Key recruitment processes and life history strategies: Bridging the temporal and spatial gap between models and data

• Background:
  – Stock-recruitment relations usually show large deviations for theoretical curves
  – This deviations are considered to be resulted from tremendous variability in early survival rates
  – Early survival processes are probably consequence of adaptation to fluctuating environment conditions in different manner (life-history strategies)

• Objectives: review recruitment processes and contribute modeling
S6: CCCC/MODEL (Oct. 17) Modeling and historical data analysis of pelagic fish, with special focus on sardine and anchovy

- Focus on modeling [especially NEMURO.SAN] and analyses of processes affecting growth, survival and recruitment of sardine and anchovy
- Traditional spawner-recruitment curve is currently adapted in NEMURO.SAN (Rose et al.)
- Mechanisms of recruitment is essential for future modeling (e.g., Takasuka et al.)
Recruitment Hypotheses

- Critical period Hypothesis
- Growth-selective (bigger is better) Hypothesis
- Growth rate-selective Hypothesis
- Stage duration Hypothesis
- Optimum window Hypothesis
- Match/mismatch Hypothesis
- Oscillating control Hypothesis (alternating bottom-up and top-down with a time lag)
- etc.
Factors affecting early survival rates

• Climate (regime shifts)
• Maternal conditions (e.g., age composition)
• Recruitment events in a series of “switches”
  – e.g., spawning time and locations - match/mismatch to subsequent food, predator and habitat conditions
• Density dependence (Ricker, BH, etc.)
• Indirect species interactions

Deterministic and stochastic processes

Constraining and activating factors
Figure from:
Winemiller and Rose (1992) with modification based on
King and McFarlane (2003)