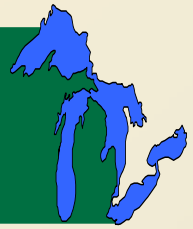
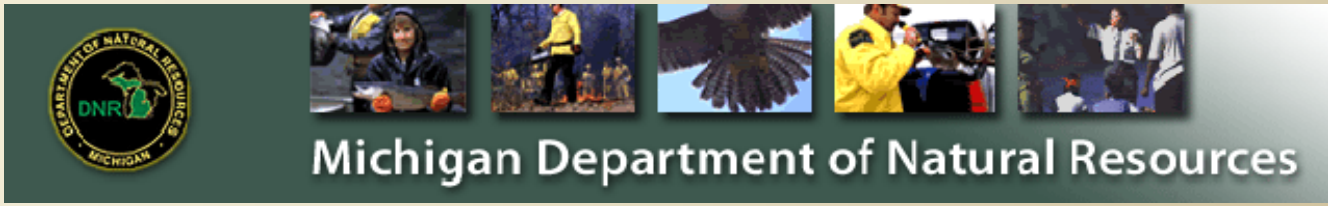
Current Status of Preyfish in Lake Michigan

Dave Warner
Randy Claramunt
Bo Bunnell
Chuck Madenjian

USGS
science for a changing world





Introduction

- Lake Michigan ecosystem continues to change and suffer from degradation
- Invasives have exerted major influence
- Chlorophyll *a,* primary production have decreased
- Key native species gone or nearly gone
  - *Diporeia sp.,* cisco, kiyi, emerald shiner
- Previous SOL, preyfish well below FCO targets

Preyfish – an Overview

- Important to economically/ecologically valuable fish
  - Chinook heavily reliant on alewife
  - Lake trout reliant on alewife, bloater, sculpins
- Import for food web
  - Conduit for energy/nutrients between benthic and pelagic zones
  - Link between zooplankton and piscivores
  - Can influence structure of zooplankton communities

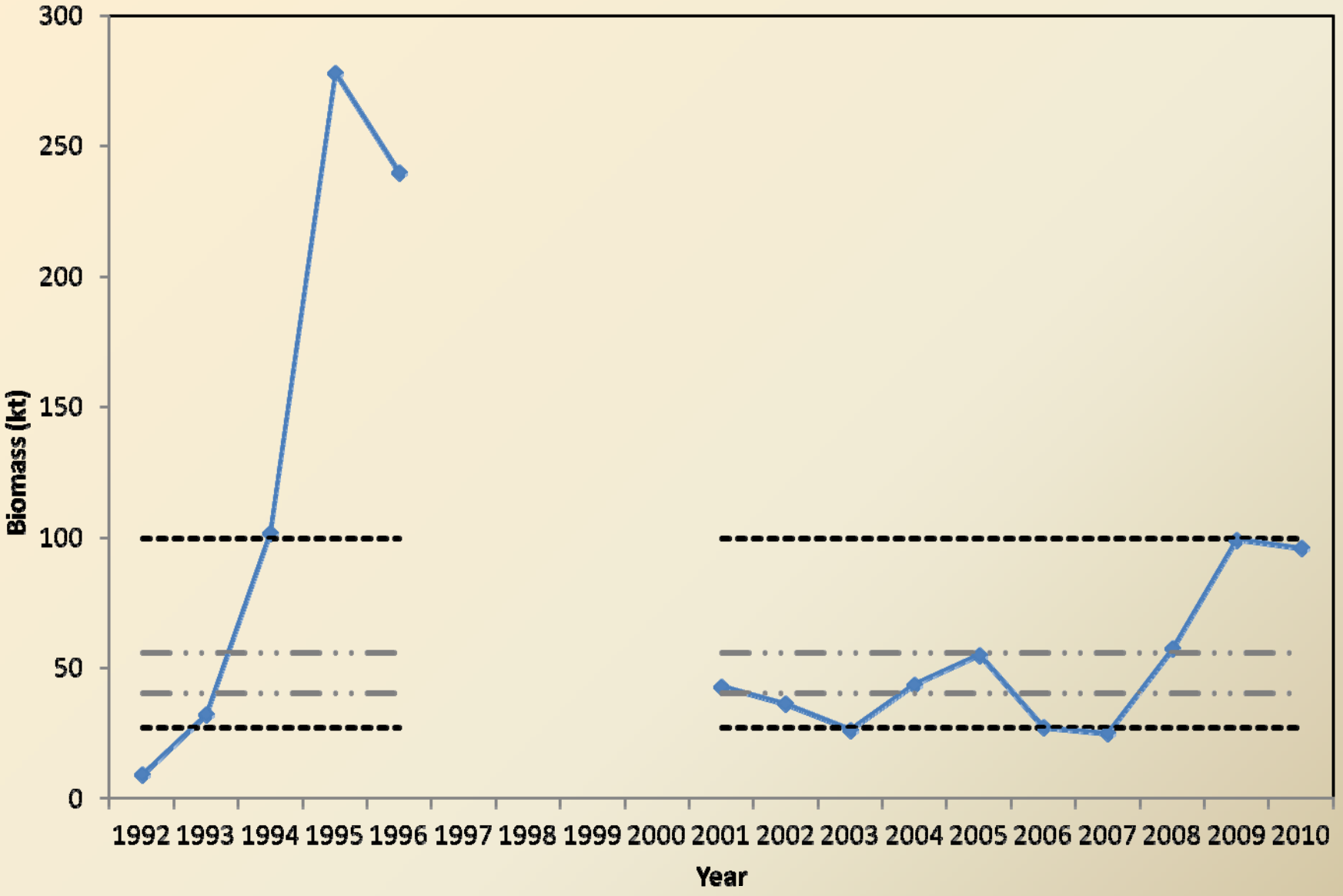
Methods – Bottom Trawl

- Sampling/estimation
  - Lakewide, annual 1973-2011
  - Currently 70 sites
  - Swept-area estimates corrected for time on bottom and trawl geometry
  - Lakewide density and abundance based on stratified weighted mean and variance estimator

