

# **EVALUATION OF ASPECTS OF THE USFWS 2008 DELTA SMELT BIOLOGICAL OPINION**

by Richard Deriso

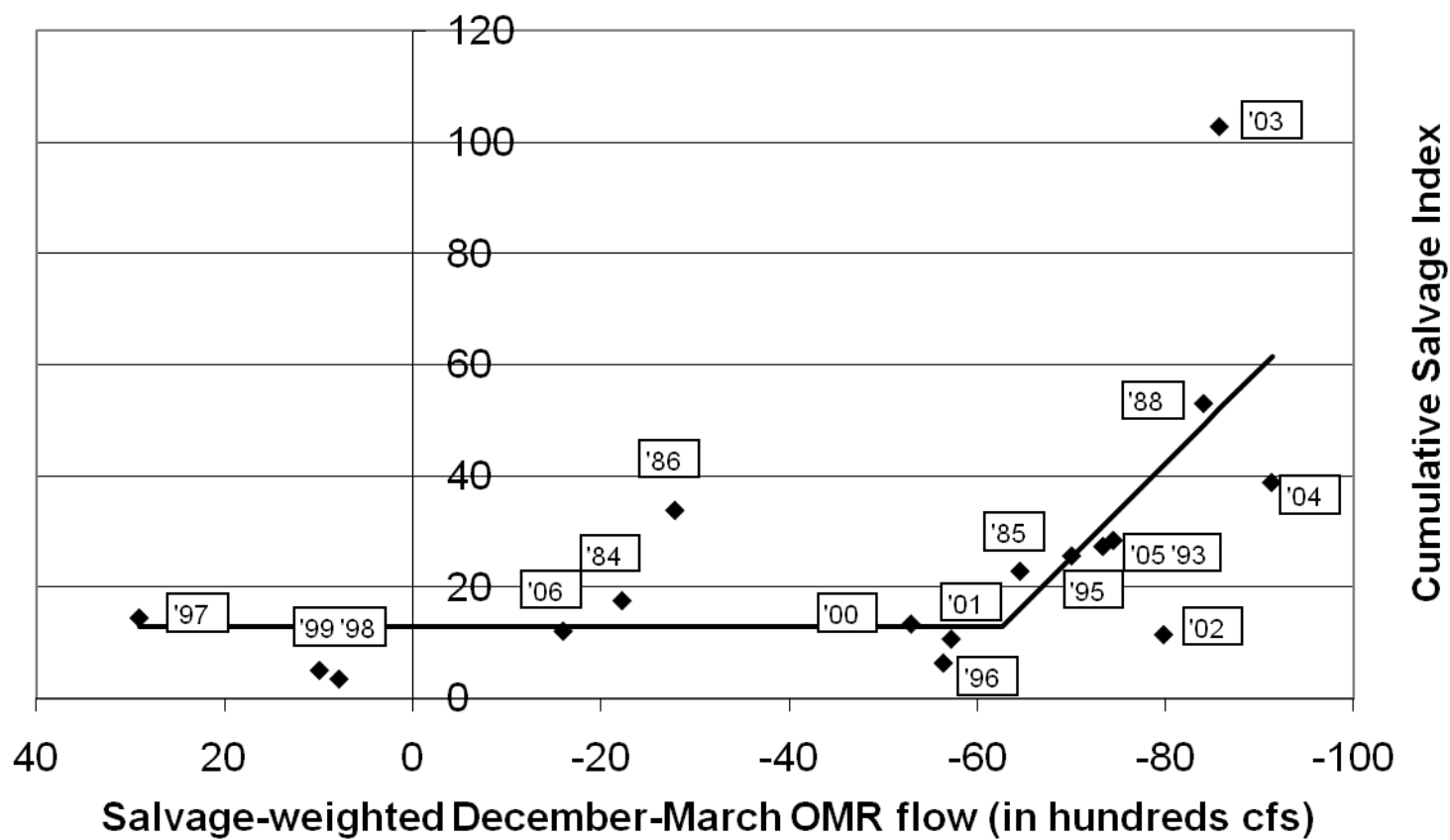
# Salvage of adults and OMR flow

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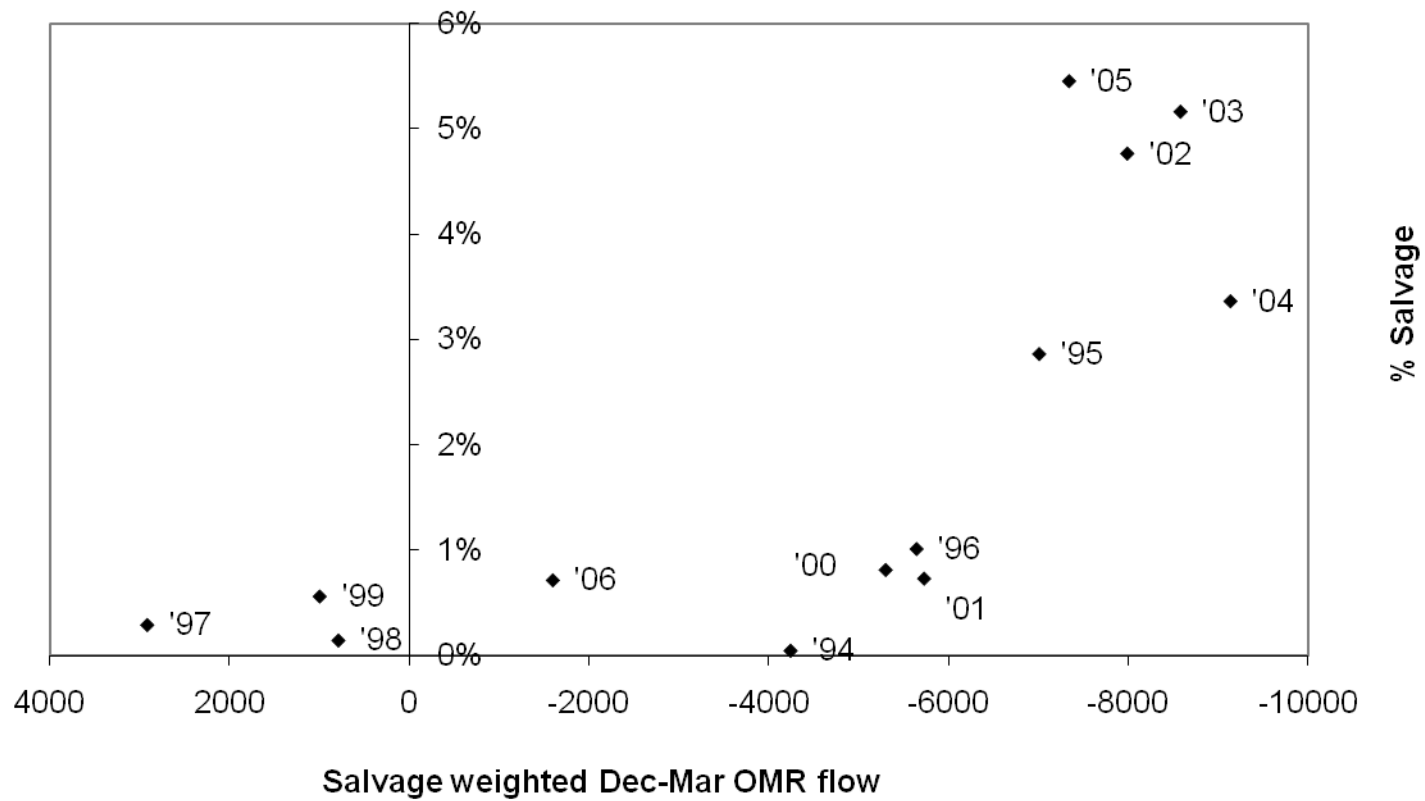
FWS's Analysis of the relationship Between Old and Middle River Flows and Adult Salvage Is Flawed

1. Improper Use of Total Adult Salvage Numbers Instead of Cumulative