

Data Requested by the MAFMC's SSC *Illex illecebrosus* Working Group

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1.0 Background

This report summarizes the results of a data request from the Mid-Atlantic Fishery Management Council's (MAFMC) *Illex illecebrosus* Working Group during the spring of 2020. The data pertain to the southern component of the *Illex illecebrosus* stock, located within the U.S. Exclusive Economic Zone in the Northwest Atlantic Ocean, and which is managed by the MAFMC.

2.0 Fishery Data

Landings of *I. illecebrosus* were updated for 2019 and are preliminary. Landings averaged 12,628 mt during 1987-2018 and totaled 27,163 mt in 2019, the latter which was the highest amount of landings since the origin of the US fishery in 1987 (Table 1, Figure 1). The 2019 landings exceeded the TAC of 24,825 mt by 9% (Table 1) and the fishery was closed on August 21. This represented the third consecutive year of fishery closures. During 1987-2019, the TAC was harvested during only five years (Table 1, Figure 2). This type of landings pattern is typical for exploited squid species due to their highly variable population size. The 2020 TAC was also set at 24,825 mt.

The distribution of estimated retained weight of *I. illecebrosus* was mapped by ten-minute square using data from the Vessel Trip Report (VTR) Database. VTR data were used because the Oracle view comprised of merged records from the 2019 VTR and Dealer Weighout databases was not yet available. The mapped data include bottom trawl trips where the retained weight of *I. illecebrosus* exceeded the fishery closure trip limit of 4,536 kg (10,000 lbs). Retained weight is shown as a cumulative percentage based on quartiles (Figure 2). The highest amounts of retained weight (top 25%) was concentrated in only two ten-minute squares; one in Statistical Area 526 and the other located south of Hudson Canyon in Statistical Area 622.

3.0 Research Survey Data

Relative abundance (stratified mean number per tow) and biomass (stratified mean kg per tow) indices for *I. illecebrosus* were derived using data from the fall bottom trawl surveys conducted during 1967-2019 (Table 2, Figure 3). The fall survey can be considered a post-fishery survey because it occurs during September-October, which is near the end of the fishing season.

The 2017 fall survey indices were not computed because the primary region of *Illex* habitat during the fall, the Mid-Atlantic Bight and Southern New England, were not sampled due to vessel mechanical problems. The 2019 relative abundance index (7.9 squid per tow) was only 50% of the 2018 index and was near the 1967-2018 median of 8.0 squid per tow.

Stratified mean body weights of *I. illecebrosus* were computed as the annual stratified mean weight per tow divided by the stratified mean number per tow of squid caught during NEFSC fall research bottom trawl surveys. Indices were not computed for 2017 for the reasons previously described. Mean body weight during 2019 (75 g) was 64% of the 1967-2018 median (Figure 4).

Nominal relative abundance (number per km²) indices for *I. illecebrosus* were derived for the 2008-2019 spring NEAMAP surveys, by staff from the Virginia Institute of Marine Science. The 2017 spike in the index decreased to a very low level of 26.1 squid per km² in 2019 (Figure 5). These indices are only informative during years of high *Illex* abundance when range expansion occurs. It is unknown whether the 2017 spike was attributable to the late timing of the survey, due to survey vessel issues, and/or sampling of only the northern portion of the survey area (Rhode Island Sound to Atlantic City, NJ), where most of the *I. illecebrosus* catches have occurred each year.

Table 1. *Illex illecebrosus* landings (mt) from NAFO Subareas 5 and 6, by fleet during 1963-2019, Total Allowable Catch (TAC, mt) and percentage of the TAC landed during 1976-2019. The 2019 landings are preliminary and do not include landings from state-permitted vessels, the latter which are not yet available.

