

Adult Striped Bass Harvest and Survival Rate Estimates: A Forty-Year Summary and Methodology Review

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Adult Striped Bass Harvest and Survival Rate Estimates

- Overview of Tagging Program (Mark-Recapture)
- Equations
- Annual Estimates and Potential Biases

Adult Striped Bass Mark-Recapture Study

- Ongoing since 1969
- Provide estimates
 - Absolute abundance
 - Rates of harvest and survival
- Use fyke traps and gill nets
- Sacramento River (Knights Landing)
- San Joaquin River (Schad Landing)

Adult Striped Bass Mark-Recapture Study

- Tag: Petersen disc tag
 - Applied to fish legal size and above
 - Applied on right-side, below first dorsal fin
 - Non-reward and reward
- Record fork length (cm), sex, condition
- Collect scale sample for aging
- Tagging during spawning migration
- Tag as many as possible



“Return all discs to Fish and Game” appears on every tag

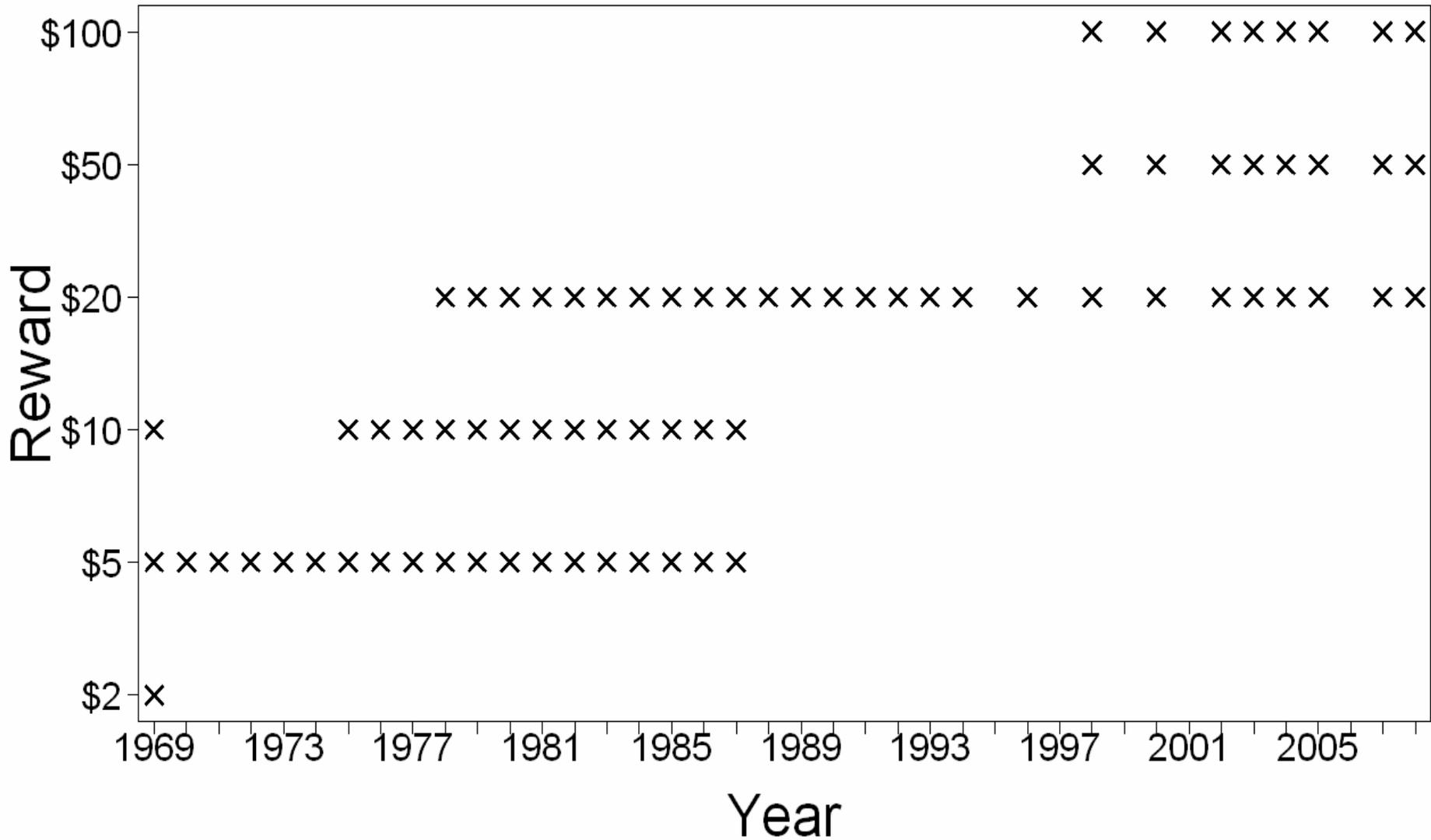
6-digit numeric non-reward tag

\$20 reward tag

\$50 reward tag

\$100 reward tag

Adult Striped Bass Reward Tag Timeline



Adult Striped Bass Mark-**Recapture** Study

- Recaptures
 - By angler
 - Subsequent tagging seasons
- Angler Tag Returns
 - Mail
 - Creel survey

Adult Striped Bass Return Rate Equation

- R_i = number of *first-year* mail tag returns from group M_i
- M_i = number of tags released
- i = tag value

$$\hat{f} = \frac{R_i}{M_i}$$

Adult Striped Bass Response Rate Equation

- Ratio of return rate of non-reward tag (nr) to reward tag (r)
- Ratio corrects for non-response

$$\hat{r} = \frac{\hat{f}_{nr}}{\hat{f}_r}$$

Adult Striped Bass Harvest Rate Equation

- Harvest Rate
- $R_{(\text{mail})}$ = number of first-year non-reward tags returned by mail
- $R_{(\text{creel})}$ = number of first-year non-reward tags collected during creel survey
- $r_{(\text{min})}$ = minimum estimated response rate
- M = number of non-reward tags released
- i = year

