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POZNAŃ UNIVERSITY OF LIFE SCIENCES

Animal Production Management

Ist MSc CONFERENCE

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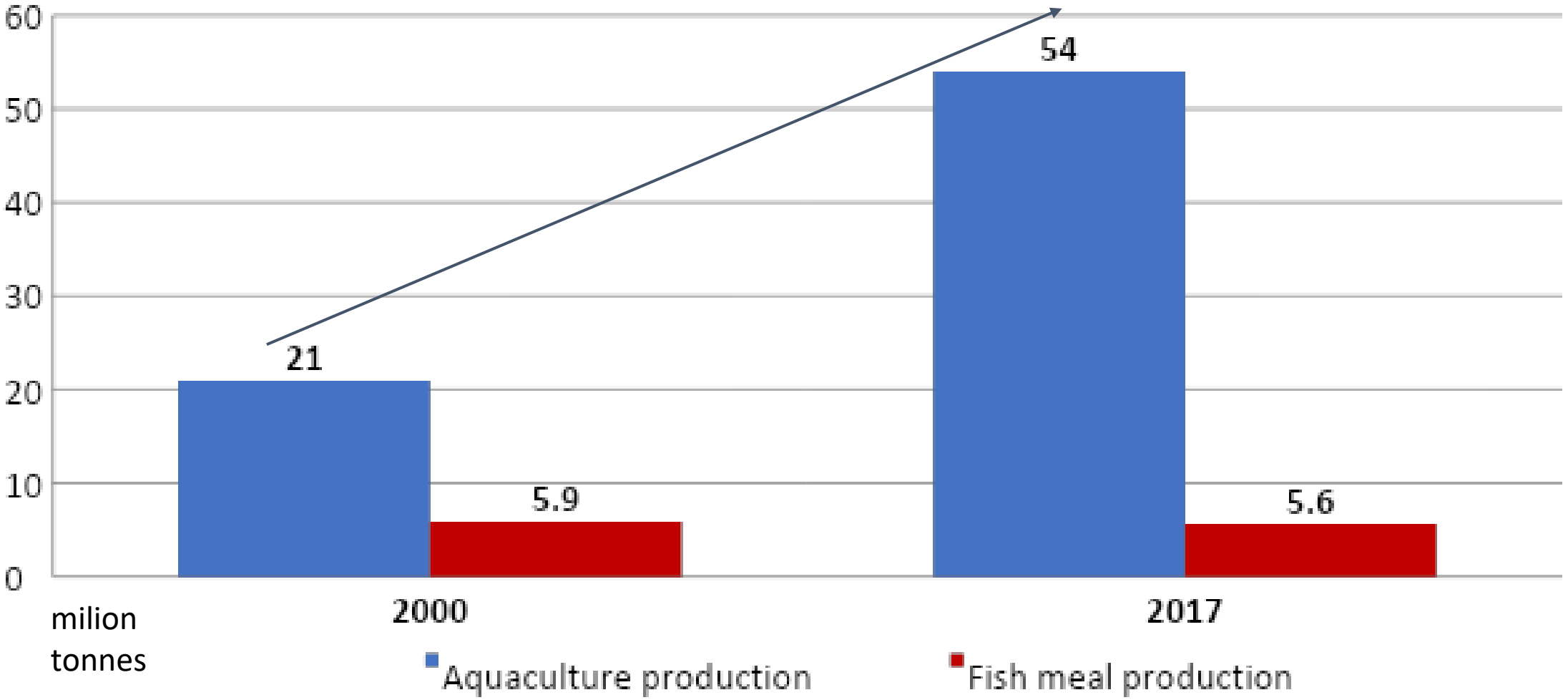
EFFECTS OF FISH MEAL DIETARY REPLACEMENT WITH SELECTED INSECT LARVAL MEALS ON THE GROWTH PERFORMANCE AND FEED UTILIZATION OF EUROPEAN CHUB (*Leuciscus cephalus)* JUVENILES

This research was funded by the project entitled “Innovative feed components in the nutrition of rheophilic fish–optimizing and increasing the efficiency of rearing juvenile stages” No. 00001-6521.1-OR1500001/17/19, Task 2.1 “Innovations” according to EU Regulation No. 508/2014, Priority 2—“Supporting environmentally sustainable, resource-efficient, innovative, competitive and knowledge-based aquaculture” realized in the Operational Program “Fisheries and Sea”.

