

Dr. Paul L. Flint, Research Wildlife Biologist
U.S. Geological Survey
Alaska Science Center
1011 E. Tudor Road
Anchorage, Alaska 99503
USA
paul_flint@usgs.gov
Phone: (907) 786-3608
Fax: (907) 786-3636

Population dynamics of sea ducks: the causes, consequences, and management of variation.

While all species of sea ducks are functionally unique, most share basic life history characteristics which constrain their population dynamics to be similar. I developed a basic population model to demonstrate the dynamics of the hypothetical "average" sea duck. I present the concepts of sensitivities and elasticities and interpret them relative to prospective population management. I define and demonstrate retrospective population variance decomposition. I contrast and discuss the difference in the results and conclusions from these two analyses. I demonstrate that these conclusions are robust over a range of life history parameter input values. This model is then expanded by including stochastic 'process' variation in input parameters. I define and discuss the estimation of process variation as this represents true biological/environmental variation. Increases in stochastic variation lead to decreases in population performance. Importantly such variation can also lead to correlations in life history parameters. Such correlations have dramatic effects on population dynamics. I discuss the differences in conclusions from deterministic and stochastic models both with and without inclusion of correlated parameters. Understanding the causes and consequences of variation in life history parameters can help identify potential management options as reductions in variation can yield positive effects on population growth. However, not all species of sea ducks fit this generalized 'average' model. By examination of variation in life history parameters among species we can perhaps understand the selection forces that led sea ducks to their existing life history patterns. Mergansers have lower adult survival but higher reproductive output than most other sea ducks. I discuss the effects of such variation in life history characteristics on both prospective and retrospective population analyses. Finally I combine the results from population models with speculation to yield a synthesis about selection pressures that led to the existing life history patterns for sea ducks.