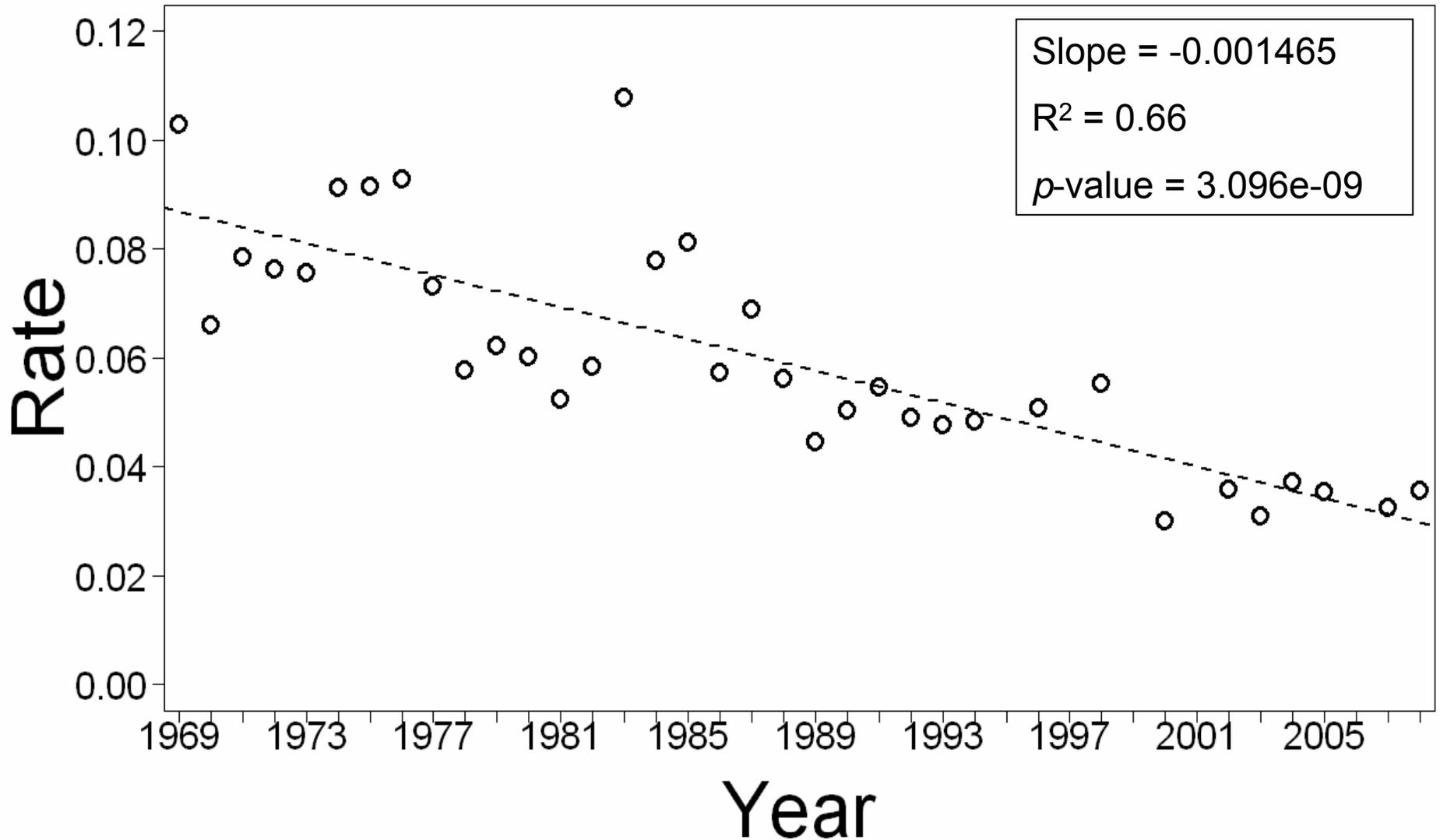
$$\hat{\mu} = \frac{\left(\frac{R_{(\text{mail})}_i}{\hat{r}_{(\text{min})}_i} + R_{(\text{creel})}_i \right)}{M(i)}$$

Adult Striped Bass (ASB) Survival Rate Equation

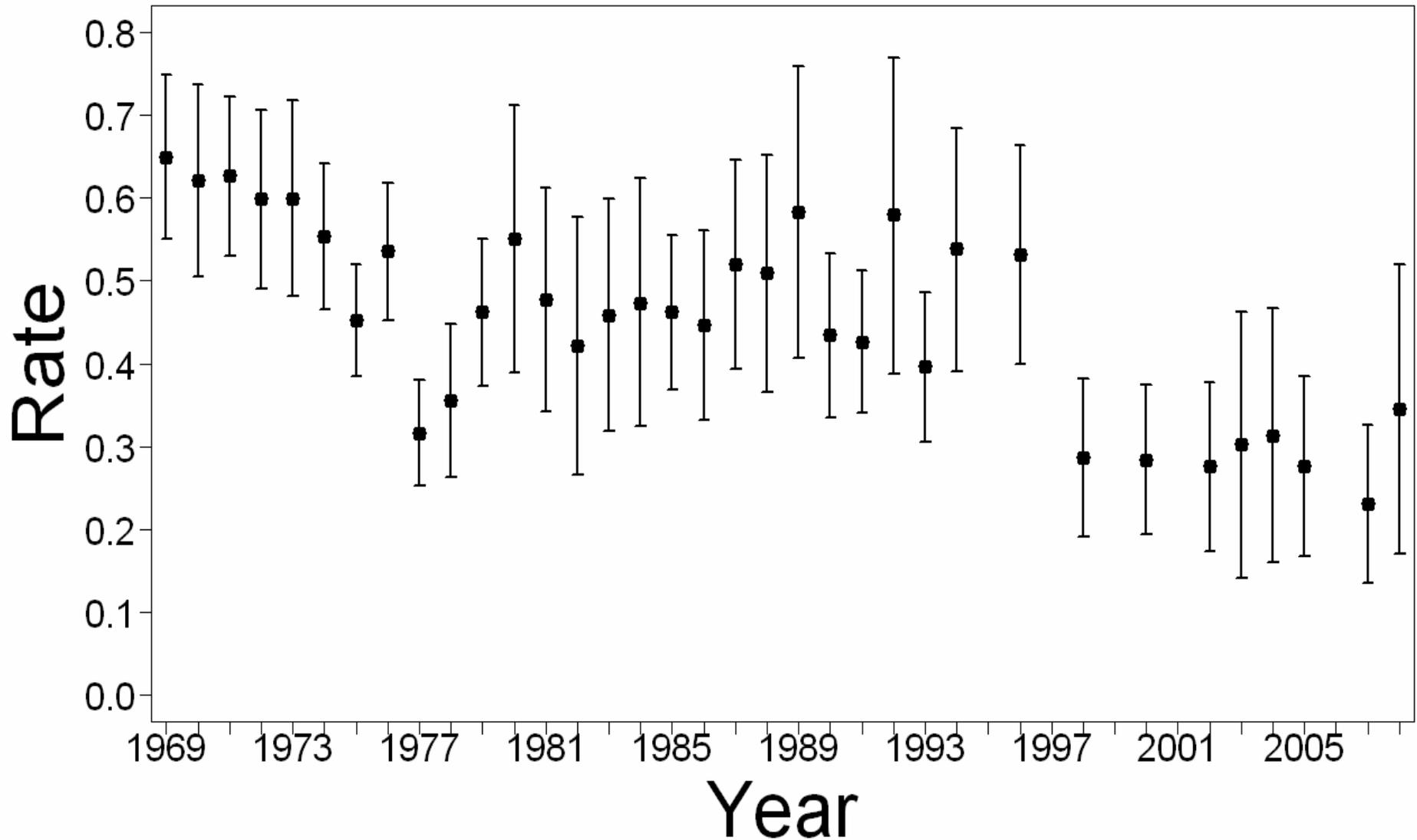
- Survival Rate (\hat{S})
- Ricker Equation 5.1
- R_{12} = recapture of year X tags in year X+1, post start of tagging (second-year tag returns)
- M_2 = number of striped bass tagged in year X+1
- M_1 = number of striped bass tagged in year X
- R_{22} = recapture of year X+1 tags in year X+1

