81

THE EFFECT OF LOW TEMPERATURE AND FASTING, DURING THE WINTER, ON ENDOCRINE PHYSIOLOGY (IGF-1, INSULIN, AND T4), METABOLISM AND SMOLTIFICATION OF COHO SALMON, *ONCORHYNCHUS KISUTCH.*

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We examined the effect of winter feeding and fasting, under both high (10°C) and low (2.5°C) temperature, on physiology of coho salmon. Treatments included: Warm-Fed (WF), Warm-Not Fed (WNF), Cold-Fed (CF) or Cold-Not Fed (CNF) during Jan and Feb. Over this period, dramatic differences in size, growth rate, condition factor, hepatosomatic index, liver glycogen, and plasma IGF-1, insulin and T4 were observed among the treatments. In general, values were highest in the WF, lowest in WNF, and intermediate in the CF and CNF groups. However, during spring, when all groups were fed and reared at 10°C, all treatments were quite similar with regard to most parameters measured. This study suggests that salmonids are capable of relatively rapid physiological adjustments to changing environmental conditions such as low temperature and minimal food availability during winter and higher temperature and increased food availability during spring. (Funded by BPA #92-022).

82

COMPARISON OF FREE AND PROTEIN-BOUND IGF-I LEVELS IN PLASMA OF COHO SALMON, *ONCORHYNCHUS KISUTCH.*

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Insulin-like growth factors (IGFs) circulate as complexes with specific binding proteins (IGFBPs) and less than 1% of IGFs exist as the free form in human serum. In teleosts, the presence of IGFBPs have been demonstrated; however, little is known about the regulation of free IGF or IGFBPs. We examined the ratio of free to protein-bound IGF-I in coho salmon plasma under various physiological conditions. Free and bound IGF-I were separated using either ultrafiltration or gel filtration chromatography (GFC). IGF-I was quantified in plasma, filtration fluid and column fractions by a RIA which detects both free and bound IGF-I. Using ultrafiltration the proportion of free IGF-I in growth hormone (GH) injected fish was approximately 1.5% of the total IGF-I. After GFC, two peaks of immunoreactive IGF-I with approximate molecular weights of 40,000 (bound) and 7,500 (free) were observed in plasma of both GH-injected and control fish. The amount of free IGF-I in GH-injected fish was higher than that of controls. These data suggest that free IGF-I is present in low levels in the plasma of coho salmon and increases after GH treatment.

83

REGULATION OF GROWTH AND METABOLISM BY INSULIN FAMILY PEPTIDES IN SALMON.

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The adaptive significance of insulin and insulin-like growth factor-I (IGF) in salmonids is their coordinate regulation of seasonal growth cycles. Their metabolic actions, seasonal blood concentrations and association with plasma binding proteins argue that insulin should dominate control of metabolism in winter whereas IGF should dominate growth regulation during the major period of protein and bone growth in spring and summer. ACTIONS: although both insulin and IGF stimulate protein and bone growth, insulin is lipogenic whereas IGF is lipolytic and mitogenic. Thus, energy gained from infrequent feeding during winter at low temperature is best stored as fat (directed by insulin) rather than protein and bone. SEASONAL BLOOD LEVELS: Plasma insulin is relatively high in fed fish during winter; IGF is low in winter and increases in spring. The vernal increase in IGF is probably due in part to associated increases in growth hormone and thyroid hormones. PLASMA BINDING: Plasma binding of IGF buffers changes in free IGF levels whereas insulin is unbound, which allows insulin to act rapidly in response to feeding. IGF responds slowly to sustained feeding that would be typical of spring/summer.

84

SEASONAL CHANGES IN CIRCULATING TRIIODOTHYRONINE LEVELS IN CHANNEL CATFISH *ICTALURUS PUNCTATUS*: RELATIONSHIP TO HEPATIC OUTER-RING DEIODINASE ACTIVITY AND PLASMA PROTEIN BINDING.

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Channel catfish were sampled at three distinct phases of their annual cycle (winter quiescence, spring reproductive development, summer somatic growth) to evaluate the potential contributions of hepatic outer-ring deiodinase (ORD) and plasma protein binding to seasonal changes in total circulating triiodothyronine (T3). A high correlation was found between circulating T3 and thyroxine (T4) levels at all sampling dates. T3 was highest in the summer, coincident with highest plasma protein and T3 blood binding capacity, whereas hepatic ORD activity was maximal in the spring. T3 levels may thus be more dependent on centrally-regulated provision of T4 or on nutrient-driven alterations in plasma protein composition than on the peripheral regulation of hepatic deiodinase activity.