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## Northern Shortfin Squid

by

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### Distribution, Biology, and Management

The northern shortfin squid, *Illex illecebrosus*, is a highly migratory, transboundary species that is distributed in the Northwest Atlantic Ocean from the Florida Straits to Newfoundland (Dawe and Hendrickson 1998). The northern component of the stock, extending from Newfoundland to the southern Scotian Shelf, is assessed annually and managed by the Northwest Atlantic Fisheries Organization (NAFO) based on a total allowable catch (TAC). The southern and U.S. stock component, extending from the Gulf of Maine to Florida (Figure 30.1), has been managed since 1977 by the Mid-Atlantic Fishery Management Council (MAFMC), based on an annual TAC, under the provisions of the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan (FMP).

*I. illecebrosus* live for less than one year, experiences high natural mortality rates, and exhibit a protracted spawning season whereby overlapping “microcohorts” enter the population throughout the year over a wide geographic area and exhibit variable growth rates. Age estimation, accomplished by counting daily growth increments in the statoliths, has been validated for *I. illecebrosus* (Dawe et al. 1985; Hurley et al. 1985). Back-calculated hatch dates from statolith-based aging studies indicate that spawning occurs throughout most of the year (Dawe and Beck 1997; Hendrickson 2004). The only confirmed spawning area is located in the Mid-Atlantic Bight where the winter cohort spawns during late May (Hendrickson 2004). Spawning may also occur offshore in the Gulf Stream/Slope Water frontal zone, where *Illex* sp. paralarvae have been collected (O’Dor and Balch 1985; Rowell et al. 1985), and south of Cape Hatteras, during winter, where *Illex* sp. hatchlings have been collected (Dawe and Beck 1985). The lifespan of the winter cohort in U.S. waters ranges from 115 to 215 days (Hendrickson 2004). The species is semelparous and fishing mortality and spawning mortality occur simultaneously on the U.S. shelf (Hendrickson and Hart 2006). The species inhabits offshore shelf and slope waters primarily during spring through autumn (Hendrickson and Holmes 2004). Species distribution and abundance are strongly influenced by oceanographic factors (Dawe and Warren 1993; Dawe et al. *In Press*). Annual survey indices of relative abundance and biomass

and average body size suggest that the stock has experienced low and high productivity periods (Hendrickson and Showell 2006; NEFSC 2006). The information provided herein reflects the results of the most recent peer-reviewed assessment of the U.S. component of the *I. illecebrosus* stock

## **The Fishery**

The onset and duration of the *Illex* fisheries reflect the timing of squid migrations through the fishing grounds. During summer through fall, a bottom trawl fishery occurs on the U.S. shelf, primarily in the Mid-Atlantic Bight, and an inshore jig fishery occurs in Newfoundland waters. Prior to 2000, *Illex* was also caught on the Scotian Shelf in an international mixed-trawl fishery for squid, argentine and silver hake (Hendrickson and Showell 2006). Total stock landings increased rapidly during the 1970s, from 1,600 mt in 1969 to a peak of 179,300 mt in 1979, and were mostly from the northern stock component (Figure 30.2). After reaching a peak of 162,100 mt in 1979, landings from the northern stock component declined rapidly to 400 mt in 1983 and have since remained at low levels. From 1982 onwards, landings from the U.S. domestic fishery have comprised the majority of the total stock landings and U.S. harvests have ranged between 2,800 mt and 31,500 mt.

During 1968-1982, U.S. EEZ landings of *I. illecebrosus* were taken primarily by international fleets and landings reached a peak of 24,900 mt in 1976 (Figure 30.3). There has been no fishing allowed in U.S. waters by international fleets since 1987. Since 1982, U.S. EEZ landings have been taken primarily by the domestic fleet. Most domestic fishery landings are taken during June-September, with a peak in July, by vessels using small-mesh bottom trawls fishing near the edge of the continental shelf. U.S. landings increased from 2,000 mt in 1988 to 18,400 mt in 1994. Landings of 23,600 mt were taken in 1998 (Table 30.1) and resulted in a fishery closure because the TAC (19,000 mt) was exceeded. After 1998, landings declined rapidly to 2,700 mt in 2002. In 2004, landings increased to a record high of 26,100 mt, but the fishery was closed again because the quota (24,000 mt) was surpassed. Landings in 2005 (12,000 mt) were less than half of the 2004 landings.

