Research
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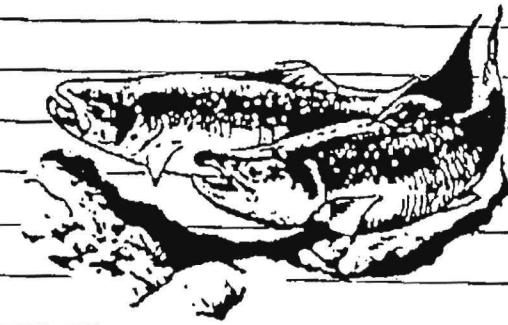
NATIONAL BIOLOGICAL SURVEY



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Diet Affects Body Composition of Chinook Salmon

Hatchery-reared salmonids often contain proportionally greater amounts of body lipid (storage fat) and proportionally lesser amounts of body protein (muscle) and ash (bone) than do their wild counterparts of equal size. The effect of body composition on postrelease survival and subsequent return of mature adults is presently unknown. High lipid deposits may benefit the fish by providing reserve energy during adaptation to the wild, or may hinder the fish by delaying transformation and downstream migration. Compositional differences between hatchery and wild fish may be attributed to various factors, including altered environment, feeding rate, level of exercise, or diet. Diets presently fed to chinook salmon (*Oncorhynchus tshawytscha*) fingerlings are formulated to produce maximum growth, and they contain higher levels of lipid in proportion to protein than would be found in natural prey. Our objective was to determine what relation exists between dietary protein level and body composition in cultured chinook salmon.

Feeding Trial Conducted

A feeding trial was conducted using juvenile spring chinook salmon averaging 1.4 g each. Seven diets were formulated using purified ingredients (casein, gelatin, dextrin, corn oil, cod liver oil, cellulose, vitamins, minerals) containing protein levels ranging from 30 to 60% of the dry diet. Total calories (metabolizable energy) were held equal among all treatments. Each diet was fed for 14 weeks to three replicate groups of 167 fish held in 140-L fiberglass tanks.

Carcass Composition Affected

Dietary protein level had no effect on fish survival, efficiency of feed conversion, or percent apparent protein retention. However, the protein efficiency ratio declined as dietary protein increased. Total weight gain increased progressively (linear response) with added increments of dietary protein. This was reflected by an increase in the percentage of carcass protein

and ash, but a decrease in the percentage carcass lipids (Fig. 1). When the data were expressed in total grams of gain, the greater increases in carcass protein and ash were proportionally offset by smaller increases in carcass lipid (Fig. 2). Thus, both total dry matter gain and caloric gain remained rather constant. The reason overall live body weight increased with added dietary protein is that muscle requires larger quantities of water for metabolic activity than does stored lipid. Thus, as protein is added to the carcass, it carries with it a larger weight of water than would an equal quantity of fat.

Further Research Required

In conclusion, chinook carcass composition, and thus the type and quantity of tissue and energy reserves, can be altered by manipulation of the protein content of the feed. Future research should focus on the range of body compositions that can be produced within the production goals of hatcheries, and the effect this has on postrelease performance. The protein requirement for chinook salmon could then be established to produce fish with the desired physical proportions of muscle, bone, and storage lipid to optimize transition to the wild environment.

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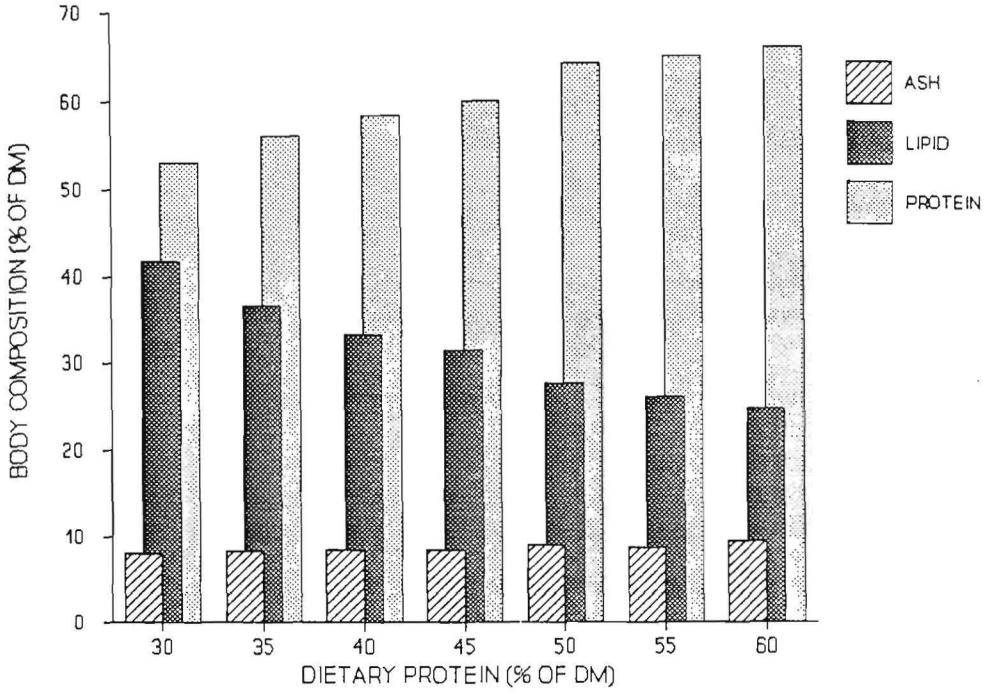