Salvage Index (such as an index of the percent of the adult population that is salvaged, Salvage/FMWT index).
2. Use of the Cumulative Salvage Index Shows That There Is No Statistically Significant Relationship Between OMR Flows and Adult Salvage for Flows Less Negative Than around -6,000 Cubic Feet per Second.

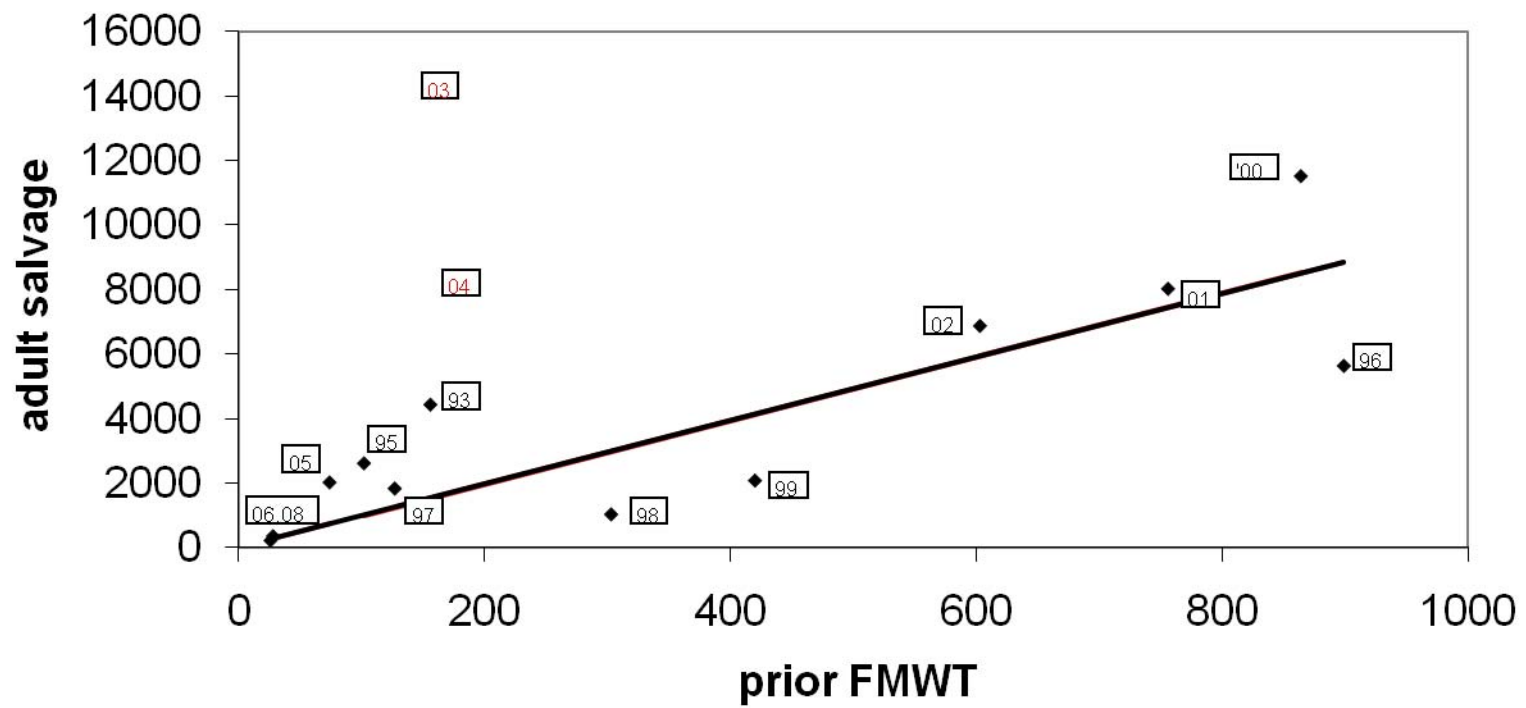
**Cumulative Salvage Index vs OMR flow  
including best piece-wise linear fit**



