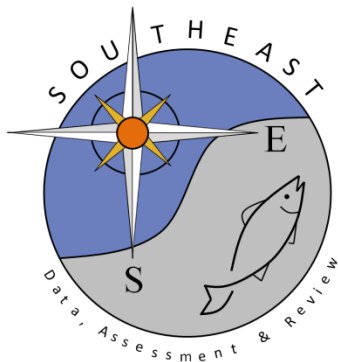


Occurrence, catch rates, and length frequencies for smooth  
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1974-2006

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## Summary

The Virginia Institute of Marine Science has conducted a fishery-independent longline survey during summer months since 1974. Data for smooth dogfish captured in the survey between 1974 and 2006 are presented. Smooth dogfish primarily occur in Virginia waters in late fall as they migrate south to wintering grounds and throughout spring as they migrate north. More than 70% of the smooth dogfish caught in the VIMS survey were captured in the month of May. Length frequency data indicate that most smooth dogfish caught in the standard survey were mature; however, alternative surveys using smaller circle hooks captured a wider range of lengths. Nominal catch rates are presented and suggest that relative abundance of smooth dogfish in Virginia waters may have been higher during the period from 1996 to 2006 than the period from 1974 to 1992; however these results may be confounded by increased sampling effort during the month of May in later years.

## Materials and Methods

### *Sampling*

The VIMS longline survey is a depth-stratified station-oriented field survey of the Chesapeake Bay and coastal waters from Cape Hatteras, NC to Cape Henlopen, DE with most effort taking place in Virginia waters (Figure 1). The gear used was the standard for the commercial longline industry at the beginning of the VIMS program in 1974. Gear characteristics have remained constant throughout. We used commercial-style longlines consisting of 4.8-mm tarred, nylon mainline that was anchored at each end and marked by buoys equipped with radar reflectors. Three-meter gangions were spaced approximately 18 m apart along the mainline and a large inflatable buoy was attached to the mainline following every 20th gangion. Standard gangions were composed of a stainless-steel tuna clip (quick snap) attached to a 2-m section of 3.2-mm tarred nylon trawl line, the end of which was attached to an 8/0 barrel swivel. We crimped one end of a 1-m section of 1.6-mm stainless-steel aircraft cable to the swivel and the other end to a Mustad-9/0, J-hook. In addition, stations in Chesapeake Bay and along and in tidal lagoons Virginia's Eastern Shore are sampled with gangions with no leader wire and smaller 14/0 circle hooks designed to target juvenile sharks in the summer nurseries. All coastal stations are in water depths between five and 30 meters, therefore nearly all gangions rest on the bottom during a set. Bait consisted of various coastal teleosts including Atlantic menhaden (*Brevoortia tyrannus*) until 1995. Only Atlantic menhaden and Atlantic mackerel (*Scomber scombrus*) were used from 1995 to 2005. A standard set consisted of 100 hooks and was approximately 2 km in length. Standard soak times were four hours long.

Data recorded for each set included 1) location, 2) start and finish times for setting and hauling, 3) maximum and minimum water depth, 4) surface and bottom water temperature (to 30 meters maximum), 5) number of hooks and hook type, 6) bait species. Beginning in 1996, temperature, dissolved oxygen, and salinity were recorded from surface to the bottom at two-meter intervals. Animals that were lost once brought to the side of the vessel were counted as catch, but broken gangions and “bite-offs” were not included in catch. All species captured were recorded and measured. Pre-caudal length, fork length, and stretch total length were measured for all sharks.

### ***Data Analyses***

We calculated length frequencies and plotted males and females separately for all smooth dogfish caught on J-hooks and circle hooks separately. Only data from the month of May were used in calculation of relative abundance. Catch per unit of effort (CPUE) was calculated for each set as the number of smooth dogfish per 100 hooks fished. Data for the standard coastal stations using standard gear (steel leader with 9/0 J-hook) and data using smaller alternative gear were analyzed separately. Raw CPUE data are presented and mean annual CPUE was calculated for coastal stations.

