Best Management Practices
Feeds and Feeding

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Guidelines

- International Feed Industry Federation (IFIF) and the Food and Agriculture Organization of the United Nations (FAO)
- Codex Alimentarius' Code of Practice on Good Animal Feeding

Introduction

- Feed mill - FDA
  - Prior to 2001, Feed Manufacturing Compliance applied only to medicated feed
  - After 2001, applied to all feed
- The FDA Food Safety Modernization Act (FSMA) Preventive Controls for Animal Food rule is now final, begins September 2016.

- Current Good Manufacturing Practices (CGMPs) established for animal food production
- Covered facilities must establish and implement a food safety system that includes an analysis of hazards and risk-based preventive controls. The rule sets requirements for a written food safety plan that includes.
- Supply-chain program is more flexible, with separate compliance dates established.
- The definition of a ‘farm’ is clarified in the Preventive Controls for Human Food final rule to cover two types of farm operations.
- Feed mills associated with farms (vertically integrated operations) not covered.

ISO, Greek “isos,” equal

- Standards in the ISO 9000 family include:

- ISO 9001:2015 - sets out the requirements of a quality management system
- ISO 9000:2015 - covers the basic concepts and language
- ISO 9004:2009 - focuses on how to make a quality management system more efficient and effective
- ISO 19011:2011 - sets out guidance on internal and external audits of quality management systems.

Feeds

- Formulation
  - Nutritional concentrations
  - Blend of ingredients

- Best – meets the unique requirements of the target species
- Incorporates ingredients that are highly digestible, complimentary, and safe

Challenge

- Few nutritional requirements quantified for species of interest in NCR
- Volume of feed sales is relatively low
- Species specific feeds not available
- Positive – feed orders filled rapidly, costs tend to be stable, can feed multiple species with same diet
- Negative – changes in body composition, fatty liver, chronic subclinical nutritional deficiencies

Nutritional recommendations for hybrid striped bass

- Crude protein 36% (32-44)
- Crude lipid 8-15% (14-16)
  - n-3 LC PUFA 0.5-1.0%
- Protein:energy 9 (36/4000 kcal/kg DE)
- Crude fiber <5-7%
- Crude ash <5%
- Nitrogen-free extract <15%

Micronutrients

- Essential amino acids (6/10)
  - Arginine 1.0 -1.5%
  - Lysine 1.4-2.1%
  - Methionine 0.7%
  - Methionine + cyst(e)ine 1.1%
  - Phenylalanine 0.9%
  - Threonine 0.9%
  - Tryptophan 0.3%
  - Requirements for histidine, leucine, isoleucine, valine unknown
  - Sparing of Phe requirement by tyrosine unknown
  - No antagonism between Lys and Arg

Micronutrients

- Minerals (3 of 12)
  - Phosphorus 0.5%
  - Zinc 37 mg/kg
  - Selenium 0.25 mg/kg
- Vitamins (6/15)
  - A 0.5 mg/kg
  - E 28 mg/kg
  - Riboflavin 5 mg/kg
  - Pantothenic acid 25 mg/kg
  - Choline 500 mg/kg
  - C 22 mg/kg

Nutritional needs of largemouth bass

- Crude protein 43-45
- Crude lipid 8-12 (14-16)
  - n-3 LC PUFA ??
- Protein:energy 25-26 (mg protein/kJ DE)
- Crude fiber <5-7
- Crude ash <5
- Nitrogen-free extract <15

Micronutrients

- Essential amino acids
  - Arginine 1.9%
  - Requirements for lysine, methionine, phenylalanine, threonine, tryptophan, histidine, leucine, isoleucine, and valine unknown

Micronutrients

- Minerals (0 of 12)
- Vitamins (0/15)


