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Atlantic hagfish

by

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Distribution, Biology and Management

The Atlantic hagfish or “slime eel”, *Myxine glutinosa*, is found in deep, cold waters to depths of at least 1100 m. In the western north Atlantic, hagfish are distributed from Davis Straits, Greenland to the continental slope waters off of Florida. In the Gulf of Maine the distribution of hagfish is primarily affected by salinity, temperature and substrate type (Collette and Klein-MacPhee 2002).

Hagfish is considered to be the most primitive vertebrate species either living or extinct (Collette and Klein-MacPhee 2002, Powell et al 2005). Hagfish evolved over at least 300 million years and have the same basic morphological traits of fossilized specimens (Bardack 1991).

Hagfish lack bones, paired fins, and a true jaw. The hagfish skeleton is composed of cartilage, the dorsal fin is actually a skin fold, and the jaw is a rasping plate with horn-like teeth. Atlantic hagfish belong to the family Myxinidae which have one pair of gill openings attached to 6-7 internal gill pouches per opening. The species has paired barbels on the tip of its snout and four barbels surrounding the mouth. Hagfish are almost blind because their eyes are rudimentary but their sense of smell is keen. The skin of the Atlantic hagfish is smooth and scale-less with a series of slime glands along both sides of the ventral midline (Collette and Klein-MacPhee 2002). These glands produce fibrous mucus that protects hagfish from predators and possibly parasites.

Atlantic hagfish inhabit soft clay or muddy sediments and spend much of their time in temporary burrows in the sea floor (Collette and Klein-MacPhee 2002). They prey primarily on shrimp, worms and small crabs (Gustafson 1935, Shelton 1978, Collette and Klein-MacPhee 2002). They are also scavengers that feed upon dead and dying fish, mammals and shellfish. Hagfish are often considered a nuisance by commercial fishermen because they can feed on targeted species (Martini et al 1997, Collette and Klein-MacPhee 2002).

Age at maturity and life expectancy are unknown in the Gulf of Maine, as are spawning locations. Length at 50% maturity for Grand Banks hagfish is estimated at 378 mm (Grant 2006). Spawning may occur at any time of year, as females have been observed in various stages of oogenesis during all seasons (Collette and MacPhee 2002, Martini et al 1997). Hagfish can possess both mature male and female sexual organs but it is unknown if both are functional at the same time (Powell et al 2005). Females produce clutches containing an average of 20-30 yolky eggs (Collette and MacPhee 2002). Time required to develop a clutch of eggs is unknown but has been estimated at 1-2 years. Development from egg to hatchling may be several months based on egg yolk volume (NEFSC 2003). Studies in the Gulf of Maine suggest that the population is composed of 10% sexually immature individuals, 59% females, roughly 6% males and approximately 25 % of the adult population of unknown gender (Martini et al 1997).

Although a hagfish fishery exists in the Gulf of Maine, the resource is not actively managed at present.

The Fishery

In the western Pacific Ocean a fishery for hagfish has existed since World War II. Overharvesting lead to the expansion of hagfish fisheries into the eastern Pacific off the northwestern US and British Columbia, and then during the late 1980's to the mid 1990's to the western Atlantic off of Maritime Canada and New England. Hagfish are utilized as a food source and their skins are valued for leather products. All hagfish are exported whole to Korea (NEFSC 2003).

In the Gulf of Maine (GOM), Atlantic hagfish are caught using modified 55-gallon plastic barrels, called hagfish pots, attached to sinking line and buoys. Typically 20-40 traps are deployed in a string for a small commercial vessel and 80-200 traps for larger vessels (NEFSC 2003). A series of funneled holes in the side of the barrel allow hagfish to enter the baited pot but doesn't allow them to escape. Several rows of 3/8" holes allow smaller animals to escape the traps.

Reporting of Atlantic hagfish landings is presently not required by law and fishery data are therefore incomplete. Atlantic hagfish landings first appear in the NEFSC commercial database in 1993 with a reported landing of approximately 500 metric tons. Annual reported landings during 1994-2000 ranged between 1,100 and 3,000 metric tons with a peak in 2000 (Table 29.1, Figure 29.2).