$$\hat{S} = \frac{(R_{12}) \times (M_2)}{(M_1) \times (R_{22})}$$

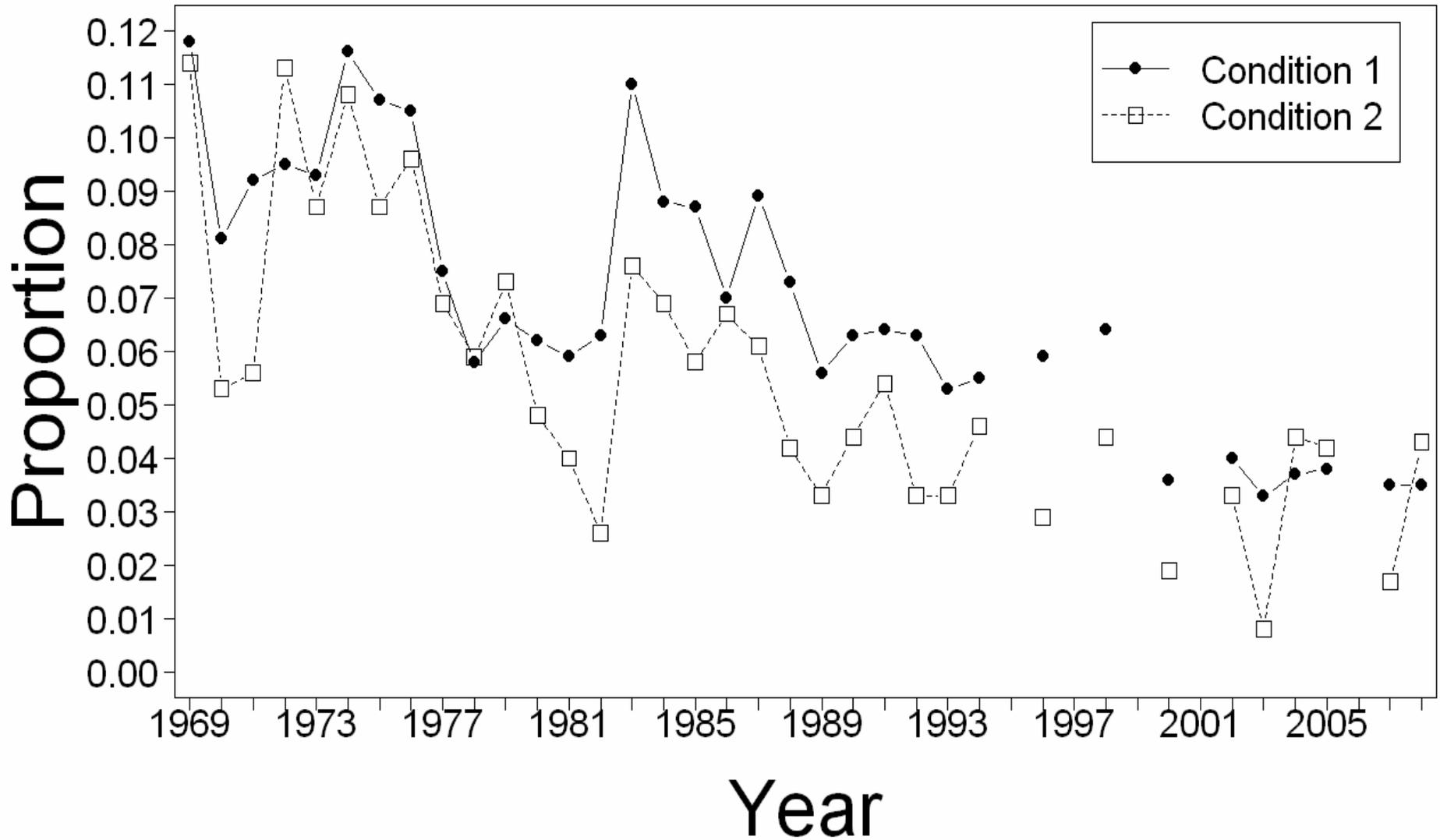
Adult Striped Bass Annual Mail Return Rate (Non-Reward Tag)



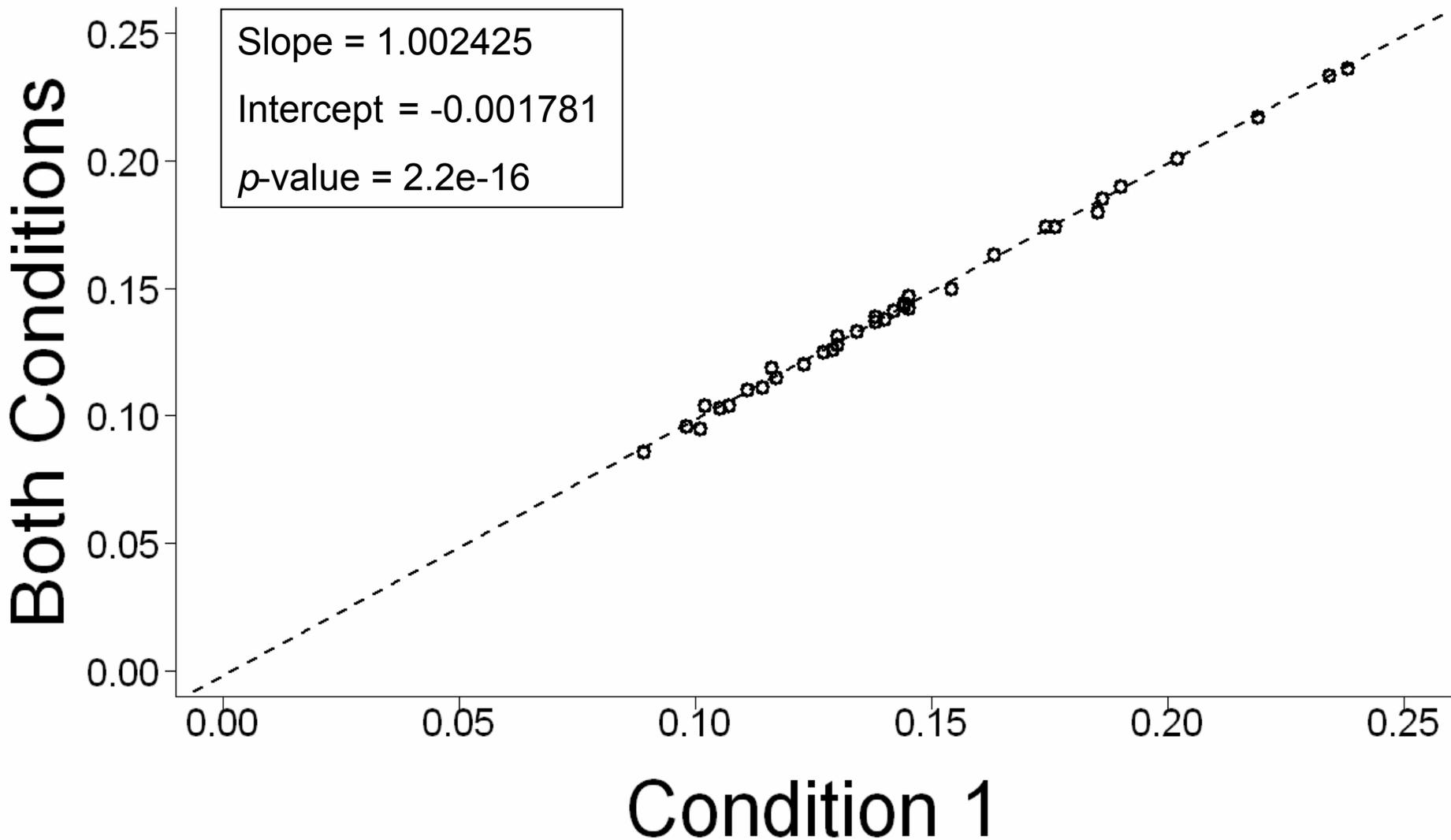
Adult Striped Bass Annual Response Rate Estimates