*Illex* discards occur in the offshore *Loligo* fishery during November through April (NEFSC 2006). Annual discards from the *Illex* and *Loligo* fisheries combined have ranged between 0.5% and 6.0% of the annual *Illex* landings by weight. Annual discards were highest during 1998 and 2004 when *Illex* landings were also highest.

## **Research Vessel Survey Indices**

NEFSC research bottom trawl surveys occur during the annual *Illex* spring inshore migration onto the shelf and also during the autumn offshore migration (Hendrickson 2004). An unknown fraction of the stock resides beyond the area sampled in these surveys. During spring surveys, *Illex* are collected in low numbers and at fewer stations than in the autumn surveys. However, the autumn survey occurs near the end of the fishing season, and therefore, autumn survey indices may represent indices of spawner escapement.

Autumn survey indices indicate that periods of high relative abundance occurred during 1976-1981 and 1987-1990 (Figure 30.4). An intermediate level of abundance occurred during 1991-

1998. The survey indices increased after 1999 and attained a record high in 2003, but declined sharply in 2004 to the level observed in 2002. In 2005, survey indices increased slightly. The magnitude of the autumn relative abundance index is not always related to the magnitude of the U.S landings during the same year (e.g. high landings occurred in 1998 and 2004, but relative abundance was high in 1998 and low in 2004). Large interannual fluctuations in autumn research survey indices are partially attributable to the fact that the survey occurs near the end of the fishing season and that squid distribution is affected by oceanographic conditions (Brodziak and Hendrickson 1999).

## Assessment Results

*I. illecebrosus* was last assessed in November 2005 at SAW 42 (NEFSC 2006). An in-season stock assessment model was developed but the results were considered preliminary because seasonal data were needed to further test the model. As a result, stock status could not be determined because estimates of fishing mortality and stock biomass were not available.

## Biological Reference Points

Amendment 8 (MAFMC 1998) of the FMP specifies  $B_{MSY}$  as 39,300 mt, MSY as 24,000 mt, and  $F_{MSY}$  as 1.22 per year (Table 30.2). However, these reference points were derived from a biomass dynamics model that does not account for the species semelparous life history or adequate spawning escapement, and therefore, should be treated with caution.

## Summary

It was not possible to evaluate stock status in 2004 because reliable estimates of stock biomass and fishing mortality were not available (NEFSC 2006). Post-fishery, autumn relative abundance indices for *Illex* reached a record high in 2003, but declined sharply in 2004 and returned to the 2002 level. The record-high survey index was followed by the highest level of landings on record in 2004, 26,000 mt, but landings subsequently declined to 12,000 mt in 2005. Fishing effort in 2004 was twice as high as in 2003.

**Table 30.1** Recreational and commercial landings of *Illex illecebrosus* (thousand metric tons).

Category	1986-95 Average	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
<b>U. S. Recreational</b>	-	-	-	-	-	-	-	-	-	-	-
<b>Commercial</b>											
<b>United States</b>	11.7	17.0	13.6	23.6	7.4	9.0	4.0	2.8	6.4	26.1	12.0
<b>Canada</b>	-	-	-	-	-	-	-	-	-	-	-
<b>Other</b>	-	-	-	-	-	-	-	-	-	-	-
<b>Total US EEZ<sup>1</sup></b>	11.7	17.0	13.6	23.6	7.4	9.0	4.0	2.8	6.4	26.1	12.0
<b>Subareas 3+4</b>	0.1	8.7	15.6	1.9	0.3	0.4	0.1	0.3	1.1	2.3	0.6
<b>Total Nominal Catch</b>	11.8	25.7	29.2	25.5	7.7	9.4	4.1	3.1	7.5	28.4	12.6

<sup>1</sup>Does not include landings reported as unidentified squid species

**Table 30.2** MSY-based reference points for the U.S. component of the *Illex illecebrosus* stock.

**MSY-based Reference Points**

MSY	=	24,000 mt
B <sub>MSY</sub>	=	39,300 mt
F <sub>MSY</sub>	=	1.22 per yr (based on a lifespan of 8 months)