Introduction: Aquaculture



Tacon, A. G. J. (2019). *Trends in Global Aquaculture and Aquafeed Production: 2000–2017. Reviews in Fisheries Science & Aquaculture, 1–14.* , FAO stats 2019

Introduction

Compensating conservation efforts

Aquaculture

A shift from commonly domesticated fish species

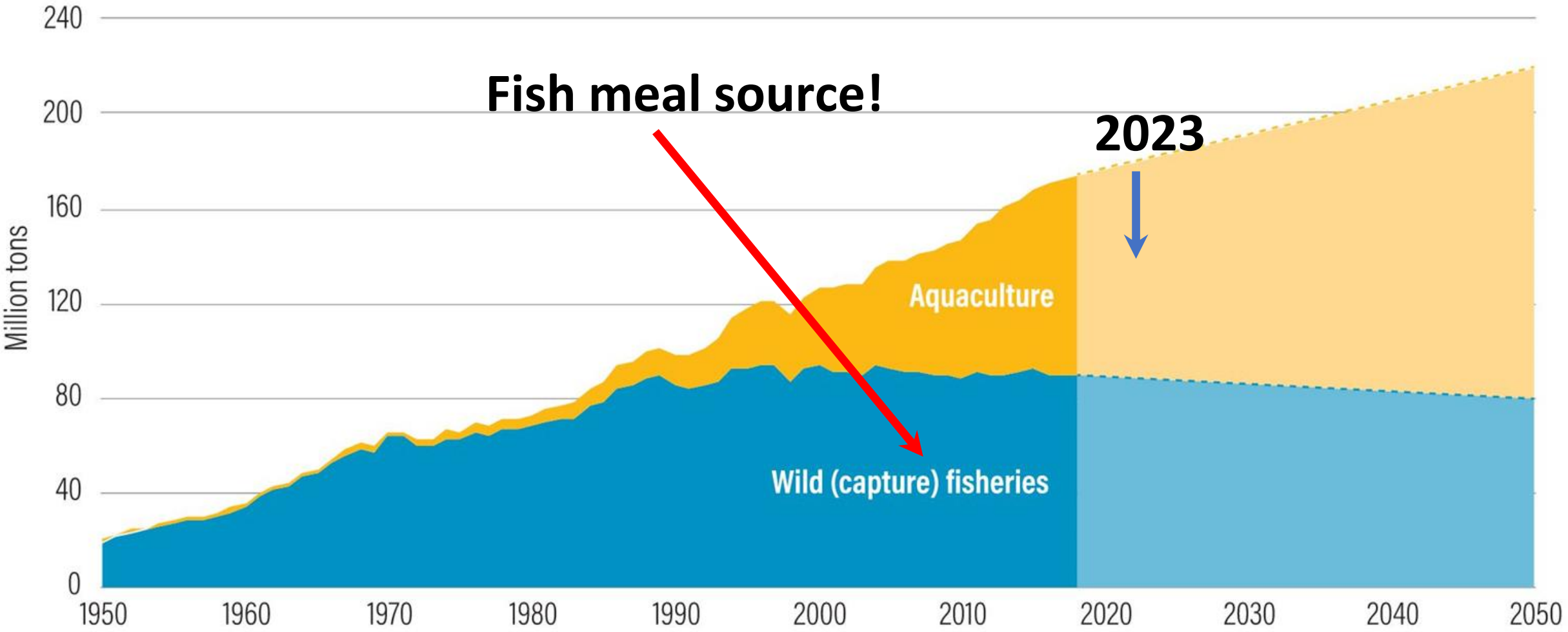
Why European Chub though?