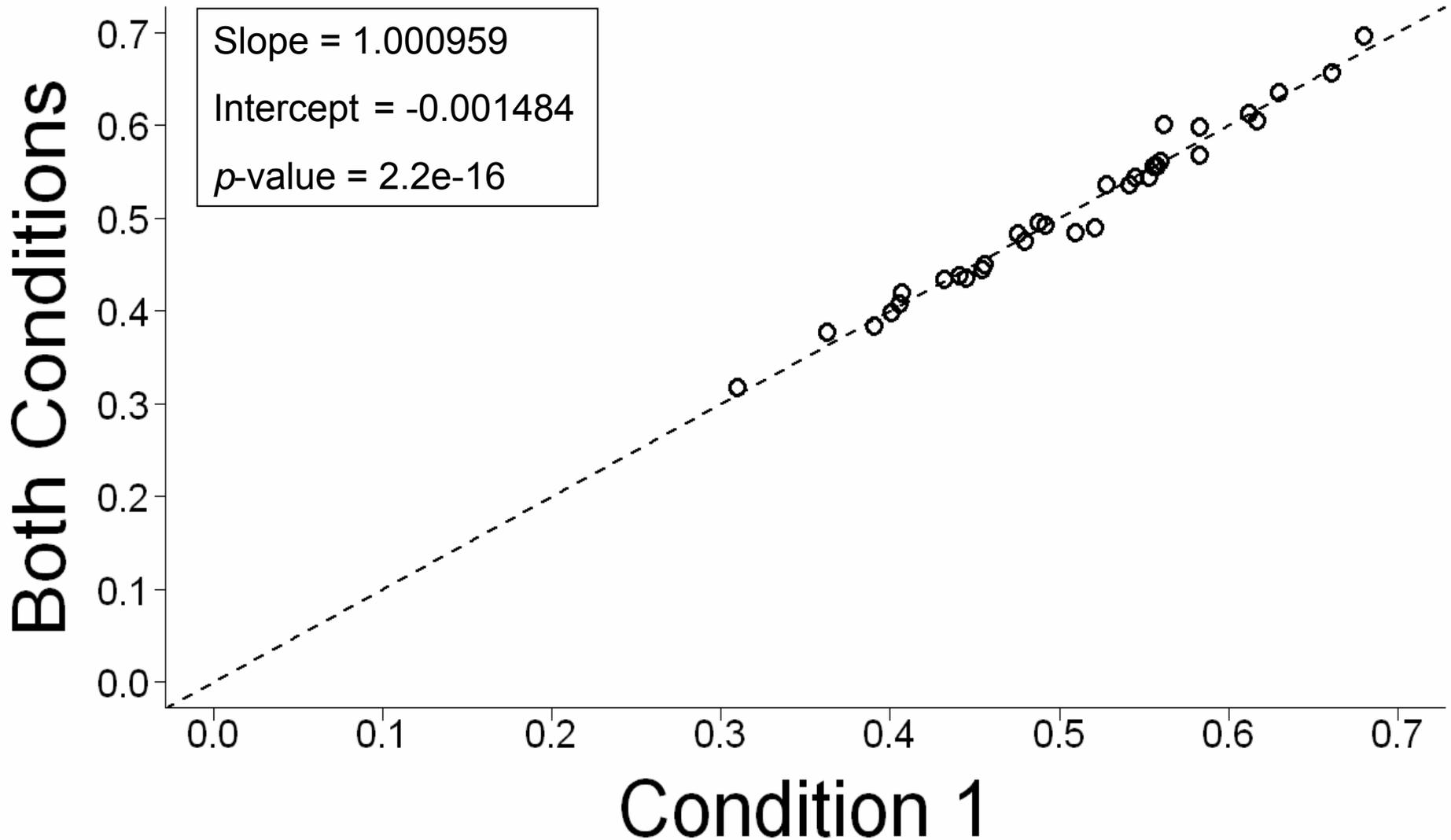
Adult Striped Bass Proportion of Tag Returns



