

The Effects of a Dairy/Yeast Prebiotic on Golden Shiners, Goldfish and Channel Catfish – A Review



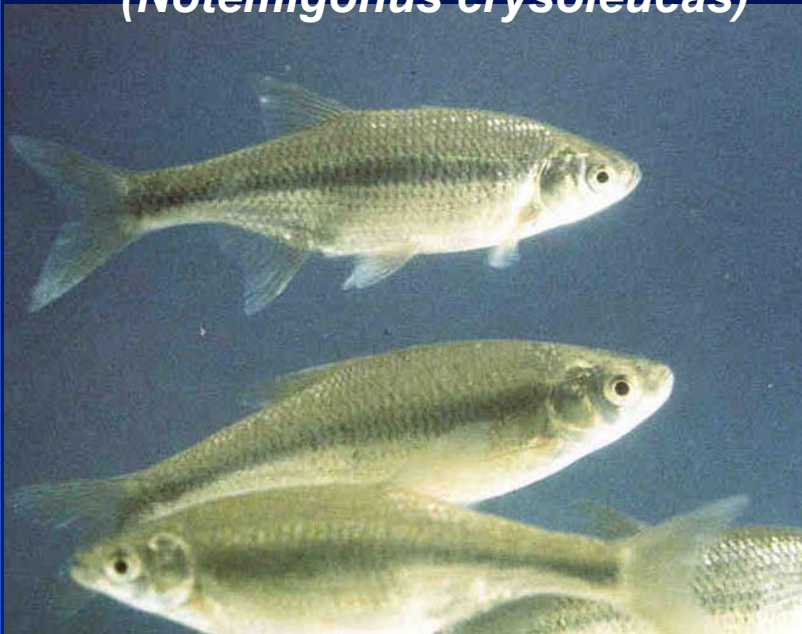
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Baitfish - Top producer is Arkansas

(Estimated value of \$38 Million in 2005 for US)

Golden shiner
(*Notemigonus crysoleucas*)



Goldfish (*Carassius auratus*)



Channel Catfish

Ictalurus punctatus

#1 Foodfish Cultured in US



Stress, Performance, & Diet

- Diets for baitfish are similar to catfish diets, but needs may differ
- Additives may improve basic performance, stress resistance, & immune function
- A dairy/yeast prebiotic has been tested in golden shiners, goldfish and channel catfish





PREBIOTICS

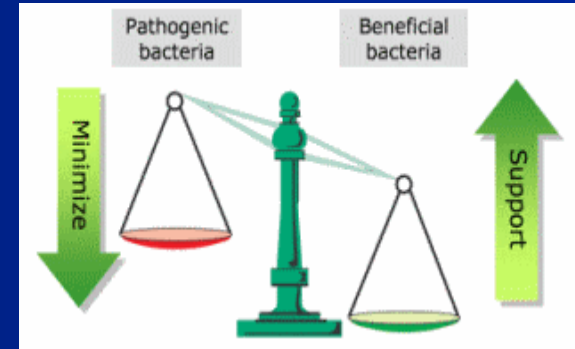


What are prebiotics?

- Non-living matter - parts of plant and microbial cell walls that alter the gut microflora (bacteria) when consumed
- Growth & feed efficiency can improve
- Bacterial metabolites can enhance immune response
- Lower gut pH - better mineral absorption

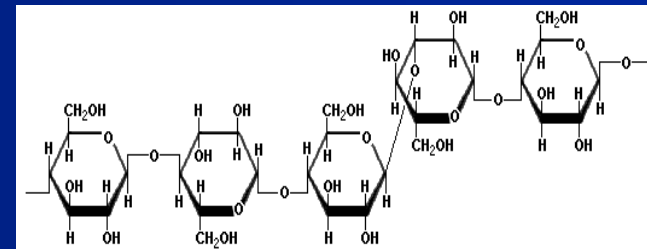
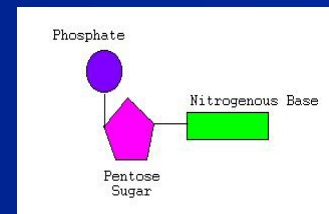
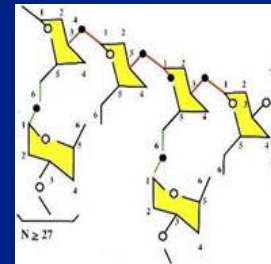
HOW DO PREBIOTICS WORK?

