Abundance of Juvenile Fall Chinook Salmon Emigrating from Lower Klamath Tributaries

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Fall Chinook Salmon Life Cycle Model Informational Workshop
13 October 2010

U.S. Department of the Interior
U.S. Geological Survey

Goals of Analysis

- Annual abundance entering mainstem Klamath
  - Inputs to SALMOD

- Abundance as a function of
  - Parent stock (spawners)
  - Tributary
  - Environment (e.g., river flow)
  - Timing and size at emigration

- Fit spawner-recruit models

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Used Ricker model

-Two parameters

α = productivity

- survival with no density dependence

β = capacity

- spawners producing maximum recruitment

- Why Ricker Model?
  - used by PFMC stock-recruit analysis (2005)
  - consistent with data Trinity River
  - Watershed area model

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Data Requirements

- Spawner abundance from “megatable”

- Juvenile abundance from trap data
  - need weekly trap efficiency
  - need mark-recapture estimates

- Four tributaries fit requirements:
  - Bogus Cr. – 8 years
  - Shasta R. – 9 years
  - Scott R. – 10 years
  - Trinity R. – 17 years

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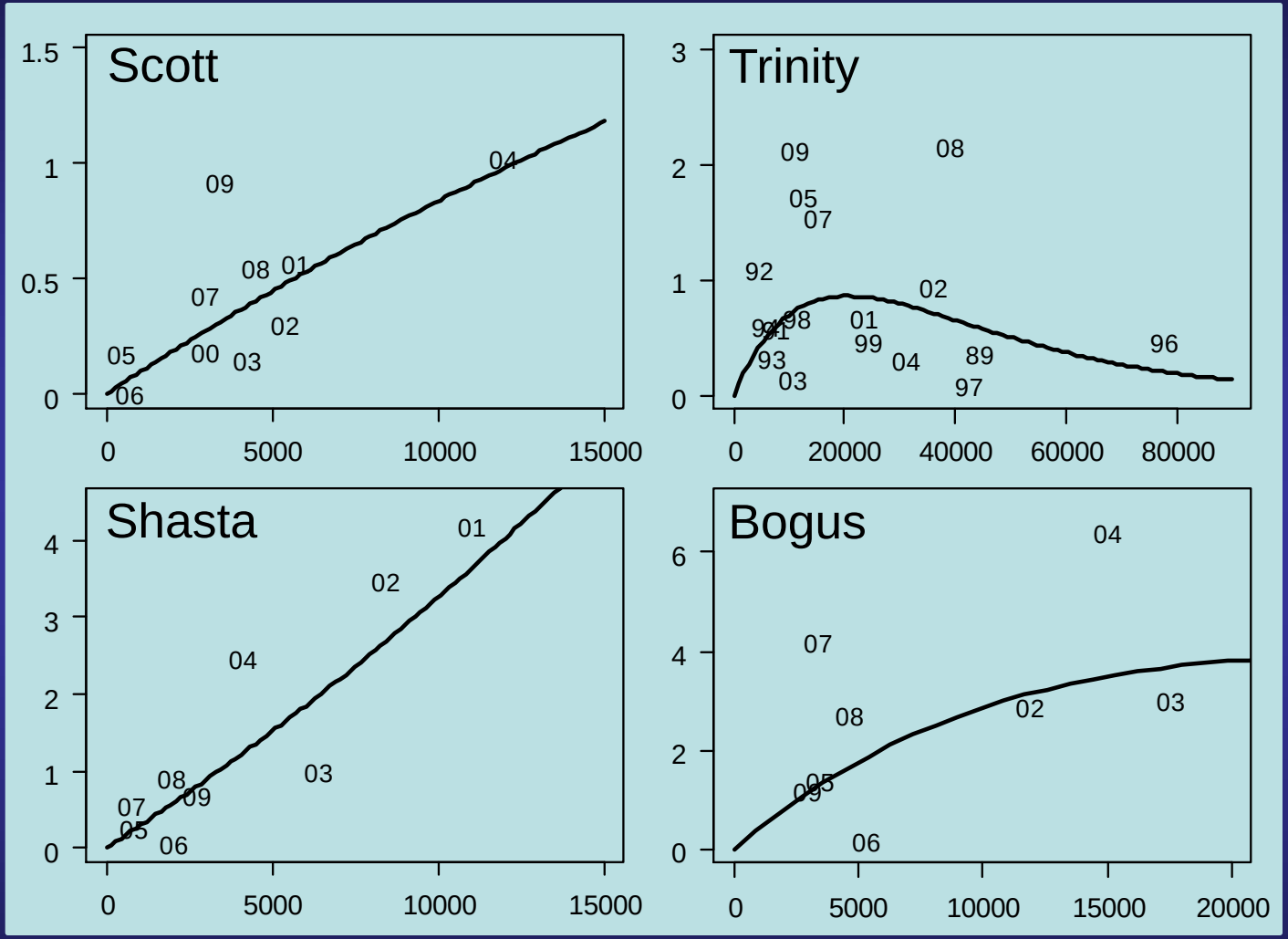
Ricker model with no covariates

