Climate Change and Marine Recreational Fisheries

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What is Climate Change?

Night vs. Day (hours)?

Winter vs. Summer (days)?

Sea Temperature Oscillations AMO (decades)

Advance and Retreat of Glaciers (1000s years)?

Early vs. Current Earth (billions years)?

Climate Change in Fisheries Context

A significant change in the statistical properties of climate over time periods relevant to humans and the fisheries they exploit. For specific metrics, it can include a change in mean, variance, or both. It may have natural and human causes.

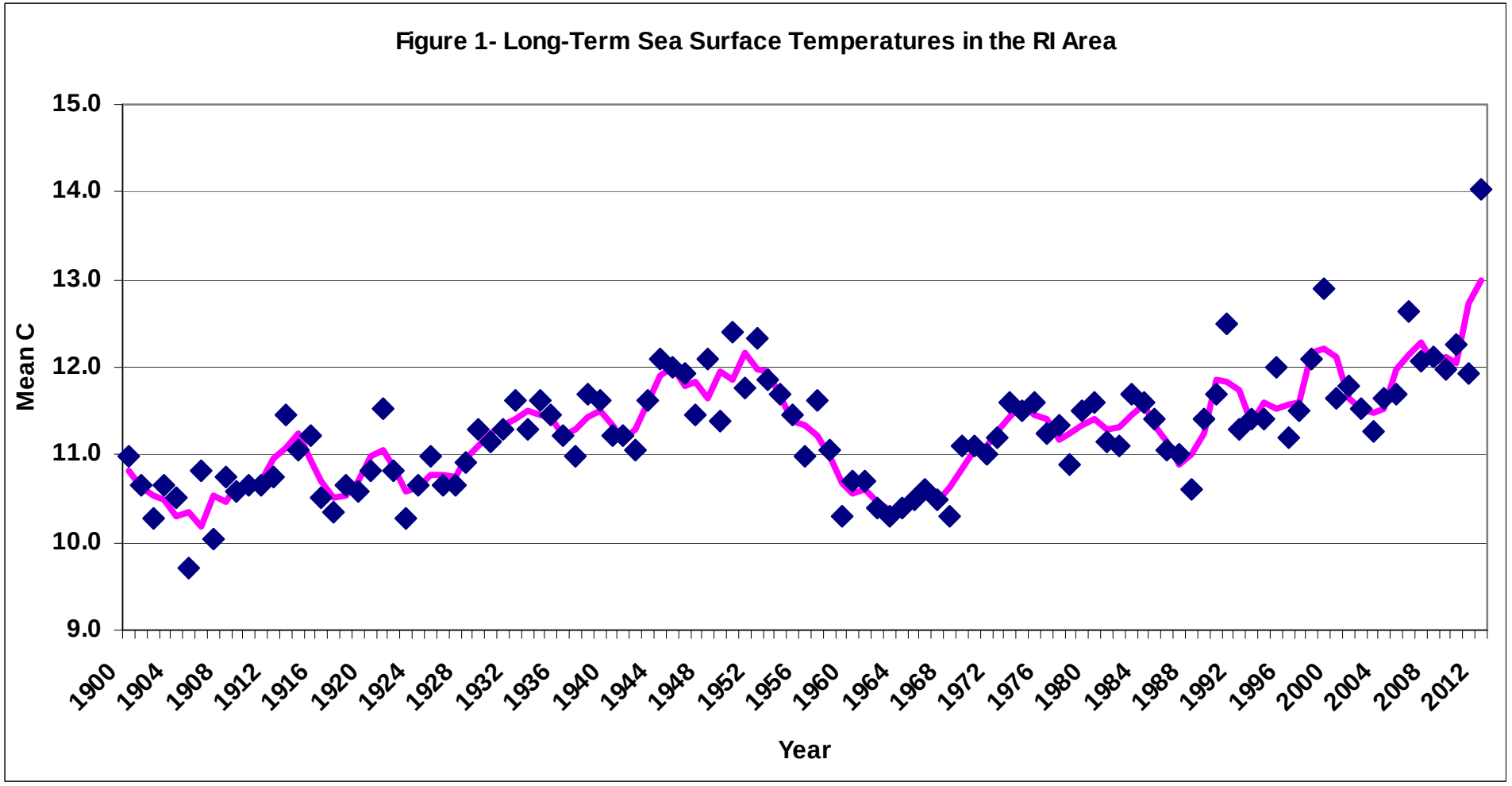
Figure 1- Long-Term Sea Surface Temperatures in the RI Area
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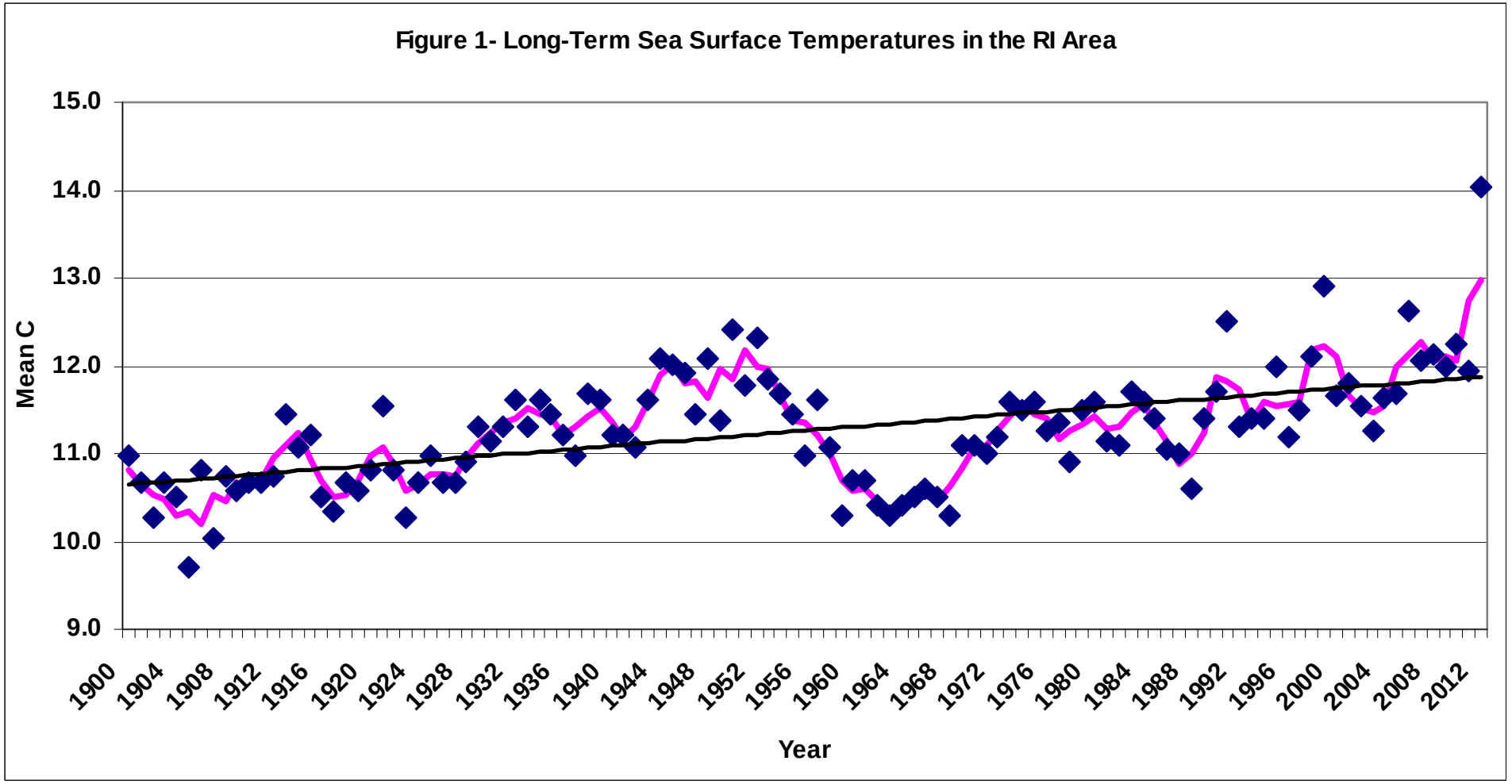
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Figure 2- Top 10 Recreational Fishes Harvested in RI from MRIP Data, 1981-1984