Fig. 1. Body composition of spring chinook salmon (*Oncorhynchus tshawytscha*) as affected by dietary protein content. Data are expressed as a percentage of dry carcass weight after a 14-week feeding trial.

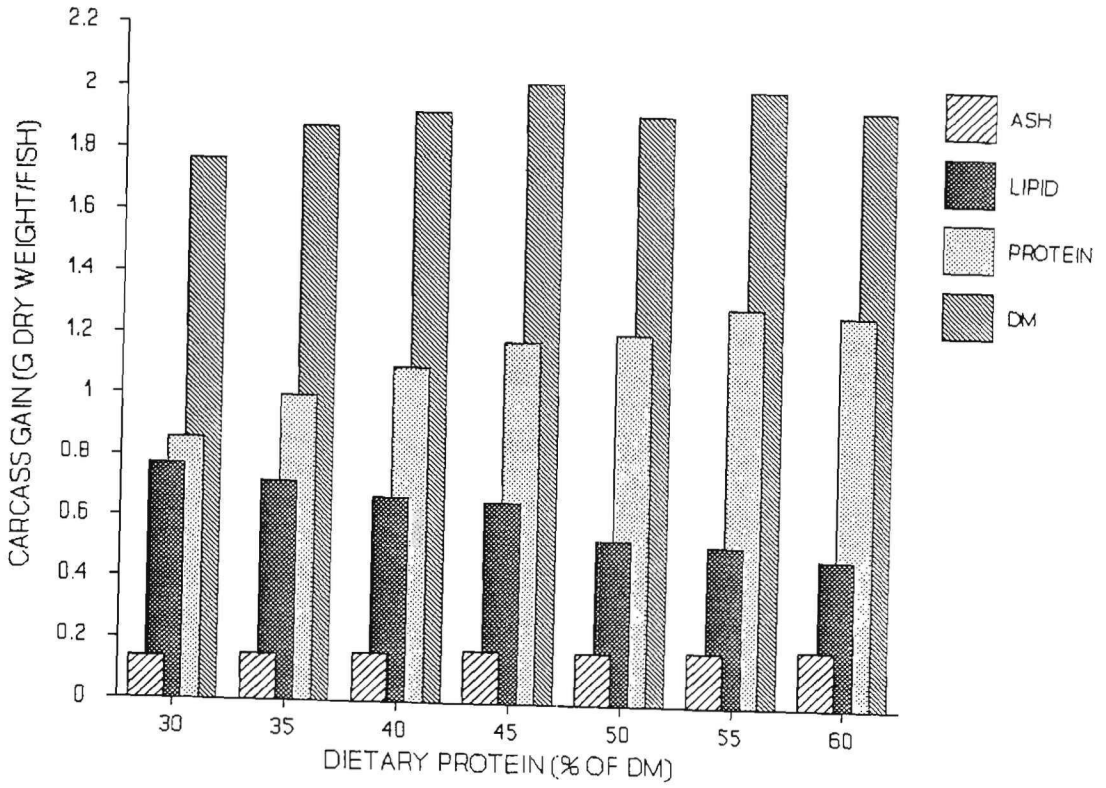

Fig. 2. Weight gain of spring chinook salmon (*Oncorhynchus tshawytscha*) as affected by dietary protein content. Data are expressed as grams of dry weight gain per fish after a 14-week feeding trial.