Juveniles (millions)



Spawners

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Ricker model with no covariates

Production varies among:
- years
- tributaries

Not enough contrast to estimate capacity

Effects of river flow on production

Flows during spawning period
Mean Oct-Nov Discharge

Flows during incubation period
Maximum Dec-Jan Discharge

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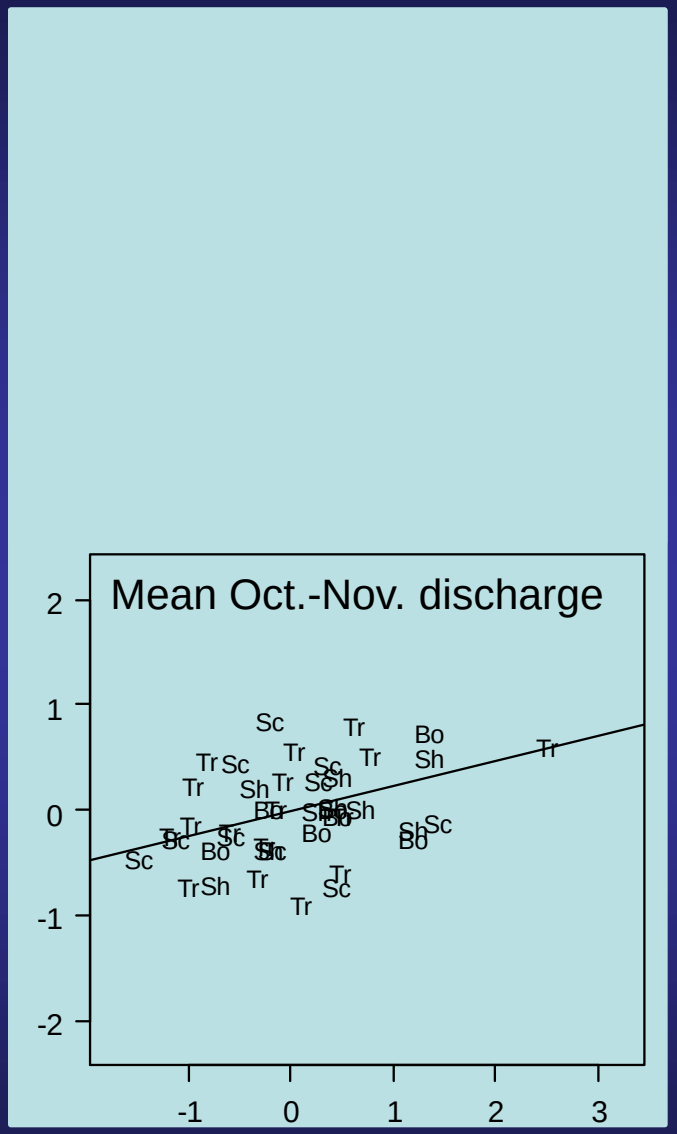
Effects of river flow on production

Deviation from spawner-recruit curve [ln(millions)]