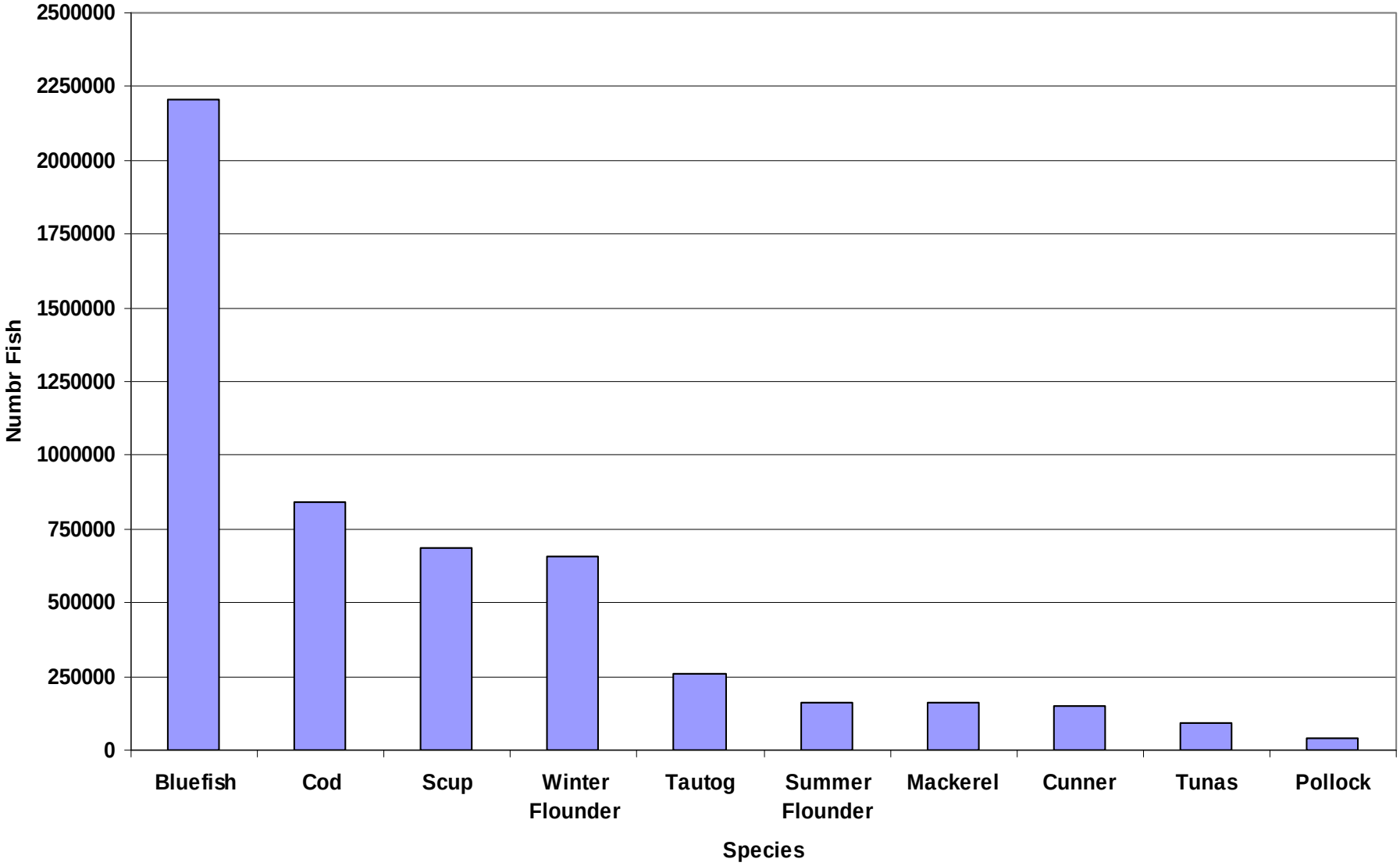
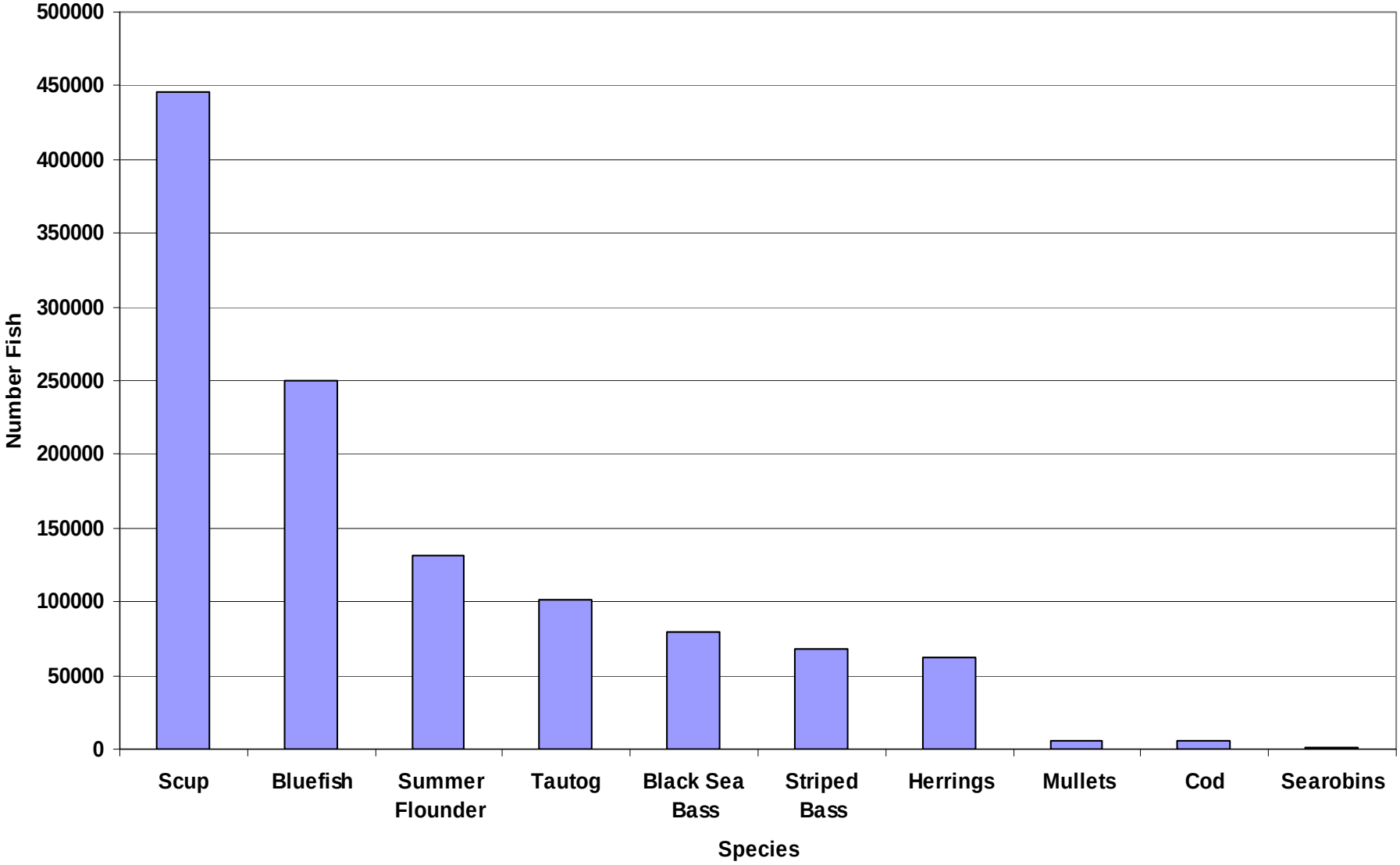


Figure 3- Top 10 Recreational Fishes Harvested in RI from MRIP Data 2009-2012



MRIP Data Findings

Marine angler catches have shifted from exploiting a more Boreal (cooler water, cod, winter flounder) mix to a more Lusitanian (warmer water, scup, sea bass) mix.