Year	Domestic	International	Total	TAC¹	% of TAC²
1963	810		810		
1964	358	2	360		
1965	444	78	522		
1966	452	118	570		
1967	707	288	995		
1968	678	2,593	3,271		
1969	562	975	1,537		
1970	408	2,418	2,826		
1971	455	6,159	6,614		
1972	472	17,169	17,641		
1973	530	18,625	19,155		
1974	148	20,480	20,628	71,000	
1975	107	17,819	17,926	71,000	
1976	229	24,707	24,936	30,000	83
1977	1,024	23,771	24,795	35,000	71
1978	385	17,207	17,592	30,000	59
1979	1,493	15,748	17,241	30,000	58
1980	299	17,529	17,828	30,000	59
1981	615	14,956	15,571	30,000	52
1982	5,871	12,762	18,633	30,000	62
1983	9,775	1,809	11,584	30,000	39
1984	9,343	576	9,919	30,000	33
1985	5,033	1,082	6,115	30,000	20
1986	6,493	977	7,470	30,000	25
1987	10,102	0	10,102	30,000	34
1988	1,958	0	1,958	30,000	7
1989	6,801	0	6,801	30,000	23
1990	11,670	0	11,670	30,000	39
1991	11,908	0	11,908	30,000	40
1992	17,827	0	17,827	30,000	59
1993	18,012	0	18,012	30,000	60
1994	18,350	0	18,350	30,000	61
1995	13,976	0	13,976	30,000	47
1996	16,969	0	16,969	21,000	81
1997	13,356	0	13,356	19,000	70
1998	23,568	0	23,568	19,000	124
1999	7,388	0	7,388	19,000	39
2000	9,011	0	9,011	24,000	38
2001	4,009	0	4,009	24,000	17
2002	2,750	0	2,750	24,000	11
2003	6,391	0	6,391	24,000	27

Table 1. (cont.)

Year	Domestic	International	Total	TAC ¹	% of TAC ²
2004	26,097	0	26,097	24,000	109
2005	12,011	0	12,011	24,000	50
2006	13,944	0	13,944	24,000	58
2007	9,022	0	9,022	24,000	38
2008	15,900	0	15,900	24,000	66
2009	18,418	0	18,418	24,000	77
2010	15,825	0	15,825	24,000	66
2011	18,797	0	18,797	23,328	81
2012	11,709	0	11,709	22,915	51
2013	3,792	0	3,792	22,915	17
2014	8,767	0	8,767	22,915	38
2015	2,422	0	2,422	22,915	11
2016	6,682	0	6,682	22,915	29
2017	22,516	0	22,516	22,915	98
2018	24,117	0	24,117	22,915	105
2019	27,163	0	27,163	24,825	109
2020				24,825	
Averages					
1963-1986	1,950	9,472	11,027		
1987-2018	12,627	0	12,627		52
1963-2018	8,051	3,961	11,941		

¹TACs during 1974 and 1975 are for *Illex illecebrosus* and *Doryteuthis pealeii* combined.

²Directed fishery closures occurred during 1998, 2004 and 2017-2019 when 95% of the quota was predicted to have been harvested. When closed, a trip limit of 4,536 kg is in effect.

Table 2. *Illex illecebrosus* relative abundance (stratified mean number per tow) and biomass (stratified mean kg per tow) indices, and CVs, derived from NEFSC fall bottom trawl surveys (offshore strata 1-40 and 61-76) conducted during 1967-2019. FSV *H. B. Bigelow* indices for 2009 onward were converted to RV *Albatross IV* units using combined-season conversion factors computed for all sizes combined (Miller et al. 2010). CVs from 2009 onward account for the variance associated with the FSV *H. B. Bigelow* conversion factors.

Year	Number per tow	CV	Kg per tow	CV
1967	1.6	17	0.24	17
1968	1.6	21	0.31	17
1969	0.6	23	0.07	26
1970	2.3	21	0.27	15
1971	1.7	12	0.34	14
1972	2.2	25	0.29	15
1973	1.5	24	0.35	25
1974	2.8	40	0.39	30
1975	8.7	36	1.42	18
1976	20.6	16	7.02	19
1977	12.6	18	3.74	18
1978	19.3	21	4.53	26
1979	19.4	11	6.05	11
1980	13.8	15	3.29	18
1981	27.1	32	9.34	40
1982	3.9	15	0.60	13
1983	1.7	14	0.23	13
1984	4.5	17	0.52	19
1985	2.4	17	0.36	18
1986	2.1	15	0.26	17
1987	15.8	31	1.53	29
1988	23.2	25	3.00	24
1989	22.4	45	3.31	57
1990	16.6	12	2.40	13
1991	5.2	17	0.69	18
1992	8.2	15	0.80	16
1993	10.4	19	1.60	20
1994	6.8	24	0.86	25
1995	8.0	30	0.70	39
1996	10.8	22	0.93	19
1997	5.8	25	0.52	17
1998	14.6	29	1.40	50
1999	1.4	16	0.19	17
2000	7.4	28	0.71	22
2001	4.5	27	0.32	23
2002	6.4	20	0.44	19
2003	28.5	61	1.95	67