**For further information**

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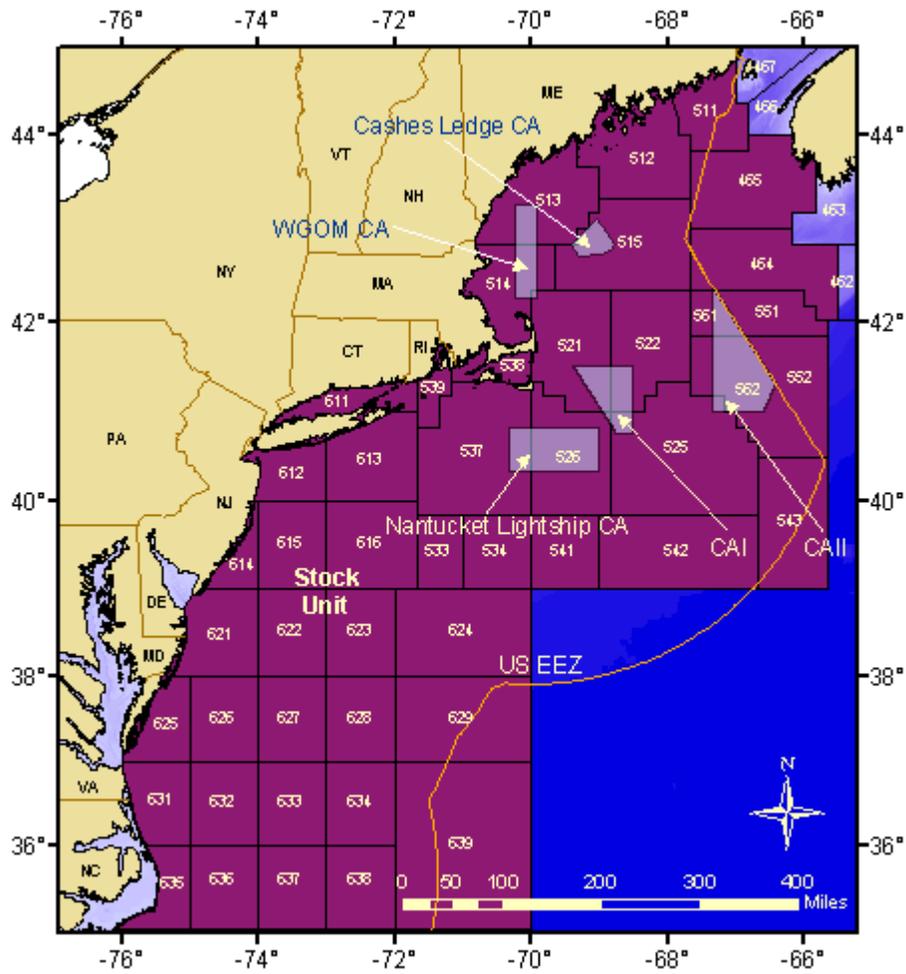


Figure 30.1. Statistical areas used to define U.S. component of the *Mex sauid* stock.