Shift is associated with a 1.5 C rise in sea temperature as well as over fishing for some species.

Bottom Trawl Surveys

University of Rhode Island Graduate School of Oceanography (URIGSO)- 1959 to 2012, samples two stations weekly at Fox Island and Whale Rock.

RI Division of Fish and Wildlife (RIDFW)- 1979 to 2012, samples 84 stations during a spring and fall cruise in Narragansett Bay RIS BIS.

Normandeau Associates (NA)- 1972-2011, samples 6 stations in upper Mt Hope Bay each month for BPS.

Figure 4- Abundance of Aggregate Fishery Resource in the RIDFW Seasonal Trawl Survey in Narragansett Bay and RI Coastal Waters

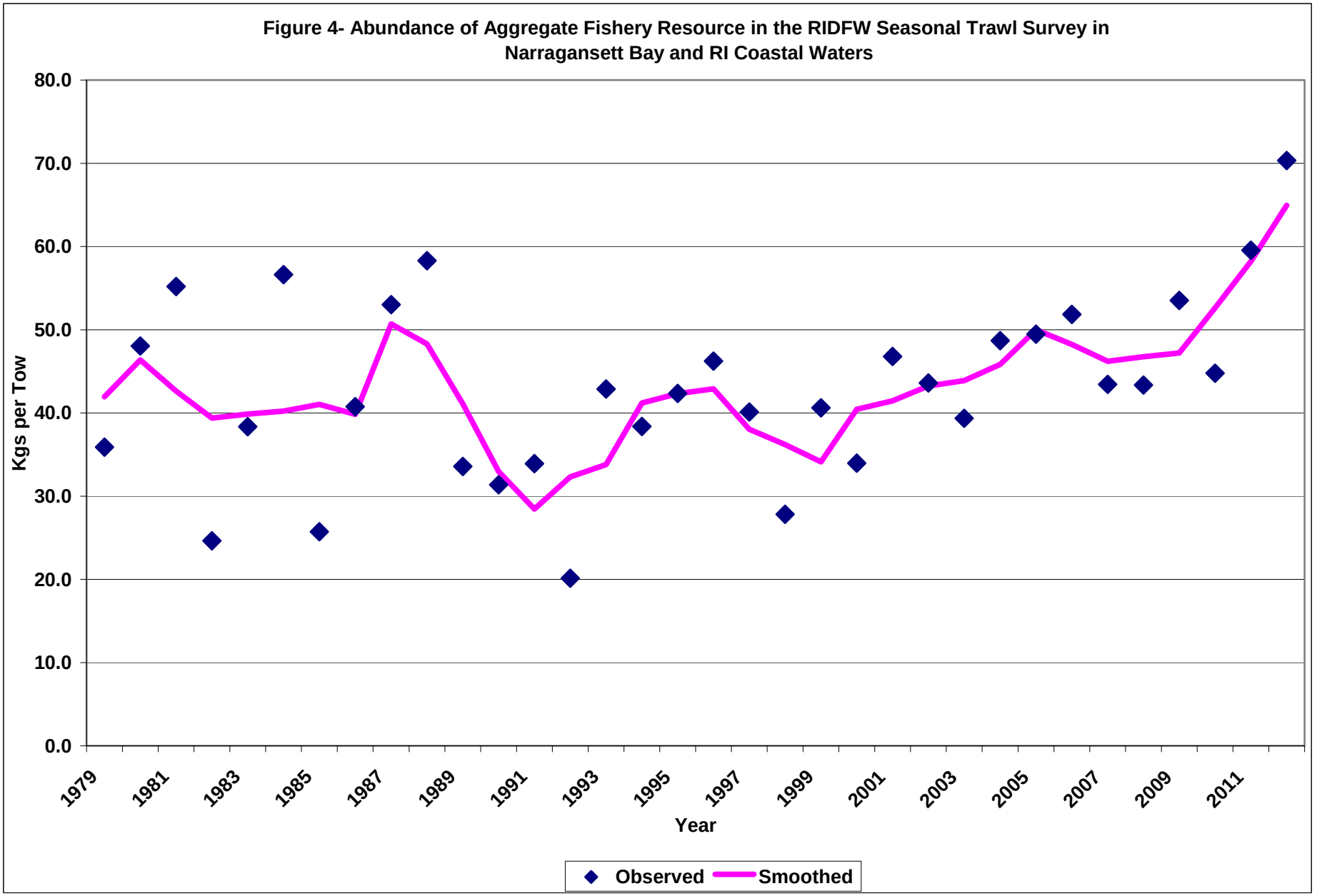


Figure 5- Abundance of Winter Flounder in the URIGSO, RIDFW, and Normandeau Trawl Surveys