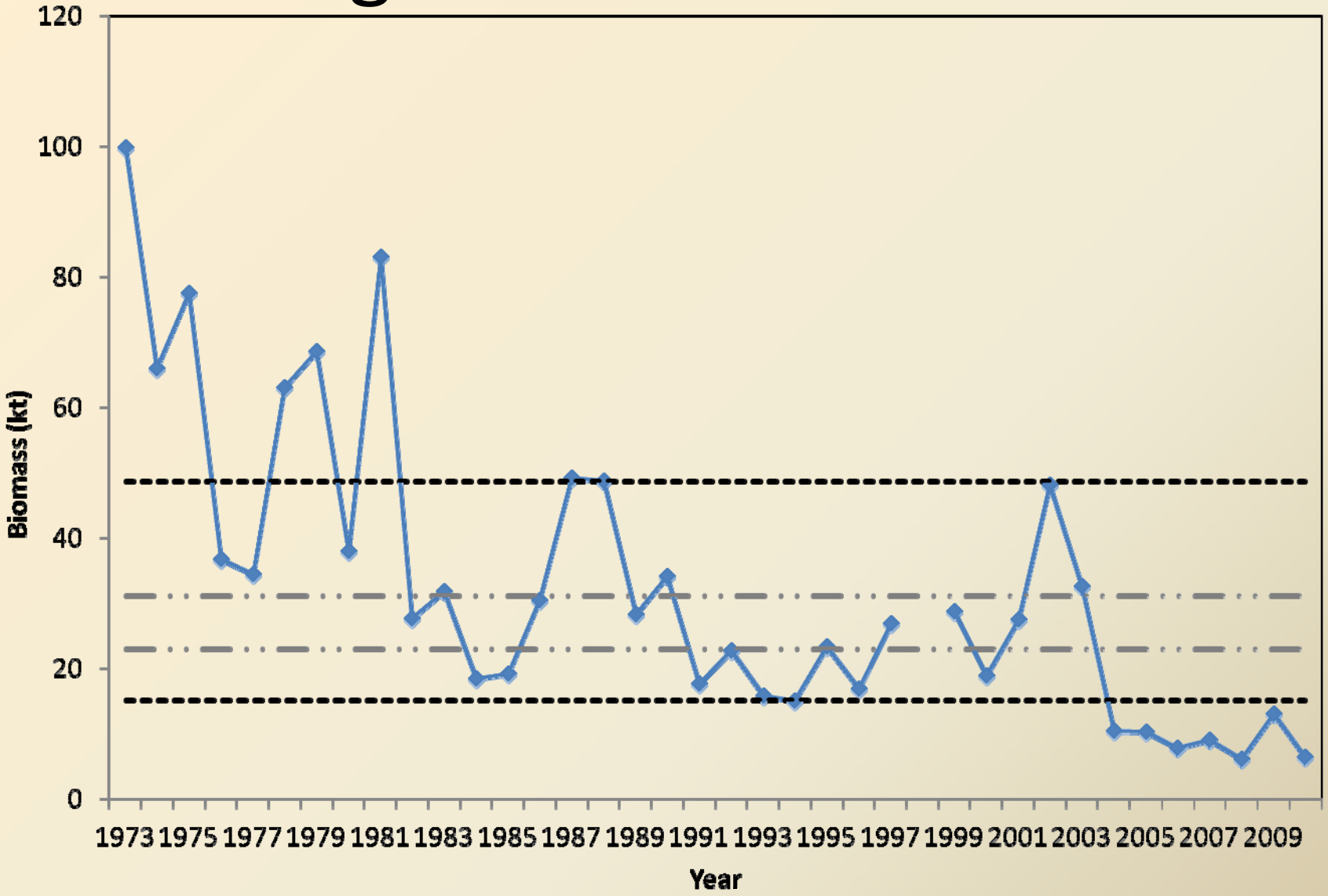
Methods – Acoustic

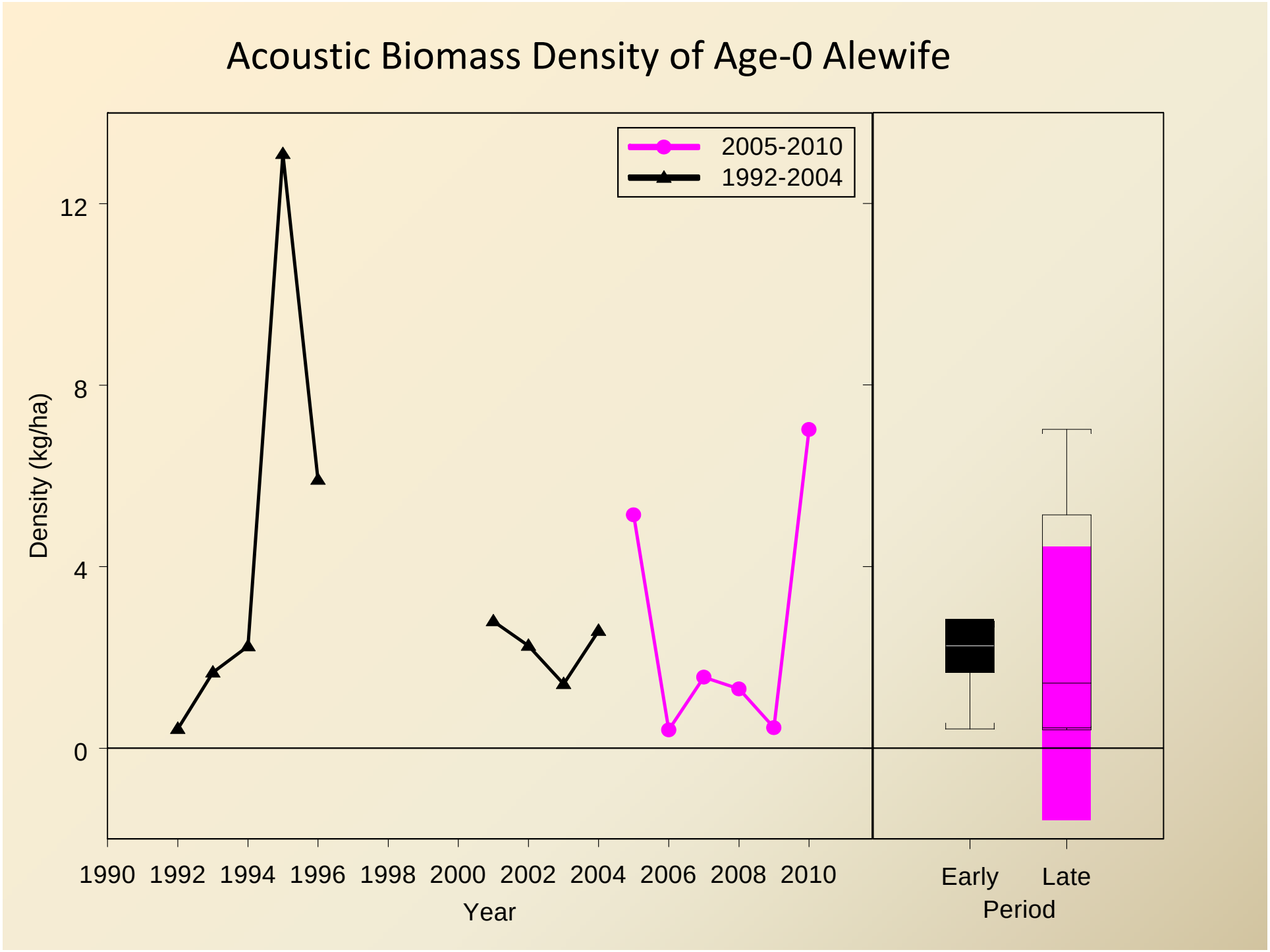
- Sampling/estimation
  - Lakewide, annual 1992-2011 (minus 1997-2000)
  - 120 kHz
  - Effort target 20 transects/400 km
  - Midwater trawls and target strength (deep targets only) used to allocate density to species
  - Lakewide density and abundance based on stratified cluster estimator