### **Results**

Smooth dogfish spend winter months in waters to the south of Virginia and summer months to the north. They are abundant in Virginia waters during spring and early summer as they migrate north and during fall as they migrate south. The VIMS longline surveys operate from May until October. Of the 764 smooth dogfish caught during normal survey operations by the VIMS longline program, 545 (71.3%) were captured in the month of May and 104 (13.6%) were captured in June. Only 48 smooth dogfish (6.3%) were captured in the months of July, August or September combined. Smooth dogfish were captured during five of 15 years sampled during October and a total of 67 (8.8%) were captured. Over the course of the survey, 18% of smooth dogfish were captured in Chesapeake Bay, 18% in tidal creeks along Virginia’s Eastern Shore, and 64% in coastal waters to 30 meters depth.

### ***Sex Ratios and Length Frequencies***

A total of 802 smooth dogfish were captured between 1974 and 2006. Of the 789 for which the sex is known, 570 (72.2%) were females and 219 (27.8%) were males. However, this ratio is skewed by the fact that there is lower recruitment of adult males than adult females to the standard J-hooks due to the smaller size of adult males. The female:male sex ratio of smooth dogfish caught on standard J-hooks was 2.95:1. However, the sex ratio was 1.17:1 in a shark survey targeting juvenile sandbar sharks (1996-2006) and 1.43:1 in a survey targeting batoids (2007). Both of these surveys use smaller circle hooks than the standard survey.

Length data were available for 668 female and 325 male smooth dogfish (Figures 3 & 4). For the standard survey using large J-hooks the mean length of female smooth dogfish was 88.7 cm PCL (S.D.=10.6cm) compared to only 75.6 cm PCL (S.D.=11.2cm) for males. Males and females were of similar sizes in the two surveys using small circle hooks. In the juvenile sharks survey (1996-2006), the mean length of females was 69.6 cm PCL (S.D.=16.3cm) and that for males was 68.6 cm PCL (S.D.=10.5cm). The mean length of smooth dogfish captured in the batoid survey was 74.2 cm PCL (S.D.=9.3cm) for females and 74.8 cm PCL (S.D.=8.6cm) for males.

### ***CPUE Trends***

There appears to be a general increasing trend in smooth dogfish CPUE in Virginia coastal waters during the month of May from 1974 to 2006 (Figure 5). However, much more effort was expended during May starting in 1996 which may have confounded these results. During the 22-year span from 1974 to 1995, only 24 sets were made in coastal waters during May. During the 11-year span between 1996 and 2006, 51 sets were made. However, between 1974 and 1994, at least one smooth dogfish was captured on only 41.7% of coastal sets made during the month of May (10 of 24 sets). By contrast, at least one smooth dogfish was captured in 70.6% of coastal sets made during May between 1996 and 2006 (36 of 51 sets).

Too few stations were sampled in Chesapeake Bay and in the lagoon along Virginia's Eastern Shore to allow the calculation of the annual mean of nominal CPUE. However, raw CPUE data (Figure 6) also suggest that abundance of smooth dogfish may have increased in the region beginning in the late 1990's.