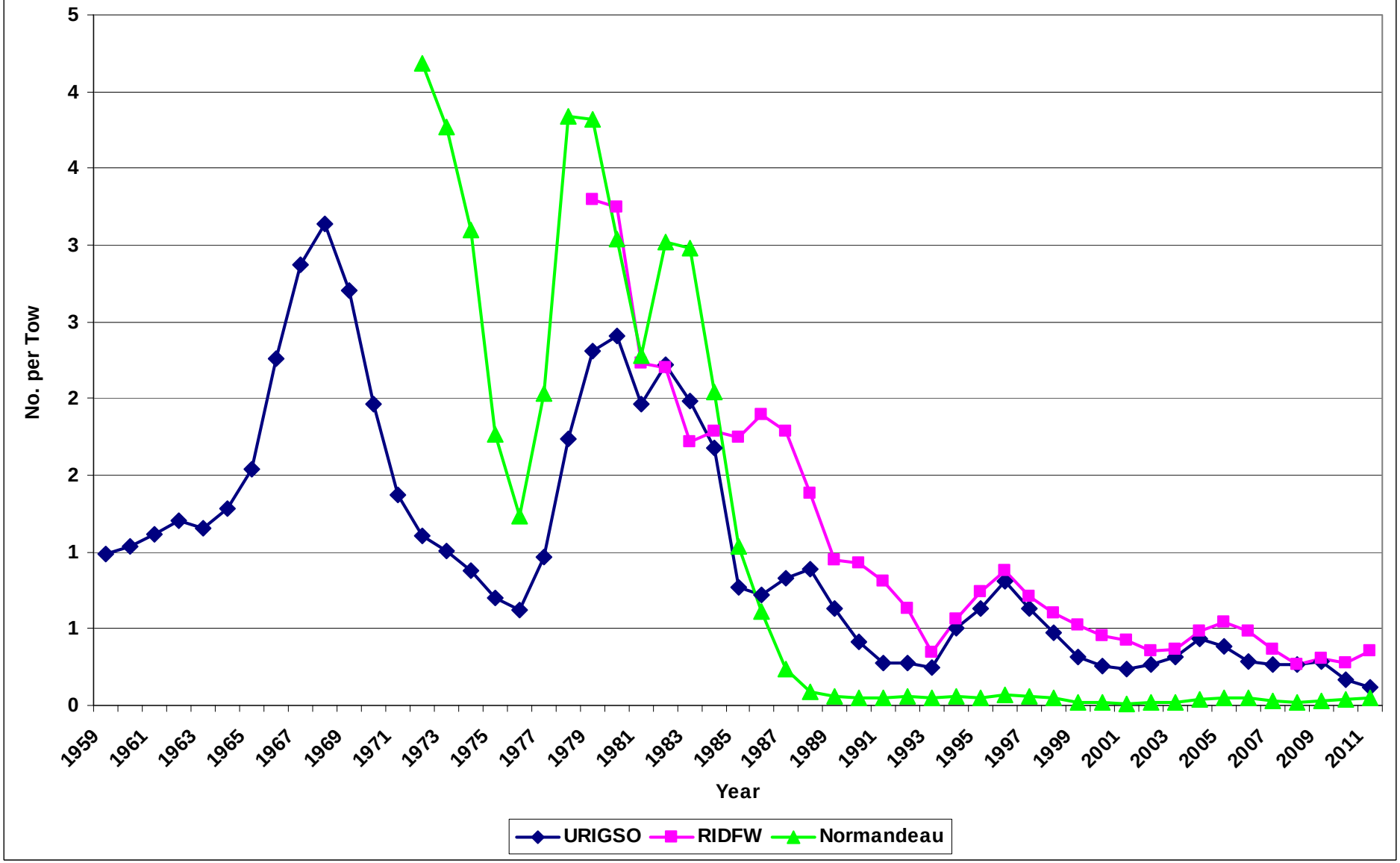


Figure 6- Abundance of Windowpane Flounder in the URIGSO, RIDFW, and Normandeau Trawl Surveys