- Feed conversion can improve when “good” bacteria such as *Lactobacillus* and *Bifidobacteria* outcompete the “bad” ones such as *E. coli*



- Effect on immune response possibly due to:

- Mannan oligosaccharides (MOS)
- Beta glucans
- Nucleotides



I. Golden Shiner Trials in Tanks, Pools & Ponds

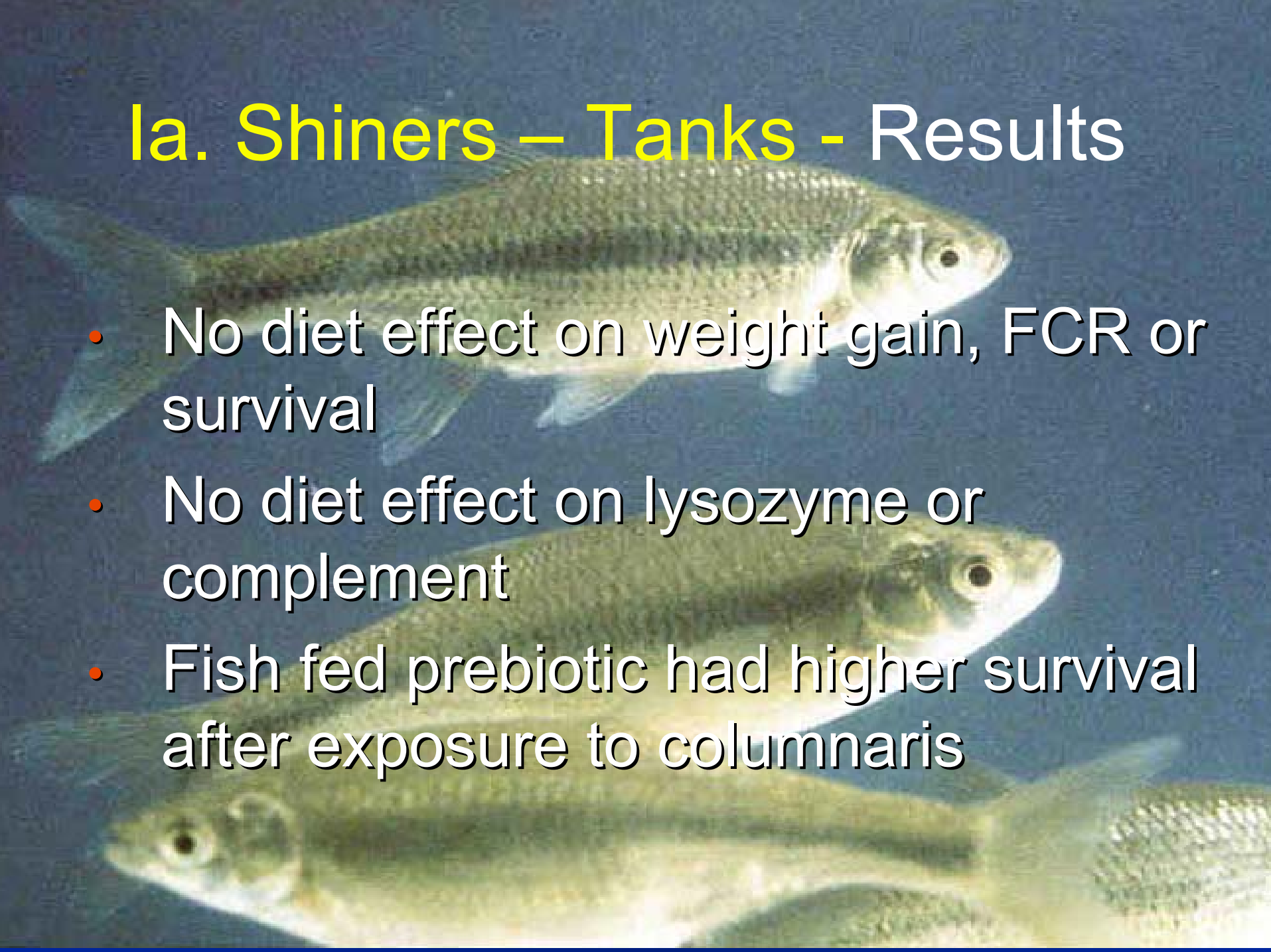


Ia. Shiners - Tanks

- 110 – L tanks in recirculating system
- Groups of 30 fish stocked in 4 tanks per diet
- Diets – practical type with or without 2% dairy/yeast prebiotic