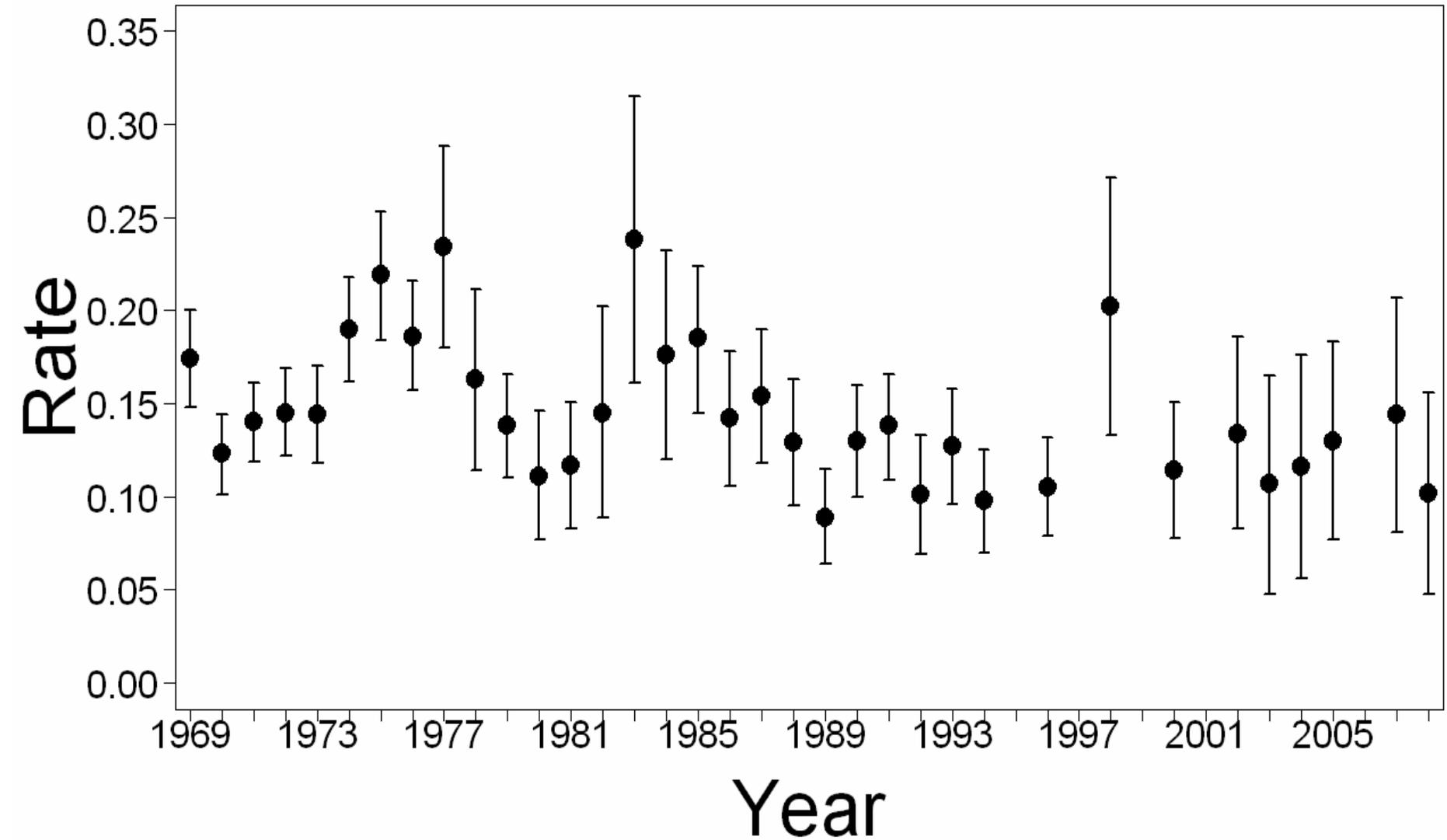
Adult Striped Bass Harvest Rate (condition comparison)



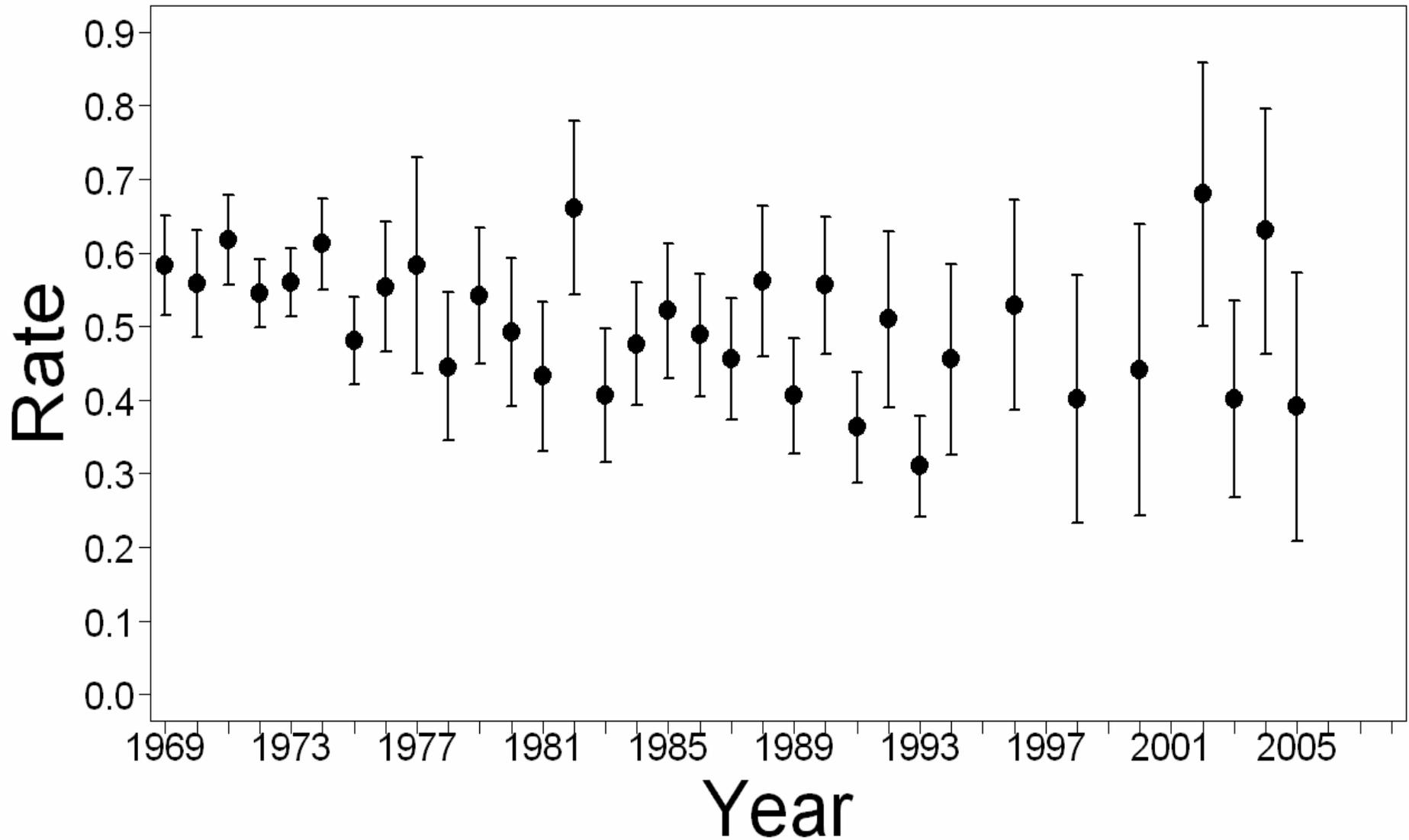
Adult Striped Bass Survival Rate (condition comparison)



