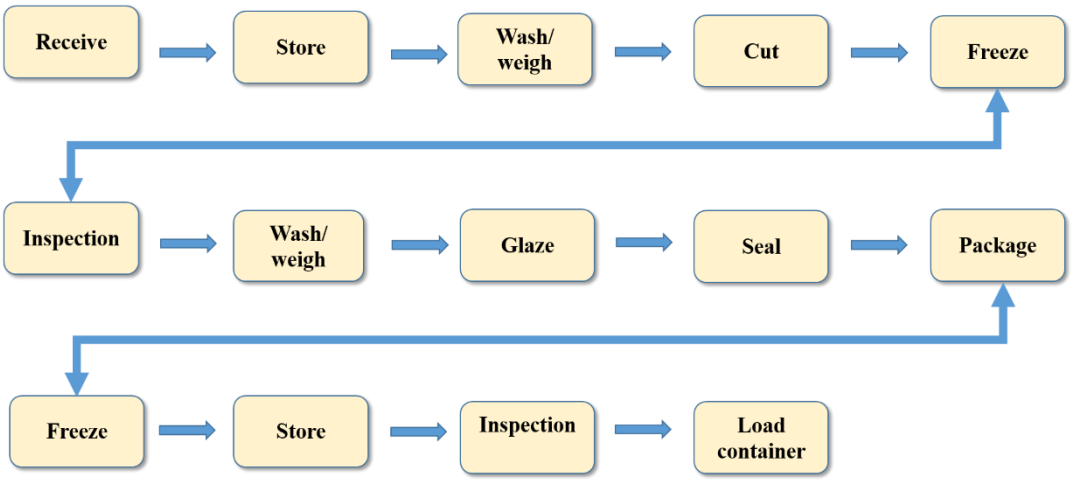

Figure 9. Schematized processing line of the queen conch meat.
Information obtained from Fisheries Division

In recent years, licensed industrial companies are trying to process conch meat to a lesser extent, but they are also experimenting with the production of new value-added conch products; protocols for these processes are not ready yet.

The VSD inspections conducted with respect to the industrial fishery and landings have not yet begun for the insular shelf artisanal fishery and landings given the lack of resources to attend the many different landing places around the island. Artisanal fishermen do not use ice to store the extracted conch meat during the 8-9 hours of a regular fishing trip, and once ashore the fresh water needed for cleaning is limited.

Conch meat harvested from the artisanal fishery not linked to a licensed processing plant is not eligible for export certification (fishers, carrier vessels, fishing sites, processing plants and conch products inspected/monitored, and certified). The majority of the artisanal conch is supplied directly to restaurants, supermarkets and hotels and is fished on demand, that is, in response to specific requests from entities to individual fishers, who may be family members in the case of small local restaurants.

7. Description of the Trade

The industrial conch fishery is considered Jamaica's most lucrative fishery. Historically, the majority (more than 90%) of the Jamaican queen conch meat production has been traded internationally with the US and France. The Jamaican Customs Agency, using the Harmonized Commodity Description and Coding System (HS) identifies live conch with the code 0307.9110.10, and uses the code 0307.9110.90 for fresh or chilled conch products and the code 0307.84 for frozen Stromboid conchs.

Based on the NOAA Fisheries database available online (NOAA/NMFS database), 100% clean conch meat were exported to the US markets during 1990 and 2002. For the period of 1990-

1995, the trade averaged less than 500MT/year and generated less than $US 1 million/year. However, with the onset of the industrial conch fishery, production increased up to 1,192MT in 1998, and generated around $US 6 million (Figure 10). The NOAA data indicate that at that time 100% cleaned meat was traded at approximately $US 4.32- 5.21/kg.

According to data from the CITES database (CITES database exporters), 44% of Jamaican conch meat exports went to the US for the period of 1994-2002, but then was reduced to only 2.6% for the period 2003-2014. In comparison, exports to France and its Caribbean territories went from 55.3% to 97.42% for the same period (Figure 10, Table 9). Exports to the European Union markets are usually 50% cleaned.

Table 9. Percent of queen conch meat as reported by exporters.

Year	CY	EU	JP	US	Total
1994		694,711	20,856	113,636	829,203
1995		1,074,914		479,490	1,554,404
1996		1,232,565		765,989	1,998,554
1997		734,244		689,065	1,423,309
1998				788,081	788,081
1999				474,257	474,257
2000		5		9,090	9,095
2001		252,074		45,360	297,434
2002		265,700		40,000	305,700
2003		393,226			393,226
2004		527,524			527,524
2005		418,494		117,289	535,783
2006		603,194		12,258	615,452
2007		434,025		7	434,032
2008		391,629			391,629
2009		429,449			429,449
2010		382,089			382,089
2011	3,178	382,797			385,975
2012		414,488		15	414,503
2013		339,054		20	339,074
2014		406,408		6,085	412,493
Total	**3,178**	**9,376,591**	**20,856**	**3,540,642**	**12,941,267**

Database codes: CY=Cayman Islands, EU=European Union, JP=Japan, US=United States of America.

Data taken from CITES database available at CITES database exporters

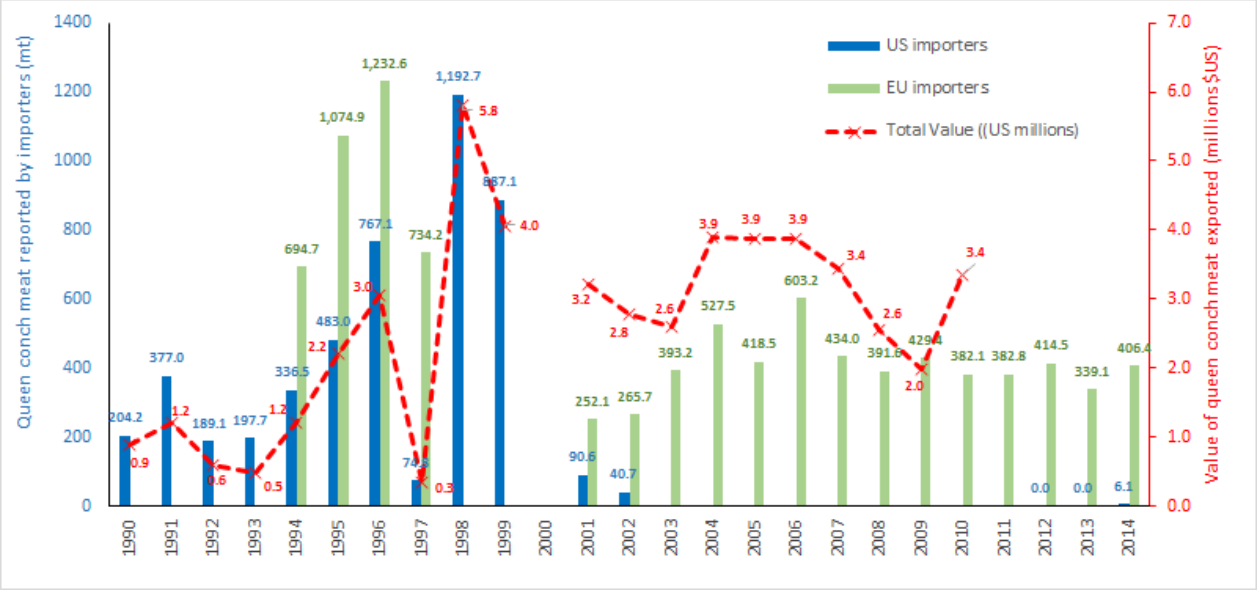

Figure 10. Jamaican queen conch meat exports to the US markets.

Data taken from NOAA Fisheries database and CITES database available at
NOAA NMFS database and CITES database exporters

The increase in conch meat exports to the EU markets are tied to clearance being extended to Jamaica in response to its compliance with health and food inspections and the improvements in their regulatory system. This clearance was extended to Jamaica back in 2000.

In general, conch meat exports in the last five years have generated approximately $US 3.5 million/year in revenues, and accounted for approximately 30-40% of the total Jamaican fishery exports, which also include spiny lobster tails, finfish species and ornamentals (on a small scale). This represents an increase compared to conch meat exports for the period 2004-2008, when revenues were approximately $US 2.7 million/year (STATIN 2015) .

Variability in export revenues is due to the fluctuation in price on the international markets. According to Lingard et al. 2012, from 1993 and 2002 the price fluctuated between $US 2.50 and $8.00/kg, with an average value of $US 4.50- 6.50/kg (Smikle 2012)

Conch meat coming from the artisanal fishery is often traded inside Jamaica, and according to several interviewed fishers and traders, it is usually considered a good seasonal family business. This meat is bought at $JA 250/pound at 50% cleaned. The cost to clean the meat to 100% is approximately $JA 200 for 6 pounds, but this high level of meat processing is only used for conch salad. Other preparations, such as soup, use 80% cleaned meat, while the other plates use 85% cleaned meat.

In Jamaica, the conch is served in three main preparations (grilled/stewed, soup, salad), with a cost between $JA 500 – 1,000 per plate. Local cultural biases have a strong influence on the local consumption of conch. For example, one of the main consumers of conch are the Rastafarians, followed by Jamaicans that visit nearby beaches. However, fish is usually preferred over conch.

Much less information is available on the trade of conch shells. The CITES database variously reports some exports as number of shells, but others are reported in kilograms, thus limiting the historical analysis of these exports. Data suggest that international trade of conch shells, bodies, carvings, and derivatives occurred mainly during 1994-2004 between Jamaica and France, Japan, Great Britain and to the US to a lesser extent. Currently, export of conch shells is thought to be limited and typically for personal use, e.g., by tourists.

In 2016, the local trade of conch shells was considered low, moving in a market that targets mostly local visitors and includes a variety of shell sizes and qualities, which in turn results in prices varying between $JA 30-100 depending on shell quality.

Conch pearls are occasionally found and usually belong to the person who cleaned the conch. As such, pearl buyers advertise their phone numbers in the restaurants, to be contacted on the rare occasions when pearls are found. Given the high prices of the pearls, and the ignorance about the pearls' value on the international market, local fishers do not have good leverage to negotiate with buyers. One person indicated that he found four pearls in 40 years of fishing.

8. Current Status of the Stock

Based on the stability in the conch production and its sustainability over time, as presented above, the conch stock on Pedro Bank is considered to be in healthy condition. However, there is need to improve the catch and effort data collection in order to increase certainty about the status of this valuable resource.

At present, there are indications that the stability of this stock may be threatened. Among these are:

a) Expansion of the fishing grounds since 2012 to the deeper sites in Pedro Bank located on its western side, including reported poaching by Hondurans and others,
b) Progressive increase in the number of licensed fishers,
c) Low effectiveness in controlling illegal fishing.

On top of these are the potential negative impacts from climate change and localized effects of organic contamination.

The condition of the conch stocks from the southern section of the island insular shelf and other offshore banks remain unknown. The only survey conducted at Morant Bank indicated the dominance of adult and stoned conch (Pears and Sary 1997). They speculated that the stock on Morant Bank serves as a minor source of Pedro Bank larval recruits, following recent research

by Stoner and his colleagues (1996), who suggested that conch recruitment across this distance could be possible.

Improvements in fishery governance, evaluation of some regulatory measures, higher involvement of the fishing community and industry, and recurrent and sufficient funding to meet management responsibilities are all of critical importance in order to maintain the stability of the queen conch in Jamaica.

9. Description of the Socio-economic performance

The fishing community in Jamaica is significant, accounting for more than 23,594 registered fishers, 7,353 vessels at the end of 2015, and around 186 different landing sites (Fisheries Division). According to the 2014-2015 census (Murray 2015) it was reported that 961 people fishing on Pedro Bank, including 468 on Middle Cay and 463 on North East Cay, and 51 fishers in Morant Bank that may be actively involved in the conch fishery. Unfortunately, Murray (2015) also mentioned that data from the census are highly uncertain because the status of around 75% of the vessels and 62% of the fishermen were considered unknown, and the census did not cover the entire country. In a similar way, Ligard et al. (2012) reported that at least 1,000 artisanal free divers, potential queen conch fishers, contribute a small proportion of the catches landed at numerous smaller sites and mainly taken to processing plants. It is estimated that 90% of artisanal fishers fish in the inshore areas, that is, the island shelf and proximal banks (Kong, undated). The remaining 10% work offshore and 5% of those reside on the Morant and Pedro cays (Kong 2003).

In addition, the Fisheries Division licensed 342 fishers to operate with conch industrial fishing, not all of them Jamaicans. The preference for foreign divers (mostly from Honduras and Dominican Republic) by some companies is believed to be related to their work capacity, as they spend up to six hours per day under water. This leads to a high productivity and is therefore highly beneficial to the contractor. Jamaican fishers are apparently not capable (or willing) to spend such a long time under water since that carries a great health risk. Therefore, it is thought by some industrial operators that employing Jamaican divers would lead to an increase in production costs.

According to the FAO (2005), artisanal fishing communities in Jamaica tend to have high rates of poverty and food insecurity. This study noted that fishing communities are among the poorest in the island based on the results of the poverty map prepared by the Planning Institute of Jamaica (PIOJ). A 2007 Caribbean Food and Nutrition Institute (CFNI) study also observed that 70.8% of fishers were food insecure, although not severely.

