PETITION TO LIST THE
Queen Conch (*Strombus gigas*)
UNDER THE ENDANGERED SPECIES ACT

Queen conch (*Strombus gigas*). National Oceanic and Atmospheric Administration

Petition Submitted to the U.S. Secretary of Commerce, Acting through the National Oceanic and Atmospheric Administration and the National Marine Fisheries Service

Petitioner:

WildEarth Guardians
1536 Wynkoop Street, Suite 301
Denver, Colorado 80202
303.573.4898

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Petition prepared by Jessica Townsend

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INTRODUCTION

WildEarth Guardians requests that the Secretary of Commerce, acting through the National Marine Fisheries Service (NMFS),[1] an agency within the National Oceanic and Atmospheric Administration (NOAA), to list the queen conch (*Strombus gigas*) as "threatened" or "endangered" under the Endangered Species Act (ESA) (16 U.S.C. §§ 1531-1544). Petitioner also requests NMFS designate critical habitat for the species in U.S. waters.

The queen conch is a large gastropod mollusk characterized by its spiral-shaped shell and distinctive pink aperture. The conch's habitat and behavioral characteristics make it particularly vulnerable to exploitation because it is slow moving, easily identifiable, and often gathers in large aggregations in shallow water. Loss of the species could negatively affect seagrass communities and other ecologically valuable species.

The queen conch is threatened by four factors identified in the ESA. First, the species' habitat is affected by a range of threats, including water pollution, degradation of seagrass beds, and destruction of essential nursery habitat. The second and most severe threat is overutilization of conch for commercial purposes, primarily the harvest of conch meat for growing local and international markets. Third, existing regulatory mechanisms are inadequate to manage the unsustainable harvest or to eliminate the widespread practice of illegal fishing. Fourth, conch are particularly biologically vulnerable to human exploitation and the resulting low adult densities limits population recovery. Human population growth will only exacerbate current threats to the species.

Listing the queen conch under the ESA would provide needed protection for this species by limiting or restricting U.S. take and import of the species. In addition, ESA listing would provide vital protection for critical habitat important for queen conch recovery.

PETITIONER

WildEarth Guardians is a nonprofit environmental advocacy organization that works to protect wildlife, wild places and wild waters. The organization has more than 14,000 members and supporters and maintains offices in New Mexico, Colorado and Arizona. WildEarth Guardians has an active endangered species program that works to protect imperiled species and their habitat throughout the United States and beyond.

ENDANGERED SPECIES ACT AND IMPLEMENTING REGULATIONS

The Endangered Species Act of 1973 protects plants and animals that are listed by the federal government as "endangered" or "threatened" (16 U.S.C. § 1531 et seq.). Any interested person may submit a written petition to the Secretary of Commerce requesting him to list a species as "endangered" or "threatened" under the ESA (50 C.F.R. § 424.14(a)). An "endangered species" is "any species that is in danger of extinction throughout all or a significant portion of its range" (16 U.S.C. § 1532(6)). A "threatened species" is defined as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant

[1] NOAA Fisheries.

portion of its range" (16 U.S.C § 1532(20)). "Species" includes subspecies and distinct population segments of sensitive taxa (16 U.S.C § 1532(16)).

The ESA sets forth listing factors under which a species can qualify for protection (16 U.S.C. § 1533(a)(1)):

A. The present or threatened destruction, modification, or curtailment of habitat or range;
B. Overutilization for commercial, recreational, scientific, or educational purposes;
C. Disease or predation;
D. The inadequacy of existing regulatory mechanisms; or
E. Other natural or manmade factors affecting its continued existence.

A taxon need only meet one of the listing criteria outlined in the ESA to qualify for federal listing.

If the Secretary determines that a species warrants listing as "endangered" or "threatened" under the ESA, he is obligated to designate critical habitat for that species based on the best scientific data available (16 U.S.C. § 1533(b)(2)).

CLASSIFICATION AND NOMENCLATURE

Common Name. *Strombus gigas* is known by the common names "queen conch" and "pink conch" (NMFS 2011b at 3). This petition uses refers to the species as "queen conch" or "conch."

Taxonomy. The petitioned species is *Strombus gigas* Linnaeus, 1758. The species' taxonomic classification is shown in Table 1.

Table 1. Taxonomy of *Strombus gigas*.

Phylum	Mollusca (mollusks)
Class	Gastropoda (univalve mollusks, *e.g.* snails and slugs)
Order	Caenogastropoda (shelled marine mollusks)
Family	Strombidae (medium to large sea snails)
Genus	*Strombus*
Species	*Gigas*

SPECIES DESCRIPTION

The queen conch is a large gastropod mollusk characterized by a hard external spiral-shaped shell with blunt spikes. The shell has a glossy pink or orange interior and a flared aperture (NMFS 2011a at 1; Davis 2005 at 1). Once conch become covered with algae and debris, the exterior of the shell often looks gray (NMFS 2011b at 2). Adults typically reach full size between 3-5 years of age and can grow up to 12 inches (30.4 cm) in shell length and weigh up to 5 pounds (2.3 kg) (NMFS 2011a at 1).