Adult Striped Bass Annual Harvest Rate Estimates

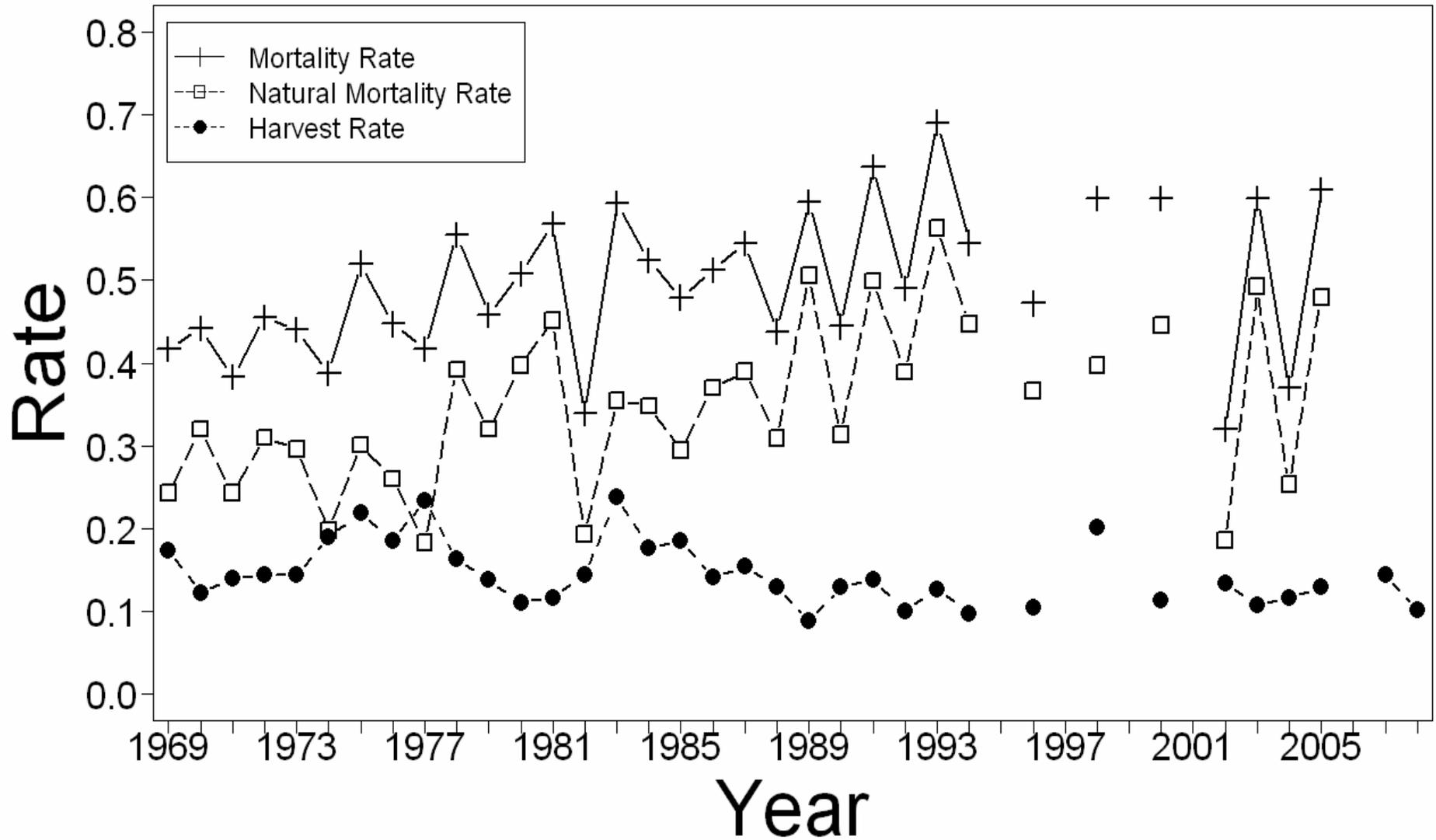


Adult Striped Bass Annual Survival Rate Estimates

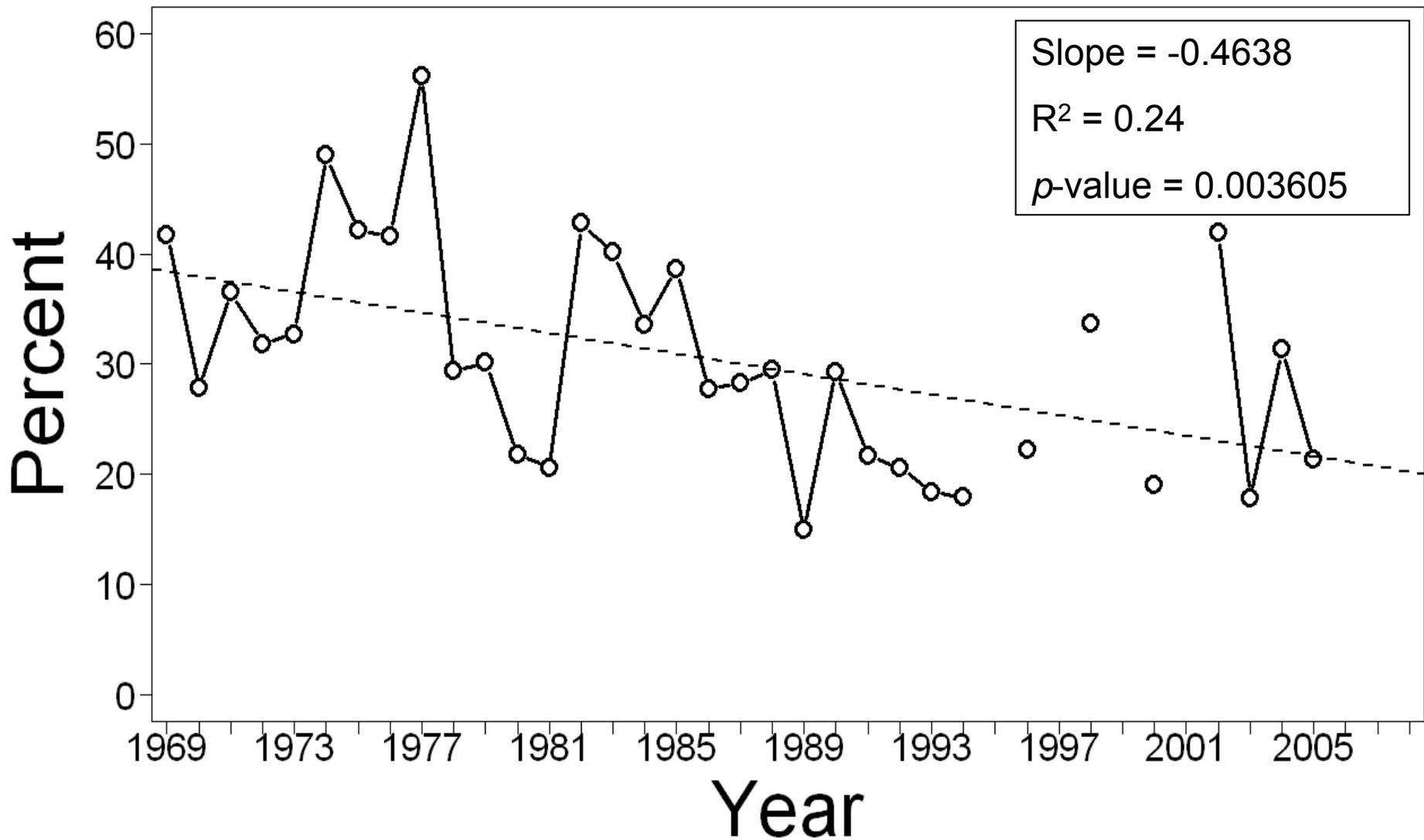


Adult Striped Bass

Annual Mortality, Natural Mortality, Harvest