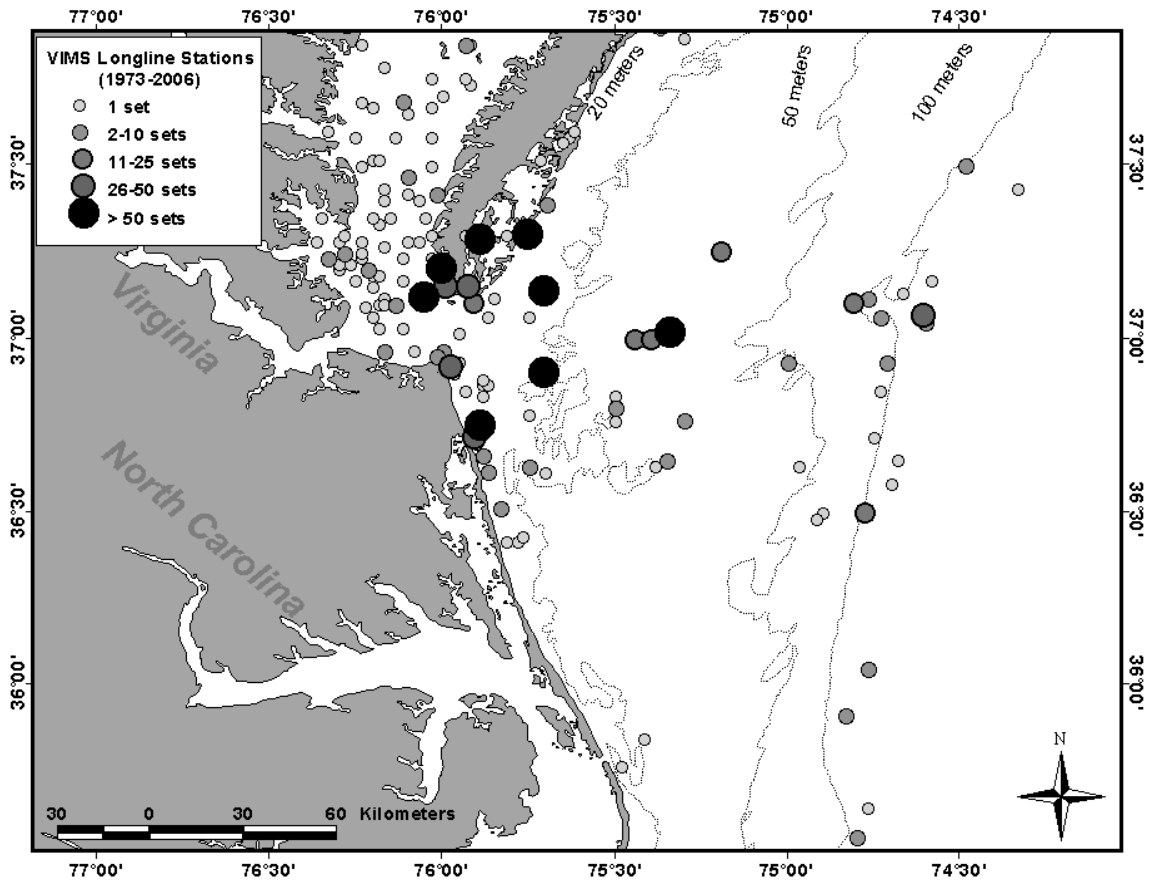


Figure 1: Distribution of longline sets made by the VIMS Shark Ecology Program 1974-2006.