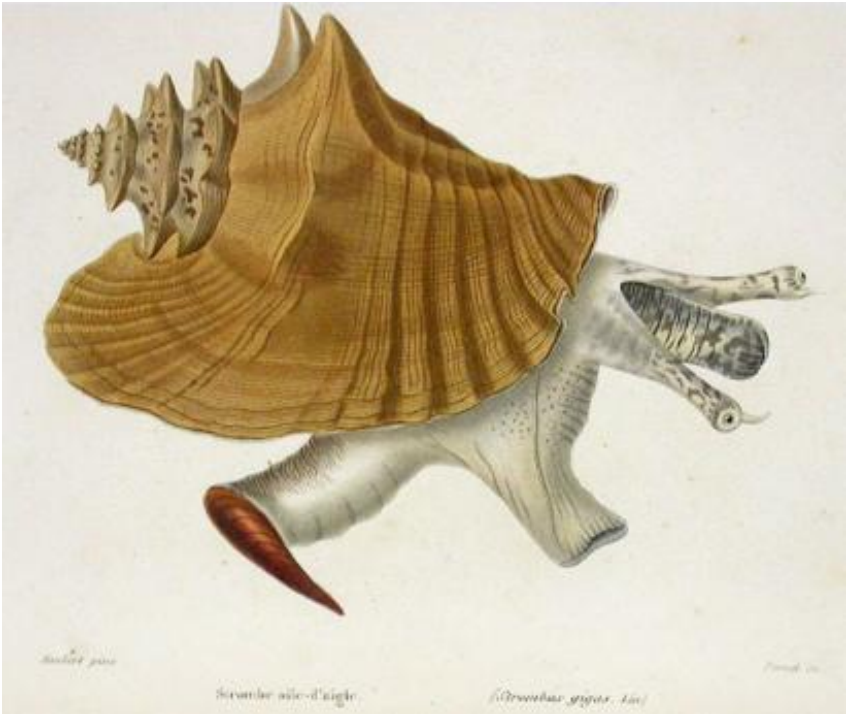

Figure 1: Illustration of *Strombus gigas*
by Louis Charles Kiener (1799-1881).
Encyclopedia of Life

Beneath the hard exterior shell is a soft body composed of a single foot, a tube-like mouth called a proboscis used for grazing, and two eyes at the end of protruding stalks (*see* Figures 1, 2; NMFS 2011a at 1; Davis 2005 at 1). There is a hardened tip, or operculum, at the end of the conch's foot used to move the animal forward in a short hopping motion called the "strombid leap" (Davis 2005 at 1).

In spite of these general characteristics, shell morphology in the queen conch is highly plastic and is influenced by a number of factors including habitat quality and food availability (NMFS 2007 at 6). This is one of several reasons why it is difficult to assess the age of queen conch by sight alone (McCarthy 2007 at 1).

Distinctive Traits. Members of Strombidae typically have thick shells with conical spires and a broad-lipped aperture with an anterior notch, referred to as the "strombid notch" (McCarthy 2007 at 1). Although there are six species of *Strombus* in the Caribbean, the queen conch is the largest and is easily distinguished based not only on its size, but its deep pink aperture (*see* Figure 3; McCarthy 2007 at 1; CITES 2003a at 4).

Figure 2: Queen conch (*Strombus gigas*) eyes and proboscis.
Lorenzo Alvarez-Filip (2008)

Figure 3: Queen conch shell.
Bob Glazer, Florida Fish and Wildlife Conservation Commission

GEOGRAPHIC DISTRIBUTION: HISTORIC AND CURRENT

Queen conch are found throughout the Caribbean Sea and Gulf of Mexico in the territorial waters of at least 36 countries and dependent territories (NMFS 2011a at 2; Davis 2005 at 1). The conch's range extends north to Bermuda and Florida and south to Brazil (*see* Figure 4; NMFS 2011a at 2).

HABITAT REQUIREMENTS

Queen conch, and juveniles in particular, actively select their habitat (CITES 2003a at 12). They are found in clean waters and generally prefer sandy or rubble sea floors with seagrass beds (CITES 2003a at 12; NMFS 2011a at 2). Individuals are also sometimes found in rocky habitats or coral reefs (CITES 2003a at 12). Conch are primarily found in depths between 10-30 meters, where there is optimum light availability for seagrass and algae growth, though they have been found at depths of up to 100 meters (CITES 2003a at 12).

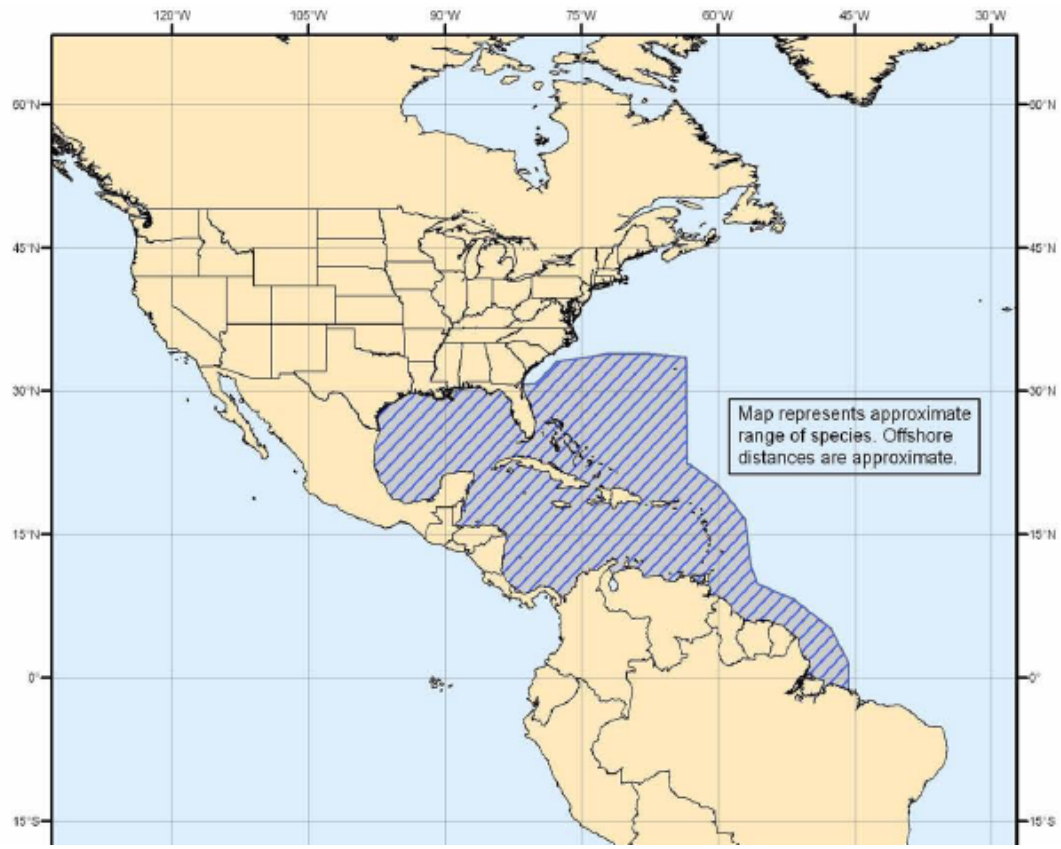

Figure 4: Queen Conch geographic range.
NMFS, Office of Protected Resources (2007)

LIFE HISTORY

Diet. Queen conch primarily feed on seagrass detritus, seagrass-colonizing epiphytes, and other macroalgae; they do not, however, feed on the living seagrasses themselves (Stoner et al. 1995 at

126). While in larvae form, queen conch feed on plankton before settling to the ocean floor (NMFS 2011b at 2).

