

This information is distributed solely for the purpose of pre-dissemination peer review. It has not been formally disseminated by NOAA. It does not represent any final agency determination or policy.

TOR 2.1 Trends in Stock Productivity:

- a.) For relevant stocks, identify trends in biological parameters i.e., life history and/or recruitment and assess their importance for the computation of BRPs and for specification of rebuilding scenarios;**
- b.) If possible, summarize trends in pertinent environmental variables that might be related to the trends in those biological parameters relevant to BRPs.**

PART I and Part II

Trends in Average Length and Weight, and Proportion Mature at Age for Relevant Stocks and Trends in Environmental Variables

by

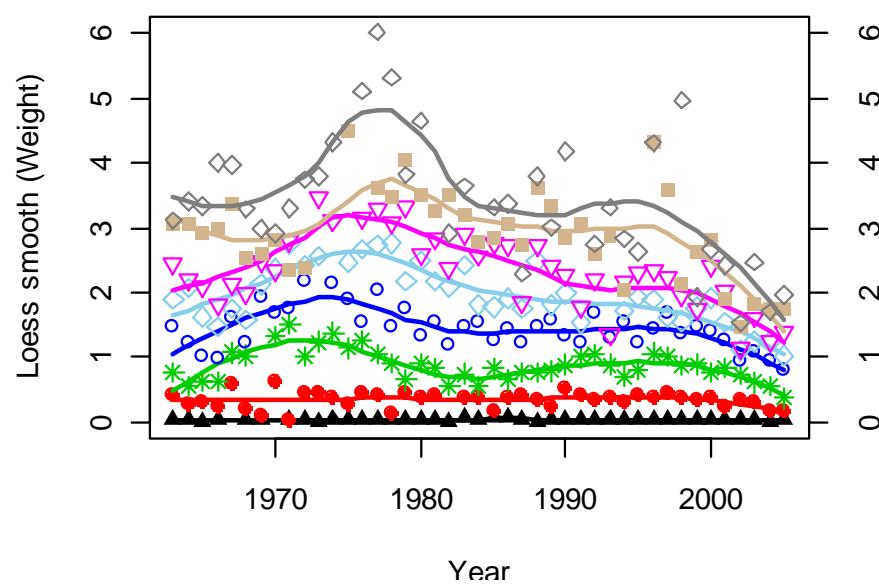
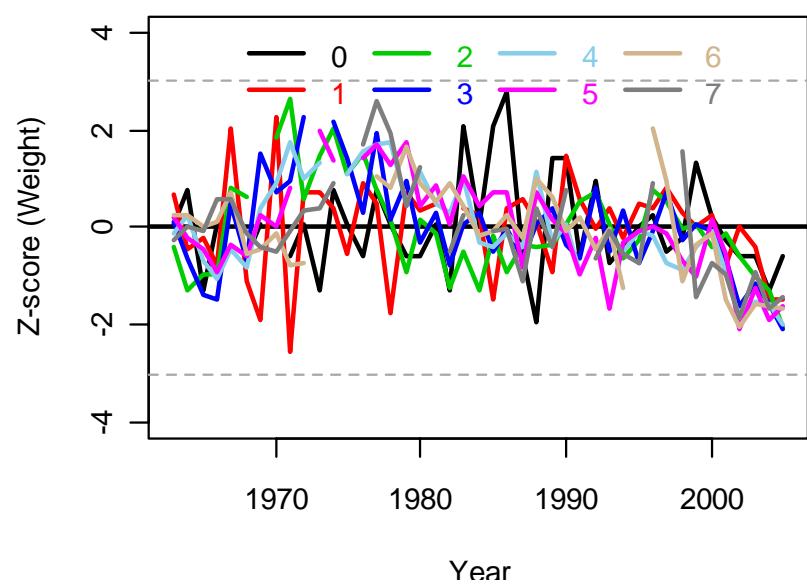
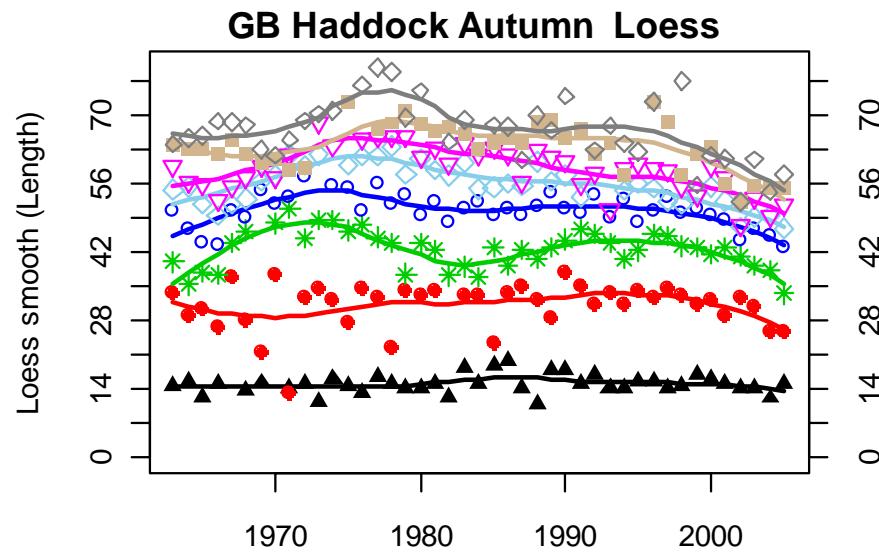
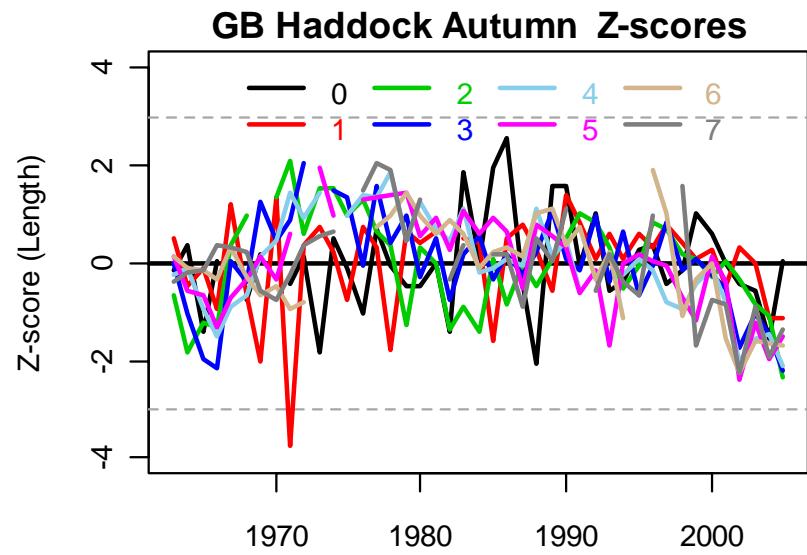
Loretta O'Brien, Paul Rago, Michele Traver, Jessica Blaylock,
Betty Holmes, Jiashen Tang, Liz Brooks, Laurel Col, Mike Fogarty,
Kevin Friedland, Larry Jacobson, Joe Kane,
Jason Link, and Sandra Sutherland

METHODS

- Estimate growth and maturity for 20 stocks
6 gadids ; 9 flatfish ; 1 semi-pelagic ; 2 pelagic ; 2 others
- Applied NEFSC survey analysis (SURVAN) software estimate stratified mean length, weight, and number per tow
- Estimate maturity ogives using logistic regression , moving average window
- Summarize environmental time series, zooplankton, food habits
- Qualitative review :
Z-scores and loess smooth : trends over time

Visual Report :