In particular, those fishers living in Pedro Bank, have low education, several cannot read or write – adequately or at all – and in meetings have expressed a desire to improve literacy, and to receive training in environmental and fisheries sciences and other subjects, which could lead to a change of occupation (TNC 2015). TNC also reported that bank residents are predominantly males that have over 16 years in the business of fishing, and are facing major challenges with regards to accessing fresh water, high year-round prevalence of pests especially

roaches, rats and mosquitoes, inadequate access to sanitary facilities (which are either poor or non-existent) and poorly erected physical infrastructure, leading to health, crime and other social concerns (Espeut 2006, Appropriate Technologies 2007, Rhiney 2014).

Given these conditions, the fisher folk on both Pedro Cays seem to be highly vulnerable to the impacts of natural hazards, especially hurricanes and other effects from the climate change. It also appears that low community cohesion, common in Jamaica rural life, combined with low economic power limits the ability of fishers to have more organized fishing organizations and therefore have a more relevant role in co-management strategies (Espeut 1993).

Most divers fishing from the Pedro Cays arrive in their late teens, with no experience of fishing on the mainland (Zenny 2012). In fact, conch divers in Jamaica have used scuba tanks or hookah since the 1990´s, and given the intense fishing and lack of good equipment and safe dive protocols, they suffer from barotrauma such as the bends or oxygen toxicity. Sometimes, they can identify the symptoms quickly and are immediately able go back in the water and return to depth that were fishing to counteract the disease at sea. It appears that fishers receive some information about dive safety, but the application of this relies on the disposition of the individual fisher.

With the installation of a new Hytech hyperbaric chamber in Discovery Bay (Figure 12) better data on diving accidents are now possible. From 2011-2015, 68% of the patients treated were fishers (ranging from 44-90%), 19% were tourists and 13% were people from clubs / sport /commercial divers. Some of the fishers received treatment more than once. This new facility was partially paid for by the Tourism Enhancement Fund (TEF), which also partially supports its operation. The funds generated from the chamber operation are not sufficient to cover the servicing costs.

According to information provided by Camilo Trench (Chief Scientific Officer), the proportion of scuba divers versus hookah divers varies on an annual basis, but appears to be higher for tank users, which may be around 65% (ranging from 31% to 89%). However, the percentage of compressor /hookah divers is slowly increasing with time. More comprehensive historical data are needed in order to establish any trends.

At present, treatment in the hyperbaric chamber costs approximately $JA 130,000 for Jamaicans and $US 5,500 for international patients. In most cases, the patient or their family pays for this expense. In rare cases, the Ministry of Health has paid for some cases (e.g., minors). In the case of recreational certified divers, most have dive insurance, which covers treatment costs; DAN insurance is the most popular. The Discovery Bay laboratory does not have enough recurrent funds to operate the hyperbaric chamber.

Figure 12. Pictures of the Hytech hyperbaric chamber installed in Discovery Bay Laboratory, UWI.
Pictures taken from http://jamaica-gleaner.com/gleaner/20130315/lead/lead94.html

During the treatment and during repetitive visits to fishing beaches, personnel from the Discovery Bay Laboratory offer education and outreach on diver safety, but there is no formal training program in place, nor are there printed or online supplemental materials that can be widely distributed among coastal communities.

The National Council on Ocean and Coastal Zone Management (NCOCZM) has a Diving Sub-Committee that has been working on draft Regulations to regulate occupational diving in Jamaica, under the lead of Mr. Peter Gayle, the principal Scientific Officer and former Safety Director of the hyperbaric facility. A document entitled "Development of Best Practice strategies for the use of Scuba Gear in Fisheries exploitation" is currently being prepared for publication and for submission to the appropriate Minister, with the hope it may become the Diving Act or be incorporated as part of the Occupational Safety and Health Act.

On the other hand, the processing of conch is labour intensive, not just because of the various conch meat preparations, but also because it is closely supervised following the EU certification requirements. The operation of the three certified processing plants may generate around 300 – 400 direct seasonal jobs, mostly women (Vanessa Fagan – Production Manager B&D Trawling Limited, personal communication). During the peak of the conch industrial landings back in the 1990-2000´s, it was estimated that around 3,000 people were actively involved in the conch processing and packing sector (Theile 2005).

In the Jamaican artisanal fishery as a whole, many associated jobs are usually done by women, who can work not only in aspects of processing, but also as vendors and sometime as fishers (Gustavson 2002). Women control the income of fishers through the sale of fish and therefore also indirectly control fishing activities, as well as cooperation with management plans and government officials (Grant 2003).

In general, the island's economy has developed largely dependent on industries associated with its natural resources, with the fishing industry accounting for US$117.6 million of Jamaica's gross domestic product in 2014. According to FAO (2005), the fishing industry contribution to the Jamaican economy in 2013 was 4.35 percent of the Gross Domestic Product (GDP) of the total Agricultural sector. The fisheries sector's (by itself) contribution to Jamaica's GDP for 2013 was 0.29 percent, with a potential to be increased. Unfortunately, no specific estimates on the contribution made specifically by the queen conch fishery are currently available.

To facilitate fishing activities, under the Customs Act specific fishing apparatus (e.g., gear, boats and engines, equipment and parts) can be exempted from paying the 12.5% import tax if they are solely for commercial fishing purposes, once it is approved by the Commissioner and by MICAF. This requires a zero rated certificate from Tax Administration Jamaica (TAJ).

10. Current Fishery Management of the Queen Conch

The initial open access conch fishery in Jamaica (Mahon et. al. 1992) has now been changed to a limited entry policy along with several strict regulations established to promote stock conservation and the long-term sustainability of the fishery. Current fishery management policies have evolved over time, but are based on the whole of the fishery in the largest context, from biological production to market access. Management is now covered under three different legal regimes: Aquaculture, Inland, Marine Production and By-Products Act; Fishing Industry Act (amended); and Endangered Species Act. Additionally, and importantly, management now involves close collaboration among three different offices (Fisheries Division, Veterinary Services Division, National and Environment Planning Agency) housed within two different Ministries. Figure 13 illustrates how these offices interact, from the determination of the annual National Total Allowable Catch (NTAC) to the start of the fishing season to the exportation of conch meat. There are close linkages at several stages within this process.

Since 1995, the NTAC has been based on field surveys carried out approximately every three to five years by the Fisheries Division. The ability to conduct periodic surveys is now stable, as they are supported by the Fisheries Development and Management Fund, which itself is supported by a cess on conch exports. Survey areas, spatial distribution patterns, conch density by size/age classes and depth strata, standing biomass and fishable biomass analysis have improved with time, and the estimation of the NTAC is conducted with high scientific standards.

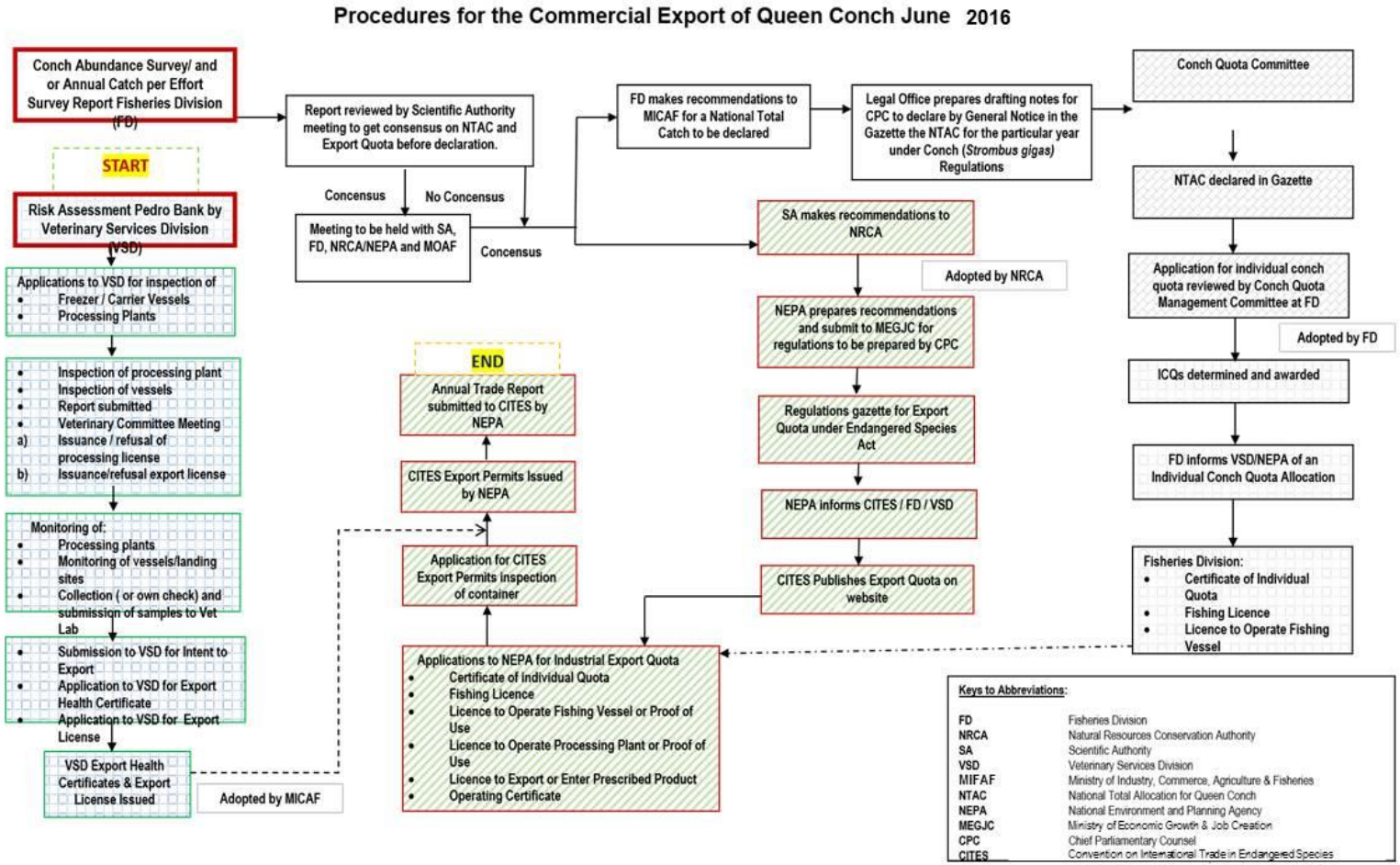

Figure 13. Procedures for the Commercial Export of Queen Conch.
Courtesy of NEPA, June 2016.

The NTAC is the maximum weight that may be landed during a conch season and it is calculated in terms of 50% cleaned conch meat. The NTAC is proposed to follow a set harvest control rule (Figure 14), which follows the 8% rule proposed by Medley (2008), i.e., on average, 8% of the standing exploitable biomass of conch can be harvested each year. The NTAC is initially set after the most recent field survey, which is used to calculate standing exploitable biomass based on the density by zone of conch within each size/age class, and area of each zone, and the average meat weight of an individual in each size/age class.

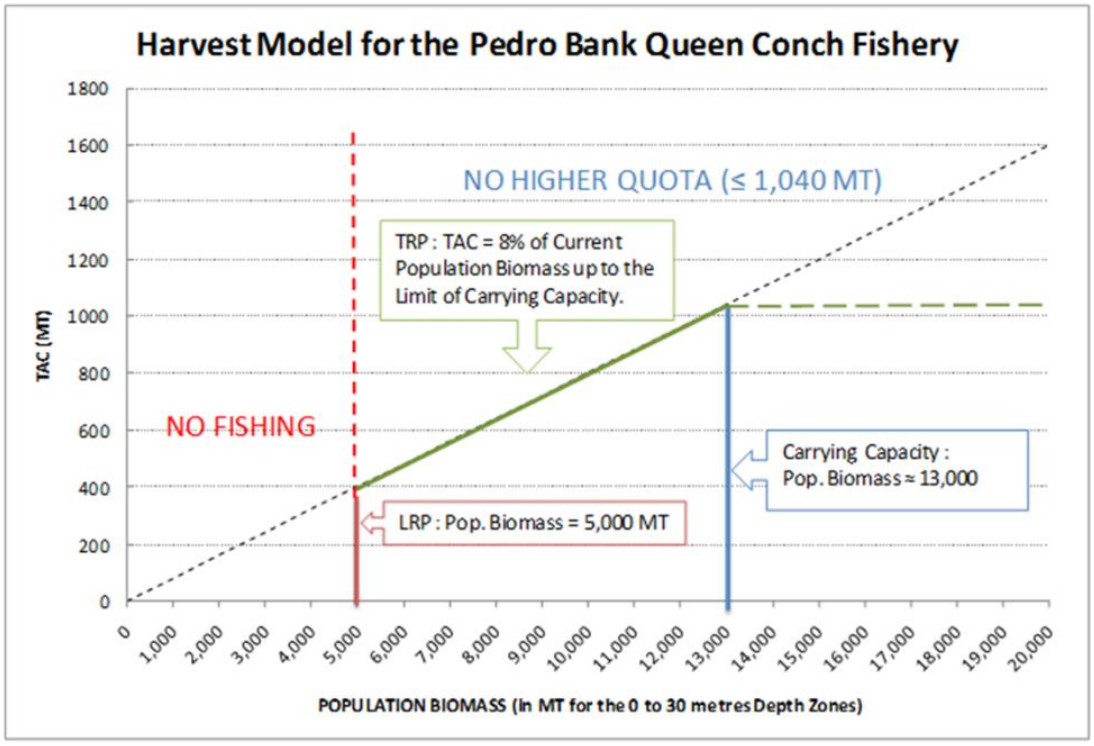

Figure 14. Harvest control rule for the Pedro Bank conch fishery.
Taken from Smikle 2010.