Reported commercial hagfish trips ranged from 94 trips in 1994 to 863 trips in 1996 and averaged slightly above 400 trips per year during 1994-2000 (Figure 29.3). Landings during 2001 to 2005 have ranged from 700-1,300 metric tons per year (Figure 29.2). Trips targeting Atlantic hagfish declined after 2001, averaging 253 per year (Figure 29.3). The NMFS Logbook database indicated that the number of vessels in the hagfish fishery peaked at 23 vessels in 1996 and 22 vessels in 2000 (Figure 29.4). Since 2000 there has been a steady decline of vessels reporting landings, with only 6 vessels reporting in 2005.

A data collection program has been proposed for Atlantic hagfish by NMFS requiring seafood dealers to acquire permits and report on the purchase of hagfish made from commercial fishing vessels to aid in the future management of this species (Federal Register 2006).

Research Vessel Survey Indices

Hagfish are encountered infrequently in the NEFSC research vessel Bottom Trawl Surveys. The stratified mean number per tow index in the Spring NEFSC survey series peaked in the mid-1970's and remained low ever since (Figure 29.5). A slight increase in 2001 and 2002 was observed but the index subsequently declined.

NEFSC autumn survey abundance indices are generally higher than in the spring (Figure 29.6). The autumn indices peaked in the early 1970's and were low during 1980's. Recent indices are among the highest in the autumn time series.

Summary

Hagfish have been harvested commercially in the Gulf of Maine since the early 1990's with peak landings of 3,000 metric tons occurring in 2000 (Figure 29.2). Survey indices have been variable but have been higher than average in recent years (Figure 29.5 and Figure 29.6).

Table 29.1. Recreational and Commercial landings of Atlantic hagfish (thousand metric tons).

Category	1993-95 Average	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
U. S. Recreational	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Commercial											
United States	1.0	2.0	1.7	1.4	2.4	3.1	0.7	1.4	1.1	1.3	0.8
Canada	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Nominal Catch	1.0	2.0	1.7	1.4	2.4	3.1	0.7	1.4	1.1	1.3	0.8

For further information

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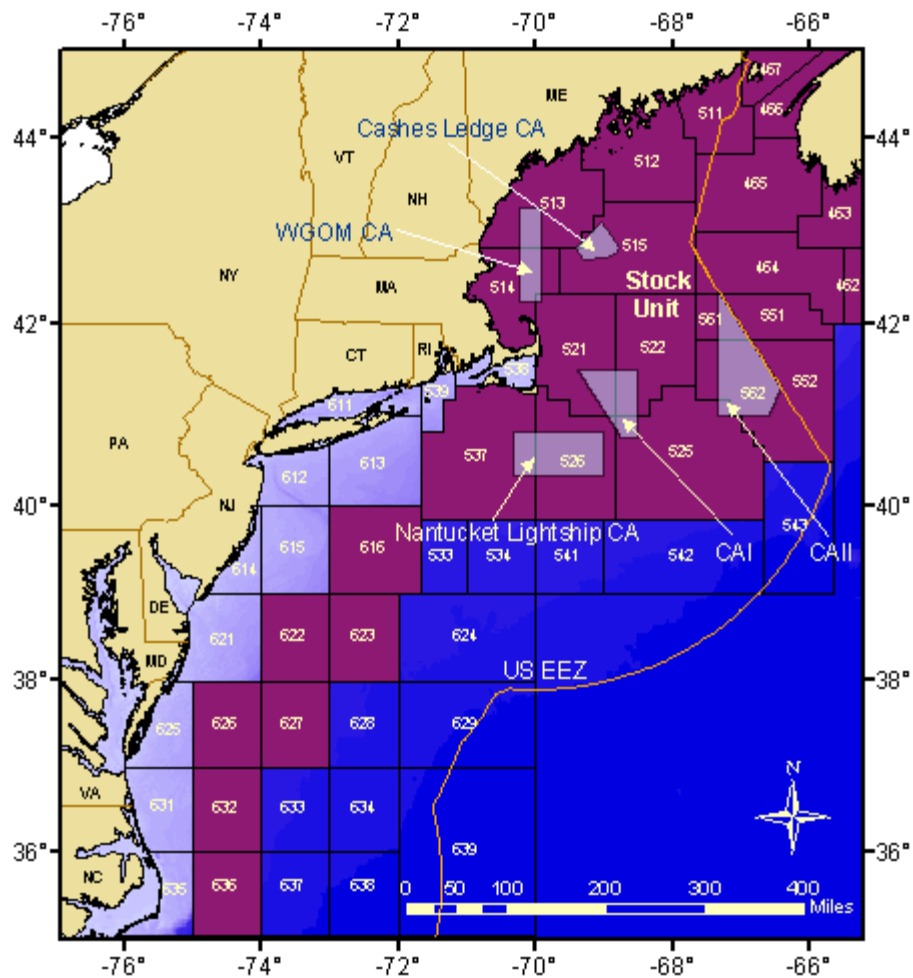