### Northern Shortfin Squid (*Illex illecebrosus*) Commercial Landings

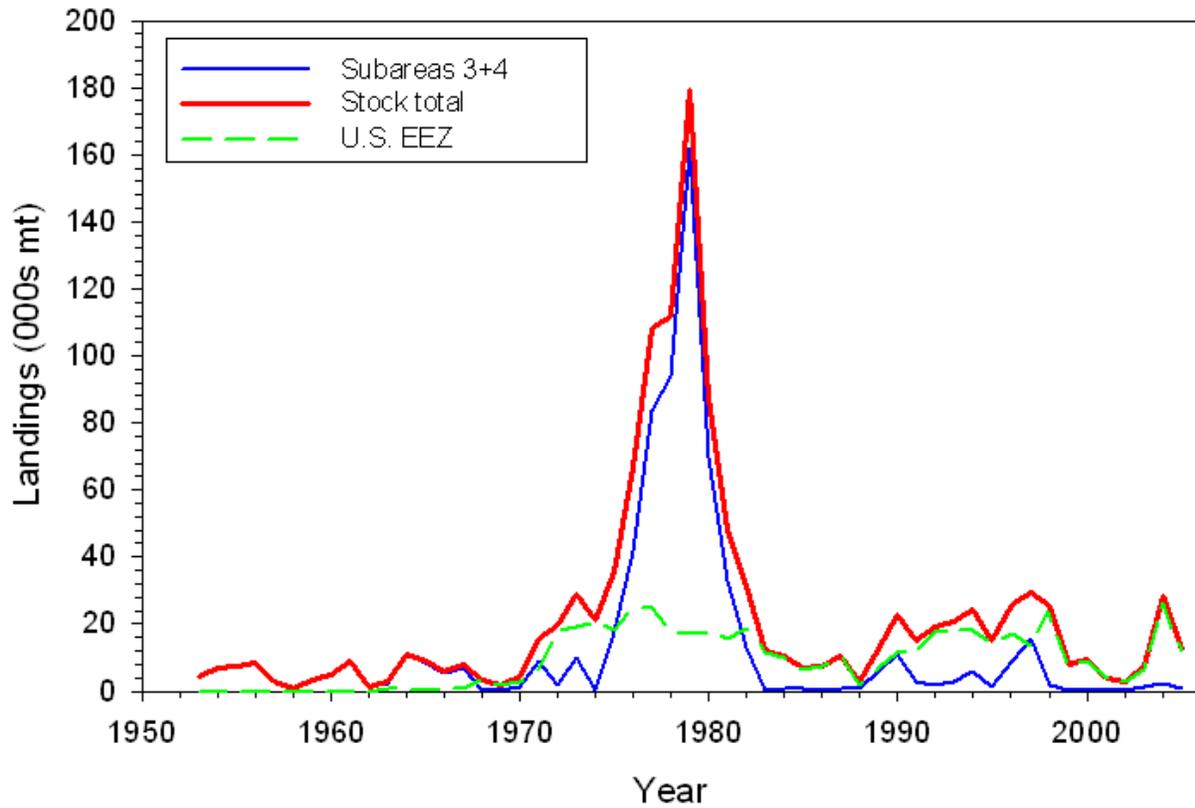


Figure 30.2. Commercial landings (000's mt) of *Illex illecebrosus* during 1953-2005.