Reproduction and Dispersal. Queen conch have separate male and female sexes and fertilization is internal (NMFS 2011a at 1). Spawning peaks with the warmest water temperatures, generally July through September, but can start as early as May and last through October (NFMS 2011b; Davis 2005 at 1). Queen conch migrate to shallow waters with clean coral sand to mate, primarily in seagrass beds, where they form large spawning aggregations (NMFS 2011b at 2; Davis 2005 at 1). Both male and female conchs may mate with multiple conches during the spawning season (NMFS 2007 at 6).

Once fertilization has occurred, female conch lay egg masses, each with hundreds of thousands of eggs (NMFS 2011a at 1; Davis 2005 at 1). A female can lay up to nine egg masses in a spawning season (Davis 2005 at 1). The eggs incubate and hatch within 3-5 days, after which the larvae spend anywhere from 2 to 8 weeks floating in the water column and feeding on plankton (NMFS 2011a at 1; Davis 2005 at 1). Larvae can travel great distances in these weeks, in some cases supplementing recruitment for overfished populations (Theile 2001 at 14). However, there is little current information on larval transport between populations (McCarthy 2007 at 1). Once morphologically developed, the larvae settle on the ocean floor and metamorphose into the adult (benthic) form (NMFS 2011a at 1; Davis 2005 at 1).

Biology of Juvenile Queen Conch. During their early years of life, juveniles remain in the seagrass beds while growing longer shells (Davis 2005 at 2). Juveniles bury themselves in the sand during most of the first year (Davis 2005 at 2; Theile 2001 at 14). For this reason, shallow coastal habitats such as seagrass beds and sandy bottoms in protected bays, with adequate water circulation and food production, are critical inshore habitats for juvenile queen conch (Theile 2001 at 14-15).

Shells of juveniles do not yet have the flared lips that characterize adult queen conch (Davis 2005 at 2). But as the flaring lip begins to form, the sub-adult conch migrate to deeper water and begin to spawn (Davis 2005 at 2).

Natural Mortality. Queen conch typically live to 20-30 years of age (NMFS 2011a at 1). The conch's primary natural predators include crabs, turtles, sharks, and rays (NMFS 2011b at 2). Juvenile conch are significantly more susceptible to predation, although the predation rate decreases as they grow larger (McCarthy 2007 at 11). It is believed that adult conch have low rates of natural mortality (McCarthy 2007 at 11).

ECOLOGY

Queen conch are found primarily in seagrass beds, which are highly productive ecosystems that provide food, shelter, and nursery grounds to myriad fish and invertebrate species (Hill 2002 at 2). One acre of seagrass can produce enough biomass to support as many as 40,000 fish and 50 million small invertebrates (Hill 2002 at 2). Moreover, seagrasses are key indicator species reflecting the health of coastal ecosystems because they are highly sensitive to changes in water quality (Hill 2002 at 2). According to some researchers, "[t]he high level of productivity,

structural complexity, and biodiversity in seagrass beds "make them the "marine equivalent of tropical rainforests" (Hill 2002 at 2).

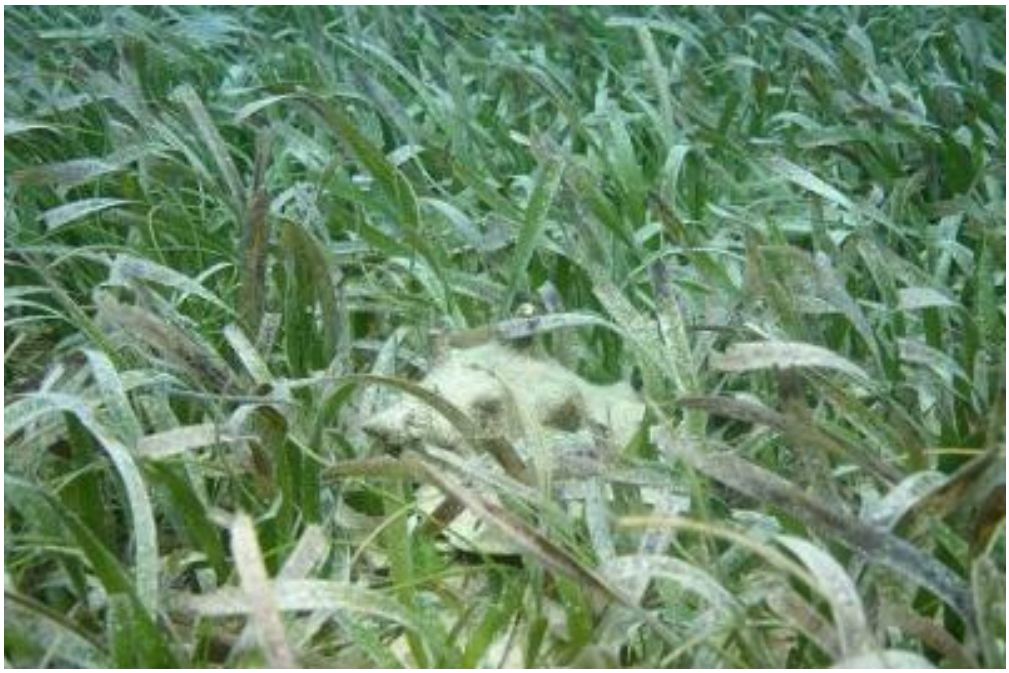

Figure 5: Queen Conch in seagrass bed.
Hol Chan Marine Reserve, Ambergis Caye, Belize

