

## Species Profile: Spiny Dogfish Population Rebuilds Quickly Due to Stringent State/Federal Management

### Introduction

The life history of spiny dogfish combined with a commercial fishery that targets mostly females has created one of the most polarizing fisheries issues on the Atlantic coast. For the last decade, commercial and recreational fishermen have often reported large schools of dogfish interfering with their fishing operations – from clogging their nets to eating their bait and targeting their catch before it can be reeled back to the boat. So why have past annual quotas been set at such low levels compared to historical catch amounts? The reason is that spiny dogfish quotas are set based on female spawning stock biomass (SSB), the necessary spawning component for rebuilding and sustaining the population. While fishermen encounter large schools of dogfish, scientists believe these fish are likely male or immature females. Further, substantial, unregulated commercial landings in the mid- to late 1990s, targeting the larger mature females (landings peaked at 60 million pounds in 1996), resulted in a precipitous decline in female SSB in the late 1990s.

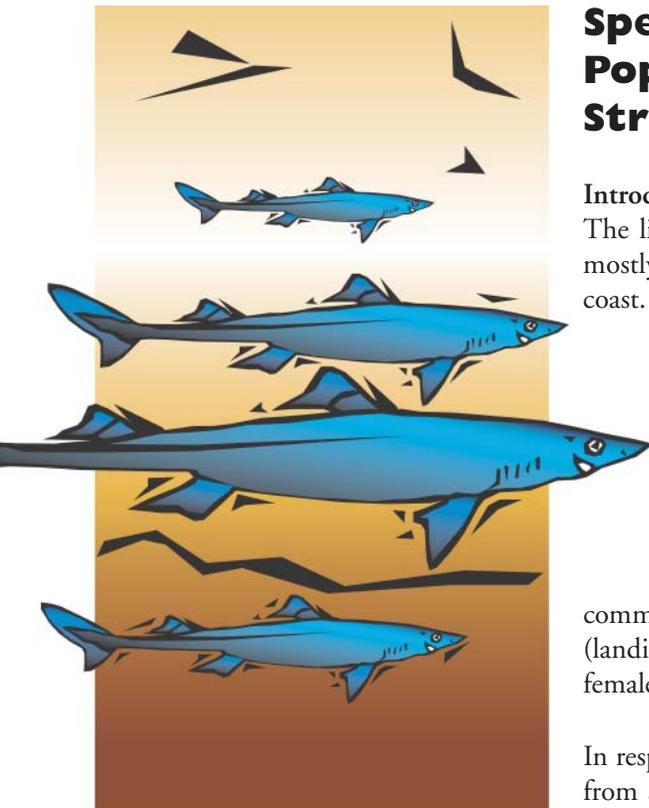
In response to these stringent quotas, dogfish were declared rebuilt in 2009 -- going from severely depleted to a fisheries management success in under a decade. The science-based rebuilding quotas not only worked, but rebuilt the stock much quicker than expected. Because the stock has rebuilt, the spiny dogfish fishery can begin a new chapter under higher quotas based on the significantly higher target fishing mortality rate. Based on this new target, the 2010/2011 annual quota was set at 15 million pounds in both state and federal waters. The potential for higher quotas is great news for fishermen, many of whom increasingly use dogfish to supplement their incomes.

### Life History

Spiny dogfish inhabit both sides of the North Atlantic and North Pacific Oceans, mostly in the temperate and subarctic areas. In the Northwest Atlantic, the stock ranges from Labrador to Florida, and is most abundant from Nova Scotia to Cape Hatteras. Spiny dogfish migrate north in the spring and summer and south in the fall and winter. In the winter and spring, they congregate primarily in Mid-Atlantic waters but also extend onto the shelf break of southern Georges Bank. In the summer, they are located farther north in Canadian waters and move inshore into bays and estuaries. By autumn, dogfish have migrated north with high concentrations in Southern New England, on Georges Bank, and in the Gulf of Maine. They remain in northern waters throughout autumn until water temperatures begin to cool and then return to the Mid-Atlantic.