Red Flags – Acoustic Alewife

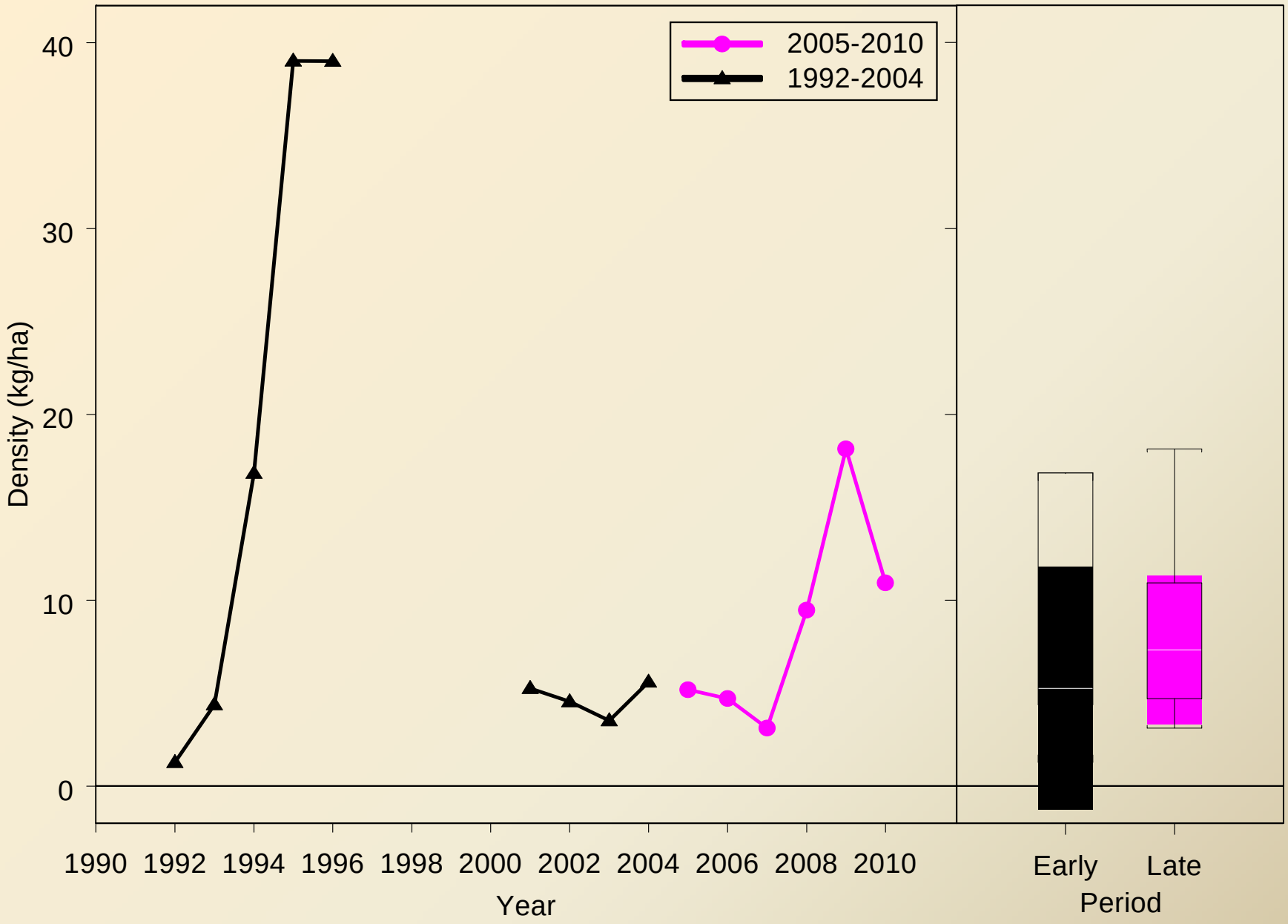


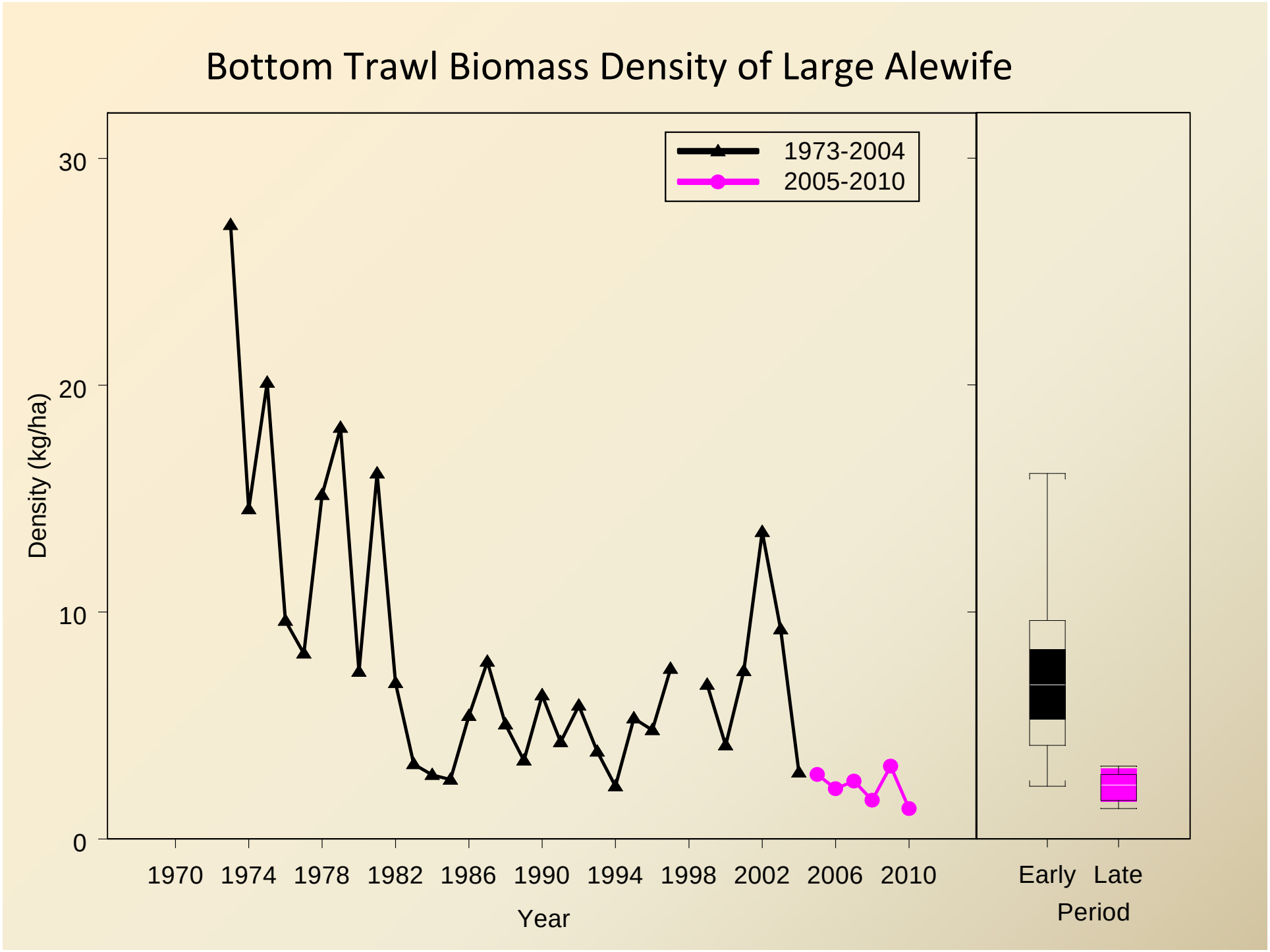
Red Flags – Bottom Trawl Alewife



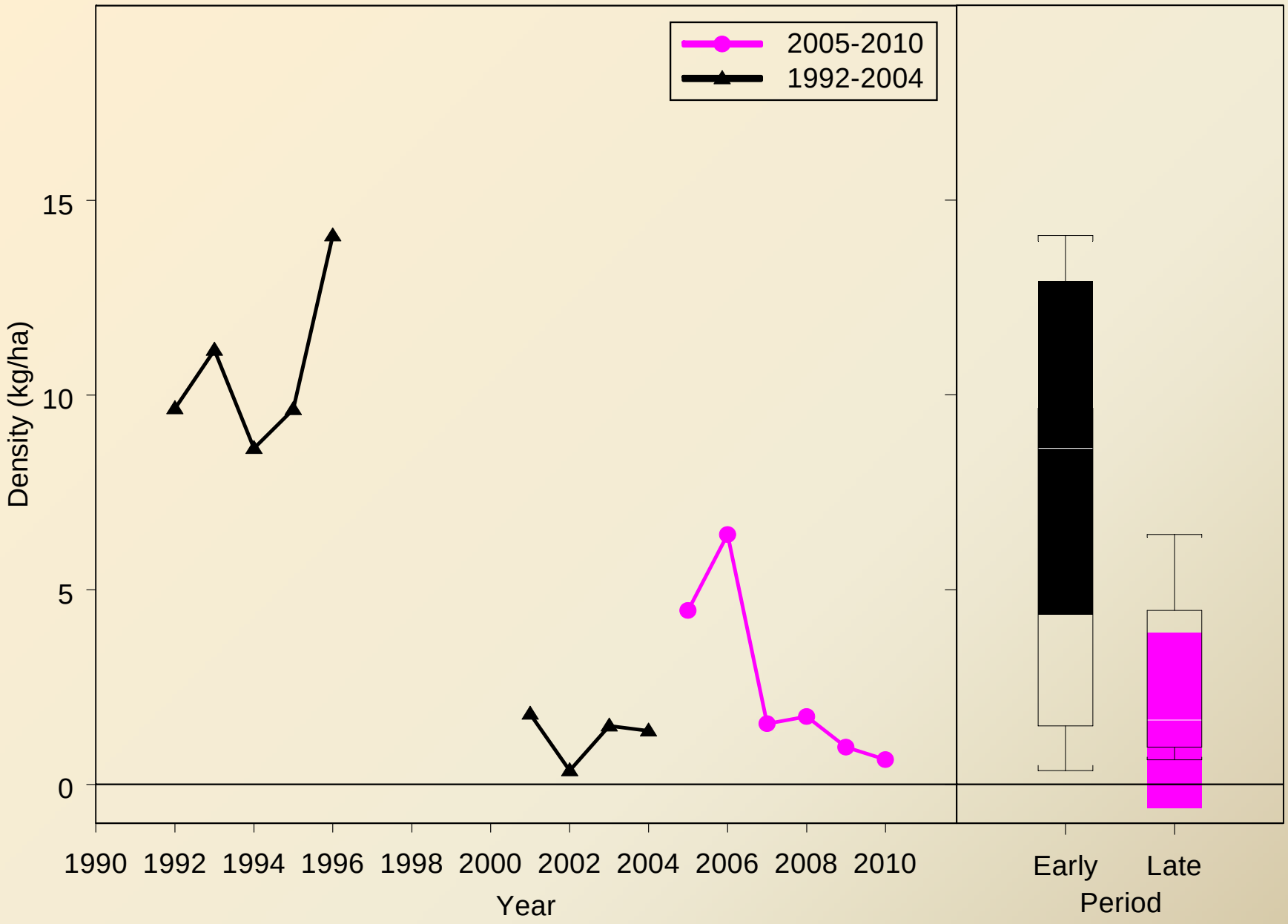

Acoustic Biomass Density of Age-0 Alewife
2005-2010
1992-2004
Density (kg/ha)
12
8
4
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010
Year
Early
Late
Period

