

Are herring (*Clupea pallasii*) energetics in Prince William Sound a limiting factor in successful recruitment of juveniles or reproduction investment of adults? - Auke Bay Laboratories

We propose to determine if the availability of energy is limiting production of PWS herring. In year 1 of the study, we made field collections of Pacific herring to examine two energetic mechanisms that could potentially inhibit herring recruitment in Prince William Sound (PWS). These were (1) overwinter mortality of juveniles, and (2) low reproductive energy investments by adults. These processes were compared among thriving (Sitka Sound) and depressed (Lynn Canal) herring stocks to calibrate PWS observations. Differences among stocks would suggest site-specific conditions that may translate into recruitment success. We propose extending these analyses over two more years to better estimate interannual variability. Collection costs can be decreased because of sampling efficiency with other projects. However, it is necessary to develop bioenergetic parameters for Pacific herring so energy consumption rates among herring from different locations can be directly compared. Energy consumption is a function of size, temperature and physiological condition. In order to compare the energy consumption rates of herring from different locations it is necessary to know how metabolic rates vary with respect to the temperatures in those locations. Therefore, we propose to supplement the field observations with a detailed bioenergetic analysis of YOY, juvenile and adult herring. The physiological parameters to be monitored (food intake, assimilation efficiency, growth, and resting metabolic rate), will be supplemented with 2 commonly used proxies for growth (RNA/DNA and enzyme analysis) to determine their suitability for measuring growth in the field. The additional data provided by the lab component will provide a secure foundation for weighing the evidence for or against energy limitations contributing to the population decline in PWS. Currently the data we seek are unavailable, however recent advances in culturing herring will allow us to make the necessary laboratory manipulations to obtain the data. While fulfilling our immediate needs for comparing herring populations, we anticipate that these data will be invaluable for future bioenergetic models describing herring growth, consumption, reproduction and response to disease. In year 3 (FY 2009) we propose to apply these data by examining the energetic cost of overwintering among healthy and disease challenged herring. This examination specifically tests the hypothesis that low levels of disease in PWS stocks are inhibiting recruitment. All of the herring culturing will be conducted at the USGS facility at Marrowstone Harbor, Washington, where herring capture, culture, and disease challenges are routine. The energetics measurements will be conducted over a range of temperatures, encapsulating the temperatures of Alaska, and will focus on three developmental stages of herring (age 0, age 1, and adults).