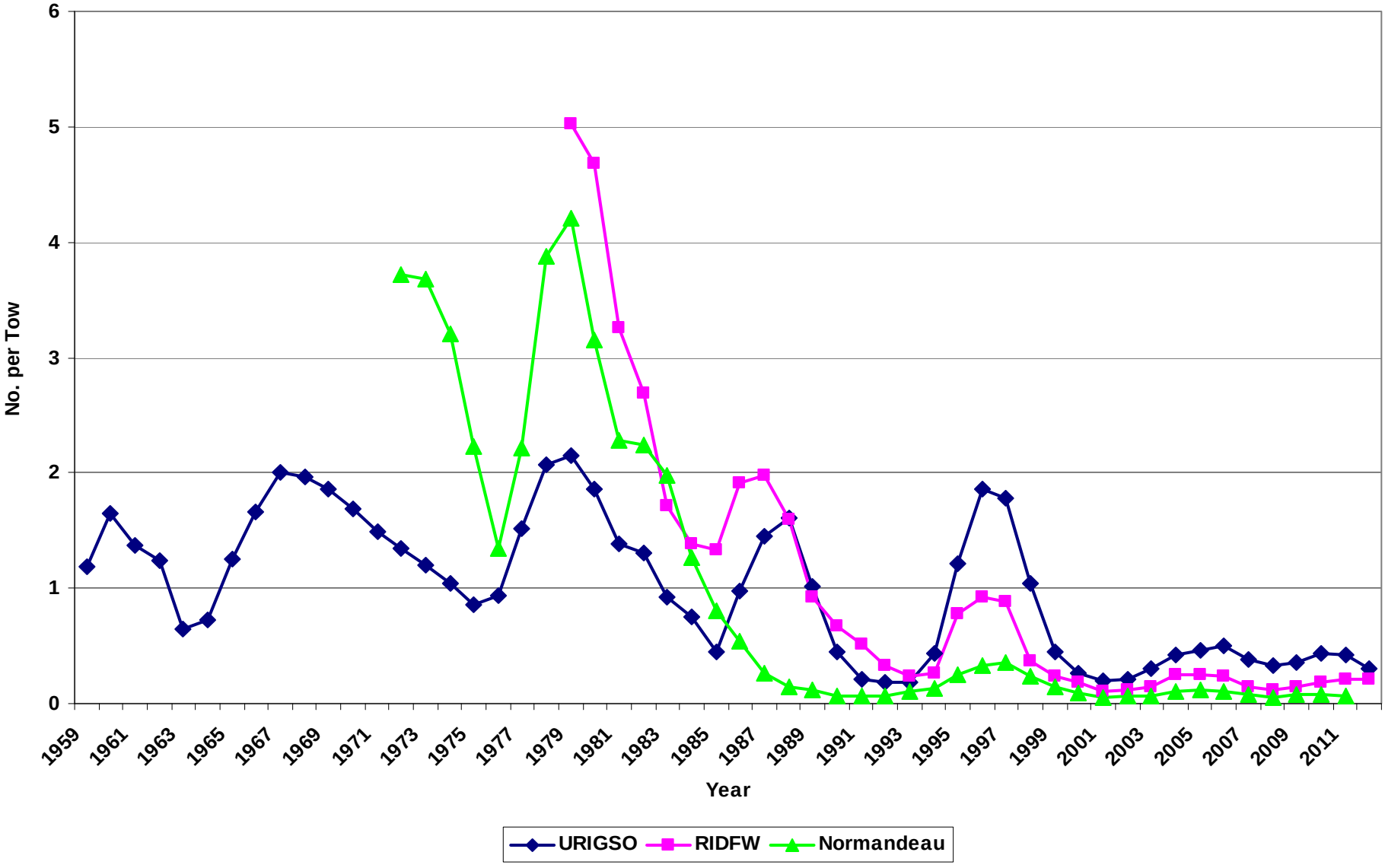


Figure 7- Abundance of Cunner in the URIGSO, RIDFW, and Normandeau Trawl Surveys

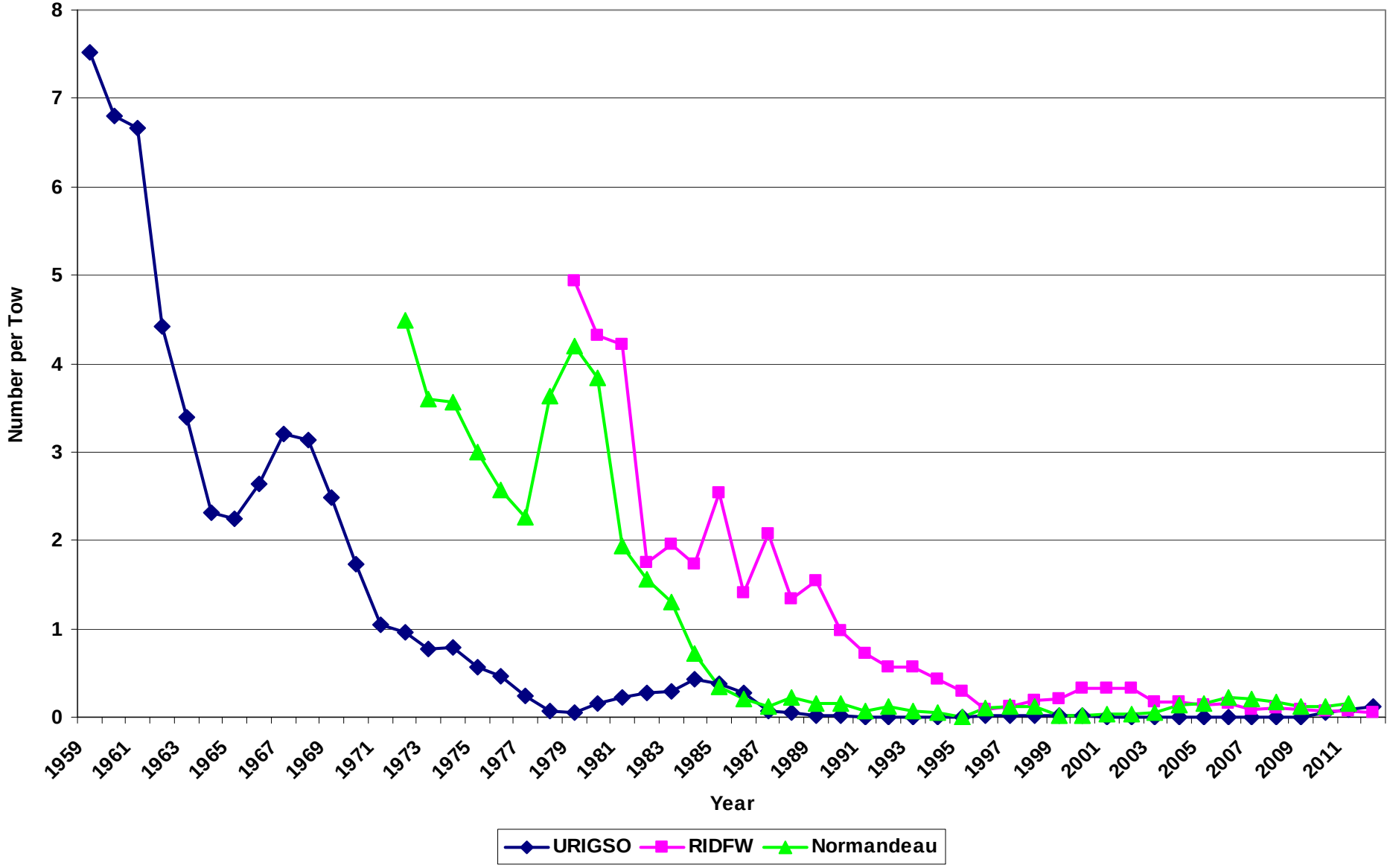


Figure 8- Abundance of Tautog in the URIGSO, RIDFW, and Normandeau Trawl Surveys

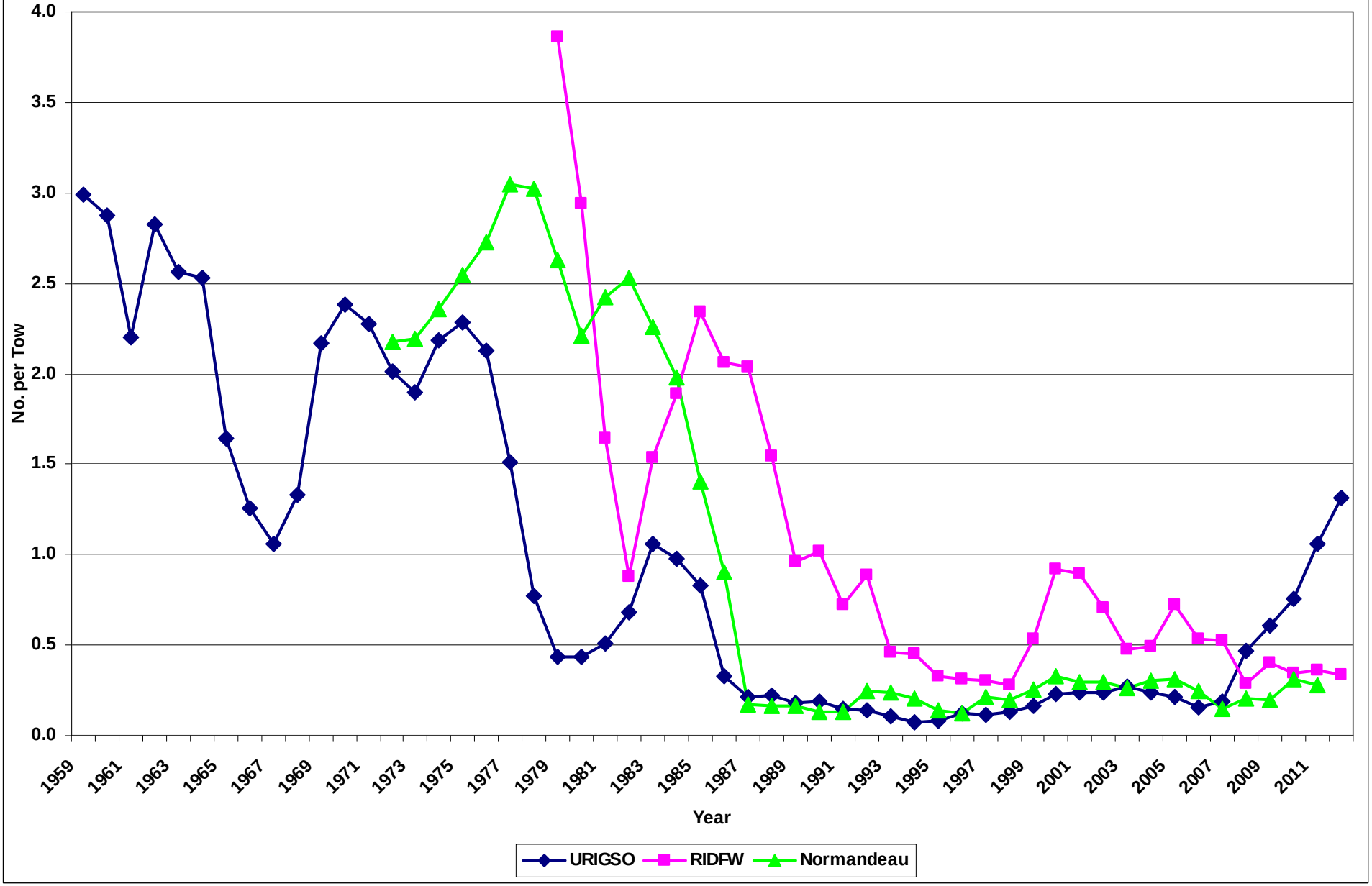