Queen conch play a vital role in shaping these communities, principally by consuming seagrass detritus (Stoner et al. 1995 at 125, 135; CITES 2003a at 14). This, in turn, shapes the entire macrofauna community structure by creating food competition and removing protective cover used by other species (Stoner et al. 1995 at 125, 135; CITES 2003a at 14). Thus, as summarized by the CITES Review of Significant Trade report, "[t]he loss or substantial decrease of *S. gigas* is therefore likely to result in significant community changes and trophic cascades that will negatively affect the productivity and future recruitment of the species as well as other ecologically and economic important fisheries resources (*e.g.*, Spiny Lobster *Panulirus argus*)" (CITES 2003a at 14).

HISTORIC AND CURRENT POPULATION STATUS AND TRENDS

Although queen conch have been harvested by local populations for centuries, the rise of a large commercial fishery in the 1970s led to overexploitation (CITES 2003a at 3; Davis 2005 at 2; Ehrhardt and Valle-Esquivel 2008). Prior to this time, conch meat was used as subsistence food and conch shells were used for jewelry and decoration (Davis 2005 at 2). Now, queen conch are harvested to meet growing international demand for conch meat, as well as demand from increased Caribbean tourism (CITES 2003a at 3; Davis 2005 at 2). The queen conch fishery has become the second most important benthic fishery in the Caribbean, after spiny lobster (CITES 2003a at 3; Davis 2005 at 2).

Unfortunately, scientists recognize that demand for conch meat now "grossly exceeds supply" and the queen conch population is quickly being depleted (Ehrhardt and Valle-Esquivel 2008). Between the 1950s and 1970s, queen conch landings (*i.e.,* the weight of queen conch catch brought ashore) were stable and averaged 2,200 tons annually (Daves 2009 at 1). However, harvest intensified in an effort to keep pace with the growing local and international demand for conch meat, "leaving most queen conch populations significantly reduced" (Daves 2009 at 1). There were a number of fishery closures in the 1980s after widespread recognition that conch populations were being depleted as a result of overfishing (Daves 2009 at 1). But these measures were insufficient and harvest continued to grow in the 1990s, peaking between 6,500 and 7,300 tons (CITES 2003b at 1-2). Harvest has fallen since this peak, averaging 5,500 tons in 1999, 4,500 tons in 2000 and 3,100 tons in 2001 (CITES 2003b at 2).

The queen conch was listed in Appendix II of the Convention on International Trade in Endangered Species (CITES) in 1992, but this did little to slow the ever-growing conch harvest (CITES 2003a at 3; Daves and Fields 2006 at 766-767; Daves 2009 at 1-2). Indeed, evidence shows that exports of queen conch meat actually tripled between 1994 and 2001 (Daves and Fields 2006 at 766-767).

Today, the queen conch remains imperiled throughout much of its range (*see* Table 2 for an account of population status by country). Analyses of queen conch populations in the Caribbean each tell a familiar story: "[o]nce abundant throughout the Caribbean, queen conch have been fished to such low levels in many localities that a viable fishery no longer exists" (CFMC 1996 at 18). Likewise, NMFS states that, "[q]ueen conch abundance is declining throughout the species' range as a result of overfishing and poaching" (NMFS 2011a at 2). And in a report summarizing queen conch fisheries in the Caribbean for the CITES Secretariat, Theile (2001 at 22) found that:

> The overall status of the Queen Conch resources in the Caribbean ranges from areas with that were severely over-exploited in the past and show little signs of recovery (*i.e.,* Bermuda, Florida, Mexico, Saba Bank, Los Roques in Venezuela), to stocks that appear heavily exploited and show signs of depletion and potential recruitment failure (*i.e.,* Belize, Dominican Republic, Haiti) and to a few areas where the overall populations may still be considered stable although that local stock depletions and populations declines have started to occur (*i.e.,* Turks and Caicos Islands and the Bahamas).

Ultimately, in its recent Review of Significant Trade, the CITES Secretariat concluded that, "intensive fishing pressure has led to population declines, stock collapses and consequently the total or temporary closure of the fishery in a number of locations . . . in some areas, population densities are so low that recruitment failure is a risk to local fisheries" (CITES 2003a at 3). In addition, some of the biggest exporting countries have little to no information on current population status (CITES 2003a at 3).

Table 2: Imperilment of Queen Conch in Significant Portion of Range.

Country	Population Status
Anguilla	Insufficient information.
Antigua and Barbuda	Some areas overfished with extremely low adult density from high fishing pressure.
Aruba	Species considered rare.
Bahamas	Shallow water stocks overfished; deep water stocks approaching status of overfishing.
Barbados	Insufficient information.
Belize	Seriously overexploited; adults becoming rare, unknown level of foreign poaching.
Bermuda	Depleted since early 1990s.
Brazil	Insufficient information.
British Virgin Islands	Insufficient information.
Cayman Islands	Decreasing.
Columbia	Some areas overfished with significant population decline and ongoing illegal fishing.
Costa Rica	Declining, but limited information.
Cuba	Previously depleted, current status unknown.
Dominica	Population overexploited and now depleted.
Dominican Republic	Population seriously ovefished; current harvest unsustainable and largely composed of juveniles, adults rare; illegal harvest and poaching.
Grenada	Some areas overfished; insufficient information on entire population.
Guadeloupe	Insufficient information.
Haiti	Depleted and seriously overfished; harvest of primarily of juveniles.
Honduras	Limited information, but current harvest rate likely not sustainable.
Jamaica	Overall stable, but unknown level of foreign poaching.
Martinique	Previously depleted, current status unknown.
Mexico	Overexploited; significant illegal fishing.
Montserrat	Previously threatened, current status unknown.
Netherlands Antilles	Severely overfished; some areas close to stock collapse.
Nicaragua	Limited information; poaching by foreign vessels.
Panama	Overfished and at extremely low density.
Puerto Rico	Depleted and overfished since 1990s.
Saint Kitts and Nevis	Some areas overexploited.
Saint Lucia	Nearshore populations overexploited.
Saint Vincent and the Grenadines	Insufficient information.
Trinidad and Tobago	Depleted.
Turks and Caicos Islands	Generally stable population, but signs of overfishing; unknown level of poaching.
United States	Severely overfished; total closure but little recovery.
Venezuela	Severely overfished; total closure but little recovery.
Virgin Islands (U.S.)	Overfished.