trend, year effects, year class effects, density effects, age truncation



RESULTS

Z-scores and loess smooth : detect overall trends

MEAN LENGTH and WEIGHT

No trend in recent years : 6 stocks

YT SNE and GB-CC

Winter Fld. SNE and GM

Fluke and Mackerel

Increasing trend: 2 stocks

Witch fld. and Silver hake adults

Declining trend: 12 stocks

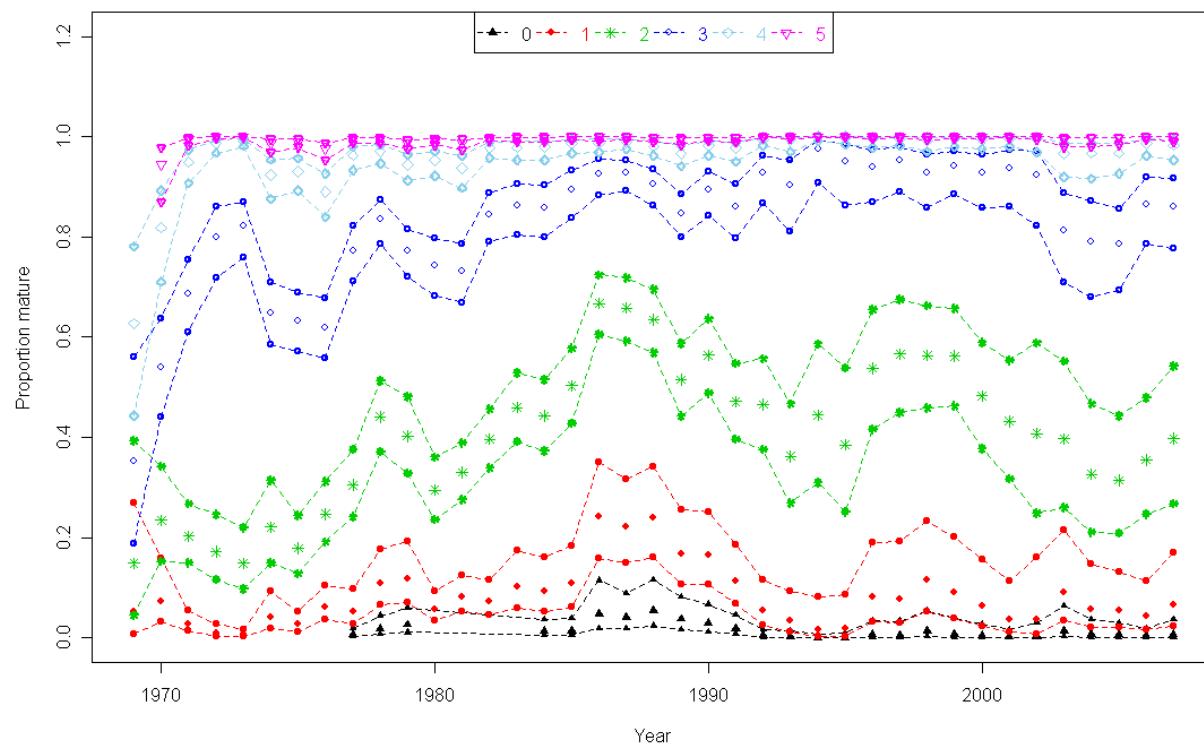
GM: cod, haddock, white hake, Am.plaice, redfish, pollock

GB cod, haddock, yellowtail fld, winter fld., silver hake (adults)

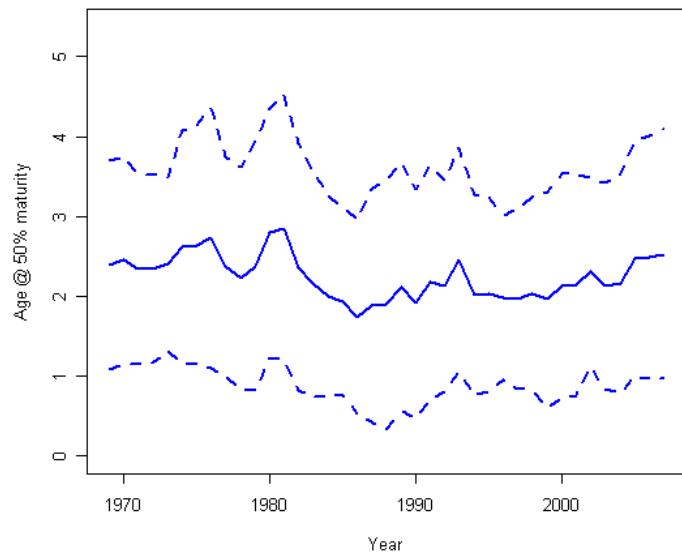
Herring

Butterfish

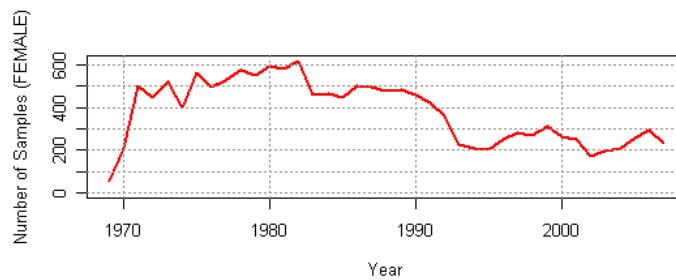
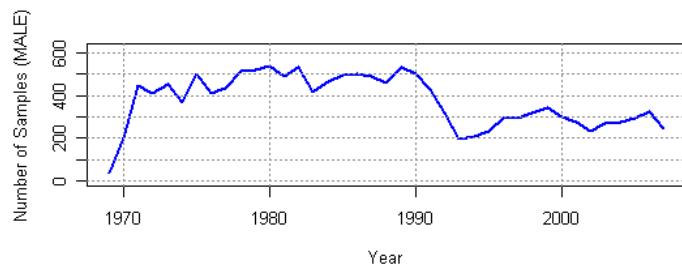
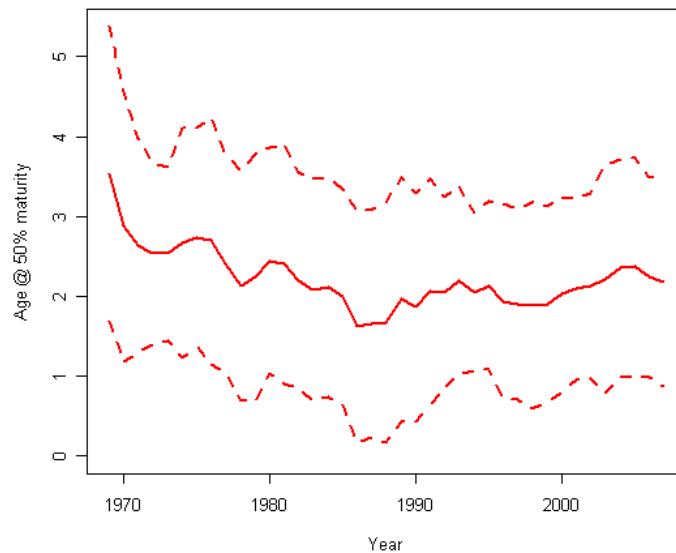
FEMALE Cod Georges Bank maturity at age w/ 95% CI



MALE Cod Georges Bank at 50% maturity (3 yr window)



FEMALE Cod Georges Bank at 50% maturity (3 yr window)



RESULTS

Proportion mature at age

No trend in recent years : 8 stocks

YT: GB, CC-GM, SNE ~ knife edge

Winter Fld. GM, GB, SNE

American plaice

Butterfish

Increasing trend: 11 stocks

GM: cod, haddock, witch, white hake, pollock, redfish

GB: cod, haddock, Silver hake

Fluke , weak

Declining trend: 2 stocks

Herring and mackerel

RESULTS

Visual Report

3 patterns :

Mean length and weight trend opposite to abundance: density effect

Mean length and weight trend with abundance

Both trends occur together :

Mean length and weight trend with abundance and other times have opposite trend : mixed effect of density and environment ??