Figure 9- Abundance of Scup in the URIGSO, RIDFW, and Normandeau Trawl Surveys

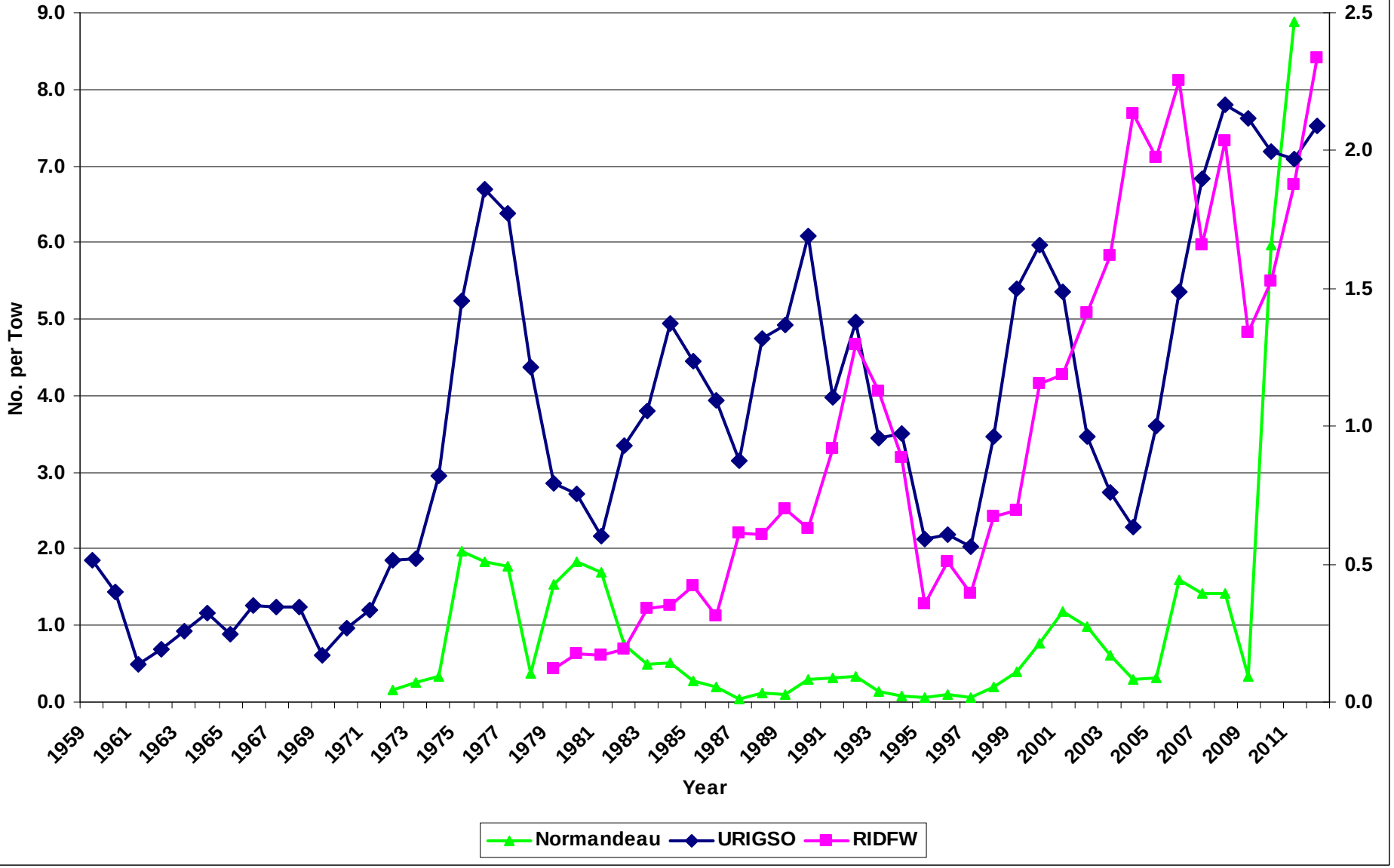


Figure 10- Abundance of Summer Flounder in the URIGSO, RIDFW, and Normandeau Trawl Surveys

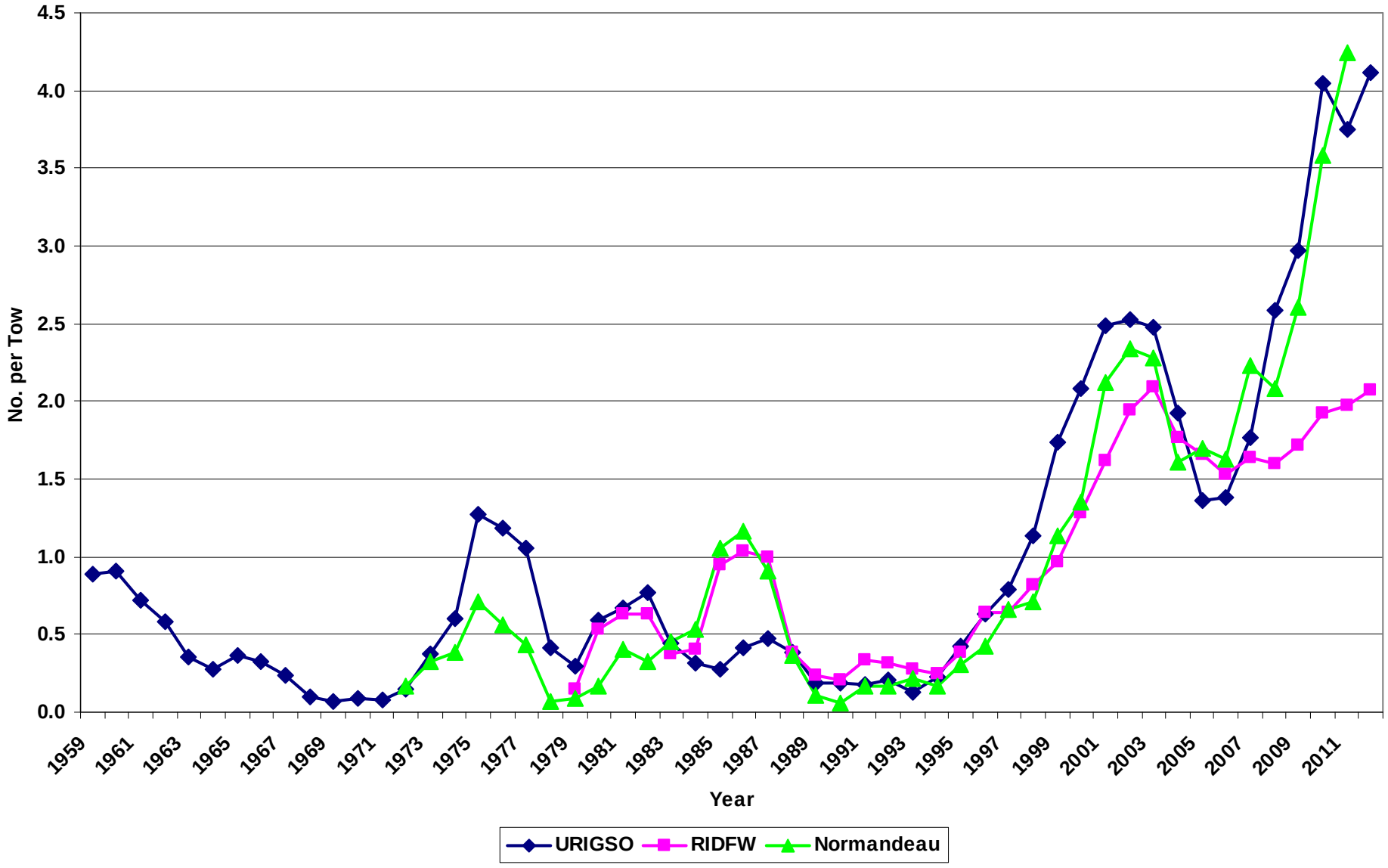


Figure 11- Abundance of Black Seabass in the URIGSO, RIDFW, and Normadeau Trawl Surveys