CITES 2003a at 6-12; Theile 2001 at 26-28; Bene and Tewfik 2003 at 47.

IDENTIFIED THREATS TO THE PETITIONED SPECIES: CRITERIA FOR LISTING

The queen conch population meets at least four of the criteria for listing identified in ESA § 4 (16 U.S.C. §1533(a)(1)) (in bold):

> **A. The present or threatened destruction, modification, or curtailment of its habitat or range;**
> **B. Overutilization for commercial, recreational, scientific, or educational purposes;**
> C. Disease or predation;
> **D. The inadequacy of existing regulatory mechanisms; or**
> **E. Other natural or manmade factors affecting its continued existence.**

Water pollution, degradation of seagrass beds, and destruction of inshore nursery grounds represent significant threats to the species. The queen conch is severely overfished throughout much of its range and existing regulatory mechanisms, including domestic and international regulation, have failed to reign in the unsustainable harvest. The queen conch is especially vulnerable to exploitation: it is slow moving, easily identifiable, and often gathers in large aggregations in shallow water.

(A) The Present and Threatened Destruction, Modification, or Curtailment of Habitat or Range

Habitat degradation is recognized by key regulatory bodies as a considerable impediment to the queen conch persistence (CITES 2003a at 15; CFMC 1996 at 5-6). The CITES Secretariat concluded that the myriad forms of habitat degradation "certainly [have] an important role to play in the decline of populations" (CITES 2003a at 15). Queen conch actively seek habitat in clean waters with sandy or rubble sea floors. In addition, there must be adequate light to support healthy seagrass beds and algae growth (CITES 2003a at 12). Hill (2002) documented that these seagrass beds currently face a number of anthropogenic threats, including prop-scarring, sedimentation, point and non-point source water pollution, and decreased water clarity. Habitat degradation also occurs as a result of siltation, dynamite use, and the use of bottom nets (CITES 2003a at 15).

Nearshore areas, vital nursery habitat for the conch, are especially affected by water pollution and habitat destruction. Juvenile queen conch have very particular habitat requirements and thrive only in clean, undisturbed nursery grounds in shallow coastal waters with certain characteristics: adequate water flow, high algae production, a proper mix of seagrass beds and surrounding sandy habitat, and access to other juveniles (as protection from predators) (CITES 2003a at 15; Theile 2001 at 14-15; CFMC 1996 at 5-6). Human development and pollution in these coastal areas leads to mortality and reduced recruitment of juvenile queen conch, which in turn threatens the entire population (CITES 2003a at 15; Theile 2001 at 14-15; CFMC 1996 at 5-6). The combination of adult overfishing and destruction of juvenile habitat is an especially dangerous threat. The Caribbean Fisheries Management Council (CFMC) concluded in its original Fishery Management Plan for queen conch in the U.S. Virgin Islands and Puerto Rico

that “if the adult population is overfished and juvenile habitat is threatened, a long term sustainable queen conch fishery is not possible” (CFMC 1996 at 5-6).

Scientists recently determined that point source water pollution by heavy metals is likely to blame for the absence of successful conch reproduction in Florida’s nearshore waters and the resulting slow recovery of the species (Spade et al. 2010 at 2). Delgado et al. (2004 at 285) studied the nearshore region of the Florida Keys and observed that adult queen conch “had severe deficiencies in reproductive behavior and gonadal development” such that most nearshore queen conch “were incapable of reproducing.” Spade et al. (2010 at 11-12) later determined that the testes of nearshore male conch fail to develop normally and that point source pollution of heavy metals such as copper and zinc may be the cause. Both metals were found in nearshore queen conch and both are known to reduce gastropod fecundity (Spade et al. 2010 at 12). Only the months after being translocated to an offshore environment, gonadal development resumed normal function (Delgado et al. 2004 at 286), further supporting the conclusion that point source pollution of heavy metals is the underlying cause for reproductive failure in nearshore conch (Spade et al 2010 at 11).

(B) Overutilization for commercial and recreational purposes

Figure 6: Empty conch shells from intensive harvest. *Andy Bruckner, NFMS*

Figure 7: Queen Conch processing. *Willy Volk, www.greenantilles.com*

Exploitation is the greatest threat to the queen conch and the principal cause of population declines (*see* NMFS 2011a at 2; CITES 2003a at 3; Theile 2001 at 61). In the 1996 queen conch Fishery Management Plan for U.S. Virgin Islands and Puerto Rico, the Caribbean Fishery Management Council (CFMC 1996 at 30) noted that:

> Practically everyone who has studied queen conch resources in the Caribbean attests to overfishing as being a significant problem since the late 1960's. In many areas, fishers themselves have acknowledged overfishing as a serious problem and indicated that the resource is noticeably declining.

Fishing pressure continues and is now impacting previously protected deep-water stocks. Theile (2001 at 22) concluded in a report on queen conch management in the Caribbean for the CITES Secretariat that “[a]fter decades of intensive fishing, the majority of the Queen Conch range

states are now in a situation whereby considerable over-fishing continues, with harvest targeting large numbers of juveniles and deeper-water stocks due to the increased use of scuba and hookah."

Queen conch are currently harvested commercially in more than 20 countries (Theile 2001 at 22) and are fished primarily for food, but also for bait (NFMS 2011a). Conch shells, generally considered a byproduct of the fishing trade, are either discarded (*See* Figure 6) or sold as curios or used in jewelry (NMFS 2011a at 2). In addition to domestic demand for conch meat, there is a substantial international market that drives the conch harvest (CITES 2003a at 3; Davis 2005 at 2).

