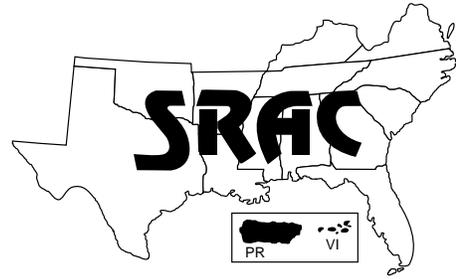


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Dietary Protein and Lipid Requirements of Golden Shiners and Goldfish

Modern intensive baitfish culture relies heavily on prepared feeds and has largely replaced semi-intensive culture methods which relied on natural foods available in the pond. Until now, prepared feeds used to supplement natural foods for baitfish were actually formulated to meet the protein and lipid needs of other cultured species such as channel catfish. However, due to the increased dependence on prepared feeds for growing baitfish, the cost effectiveness of these commercial feeds has been questioned. To address these concerns, aquaculture specialists at the University of Arkansas, Pine Bluff (UAPB) have conducted research to determine the protein and lipid requirements of commercially important baitfish species.

Protein

Dietary protein is critical for the growth and development of fish because it provides essential amino acids. Amino acids are used by the fish to build the proteins necessary for muscle formation and enzymatic function. When the requirement for amino acids has been met, excess dietary protein also can be metabolized for energy. It is important to minimize the amount of protein used for energy because protein is the

The Southern Regional Aquaculture Center has supported a regional research project to improve diets and feeding methods for intensive baitfish production in ponds. Results of this research should assist aquaculturists and feed manufacturers to modify management methods and diet formulations to enhance profitability. This publication was compiled by Wendy M. Sealey, Daniel E. Barziza, James T. Davis and Delbert M. Gatlin III, based on research conducted at the University of Arkansas, Pine Bluff.

most expensive component of the feed. The energy needs of the fish can be met by less expensive lipid and carbohydrate sources.

At UAPB, researchers have conducted feeding trials to establish the minimum dietary protein requirements of golden shiners and goldfish. Fish were stocked into aquaria and fed prepared diets

containing graded levels of protein. The minimum dietary protein requirement of both golden shiners and goldfish in aquaria was determined to be 29 percent based on weight gain.

A pond study comparing the performance of golden shiners fed a high (31 percent) or low (24 percent) level of dietary protein with a constant energy to protein ratio (10.3 kcal/g) also was conducted. After 4 weeks of feeding, fish fed the higher protein diet weighed more, but by the end of the study (10 weeks), no differences in weight gain, total yield or size



Figure 1. Prepared feeds can increase production in baitfish pond.

class distribution were noted. Feed intake did not differ between the two groups.

These studies suggest that the typical protein level of many commercial baitfish feeds (32 percent) can be lowered substantially depending on the availability of natural foods in the pond. Lowering the protein level of commercial baitfish diets will decrease feed costs and increase profits for baitfish producers.

Lipid

The primary functions of dietary lipid are to provide energy and essential fatty acids.

Lipid also is needed for absorption of fat-soluble vitamins. However, excess dietary lipid has been reported to cause inadequate protein intake and suppress growth. Also, feed pellets manufactured with excess lipid tend to be of poor quality and go rancid when stored.

To determine the lipid requirements of golden shiners and goldfish, UAPB researchers fed the fish (in aquaria) diets containing graded levels of lipid. Golden shiners grew well when fed diets with 7 to 12 percent lipid, but peak growth occurred when fish were fed the diet containing 12 percent lipid. In a similar study, goldfish fed diets with 4.5 to 7 percent lipid had the greatest weight gain. However, goldfish fed a 4.5 percent lipid diet had a lower survival rate than fish fed 7 to 13 percent lipid. This indicates a larger amount of lipid is necessary to maximize production of goldfish in aquaria.



Figure 2. Availability of natural foods must be considered when feeding baitfish prepared feeds.

These studies have identified the minimum amount of lipid necessary to maintain growth and survival in golden shiners and goldfish. Higher levels of lipid in the diet may increase the accumulation of body fat in baitfish. However, lipid is a relatively inexpensive source of energy with which to increase weight gain.

Energy:protein ratio

Dietary protein and energy must be kept in proper balance because a deficiency or excess of dietary energy can reduce growth rates. Fish fed diets deficient in energy will metabolize more expensive dietary protein to meet energy requirements. Excess dietary energy can decrease protein intake and suppress growth.

Feeding trials at UAPB used prepared diets containing graded levels of both protein and lipid to demonstrate the importance of a proper energy to protein ratio. These trials established that the optimum energy to protein ratio for both golden shiners and gold-

fish is 9.7 kcal of energy/gram of protein. This ratio gives prepared diets maximum efficiency in meeting the nutritional needs of baitfish. If protein levels of commercial diets are lowered, then energy levels should be adjusted to maintain an optimum dietary energy to protein ratio.

Conclusions

The intensification of baitfish production has increased the need for feeds which meet the nutritional requirements of commercially cultured baitfish species without costly excesses. The establishment of minimum requirements for dietary protein (29 percent) and lipid (13 percent), as well as an energy to protein ratio of 9.7 kcal/g for golden shiners and goldfish, makes it possible to formulate feeds that increase the profitability of baitfish production through reduced feed costs and increased productivity.

References

- Lochmann, R.T. and H. Phillips. 1994. Dietary protein requirement of juvenile golden shiners (*Notemigonus crysoleucas*) and goldfish (*Carassius auratus*) in aquaria. *Aquaculture* 128:277-285.
- Lochmann, R.T. and H. Phillips. 1996. Nutrition and feeding of baitfish. *Aquaculture Magazine*. July / August pp. 87-89.