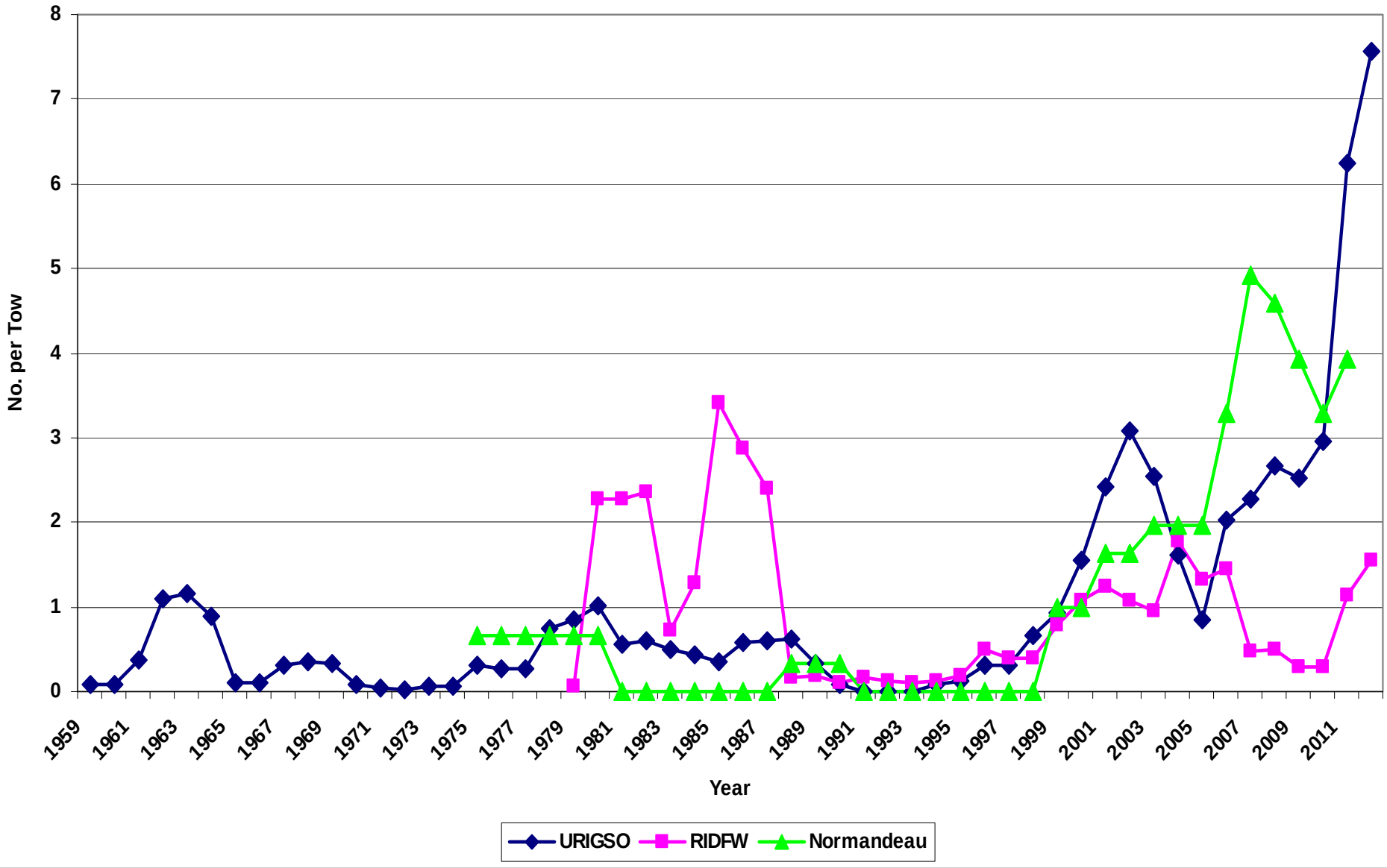


Figure 12- Abundance of Striped Bass in the URIGSO, RIDFW, and Normandeau Trawl Surveys

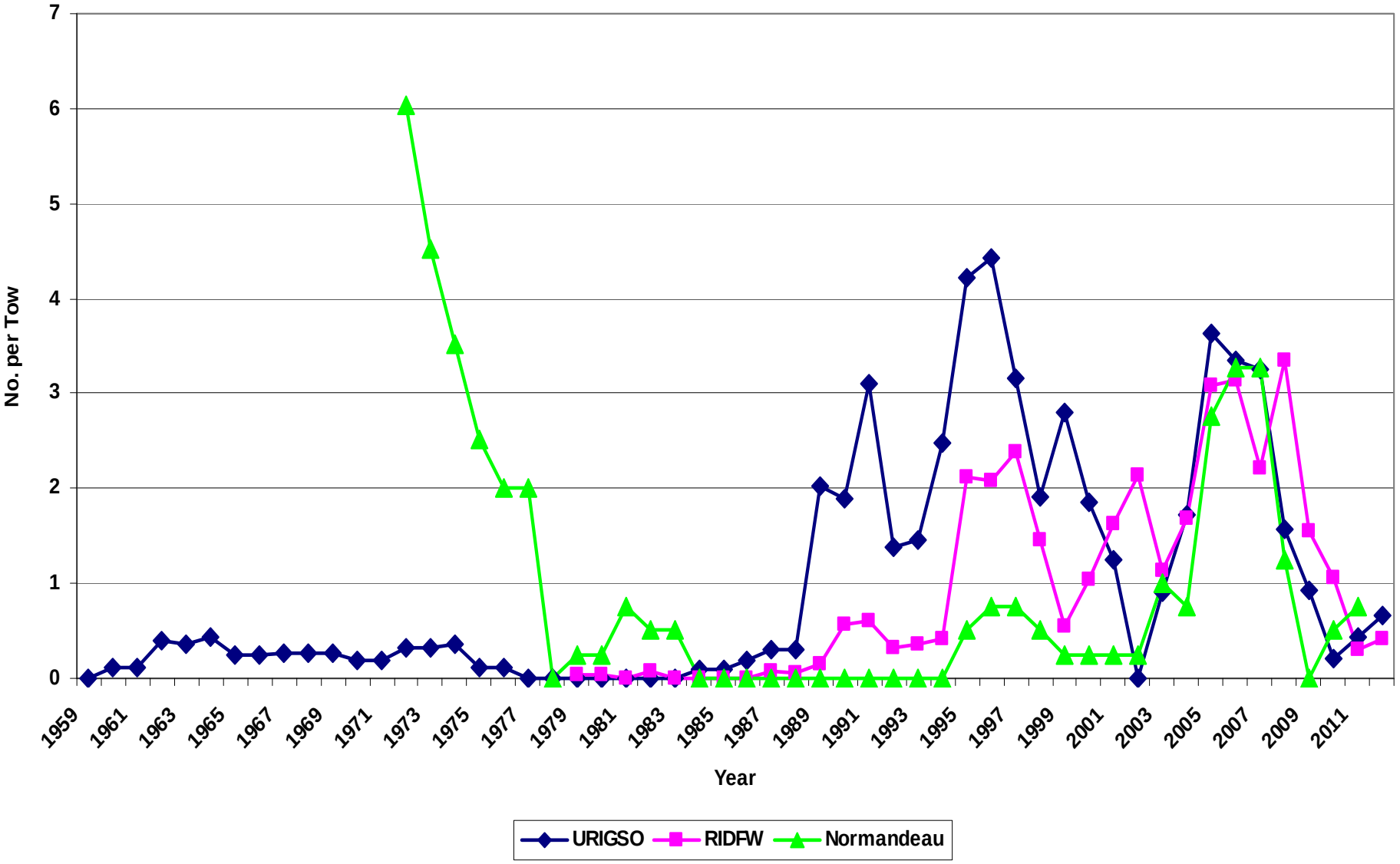
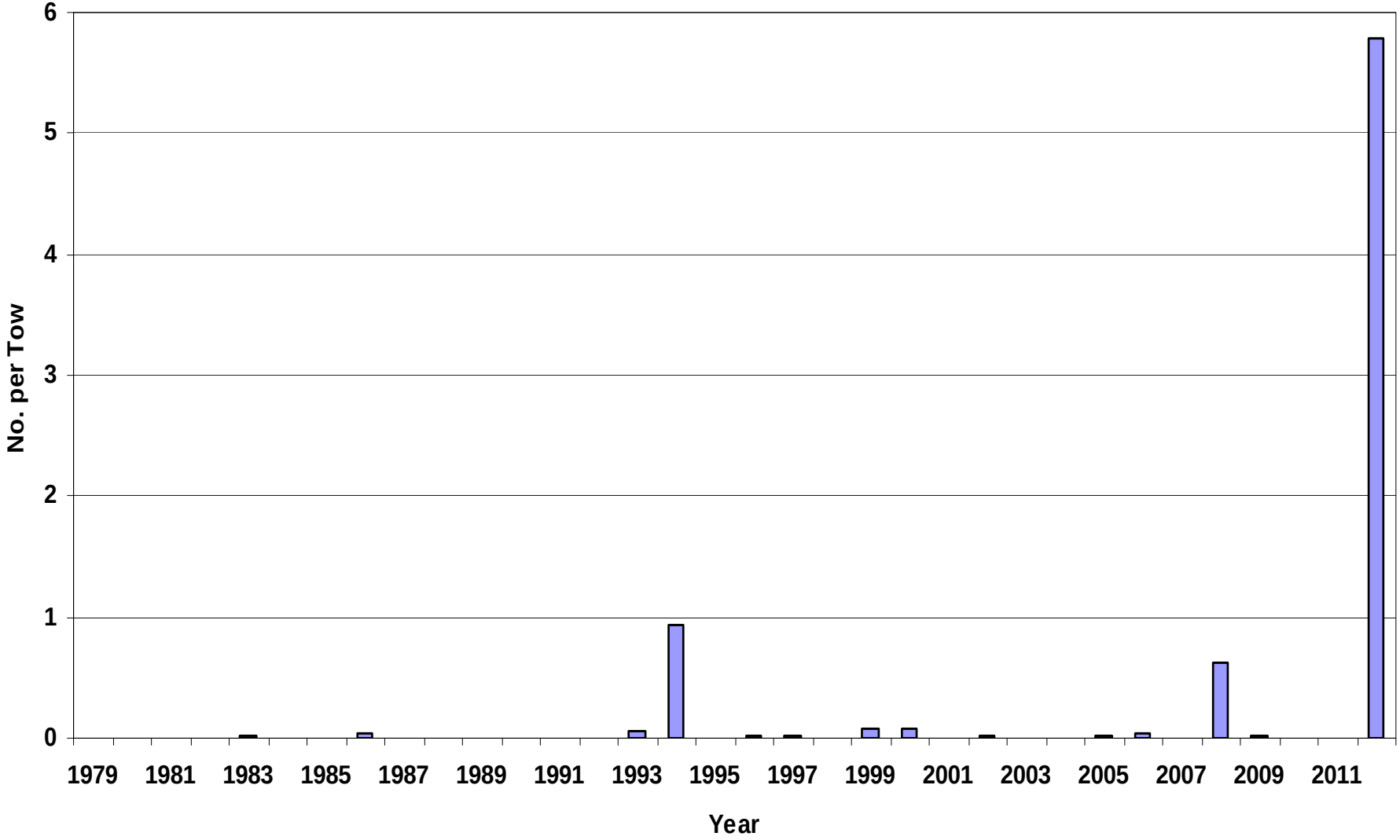