RESULTS

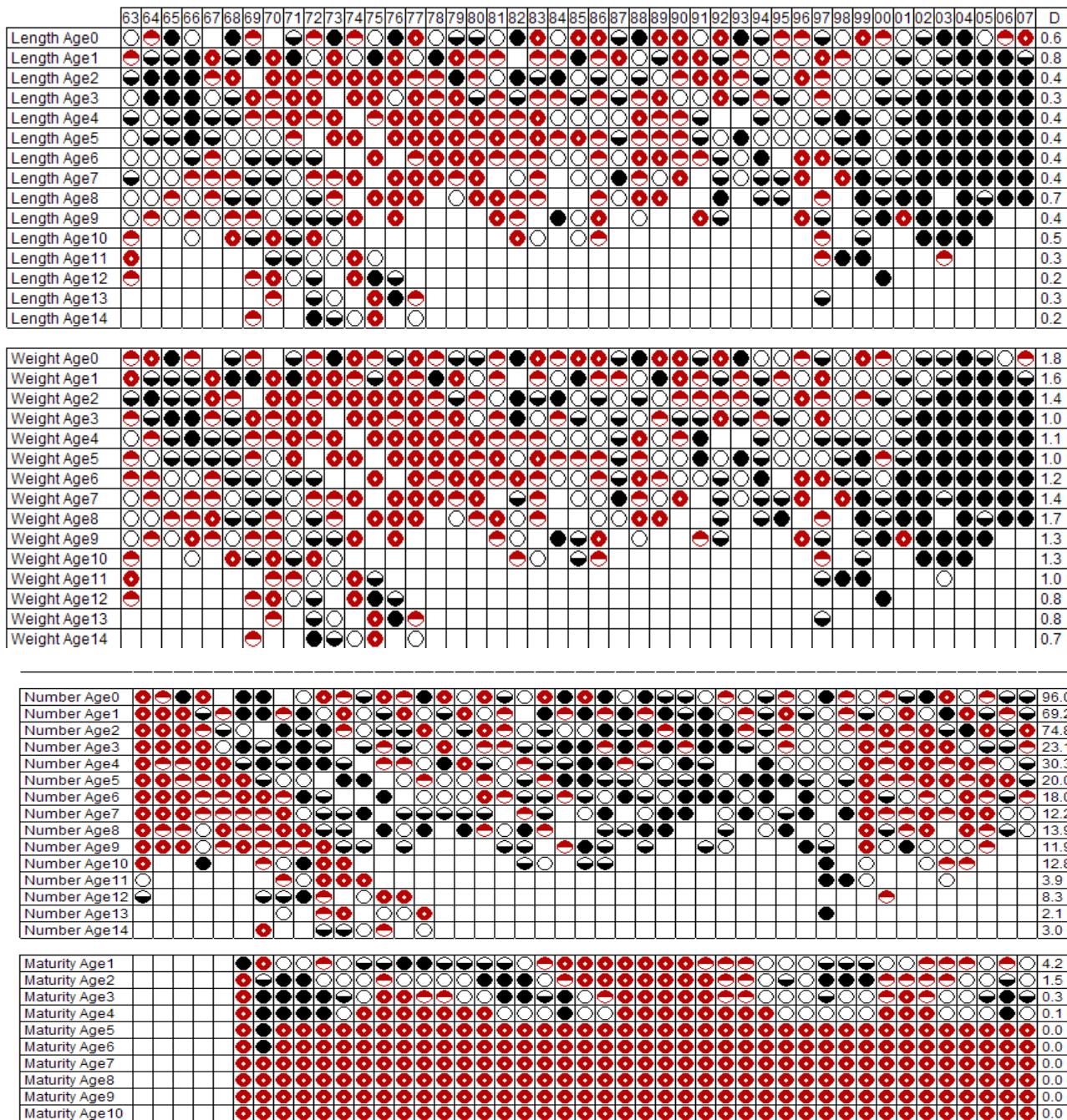
Visual Report

Mean length and weight trend opposite to abundance: density effect

GB: haddock , Yt

**GM: cod, witch, Am.plaice, winter fld, pollock, redfish, haddock
Butterfish**

GB haddock



Legend

Legend: Highest 2nd Highest Middle 2nd Lowest Lowest

D = Measure of Dispersion: Range/Median

RESULTS

Visual Report

Mean length and weight trend with abundance

GB cod

GB winter fld.

GM winter fld

white hake

CC-GM YT

GB cod

RESULTS

Visual Report

Both trends:

Mean length and weight trend with abundance and other times have opposite trend

GB YT

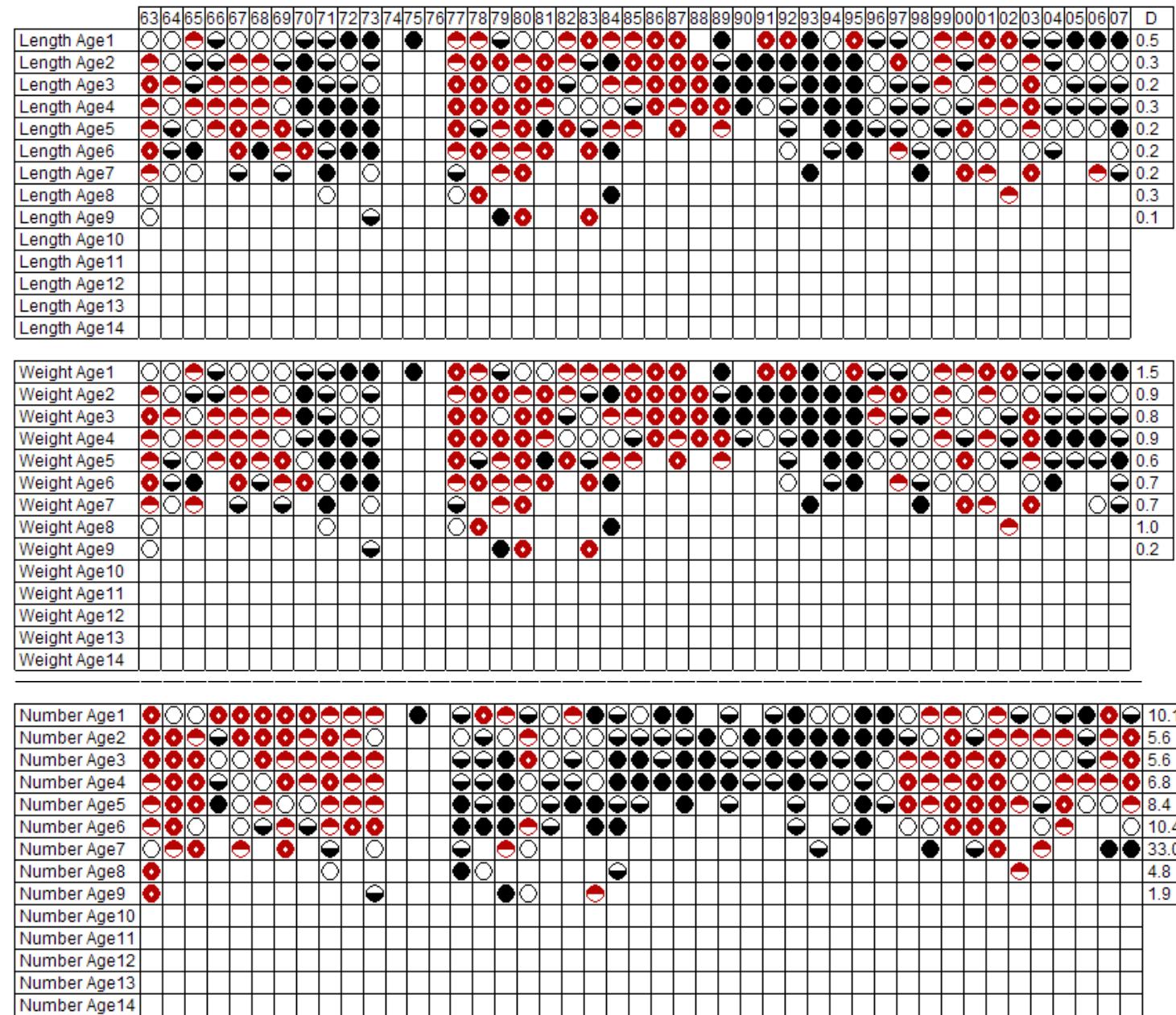
SNE YT

SNE winter fld.

Silver hake

Mackerel

GB YT



Legend

Highest 2nd Highest Middle 2nd Lowest Lowest

D = Measure of Dispersion: Range/Median

Rearranged data :

by area:

juveniles

adults

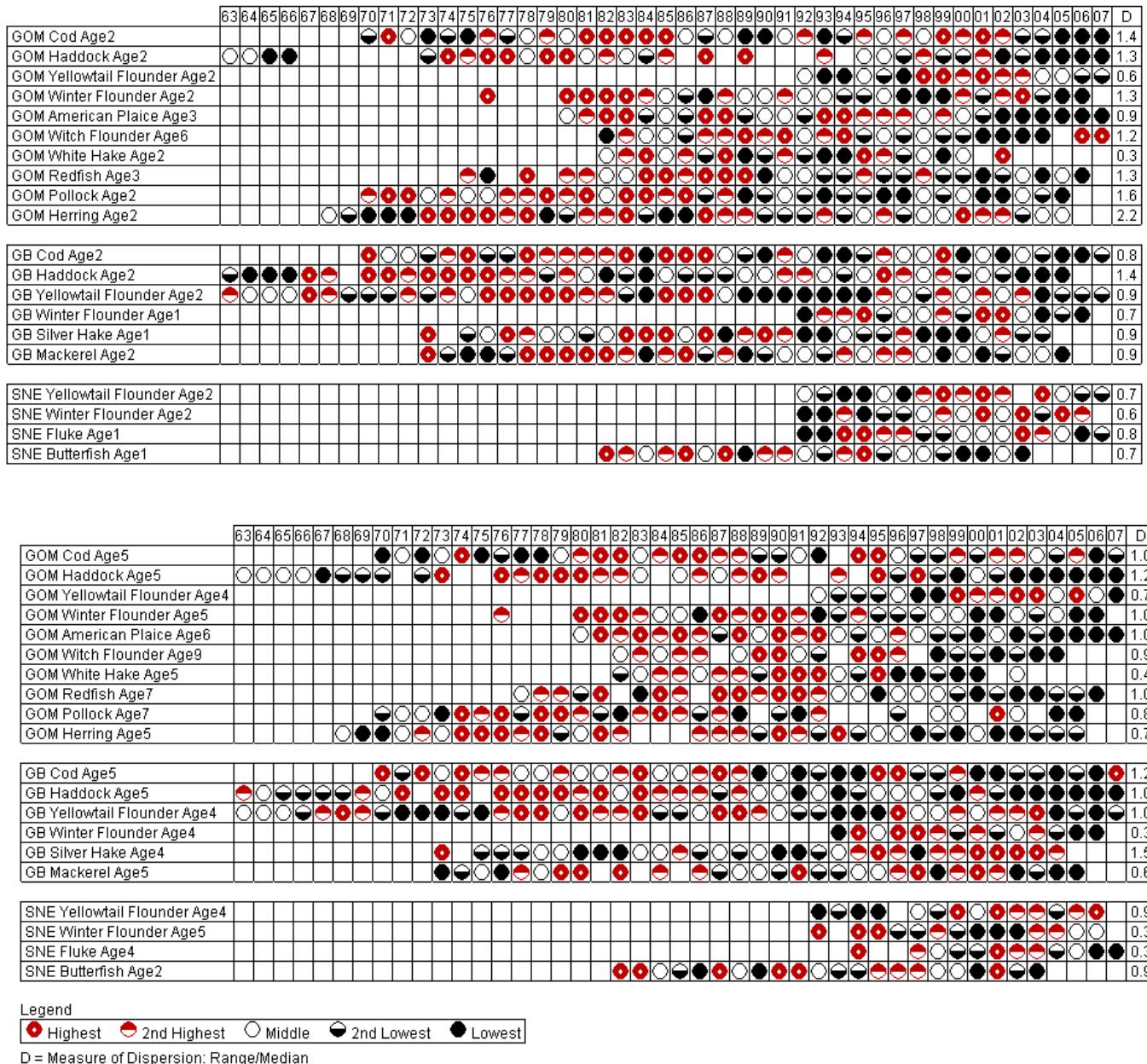
Species groups

juv

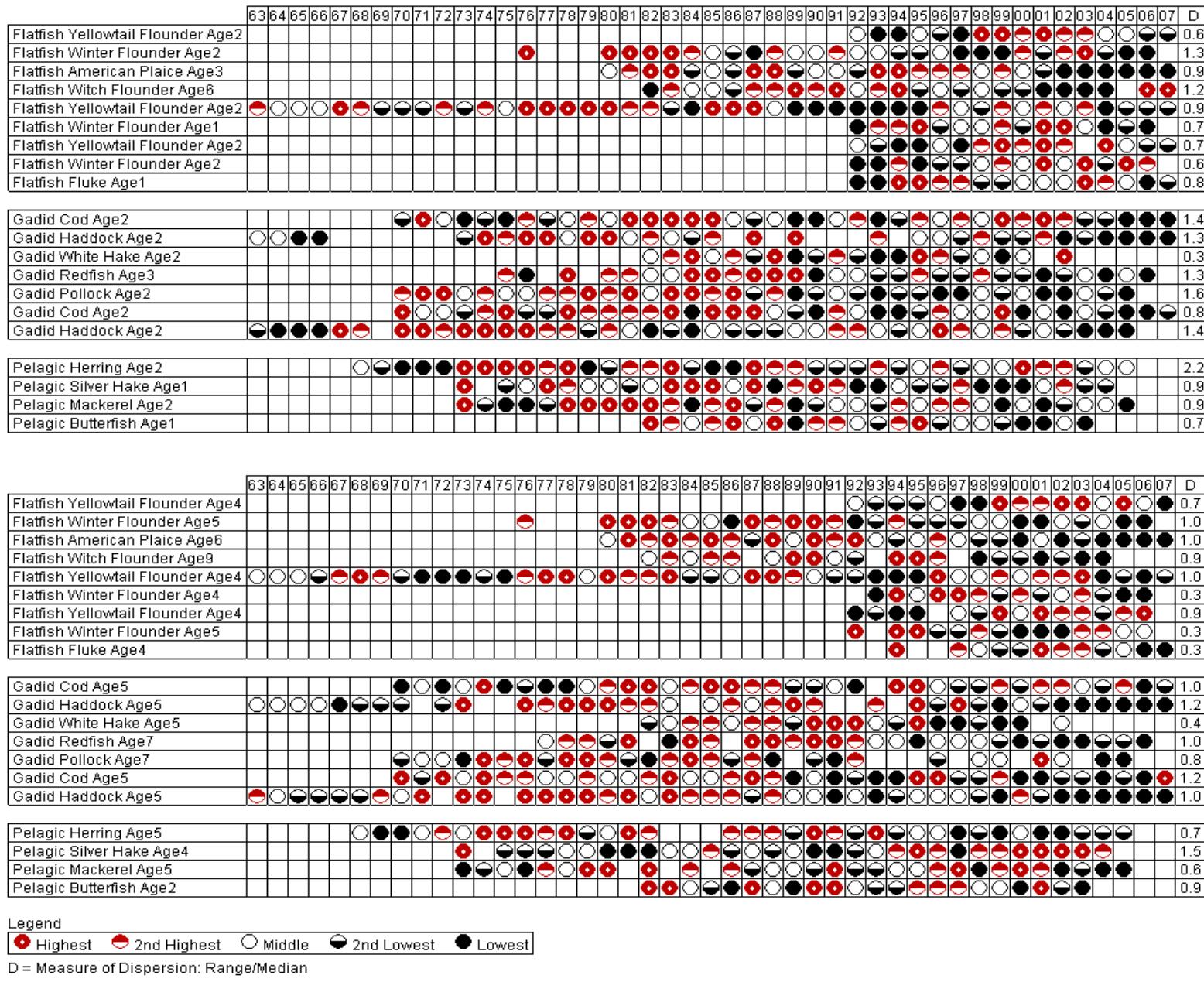
adults

Juv. And adults , adjacent , by area

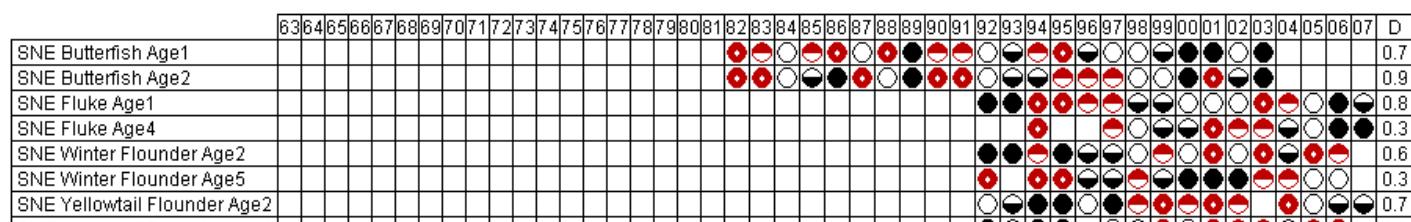
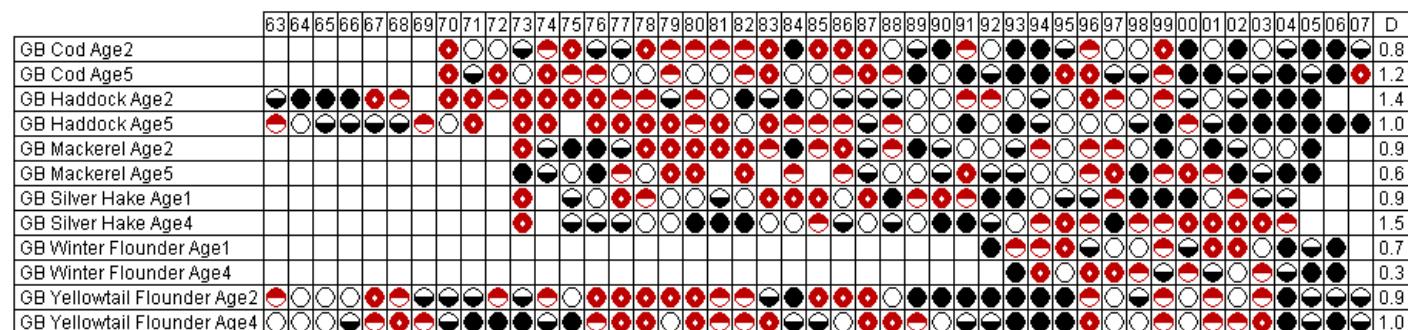
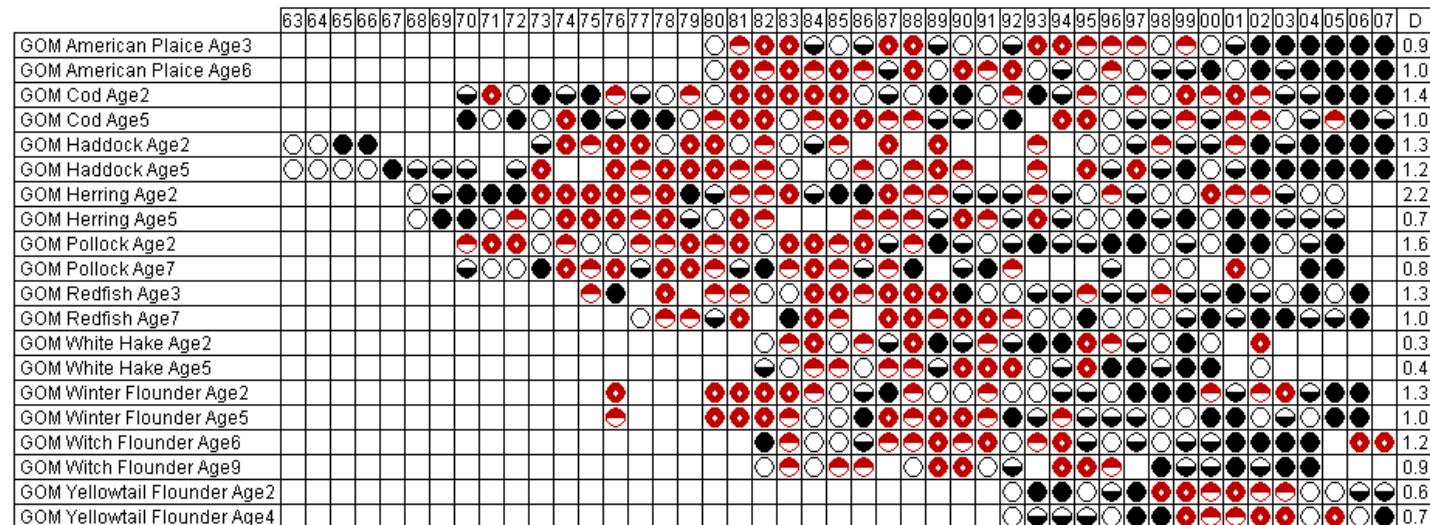
Mean Wt.



