

# Spring gillnetting surveys in US water of Lake Huron

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- **Eshenroder, R. L.**, et al. **1995**. Lake trout rehabilitation in Lake Huron. **Journal of Great Lakes Research** 21 (Supplement 1):108:127.
- **Ebener, M. P.** (Editor). **1998**. A lake trout rehabilitation guide for Lake Huron. **Great Lakes Fishery Commission**, Ann Arbor, Michigan.
- **Wilberg, M. J.**, et al. **2002**. Survival of juvenile lake trout stocked in Western Lake Huron during 1974-1992. **North American Journal of Fisheries Management** 22:213-218.
- **Johnson, J. E.**, et al. **2004**. Lessons in rehabilitation stocking and management of lake trout in Lake Huron. **American Fisheries Society Symposium** 44: 161-175.

# Survey measurements in changing environments

- Delay in recruitment
- Decline in age 1 survival
- Changes in depth distribution
- Management implication of recruitment

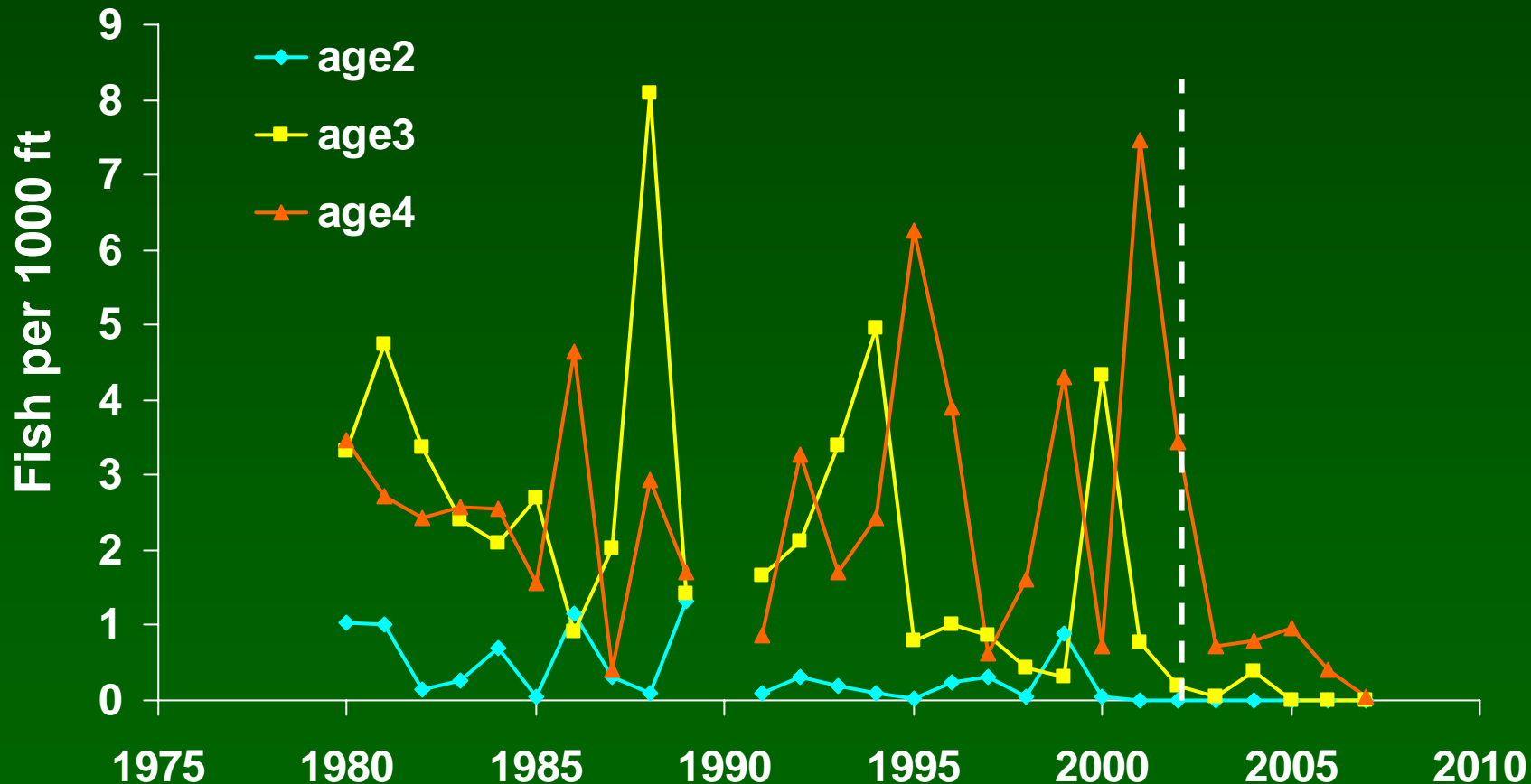


# Ages 2-4 catch rates

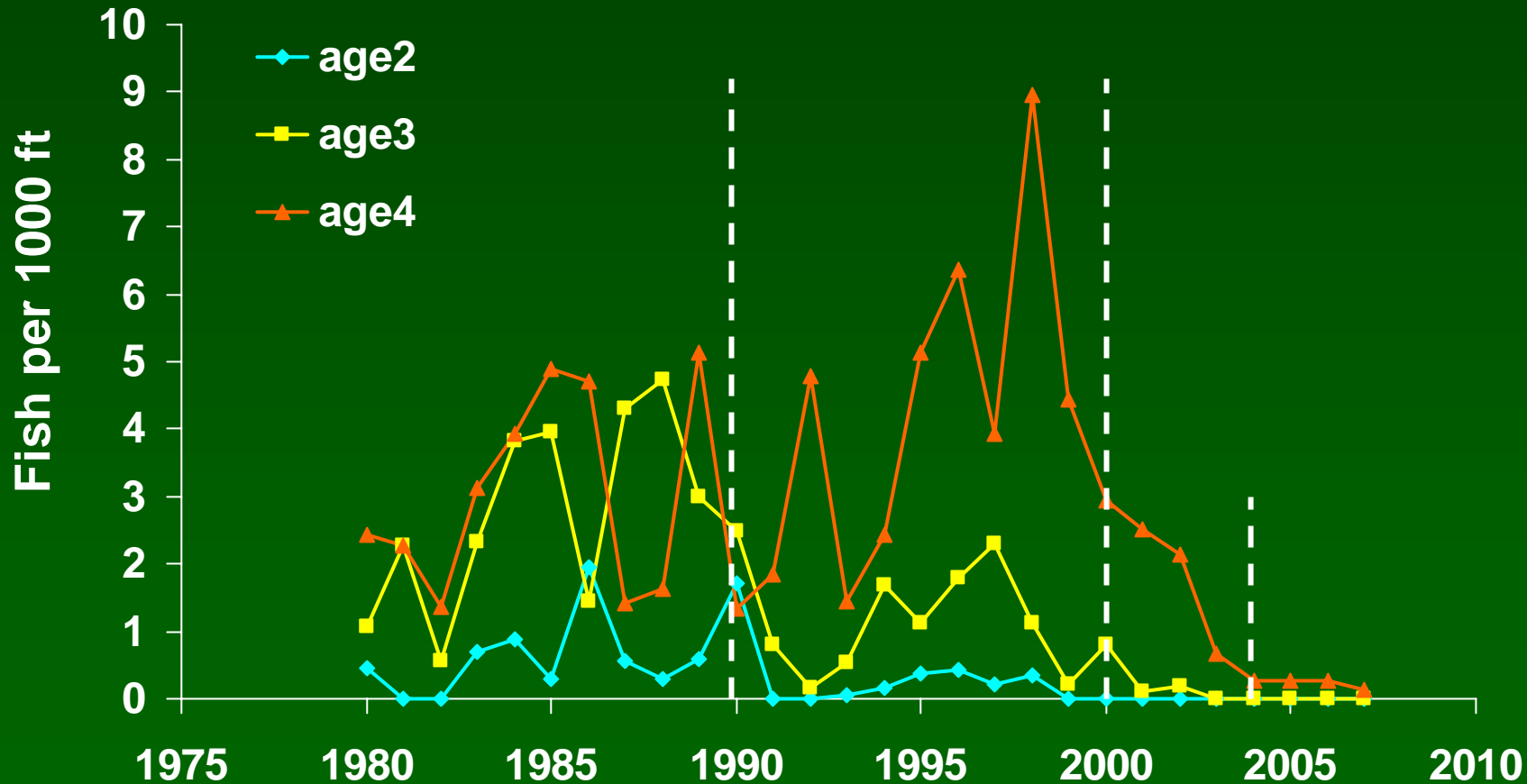
- Changes started from the south;
- Differences: 1980s, 1990s, and 2000s;
- Near zero catch of age 4 in recent years.