Figure 29.1. Statistical areas used to define the Atlantic haddock stock.

Atlantic Hagfish Total Commercial Landings

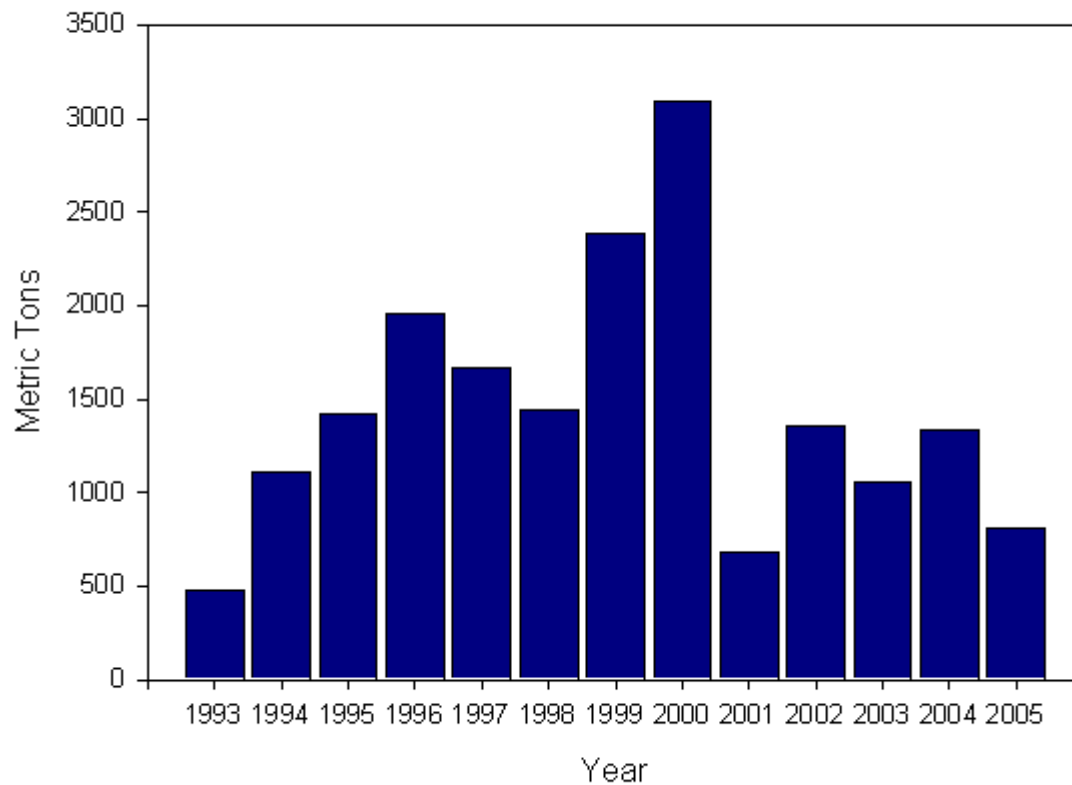


Figure 29.2. Reported commercial landings in the NMFS commercial database for Atlantic hagfish, 1993-2005.