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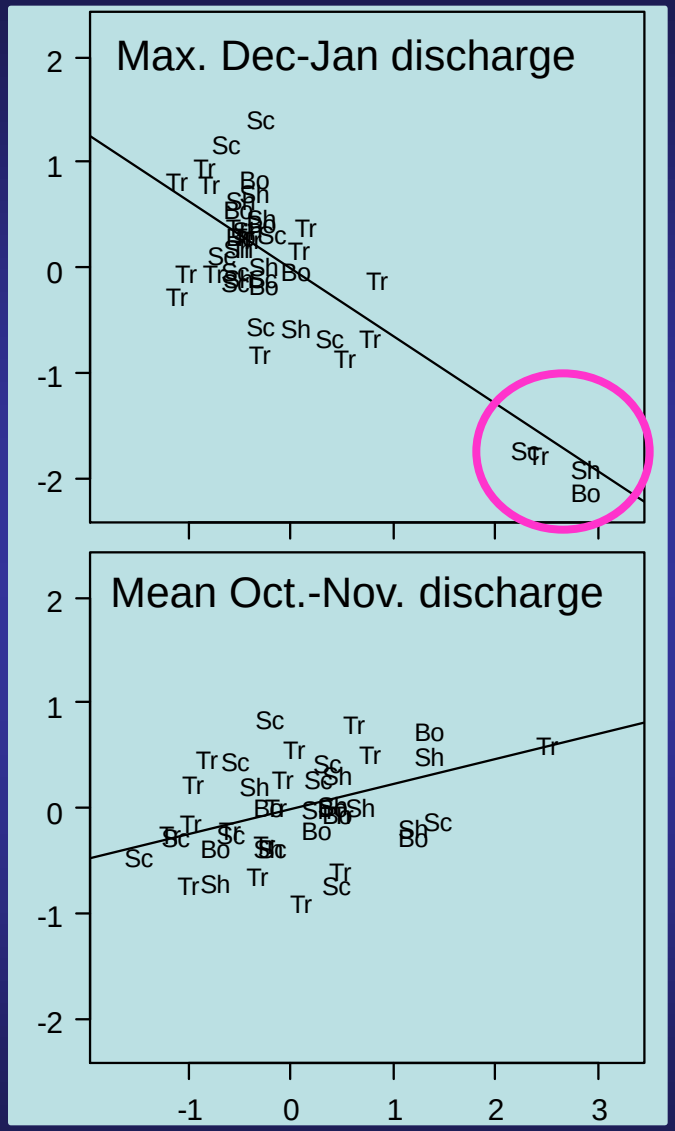
Effects of river flow on production

Deviation from spawner-recruit curve [ln(millions)]



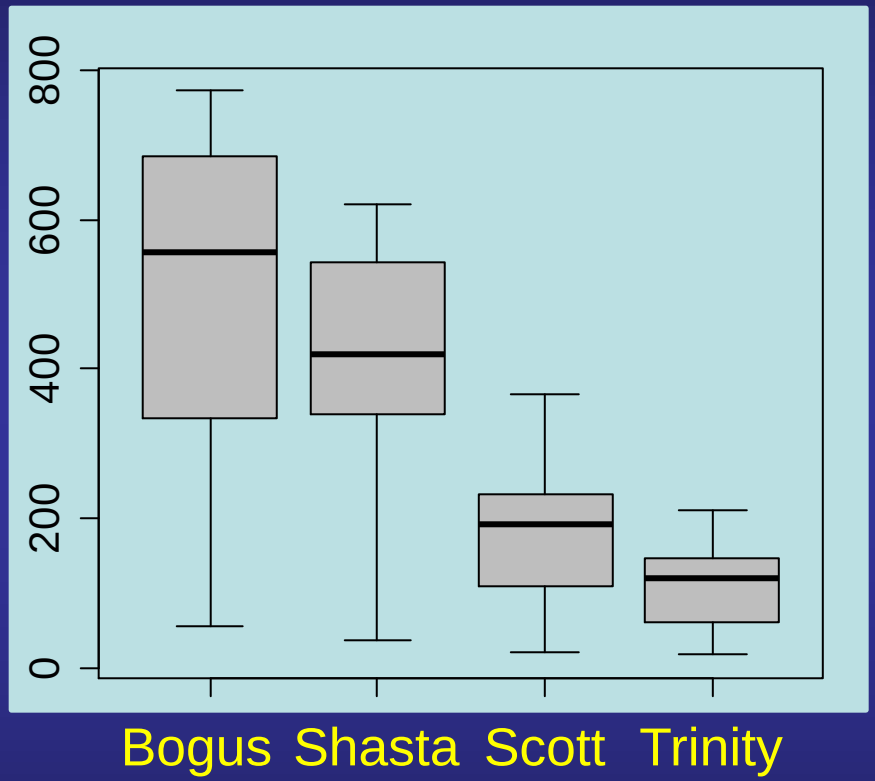
1997 & 2006 Winter flood events

Standardized discharge

Variation in productivity (α) among Tribs.