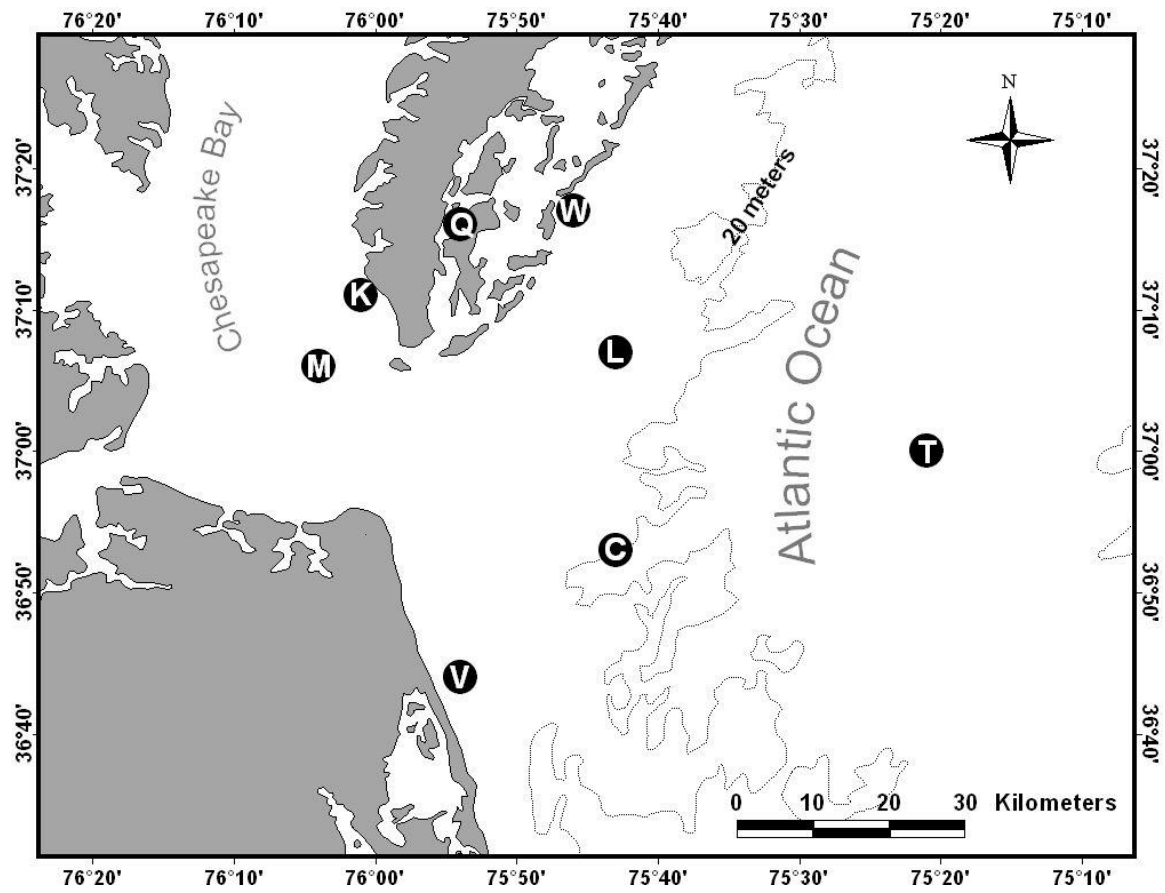


Figure 2: Standard stations fished by the VIMS longline survey.