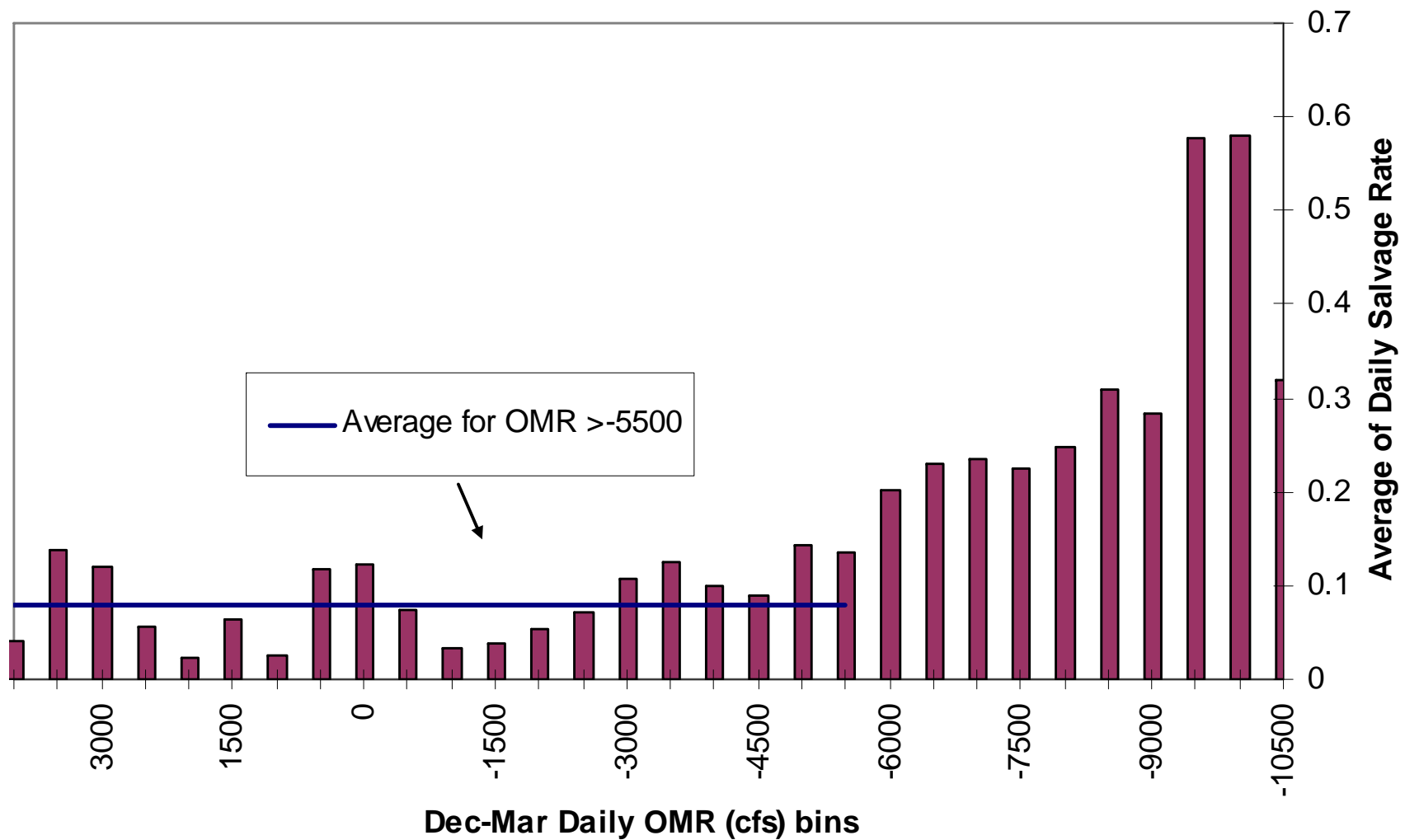
**% Adult Salvage measured by ratio of Salvage to previous December abundance estimate (from Newman 2008) vs OMR flow**