Table 2. (cont.)				
Year	Number per tow	CV	Kg per tow	CV
2004	5.1	24	0.41	22
2005	11.0	35	0.74	41
2006	29.5	43	2.85	31
2007	15.7	33	1.31	33
2008	10.4	22	0.98	20
2009	8.7	18	0.93	21
2010	10.0	23	0.53	23
2011	6.3	20	0.54	20
2012	8.0	17	0.54	15
2013	4.7	17	0.36	16
2014	8.3	14	0.64	14
2015	9.5	36	0.52	16
2016	7.6	21	0.66	27
2017 ¹	-		-	
2018	15.8	23	1.32	15
2019	7.9	21	0.60	16
Median				
1967-2018	8.0		1.00	

¹ The 2017 fall survey indices were not computed because the primary areas of *Illex* habitat, the Mid-Atlantic Bight and Southern New England, were not sampled due to vessel mechanical problems.

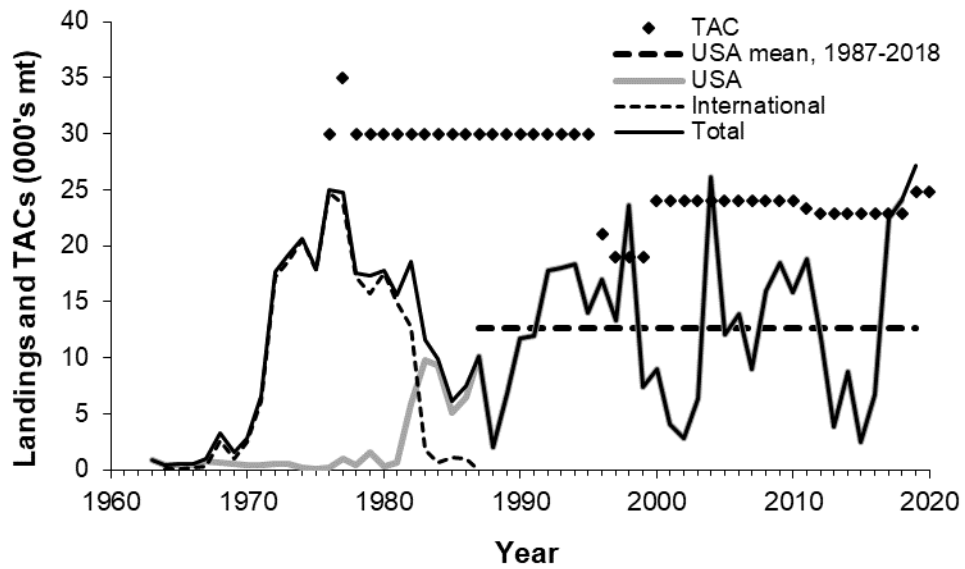


Figure 1. Landings (000's mt) of *Illex illecebrosus* from NAFO Subareas 5+6, by fleet during 1963-2019, and TACs (000's mt) for the same region during 1975-2019. The 2019 landings are preliminary. Fishery closures occurred during 1998, 2004 and 2017-2019.