# Ages 2-4 catch rates

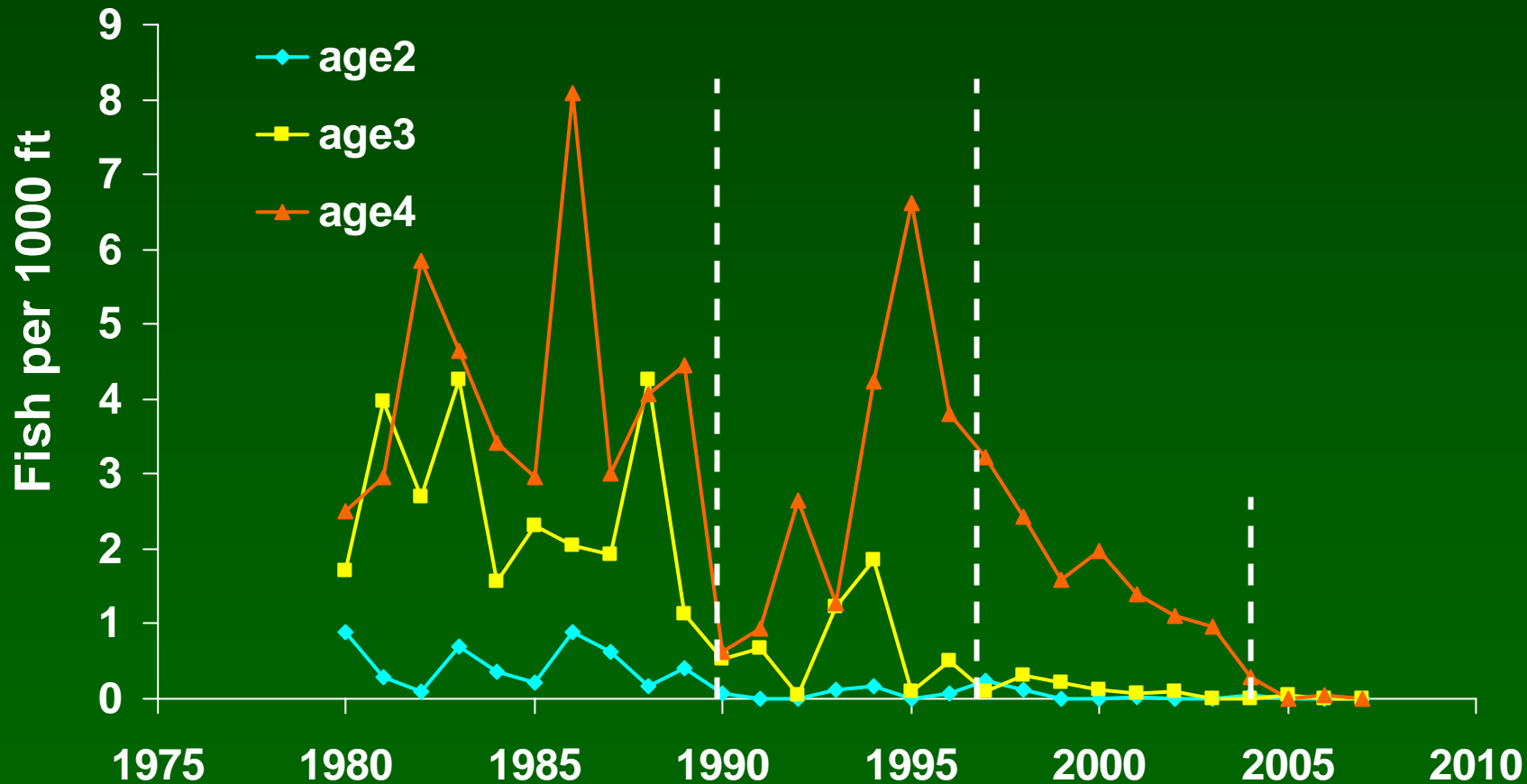
## northern Lake Huron



# Ages 2-4 catch rates north-central Lake Huron



# Ages 2-4 catch rates southern Lake Huron

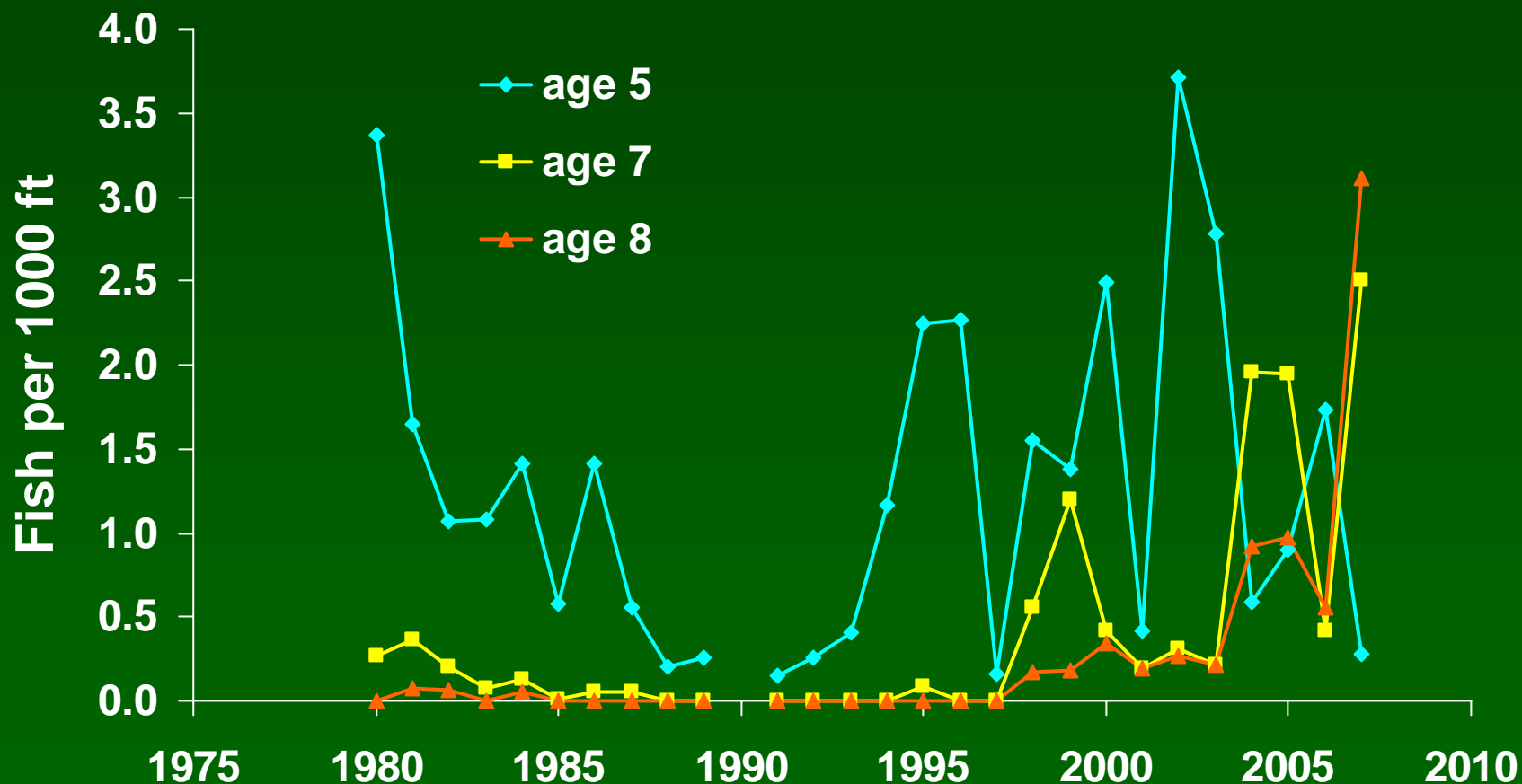




# Ages 5-8 catch rates

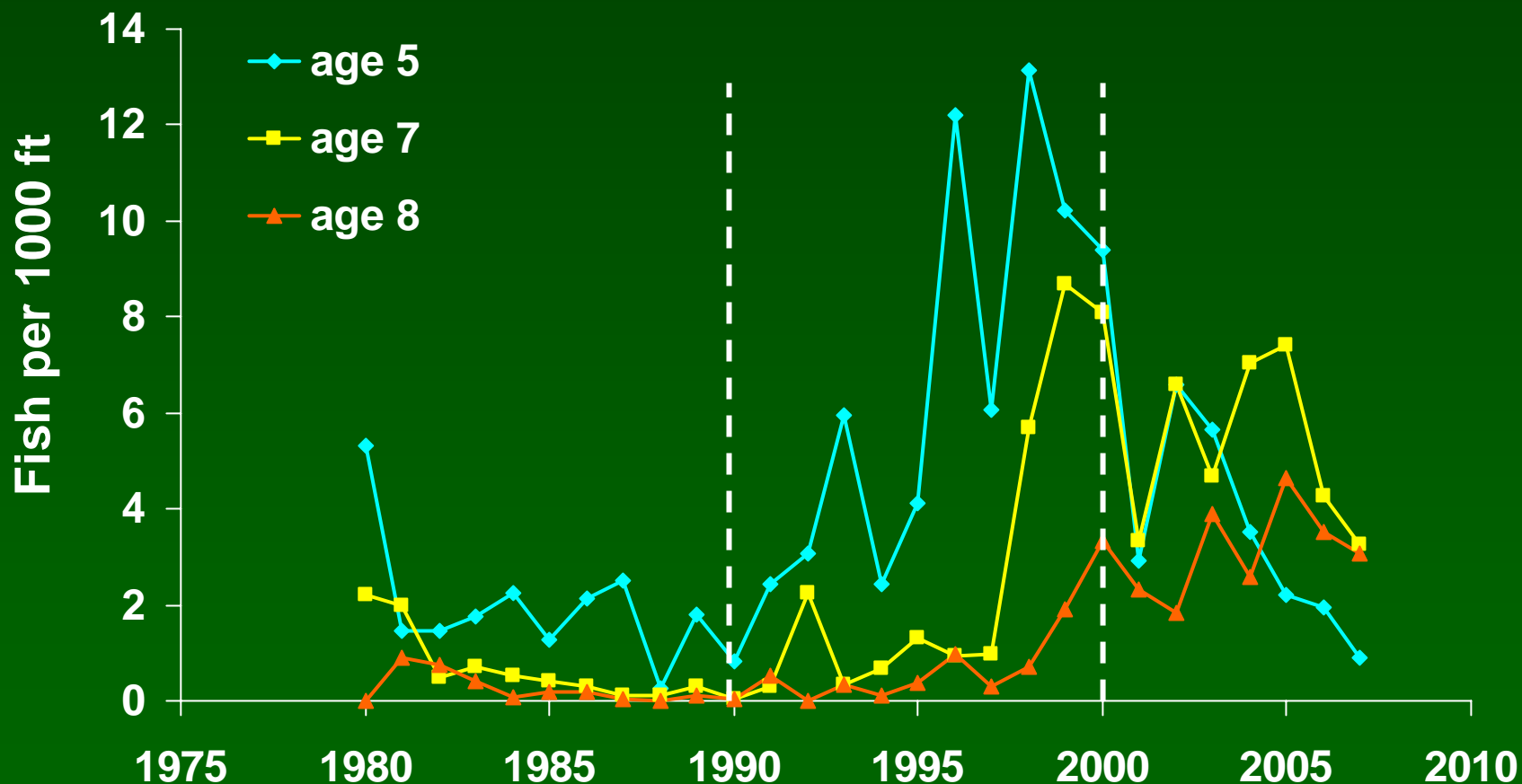
- Only the south and north-central have shown clear declines in age 5 catch rate during the 2000s;
- Only the south has started to show decline in ages 7-8 catch rates during the recent years.