Atlantic Hagfish Reported VTR Trips

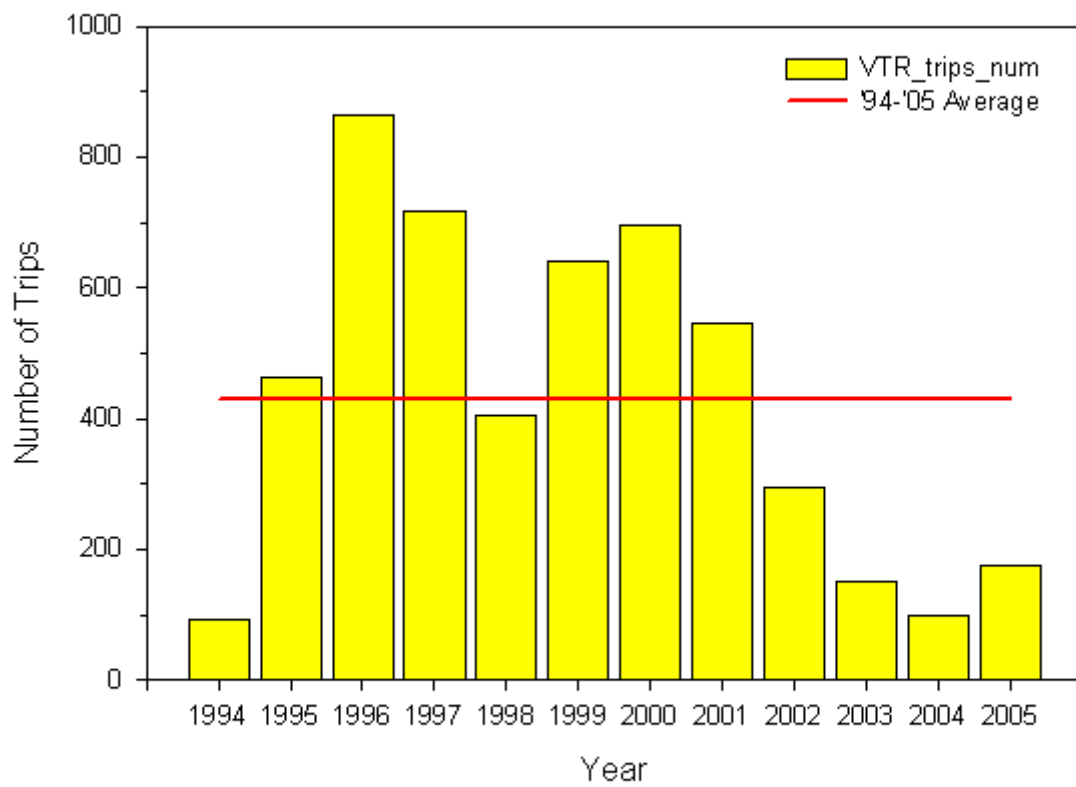


Figure 29.3. Reported hagfish trips in the NMFS Vessel Trip Report (VTR) database, 1994-2005.