The conch fishery is considered the second most important benthic fishery in the Caribbean, after spiny lobster (CITES 2003a at 3; Davis 2005 at 2). In some countries, including Jamaica and the Turks and Caicos Islands, the queen conch fishery is the principal fishery in terms of total landings and economic income generated (Theile 2001 at 22). While some countries maintain only a small, locally-oriented fishery, other nations (including Jamaica, Belize, Colombia, Honduras, and the Turks and Caicos Islands) have large industrial fisheries that are largely export-oriented and employ larger fishing vessels to take substantially larger harvests (Theile 2001 at 22).

Total annual take has increased substantially in past decades to meet growing international demand for conch meat. Take of queen conch has risen dramatically from a stable level of 2,200 tons per year in the 1950s through 1970s, to between 6,500 and 7,300 tons per year in the mid-1990s (CITES 2003b at 1-2; Daves 2009). However, these data may grossly underestimate total annual landings, because available data is limited and based largely on estimates that fail to account for the high levels of unreported and illegal harvest. Theile (2001 at 29) cautions that total annual landings of queen conch in the Caribbean are almost certainly considerably higher than reported.

The U.S. is the single largest consumer of internationally traded conch, importing, on average, 78 percent of exported conch meat (CITES 2003a at 24). The next largest importer is France (including Caribbean regions Martinique and Guadeloupe), a distant second at 19 percent (CITES 2003a at 24). Theile (2002b) reports that the U.S. imports between 2,000-2,500 tons of conch meat per year—an amount roughly equivalent to the harvest level of the entire pre-industrial conch fishery (Daves 2009). The largest exporting countries are the Dominican Republic, Honduras, and Jamaica, each declaring total annual landings of approximately 1,000 tons of conch meat, followed by the Bahamas and the Turks and Caicos Islands with annual landings of 680 and 780 tons, respectively (Theile 2002 at 3).

The current demand for conch meat "grossly exceeds supply" and the queen conch population is steadily being depleted (Ehrhardt and Valle-Esquivel 2008). In addition to dramatically higher annual landings than was historically sustainable, the use of modern dive gear has led to harvest of previously unexploited populations in deeper waters (CITES 2003a at 14). Traditionally, conch were harvested in shallow waters using long hooked poles, bottom gillnets, tangle nets, or free diving; some areas still employ these methods, particularly where gear restrictions are imposed (Theile 2001 at 23; Davis 2005 at 2). However, now that many of these shallow-water

stocks are depleted, fishing efforts are turning to modern dive gear, such as scuba and hookah (compressor diving), to exploit deep-water stocks (Theile 2001 at 23). The CITES Secretariat concluded that, as a result, "former deep-water refugia (>20 m) have also become subject to intense exploitation" (CITES 2003a at 3). This is particularly concerning because scientists consider these areas to be important refuges for spawning stock (Theile 2001 at 23).

By way of example, Aiken et al. (2006) described the impact of modern dive gear in the Jamaican queen conch fishery, noting that fishing was originally limited to small-scale free diving operations, but in 1990 an industrial fishery operation based on modern dive gear allowed divers to reach depths approaching 30 meters. As a result, the total weight of conch exported from Jamaica jumped from less than 50 tons annually to nearly 2000 tons in 1996 (Aiken et al. 2006 at 333).

In some countries, regulations banning the use of scuba and hookah have been successful at limiting both the depth divers can exploit conch populations and the overall size of the harvest (Theile 2001 at 49). But overfishing continues to be the single greatest threat to the species and, as described below, existing regulations are insufficient to check the unsustainable and often illegal harvest of queen conch.

(D) The inadequacy of existing regulatory mechanisms

It is widely acknowledged that current regulatory measures to conserve queen conch have been ineffectual. Daves and Fields (2006 at 763) state that "[d]espite years of regional discussions and trade regulation under CITES, most queen conch fisheries suffer from uncoordinated management and unsustainable harvest." Similarly, de Jesus-Navarrete et al. (2003 at 219) found that "[i]n spite of international policies in the management of the resource, such as bans, catch quotas and in many cases the close of the fishery, there has been no substantial recovery of populations." Indeed, Theile (2001 at 61), in a report for the CITES Secretariat, identified "persistent lack of enforcement of existing regulations" as a key reason for the queen conch population decline. High levels of illegal and unreported fishing continue to undermine existing regulations and threaten the survival of the species (CITES 2003a at 38).

US. Regulation. Despite existing regulatory measures, U.S. populations of queen conch remain depleted. Most notably, in Florida, the conch fishery has been completely closed since 1986 (Glazer 2001 at 1) and yet recovery has been extremely slow (CITES 2003a at 5). Spade et al. (2010 at 1) now report that "recovery of adult conchs in spawning aggregations within the Florida Keys has been modest," and severe limitations on nearshore reproduction remain as a result of water pollution.

Puerto Rico and the U.S. Virgin Islands administers conch take under a Fishery Management Plan (FMP), developed by the Caribbean Fishery Management Council (one of eight regional fishery management councils established by the Magnuson-Stevens Fishery Conservation and Management Act pursuant to 16 U.S.C. § 1852) (*see* CFMC 1996; 50 C.F.R. § 622). The FMP has been amended twice since it was originally implemented and currently sets the following limits on queen conch fishing: a seasonal closure from November 1 through May 31 (50 C.F.R. § 622.32(b)(1)iv); a closure of federal waters once St. Croix has reached is territorial quota (50

C.F.R. 622.33(d)); size restrictions requiring shell length of at least 9 inches or lip width of at least 3/8 inch (50 C.F.R 622.37(g)); gear restrictions prohibiting the use of scuba or hookah gear (50 C.F.R. 622.41(f)); a requirement that all harvested conch be brought ashore with meat and shell intact (50 C.F.R. 622.38(f)); and take limits for both recreational and commercial trips (50 C.F.R. 622.39(e)(2), 50 C.F.R. 622.44). In addition, the U.S. Virgin Islands has implemented separate harvest quotas of 50,000 pounds for the territorial waters of St. Croix and 50,000 pounds for the territorial waters of St. Thomas and St. John (*see* 76 Fed. Reg. 3597). Despite these measures, conch populations in both Puerto Rico and the U.S. Virgin Islands are still considered overfished and in decline (Theile 2001 at 21; CITES 2003a at 10, 12).