# Ages 5, 7-8 catch rates northern Lake Huron

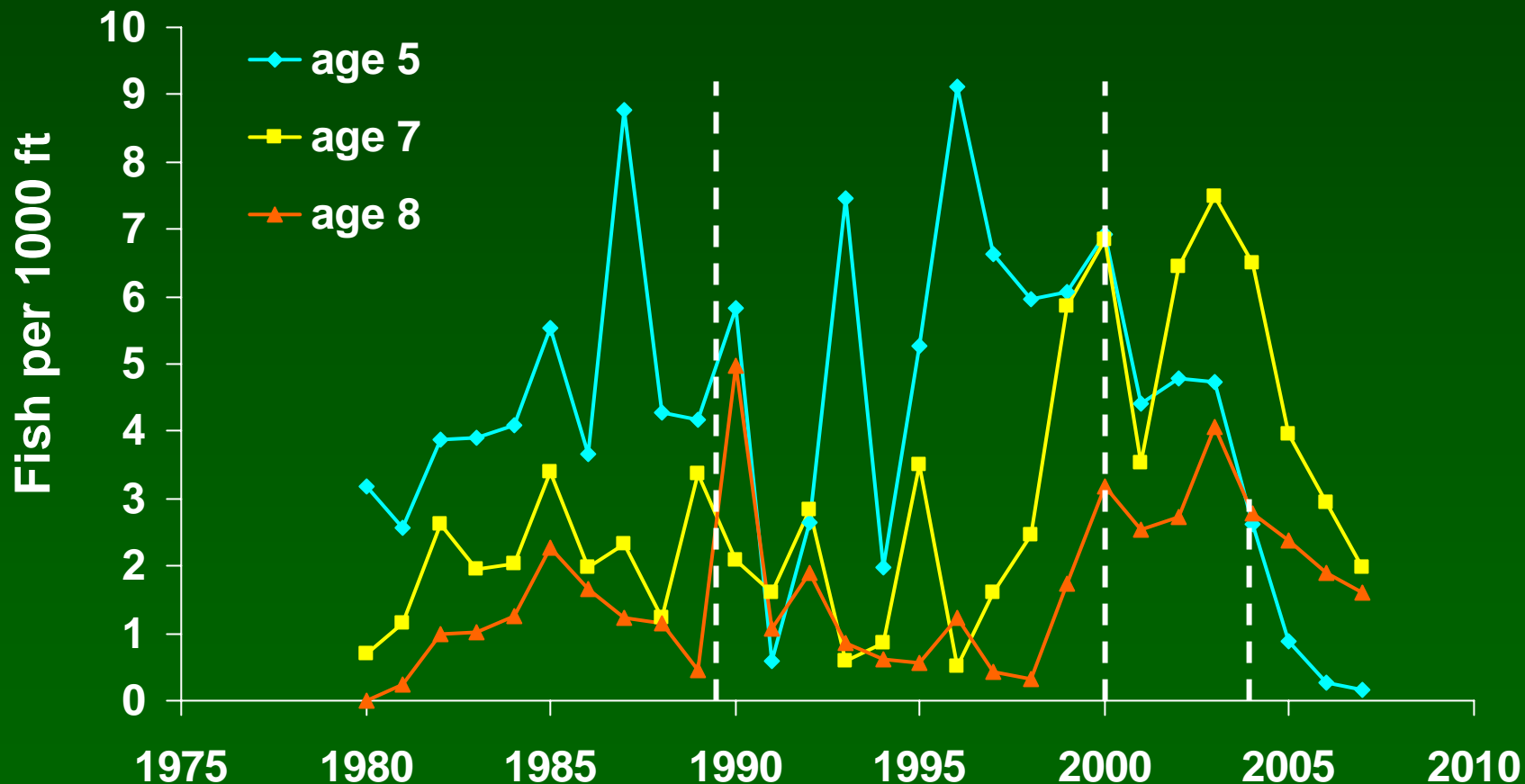


# Ages 5, 7-8 catch rates

## north-central Lake Huron



# Ages 5, 7-8 catch rates southern Lake Huron

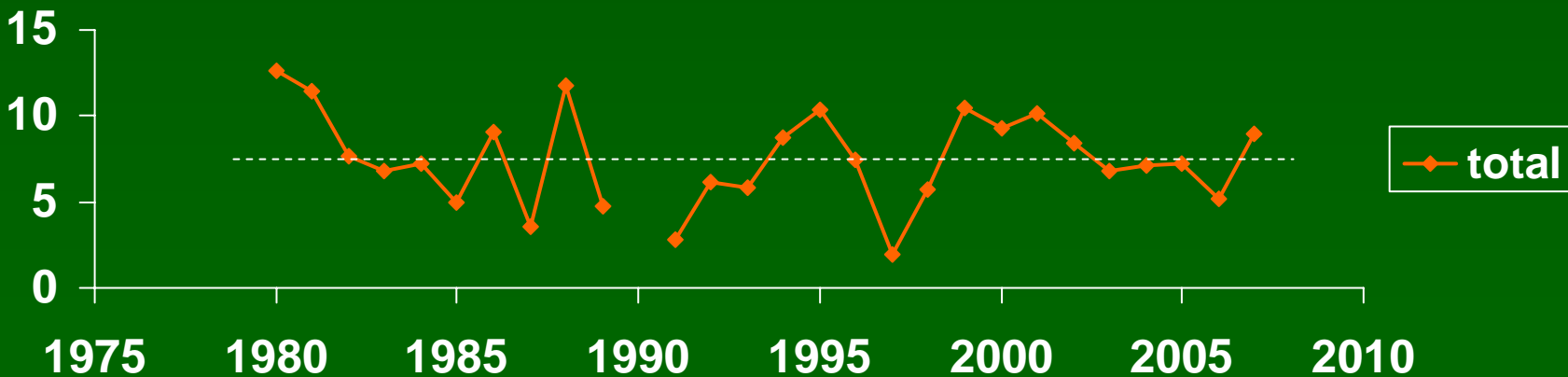
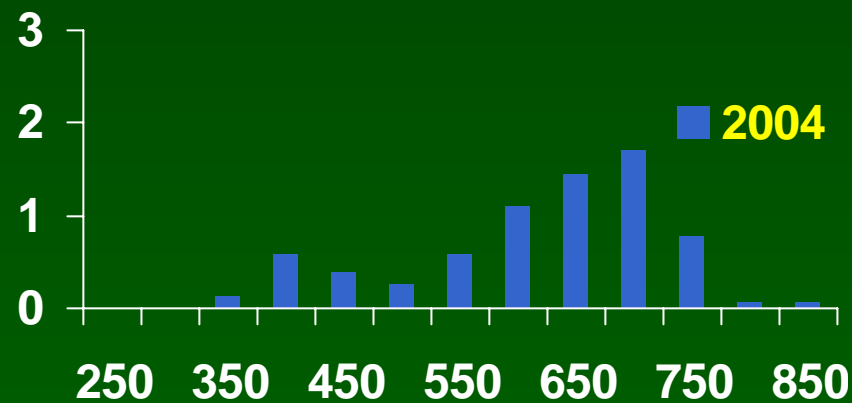
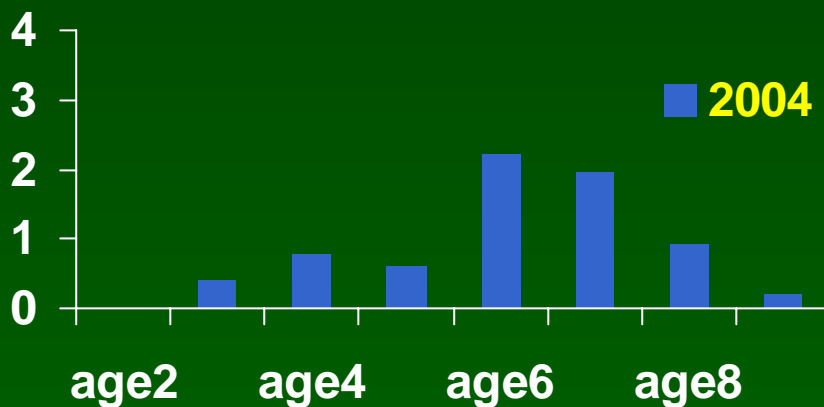
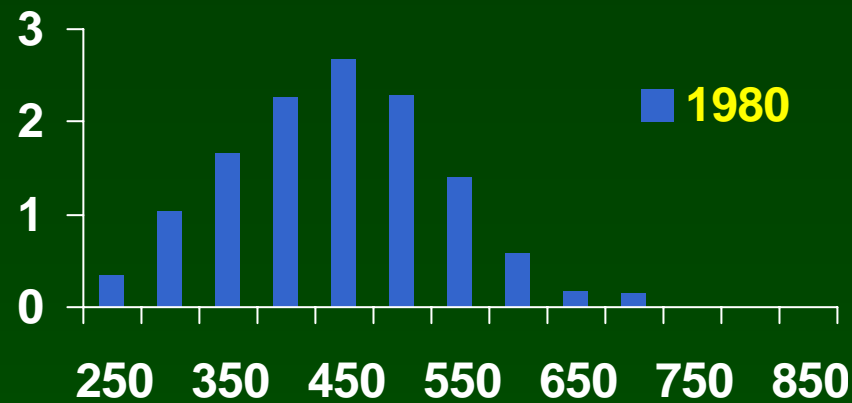
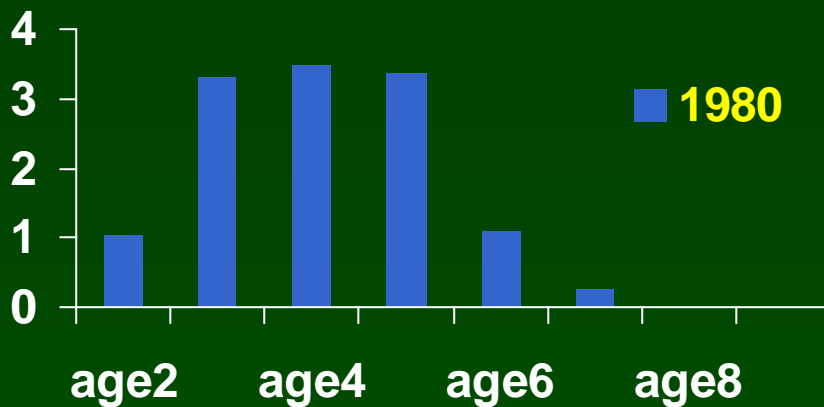


# Total catch rates and age/size structure

- Right-truncated versus left-truncated age/size structures;
- In the south and north-central, recent decline in total catch rate were due to rapid decline in ages 4-6 catch rates.
- Complication of depth distribution and weather conditions

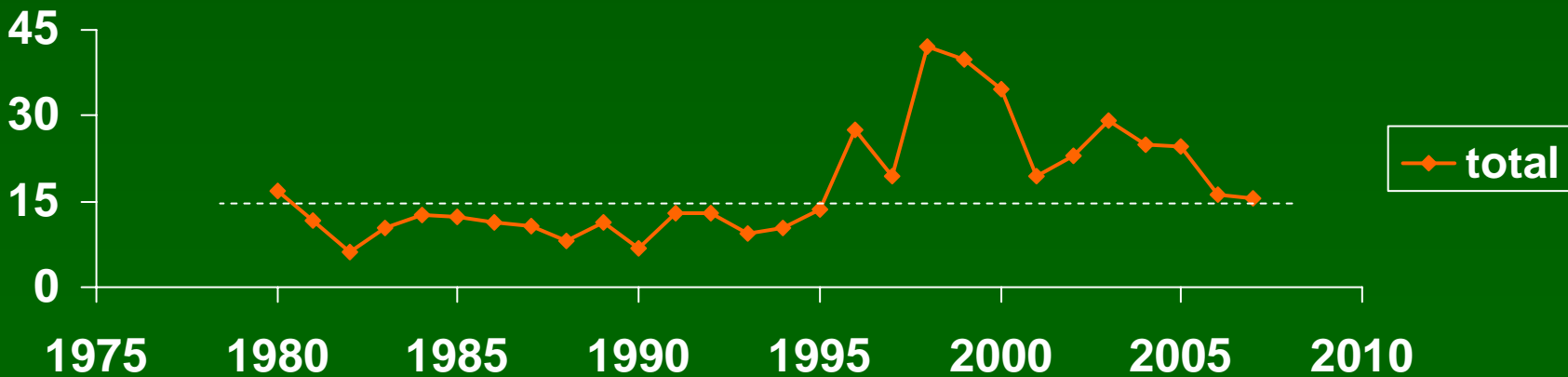
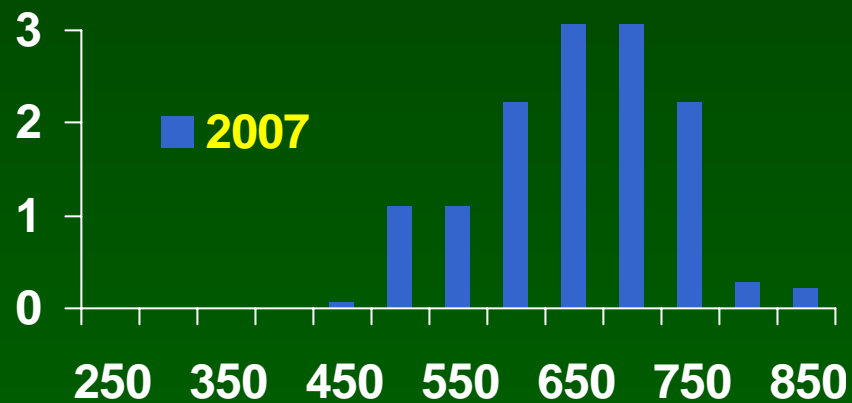
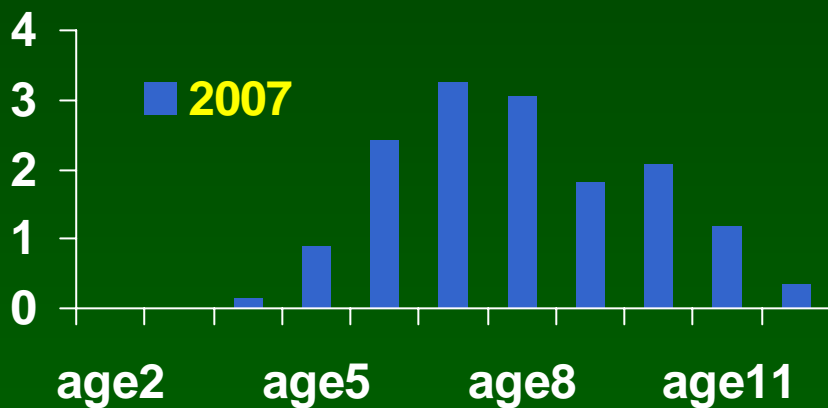
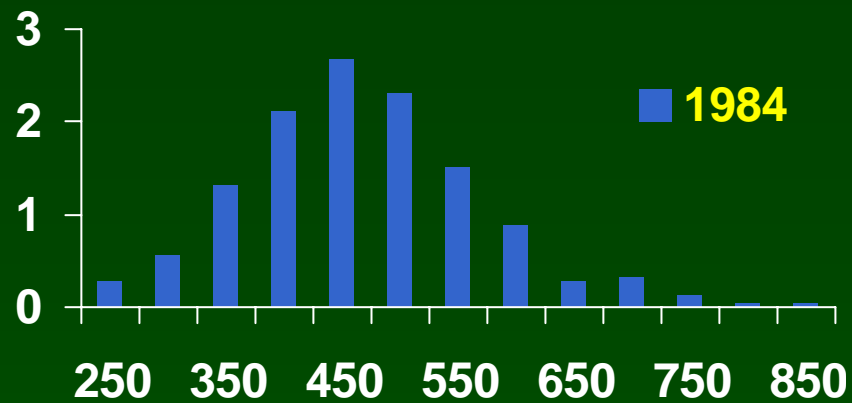
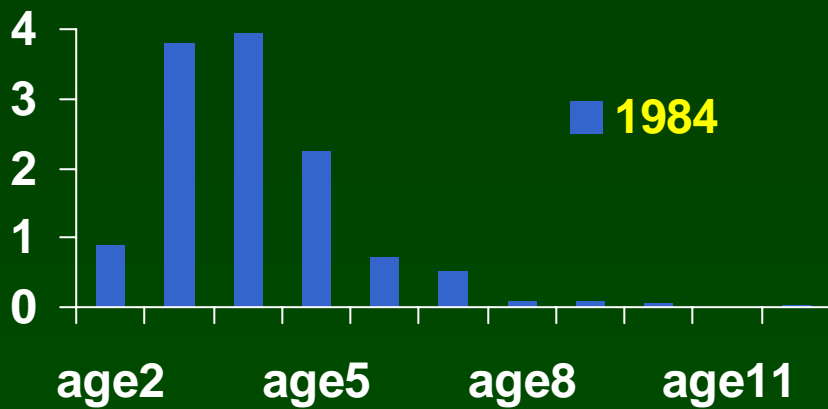
MH1