- Decreased species abundance
- Ornamental and recreational angling fish species in Poland
- Pollution bioindicators and model for toxicity test

Main idea: Restocking

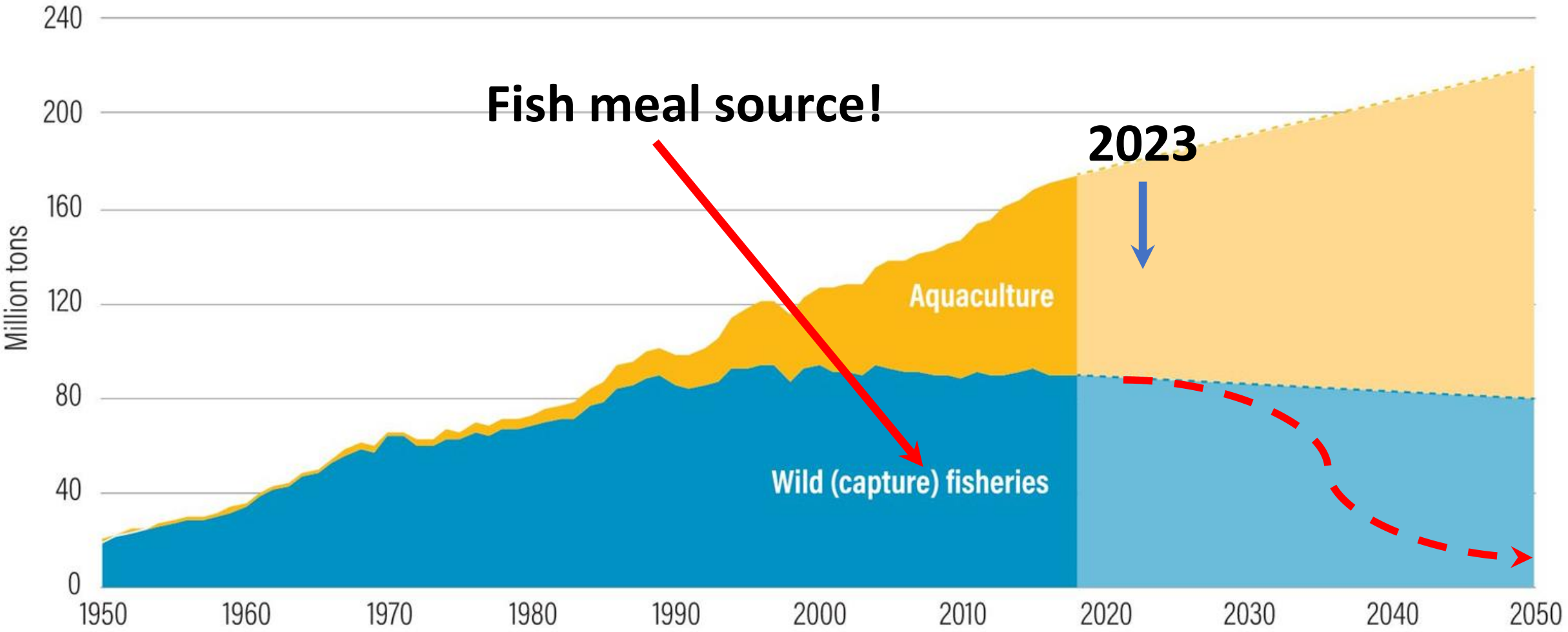
Why do we need alternatives?

Increasing Aquaculture production and constant fisheries



Why do we need alternatives?