Caribbean Regulation. There is currently no regional organization in the Caribbean responsible for regional management and conservation of queen conch resources (NMFS 2011a at 2; Daves and Fields 2009 at 767). Individual countries, however, have implemented a range of regulatory mechanisms for conch fisheries. The most common regulations include minimum size of shell length, lip width and/or the presence of a flared lip (to protect immature juvenile conch); gear restrictions (*i.e.*, no scuba or hookah gear); area closures or total fishery closures; harvest restrictions (*i.e.*, seasonal catch and export quotas or daily take limits); and limited entry measures (*see* Theile 2001 at 48-51; CITES 2003a at 39-48; CFMC 1996 at 30).

A number of problems plague these management restrictions, including widespread underreported take and insufficient monitoring of the harvest (CITES 2003a at 4). In addition, conch meat is often separated from the shell before inspectors can check the conch's state of maturity, further complicating conch harvest monitoring (Aiken et al. 2006). Another enormous challenge is the high level of illegal fishing, discussed in further detail below.

International Regulation. The two principal international measures to conserve the queen conch are the SPAW Protocol of the Cartagena Convention and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). There have also been a range of bilateral, sub-regional and regional meetings held by different organizations and institutions to discuss management of the queen conch resource, resulting in two formal declarations to collaborate on regional management measures and other management efforts (CITES 2003a at 39).

In 1990, the Parties to the Cartagena Convention (the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region) listed the queen conch in Annex II of its Protocol Concerning Specially Protected Areas and Wildlife (SPAW Protocol), intended to protect fragile species and ecosystems (NMFS 2011a at 2-3). The listing requires Parties to "adopt adequate measures to ensure the protection and recovery of the species," "to regulate the use of the species" and to "formulate, adopt and implement plans for their management and use" (CITES 2003a at 39). Although this Protocol was adopted in 1990, it only recently entered into force and fewer than half of the States have ratified the SPAW Protocol (CITES 2003a at 39).

In 1992, queen conch was included in Appendix II of the CITES Convention, after listing was proposed by the United States (CITES 2003a at 5). The legal implication of this listing is that shipments of conch from member countries must be accompanied by a CITES permit from the

exporting country stating that the harvest was acquired legally and that export of the resource is sustainable (CITES 2003a at 4; Davis 2005 at 3; Theile 2001 at 4-5). All countries within the queen conch range are Parties to CITES, with the exception of Haiti and the Turks and Caicos Islands (CITES 2003a at 39).

Despite the CITES listing, concerns continued to mount about overexploitation of conch populations, illegal fishing, and lack of enforcement of the CITES provisions (Theile 2002 at 3; Daves 2009). As a result, the queen conch was included in the CITES Review of Significant Trade process in both 1995 and 2001 (Daves 2009). The review involved a thorough examination of the population and trade status (Daves 2009). Conch take by three countries warranted "urgent concern" (Dominican Republic, Honduras, and Haiti) and it was recommended that parties suspend imports from these countries until they came into compliance with CITES (CITES 2003b at 1; Daves 2009).

Enforcement problems continue and the CITES Secretariat itself recognized that "[m]any countries in the Caribbean sub-region still face difficulties in the implementation and enforcement of CITES and some lack adequate legislation to fully implement the provisions of the Convention" (CITES 2003a at 39). Notably, CITES Deputy Secretary-General Jim Armstrong stated in 2003 that "[d]espite collaboration between CITES and the queen conch range States over the past six years, this species continues to decline" (CITES 2003b at 1).

Illegal, Unreported and Unregulated Take. Illegal fishing of queen conch is rampant throughout the Caribbean (NMFS 2011a at 2; CITES 2003a at 38; Theile 2001 at 45). This fact alone underscores the inadequacy of existing regulatory mechanisms.

In its Review of Significant Trade, the CITES Secretariat emphasized the pervasive problem of illegal and unreported conch fishing:

> Illegal trade across international borders continues often due to lack of knowledge, awareness and poor enforcement of CITES provisions in Queen Conch range States, as well as in importing countries. However, intentional and concealed illegal trade, especially in the form of illegal fishing by vessels in foreign territorial or EEZ waters and subsequent illegal import and landing of the product in the vessel's home port, appears widespread and seriously undermines the management and conservation of *S. gigas* resources.

(CITES 2003a at 38).

The report concluded that "considerable amounts of meat entering international trade may in fact have been obtained in contravention with existing fisheries regulations, and illegally" (CITES 2003a at 4). Theile (2002b at 3) stated that "the overall harvest is likely to be significantly greater [than reported catch] owing to the high levels of illegal and unreported fishing and to queen conch taken as bait." The Dominican Republic and Honduras, in particular, are suspected of large-scale illegal harvest in the offshore banks of Jamaica, even during times that the Jamaican fishery is closed (CITES 2003a at 38; Aiken et al. 2006 at 336; Theile 2002 at 3).

(E) Other natural or manmade factors affecting continued existence

There are additional natural and manmade factors that threaten queen conch persistence and exacerbate the already considerable threats of overfishing, habitat degradation, and inadequate regulation.

Biological Vulnerability. A number of biological factors render the queen conch particularly vulnerable to overfishing, including the species slow growth, late maturation, limited mobility, occurrence in shallow waters, and tendency to aggregate in large spawning groups (CITES 2003a at 14; Aiken et al. 2006). Queen conch grow slowly and do not become sexually mature until they are approximately 4 years old (CITES 2003a at 14; Davis 2005 at 1). Conch are easily targeted by divers because they are slow-moving and have brightly-colored shells (Catarci 2004 at 1; Aiken et al. 2006). Conch populations are even more vulnerable during spawning season when they gather ion large aggregations in shallow waters with hundreds of thousands of individuals, making it extremely easy for divers to harvest large numbers of animals (CITES 2003a at 14; McCarthy 2007 at 1).