Subsequently, in any particular year, the NTAC does not increase if it is not supported by a field survey recommendation; however, it can decrease depending on the performance of the fishery in the previous year(s), e.g. declines in CPUE are evident, or other potential problems are suspected, e.g., lack of noticeable recruitment of juveniles that may impact future standing exploitable stock. Under the proposed control rule, the maximum NTAC is 1,040 MT, regardless of the density of conch observed in field surveys. This maximum serves as a buffer against errors in the estimation of exploitable stock, since high levels of exploitation could rapidly lead to stock decline under this scenario. A side effect, however, would also be to help maintain conch value on the market. The lowest harvest level under the control rule would be 400 MT, which corresponds to a density of conch below which reproductive effort might decline, as indicated by the work of Stoner and Ray-Culp (2000). If density falls below this

level, the fishery is closed. Harvest between the maximum and minimum levels is automatically set at 8% of the exploitable biomass, unless counter indications are observed.

It is important to note that the use of the proposed harvest control rule to set the NTAC, and specifically its basis on Medley's 8% rule, is justified because the built-in buffers to reduce risk of either scientific or management failure: (1) places a cap on maximum harvest, (2) defines a minimum density for no harvest, (3) ensures that increased harvest requires survey validation (while declines do not). Further, the existence of external buffers against management failure is also a key element of the harvest control rule. Most importantly, the western end of Pedro Bank is a *de facto* reserve area due to its depth. Additionally, an expanded reserve area is planned for the eastern end of Pedro Bank, near Southwest Cay (Also called Bird Cay). These areas will exempt a significant proportion of the spawning stock from exploitation and thus act as an insurance policy. Lastly, this management approach is now backed by over 20 years of experience in both managing the conch fishery and, importantly, quantifying and understanding the response of the Pedro Bank conch population to both natural and harvesting perturbations.

Illegal fishing is a major concern for the management of the queen conch fishery. It has been estimated that poaching results in significant losses, potentially up to US$ 2.65 million annually (Kong, personal communication), with the take by poachers approaching 50% of the NTAC, as a precautionarily high upper estimate. Losses from poaching within areas $\leq$ 30 m, however, are accounted for because the NTAC is based on conch density assessments from the field surveys, and the measured density reflects the intensity of both legal and illegal fishing. Nevertheless, poaching reduces the potential harvest for legal fishers.

The NTAC must be gazetted at least 30 days prior to the end of the close season. Following the annual establishment of the NTAC, the process continues with the allocation of a non-transferable individual quota among the licensed companies. Each quota holder receives a a conch quota certificate i verifying such allocation.Companies may be allocated unutilized quota if other companies fail to harvest a given proportion of their quota within a specified time period.

To become a quota holder, the company, the vessels, the small carriers, the fishers associated and the personnel participating in the processing must possess a valid license, which are also granted annually by the Fisheries Division. In order to keep their license valid, the company is required to present reports on the level of processing and quantity of conch meat in their possession at least seven days prior of the commencement of the close season. The carrier and production boats should install and keep operationally a satellite vessel monitoring system, and to follow health and safety procedures needed to maintain high product quality standards consistent with VSD certifications. In addition, any commercial cold storage facility is required to declare for whom the conch meat is stored within 72 hours of the receipt of conch meat. This product maybe sold during the first 21 days of the conch close season.

The distribution of the NTAC into individual conch quotas is determined based on the following criteria related to (1) Historical involvement and performance and (2) Current investment. Importantly, these criteria are based on the number of consecutive years a company has been fishing conch and the relevant period of involvement, defined as the number

of consecutive years in the fishery since 1995. All weights are in terms of 50% clean conch meat exported and/or the sold locally.

- **Number of Years in the Fishery**: The number of consecutive years a company/individual has been fishing conch, relative to the cumulative number of consecutive years over all quota holders,
- **Catch History**: The company/individual's catch history, calculated as the total cumulative amount of conch lawfully landed and allocated to the quota holder during the relevant years of involvement,
- **Performance**: The company/individual's performance in the fishery as determined by the proportion of utilization of the individual conch catch quota allocated over the relevant period times the relative period of involvement, relative to all conch quota holders,
- **Total Investment**: The proportion of lawful and duly authorized investment specific to the conch industry, relative to all such investment, subject to the constraint that such investments were used in the previous year,
- **Production Capacity**: The capacity of duly licensed processing establishment, including raw material holding, ice making capacity, blast freezing capacity, and finished product holding capacity, and
- **Ownership of Motor Fishing Vessel:** The proportion of motor fishing vessels / fishery vessels owned relative to all such vessels in the fishery. Modified canoes, open hull boats or vessels driven by outboard engines are not considered to be motor fishing or fishery vessels.

See ANNEX 2 for full description of the definitions and criteria utilized to distribute the NTAC among licensed fishers, including detailed examples of their calculation and application.

To verify the compliance to management regulations, inspectors from the Fisheries Division may have access to the processing, storage or selling facilities and to remove any conch meat that has not been reported. Once inspectors are satisfied, the Fisheries Division issues a certificate.

On the other hand, VSD inspections of freezers, carriers vessels, and processing plants results in a technical report that is submitted to the Veterinary Committee responsible for issuance or refusal of the processing licensing, and issuance or refusal of export license. An applicant should present to VSD a letter of intent to export in order to get the correspondent Export Health Certificate and Export License.

Since 2014 the conch fishing season opens in April, when the spiny lobster fishing season is closed, but these periods do not always coincide because the commencement of conch close season may vary depending on serval factors such as the delayed issuing of conch fishing licences or the disruption of fishing activities due to tropical storm or hurricane events. The established start of the close season for conch is August 1, but in the recent past, the close season for conch has commenced on September 1 because of the aforementioned reasons.

To promote conservation of the resource, no person is allowed to collect, offer or sell immature conch (< 22 cm shell length or possession of a flared lip), and areas or times where fishing is not permitted can be established. At present, Jamaica has declared 16 Special Fishery Conservation Areas. These areas are managed in partnership with NGO´s according to formalized agreements, for which the government provides a subvention to some of the NGO Partners to conduct day to day operations. In addition, the National Environment and Planning Agency (NEPA) has declared three National Parks in the marine environment: Montego Bay Marine Park (1992), Negril Marine Park (1998), and Ocho Rios Marine Park (1999). All of these may contribute to the conservation of natural queen conch populations. However, effective enforcement of many of these protected areas is inadequate due to lack of resources, as has been mentioned by many stakeholders, and actual benefits of this protection to the queen conch population are still unknown.

11. Stakeholder Roles and Legal Responsibilities

In Jamaica, the management of the queen conch fishery has multiple agencies and stakeholders involved and at different levels, so there is a some amount of overlap of mandates regarding sustainability, production, trade, socio-economics and administration. It appears that there is not much of a conflict at present, because neither the Fisheries Division nor any of the other entities are strictly enforcing the current laws and regulations given the limited resources available for the enforcement of such activities.

To counteract this situation, collaboration among government agencies and with the conch industry has been progressively increasing with time. In fact, cooperative activities are arranged on an ad hoc basis for specific purposes. However, because the participation of these stakeholders, particularly those related directly to the production and trade of the conch, in the decision-making process remains low, and because communication mechanisms are not efficient, these stakeholders insist on more transparent mechanisms, especially in the allocation of individual quotas and the allocation of funds for management support.

A detailed description of the all stakeholders participating in the queen conch fishery is presented in Table 10.

Table 10. Stakeholders roles and responsibilities involved in the queen conch fishery.

Actor	Higher hierarchy	Organization	General responsibilities	Queen conch specific responsibilities
Government	Ministry of Industry, Commerce, Agriculture and Fisheries	Fisheries Division	The executive agency responsible for the development and implementation of policies and programmes, the management and regulation of capture fisheries, aquaculture and related activities.	They conducts activities related to the fisheries extension, fisheries administration, research and monitoring, development and maintenance of infrastructure on fishing beaches (including Pedro and Morant Cays), and training and education among others. Fisheries inspectors have a dual role of fisheries extension and enforcement, a situation that is considered contradictory and is negatively affecting cooperation in extension and training. At present, the Division is inadequately funded and partially relies on extra-budgetary funding to execute its routine programmes.
		Veterinary Services Division (VSD)	The agency responsible for conducting food safety monitoring along with other environmental parameters. For that, they use their own facilities.	They licence fishing vessels and processing plants to harvest product for human consumption. The national standards under the Aquaculture, Inland and Marine Products and By-Products Act follow closely the EU requirements and standards. They measure water quality and determine food safety parameters and bio-toxins analysis, They also inspect freezers onboard and processing plants, and collect information on conch landings (excluding artisanal production). VSD receipts information from VMS installed aboard queen conch industrial fishing vessel. They are responsible for the elaboration of risk assessments and the issuance export health certificate and export licenses. They are required to prepare annual reports regarding the export of queen conch products
		Bureau of Standards (BSJ)	The agency responsible for facilitating the development of standards and other requirements to which particular commodities, services, practices and processes must comply; monitoring for compliance; conducting tests and calibrating instruments; certifying products and management systems; providing industrial training and promoting research and education in standardization.	A representative is part of the Veterinary Committee that considers applications and recommends to the VSD the granting of licence for fishing vessels and processing plants. Provide advice on policies regarding queen conch exports.

		Trade Board Limited	Responsible for facilitates the increase of trade nationally, regionally and internationally, and to ensure compliance with environmental procedures and standards with respect to trade.	It is Jamaica's certifying authority for goods exported under various trade agreements, and so are responsible for issuance of Import and Export Licenses and issuance of Certificates of Origin among other related matters.
	Ministry of Environment	National Environment & Planning Agency (NEPA)	Has overall responsibility for the conservation of the coastal environment and aquatic resources and the planning and development in coastal regions. NEPA represents a merger between the Natural Resources Conservation Authority (NRCA), the Town Planning Department (TPD) and the Land Development and Utilization Commission (LDUC).	NEPA Conservation and Protection Sub- Division is the country administrative CITES focal point and the secretariat for the local Management and Scientific Authorities. Advise the Minister responsible for the environment portfolio of NRCA's recommendation regarding the annual export quota and inform CITES.
		Natural Resources Conservation Authority (NRCA)	This Authority advises Minister responsible for the environment portfolio on matters of policy relating to trade in endangered species of wild fauna and flora.	Determine the annual queen conch export quota based on CITES Scientific Authority recommendations.
		National Council Oceans & Coastal Zone Management (NCOCZM)	A council established in 1998, with a mandate to develop and implement of a rational, harmonized national policy on ocean and coastal resource management. The policy goals are the sustainable development and conservation of coastal and ocean resources and ecosystems, collection of baseline data and research, the utilization of scientific and traditional knowledge, and promotion of integrated coastal zone management. The Council membership consists of directors or senior officials of agencies whose roles and functions pertain to ocean and coastal affairs.	Provide policy guidance for the conch fishery, ensuring that management and governance of the species is consistent with national goals and with international obligations regarding ocean matters

		Environmental and Risk Management Division	A division that provides policy guidance to facilitate the effective operations to, NEPA and Forestry Department, and statutory bodies which have responsibility for service delivery in environmental protection, conservation and management. They develop, monitor and evaluate national policies in relation to sustainable development, natural resources management, pollution and waste, environmental stewardship, trade and environment, and climate change.	Provide policy guidance and support to NEPA related to the sustainable management of wild fauna and flora. Ensure the preparation of the regulations governing the trade in queen conch and by- products.
	Ministry of National Security	Jamaica Defense Force Coast Guard Service (JDF-CG)	They are responsible for monitoring, control and surveillance activities in the offshore areas and EEZ, defending and protecting the sovereignty of Jamaica from external forces or threats.	They have a station on Pedro Bank (Middle Cay), which facilitates patrolling in the Bank. Usually, a team of six to eight non-commissioned officers and two JCF-MP officers to the CG base on Middle Cay are present once a week using a patrol vessel (one of three county class vessels), or a helicopter from the JDF Air Wing base at Up Park Camp, Kingston. Between 1999 and 2006 the JDF-CG caught more than 10 vessels fishing illegally in Pedro Bank.
		Marine Police of the Jamaica Constabulary Force (JCF)	They are responsible for the maintenance of law and order, prevention and detection of crime, investigation of alleged crimes, protection of life and property, and the enforcement of all criminal laws as defined by the Jamaican jurisdiction.	They enforce laws relating to fisheries, harbors, shipping and drugs. With respect to the enforcement of fisheries laws, the Marine Police largely operates within the inshore areas.
	Ministry of Sciences, Energy and Technology	The Scientific Research Council	The agency responsible for the fostering and coordinating of scientific research and the promotion of its application. Most of the Council's projects support the growth and development of the agro-industrial sector in Jamaica through research, adaptation of available technologies, creation of new and appropriate technologies and the provision of training and technical assistance.	Despite its potential, the involvement of this council in queen conch fishery remains low, it is conducting studies indirectly related, such as various topics on climate change.