## Adult salvage vs prior FMWT



## Average Daily Salvage Rate vs Daily OMR 1984-2006 Dec-Mar



# Test of effect of fall X2 on recruitment as measured in summer TNS

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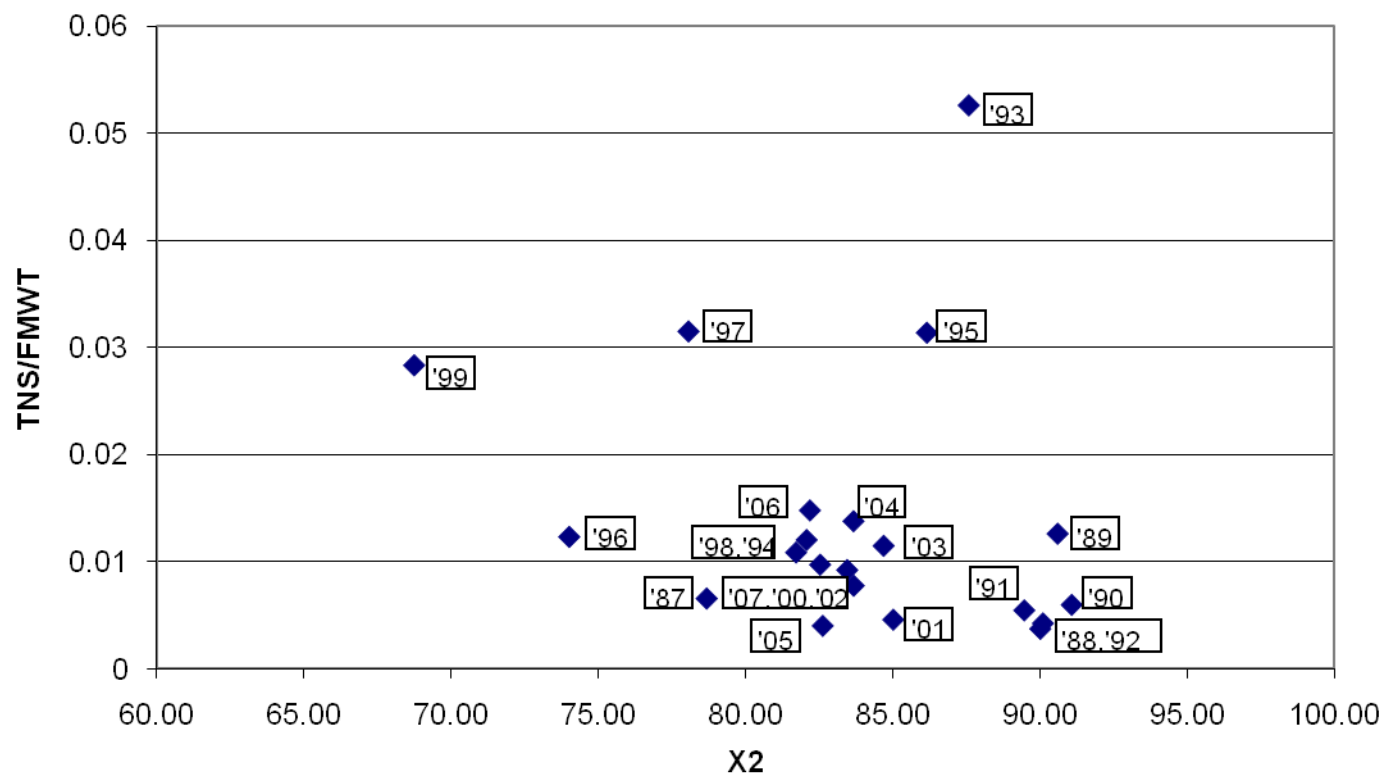
The Model Used in FWS's Analysis to Compare the Effect of Fall X2 on Population Survival is flawed.

1. FWS Used a Linear Additive Model
2. FWS Should Have Used a Multiplicative Stock-Recruit Model
3. Applied Ricker stock-recruitment model

$$R = S * \exp(a - bS - cX2 + \varepsilon)$$

4. Neither the density-dependent term ( $bS$ ) nor the environmental covariate ( $c * X2$ ) were significant at p-value = 0.05.

Juvenile survival index (TNS/FMWT) versus previous fall X2





# The BiOp Fails to Evaluate Population Level Effects Using the Population Growth Rate

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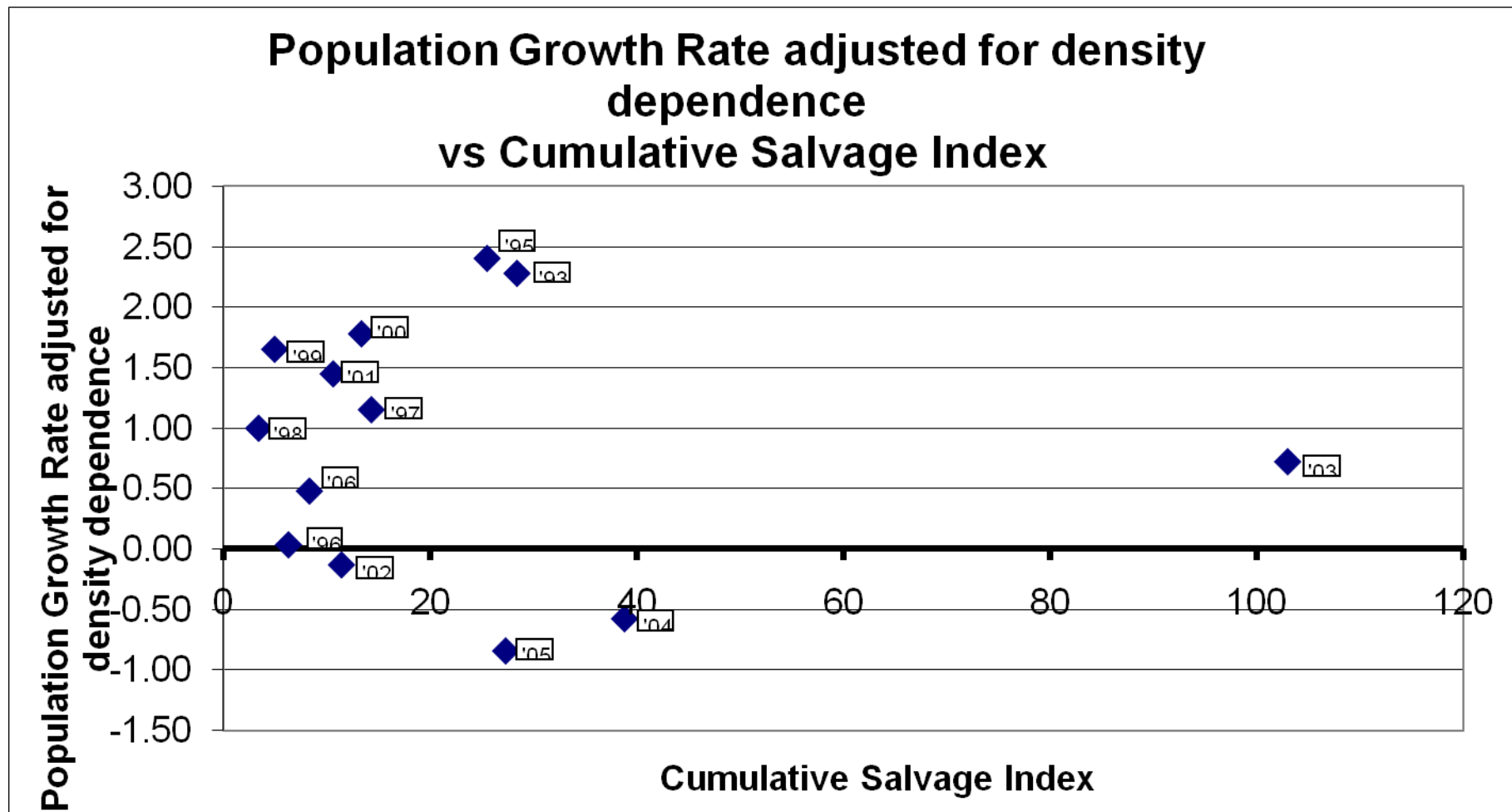
- The life-cycle model used for this analysis is a standard Ricker stock-recruitment model in which consecutive year FMWT estimates take the role of stock (S) and recruitment (R), respectively
- Several hypotheses about effects of covariates (X) on population growth rate were tested with the Ricker model framework:

$$R=S*\exp(a-bS-cX+\varepsilon)$$

# Test of effect of adult salvage rate on population growth rate

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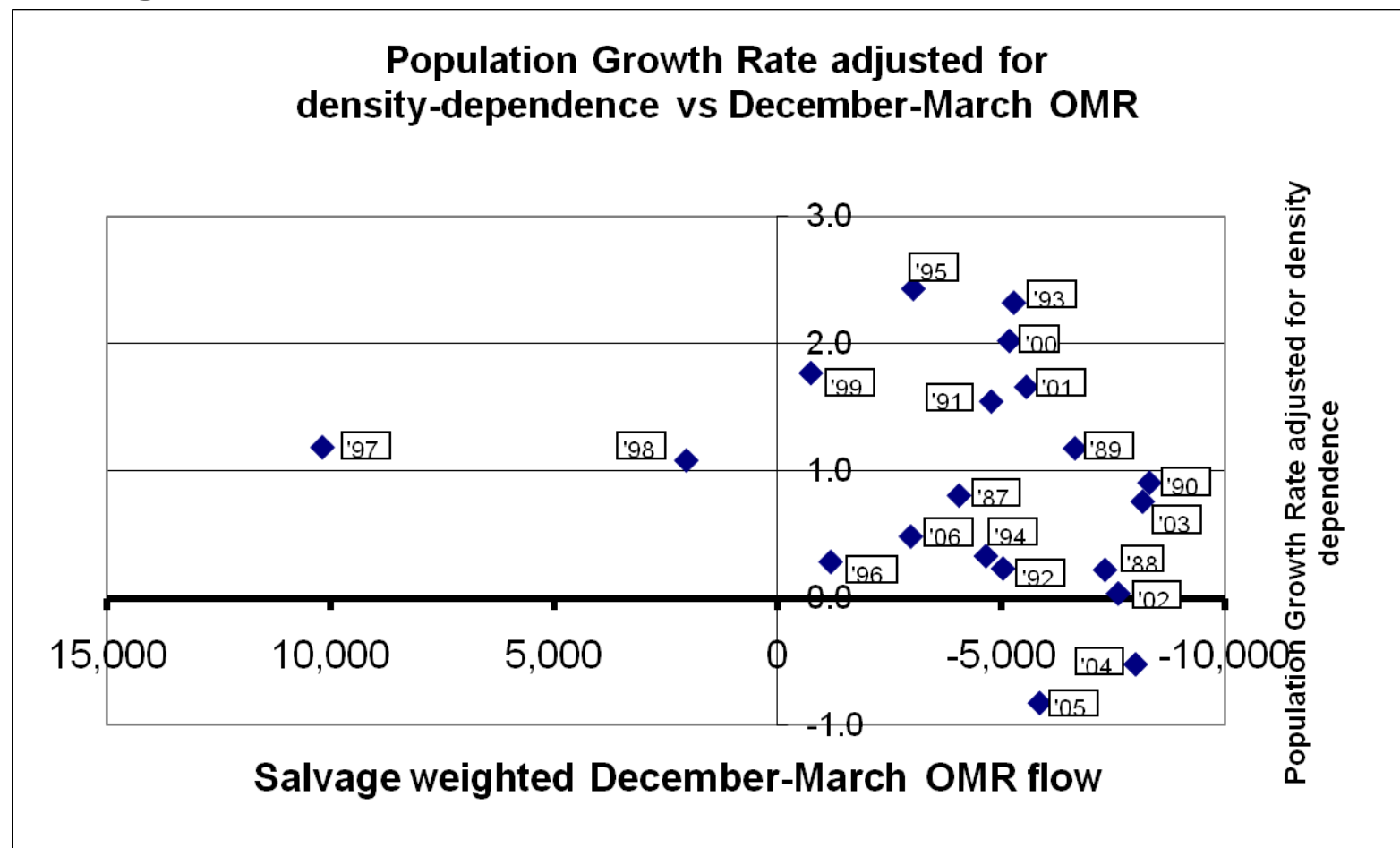
Cumulative salvage rate was not statistically significant as can be illustrated below:



# Test of effect of Dec-Mar OMR flow on population growth rate

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Dec-Mar average OMR flow was not statistically significant as can be illustrated below:



## Entrainment estimates for larvae and juvenile delta smelt made in Kimmerer (2008)

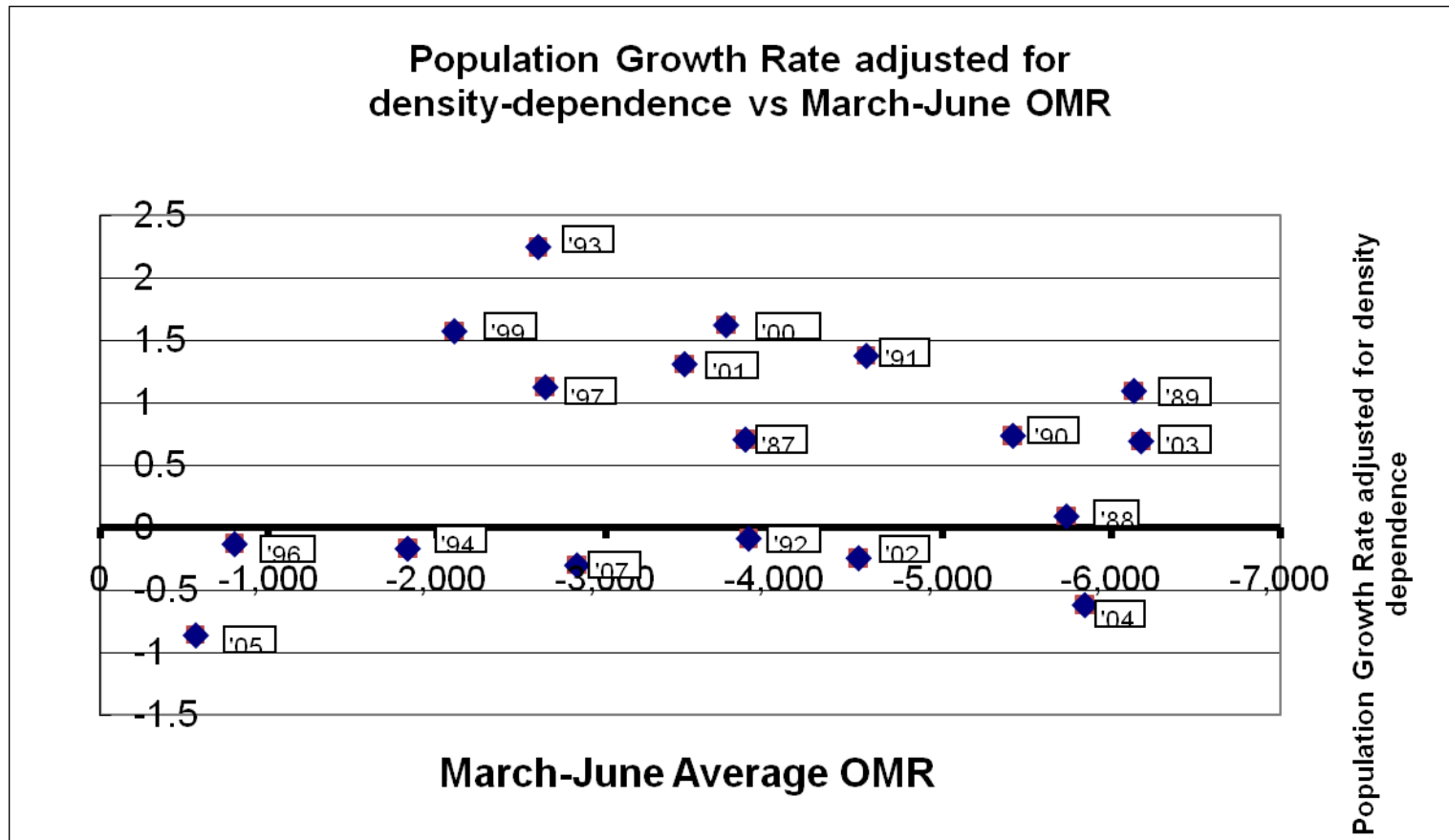
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A major assumption of the method employed in that paper is that daily negative OMR flow is proportional to daily entrainment. That assumption works its way into annual spring averages as shown in Figure E-7 of the BiOp. The assumption however is **not** supported by analysis of the population growth rate as shown in the next slide.