Adult Striped Bass Harvest Rate as a Percent of Mortality Rate



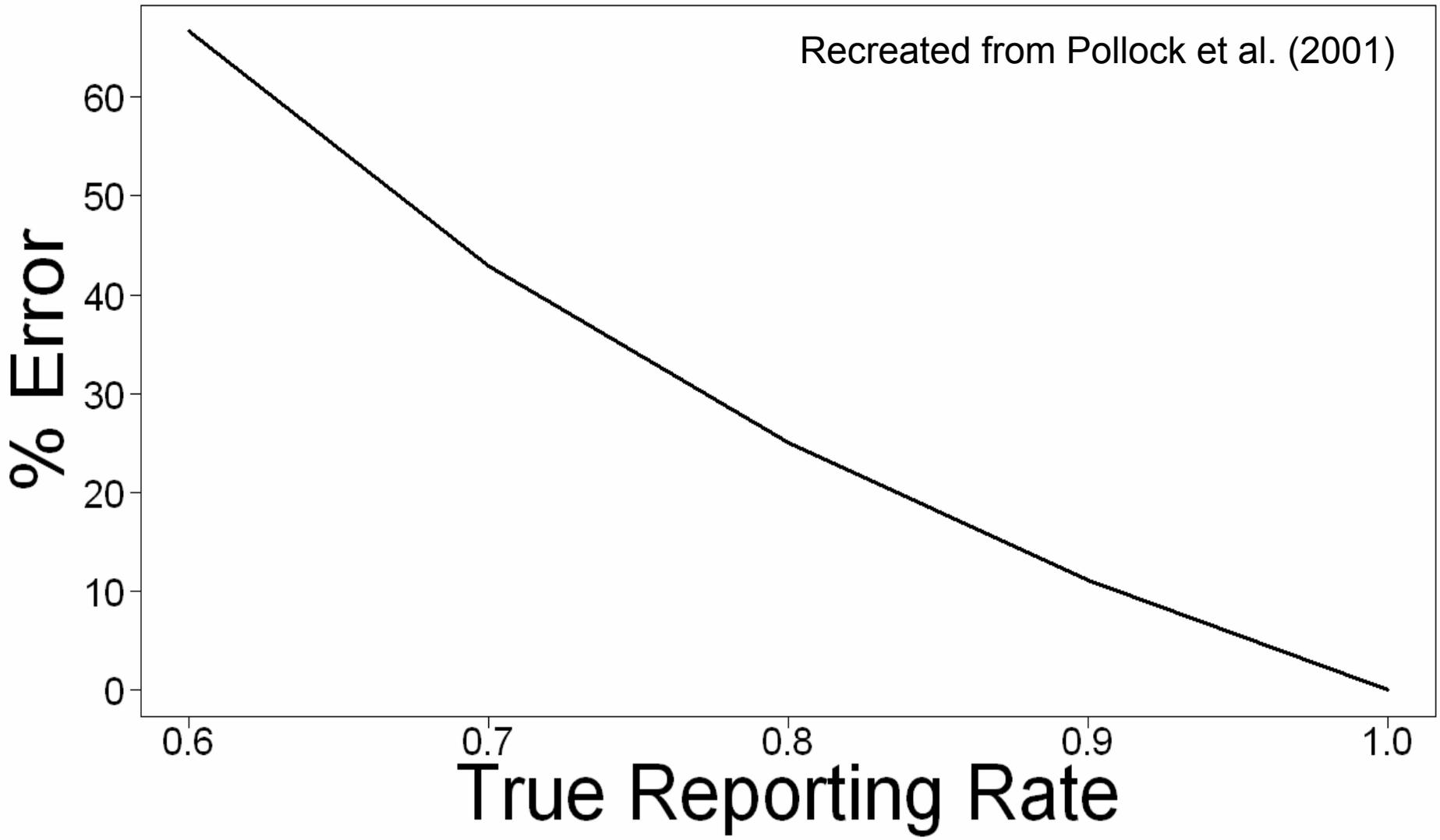
Adult Striped Bass Mark-Recapture Study

- Potential Biases within Estimates
 - Under reporting of reward tag
 - Reward too low