Mean
Wt



Mean
Wt



Legend

● Highest ● 2nd Highest ○ Middle ● 2nd Lowest ● Lowest

D = Measure of Dispersion: Range/Median

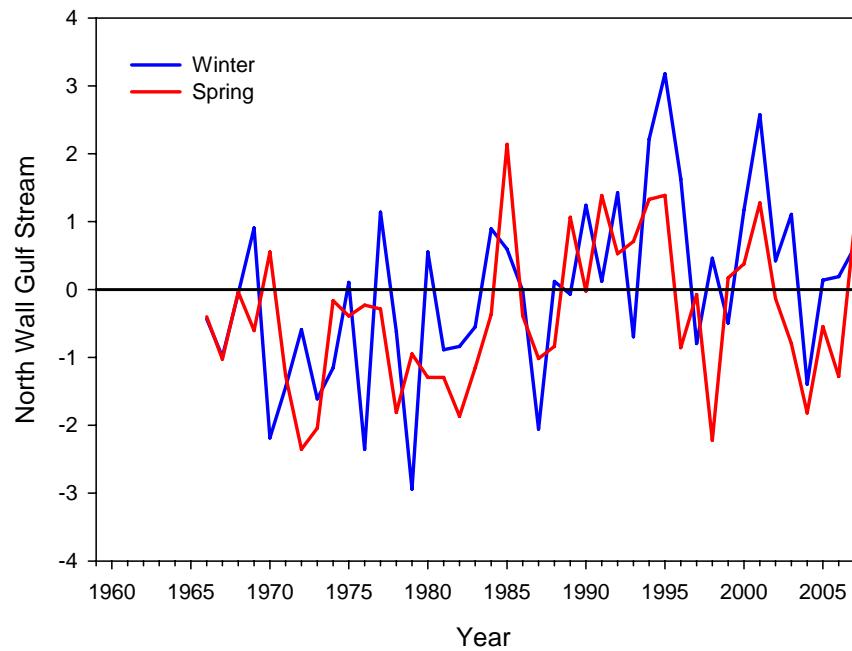
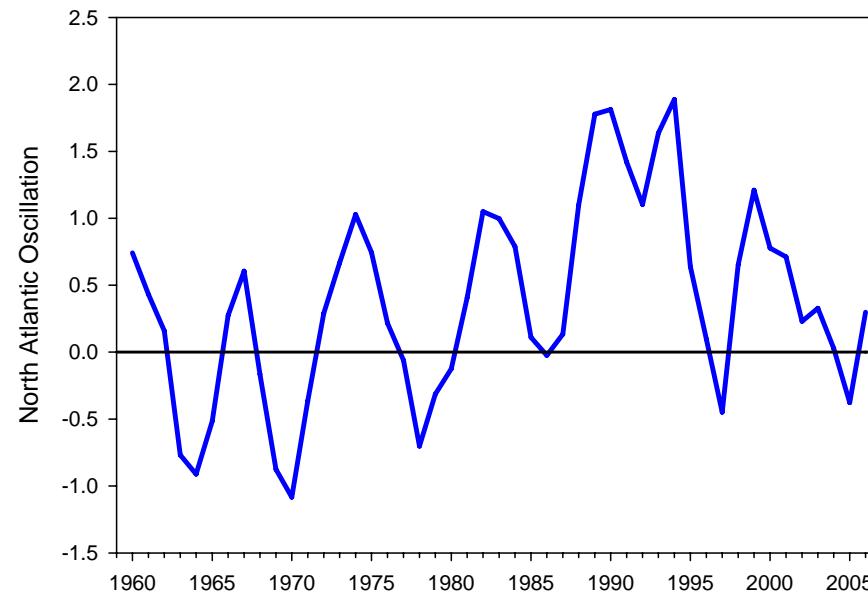
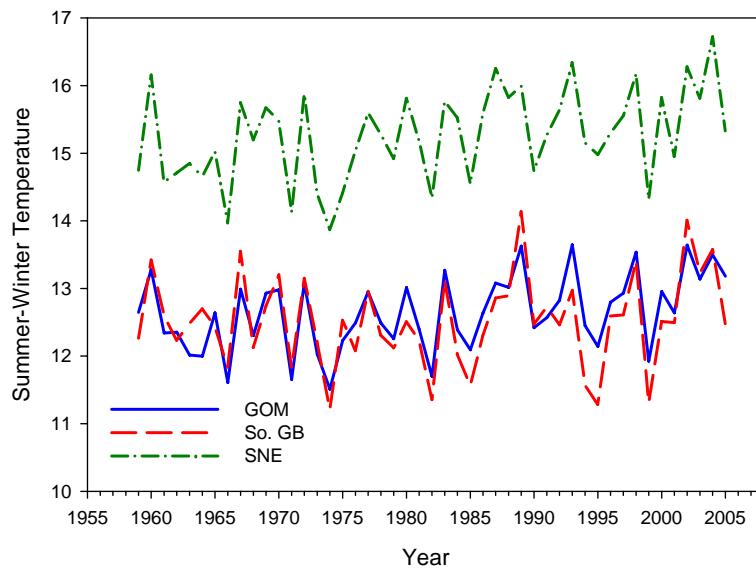