		National Commission on Science and Technology	The Commission is the umbrella organization responsible for fostering and advancing the national policy and strategy for science and technology in Jamaica. It also promotes the development and utilization of local science and technology capabilities, for competitive and profitable production through education of the populace, partnership of government, private sector, academic institutions and such other bodies or institutions, among other related issues.	This entity does not currently interface with the conch management regime but based on its mandate the entity should among other things, provide capacity building support related to the sustainable management of Queen Conch
	Ministry of Finance and Planning	Statistic Institute of Jamaica (STATIN)	Responsible for the collection, compilation, analyses, and publishing of statistical information relating to the commercial, industrial, social, economic and general activities and condition of the people. This work is done in collaboration with public agencies.	The agency conducts census in Jamaica, including fishermen, and promote and develop integrated social and economic national statistics.
		Jamaica Customs Agency (JCA)	The agency responsible for the collection of revenue, protection of Jamaica's borders against illicit imports and the facilitation of trade.	They are responsible for enforcing import and export restrictions and prohibitions, thus an Export Officer is present at the time of packing the container at the processing plant and verifies the quantity of specimens/ products being traded on the CITES documents.
	Ministry of Transport, Work and Housing	Maritime Authority of Jamaica (MAJ)	Agency with the purpose of developing and regulating matters relating to merchants shipping and seafarers. The Authority has responsibility for wide-ranging activities including the safety of shipping, regulating the construction of ships and navigation, the prevention of marine pollution, and the establishment of maritime training and safety standards, among other related issues.	Responsible for safety and sea worthy inspections of vessels. Certificates of Vessel Registration and vessel safety from the MAJ are mandatory prerequisites for licences from the Fisheries Division and the VSD

		Port Authority of Jamaica	A corporation and the principal maritime agency responsible for the regulation and development of Jamaica's port and shipping industry. The Port Authority is responsible for the safety of all vessels navigating the ports of entry and regulation of the tariffs charged on goods passing through the public wharves	Has no responsibility directly related to conch but will be the main entity responsible if Jamaica ratifies the FAO Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing.
	Ministry of Labour and Social Security:	Work Permit Department	Mandate is to promote a stable industrial climate through tripartite dialogue; ensure the highest standards of occupational safety and health at the workplace; facilitate increased access to employment and effectively manage social protection programmes including those for groups with special needs such as households below the poverty line, the elderly and persons with disabilities.	Responsible to grant Work Permits to foreign fishers including captians for large industrial vessels.
	Ministry of Health	Standards and Regulation Division	Responsible for among other things developing and monitoring of health standards for the handling of foods including fish and fish products	Conduct required training of fishers and grant Food Handler's Permit to competent fishers. Conduct health inspections on foreign poachers caught fishing illegally in Jamaican maritime space
	Ministry of Justice (MOJ)	Attorney General Office	This is the office responsible for both civil and criminal proceedings, as well as giving general legal advice and advice on legislation.	Responsible for assessing all draft of fisheries related policies, laws and regulations and regional and international treaties and agreements to ensure that they are consistent with the Constitution and all existing laws and Regulations.

Academia	University of the West Indies (UWI)	Life Science Department, Center for Marine Sciences, Discovery Bay Marine Laboratory	The university is the largest and longest standing higher education provider in the English-speaking Caribbean. The Mona Campus has five faculties (social, economic, political, cultural, and environmental) and around 15,000 students.	UWI has played an important role in this fishery through the research and technical advice offered during long-standing relationship between the Life Science Department and Fisheries Division. They have also contributed as part of the Fisheries Advisory Board and the CITES Scientific Authority.
	Institute of Jamaica (IOJ)	National Museum of Natural	This is an educational organization focused on the cultural, scientific and artistic aspects of Jamaica cultural heritage.	They provide technical advice to NEPA as part of the CITES Scientific Authority.
	Urban Development Corporation (UDC)		An organization committed to making development happen for the people of Jamaica while nurturing a culture which values both our internal and external customers.	They provide technical advice to NEPA as part of the CITES Scientific Authority.
Producers	Industrial fishers	Licensed companies	B & D Trawling Ltd Rainforest Seafoods Ltd Ton-Rick Enterprises Limited Newport Fish & Meat Waterwheel Estate Limited Seafood & Ting Int´l Ltd Everything Seafood Ltd Cole´s Seafood & More Seafood Inc. Ltd	Enterprises dedicated to the extraction, processing, and national and international trade of the queen conch products.
	Artisanal fishers	Artisanal fishers associated to the industry	In 2015 a total of 342 licensed fishers working associated with the conch industry. Many of them are seasonal residents in Pedro Cays.	People directly involved in the extraction of the queen conch at sea, that operates with the support on the industrial licensed companies.

		Artisanal fishers not associated to the industry	Unknown number of artisanal fishers fishing for the queen conch in the country south-section of the insular shelf and occasionally in other nearshore and offshore banks. It is expected that around 1,000 persons make up this group.	People directly involved in the extraction of the queen conch at sea, which operations are not supported by the industrial licensed companies.
		Jamaica Fisherman's Cooperative Union (JFCU)	JFCU is a secondary co-operative society with membership of nine primary fishermen co-operatives and several hundred individual fishermen. Combined membership in the JFCU is about 4,000, 25% of them fishers. They are committed to improving the social and economic welfare of its member stakeholders by utilizing their united funds and efforts in an effective and efficient manner. Operates under the Ministry of Industry and Commerce, responsible for all cooperatives and friendly societies.	The JFCU provides a wide range of services of commercial fishing equipment to fishermen in the island and is managed by a nine-man board representing member societies. The JFCU also provide advocacy on behalf of the artisanal fishers as well as technical advice as part of the Fisheries Advisory Board and several ad hoc committees established from time to time.
	Funding Entities	Local NGOs International NGOs Governmental Funding Entities	Play a supporting role in the management of conch mainly through technical and financial assistance. Such entities include: EFJ,TNC, JET, YEC Ltd., CCAM	Funding entities can provide funding to support the full range of issues relevant to the management and development of the conch sector. Local NGOs work with fishers to implement fisheries management strategy allowing for stakeholders to meet and discuss, input into policy, seek solutions and provide information to stakeholders including fisherfolk.
Sources of funding	Fisheries Development Management Fund (FDMF)		Established in 2009 with the purpose to facilitate the sustainable management and development of the fishery sector. The fund is comprised by a fee imposed on every pound of conch meat exported. The amount was initially established at $US 0.75, but has increased to $1.00. Currently there are plans to reduce this rate.	Provide funding for fisheries management issues in general, including the queen conch.

	Tourism Enhancement Fund (TEF)		Established in 2005 with the purpose of promoting growth and development in the tourism sector, encouraging better management of environmental resources in Jamaica. Fund comes with the US$20 charged to incoming airline passengers and US$2.00 for cruise passengers.	Provide funding to operate the Discovery Bay hyperbaric chamber used in the treatment of fishers after a diving accident.
Regional bodies	CARICOM/CRFM		Is the Caribbean regional agreement established with the purpose of promoting the efficient management and the conservation and development of aquatic resources in the CARICOM States, the promotion of cooperative agreements among interested States, and the provision of technical advisory and consultative services to fisheries divisions of Member States. The mechanism is composed of three different instances: the Ministerial Council, the Forum and the Executive Committee.	Provide technical support for government agencies and help in the identification of regional collaboration and partnerships in developing specific fisheries management CRFM projects.
	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)		The international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. At present has been signed by 182 countries worldwide.	Provide technical support for government agencies and help in the identification of regional collaboration and partnerships in developing specific fisheries management projects. Review and publish the national export quotas.

	Western Central Atlantic Fishery Commission (WECAFC)		To promote the effective conservation, management and development of the living marine resources of the area of competence of the Commission, in accordance with the FAO Code of Conduct for Responsible Fisheries and addresses common problems of fisheries management and development faced by Members of the Commission. The Commission does not have any regulatory power and can only perform advisory functions.	Provide technical support for government agencies and help in the identification of regional collaboration and partnerships in developing specific fisheries management projects.
	United Nations Environment Program, Caribbean Regional Office (UNEP/CEP)		The United Nations program that takes into consideration the importance and value of the Wider Caribbean Region's fragile and vulnerable coastal and marine ecosystems, including an abundance of mainly endemic flora and fauna. It is responsible for assessing and manage issues relative to environmental pollution, be the Secretariat of the Specially Protected Areas and Wildlife (SPAW) Protocol, and communication, education, training awareness activities. The SPAW protocol allows harvesting of listed species but encourages member states to "adopt appropriate measures to ensure the protection and recovery of the species ….. and regulate [their] use.	The queen conch is a listed species, but Jamaica is not a signatory of the Protocol.

12. Problems of the Fishery

Actual problems or challenges in the management of the queen conch fishery arise from different perspectives, including those related to the bio-ecological condition of the natural conch population within the ecosystems they live, along with those related to the people involved, thus covering a wide variety of socio-economic aspects. There are also situations related to administration and the overall governance of the fishery.

The description of these problems within the national and international contexts is presented in Tables 11 – 12. These challenges were analyzed and prioritized by participants attending the second workshop held at the Fisheries Division conference room last July 17, 2016 (Annex 3).

Table 11. Description of challenges in the queen conch fishery in the national context.

Dimension	Description of the Challenge	Degree of Impact		
		High	Medium	Low
Biological / Environmental	1. Complex and still unknown basic biological characteristics of the species (reproduction, growth, morphology, recruitment) limits their application to fishery management.	X		
	2. Incomplete information on conch genetic and ecological connectivity across the Jamaica EEZ, and lack of information on ocean circulation patterns result in partial understanding of recruitment dynamics.	X		
	3. Habitat degradation and reduced water quality (mainly in coastal areas) may reduce the level of conch recruitment and survival.		X	
	4. Currently the lack of information on conch distribution, abundance and habitats in nearshore and offshore banks (with the exception of Pedro Bank) and on the main island insular shelf is limiting the application of spatial variables to fisheries management.	X		
	5. Increases in water temperature observed may alter conch reproduction and recruitment.		X	
	6. Potential decreases in pH (increases in acidity) in oceanic waters can reduce conch shell formation (specifically in larvae) and predator resistance.		X	
	7. High recruitment areas over the entire Jamaica EEZ are not yet identified, which limits the possibility to apply spatial conservation strategies, sources and sink areas and mechanisms of connectivity.		X	
	8. Potential increases in storms/hurricanes due to climate change can negatively impact recruitment success and disturb juvenile and adult queen conch grounds.		X	
	9. There is a potential for oil exploration/exploitation on Pedro Bank and its surroundings, with still unknown consequences to the natural conch populations.		X	
Social	10. Artisanal fishers do not use or benefit from the portion of the quota allocated to them, which is of growing concern relative to transparency and charges of corruption.			X
	11. The overall national consumption of the conch meat in Jamaica remains low, which			X

	negatively impacts societal benefits.			
	12. Poaching significantly reduces the allocation of individual quota.	X		
	13. Management objectives and regulations are not clear to all users, resulting in low compliance of fishing regulations.		X	
	14. Divers in this fishery are affected from barotraumas due to the low training and safety protocols in place.	X		
	15. Local communities are not using all potential conch products to generate family income and thus losing business opportunities.		X	
	16. Fishermen are not benefiting from new technology developed to control illegal fishing, nor are they receiving appropriate training for its use.	X		
	17. Not all companies utilize local divers in their industrial operations, reducing the participation of nationals in the fishery.	X		
	18. Misreporting may affect the estimation of the NTAC, thus affecting all fishers involved in the fishery.	X		
Economic	19. Fuel costs are extremely high given the long distance and the large fishing area.	X		
	20. Reductions in the cess per exported pound of conch will negatively impact budgets for overall proper management of the queen conch.	X		
	21. Poaching from foreign fleet reduces the potential profits to legal national licensed stakeholders.	X		
	22. There is no mechanism in place to adjust the cess per exported pound of conch for trade dynamics, which may impact the profitability if the conch industry.			X
	23. There is not enough transparency in the management of the Fisheries Management and Development Fund.	X		
	24. Budgets allocated to government agencies are not enough to fulfill their legal responsibilities.	X		
	25. Given the lack of a protocol to relate the production of new conch value-added products with the NTAC, the possibilities to expand the fishery's economic benefits are being restricted.		X	
	26. The current pattern of patrolling at sea by the Coast Guard is insufficient, and economic incentives for fisheries enforcement are low.	X		
	27. At present, Jamaican queen conch products depend on the EU market, increasing risks due to market volatility.	X		