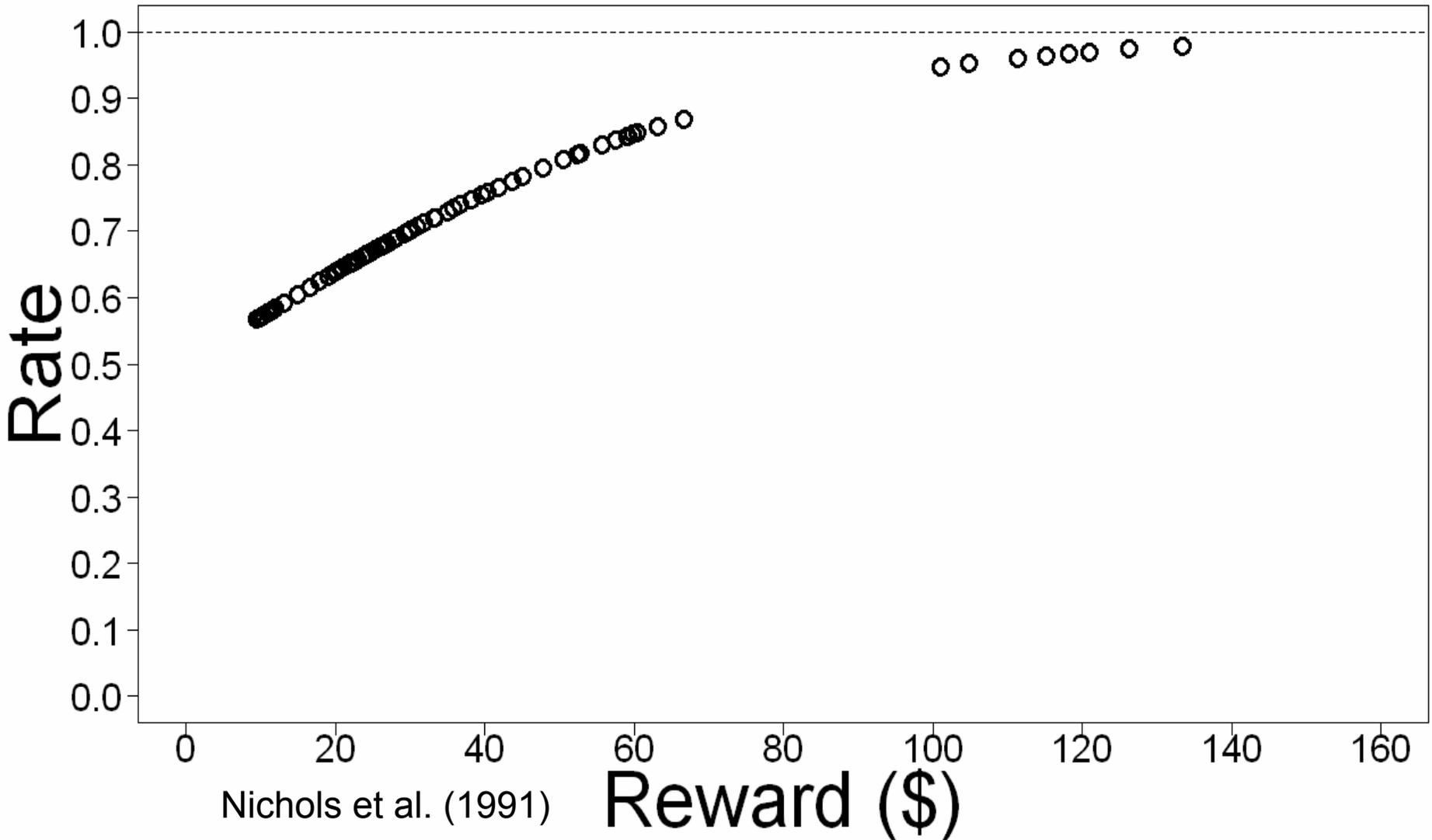
Adult Striped Bass

Percent Error of Reporting Rate Estimate

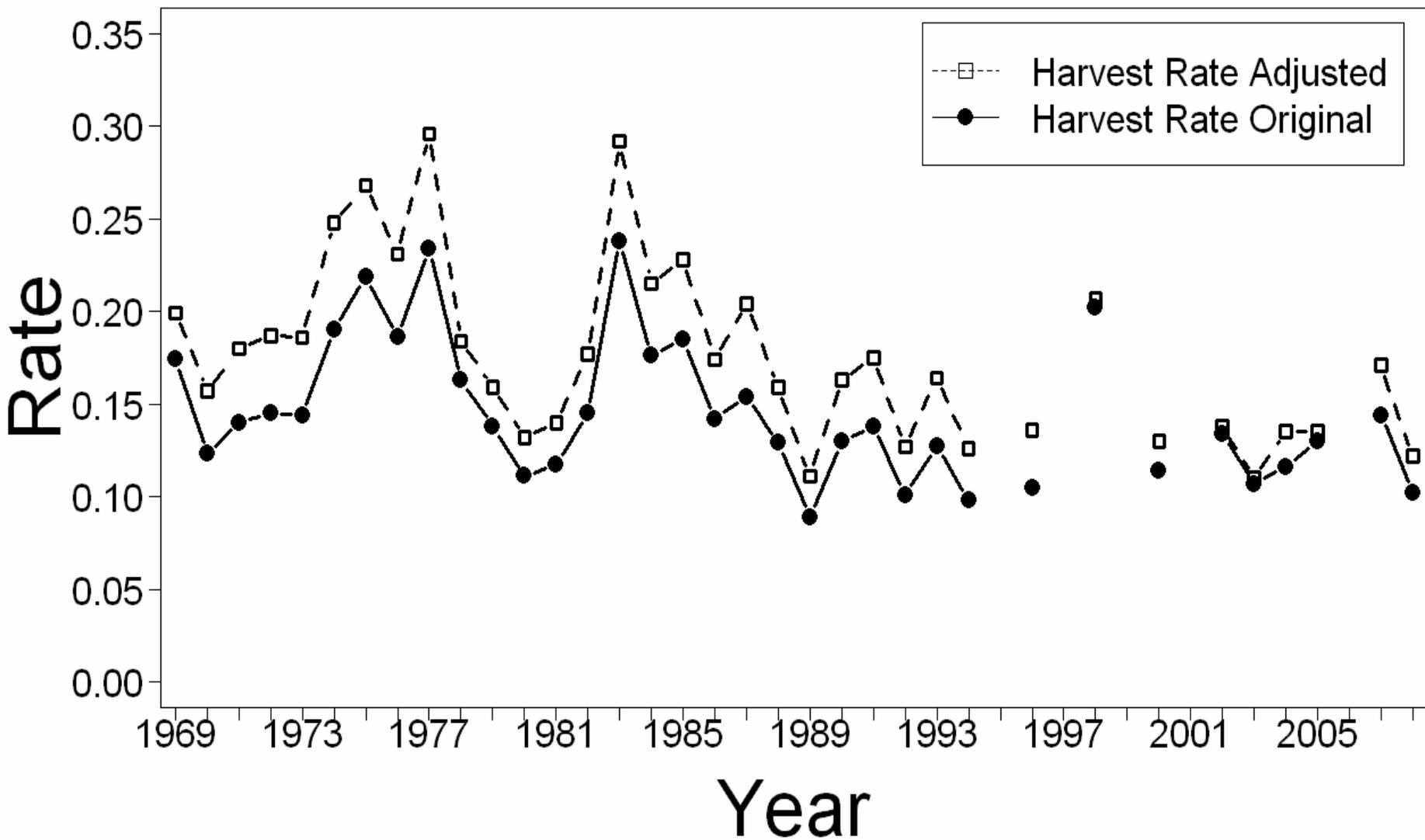
Recreated from Pollock et al. (2001)



Adult Striped Bass Estimated Reporting Rate



Adult Striped Bass Annual Harvest Rate Estimates



Adult Striped Bass

Conclusion & Recommendations

- Useful estimates of harvest and survival
- Biases when using tag return data
- Recommendations to consider
 - Eliminate non-reward tag
 - Use only one high-dollar reward tag
 - Increase value of high-dollar reward tag
 - Continued outreach