



AYK SUSTAINABLE SALMON INITIATIVE

Project Synopsis

YUKON RIVER WATERSHED



(Christian E. Zimmerman)

PROJECT 406

PRINCIPAL INVESTIGATOR

F. Joseph Margraf
*University of Alaska
Fairbanks*

RESEARCH PERIOD

May 2004 -
July 2005

BUDGET

\$20,952.00

SPARING THE KNIFE

Determining the amount of energy stored by Chinook salmon is critical to the study of the success of these commercially and culturally important Yukon River fish. Traditional methods used to analyze the amounts of water, fat, protein, ash, and other components stored require laboratory facilities and personnel, as well as the sacrifice of the fish. Bioelectric impedance analysis (BIA), a nonlethal method which consists of measuring a current while it is passed through a subject, has long been used on humans and has recently been demonstrated to work on fish.

OUR OBJECTIVES

Develop BIA models for Chinook salmon that will permit the non-lethal estimation of body composition (for example, fat, protein, and water content) for use in future field applications.

HOW WE DID IT

To develop our models, we measured electrical resistance and reactance, and then sacrificed the fish to compare the BIA to traditional body content analysis. We intended to collect 100 Chinook salmon of both sexes and of varying sizes, energy levels, and in different areas of the Yukon River. Due to difficulties obtaining Chinook salmon during a poor run, we were able to collect 46 Chinook salmon from the Rapids Research Center. We supplemented our study with 86 chum salmon from two

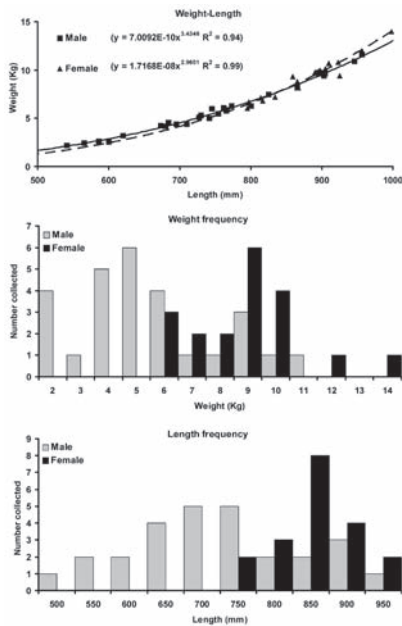
RESEARCH

FRAMEWORK:

SALMON LIFE CYCLE –
PRIORITY #2

SNAPSHOT

Models were developed for the use of bioelectric impedance analysis of Yukon River Chinook and chum salmon. This kind of easily deployed analysis allows researchers to determine the body content and energy density of individual fish in a nonlethal manner.



Size (mid-eye-to-fork length in mm and weight to nearest 0.1 Kg) demographics for 46 Chinook salmon collected from the Yukon River, 2004. (Magraf, UAF)

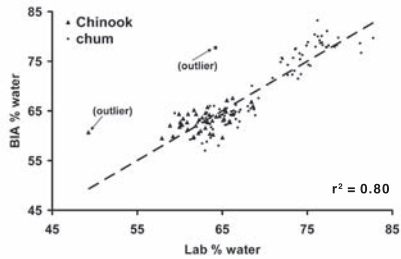
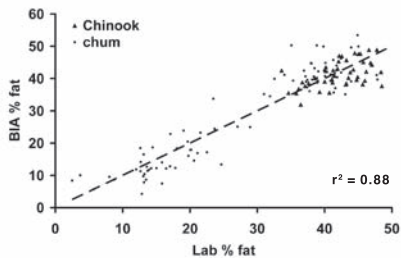


Figure 3 (A).



Proximate analysis values for fat (lipid) content (x-axis) plotted against the BIA predicted value for fat content (y-axis), expressed as percent dry weight. (Magraf, UAF)

AYK SSI Mission: To collaboratively develop and implement a comprehensive research plan to understand the causes of the declines and recoveries of AYK salmon.

ARCTIC-YUKON-KUSKOKWIM SUSTAINABLE SALMON INITIATIVE

BERING SEA FISHERMEN'S ASSOCIATION
110 W. 15TH AVENUE
ANCHORAGE, AK 99501
(907) 279-6519

areas along the river. We conducted BIA measurements in two different locations on each fish, homogenized them using an industrial grinder, and analyzed samples in a laboratory using traditional methods.

WHAT WE DISCOVERED

Despite some problems obtaining Chinook salmon from the planned locations, we successfully developed usable BIA models of body composition and energy density by combining the Chinook salmon data with similar data from chum salmon. Our ability to predict body composition of salmon exceeds that of techniques used on humans in a medical context. We were able to predict fat and protein components and energy density by BIA with accuracies that equal or exceed those obtained in far more sophisticated laboratory settings for small mammals.

PRODUCTS AND OUTREACH

Our models are available to researchers for use in further studies of Chinook and chum salmon in the Yukon River or, potentially, in other rivers.

WHAT'S NEXT?

Application of our BIA models to predict energy levels of fish during their migration will allow managers to evaluate salmon energy use along the migratory path. Correlations with tracking and genetic studies may help scientists better understand the relationship between fat content and distance to spawning grounds. BIA models also provide tools for investigations of the differences in energy stores in spawning and recruitment success, the effects of global warming on salmon stocks, and differences in annual flow and temperature changes on migratory energy costs and recruitment success.