	28. Conch pearls are the most valued product in the queen conch fishery, however it remains unregulated.		X	
Institutional	29. Incomplete and sporadic catch and effort data from the conch industrial fishery are not reliable for establishing the proper fishery indicators or conducting traditional stock assessments.			X
	30. Inconsistent or nonexistent monitoring of artisanal conch fishing operations results in incomplete catch data sets.	X		
	31. Available/historical data from of the conch fishery are not being compiled in any data depository system, resulting in unnecessary effort when conducting conch assessments.			X
	32. The system to determine the annual NTAC and its allocation to individual quota holders is not perceived as transparent, which is negatively affecting the overall governance in the fishery.			X
	33. Government agencies lack a protocol to discuss and agree on a wide variety of issues related to fishery enforcement, which in turn reduce their success in prosecuting fishing violators.	X		
	34. Patrol boats/planes do not always have a Spanish speaker on board.	X		
	35. With the limited data and the perceived loss in weight due to processing, especially for the 50% clean meat category, may result in the demand for extra quantities above the quota	X		
	36. Conversion factors for new conch products (trimmings and opercula) are not yet developed, and not tied directly to the sustainability of conch population.			X
	37. Conversion factors require precise measurements of losses in weight, sometimes small quantities, but the scales utilized did not meet specification.			X
	38. The opening of the conch season is not fixed, and delays are extending fishing into the reproductive season.	X		
	39. The coastguard boats are good working platforms and can potentially support research initiatives, but their participation in research and education is low.		X	
	40. There is no suitable patrol boat stationed on Pedro bank on a permanent basis, which needed if illegal fishing is to be reduced.	X		

	41. There is no training protocol in place to educate enforcement personnel on all fishery management objectives, their associated regulations and prohibitions, nor their ecological basis.	**X**		
	42. Agencies with conch management responsibilities do collaborate, but the communication channels are not efficient, thus resulting inadequate networking.		**X**	
	43. The participation of conch fishers in decision making remains low.	**X**		
	44. Veterinary Services Division's quality control protocols are not being applied to the artisanal fishers that are not associated with industrial operations, thus increasing health risks in local communities and visitors.		**X**	

Table 12. Description of challenges in the queen conch fishery in the international context.

Dimension	Description of the Challenge	Degree of Impact		
		High	Medium	Low
Environmental	1. Jamaica develops international partnerships to conduct research as part of regional projects, however, opportunities are sporadic and do not respond to a regional research agenda.		**X**	
Social	2. Collaboration with neighboring countries towards improving training and diving safety for fishers infrequently occur or planned.		**X**	
Economic	3. Jamaica is not looking for funding within CITES to strengthen VSD inspection and certification system as a system to improve conch product traceability in the international trade.		**X**	
Institutional	4. Formal communications with other conch harvesting countries political and management authorities to counteract foreign illegal fishing are not taking place in a frequent and strategic manner, despite the existence of regional agreements.	**X**		
	5. Enforcement personnel in Jamaica do not have enough opportunities to work with enforcement personnel from neighboring countries to collaboratively combat illegal fishing and trade.		**X**	
	6. There is not enough education and outreach among technical, political and judicial personnel in regard to queen conch biology and fisheries management issues.	**X**		

13. Existing Legal Framework

The fishing activities in Jamaica are regulated by the Fishing Industry Act, 1975 and Fishing Industry Regulations, 1976. In the context of the queen conch, that law includes aspects of the generalities of the management of the fishery, the licensing of fishers and vessels, the establishment of the close season, and applying the Fishing Industry (Conservation of Conch (Genus Strombus)) Regulations 2000 gazetted in March 20, 2000. However, a new Fisheries Act is being developed and is expected to be presented to the Cabinet in 2017. This is an almost 20-year effort that is intended to address many of the issues identified as problems in this fishery, including a new set of incentives for the improvement of the enforcement and surveillance, among others.

The Aquaculture Inland and Marine Products and By-Products Act (1999) establishes the procedures for inspections and licensing, as well as the food safety standards and quality assurance for conch harvesting, handling, transport, processing, storage to export, and the export licensing administered by the Veterinary Services Division.

In addition, the Conch (export Levy) Act, 2009 established the Fisheries Management Development Fund and Board. This fund is a source of funding critical to the maintenance of resource management strategies and is being used to facilitate the sustainable management and development of the capture and culture fisheries sector in general.

By means of the Endangered Species (Protection, Conservation and Regulation of Trade) Act (2000), the protection and conservation of the conch resource were mandated, and the conch trade and application for export quota were regulated. It also prohibits the trade in endangered species. Scientific and Management Authorities have been established to monitor the trade of fauna and flora listed in CITES, Appendices I, II and III.

Similarly, the Natural Resources Conservation Authority Act (1991) established the Natural Resources Conservation Authority, with a mandate to ensure the effective management of the physical environment of Jamaica and the management of marine parks and protected areas. It regulates the request of environmental impact statement for applicants and provides for the establishment of marine parks and protected areas, where fishing activities are prohibited.

Beach Control Act (1956) regulated the proper management of Jamaica's coastal and marine resources by a system of licensing of activities on the foreshore and the floor of the sea. The Act also addresses other issues such as access to the shoreline, and other rights associated with fishing and public recreation, as well as the establishment of marine protected areas. Stipulated is that any intervention or use of the sea floor will require a license.

The Morant and Pedro Cays Act (1907) prohibited unauthorized fishing, catching of turtles and birds and trespassing on the Cays. The Act allows for Fishery Inspectors to inspect the Cays and ensure conformity with the legislation.

Other laws that may apply in the context of the queen conch fishery are the following:

- Maritime Areas Act (1996)
- The Exclusive Economic Zone Act (1991)

- Shipping Act, 1999
- Harbours Act, 1874

SECTION II. UPDATED FISHERY MANAGEMENT PLAN

14. Goal

The goal of the queen conch fishery management plan is to provide for and promote the effective management and sustainable development of the fishery in accordance with:

a) Regional and internationally recognized norms, standards and best practices; and
b) An ecosystem approach to fisheries management that ensures that: (i) the development and management of conch fisheries and other related activities; and (ii) the multiple needs and desires of society are addressed without jeopardizing the options for future generations to benefit from the full range of goods and services provided by conch resources.

15. Principles

The plan is guided by the following principles:

(a) Conch fisheries resources shall be managed as a renewable asset so as to ensure utilization of the resources at optimum sustainable yield;
(b) The marine environment shall be managed (i) as an asset for current and succeeding generations; and (ii) to ensure the protection of fishery resources and human health;
(c) The application of measures to counteract data and information gaps that would result in the stability of the conch natural populations while allowing for responsible conch fishing;
(d) Subject to paragraphs (a), (b) and (c) the conch fishery resources shall be managed to achieve economic growth, human resource development, employment creation and a sound ecological balance, consistent with Jamaica's national development objectives;
(e) Conch fishery management where applicable and feasible will be consistent with relevant regional or international obligations and applicable rules of international law;
(f) The user-pays principle shall be applied where applicable;
(g) To the extent practicable, stakeholder participation in the management of conch fishery resources shall be promoted;
(h) Responsible management of conch fishery resources, based on the best available scientific information shall be promoted;
(i) The livelihood of persons in conch fishing communities and their access to fishing resources shall not be affected negatively by coastal, watershed or any other developments, alterations, activities or accidents that may affect such communities; and
(j) Management, educational and enforcement activities targeting the conch resource and fishery should be coordinated across all fisheries, to the extent possible.

16. Objectives

In compliance with the goal and principles, the plan is set to fulfill the following objectives:

I. To control , monitor and conduct surveillance and enforcement in relation to the conch capture fishery to maintain optimum yield.
II. To enhance sustainability and resilience of the conch resource by protecting and conserving ecologically important habitats, including water quality.
III. To promote the rehabilitation of overexploited stocks.
IV. To control and monitor all activities relating to the processing of conch with a view to optimizing the value of the conch resource by the establishment of processing standards and legal minimum levels of processing (such as, valued added : partially or wholly cooked, canned conch etc.).
V. To enhance employment opportunities.
VI. To enhance economic development within Jamaica.
VII. To obtain optimum foreign exchange earnings from the export of conch.
VIII. To increase domestic consumption of conch products (residents and tourists).
IX. To enhance and maintain transparency and communication.
X. To increase conch diver safety and health.
XI. To promote regional collaborations based on international agreements to counteract IUU fishing and improve regional management.

17. Proposed management actions

1. Formally establish three queen conch management units: (1) Southern island shelf, (2) Pedro Bank, and (3) other outlying banks. Based on the 200m contour, produced by GEBCO, these management units may occupy a total area of 16,938 km2, with Pedro Bank accounting for 54.4%, the South Bank with 31.1% and the remaining 14.5% comprising the other oceanic banks (Figure

2. Design and implement an objective system (including annual time frame) for the determining of the annual fishing NTAC and export quota, by management unit, in consultation with the licensed fishers. This system should be gazetted and based on field surveys, harvest control rules, the best available scientific information and application of the precautionary principle. (Objectives: I, II, VI, IX)

3. (a) Design and implement a limited entry system for the industrial conch fishery.
(b) Update and standardize the system to allocate the NTAC among licensed fishermen. The system(s) must explicitly identify the criteria used for entry and allocation and how those criteria will be interpreted and scored. The system(s) should be understandable by all stakeholders and gazetted. (Objectives: I, II, VI, IX)

4. Establish accountability measures to be implemented if catch targets (individual or overall) are exceeded with the goal of offsetting the overage.

5. The harvesting of conch on Pedro Bank from divers based on industrial vessels should be limited to areas between 10m to 30m in depth. No fishing for conch in waters deeper than 30 m. (Objectives: I, II, III, V, X)

6. Establish a minimum 4 - 5 month close season for conch fishing. (Objectives: I, II, III)

7.

8. By management area, establish a minimum legal "size" (e.g., based on lip thickness (for a rationale based on reproduction), shell length or other criteria). (Objectives: II, III)

9. Define, determine and protect Essential Habitat for conch in the three fishery management units. This would require the production/update of habitat maps at least to 30m in depth. (Objectives: II, III)

10. Require the implementation of a recovery plan once the resource has been declared by the management authority to be in an overfished condition. The queen conch recovery plan needs to be developed in a participative way.

11. Fishery and conservation authorities will work in collaboration to establish a no-take conch fishing reserve in the vicinity of the Pedro Cays that contains essential conch habitat, especially nursery areas, (such as the southeast section of the bank, recognized important conch nursery area). In addition they will establish a no-take conch fishing reserve on the southern shelf of Jamaica that contains essential conch habitat, especially spawning and nursery areas (this would need additional field work). (Objectives: I, II, III)

12. Mandate the improvement of catch and effort monitoring program, needed to determine the status of the conch stocks. (Objectives: I, II, III)

13. Establish a protocol to calculate different conversion factors (various degrees of conch meat processing, relationship between valued-added conch products and individual quota, and number of conch meats to the pound). Existing values are to be updated as necessary. (Objectives: I, II, III, VII)

14. Establish exclusive artisanal fishing zones needed to promote the Jamaica economic development, allowing for stock recovery when needed. Such fishing zones require determination of the existence of a fishable biomass determined by the fisheries authority and minimum standards for safe consumption of their products. Every artisanal conch fisher has a valid fisher ID, which can be used to establish a limited entry policy for artisanal fishery. Criteria and conditions to determine the artisanal character of the fisher should be well known and accepted by majority of them. (Objectives: III, IV, V, VI, VIII)

15. Establish agreements to improve effectiveness of enforcement and surveillance at national and international scenarios. Agreements may include: a) Organization of annual regional meetings within CARICOMP/CRFM and OSPESCA to evaluate the progress and effectiveness of the enforcement following considerations in the MOU to counteract IUU fishing; and b) Establishing bi-national agreements with Honduras, Haiti and Dominican Republic looking for collaborative effort to reduce IUU fishing in Jamaica. (Objectives: I, II, VI, XI)

16. Fisheries Division will support communication between the conch industry (at industrial and artisanal levels) and other government agencies in order to implement the Trade Facilitation Task Force to boost the conch trade and improve inter-agency collaboration and

transparency. Special campaigns will be included in order to promote the conch domestic consumption. (Objectives: V, VI, VII)

17. Fishery and conservation managers will participate in existing or new small business initiatives looking for the development of coastal fishing communities programs supported by public or private funds. (Objectives: V, VI)

18. Fishery and enforcement authorities will work collaboratively with other government agencies towards adopting safety protocols to prevent/treat dive disease. The collaboration will establish a diver training program, which must be administered to all licensed conch fishers. (Objectives: V, X)

19. Fisheries, enforcement and conservation authorities will work collaboratively with key stakeholders in the design and application of education and outreach programs to promote greater support to fishery and conservation management, and understanding of the conch ecological and economic role in Jamaica fisheries. (Objectives: II, III, IX)

20. Fishery authorities will build linkages with public and private stakeholders needed to improve fishery governance, based on the best scientific information. (Objectives: I – XII)