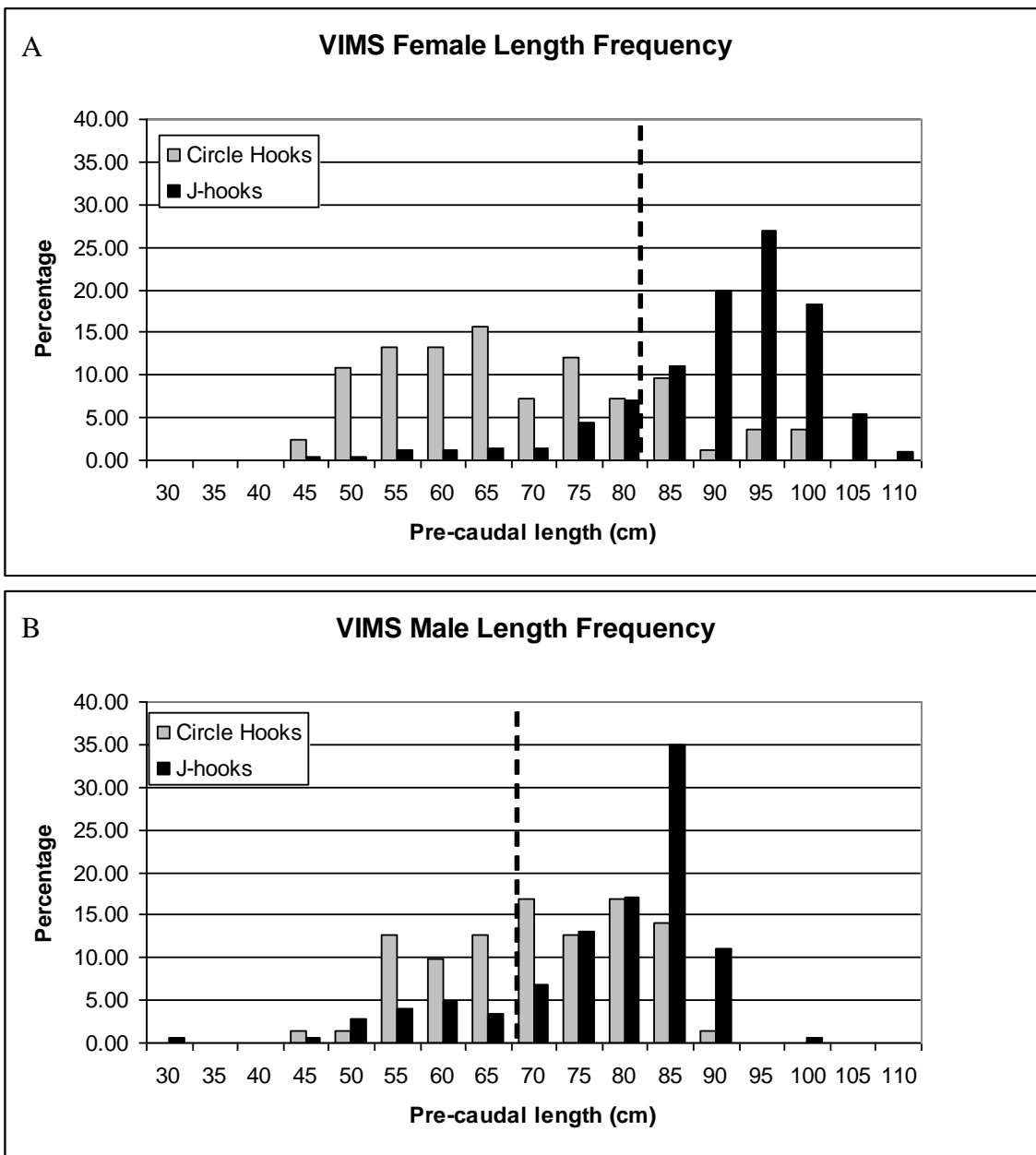


Figure 3: Length frequency of smooth dogfish caught in the VIMS longline survey. A) Females using standard 9/0 J-hooks and alternative 14/0 Circle hooks. B) Males using standard 9/0 J-hooks and alternative 14/0 Circle hooks. Dashed lines represent approximate size at 50% maturity.