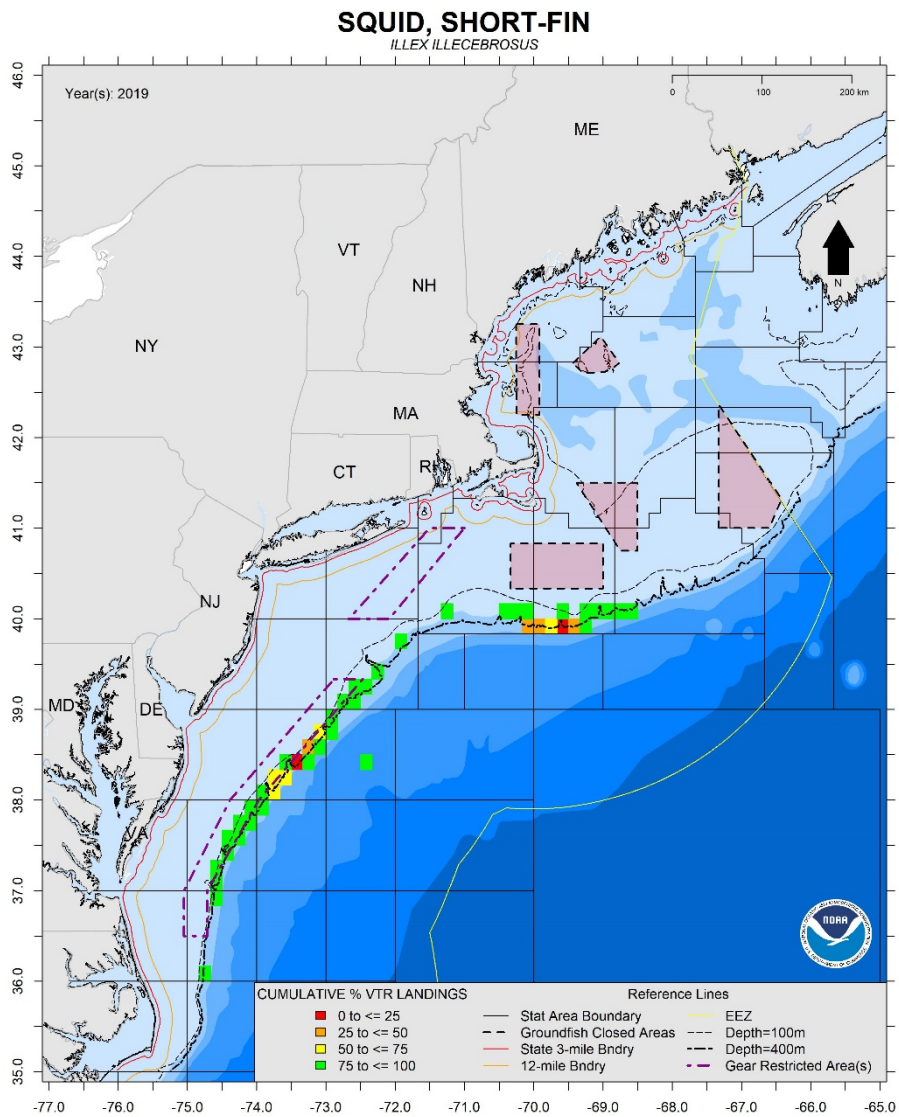


Figure 2. Spatial distribution, by ten-minute square, of the cumulative percentages of captain-estimated *Illex illecebrosus* retained weight for bottom trawl trips that retained greater than 4,536 kg (10,000 lbs) of *I. illecebrosus* based on the 2019 Vessel Trip Reports. Shaded ten-minute squares located seaward of the 400-m isobaths are incorrect fishing locations reported on Vessel Trip Reports.

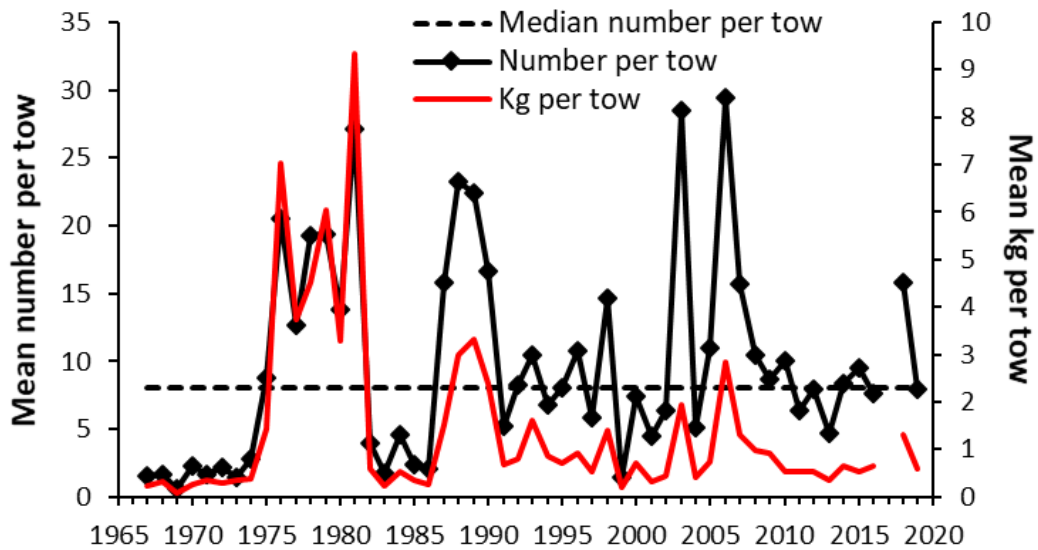


Figure 3. *Illex illecebrosus* indices of relative abundance (stratified mean number per tow) and biomass (stratified mean kg per tow) derived from NEFSC fall bottom trawl survey data, 1967-2019. The 2017 fall survey indices were not computed because the primary region of *Illex* habitat during the fall, the Mid-Atlantic Bight and Southern New England, were not sampled due to vessel mechanical problems.