Acoustic Biomass Density of YAO Alewife

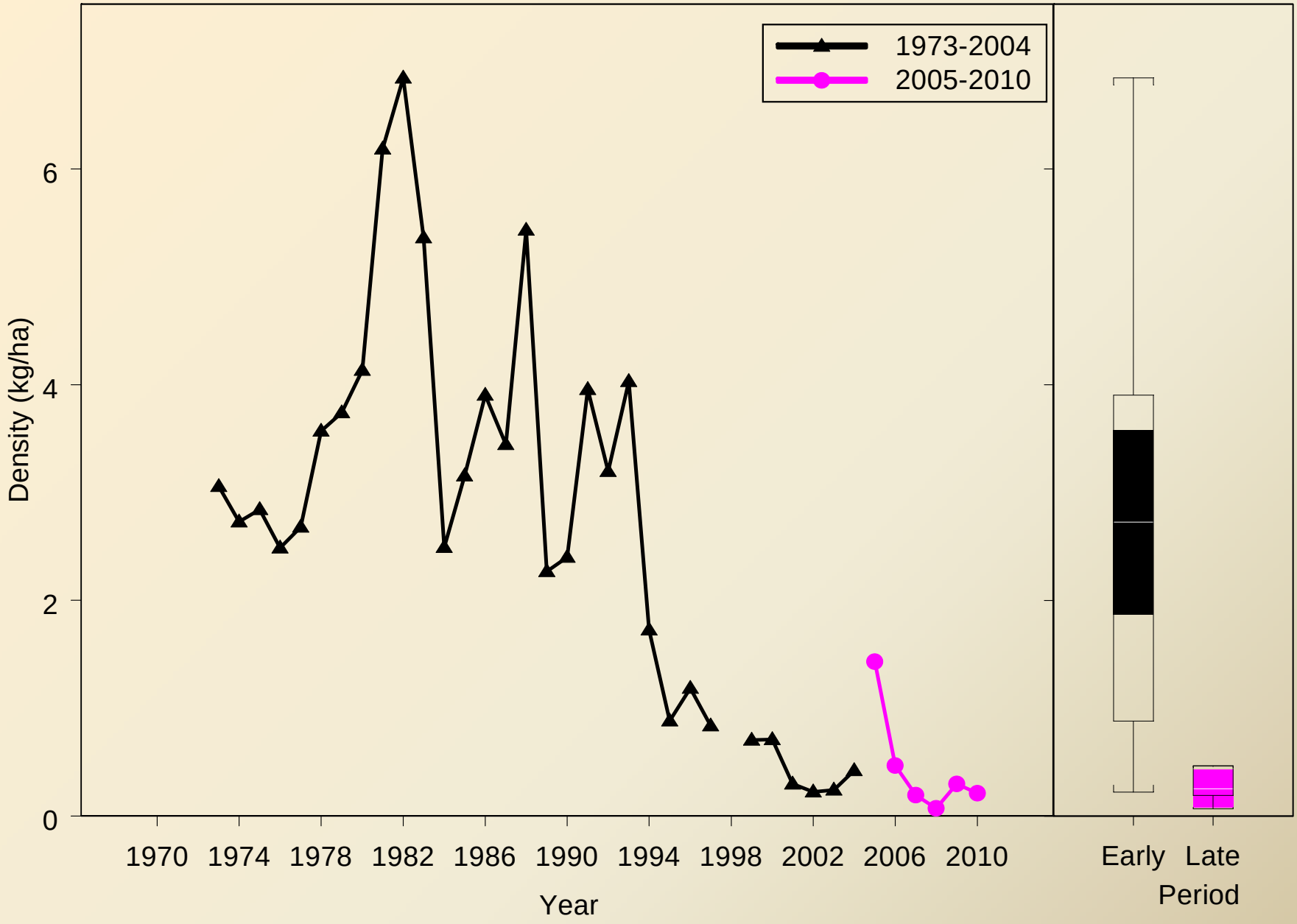


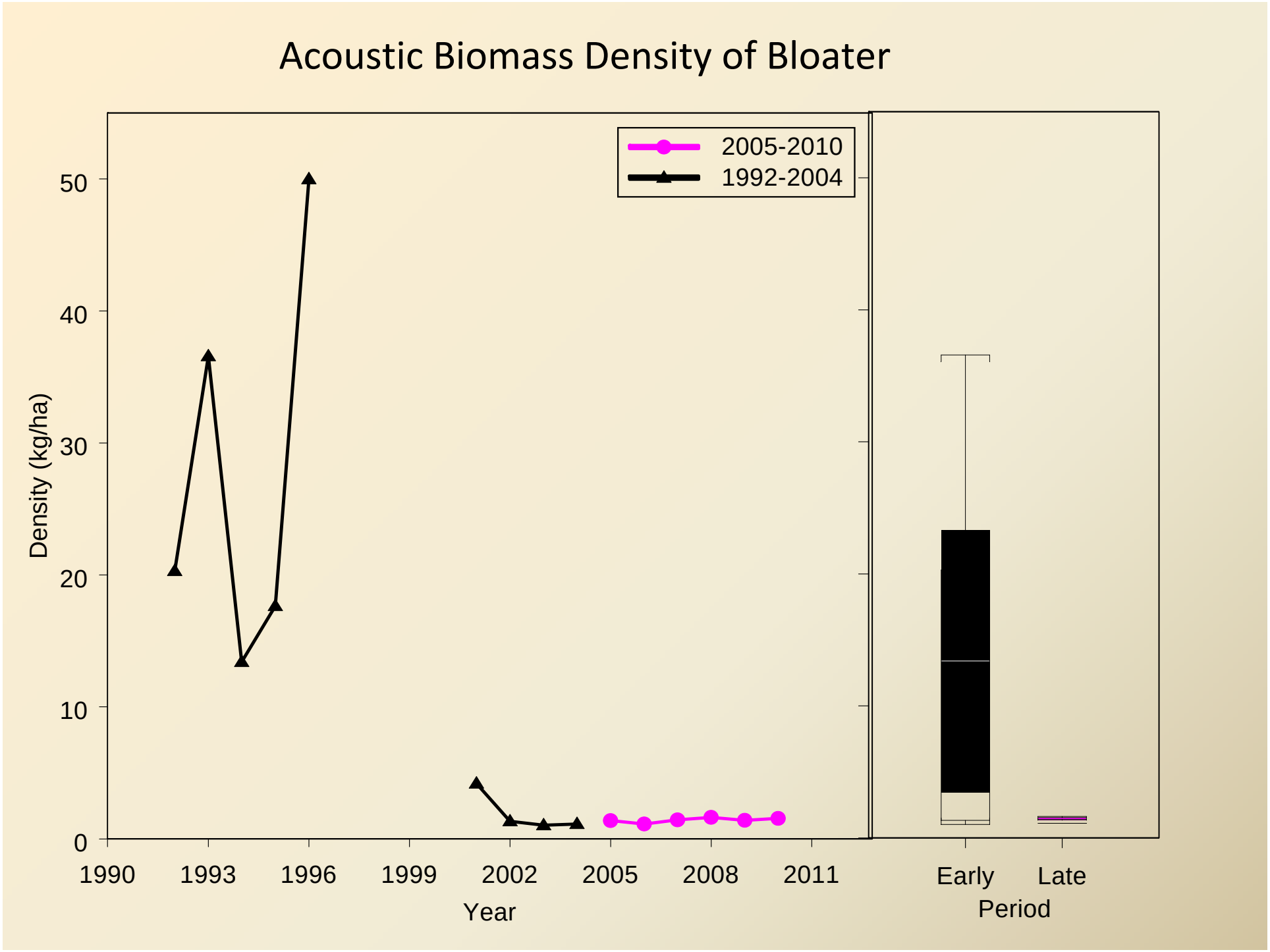

Bottom Trawl Biomass Density of Large Alewife
1973-2004
2005-2010
Density (kg/ha)
0
10
20
30
1970
1974
1978
1982
1986
1990
1994
1998
2002
2006
2010
Year
Early
Late
Period

