Fish 450 Final Exam  
Autumn 2004  

Exams are Due Wednesday December 15th by NOON 
In Peter Westley’s Mailbox in the Fisheries Building (1st floor)  

INSTRUCTIONS: Pick 2 of the following 5 questions to answer. Write well organized, thoughtful essays that show you understand the connections and complexities concerning the question. Use all the materials at your disposal (i.e. class notes, book manuscript, primary literature) to help you formulate your responses. Your answers should reflect your own understanding and interpretation of the material thus, PLEASE WORK INDEPENDENTLY!!

ESSAY FORMAT: Essays should be typed, spell-checked, and proof-read. Double space responses and use a standard font (e.g. Arial/Times New Roman). Each essay should be less than 1000 words.

1. Chinook salmon (Oncorhynchus tshawytscha) exhibit two distinct and intriguing, life history strategies; ocean-type and stream-type. Discuss trade-offs to growth and survival by exhibiting an ocean-type versus stream-type life history strategy. Be sure to address the following details in your answer:
   (1) Geographic distribution of the two life histories (i.e. is there a latitudinal cline of one life history versus another?)
   (2) Which habitats tend to produce ocean-type chinook and plausible reasons why?
   (3) Which habitats tend to produce stream-type chinook and plausible reasons why?
   (4) Spawning time of each strategy and why we see the patterns observed.
   (5) Age at maturity

2. Diel vertical migration (DVM) is observed in a wide range of taxa, including juvenile sockeye salmon (O. nerka) in lakes. In your own words, describe DVM and the three primary hypotheses put forth in class to explain this behavioral pattern. In the final part of your essay, predict the patterns of DVM you would expect to see in lakes with the following characteristics:
   (a) Highly productive and turbid during summer growing season
   (b) Large suite of piscivorous predators, low production, well stratified water column during the summer growing season
   (c) Well mixed water column during the late autumn
Be sure to include how you derived your predictions.

3. In the last several years, the Alagnak River, Alaska has experienced dramatically high (unprecedented in over 500 years of record) returns of adult sockeye salmon. Describe the possible consequences for egg-fry survival, fry growth rate, size of smolts, age of smolts, and smolt-adult survival. Explain the processes that would cause these effects.
4. Pacific salmon have large eggs and a protracted period of incubation. Discuss the benefits of these traits in terms of juvenile salmon growth and ultimate survival. If autumn spawning period and large egg size result in large fitness benefits, why do we continue to see variation in these traits among individuals? Said another way, why do we perpetually see variation in spawning date and egg size if having large eggs and spawning early is the “best” strategy?

5. Consider the following hypothetical age distribution of a chinook population:

(Numbers are reported in percents)

<table>
<thead>
<tr>
<th>Age</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>1.2</td>
<td>54</td>
<td>46</td>
</tr>
<tr>
<td>1.3</td>
<td>44</td>
<td>56</td>
</tr>
<tr>
<td>1.4</td>
<td>57</td>
<td>43</td>
</tr>
</tbody>
</table>

Why might the sex ratio vary in this manner? Explain, for males and females, the costs and benefits of maturing at the different ages.