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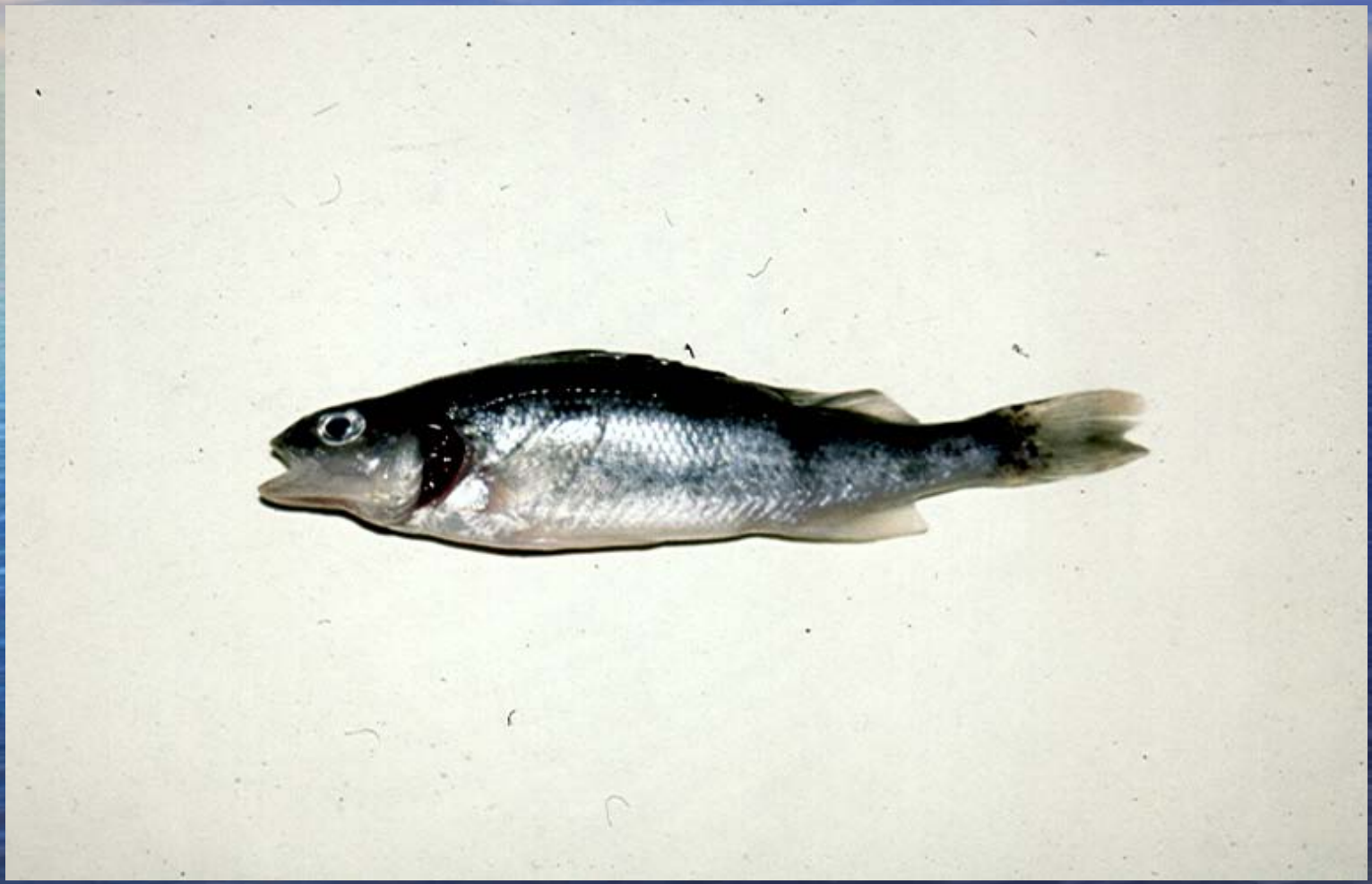

Final challenge

- Trust

Feeding

- Pellet size – Feed the smallest fish
- Frequency – Decreases as animals get older
  - larvae – constant supply of food
- Consistent

- Avoid excess food
  - Cost money
  - Expensive fertilizer
- Ad libitum, satiation or restricted feeding?


René Spaargaren

Storage

- Cool, dry
- Formulations affect storage – fish meal and oil
- Nutrient losses – fatty acids, vitamins
- Contamination – rodents, fungal, bacterial

- Storage needs a function of volume, purchasing frequency and trust in mill
- Small frequent purchases – chest freezers, sealed room, basement.
- Bulk orders – Sealed rooms, walk-in coolers/freezers

Waste Management

- Ponds – drain, dry and disk
- Raceways, tanks – separate physical unit to trap and retain waste
- Cages/net pens – move or place in area with current
- Valuable product – high N

Summary

- Develop a relationship with feed mill – partnership
- Establish a schedule for feeding and maintain consistency
- Plan for feed storage
- Develop a waste management plan