Acoustic Biomass Density of Rainbow Smelt

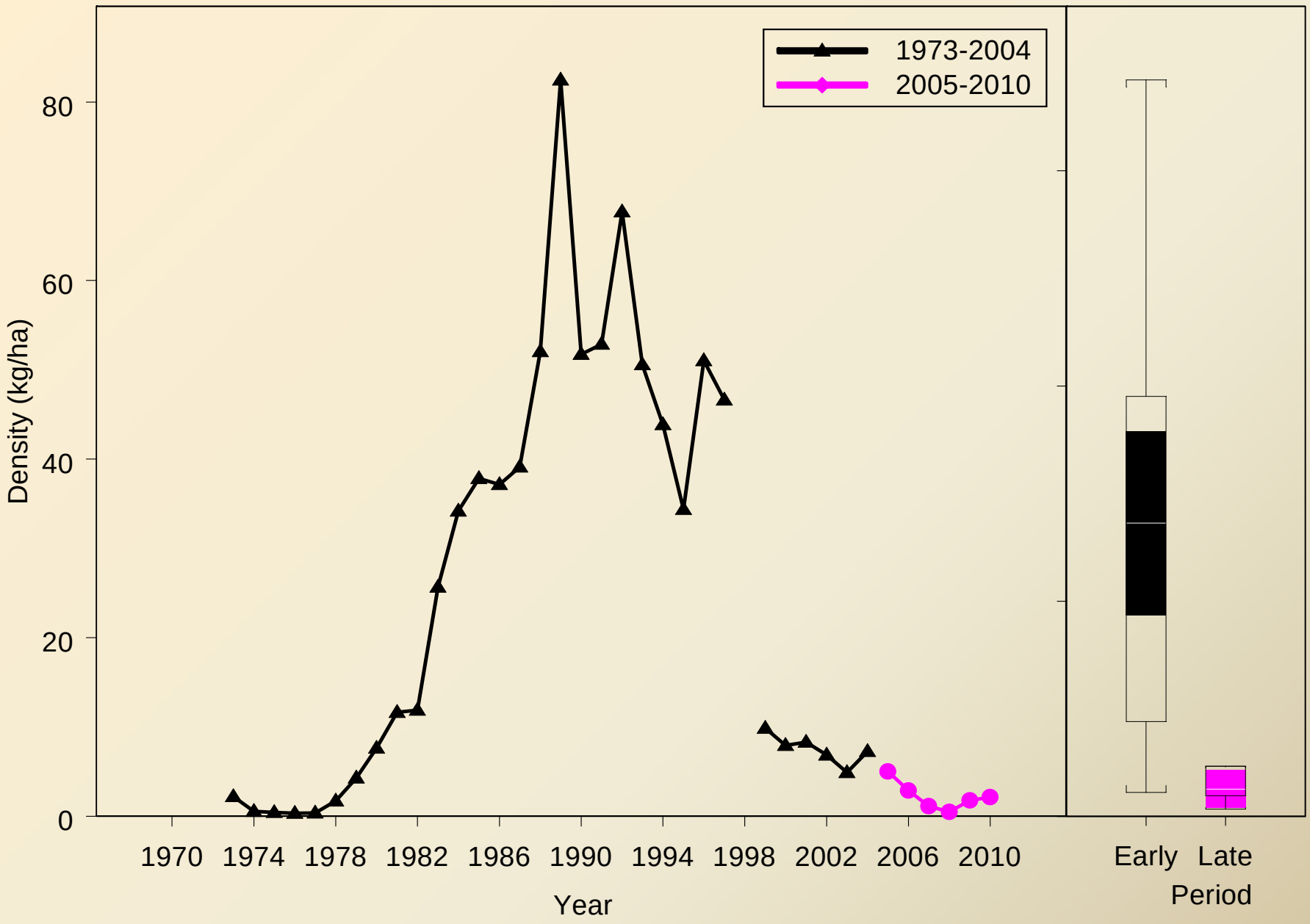


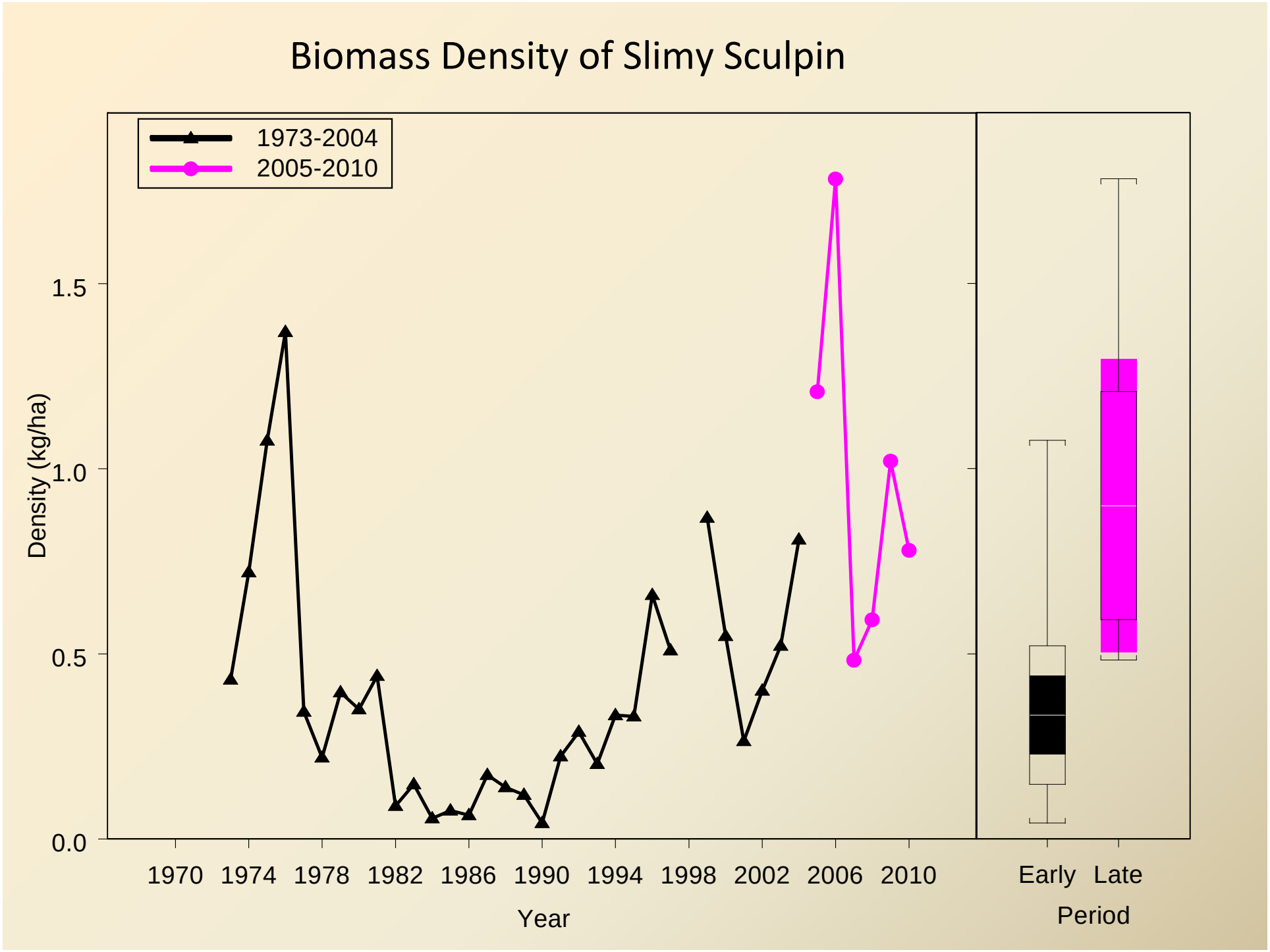
Bottom Trawl Biomass Density of Large Rainbow Smelt