Juvenile spiny dogfish school by size until sexually mature and then aggregate by both size and sex. Female dogfish reach sexual maturity at 12 years (~29.5 inches), while males reach sexual maturity at six years (~23.6 inches). Mating occurs in the winter months and the pups are delivered on the offshore wintering grounds. Females give birth every two years with litters ranging from two to 15 pups. While carrying one litter, the female will begin developing eggs for the fertilization of her next litter. After an 18 to 24 month gestation period, the longest of any vertebrate, pups are released live and fully formed at about 14 inches.

Whales, dolphins, silver hake, white hake, weakfish, goosefish, Atlantic cod, bluefish, striped bass and other large predatory species feed on dogfish. Spiny dogfish are op-



### Spiny Dogfish *Squalus acanthias*

**Common Names:** spurdog, mud shark, piked dogfish. The common name “dogfish” originated from fishermen who described these fish as chasing smaller fish in large doglike packs.

#### Interesting Facts:

\* Longest gestation period of any vertebrate (18-24 months), gives birth to live young with litters from 2-15 pups (average 6 pups).

\* Genus name *Squalus* is Latin for “a kind of sea-fish” while the species name *acanthias* translates as “a prickly thing,” describing the spines found on the dorsal fins.

**Oldest Recorded:** 100 years

#### Age/Length at Maturity:

\* Females - 12 years/29.5 - 31.5”

\* Males - 6 years/23.6”

#### Age/Length at Recruitment:

\* Females - 10-13 years/32.3-34.3”

\* Males - 15-18 years/29.1-30.7”

**Stock Status:** Rebuilt; not overfished and overfishing not occurring

portunistic feeders, eating several commercially important species, such as Atlantic herring, Atlantic mackerel, squid, and to a lesser extent cod and haddock.

### Commercial Fisheries

Prior to the Fishery Conservation and Management Act of 1976 (now known as the Magnuson-Stevens Reauthorization Act), foreign fleets caught the majority of dogfish in U.S. waters but U.S. fishermen have had uncontested access ever since the Act's passage. The National Marine Fisheries Service (NMFS) encouraged commercial fishermen to target the bountiful stocks of spiny dogfish in the 1980s and 1990s when stocks of other commercially valuable fish in the Northeast declined. Then in 1998, NMFS determined that spiny dogfish were overfished and implemented stringent harvest restrictions in federal waters to allow the stock to rebound. The states followed shortly after with complementary regulations for state waters.

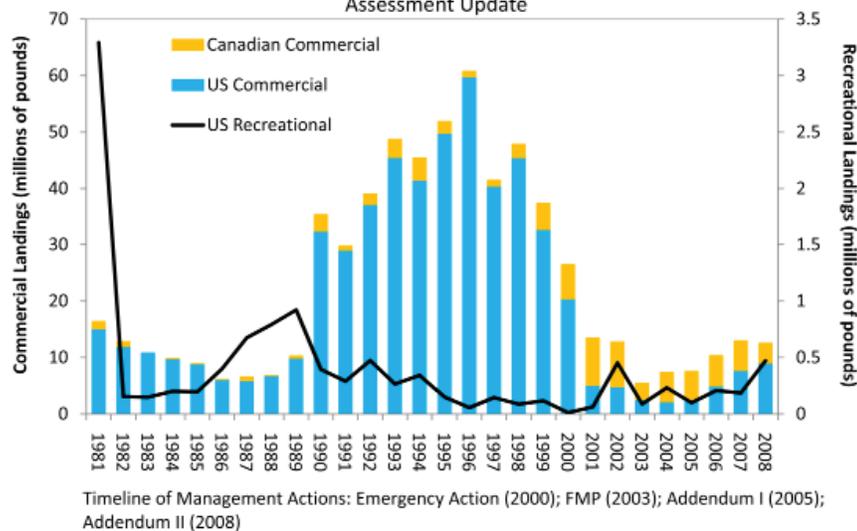


Photo courtesy of NEAMAP

Today, commercial fishermen catch spiny dogfish using longlines, trawls, and purse seines. Fishermen target female dogfish because the females grow larger than males and tend to school together. Processors prefer the larger dogfish because they are easier to hold and cut. The commercial fishery supplies the European food fish markets that use dogfish 'belly flaps' for fish and chips in England and as a popular beer garden snack called shillerlocken in Germany. There is also a small scientific fishery in Maine, which uses spiny dogfish to study several of the species' unique biological characteristics. Dogfish have an organ called a rectal gland whose study helps scientists better understand the function of human kidneys. They also secrete a molecule called squalamine, which has strong antibiotic characteristics and shows promise as an anticancer agent.