Lake trout per 1000 ft



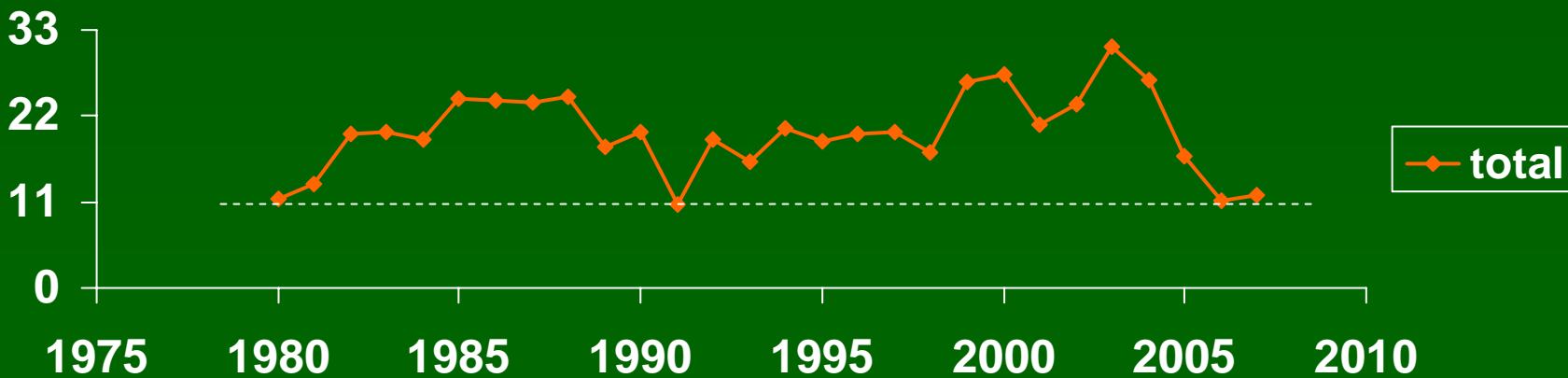
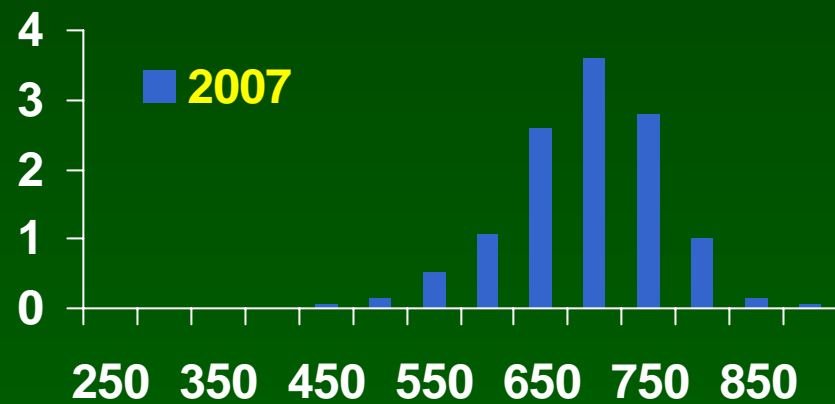
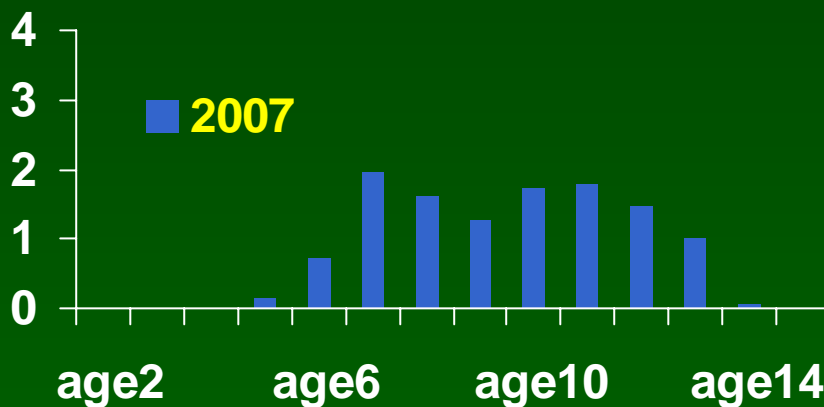
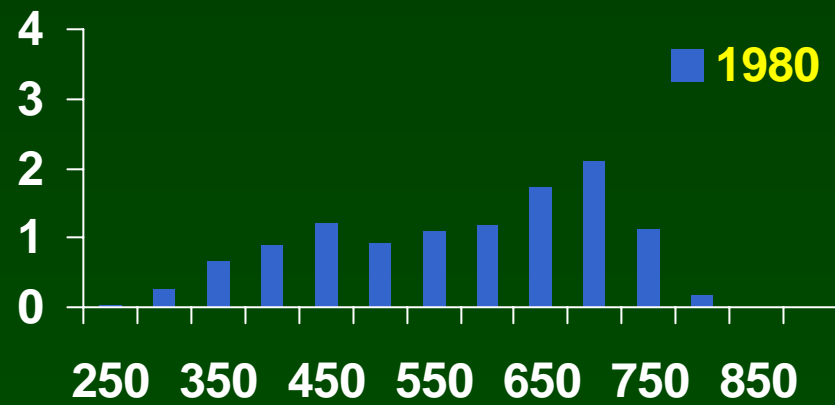
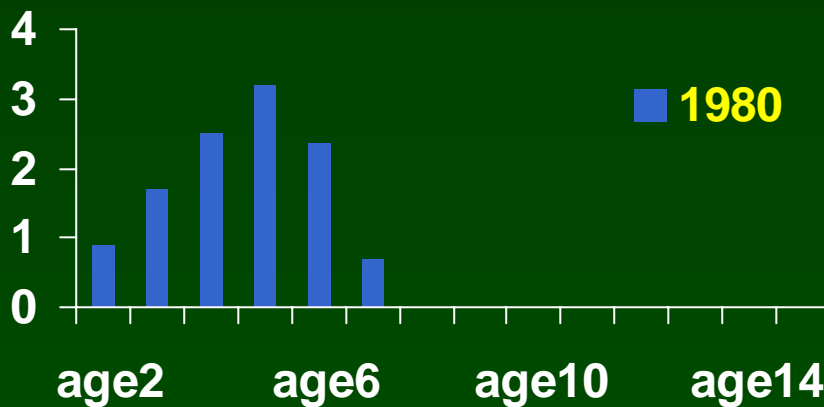
MH2