Model including flow covariates

Annual productivity
(α, juveniles/spawner)



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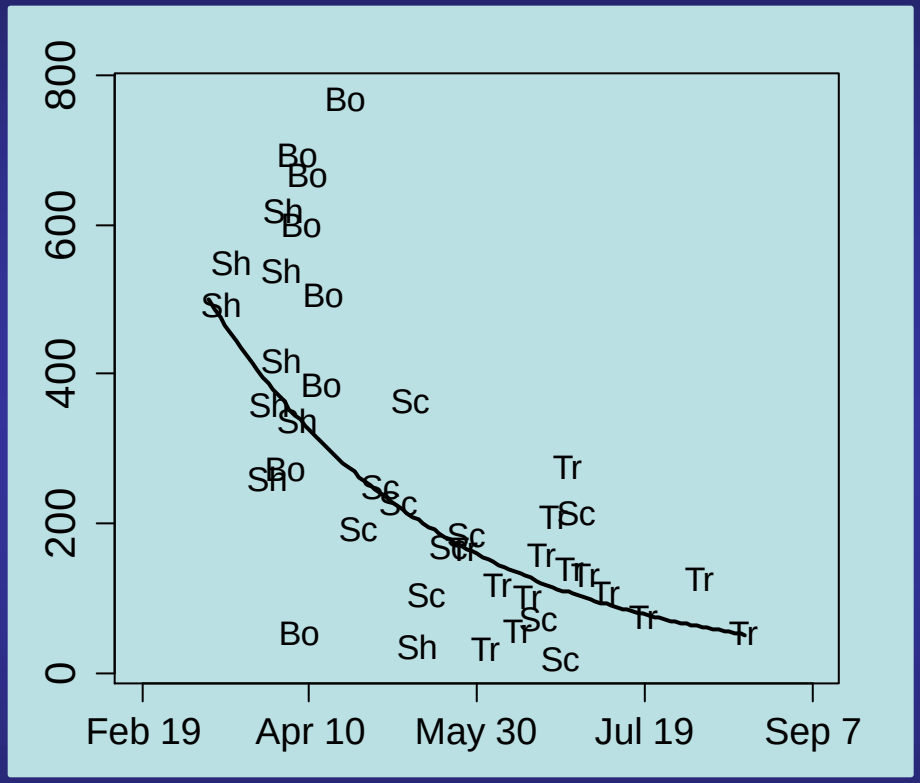
Effects of Emigration Timing on Productivity

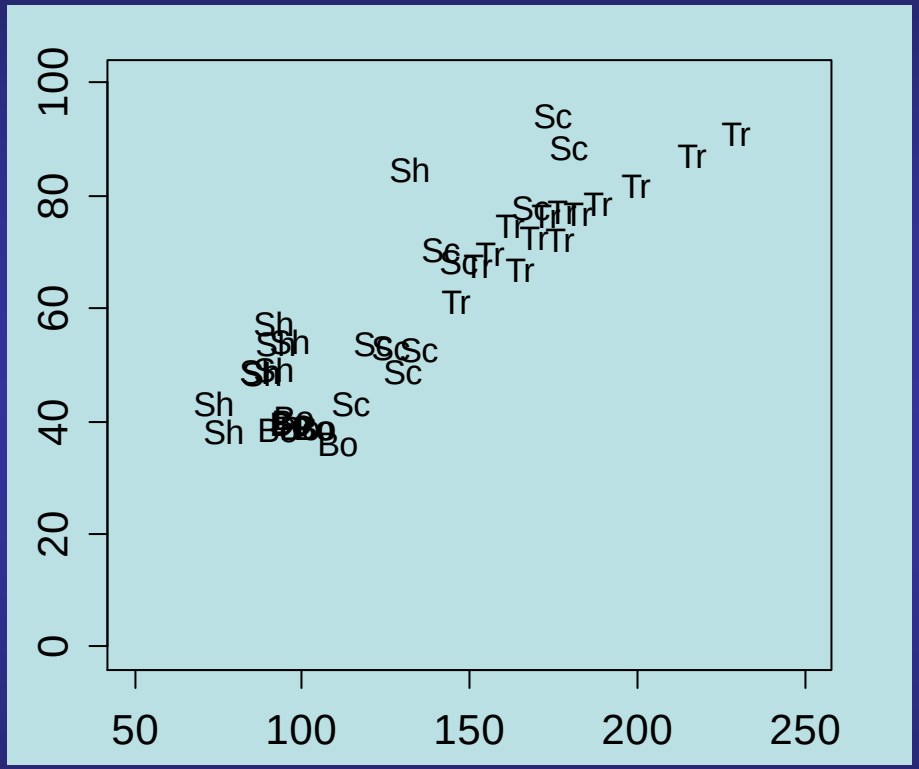
Annual productivity
(α, juveniles/spawner)