# Test of effect of March-June OMR flow on population growth rate

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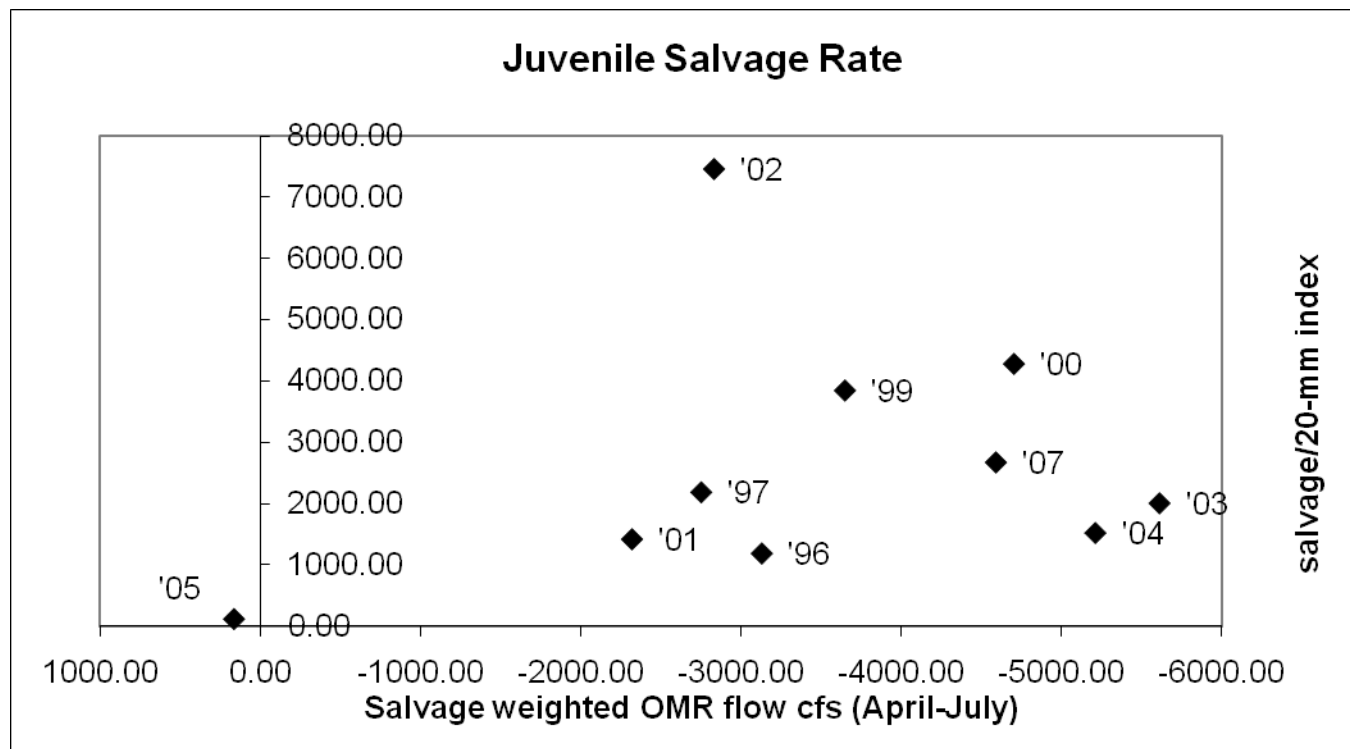
March-June average OMR flow was not statistically significant as can be illustrated below:



# Juvenile salvage rate is not related to salvage weighted (Apr-Jul) OMR flows

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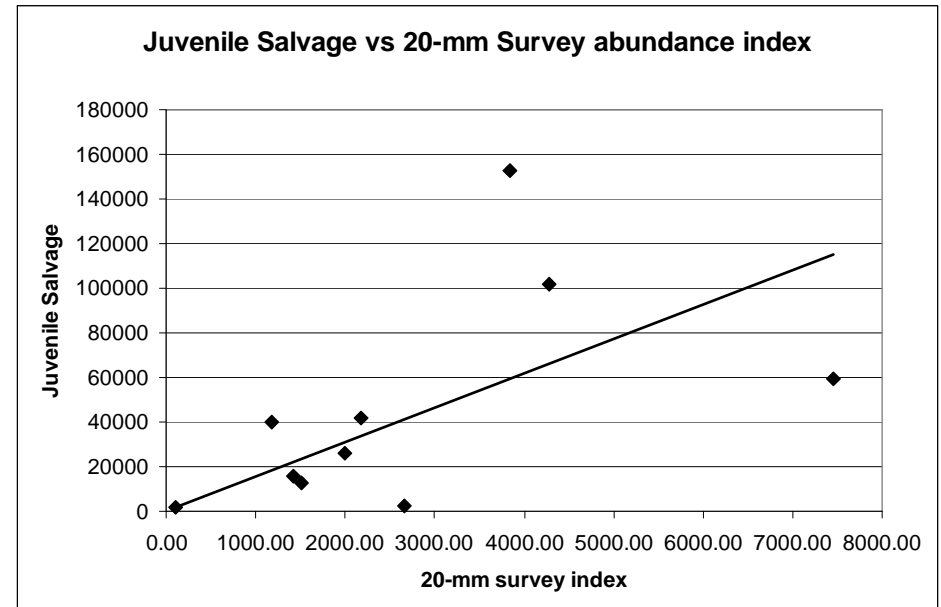
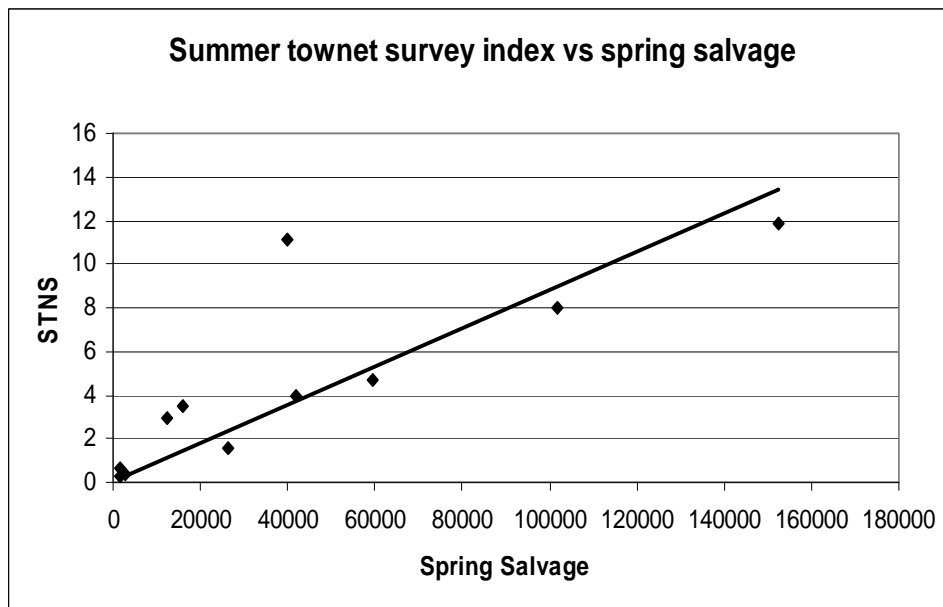
Salvage weighted Apr-Jul OMR flow was not statistically significant vs juvenile salvage rate (salvage/20mm index) R-square=0.02