Lake trout per 1000 ft



MH345

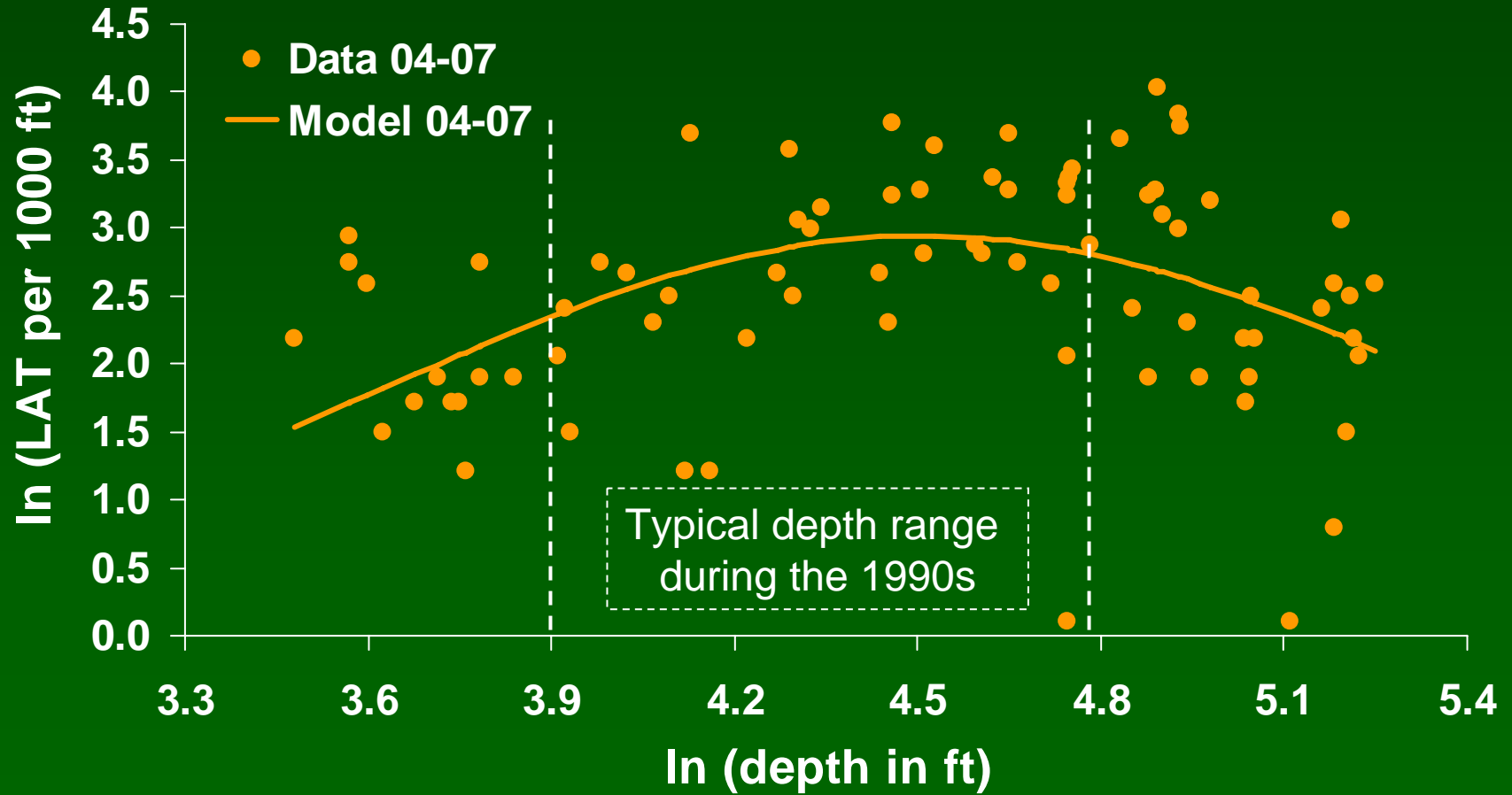
Lake trout per 1000 ft





# Complication of depth distribution

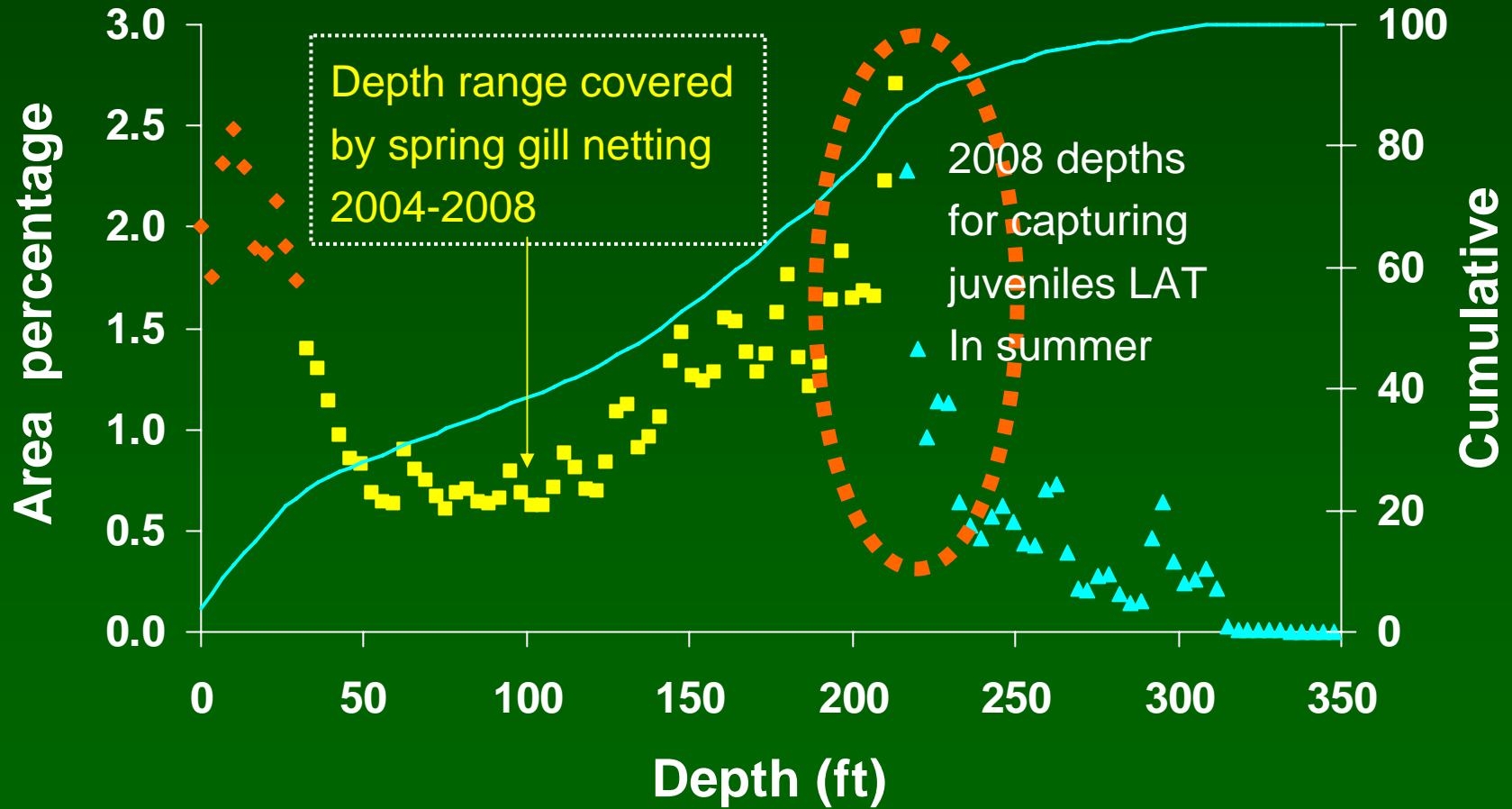
## the example of southern Lake Huron



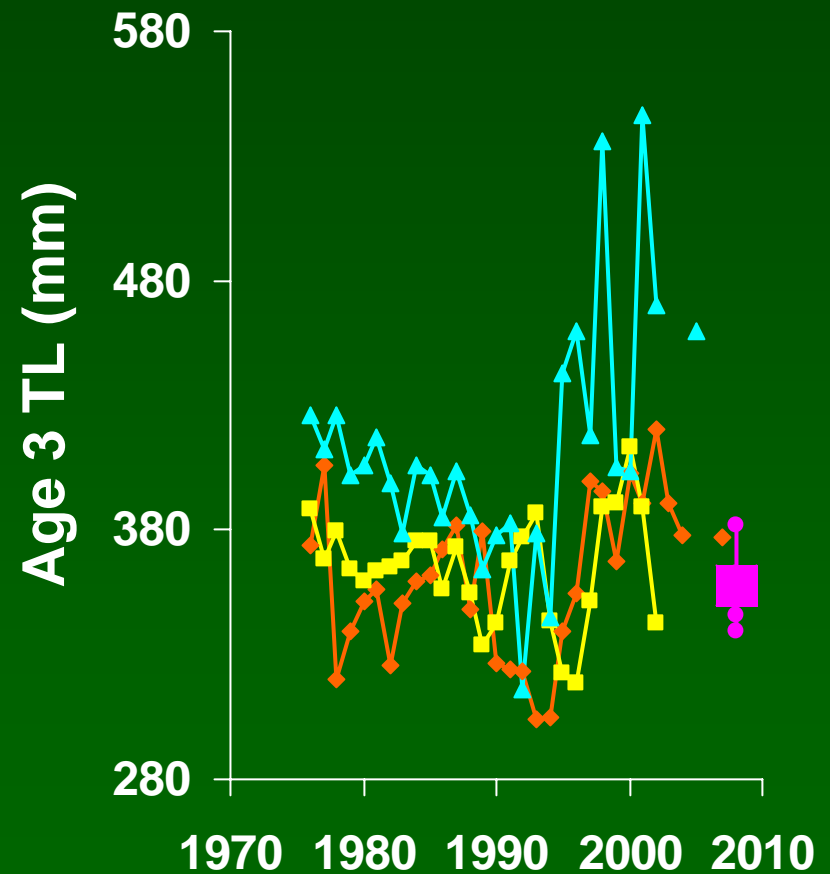
# Evidence of delayed recruitment

- Spring survey:
  - relative larger size at age
  - from relatively shallow waters,
  - declined catch rates in recent years
- Summer survey:
  - much smaller size at age
  - from much deeper waters,
  - often much higher catch rates.

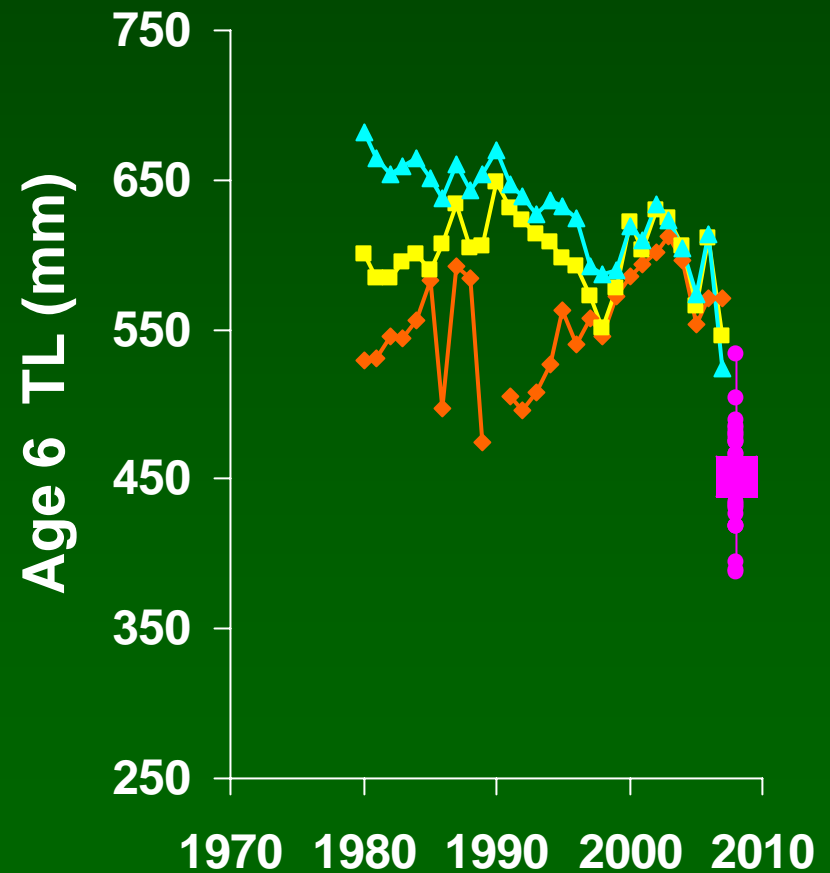
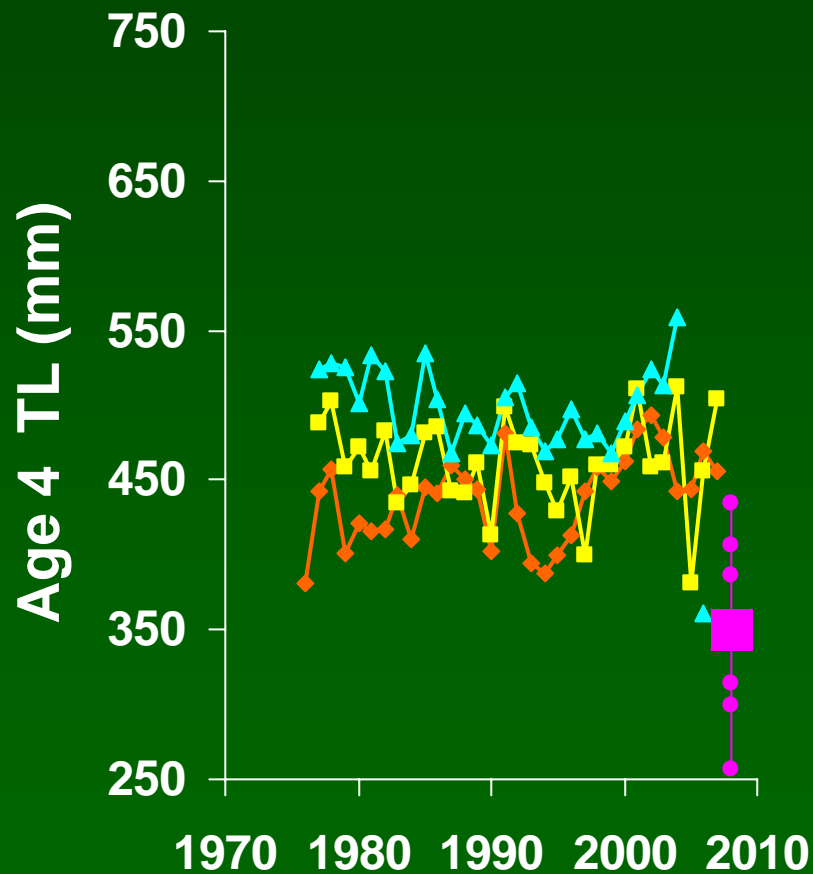
# Area percentage at depth in southern Lake Huron