Mean date of emigration

Size at Emigration

Mean length (mm)



Mean day of emigration

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Why does productivity decline with emigration date?

Mixture of life stages

Egg to fry survival > Egg to parr survival

Earlier emigration
= smaller mean size
= more fry relative to parr
= higher average survival
= higher estimated productivity

Capacity Predicted from Watershed Area
From Parken et al. (2006)

1/Beta = spawner level that maximizes recruitment

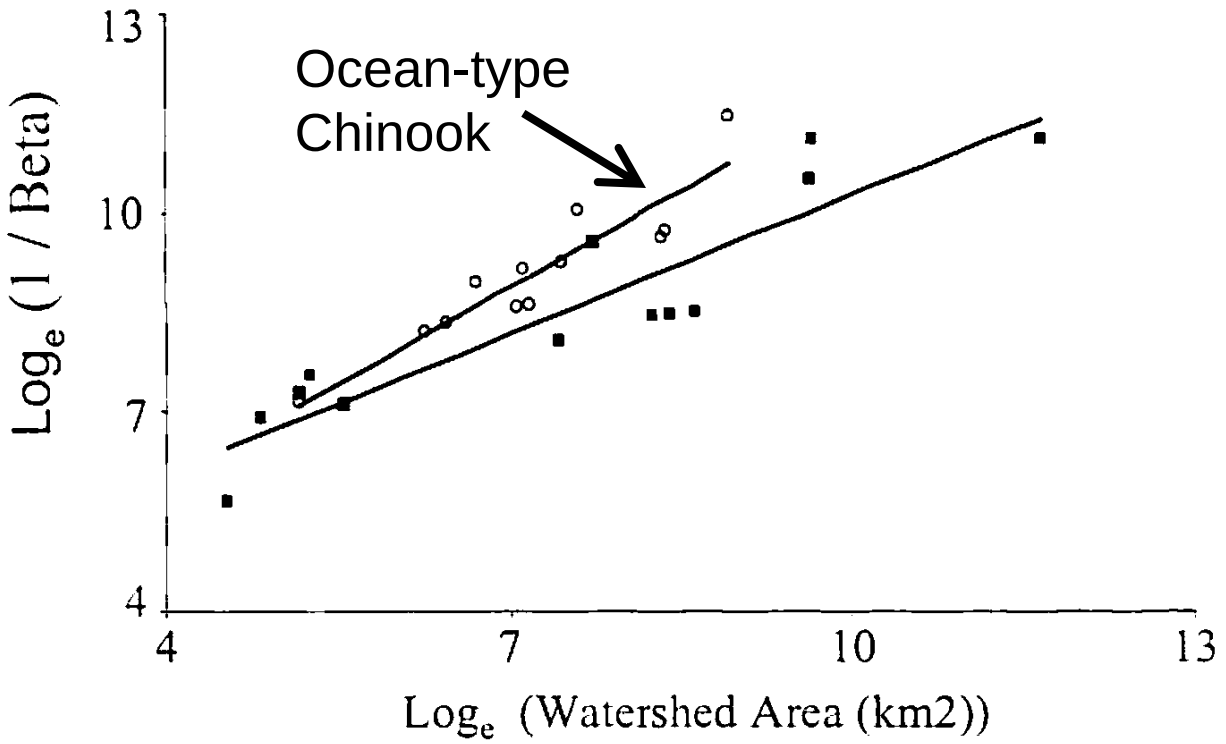
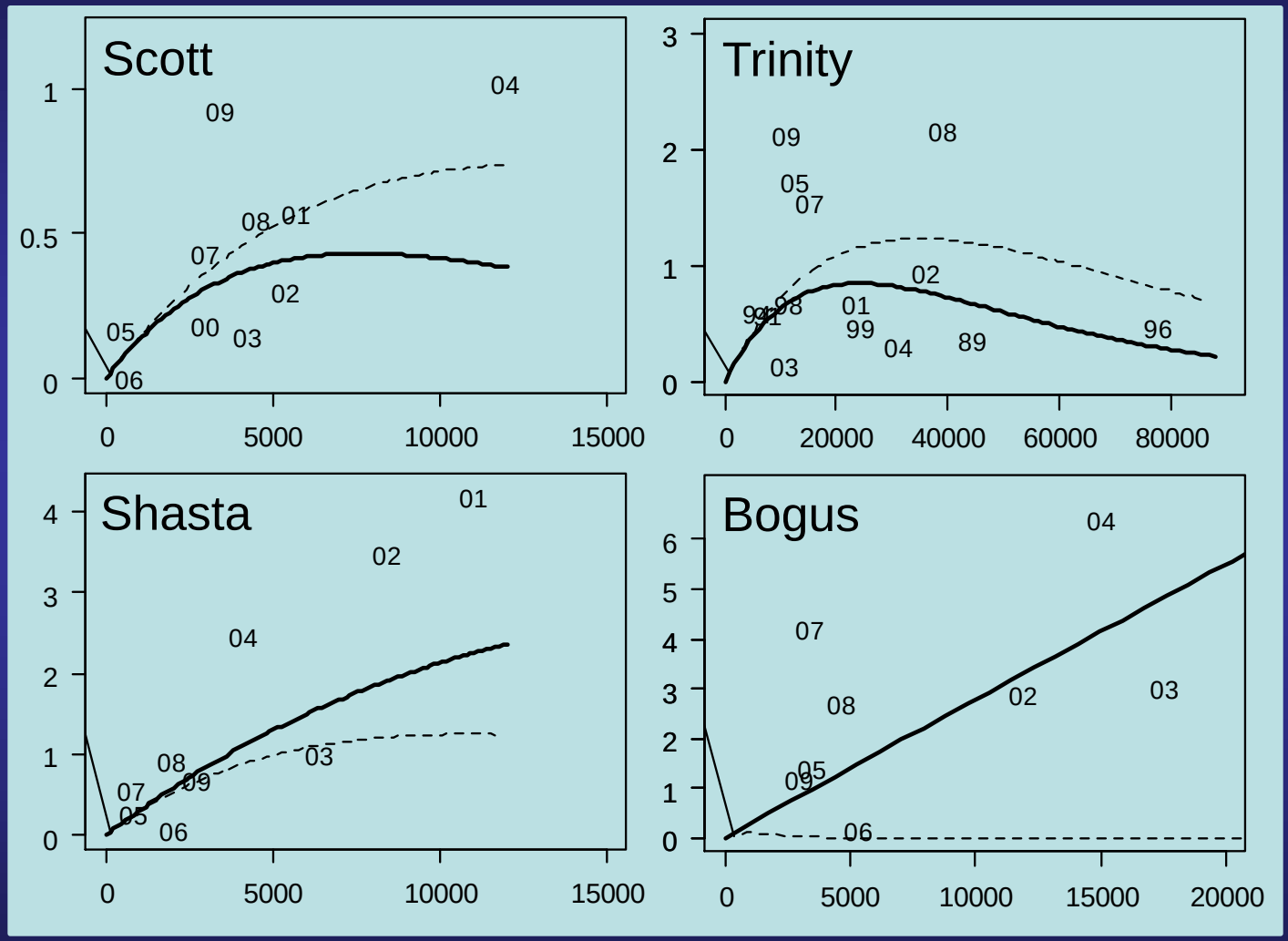


Figure 4. Relationships between watershed area and stock-recruitment reference points (Smsy and Srep) and association with the inverse of the beta parameter for ocean- and stream-type stocks. Regression parameters are in Table 4.

Ricker model at mean flows (solid)
Capacity predicted from watershed area (dashed)



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Summary

Productivity
- Tributary
- Timing and size at emigration
- Influenced by flow

Capacity
- Watershed area

Develop S-R curves for data poor watersheds
Link juvenile production to environment

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Acknowledgements

Many individuals from many agencies toiled over many years to collect the data shown here.

Such analyses are impossible without their hard work!

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Questions

Source: www.napavalleyregister.com/articles/2008/02/1...