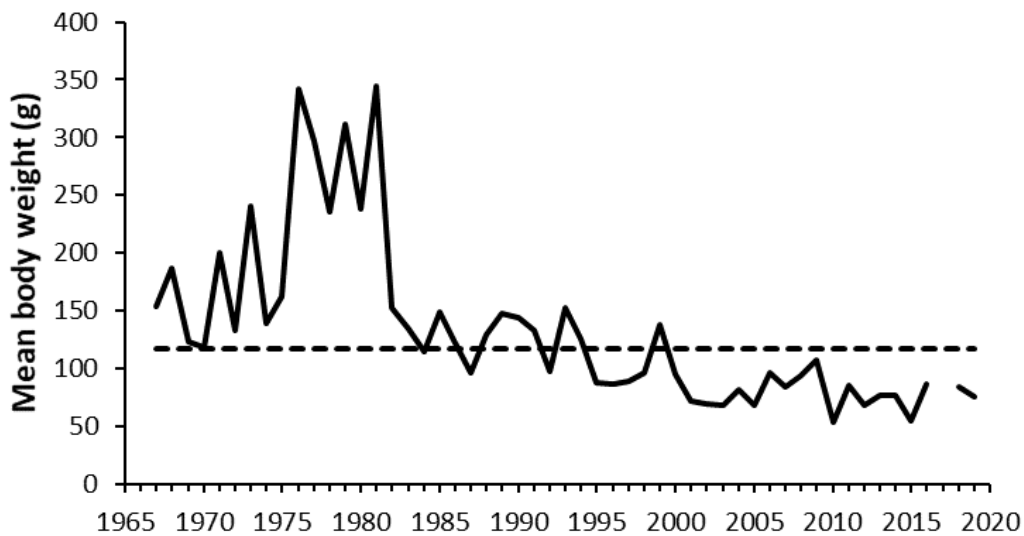


Figure 4. Stratified mean body weights of *Illex illecebrosus* (stratified mean kg per tow/ stratified mean number per tow) derived from NEFSC fall bottom trawl survey data, 1967-2019. The dashed line represents the 1967-2018 median. Indices were not computed for 2017 (refer to Figure 4 caption for explanation).

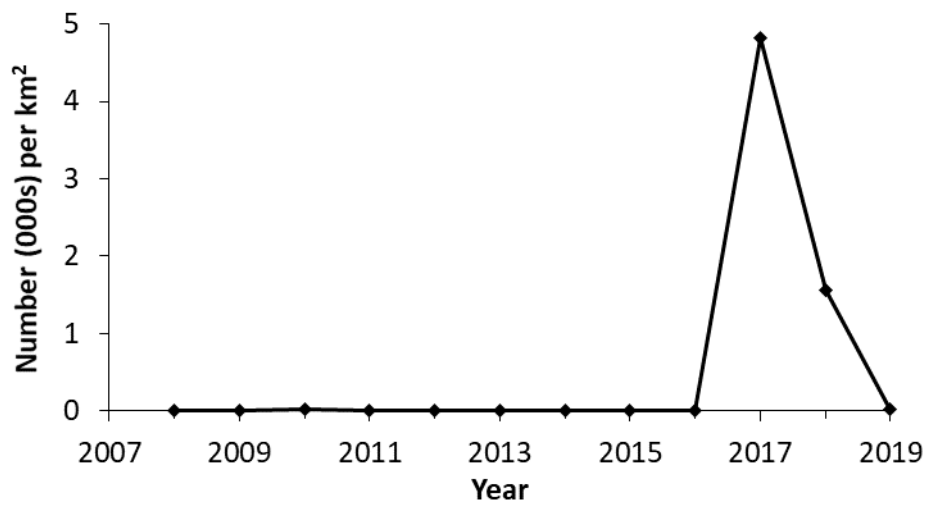


Figure 5. Nominal relative abundance (number per km²) indices of *Illex illecebrosus* derived from the spring NEAMAP surveys during 2008-2019. Data source: Virginia Institute of Marine Science.