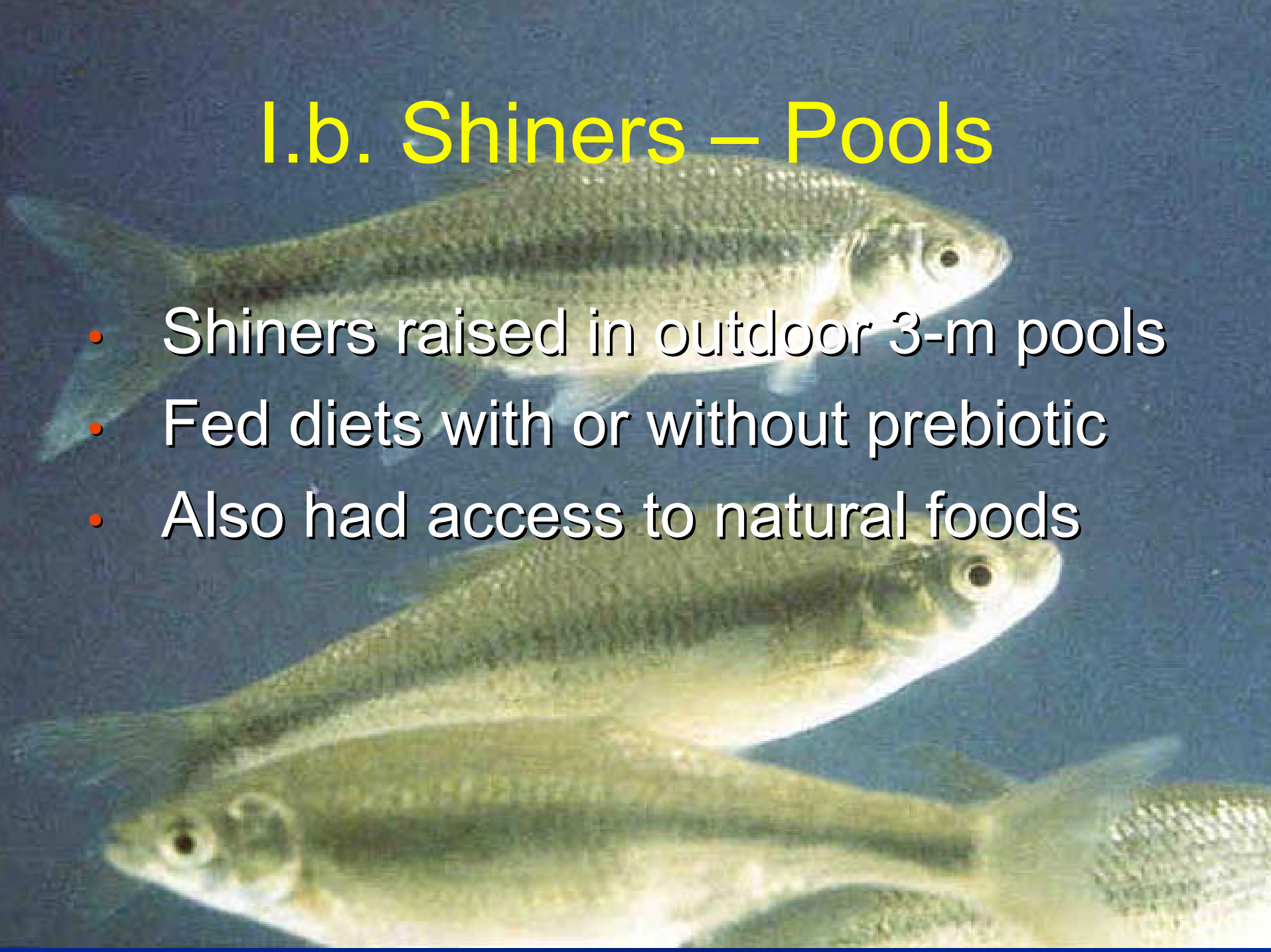
Ia. Shiners – Tanks - Results

- No diet effect on weight gain, FCR or survival
- No diet effect on lysozyme or complement
- Fish fed prebiotic had higher survival after exposure to columnaris