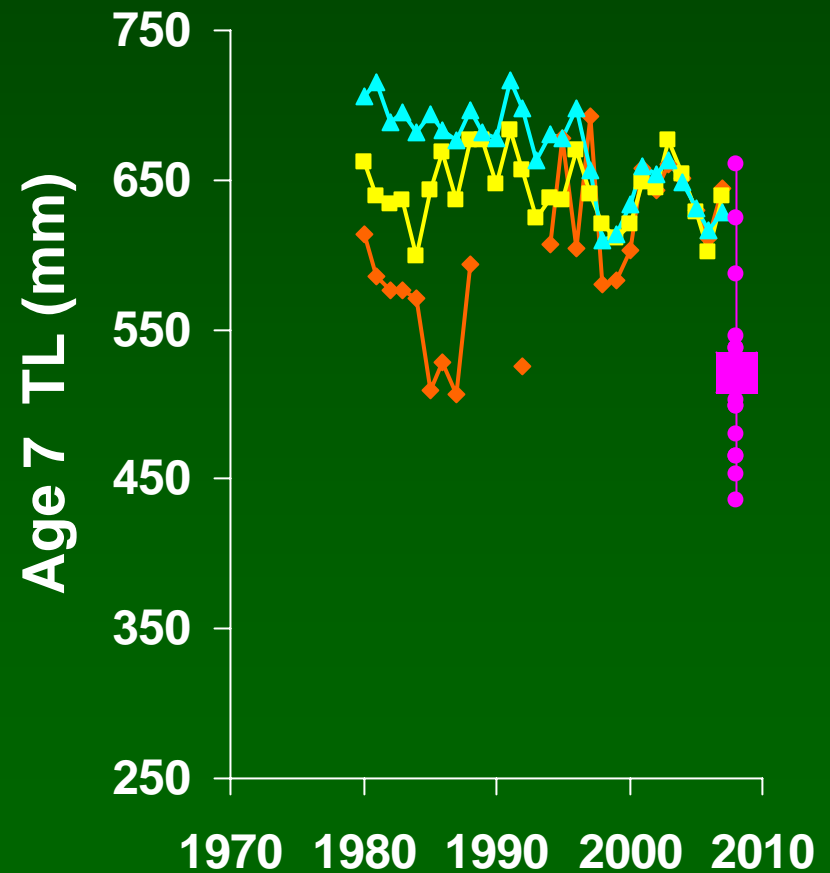
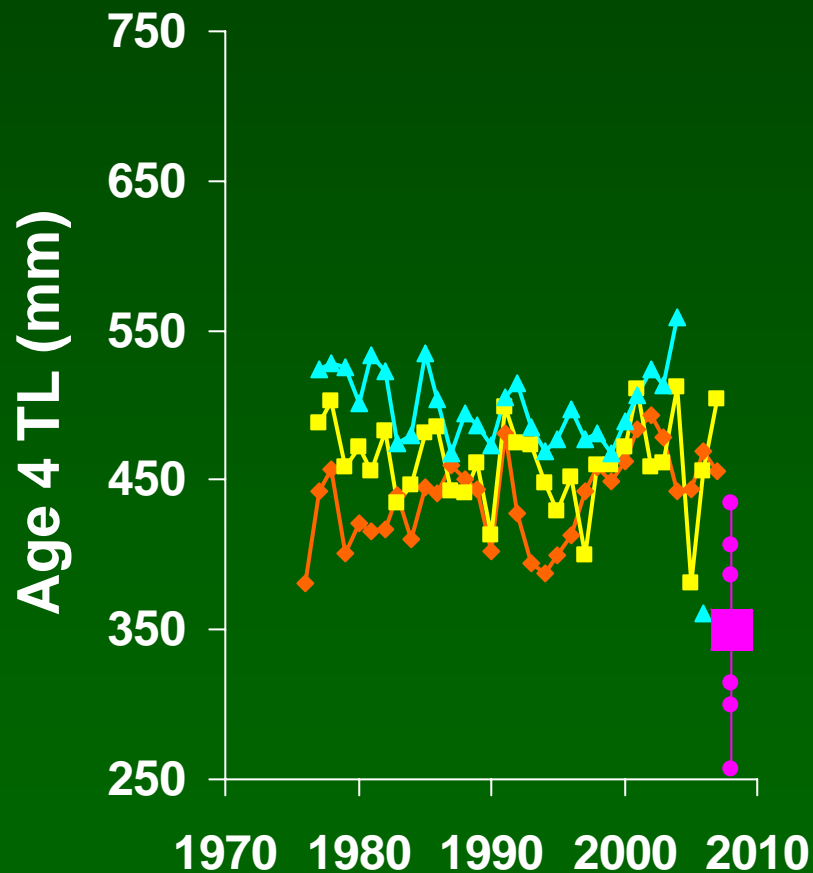
# Annual and region average in May, compared with individual & average in Aug, 2008



# Annual and region average in May, compared with individual & average in Aug, 2008



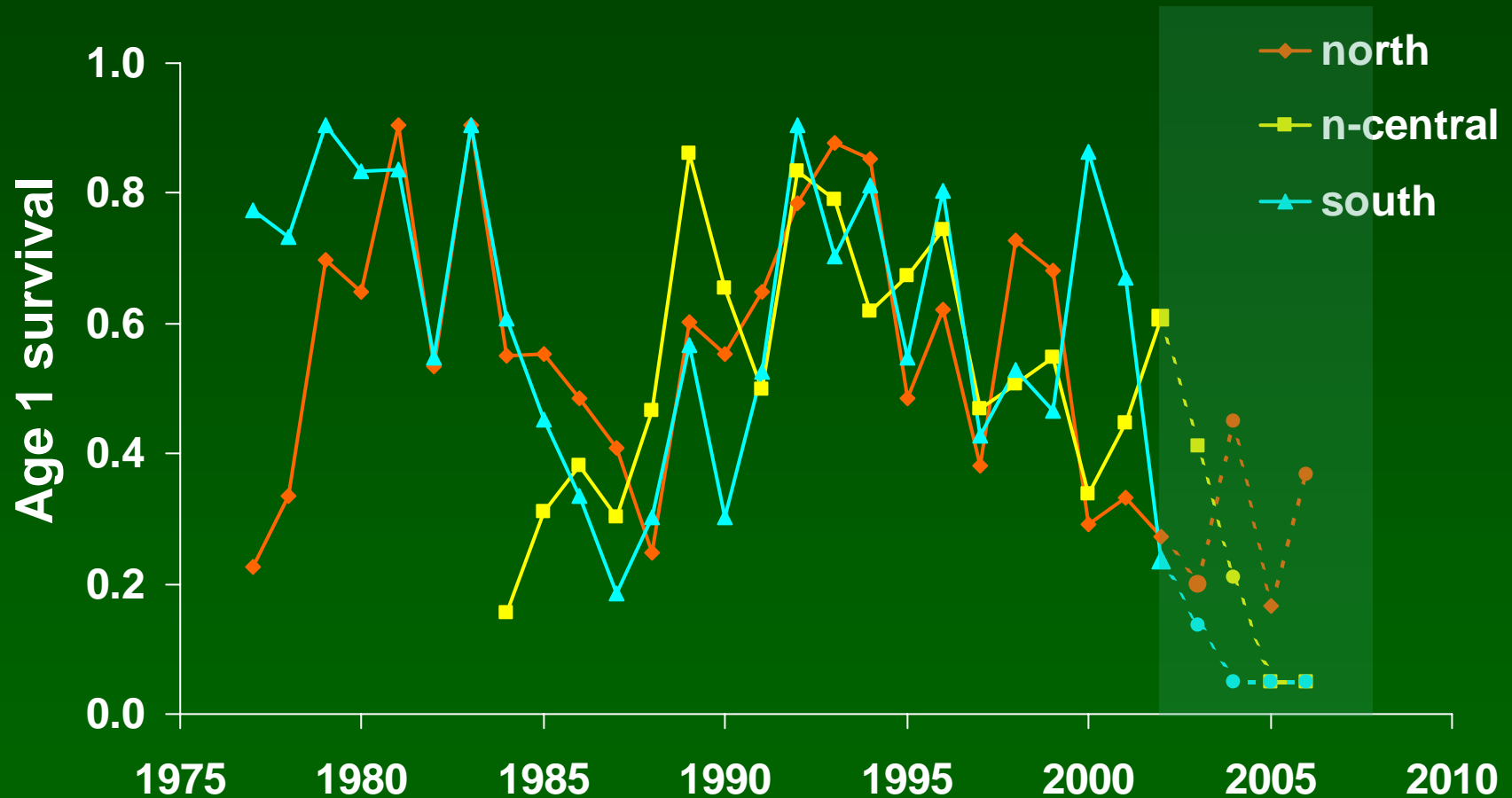
# Annual and region average in May, compared with individual & average in Aug, 2008



# Factors influencing recruitment

- Substantially delayed recruitment imply lower level recruitment.
- Age 1 survival:
  - Adult density;
  - Food availability to adults.