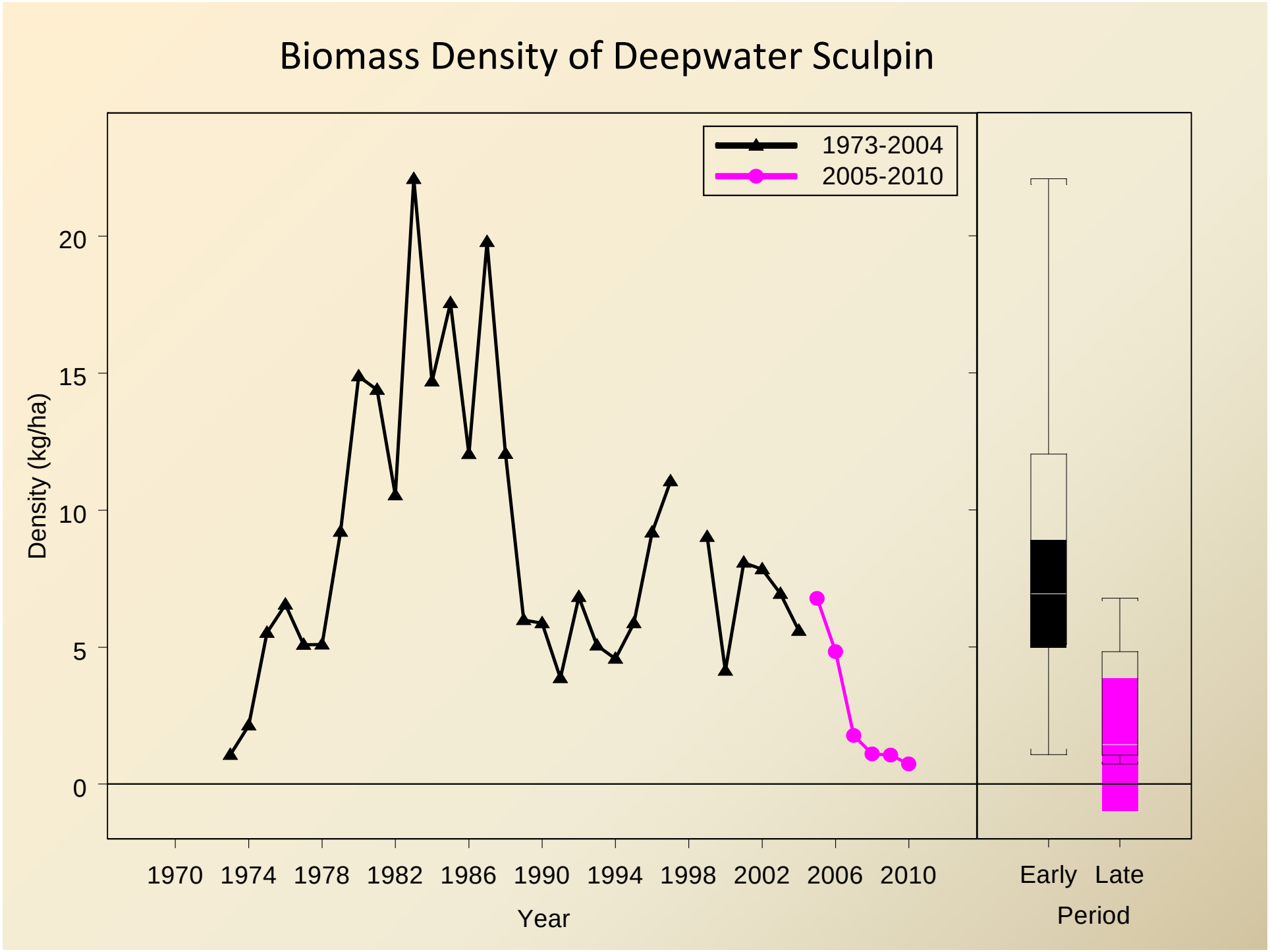



Acoustic Biomass Density of Bloater
2005-2010
1992-2004
Density (kg/ha)
0
10
20
30
40
50
1990
1993
1996
1999
2002
2005
2008
2011
Year
Early
Late
Period

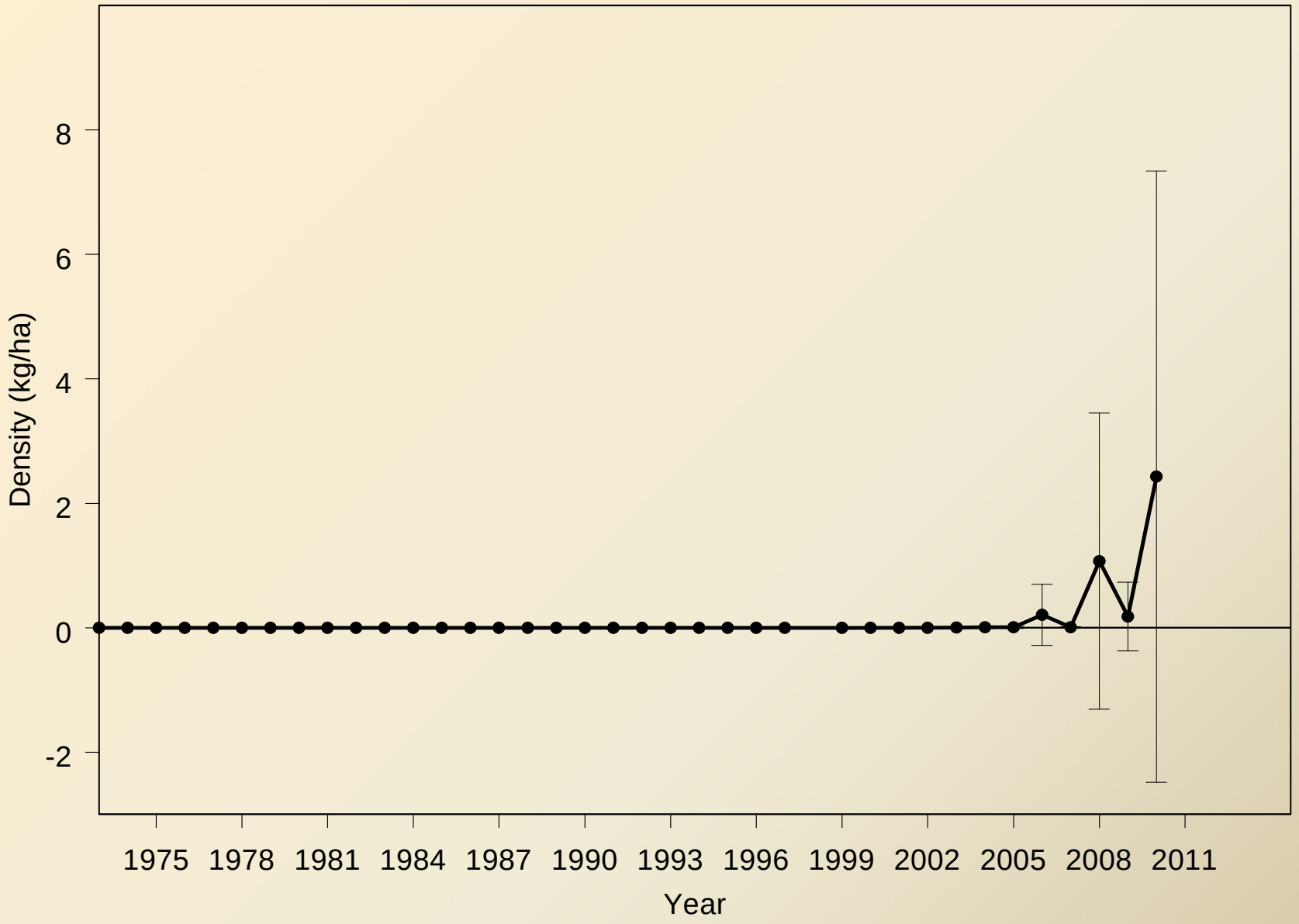
Bottom Trawl Biomass Density of Large Bloater