I.b. Shiners – Pools

- Shiners raised in outdoor 3-m pools
- Fed diets with or without prebiotic
- Also had access to natural foods

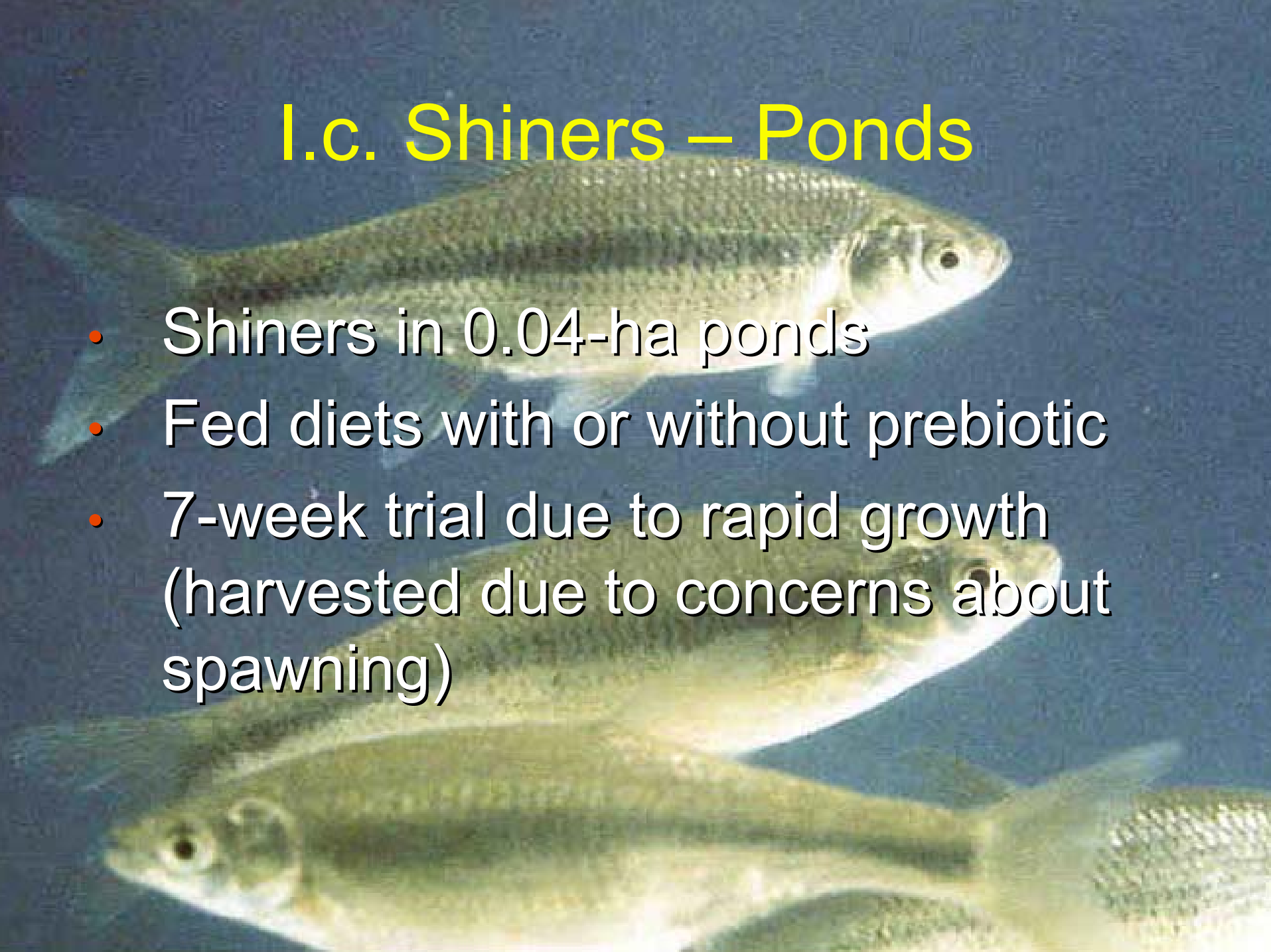


I.b. Shiners – Pools - Results

- No diet effect on weight gain, FCR or survival
- No diet effect on lysozyme or complement
- Fish fed prebiotic had higher survival **after crowding stress** and exposure to columnaris

I.c. Shiners – Ponds

- Shiners in 0.04-ha ponds
- Fed diets with or without prebiotic
- 7-week trial due to rapid growth (harvested due to concerns about spawning)



I.c. Shiners – Ponds - Results

- No diet effect on weight gain, FCR, survival or net yield
- Condition factor higher in fish fed control diet
- Fish fed prebiotic had higher survival **after crowding stress** and exposure to columnaris
- Economic analysis indicates prebiotic use would be advantageous

2.a. Goldfish - Tanks & Pools

(Savolainen & Gatlin 2009)

- Goldfish in tanks with or without access to natural foods
- Diets – practical type with or without 2% dairy/yeast prebiotic
- Main effects (growth, FCR) due to natural foods – not prepared diet
- *Aeromonas* challenge – no diet effect

2.b. Goldfish - Tanks

(Lochmann et al., in review)

- 110 – L tanks in recirculating system
- Groups of 30 fish stocked in 4 tanks per diet
- Diets – practical type with or without 2% dairy/yeast prebiotic
- Fish fed twice daily to satiation
- **Results: No diet effects on growth, FCR, and survival – Columnaris challenge inconclusive**

2.c. Goldfish - Pools

(Lochmann et al., in review)

- Groups of 400 fish in 3-m pools
- Diets – practical type with or without 2% dairy/yeast prebiotic
- Fish fed twice daily for 10 weeks

2.c. Goldfish – Pools -Results

(Lochmann et al., in review)

- Weight gain and condition factor higher in fish fed prebiotic
- Fish fed prebiotic had higher survival **after crowding stress** and exposure to columnaris
- Effect seen in diets with 4% lipid but not in diets with 10% lipid

3.a. Channel Catfish - Tanks

- 3 trials in recirculating systems at 26 – 28 C
- Practical diet with or without prebiotic (2%)
- Fish fed once daily for ≥ 10 weeks
- Measured growth, FCR, survival, non-specific immune responses
- Measured survival of catfish to ESC challenge