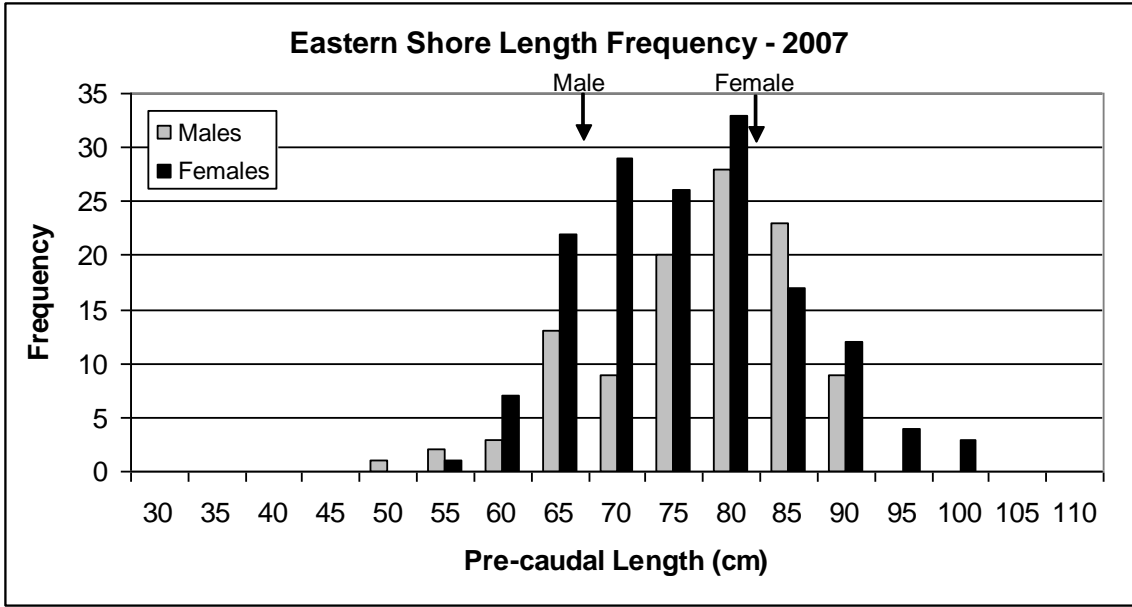


Figure 4: Length frequency of smooth dogfish caught in the VIMS Eastern Shore batoids survey during May 