In areas where queen conch populations are already low, recovery is further impacted by the Allee effect. Because conch reproduce through internal fertilization and are very slow-moving, a certain population density is necessary to ensure that male and female conch encounter each other and copulate (Ehrhardt and Valle-Esquivel 2008 at 6). Stoner and Ray-Culp (2000 at 299) determined that successful mating requires populations above 56 individuals per hectare and noted that "[c]onch populations in most nations are now probably at or near densities where Allee effects present a serious obstacle to stock recovery" (Stoner and Ray-Culp 2000 at 301). Thus, fishery exploitation can have a serious impact on future recruitment. Even seasonal closures and size limitations on fishing will have little effect on population recovery if adult density is already too low for mating and spawning to occur (Stoner and Ray-Culp 2000 at 301; Ehrhardt and Valle-Esquivel 2008 at 6).

Human Population Growth. The queen conch fishery is largely fueled by international demand for conch meat. Human population growth in the United States and other importing countries presents a significant risk to the species from consumption. The U.S. Census Bureau estimates that the U.S. population will increase to 392 million people by 2050, a 50 percent increase over the 1990 population (Day 2011 at 1). In additional, local population growth in countries within the queen conch's range could further exacerbate the current threats from habitat degradation and overfishing.

Synergistic Effects. Any or all of the aforementioned threats could work synergistically to cause the extinction of the queen conch. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction. Ongoing habitat destruction and fragmentation are the primary drivers of contemporary extinctions, particularly in the tropical realm, but synergistic interactions with hunting, fire, invasive species and climate change are being revealed with increasing frequency" (Brook et al. 2008 at 457).

The combined effects of threats of habitat loss, legal and illegal exploitation, and other factors including low reproductive rates could cause a greater reduction in conch populations than would be expected from simply the additive impacts of individual threats. "[H]abitat loss can cause some extinctions directly by removing all individuals over a short period of time, but it can also be indirectly responsible for lagged extinctions by facilitating invasions, improving hunter access, eliminating prey, altering biophysical conditions and increasing inbreeding depression. Together, these interacting and self-reinforcing systematic and stochastic processes play a dominant role in driving the dynamics of population trajectories as extinction is approached" (Brook et al. 2008 at 453).

Conch are already at risk due to loss of habitat and life history characteristics, and are especially vulnerable to the synergistic impacts of other threats. "Traits such as ecological specialization and low population density act synergistically to elevate extinction risk above that expected from their additive contributions, because rarity itself imparts higher risk and specialization reduces the capacity of a species to adapt to habitat loss by shifting range or changing diet. Similarly, interactions between environmental factors and intrinsic characteristics make large-bodied, long-generation and low-fecundity species particularly predisposed to anthropogenic threats given their lower replacement rates" (Brook et al. 2008 at 455).

> [O]nly by treating extinction as a synergistic process will predictions of risk for most species approximate reality, and conservation efforts therefore be effective. However challenging it is, policy to mitigate biodiversity loss must accept the need to manage multiple threatening processes simultaneously over longer terms. Habitat preservation, restoring degraded landscapes, maintaining or creating connectivity, avoiding overharvest, reducing fire risk and cutting carbon emissions have to be planned in unison. Otherwise, conservation actions which only tackle individual threats risk becoming half-measures which end in failure, due to uncontrolled cascading effects.

(Brook et al. 2008 at 459).

VALUE OF LISTING

As described above, existing regulatory measures are insufficient to protect the queen conch population from further decline. Listing the queen conch as either "threatened" or "endangered" under the ESA would provide needed regulation to halt further exploitation of this species. In particular, if listed, the ESA would prohibit the import or export of queen conch to or from the U.S. (*see* 16 U.S.C. § 1538(a)(1)(A)). Given that the U.S. is by far the world's largest importer of queen conch, limiting or restricting U.S. importation of the species would likely do more to stop overfishing and illegal harvest of queen conch than any other regulatory mechanism.

In addition, listing the queen conch under the ESA would ensure adequate habitat protection, take restrictions, and recovery planning for queen conch in Florida, Puerto Rico and the U.S. Virgin Islands (*see* 16 U.S.C. § 1538(a)(1)(B). Listing would also encourage international efforts to protect queen conch through financial and technical assistance in developing conservation programs, as well as through law enforcement assistance (*see* 16 U.S.C. § 1537).

CONCLUSION AND REQUESTED DESIGNATION

The queen conch (*Strombus gigas*) merits listing as an "endangered" or "threatened" species under the ESA. The species is depleted or in decline throughout its range and continues to face overwhelming threats from overfishing and illegal harvest, as well as water pollution and degradation of shallow-water nursery grounds. Queen conch are especially vulnerable to overfishing and recovery of the species will be significantly hampered by the already low adult densities in many areas. Current regulatory regimes, both national and international, have been proven inadequate by the continuing unsustainable harvest and high levels of illegal fishing in direct contravention of legal agreements.

Listing the queen conch under the ESA would provide essential protection for this species by eliminating the U.S. import market, which currently drives a substantial majority of conch exports. In addition, ESA listing would allow for designation of critical habitat to protect vital nursery grounds and existing spawning stock.

WildEarth Guardians hereby petitions the National Marine Fisheries Service within the U.S. Department of Commerce to list the queen conch (*Strombus gigas*) as an "endangered" or "threatened" species pursuant to the ESA. This listing action is warranted, given that queen conch are threatened by four of the five listing factors: present and threatened destruction, modification and curtailment of habitat and range; overutilization; the inadequacy of existing regulatory mechanisms; and other natural or manmade factors affecting its continued existence.

Since threats to seagrass beds, as well as vital nearshore nursery grounds, are a significant cause of imperilment for the queen conch, WildEarth Guardians also requests that critical habitat be designated for this species in its U.S. range concurrent with final ESA listing.

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