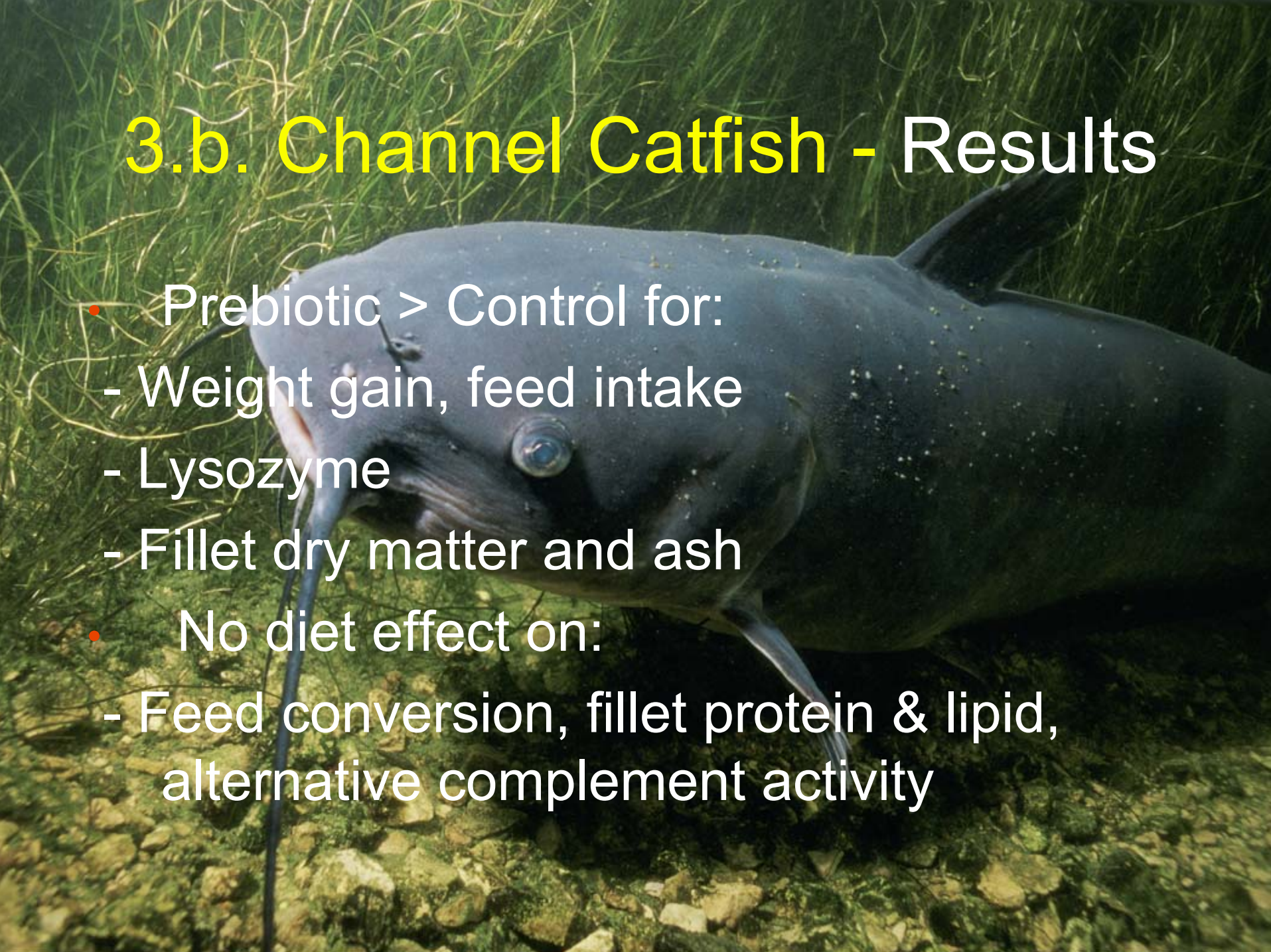
3.a. Channel Catfish - Results

- No diet effect on growth, FCR, or survival
- No diet effect on lysozyme or alternative complement activity
- No diet effect on survival of catfish to ESC challenge
- However, during an unintended outbreak of columnaris, fish fed the prebiotic diet had no mortality (control fish had mortality)

3.b. Channel Catfish - Tanks

- 1 trial in recirculating system at 16 C
- Practical diet with or without prebiotic (2%)
- Fish fed once daily for 13 weeks
- Measured growth, FCR, survival, non-specific immune responses
- Analyzed fillet composition

3.b. Channel Catfish - Results

- Prebiotic > Control for:
 - Weight gain, feed intake
 - Lysozyme
 - Fillet dry matter and ash
 - No diet effect on:
 - Feed conversion, fillet protein & lipid, alternative complement activity
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- A large channel catfish is shown swimming in a pond. The fish is dark grey with a lighter underbelly and prominent whiskers. The background consists of green grass and rocks at the bottom of the pond.