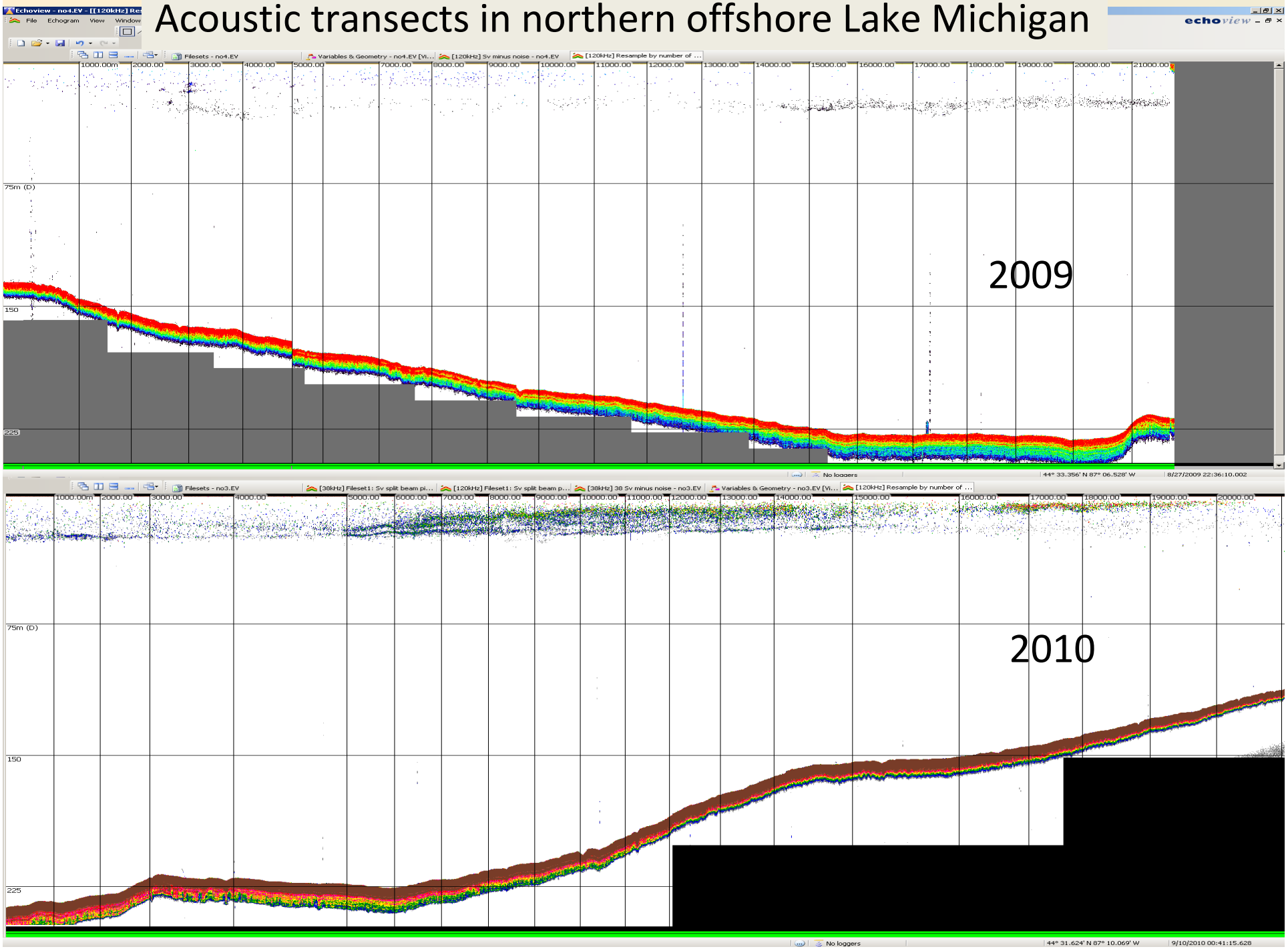

Biomass Density of Slimy Sculpin
1973-2004
2005-2010
Density (kg/ha)
0.0
0.5
1.0
1.5
1970
1974
1978
1982
1986
1990
1994
1998
2002
2006
2010
Year
Early
Late
Period


Biomass Density of Deepwater Sculpin
1973-2004
2005-2010
Density (kg/ha)
0
5
10
15
20
1970
1974
1978
1982
1986
1990
1994
1998
2002
2006
2010
Year
Early
Late
Period

Biomass Density of Round Gobies



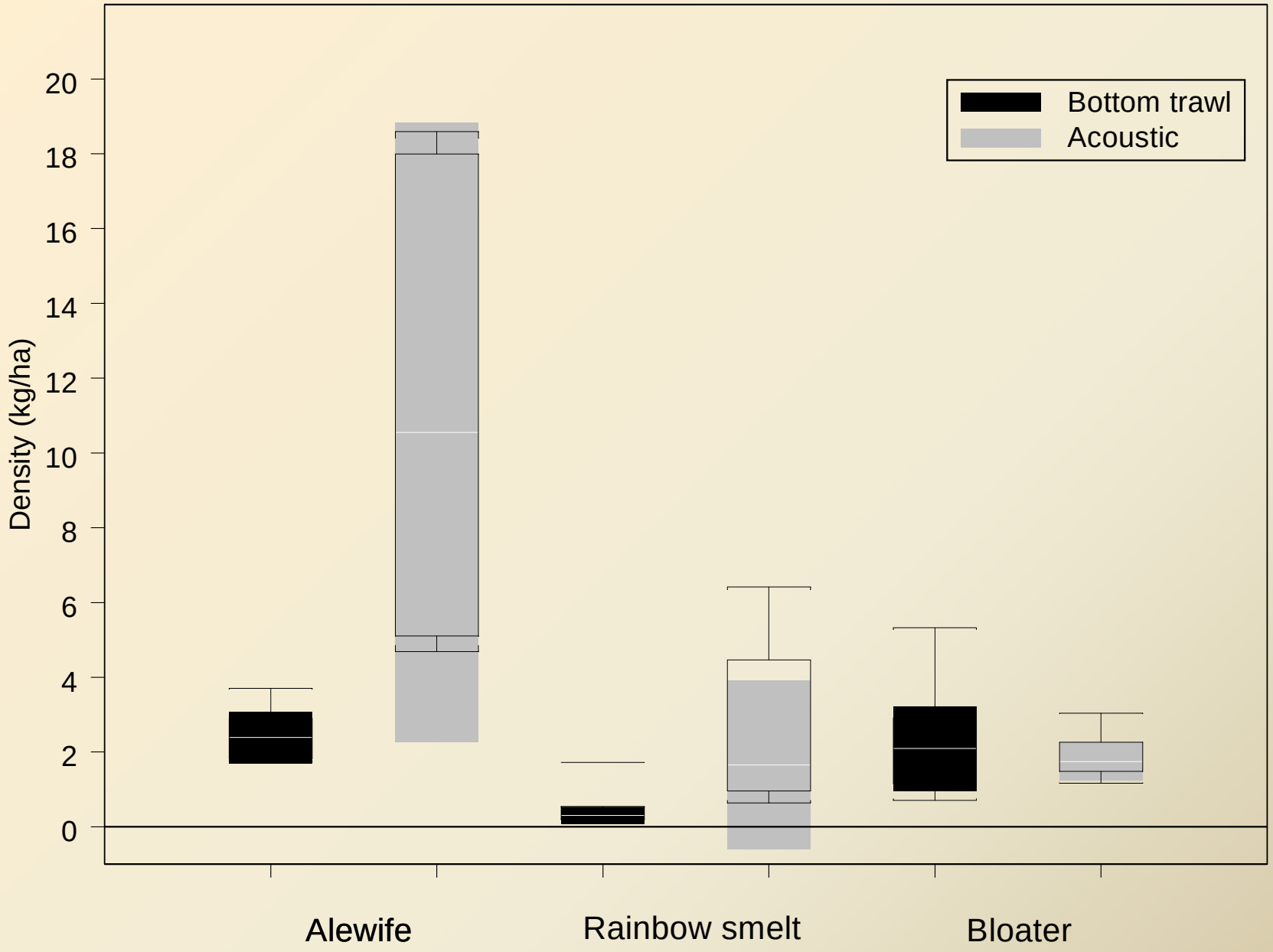
Acoustic transects in northern offshore Lake Michigan



Bottom Trawl/Acoustic Comparison

- Are findings consistent between surveys?
- If not, are differences understood?
- Are results consistent with other observations of the system?

Comparison of Bottom Trawl and Acoustic Biomass Density, 2005-2010



Bottom Trawl Summary

- Alewife biomass 2nd lowest in time series
- Total biomass is 3rd lowest
- Round goby had highest biomass in 2010
  - Biomass from three heavy catches at < 18 m
  - High degree of uncertainty (*RSE* = 57%)
- Bloater biomass still <10% of 1973-2004 average

Acoustic Summary

- Two large alewife year classes in 2005-2010
  - 2005 and 2010
- Alewife biomass 68% of 1992-2004 mean
- Bloater biomass <15% of 1992-2004 mean
- Rainbow smelt 2nd lowest in time series
- Total biomass is <40% of 1992-2004 mean
- Much more biomass offshore than in other years

Conclusions

- Surveys seem to tell different story for alewife, but…
  - Not recruited to bottom trawl until age 3-5
  - Acoustic results consistent with die-off and growth of predators
- Survey results for other pelagics similar
- Total preyfish biomass remains well below FCO
- Preyfish community dominated by exotic species
  - Goby and alewife

Conclusions

- High variability makes red flags difficult