2007. Arrows represent approximate sizes at 50% maturity.



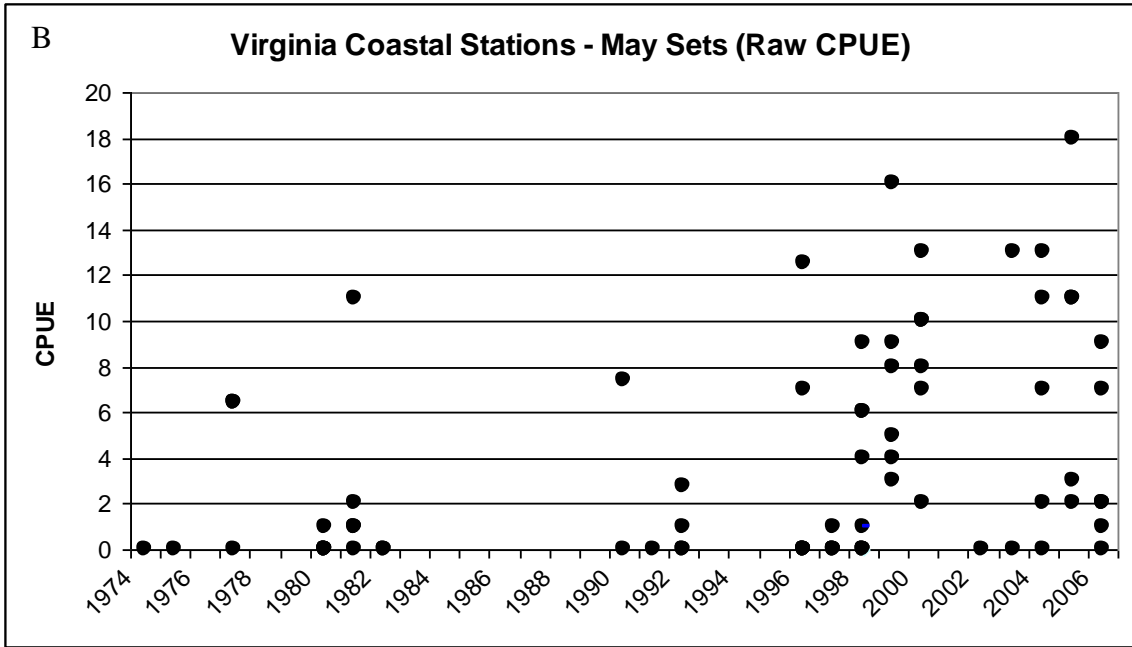
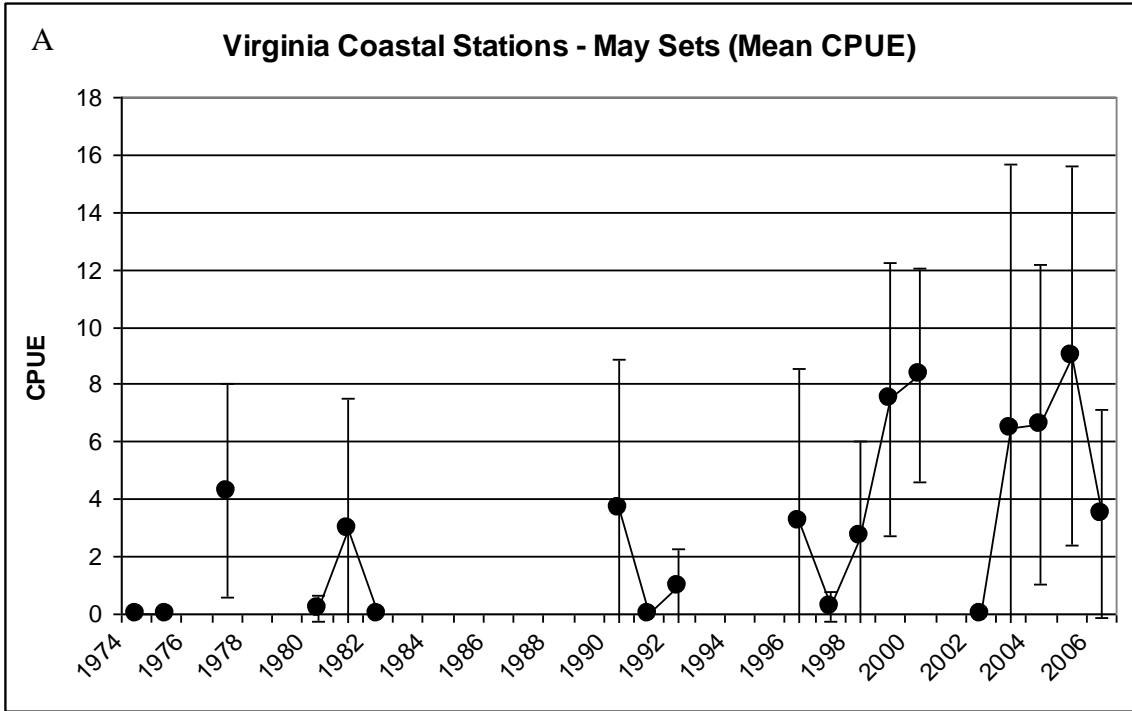