21. Establish a Fishery Scientific Advisory Committee with the mandate for developing research priorities for enhancing the management and utilization of the conch resource. Priorities should be incorporated into 5-year plans. Membership in the committee should be drawn from representatives from pertinent agencies, academia, and other non-governmental organizations, and should incorporate expertise in aspects of biological/environmental, social and economic dimensions of the fishery. (Objectives: I – XI)

22. The Fishery Development and Management Board will establish criteria for the allocation of the Fishery Development and Management Fund to conch fishery versus non-conch fisheries activities. Non-emergency allocations should be announced at least one year in advance. (Objectives: IX)

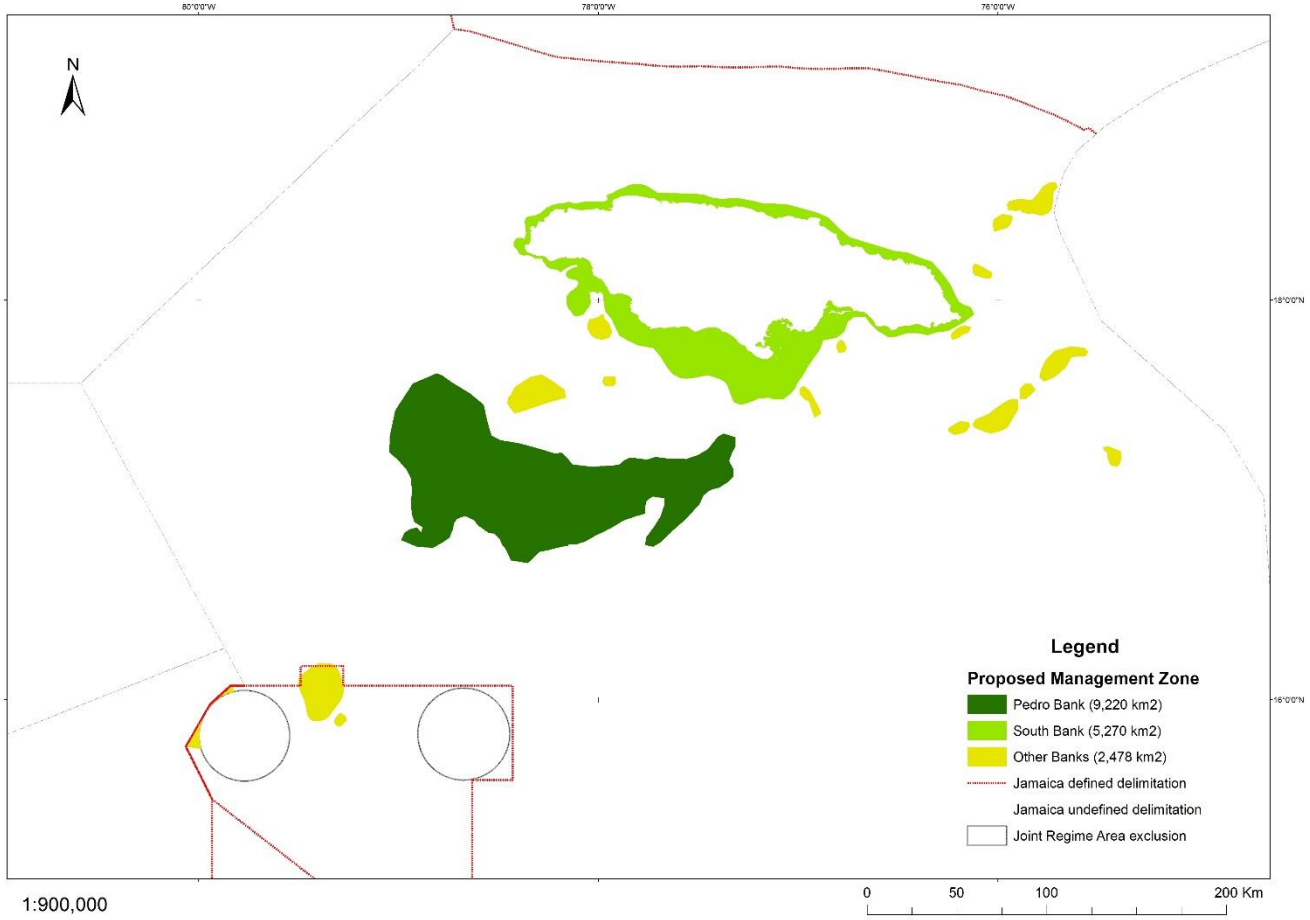

Figure 15. Spatial distribution of the proposed management units for the queen conch fishery, based on the 200m depth contour. Bathymetric information taken from GEBCO available at http://www.marineregions.org/eezdetails.php?eez_id=166

18. Research needs

The scientific advisory committee (Recommendation 21, above) will develop a specific agenda to attend the research needs and build strategies for its progressive implementation. Although needs should be prioritized with 5-year plans, these plans can be amended as the need arises. Implementation of the research plan will be based on available funding, but it is expected that a portion of the Fisheries Development and Management Fund will be allocated to address at least some research priorities, according to criteria established under Recommendation 22, above.

The committee would report its research recommendations jointly to the Fisheries Development and Management Board, which would subsequently notify the Fisheries Division and other pertinent agencies for collaboration and implementation.

The resultant research agenda prepared by the committee would be considered a complementarily annex of this fisheries management plan.

19. Timeline and responsibilities

This management plan is being formulated to be fully implemented during the next 10 years, as presented in Table 13.

Table 13. Summary of proposed management regulations with time frame scenarios.

ID	Proposed management regulation	Responsible stakeholder	Time frame in years		
			Short term (3)	Medium term (5)	Long term (10)
1	Formally establish three management units in the queen conch fishery.	Fisheries Division	X		
2	Design and implement an objective system (including annual time frame) for the determining of the annual fishing NTAC and export quota, by management units.	Fisheries Division, CITES Scientific and administrative authorities, users representation	X		
3	Design and implement a limited entry system for the industrial conch fishery and standardize the system to allocate the NTAC among licensed fishermen.	Fisheries Division	X		
4	Establish accountability measures to be implemented if catch targets (individual or overall) are exceeded with the goal of offsetting the overage.	Fisheries Division, CITES Scientific and administrative authorities, users representation	X		
5	Harvesting of conch on Pedro Bank from divers based on industrial vessels should be limited to areas between 10m to 30m in depth.	Fisheries Division	X		
6	Establish a minimum 4 – 5 month close	Fisheries Division,	X		

	season for conch fishing.	users representation			
7	VMS requirements.	VSD, Fisheries Division	**X**		
8	By management area, establish a minimum legal "size"	Fisheries Division, CITES Scientific and administrative authorities, users representation	**X**		
9	Define, determine and protect Essential Habitat for conch in the three fishery management units.	Fisheries Division, NEPA, users representation, NGOs			**X**
10	Require the implementation of a recovery plan once the resource has been declared by the management authority to be in an overfished condition.	Fisheries Division, CITES Scientific and administrative authorities, users representation		**X**	
11	Work in collaboration to establish a no-take conch fishing reserve.			**X**	
12	Mandate the improvement of catch and effort monitoring program.	Fisheries Division, users representation	**X**		
13	Develop a protocol to calculate different conversion factors. Values are updated.	Fisheries Division, users representation	**X** (Pedro)		**X** (other areas)
14	Establish an exclusive artisanal fishing zones needed to promote the Jamaica economic development, allowing for stock recovery when needed, and minimum standards for safe consumption of their products.	Fisheries Division, VSD, NEPA, MOH, conch industry, trade agencies, tourism authorities, and NGO´s and users	**X** (Pedro)	**X** (other areas)	
15	Establish agreements to improve effectiveness of enforcement and surveillance at national and international scenarios.	Fisheries Division, Coast Guard, Marine Police, users representation, NGOs	**X** (national)	**X** (interna-tional)	
16	Fisheries Division will support communication between the conch industry and develop special campaigns.	Fisheries Division, Discovery Bay Marine Laboratory/Medic, MOH, conch industry, & NGOs	**X**		
17	Fishery and conservation managers will participate in existing or new small business initiatives looking for the development of coastal fishing communities programs.	Fisheries Division, NEPA, Trade agencies, JFCU, conch industry		**X**	
18	Fishery and enforcement authorities will work collaboratively with other government agencies towards adopting safety protocols to prevent/treat dive disease.	Coast Guard, Marine Police, Fisheries Division, users representation		**X**	
19	Fisheries, enforcement and conservation authorities will work collaboratively with key stakeholders in the design and application of education and outreach programs to promote greater support to fishery and conservation management.	Fisheries Division, users representation, Academic, NGOs		**X**	

20	Fisheries Division should build linkages with public and private stakeholders needed to improve fishery governance, based on the best scientific information.	Fisheries Division, users representation, Academic, NGOs	**X**		
21	Establish a Scientific Advisory Committee with the mandate for developing research priorities for enhancing the management and utilization of the conch resource.	Fisheries Division, NRCA, NEPA, SA users representation, NGO´s	**X**		
22	The Fishery Development and Management Board will establish criteria for the allocation of the Fishery Development and Management Fund to conch fishery versus non-conch fisheries activities.	FDMF board, NRCA, NEPA, SA		**X**	

20. Adoption and implementation strategies

Legal adoption of the queen conch fisheries management plan will require a formal revision process as mandated under existing Jamaican laws and regulations. This process will no doubt be impacted by the development of the new fisheries act currently under consideration. However, several of the proposed measures are already being considered in that act, and depending on the degree of responsibility this new act will grant to the national fishery authority, the implementation of the proposed measures will be feasible in the short or medium term.

The formulation of an integrated research agenda has great relevance in placing the Jamaican conch management regime on a sound scientific basis, with that research spanning the full extent of the fishery, from biological production and socio-economic impact, to utilization and marketing, both locally and internationally. An integrated research program would overcome the otherwise slow scientific progress resulting from isolated efforts, given the limitations and constraints in time and coverage of individual research projects. Environmental and biological data still need to be complied and analyzed in order to reduce the risks in the management decision. In a similar way, the socio-economic aspects that deeply underlay fisheries management and the benefits accruing from the conch resource require evaluation and special considerations that address issues such as fishermen health, improvement in their life quality, and the innovations needed to reach new markets and customers.

In the end, the success of this management plan will be based on the collaborative work among government institutions and the establishment or strengthening of partnerships with the conch industry and other private organizations, including environmental NGO´s, tourism associations, fishing cooperatives, local restaurants, among others. Communications and the collaborative work done in a transparent way would help in the building of trust and in the increase in the fishery governance. With this view, good governance is essential as it not only promotes the broad participation of the stakeholders, but also facilitates improvement in fisheries management itself, and the conservation / sustainability of the natural conch populations, as advised in the management plan.

Considering that the queen conch national management plan is in accordance with the recently approved queen conch regional fisheries management and conservation plan, it is expected to obtain support from CITES, CARICOMP/CRFM, OECS, Foreign Affairs Ministries across the Caribbean region and OSPESCA, whose support are needed to overcome the IUU fishing, develop regional and local conservation actions, increase education about the various aspects of the conch bio-ecology, and develop new conch products and markets, among other issues. In particular, all initiatives regarding training and education programs should be specifically developed targeting each of the various stakeholders and users, and must foster understanding of the relevance and justification of the fishery management regime in place.

21. Funding strategies

The numerous and variety of topics included in this management plan for Jamaica's queen conch stocks demands several funding strategies. At present, an important percentage of the available funds comes from the conch cess that is administered by the Fisheries Development and Management Fund.

While this Fund remains a solid alternative, it is market dependent and cannot cover all needs. Additional ways to increase the magnitude of the FDMF, thus perhaps by exploring the inclusion of contributions from spiny lobster or fish licensed exporters.

Alternative funding to implement this management plan may come from:

- Increases in the government institutions annual budgets
- National and international grants for scientific / management purposes
- Direct or in-kind funding from international / regional organizations

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ANNEXES

ANNEX 1. Definitions

Accountability Measure: Management measure designed to reduce the risk that a fishery or fishery sub-component (e.g. vessels, sectors, fishing category) will exceed its allowable take (quota), or to offset an overage when it occurs. Accountability measures are defined ahead of time and are automatically triggered when defined target catch levels are exceeded.

Artisanal fishery: (1) Traditional fishery involving small-scale operations using relatively small amounts of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, mainly for local consumption; (2) Traditional fishery with similar small-scale characteristics but making longer fishing trips from Mainland Jamaica to the Pedro Bank of up to 4 days; (3) Traditional fishery with similar small-scale characteristics but operate as part of an industrial operation for exports.

Canoe: Support fishing boat, usually of small or medium size (4-18m of LOA), licensed and registered to fish that operate in the artisanal fishery or in association with the large scale industrial fishery.

Carrier vessel: Vessel employed in the industrial conch fishery that does not engage in fishing but is used to receive, temporarily store and transport catch from smaller vessels either to industrial fishing vessels or directly to authorized mainland landing sites.

Catch per Unit Effort (CPUE): The catch of fish or animals in numbers or weight taken during a defined time interval using a defined gear and method of fishing (*https://gfp.sd.gov/fishing-boating/tacklebox/lake...lakes/.../technical-terminology.pdf)*

Cess (conch levy): A tax per pound of conch meat exported, to be paid when an exporter applies for an export health certificate and export license for a consignment of conch.