Atlantic Hagfish Reported Number of Vessels

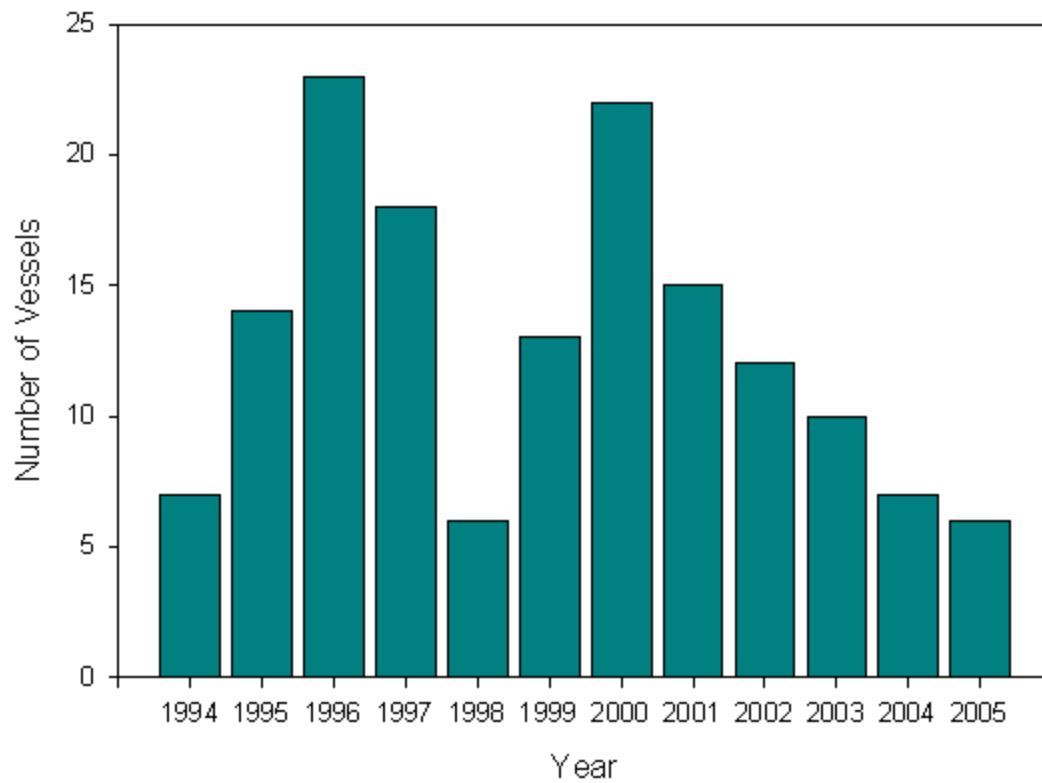


Figure 29.4. Reported hagfish vessels in the NMFS Vessel Trip Report (VTR) database, 1994-2005.