Northern Shortfin Squid (*Illex illecebrosus*)  
Commercial Landings

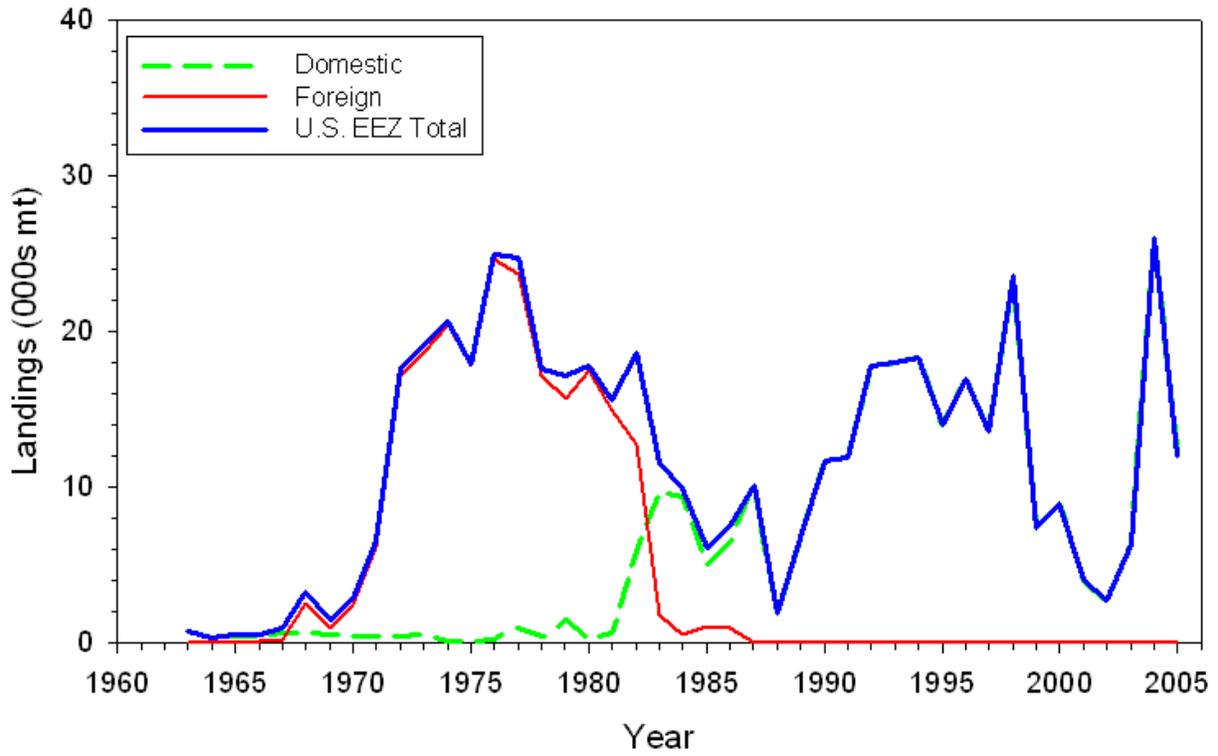


Figure 30.3 Commercial landings (000's mt) of *Illex illecebrosus* in subareas 5 & 6, 1963-2005.

Northern Shortfin Squid (*Illex illecebrosus*)  
Autumn Survey Indices

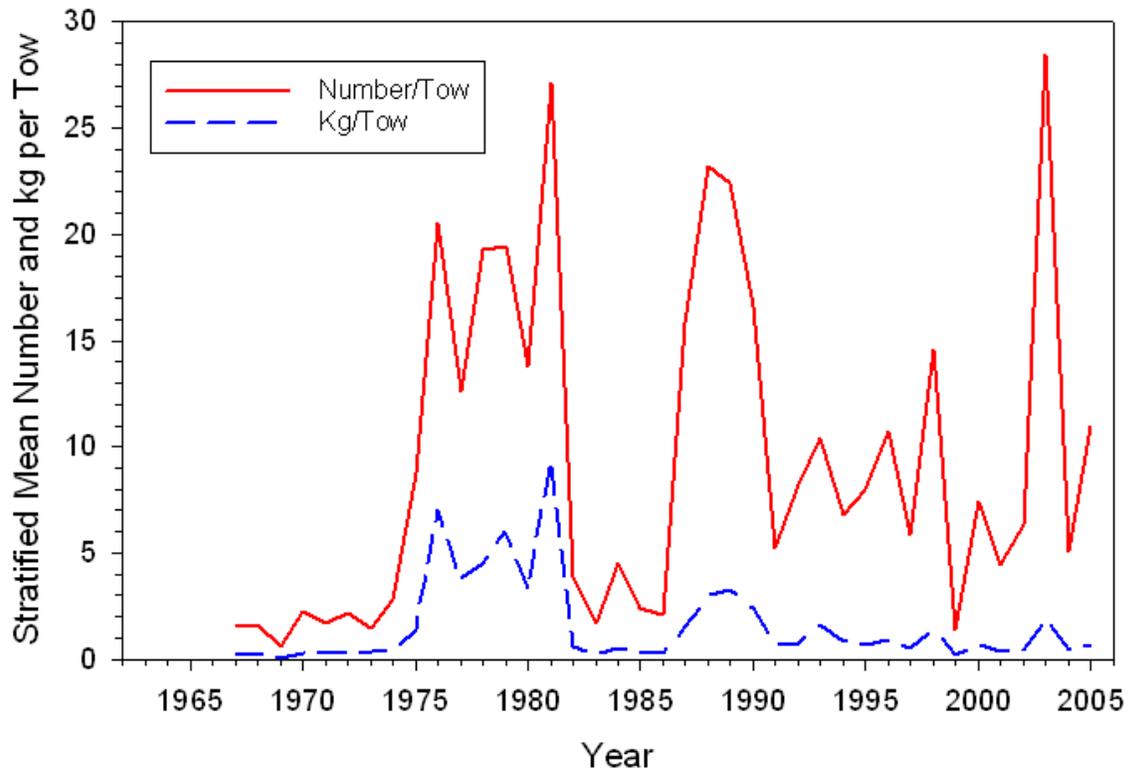


Figure 30.4 Indices of relative abundance (stratified mean number per tow) and biomass (stratified mean kg per tow) of *Illex illecebrosus* in NEFSC bottom trawl surveys, 1967-2005.