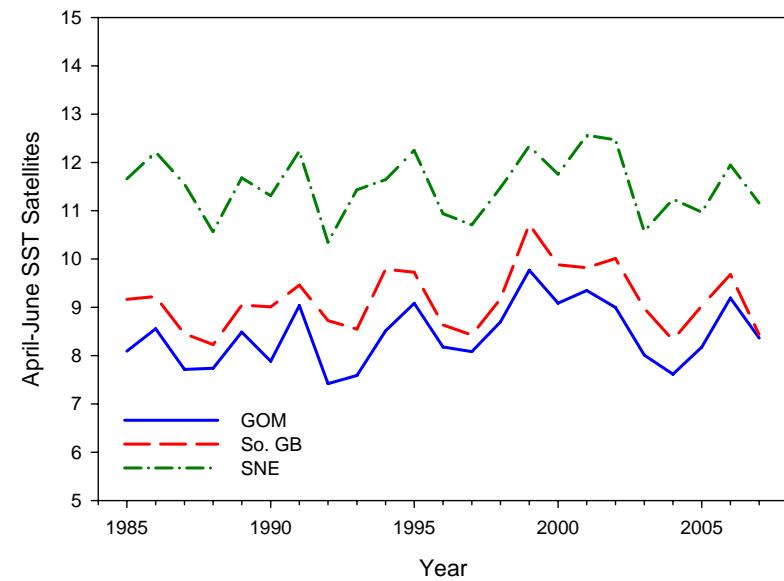
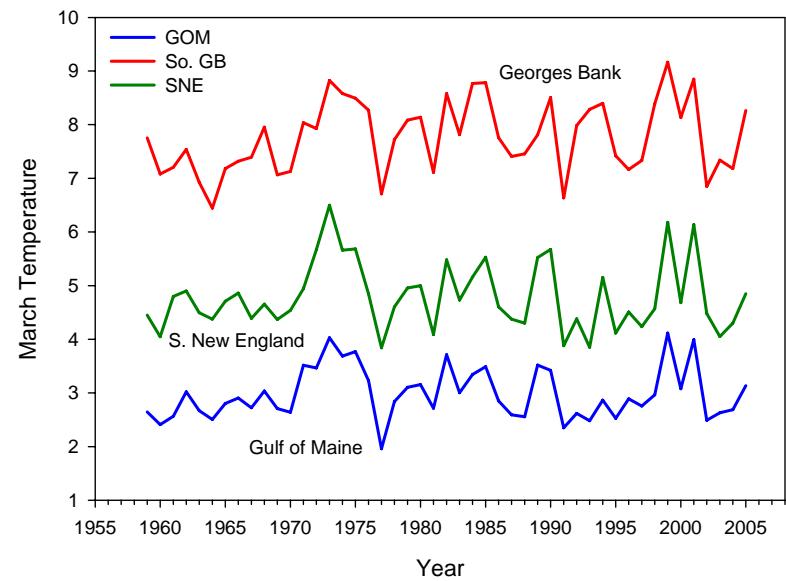
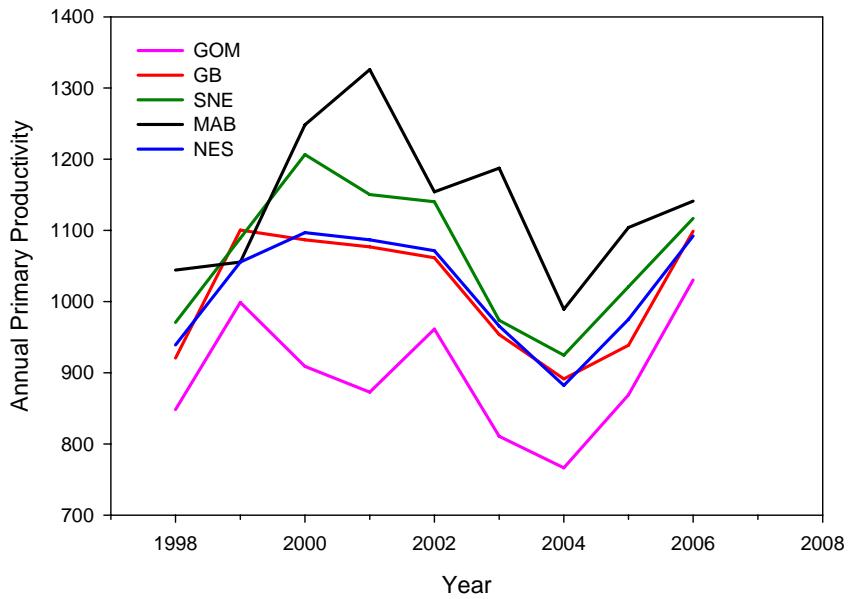
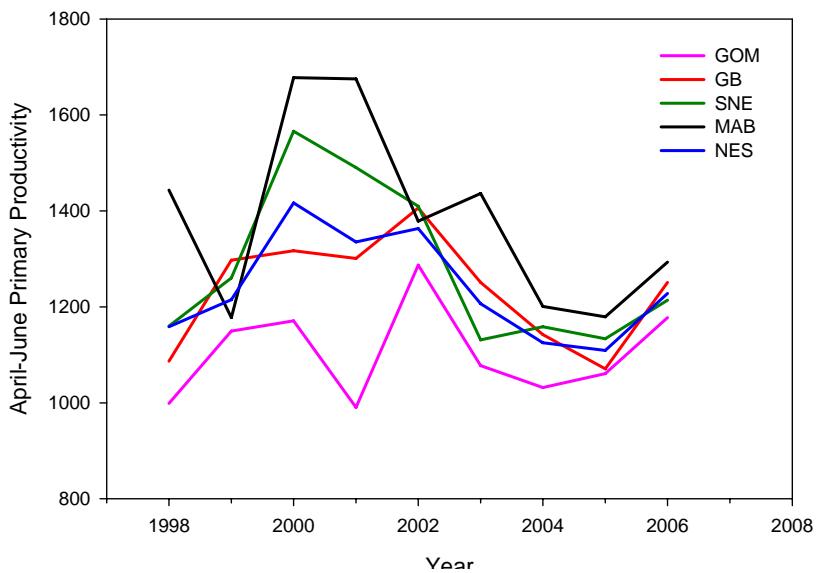
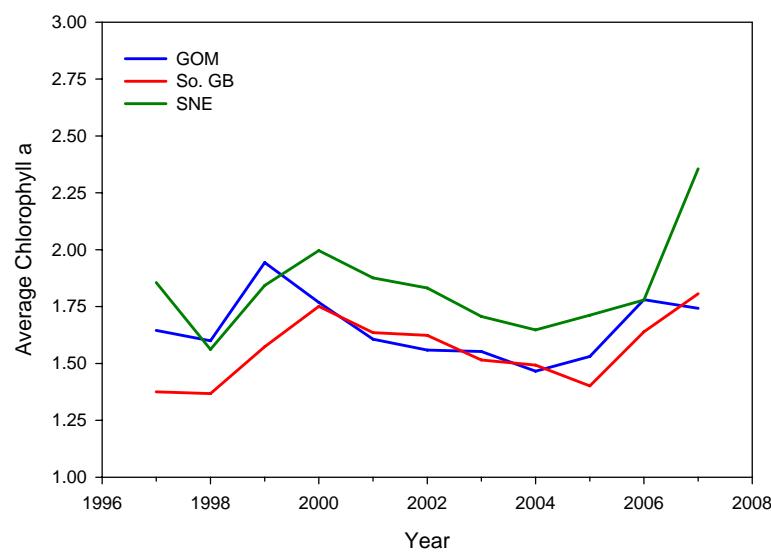
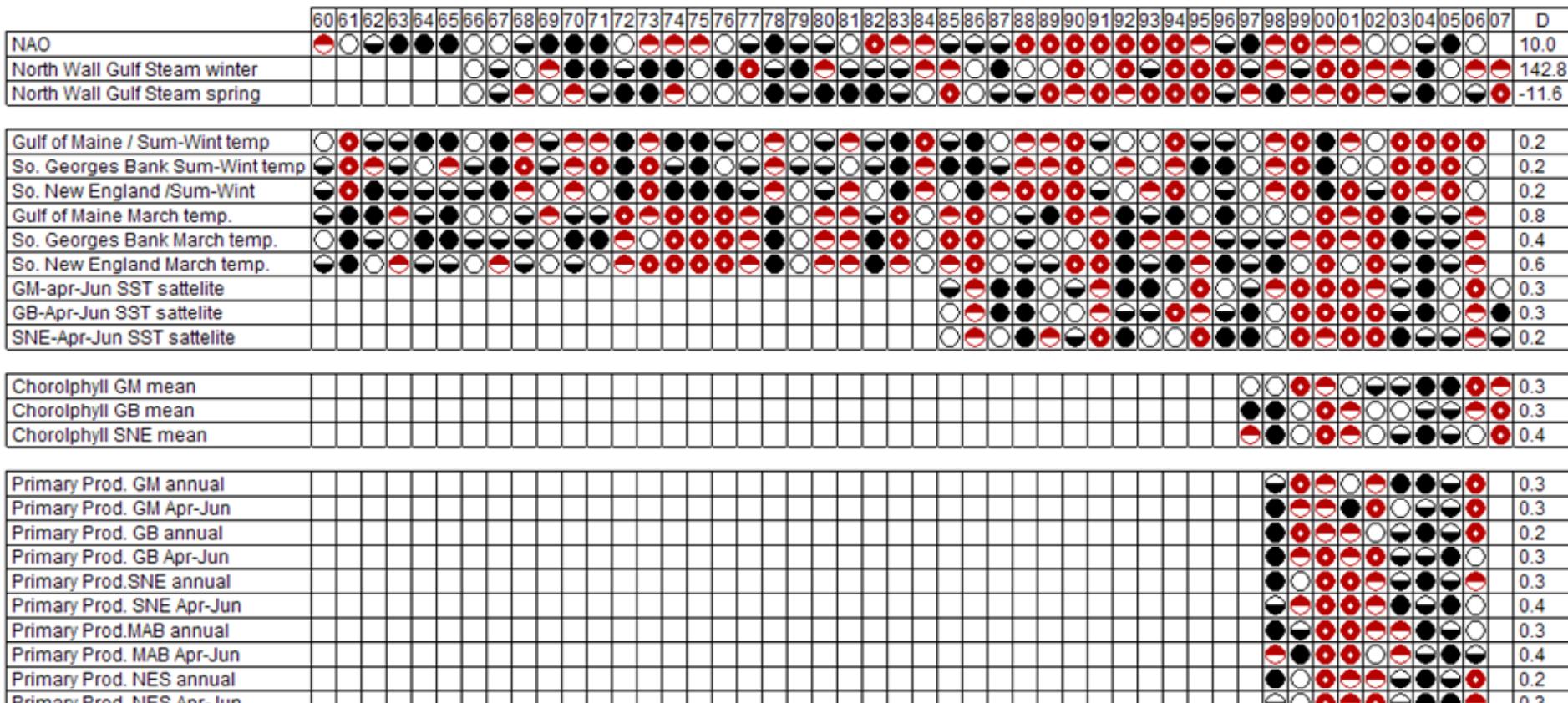