Close season: Seasonal closure. The banning of fishing activity (in an area or of an entire fishery) for a specific period of time. Closure is often linked to key life stages or periods, such as to protect juveniles or spawners.

Conversion factor: A number or formula used when converting the volume or mass (more commonly referred to as the "weight") of a product at one stage in the production chain to its volume or mass at another stage in the chain (http://www.fao.org/fishery/cwp/handbook/I/en).

Dory: Small vessel deployed from a mother vessel for the purpose of fishing for conch and transferring the catch back to the mother vessel on a daily basis. Dories are stored on the mother vessel when in transit.

Exploitable biomass: Refers to that portion of a stock's biomass that is available to the fishery, as determined by distribution, gear limitations and/or legal action (https://definedterm.com/a/definition/174512).

Fishing effort: The amount of fishing used on the fishing grounds over a given unit of time. When two or more kinds of gear are used, the respective efforts must be adjusted to some standard type before being added. Sometimes referred to as Effective fishing effort (http://www.fao.org/fishery/cwp/handbook/N/en).

Ecosystem Approach to Fisheries: The planning, development and managing of fisheries in a manner that addresses: (1) the production of the species in the larger contexts of its ecology and environment; and (2) the multiple needs and desires of societies, without jeopardizing the options for future generations to benefit from the full range of goods and services provided by marine ecosystems. (FAO 2005[3]).

Enforcement: Personnel and mechanism(s) available to ensure compliance of fishery regulations. It involves a broad suite of stakeholders, including administrative personnel, the judiciary and the armed forces.

Essential Habitat: waters and substrate necessary for conch for spawning, breeding, feeding, growth and survival (http://www.habitat.noaa.gov/protection/efh/).

Fishery Development and Management Fund: the Fund created from a cess on conch exports with the purpose to strengthen and promote the fisheries management and development in Jamaica. This fund does not go to the Fisheries Division. It has a separate life and board that oversees its use.

Fishery Management Unit: An area where the fishery is taken place that has been declared by the Minister/fishing authority for the purposes of fishery management. Multiple fishery management units allow for spatial variations in management approaches.

Fully exploited: Term used to characterize a stock that is probably neither being overexploited nor underexploited and is producing, on average, close to its Maximum Sustainable Yield.

Harvest control rules: Predefined set of rules used to set the exploitation rate as a function of important considerations such as current stock size and to reduce the chance of overfishing of a resource. Controls usually include some limit on fishing effort or, at the very least, controls on fishing capacity (Medley 2008).

Hookah: a diving system consisting of an air hose connected to a small portable compressor that supplies a continuous source of air to divers. This device is operated from small canoes, utilized by both industrial and artisanal fishers.

Individual quota: The maximum weight of 50% cleaned conch meat that maybe landed by a licensed fisherman, vessel or company, as allocated to that fisherman, vessel or company, and extracted from authorized fishing grounds.

[3] FAO 2005. Putting into practice the ecosystem approach to fisheries. Rome, FAO. 2005. 76p.

Industrial fishing vessel: Large vessels (20-25 m in LOA and 30-38 TRN storage capacity) licensed and registered to fish conch for industrial companies. Such vessels usually provide support to approximately 10 small canoes.

IUU fishing: Illegal, Unreported and Unregulated fishing conducted within areas under national jurisdiction or on the high seas that poses a direct and significant threat to effective conservation and management of many exploited stocks, and undermines economic and social benefits. IUU fishing tends to promote additional IUU fishing, creating a downward cycle of management failure (FAO 2002[4]).

Juvenile: A young animal that has not reached sexual maturity.

License: A license is a document giving the fisher/producer the right to operate in a fishery according to the terms established by the regulating authority.

Limited entry: Fishery where the number of operators (and/or size of boats) is restricted through licence limitation or quota systems, to control the amount of fishing effort. It frequently involves controls on the number and size of vessels, and conditions relating to the transfer of fishing rights or the replacement of vessels.

Maximum Sustainable Yield (MSY): The largest average catch or yield that can continuously be taken from a stock under existing environmental conditions. For species with fluctuating recruitment, the maximum might be obtained by taking fewer fish in some years than in others. Also called: maximum equilibrium catch; maximum sustained yield; sustainable catch (https://definedterm.com/a/definition/179433).

Monitoring system: The effective supervision of fishing activities and the collection, measurement and analysis of data on fishing related activities, including, but not limited to catch volumes, species composition, fishing effort, by-catch, gears, discards, area of operations, etc.

Mother Vessel: A large vessel employed in the industrial conch fishery that serves as the support base for divers and dories. Divers and dories are deployed on a daily basis during fishing operations. Divers reside on the mother vessel, which also stores the dories during transit.

National Total Allowable Catch (NTAC): Maximum weight, expressed in 50% cleaned conch meat, that may be landed by the entirety of conch licensed fishermen during the conch season, extracted from authorized fishing grounds.

Non-Detriment Finding: Conclusion that an export will not be detrimental to the survival of the species. The NDFs are elaborated by the CITES Scientific Authority of the State of export

[4] FAO 2002. Implementation of the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing. FAO Technical Guidelines for Responsible Fisheries. No. 9. Rome. 122p.

and approved by the national Administrative Authority. An export permit based on an approved NDF is a necessity for all exports of species listed under Appendix II of CITES.

Ontogeny: The process of an individual organism growing organically, events involved in an organism changing gradually from a simple to a more complex level, also referring to the life cycle of an organism (http://www.biology-online.org/dictionary/Ontogeny).

Open season: the period when fishing is allowed, and it is outside of the close season.

Optimum sustainable yield: Is a long-term average amount of the desired yield for a stock, stock complex, or fishery that provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems. It modifies MSY by *lowering* the allowable catch on the basis of relevant economic, social and ecological factors (www.fisherycouncils.org/SSCpapers/OYoverview_ppt.pdf).

Over-exploitation: Rate of exploitation where the resource stock is drawn below the size that, on average, would support the long-term maximum sustainable yield (MSY) of the fishery (https://definedterm.com/a/definition/179582).

Overfished: A stock or stock complex is considered ‘‘overfished’’ when its biomass has declined below a level that jeopardizes the capacity of the stock or stock complex to produce MSY on a continuing basis.

Overfishing: (to overfish) occurs whenever a stock or stock complex is subjected to a level of fishing mortality or annual total catch that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis. Often referred to as overexploitation and equated to biological overfishing. It results from a combination of growth overfishing and recruitment overfishing and occurs often together with ecosystem overfishing and economic overfishing.

Precautionary principle: A set of agreed cost-effective measures and actions, including future courses of action, which ensures prudent foresight and reduces or avoids risk to the resources, the environment and the people to the extent possible, taking explicitly into account existing uncertainties and the potential consequences of being wrong. The *Fishery Manager's Guidebook* issued in 2009 by FAO advises that the precautionary approach or principle should be applied when ecosystem resilience and human impact (including reversibility) are difficult to forecast and hard to distinguish from natural changes. The precautionary principle suggests that when an action risks harm, it should not be proceeded with until it can be scientifically proven to be safe.

Processing establishment: Any place (other than a fishing vessel or post-harvest handling facility) in which any fish or invertebrate’s products are processed or handled for trade.

Queen conch: Large marine gastropod of the Strombidae family with the scientific name *Lobatus gigas*. Current suggested synonyms for *Lobatus gigas* include *Strombus gigas* and *Eustrombus gigas*.

Rebuilding plan: A plan that must be designed and implemented when a stock (management unit) has been overfished, with the goal to rebuild the stock to the level that can support maximum sustainable yield (MSY). A typical rebuilding plan allows fishing to continue, but at a reduced level so that the stock will increase to the target level that supports MSY.

Reference point: Management-oriented threshold based on biological or economic characteristics of the fishery (Caddy and Mahon 1995). Their choice and levels capture in broad terms the management objective for the fishery. For example, harvest control rules typically contain thresholds at which allowable fishing levels change abruptly.

Relevant years of involvement: The number of consecutive years of involvement of each applicant during the Relevant Period. The Relevant Years of Involvement in respect of each New Entrant shall be zero.

SCUBA: A "self-contained underwater breathing apparatus" consisting of a metal high-pressure cylindrical tank containing compressed air, delivering air to the diver at ambient pressure through a regulator. The diver is able to swim freely untethered to a boat on the surface.

Stock: A biological fish stock is a group of fish of the same species that live in the same geographic area and mix enough to breed with each other when mature. A management stock may refer to a biological stock, or a multispecies complex that is managed as a single unit (http://www.nmfs.noaa.gov/stories/2012/05/05_23_12stock_assessment_101_part1.html).

Stoned conch: An adult conch with a fairly thick lip, loss of the broad lip, with fairly worn spines and rough and brittle outer surface (Tewfik 1996).

Subsistence fishing: A fishery where the fish caught are shared and consumed directly by the families and kin of the fishers rather than being bought by middle-(wo)men and sold at the next larger market

Vessel Monitoring System: The satellite-based reporting and surveillance system primarily used to monitor fishing and related activities of a fishing vessel or conveyance, including, the determination of the identity of a vessel, its location, time and speed and special codes, and includes the use of a vessel location device.

ANNEX 2. Criteria for NTAC distribution

Fisheries Division
Ministry of Industry, Commerce, Agriculture and Fisheries

INDIVIDUAL CONCH CATCH QUOTA ALLOCATION CRITERIA
OVERVIEW AND DEFINITIONS

Background

The queen conch industry is governed by three main pieces of legislations:

1. The Fishing Industry Act – Administered by the Fisheries Division, Ministry of Industry, Commerce, Agriculture and Fisheries, (hereinafter referred to as "MICAF");

2. The Aquaculture, Inland and Marine Product and By-Product Act – Administered by the Veterinary Services Division of the Ministry;

3. The Endangered Species Act – Administered by the National Environment and Planning Agency (NEPA), Ministry of Health and Environment / Office of the Prime Minister.

There are two distinct quota categories:

1. The Minister of MICAF declares the National Total Allowable Catch (NTAC) for conch in respect of each conch-fishing season based on the recommendation of the Fisheries Division.

2. The National Export Quota for conch in respect of each conch-fishing season is declared by NEPA on the recommendation of the Jamaica CITES Scientific Authority. Under the Endangered Species Act, NEPA declares a National Export Quota and such export quota may be less than but not more that the NTAC for conch declared by the Minister of MICAF.

There are two (2) corresponding categories of Individual Conch Quota that are allocated by two different Government agencies. These are:

1. Individual Conch Catch Quota – issued as a Condition of Licence to fish for conch by the Licensing Authority under the Fishing Industry Act.

2. Individual Conch Export Quota – issued by NEPA, the local CITES Management Authority.

Individual Conch Quota Allocation Formula

Note that the allocation system of Individual Conch Quota is governed by the Settlement of Law Suit Agreement between the Minister with responsibility for fisheries and DYC Fishing Limited entered into April 11, 2001. (Is this still needed?)

Qualifying Criteria

1. No company / individual shall be qualified for a Conch Catch Quota unless said company / individual has satisfied all the relevant requirements under the Fishing Industry Act and has been duly licensed by the Fisheries Division as a bona fide commercial fisher.

2. No company / individual shall be qualified for a Conch Catch Quota unless said company / individual has satisfied all the relevant requirements under the Aquaculture Act and is in possession of a valid licence issued by the Veterinary Services Division.

3. Every fishing vessel tendered in support of an application for an individual Conch Catch Quota must satisfy all the relevant requirements under the Shipping Act, the Fishing Industry Act, the Aquaculture Inland and Marine Product and By-Product Act any other relevant Act and/or Regulation that may be in force from time to time.

Criteria for Consideration for Conch Catch Quota

The criteria for the consideration of a Conch Catch Quota for a company / individual are:

1. Historical involvement and performance.

    a) Number of years in conch fishery
    b) Catch history
    c) Performance (Utilization of Conch Catch Quota)

2. Investment

    a) Level of investment specific to the conch industry.
    b) Production capacity of processing establishment
    c) Ownership of Motor Vessel

Weight of Criteria

The six (6) sub-criteria above are weighted as a relative percentage of the National Total Allowable Catch (NTAC).

Criteria	% Total Quota Assigned
Historical Involvement and Performance	
Number of Years in fishery	25
Catch History	27
Performance (Utilization of Quota)	29
Sub-Total	81
Investment	
Total Investment Specific to the Conch Industry	7
Production Capacity of Processing Establishment	4
Ownership of Motor Fishing /Fishery Vessel	8
Sub-Total	19
Grand Total	100

The relative weight of the above criteria/sub-criteria reflects the emphasis that the MICAF places on each. The Ministry of Investment, Commerce, Agriculture and Fisheries' mandate under existing legislation is the management of primary production and the assurance of safe and wholesome fish and fish-products for export. With respect to the conch fishery this includes inter alia, to determine and issue Catch Quota for Conch. Hence significant weight must be placed on primary production as reflected by 10% being allocated to ownership of a motor fishing/fishery vessel and 60% allocated to historical involvement and performance. The MICAF however, fully recognizes the important consideration of other relevant investments and attaches importance to the ownership of processing establishments and other investments specific to the conch industry.