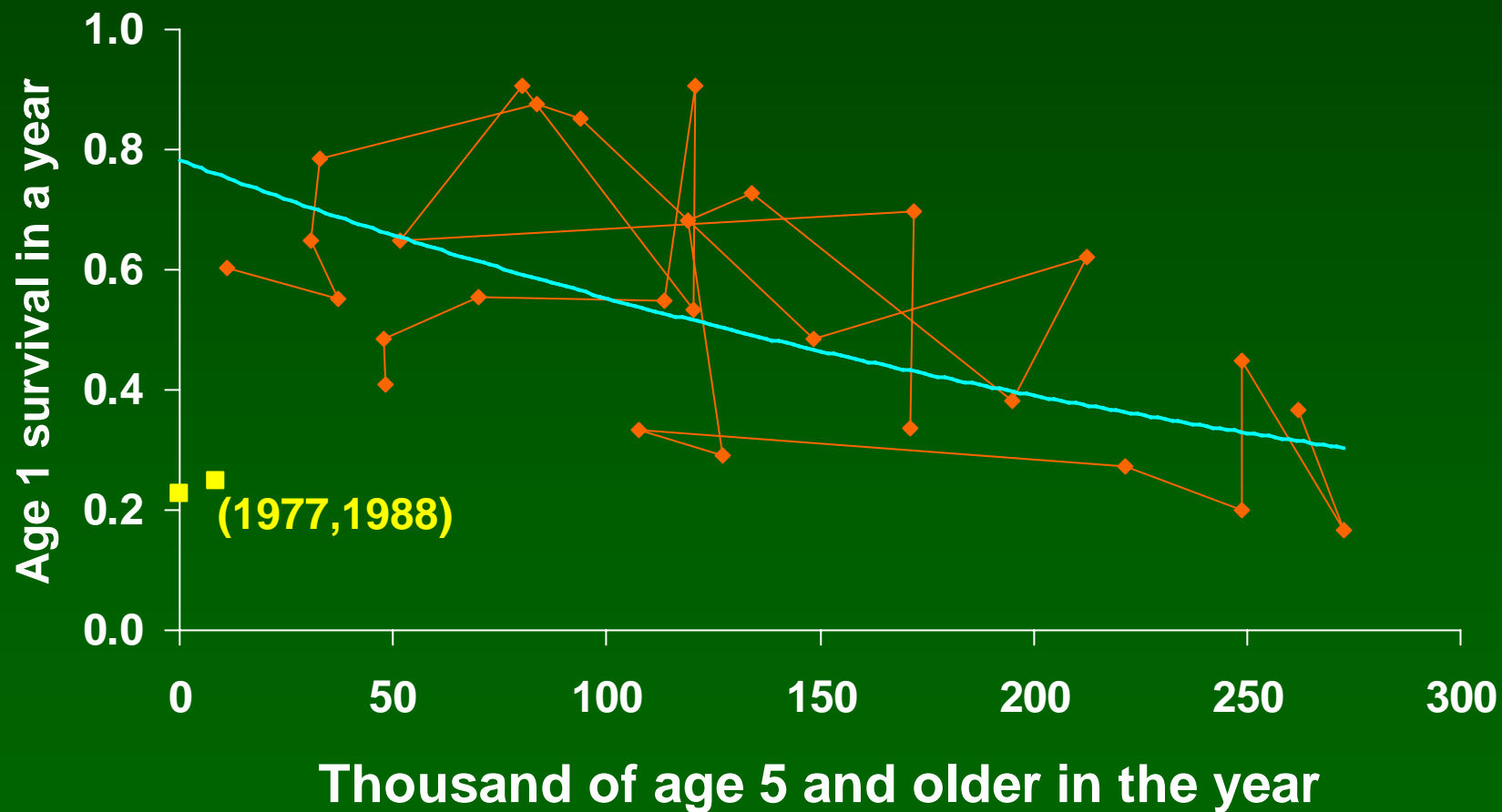
# SCAA estimates of age 1 survival





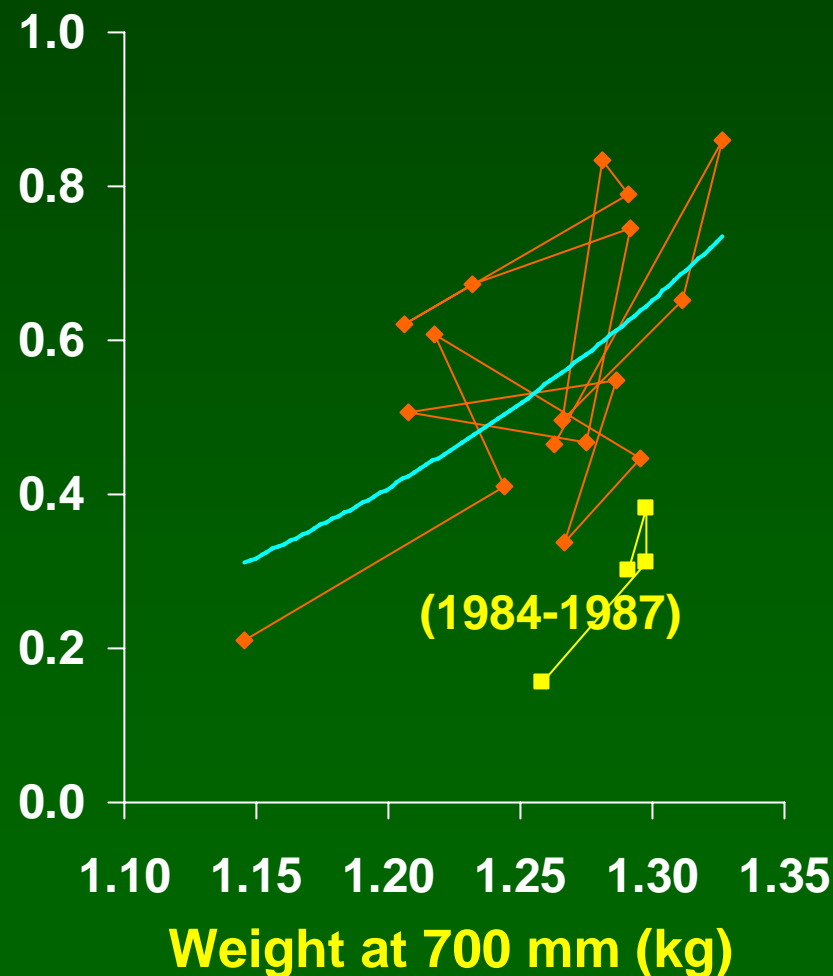
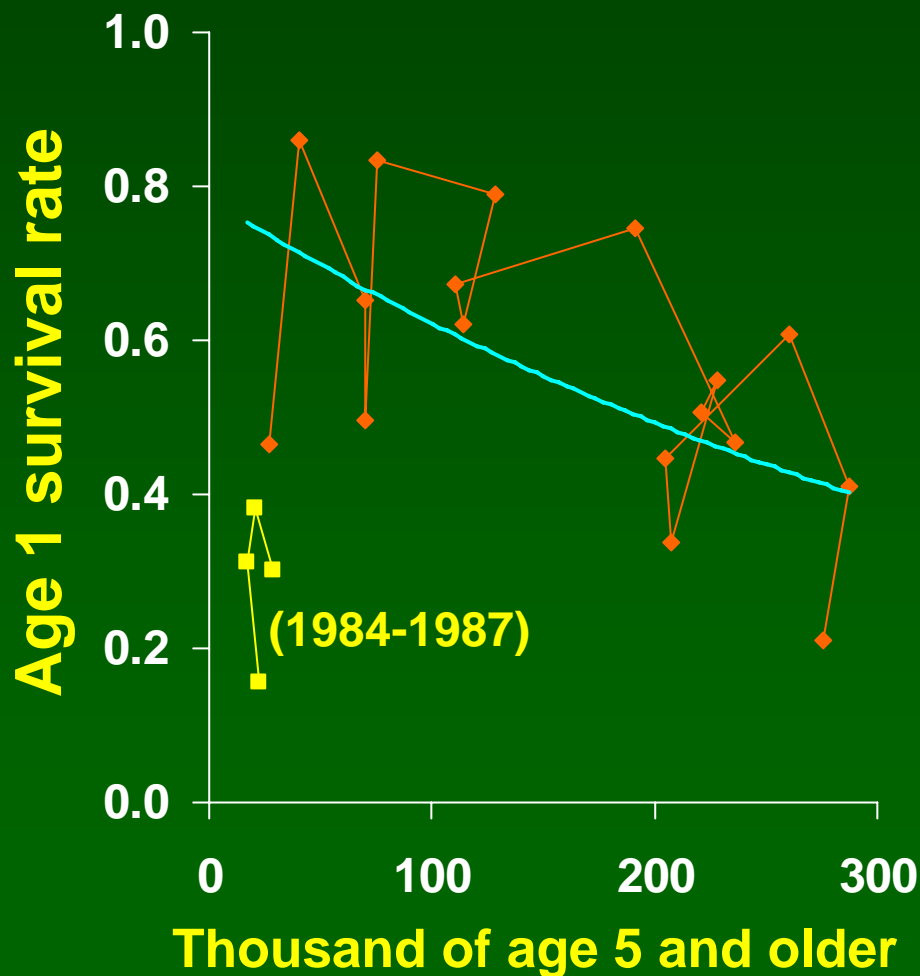
# Age 1 survival versus adult abundance

## northern Lake Huron SCAA



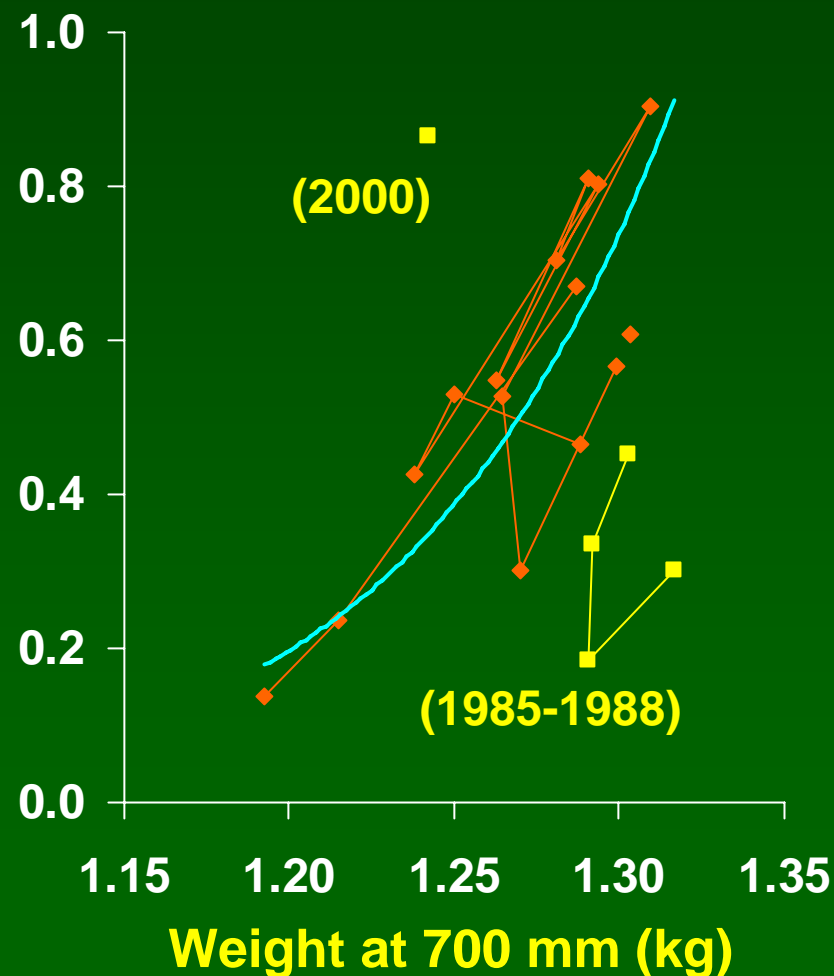
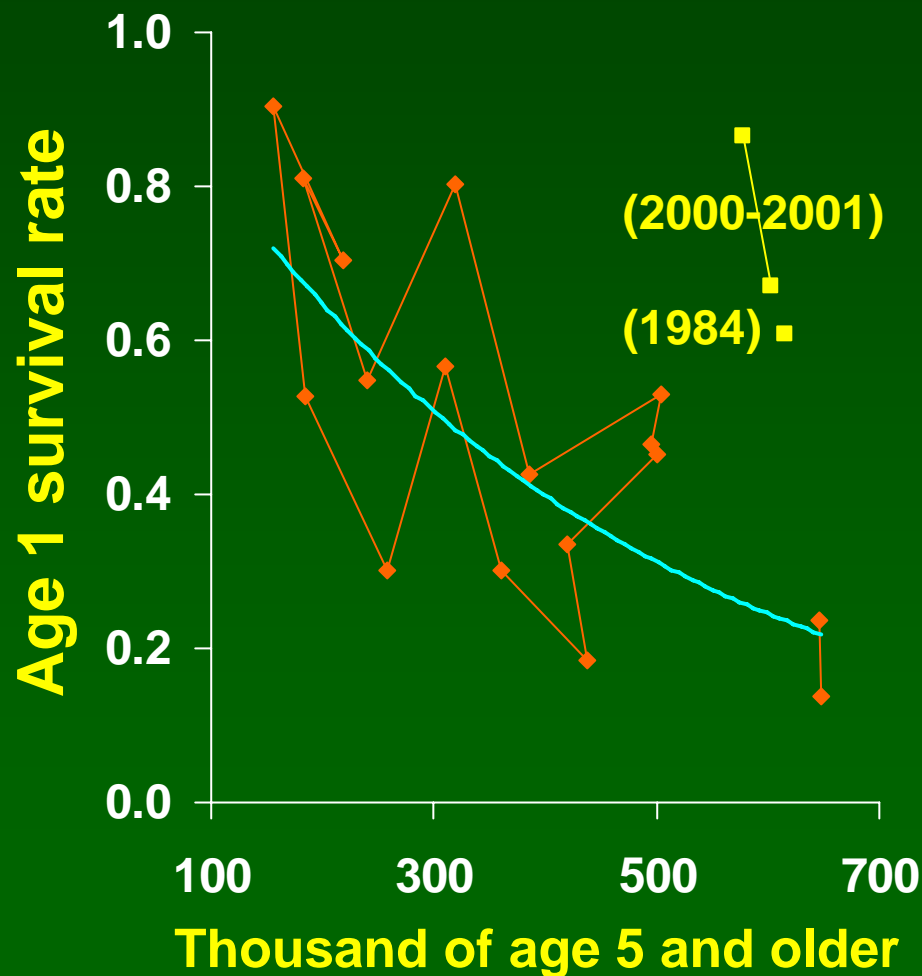
# Age 1 survival versus adult abundance

## north-central Lake Huron SCAA



# Age 1 survival versus adult abundance

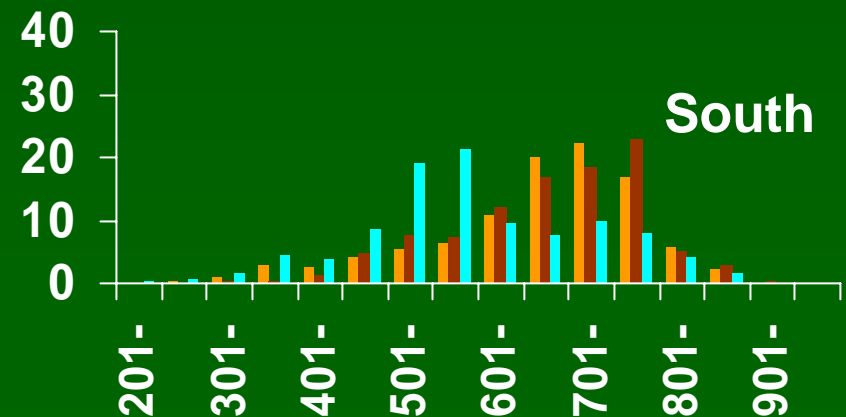
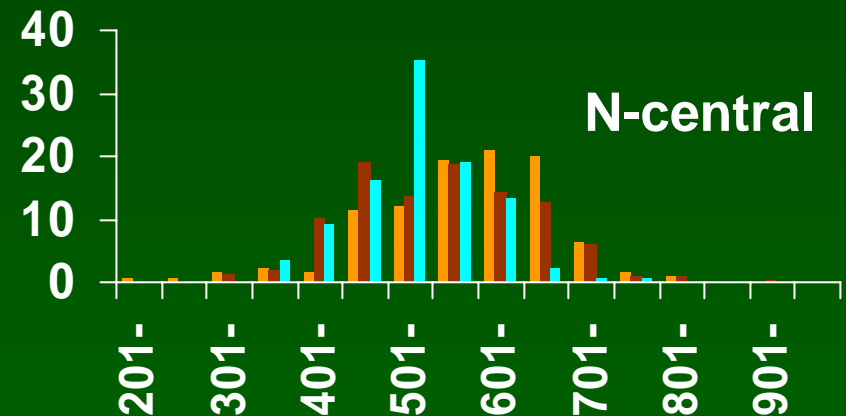
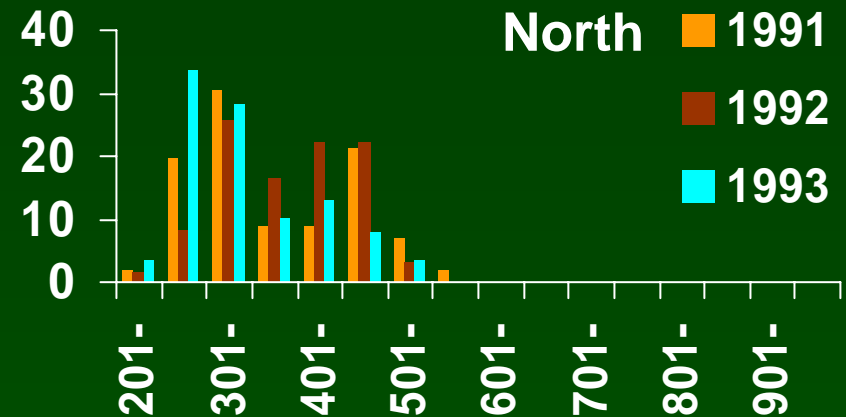
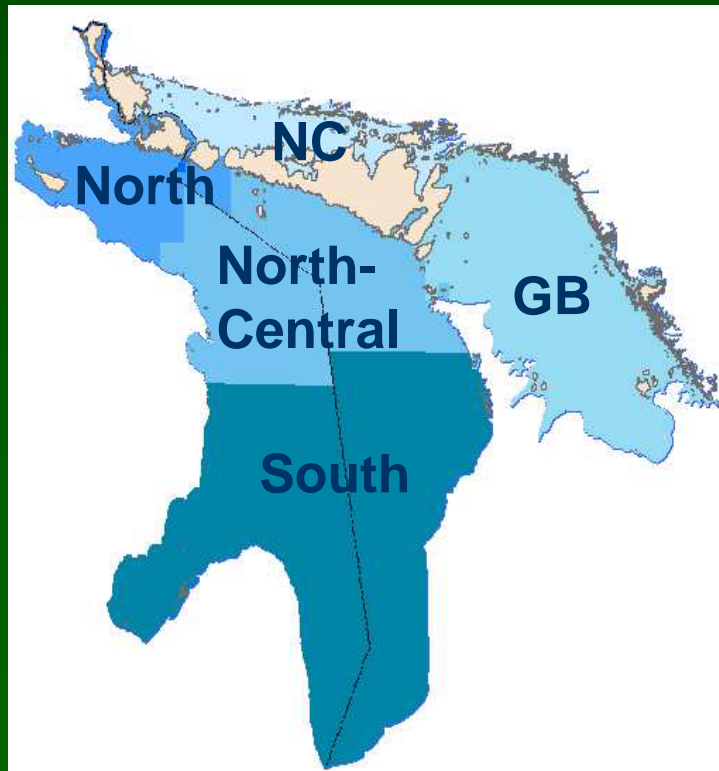
## southern Lake Huron SCAA