**Figure 1. Spiny Dogfish Landings**

Sources: 2010 TRAC Status Update and 2009 NEFSC Spiny Dogfish Stock Assessment Update



Landings were approximately 37.2 million pounds in 1992, gradually increasing to a peak of about 60 million pounds in 1996. In the late 1990s, landings declined to an average of around 40 million. After federal and state regulations were implemented in the early 2000s, landings declined to less than five million pounds in 2001 and 2002. They then ranged between two and eight million pounds between 2003 and 2009. As the stock began to improve, landings were increased to 12 million pounds in 2009 and 2010 respectively. Commercial landings continue to be mostly female dogfish, with female landings comprising about 98% of the total commercial catch. The 2010/2011 quota is 15 million pounds in state and federal waters.

### Stock Status

The current composition of the dogfish population has created challenges for both fishermen and managers. Fishermen often encounter large numbers of dogfish but these fish are usually not the large spawning females necessary to ensure stock rebuilding. The life history of the spiny dogfish requires a large female spawning stock for the population to be sustainable—a large biomass of males or immature females does not equate to a sustainable stock.

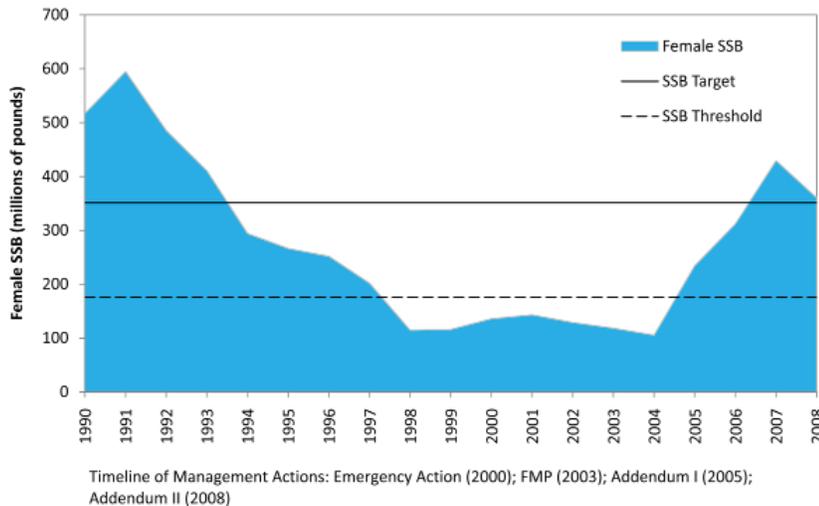
The most recent stock assessment documents are the 2010 Transboundary Resource Assessment Committee (TRAC) assessment and 2010 Northeast Fisheries Science Center (NEFSC) Biological Reference Points for Spiny Dogfish (BRP) report. The BRP report updated the selectivity pattern (what size dogfish are being caught) in the fishery which strongly influences the length-based life history model used to set the fishing mortality target and threshold rates. The updated fishing mortality target is 0.207 and the threshold is 0.325. The updated SSB target and threshold are 159,288 and 79,644 metric tons (mt), respectively.

The 2010 TRAC found SSB to exceed the target in 2008 and 2009 at 195,000 and 163,000 mt, respectively. Fishing mortality ranged from 0.09 and 0.13 between 2005 and 2009 and has been consistently below the fishing mortality target. As such, spiny dogfish are not overfished and overfishing is not occurring.

Other positive trends include increases in pup biomass over the last few years and recruitment in 2009 that was the fifth highest in the 42-year NEFSC Spring Survey. Unfortunately, record low pup production from 1997 to 2003 has left a recruitment deficit that will cause SSB to drop around 2012. The amplitude of this drop increases as fishing mortality increases and still occurs when fishing mortality is hypothetically zero.