Figure 13 - Abundance of Spot, Leiostomus xanthurus, in the RIDFW Trawl Survey



Projection of the Fisheries System State

Markov Chain Model (Saila and Erzini 1987)

System state in next step is dependent on last state and a set of transition probabilities

Use RIDFW trawl data 1979-2012, aggregated by species groups, to estimate the transition probabilities

Propagate system forward in time from 2012 state.

Species Groups

Crustaceans (crabs and lobster)

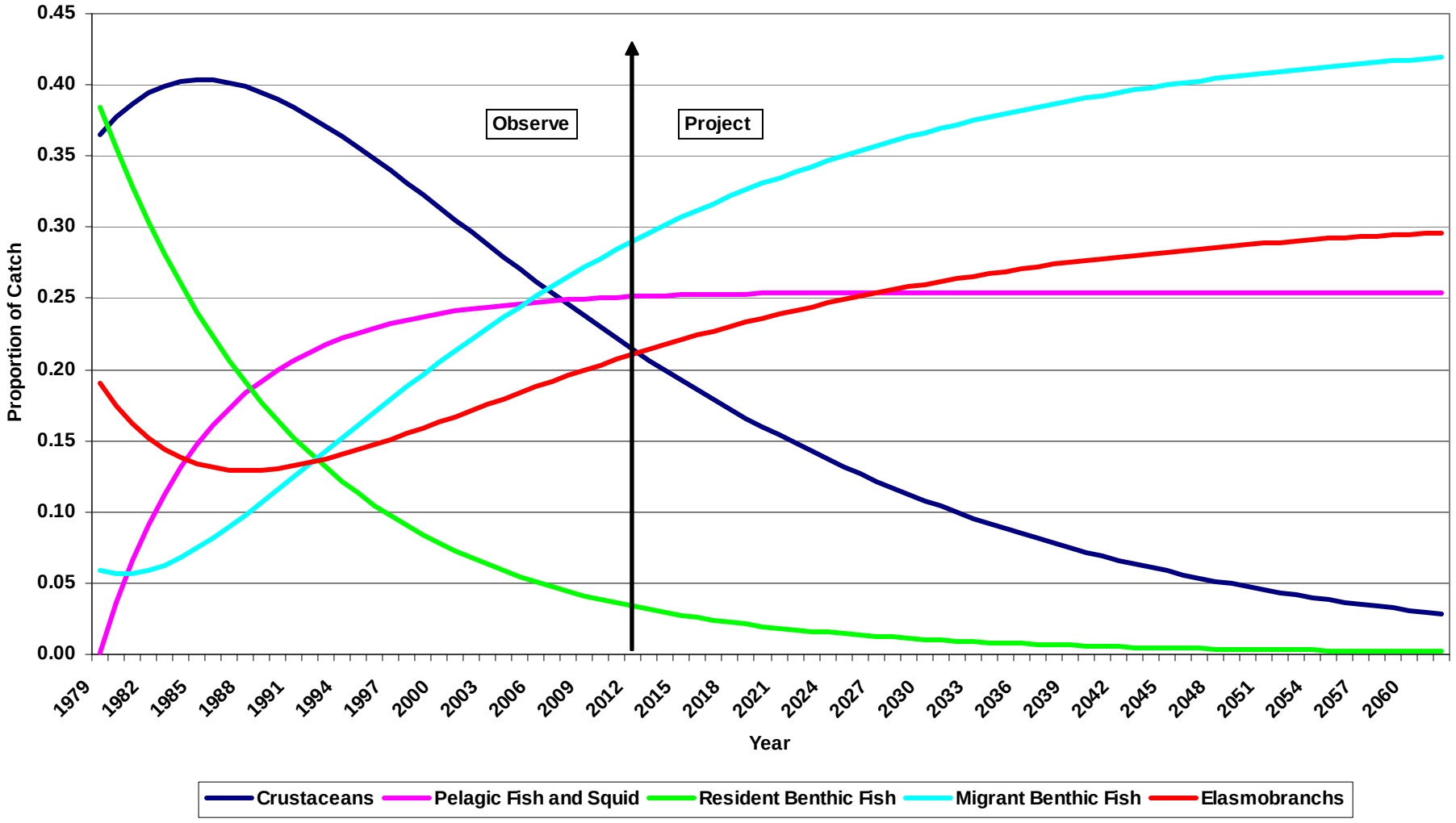
Pelagic Fish and Squid

Resident Demersal Fishes

Migrant Demersal Fishes

Elasmobranchs (dogfish and skates)

Figure 16- Projection of Species Groups from Markov Analysis of RIDFW Trawl Survey Data



Conclusions

Still plenty of fish in the Bay and RI waters, just different kinds.

Recreational fishing adapting to the new species mix.

Assemblage shifting from NE boreal, cooler water species to warmer mid-Atlantic types in association with rising sea temperature (Collie et al. 2008).

Modeling suggests this shift will persist in the future with the emergence of new species.


JOHN H. CHAFEE
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