Figure 2.1.5. North Wall Gulf Stream, winter and spring from 1966-2007.





Environmental Data



Legend

Highest 2nd Highest Middle 2nd Lowest Lowest

D = Measure of Dispersion: Range/Median

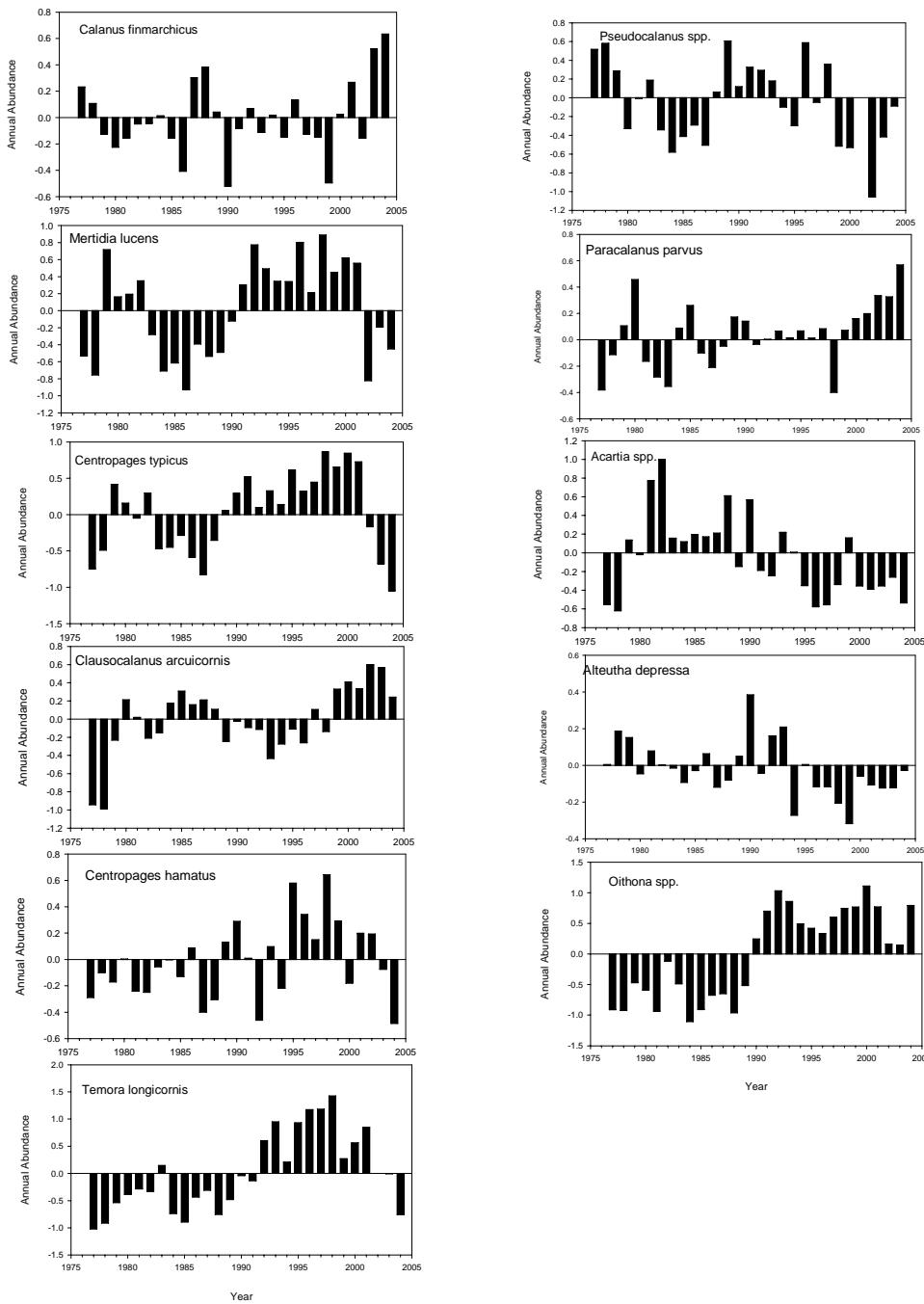
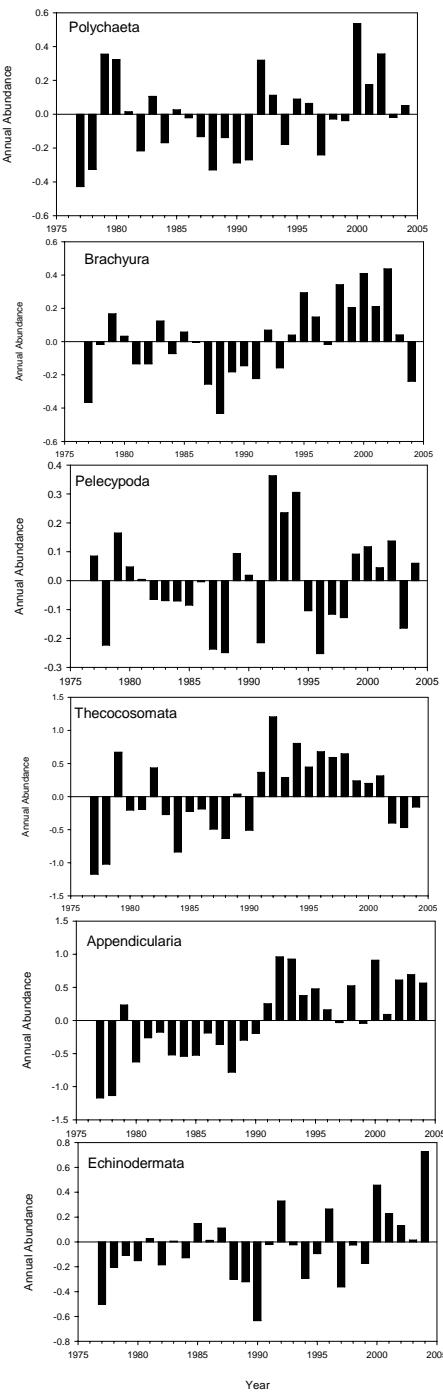
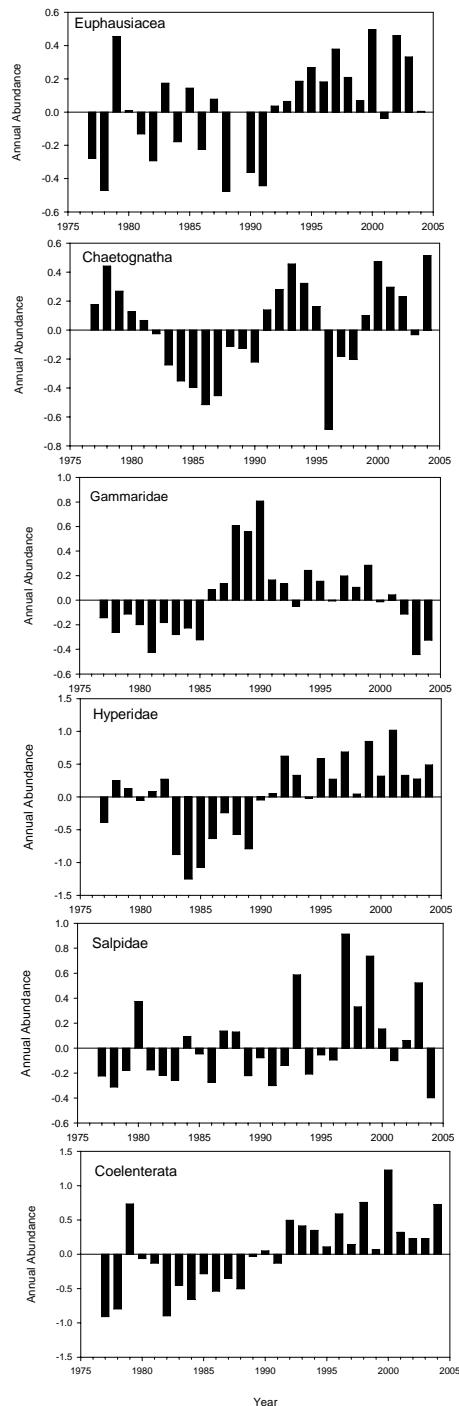


Figure 2.1.10. Annual abundance anomalies of common zooplankton taxa on Georges Bank from 1977-2004.