Figure 5: Catch per unit of effort (sharks per 100 hooks) for smooth dogfish at standard coastal stations fished by the VIMS longline survey. A) Mean annual CPUE with standard deviation. B) Raw CPUE data.

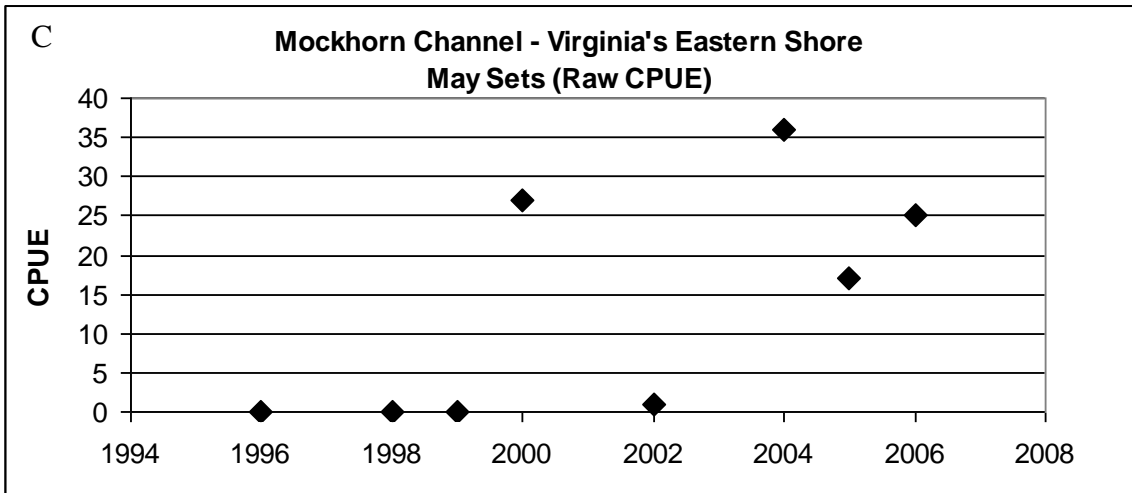
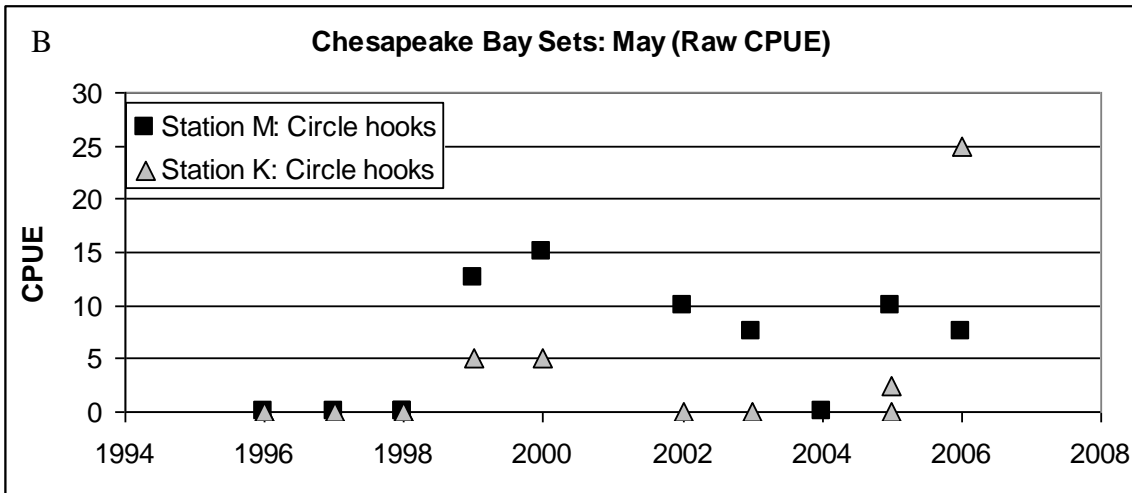
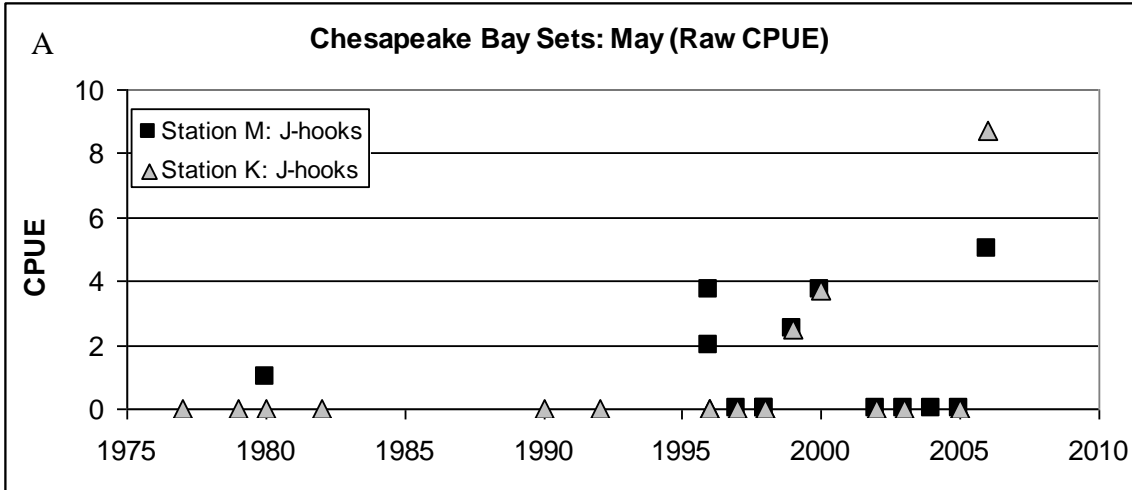


Figure 6: Raw CPUE for smooth dogfish caught at standard stations in Chesapeake Bay and Eastern Shore Lagoons. A) Standard J-hooks at Kiptopeke (K) and Middleground (M) in Chesapeake Bay. B) Alternative circle hooks at Kiptopeke (K) and Middleground (M) in Chesapeake Bay. C) Alternative circle hooks in Mockhorn Channel on Virginia's Eastern Shore.