As part of our commitment in ensuring safe and high quality product for human consumption both in the local and global marketplace, compliance with the Aquaculture, Inland and Marine Product and By-Product Act with respect to motor fishing vessels and processing establishments is regarded as a non-negotiable criterion for any company / individual to qualify for an individual Conch Catch Quota.

The MICAF also recognizes its' responsibility to companies and/or individuals that depend on marine resources for a livelihood. Hence the important issue of historical involvement and performance must be included as important criteria in considering any allocation of an Individual Conch Catch Quota.

Allocation of Individual Conch Catch Quota

Historical Involvement and Performance

Number of Years in Fishery

Number of Years in Conch Fishery is defined as the total number of consecutive years of involvement in the conch fishery. Applicants will be regarded as New Entrants with zero number of years in conch fishery under the following circumstances:

1. Nonparticipation for a period of two (2) or more consecutive years.
2. Nonparticipation due to cancellation of Conch Quota Allocation and/or licence(s) to fish conch.
3. No history of involvement in the conch fishery

For the purpose of ease of calculation, the proportion allocated to historical involvement (i.e., 25% of the NTAC) will be treated as 100%. This will facilitate the allocation of percentage points with respect to that proportion assigned to historical involvement.

That proportion of each applicant's total Number of Years in the Conch Fishery relative to the total Number of Years in the Conch Fishery for all applicants will be taken as the proportion allocation for each applicant in respect of the proportion of the NTAC assigned for Historical Landings.

Example:

Consider five (5) applicants, four (4) with historical involvement and one (1) new entrant.

Applicant	No. of Years in Conch Industry	%Total No. of Years
A	15	50.00
B	9	30.00
C	4	13.33
D	2	6.67
E	0	0.00
Total	30	100

Therefore, each Applicant's proportion of the NTAC assigned for number of years in the conch Industry will be apportioned as set out in the table below:

Applicant	Proportion of NTAC Assigned for No. Years in Conch Industry
A	50.00 %
B	30.00 %
C	13.33 %
D	6.67 %
E	0.00 %
Total	100 %

Catch History

Historical Landings is defined as the total quantity of the conch lawfully allocated to a specific quota holder that was landed or caused to be landed by the said quota holder during the Relevant Years of Involvement.

The **Relevant Years of Involvement (RYI)** is defined as the number of consecutive years of involvement of each applicant during the Relevant Period. The Relevant Years of Involvement in respect of each New Entrant (see above) shall be zero.

The **Relevant Period** is defined as the period commencing 1995 to the conch fishing year immediately preceding the time of application for an Individual Conch Quota.

For the purpose of ease of calculation, the proportion allocated to historical landings (i.e., 27% of the NTAC) will be treated as 100%. This will facilitate the allocation of percentage points with respect to that proportion assigned to historical landings. Applicants must provide verifiable documentary proof of historical landings for the Relevant Years of Involvement (RYI).

That proportion of each applicant's total historical landings relative to the total historical landings for all applicants will be taken as the proportion allocation for each applicant in respect of the proportion of the NTAC assigned for Historical Landings.

Example:

Consider five (5) applicants, four (4) with historical landings and one (1) new entrant.

Applicant	Total Historical Landings (Relevant Period) (kg)	% Total Historical Landings
1	100,000	10
2	500,000	50
3	200,000	20
4	200,000	20
5	0	0
Total	1,000,000 kg	100 %

From the above table, the proportion of the total quota assigned to Catch History for each applicant would be as follows:

Applicant	% Quota Assigned to Catch History
1	10
2	50
3	20
4	20
5	0
TOTAL	100 %

Performance (Utilization of Conch Catch Quota)

Performance is a measure of the utilization of the individual conch catch quota allocated to conch quota holders and may be interpreted as a weighting of the total conch catch quotas allocated during the Relevant Years of Performance relative to the total quantity of 50% clean conch meats exported and or sold locally for the same time period.

For ease of calculation, the proportion allocated to Performance (utilization of conch catch quota) (i.e., 29% of the NTAC) will be treated as 100%. This will facilitate the allocation of percentage points with respect to that proportion assigned to Performance (utilization of conch catch quota). Applicants must provide verifiable documentary proof of:

1. The total Conch Catch Quotas allocated for the Relevant Years of Performance (RYP).
2. The total quantity of 50% clean conch meats exported and or sold locally for the Relevant Years of Performance (RYP).

The proportion of the quota assigned to Performance (utilization of conch catch quota) that will be allocated to each Applicant (hereinafter referred to as "Individual Performance Quota") will be determined by:

1. The Relevant Years of Performance.
2. The Performance Index of each Applicant, and
3. The Performance Factor

Relevant Years of Performance (RYP)

The **Relevant Years of Performance** is defined as the number of consecutive years of utilization of the individual conch catch quota allocated to each applicant during the Relevant Period. The Relevant Years of Performance in respect of each New Entrant (see above) shall be zero.

The **Relevant Period** is defined as the period commencing 1995 to the conch fishing year immediately preceding the time of application for an Individual Conch Quota.

Performance Index (PI)

Performance Index is defined as the product of the total number of Relevant Years of Performance and the total quantity of 50% clean conch meats exported and or sold for the period 1995 to the conch fishing year immediately preceding the time of application for an Individual Conch Quota divided by the total conch catch quota allocated for the same period. This is summarized by the equation below:

$$\textbf{Performance Index} = \frac{\textbf{Total Quantity Export/Sold (kg)}}{\textbf{Total Allocated Quota (kg)}} \times \textbf{Relevant Years of Performance}$$

Performance Factor (PF)

Performance Factor is defined as: The proportion of NTAC assigned to Performance (utilization of conch catch quota) (29%NTAC) divided by the sum of the Performance Indices of all Applicants. This summarized by the equation below:

$$\textbf{Performance Factor} = \frac{\textbf{Total Performance Quota (29\%NTAC)}}{\textbf{Total Performance Indices}}$$

Individual Performance Quota

The Individual Performance Quota for each Applicant is calculated by multiplying the Performance Index of each Applicant by the Performance Factor. This is summarized by the equation below:

Individual Performance Quota = Performance Factor X Performance Index

Example: Performance Index

Applicant	**Total Quota Allocated** (Relevant Years of Involvement)	**Total 50% Conch Meats Exported/Sold**	**Relevant Years of Performance**	**Performance Index**
1	1,000	1,000	10	10
2	2,000	1,800	10	9
3	5,000	4,500	5	4.5
4	1,000	250	5	1.25
5	1,000	750	0	0
Total	10000	8,300	30	24.75

Given: Performance Quota (29%NTAC) = 130.5 MT
Therefore:

$$\text{Performance Factor} = \frac{\text{Total Performance Quota (29\%NTAC)}}{}$$

Total Performance Indices

Performance Factor = 130.5 = 5.272727273
24.75

Individual Performance Quota

Applicant	Performance Index	Performance Factor	Individual Performance Quota (MT)
1	10	5.272727273	52.727273
2	9	5.272727273	47.454545
3	4.5	5.272727273	23.727273
4	1.25	5.272727273	6.5909091
5	0	5.272727273	0
		Total	130.5

Investment in the Conch Industry

Investments in the conch industry are defined as:

1. all investments directly related to the applicants involvement in the conch industry
2. Where applicable specific investment(s) shall be lawful and duly authorized in accordance with the relevant legislation. For example, a motor fishing vessel shall satisfy all the relevant requirements under the Shipping Act, Fishing Industry Act and Aquaculture, Inland and Marine Product and By-Product Act and any other relevant laws before said motor fishing vessel can be eligible for consideration as an Investment in the Conch Industry.

Notwithstanding the possession of valid licences/Permits/Authorizations, the non-utilization of any investment(s) during the conch fishing season immediately prior to the current application for an Individual Conch Quota shall disqualify the said investment(s) for consideration.

All applicants shall provide documentary proof of their total investment specific to their operation in the conch fishery.

The proportion of the NTAC allotted to Investment in the conch industry (i.e., 7% of NTAC assigned to Total Investments Specific to the Conch Industry) will be treated as 100%. This will facilitate the allocation of percentage points with respect to that proportion of the NTAC assigned to Investments in the conch industry.

After verification by a qualified Valuator, that proportion of each applicant's total Investments specific to the conch industry relative to the total investments for all applicants will be taken as the proportion allocation for each applicant in respect of the proportion of the NTAC assigned for Total Investment in the conch industry.

Example: Consider four (4) applicants.

Applicant	Investment	% Total Investments
1	$100,000	10
2	$500,000	50
3	$200,000	20
4	$200,000	20
Total	$1,000,000	100 %

From the above table, the proportion of quota assigned to Investment for each applicant would be as follows:

Applicant	% Quota Assigned to Investment Specific to the Conch Industry
1	10
2	50
3	20
4	20
TOTAL	100 %

Processing Establishment's Production Capacity

Only Processing Establishments duly licensed by the Veterinary Services Division to process conch meats are eligible for consideration. Notwithstanding the possession of a valid licence, the non-utilization of the processing establishment to process conch meat during the conch fishing season immediately prior to the current application for an Individual Conch Quota shall disqualify the said processing establishment for consideration.

For the purposes of this exercise, production capacity is defined as the maximum daily quantity of processed conch meat that can be lawfully produced and stored using authorized equipment (i.e., Raw material holding area, Ice Making Machine, Blast freezer and finished product holding area) by a processing establishment within a production cycle (i.e., the period required to produce one standard shipment of processed conch meat).

The following sub-sub-criteria after verification by the Veterinary Services Division will be used to determine the production capacity of each processing establishment.

1. Raw material holding area capacity.
2. Ice making Capacity
3. Blast freezer capacity.
4. Finished product holding area capacity.

The proportion allotted to the production capacity of processing establishments. (i.e., 4% of NTAC) will be treated as 100%. This will facilitate the allocation of percentage points with respect to that proportion assigned to production capacity of processing establishments.

Each sub-sub-criterion will be weighted as 25 % of the proportion allotted to the production capacity of processing establishments. (i.e., 10% of NTAC)

The sum of the proportion of the sub-sub-criteria of each applicant's processing establishment relative to the total for all processing establishments will be taken as the proportion allocation for each applicant in respect of the proportion of the NTAC assigned for Production Capacity

Example: Total NTAC allocated to Production Capacity = 18 MT

Allocation for each Production Capacity Sub-Sub-Criterion

Sub-sub-criterion	% of Total	MT
Raw material holding area capacity	25	4.5
Ice making Capacity	25	4.5
Blast freezer capacity	25	4.5
Finished product holding area capacity	25	4.5
Total	**100**	**18**

Consider four (4) applicants with processing establishments.

Allocation for Raw Material Holding Area Capacity

Applicant	Holding Area Capacity (kg/day)	% Total Holding Area Capacity	Holding Area Capacity Allocation (MT)
1	10,000	50	2.25
2	5,000	25	1.125
3	2,000	10	0.45
4	3,000	15	0.675
Total	20,000 kg.	100 %	4.5

The allocation for each sub-sub-criterion is calculated similarly as per the above table (Allocation for Raw Material Holding Area Capacity).

The total Sub-allocation in respect of Production Capacity for processing establishments is determined by summing all the calculated allocation for each Production Capacity sub-sub-criterion.

Ownership of Motor Fishing Vessel (MFV)

Only motor fishing vessels that satisfy all the relevant requirements including inter alia, the Shipping Act, Fishing Industry Act and Aquaculture, Inland and Marine Product and By-Product Act will be eligible for consideration.

Notwithstanding the possession of valid licences/Permits/Auhtorizations, the non-utilization of the motor fishing vessel to harvest or harvest, handle and transport or transport conch meat during the conch fishing season immediately prior to the current application for an Individual Conch Quota shall disqualify the said motor fishing vessel(s) for consideration in the quota allocation process.

The proportion allotted to ownership of motor fishing vessel (i.e., 8% of the NTAC) will be treated as 100%. This will facilitate the allocation of percentage points with respect to that proportion assigned to ownership of motor fishing vessel.

That proportion of the total number of motor fishing vessel (licensed to and utilized in the Conch Fishery) owned by each applicant relative to the total number of motor fishing vessels owned by all applicants will be taken as the allocation proportion for each applicant in respect of the proportion of the NTAC assigned for ownership of motor fishing vessels.

For example, if there were four (4) applicants, three with one vessel each and one with two vessels. The percentage points per vessel would be 100 divided by 5, which is 20 percentage points per vessel. Therefore the percentage allocation in respect of ownership of motor vessels per applicant would be as follows:

Proportion of NTAC allocated to Motor Fishing Vessel = 100 MT

Applicant	Number of MFV	% of Total No. MFV	MFV Allocation MT
1	1	20	1.6
2	1	20	1.6
3	1	20	1.6
4	2	40	3.2
TOTAL	5	100 %	8

Calculation of Total Individual Conch Catch Quota

The total individual Conch Catch Quota per Applicant will be determined by summing the quantity of quota calculated in respect of each of the six (6) sub-criteria discussed above.

Fisheries Division
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