# The challenge

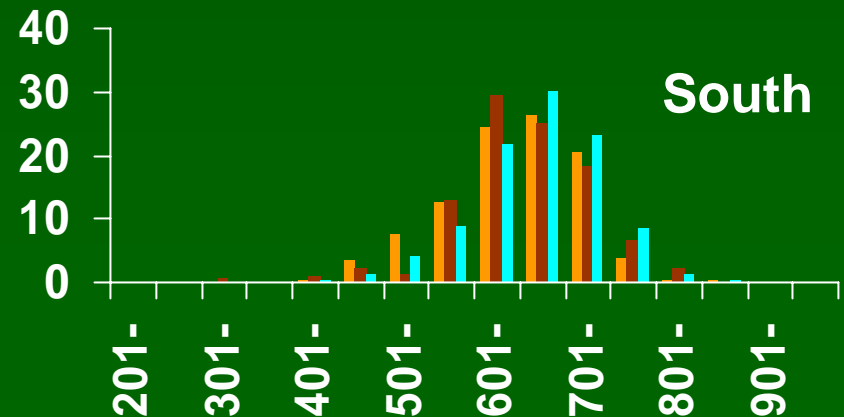
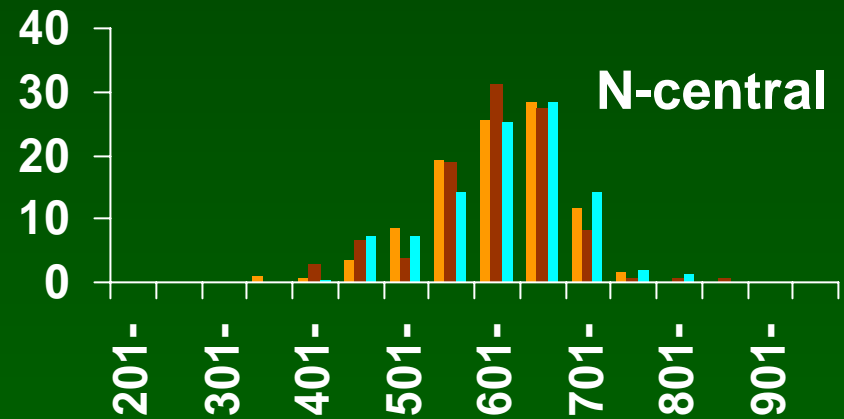
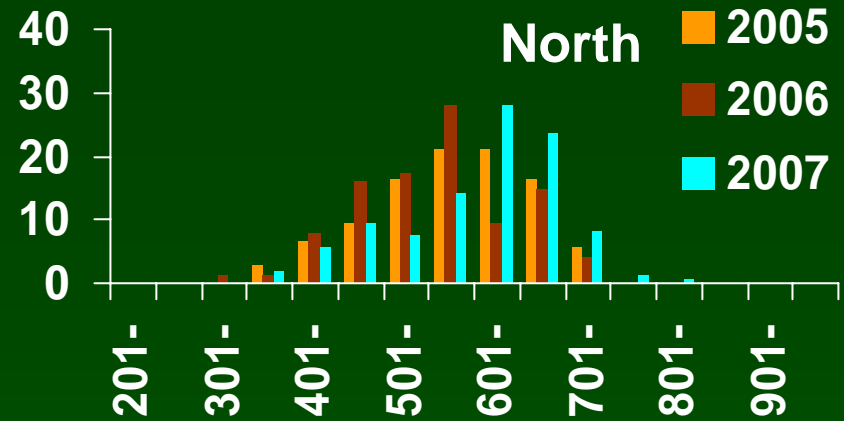
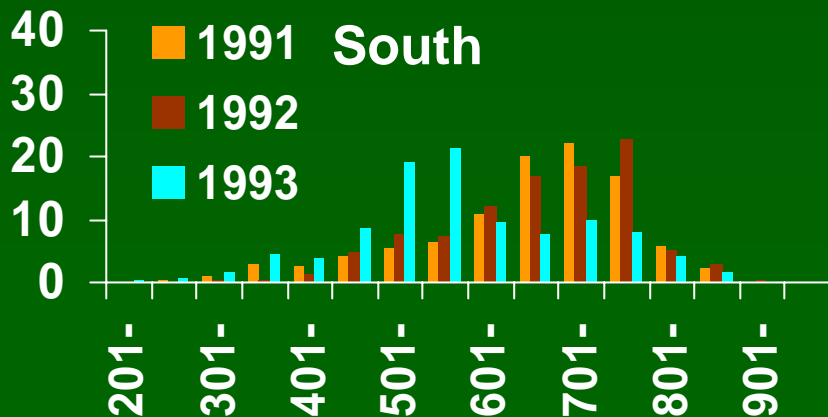
- Build up adults and maintain age 1 survival, in changing food-web conditions.
- Adequate fishery management for maximizing the opportunity of natural reproduction and recruitments.

# Percentage of size groups 1991-1993



# Percentage of size groups

Spatial and temporal comparison



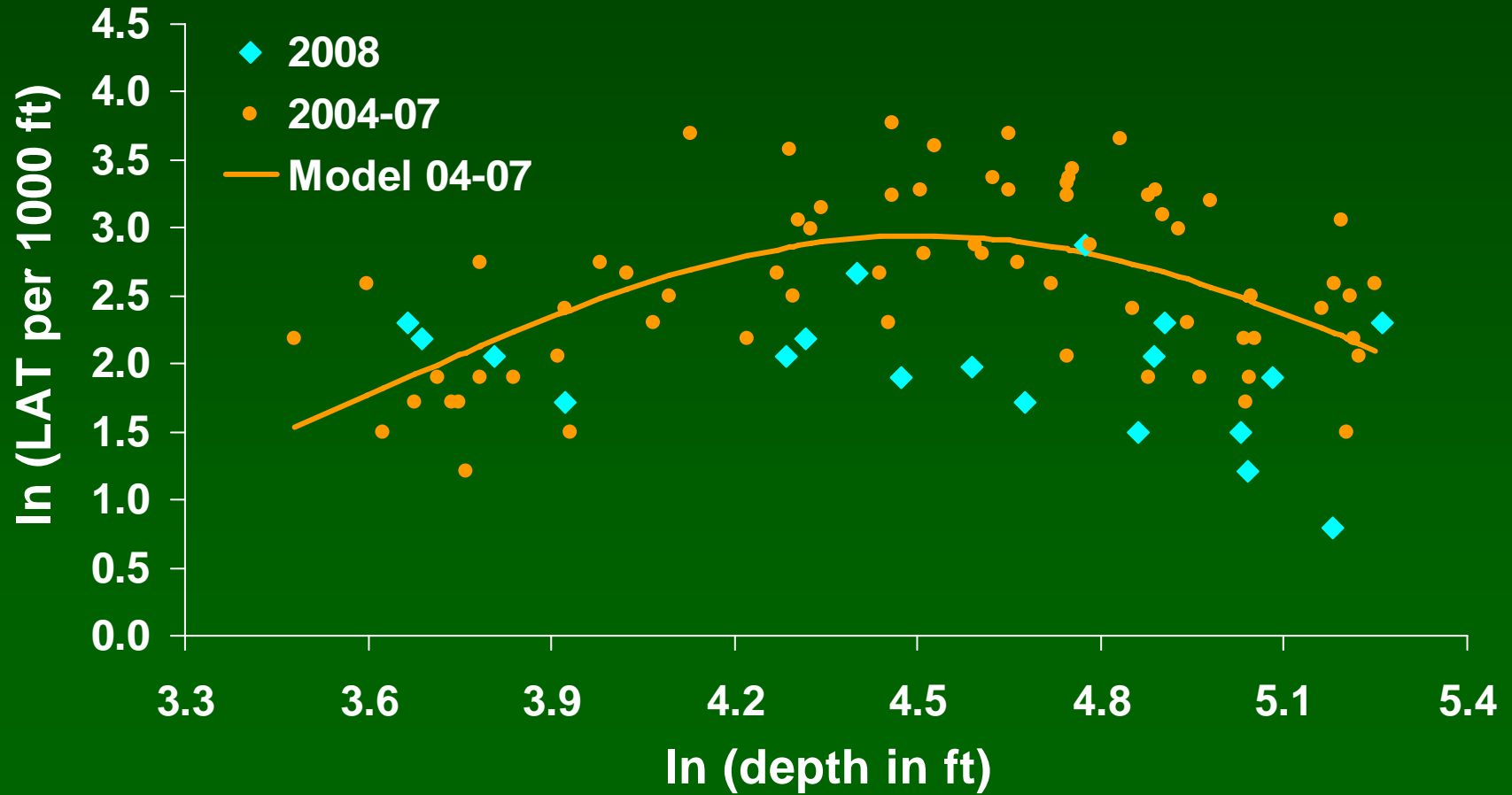


- **Process comparison among lakes**
  - Processes
  - Food-web conditions
  - Importance of managements
- **Need for understanding lake trout juvenile ecology**
  - Respond to food-web changes
  - Respond to changes in adult density
- **Recruitment regulation and lake trout stocking**
  - Lake trout stocking, and salmon stocking
  - Lake trout stocking in changing food-webs
  - Lake trout stocking and adult densities
- **Survey measurement in changing environments**
  - Adequacy of current surveys
  - Fall, spring, and summer surveys (gillnetting and trawling)
- **The next workshop**
  - Topics: management strategies, and ....
  - Format: the same? IAGLR or AFS symposium? ....





# Spring gillnetting catch rate in southern Lake Huron (MH345)



# Parameters indicating changes in lake trout depth distribution in southern Lake Huron

Year	Maximum catch rate		Optimum depth (ft)		Depth dispersion of catch rate	
	average	95% confidence	average	95% confidence	average	95% confidence
2004	37.9	36.5--39.3	188.6	177--201	1.60	1.54--1.66
2005	18.7	18.4--19.0	132.7	124--143	2.02	1.86--2.19
2006	15.8	15.6--16.1	120.9	104--141	2.41	2.15--2.67
2007	12.1	11.9--12.2	91.8	80--106	3.14	2.89--3.39
2008	9.1	8.9--9.3	48.4	43--55	2.55	2.24--2.87