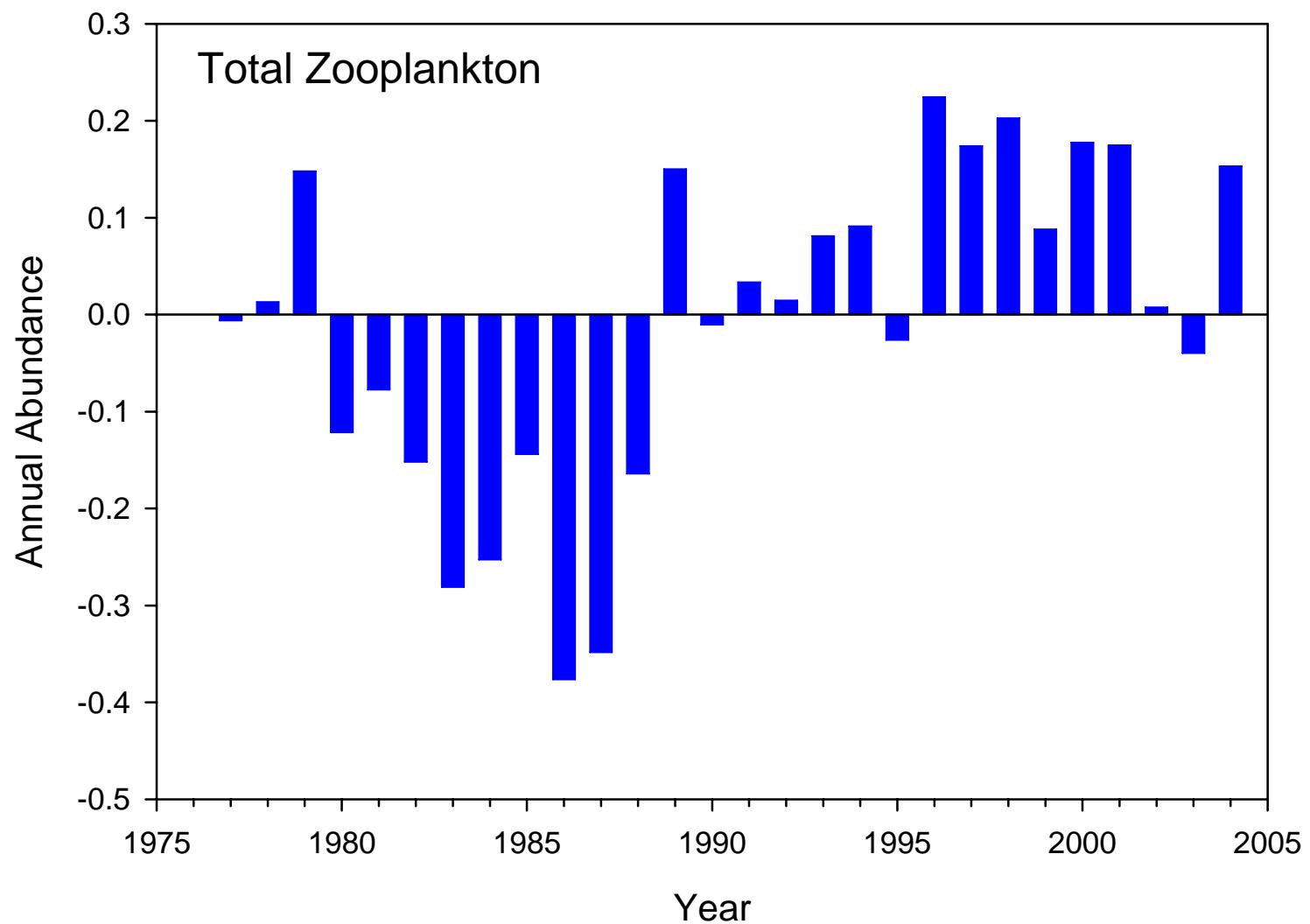
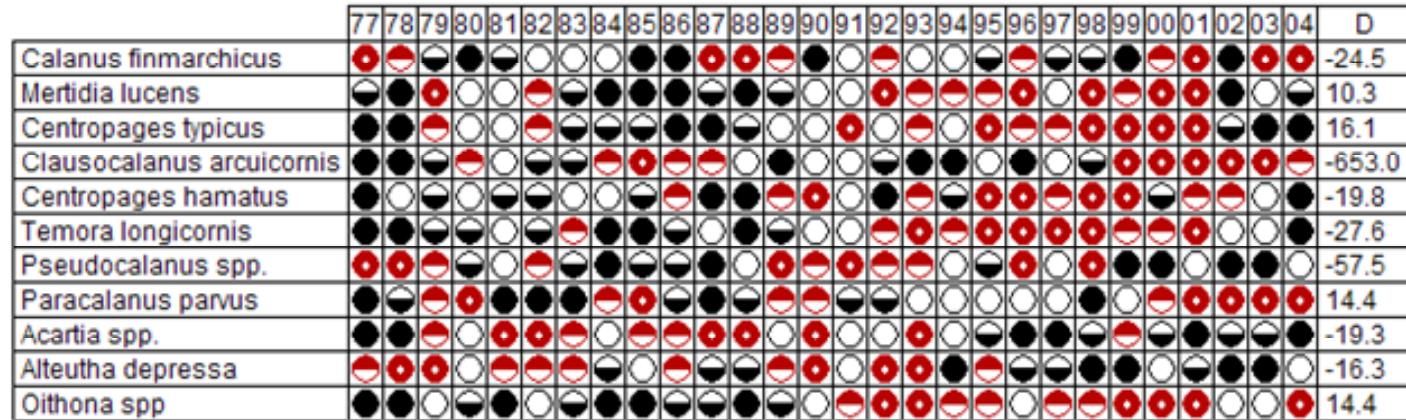


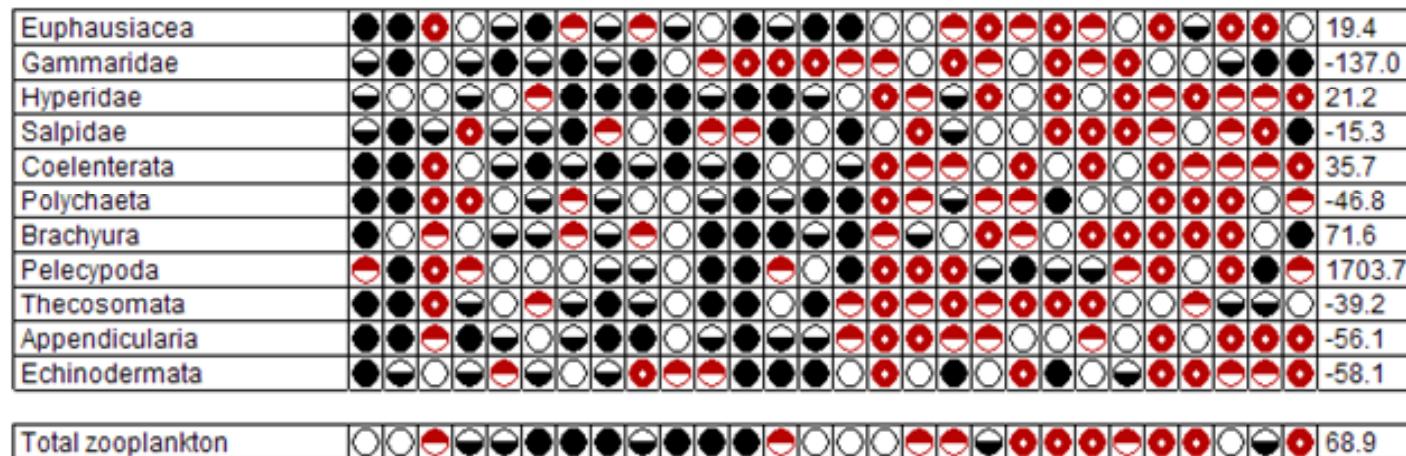
Figure 2.1.12 . Total zooplankton abundance anomalies on Georges Bank from 1977-2004.

Annual Abundance Anomalies of Common Georges Bank Zooplankton Taxa

COPEPODS IN DECREASING SIZE



OTHER TAXA IN DECREASING SIZE



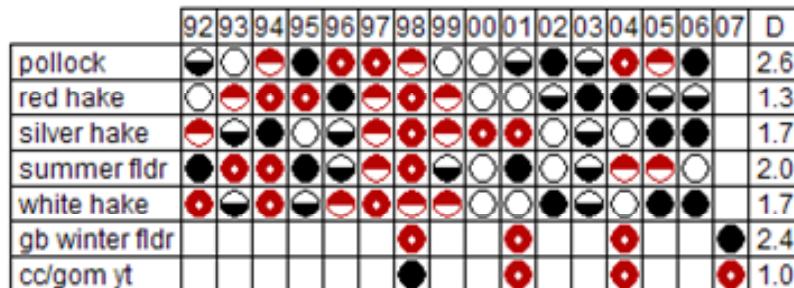
Legend

● Highest ● 2nd Highest ○ Middle ● 2nd Lowest ● Lowest

D = Measure of Dispersion: Range/Median

Data from Joe Kane – Narragansett

Spring Percent Body Weight

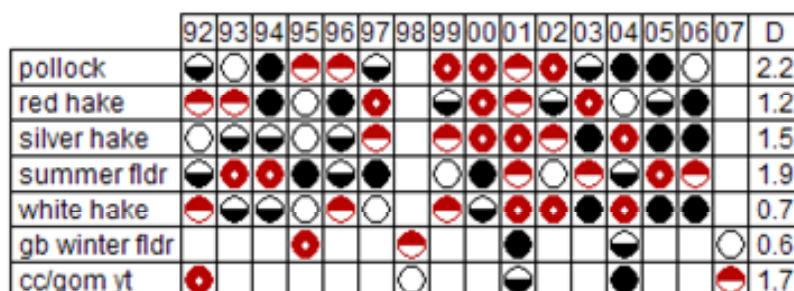


Legend



D = Measure of Dispersion: Range/Median

Autumn Percent Body Weight



Legend



D = Measure of Dispersion: Range/Median

Summary

Trends in length and weight: 14 / 20 stock
2 increasing , 12 decreasing, 6 no trend

Trends in maturation: 11 increasing , 2 decreasing, 7 no change

Global : NAO and NWGS show increasing ++ anomalies recent years

Regional: Overall warming trend (summ-wint temps)

Recent inc/ shift in GB zooplankton anomalies..~ 1990
-associated w/ chg in SShelf inflow / inc. freshening of shelf water

Summary

**Growth & maturity integrate lifetime environmental effects experienced by fish
...provide a coarse measure of env. change**

Other studies:

NAO , NWGS assos. w/ copepod abundance in N. SEA

Strong corr. of larval growth of haddock and abundance of Pseudocalanus

Challenge: determine the associations influencing growth of age 1+ fish

At the least, tracking trends in mean length and weight provides a means of monitoring stk productivity