**Figure 2. Spiny Dogfish Female Spawning Stock Biomass (>=80 cm)**

Source: NEFSC Spiny Dogfish Stock Assessment Update, 2009



### Atlantic Coastal Management

In 1998, NMFS declared spiny dogfish overfished and initiated the development of a joint fishery management plan (FMP) between the Mid-Atlantic (MAFMC) and New England Fishery Management Councils (NEFMC) in 1999. The Commission began development of an interstate FMP to complement the federal plan in 1999. The Interstate FMP was approved in late 2003 and implemented for the 2003-2004 fishing year.

Both the Commission and federal plans use a fishing mortality rate to set annual quotas and trip limits but there are a few differences between the federal and interstate management programs. The federal plan allocates the annual quota seasonally between two periods; 57.9% of the quota is available from May 1 to October 31 and 42.1% is available from November 1 to April 30.

Addendum II to the Commission FMP replaced the seasonal allocation with a regional allocation. Under Addendum II, 58% of the quota is allocated to the states of Maine to Connecticut, 26% is allocated to the states of New York to Virginia, and the remaining 16% is allocated to North Carolina. North Carolina received its own percentage because the seasonal migrations of spiny dogfish make dogfish unavailable to their fishermen until late into the fishing season when most, or all, of the quota has already been harvested. The interstate plan also includes paybacks for quota overages, allows for a five percent rollover once the stock is rebuilt, and allows for up to 1,000 spiny dogfish to be harvested for biomedical supply.

## Spiny Dogfish: Reflections from the Past

Fishermen frequently talk about an overabundance of spiny dogfish impacting their fishing experiences and their ability to catch other fish species. According to Bigelow and Schroeder's *Fishes of the Gulf of Maine*, first published in 1925 and later revised in the 1950s, today's fishermen are not the only ones who had issues with dogfish population levels. The seminal guide to fishes found in the Gulf of Maine contains observations about the gregarious and ubiquitous nature of spiny dogfish beginning as far back as the early 1900s. Read below for a couple of excerpts:

### Habits

"Voracious almost beyond belief, the dogfish entirely deserves its bad reputation. Not only does it harry and drive off mackerel, herring, and even fish as large as cod and haddock, but it destroys vast numbers of them. Again and again fishermen have described packs of dogs dashing among schools of mackerel, and even attacking them within the seines, biting through the net, and releasing such of the catch as escapes them. At one time or another they prey on practically all species of Gulf of Maine fish smaller than themselves, and squid are also a regular article of diet whenever they are found..... Often, too, they bite groundfish from the hooks of long lines, or take the baits and make it futile to fish with hook and line where they abound."

### Occurrence in the Gulf of Maine

"The spiny dogfish ("dogfish" or "dog" in common parlance) makes up for the comparative rarity of other sharks in the Gulf of Maine by its obnoxious abundance. To mention all the localities from which it has been reported there would be simply to list every seaside village and fishing ground from Cape Cod to Cape Sable."

In February 2010, the Commission's Spiny Dogfish and Coastal Sharks Management Board (Board) approved a 15 million pound quota with a maximum possession limit of 3,000 pounds for the 2010/2011 fishing year (May 1 – April 30). Upon having declared the resource rebuilt this summer, the federal government adopted a 15 million pound quota for the 2010/2011 fishery as well.

MAFMC is currently drafting Amendment 3 to the Spiny Dogfish FMP which will include options to replace the seasonal quota with a regional, state share, or annual quota allocation. MAFMC may also include research set-aside provisions, specifying spiny dogfish quota by sex, limiting access to spiny dogfish permits, recreational measures, essential fish habitat, and a management measure rollover provision. The Amendment 3 is scheduled to be implemented in summer/fall of 2011 at the earliest.

At its May and August meetings, the Commission's Board discussed the concept of further allocating state water spiny dogfish quota by state shares. The issue was raised because states under a regional quota allocation scheme are unable to effectively increase or decrease possession limits to maximize the value of landed dogfish. To prevent a state under a regional quota agreement from losing out on quota while other states continue harvesting under higher possession limits, all states within a region would have to lower their possession limit. Establishing state shares would provide states greater flexibility in managing their possession limits to best meet their needs. However, given the contentious nature of this issue (who gets what percentage), it's unclear whether the Board will ultimately move forward on a draft addendum.

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