Atlantic Hagfish NEFSC Spring Survey Abundance Index

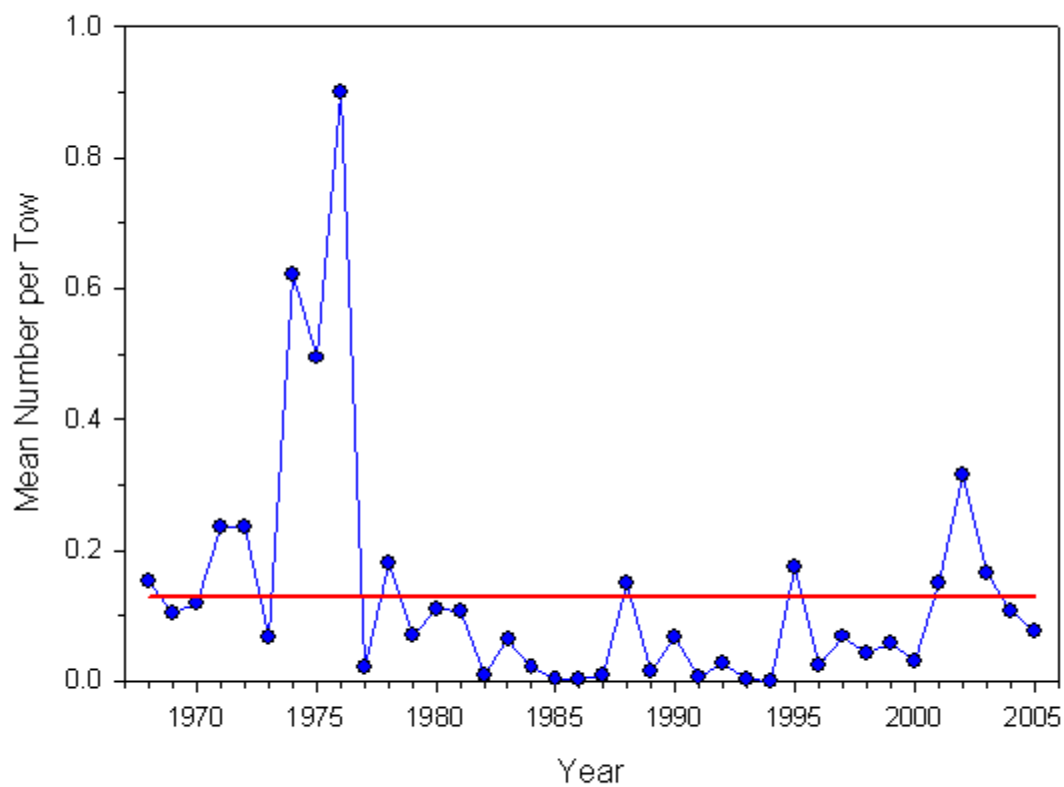


Figure 29.5. Abundance index (stratified mean number per tow) of Atlantic hagfish in NEFSC spring bottom trawl surveys, 1968-2005.

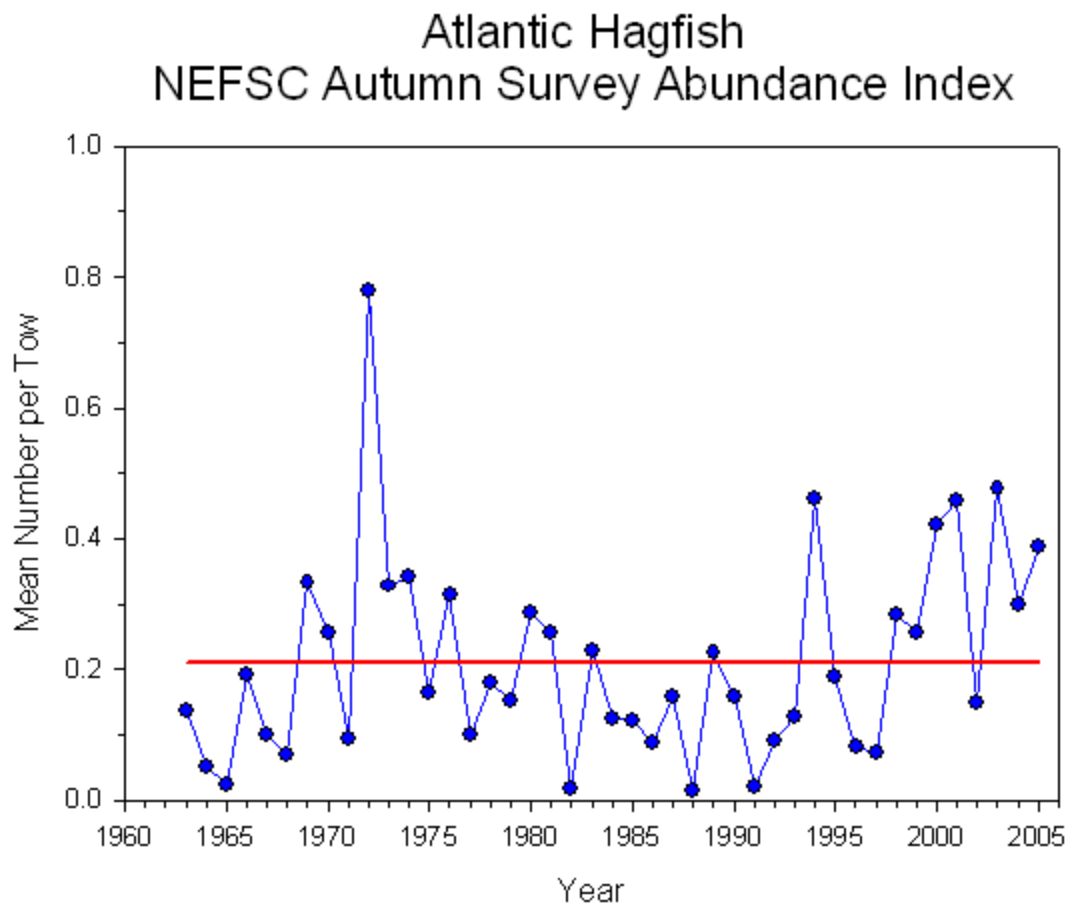


Figure 29.6. Abundance index (stratified mean number per tow) of Atlantic hagfish in NEFSC autumn bottom trawl surveys, 1963-2005.