# Juvenile salvage is a measure of juvenile delta smelt abundance

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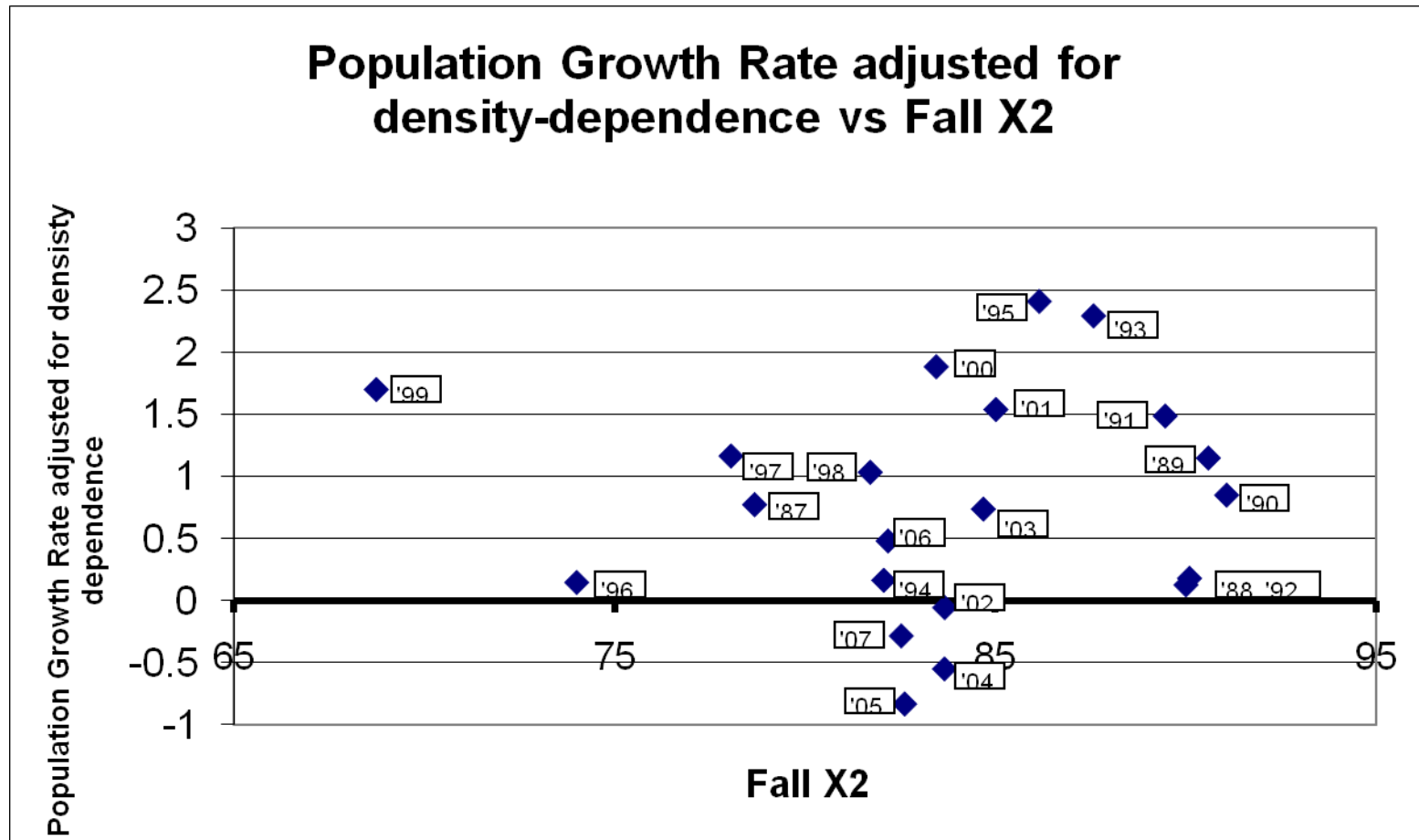
Salvage of juvenile smelt is correlated with both the 20mm index and with the summer TNS.



# Test of effect of fall X2 on population growth rate

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Sept-Dec average X2 was not statistically significant as can be illustrated below:





# Closing points about this presentation

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1. Foregoing analysis is standard fisheries analysis and it was not done in the BiOp
2. The approach taken avoided relying on highly parameterized models that make a large number of assumptions.
3. A slightly more complex approach based on life-stage structured population dynamics (work with Ray Hilborn and Mark Maunder) shows preliminary results similar to those obtained with the Ricker model.