SUMMARY

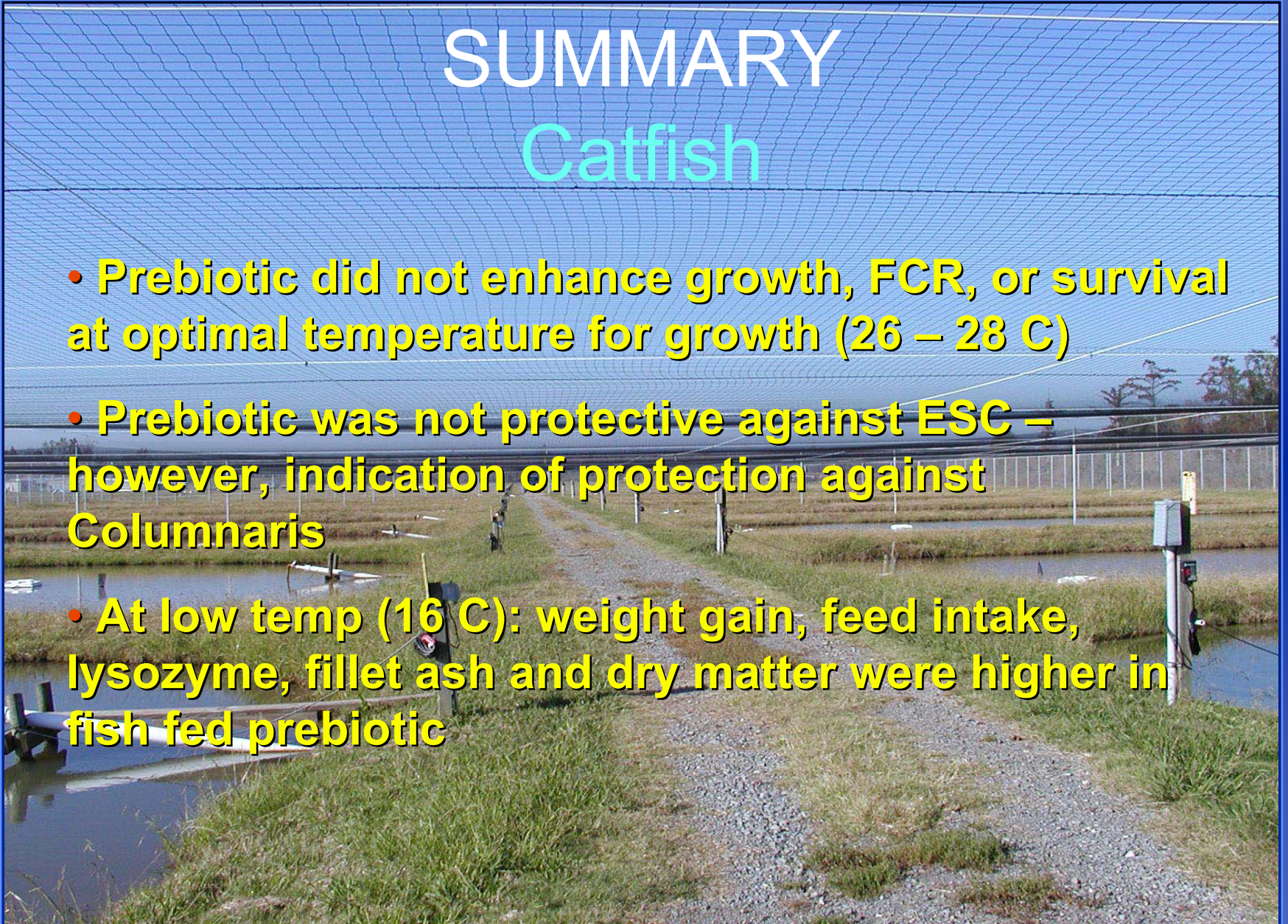
Baitfish

- Main benefit of prebiotic in golden shiners is enhanced specific immune response (survival of exposure to *Columnaris*) – in outdoor systems, need stressor first to see benefits
- Prebiotic improved weight gain and condition index of goldfish in outdoor systems, in addition to survival of *Columnaris* challenge (in 4% fat diets)
- Economics were favorable for prebiotic use based on challenge results in pond study

SUMMARY

Catfish

- Prebiotic did not enhance growth, FCR, or survival at optimal temperature for growth (26 – 28 C)
- Prebiotic was not protective against ESC – however, indication of protection against *Columnaris*
- At low temp (16 C): weight gain, feed intake, lysozyme, fillet ash and dry matter were higher in fish fed prebiotic



Future Work

- Explore mechanism of prebiotic function – gut microflora characterization
- Test efficacy of the prebiotic against different pathogens in different species with different stressors and temperatures
- Expand economic analysis – higher diet cost not attractive, but need cost/benefit analysis to assess feasibility of prebiotic use

Acknowledgments

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