We are in the point in which wild fish capture may collapse



Aquaculture: Ultimate goal of production

Fish meal substitutes

Alternative nutritional approaches

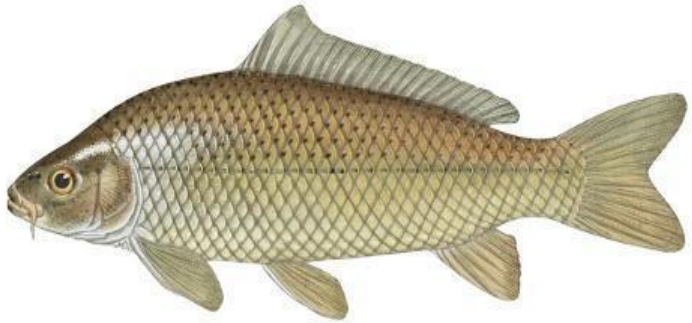
Cost-effectiveness and Environmental sustainability

Insects are natural feed source for wild fish!
All farmed species consume insects in the wild

Trouts
Insects = up to 55% of the diet

Salmon
Insects = over 40% of the diet

Sturgeons
Insects = up to 67% of the diet

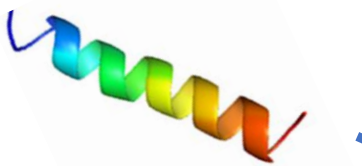


Carps
Insects = up to 95% of the diet!

Nogales Merida et al. 2018, Gerrity et al. 2014

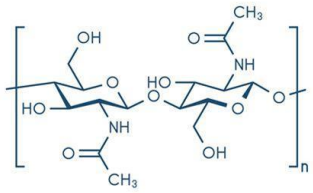
Positive gastrointestinal tract microbiota modification

Fish health and product safety improvement



Antimicrobial peptides

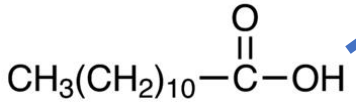
Pathogen decrease



Chitin

Beneficial bacteria increase

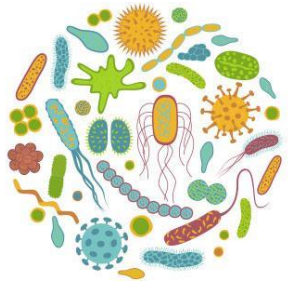
Immune system stimulation



Lauric acid

Bacteriostatic

Antiinflamatory



Increase of *Bacillus* and *Lactobacillus* populations

Decrease of *Aeromonas* pathogenic populations

Gut health improvement

Immune answer enhancement

32 % higher lysosyme activity

Józefiak et al. 2018, Rimoldi et al. 2019, Xiao et al. 2018, Rawski et al. in press.,

Goal of the Study

Our study aimed to evaluate the possibility of using insect-derived meals as an alternative to fish meal in diets for the European Chub (*Leuciscus cephalus*) juveniles.

To evaluate the effectiveness of insect meals in the diet of European chub juveniles

to develop feeds best suited for practical application in rearing the highest quality chub juveniles to increase restocking success

Materials and Methods

Experimental Design

- Fish were kept in an experimental recirculation aquaculture system in 20 growth tanks, each with 400 dm^3 net capacity.
- A total of 4000 chub juveniles with an average weight of 29g were randomly divided into four groups, with five replicates each (200 fish/tank).

- The effects of the various diets on the efficiency of rearing chub juveniles were assessed based on the following parameters
    - ❑ Feed utilization
    - ❑ Fish growth performance

Materials and Methods

Experimental Design

- CON—diet with 300 g of fish meal per kilogram and no insect meal
- HI—diet with 150 g of fish meal and 200 g of *Hermetia illucens* meal per kilogram
- TM—diet with 150 g of fish meal and 200 g of *Tenebrio molitor* meal per kilogram
- ZM—diet with 150 g of fish meal and 200 g of *Zophobas morio* meal per kilogram.

Materials and Methods

Experimental Diet Design

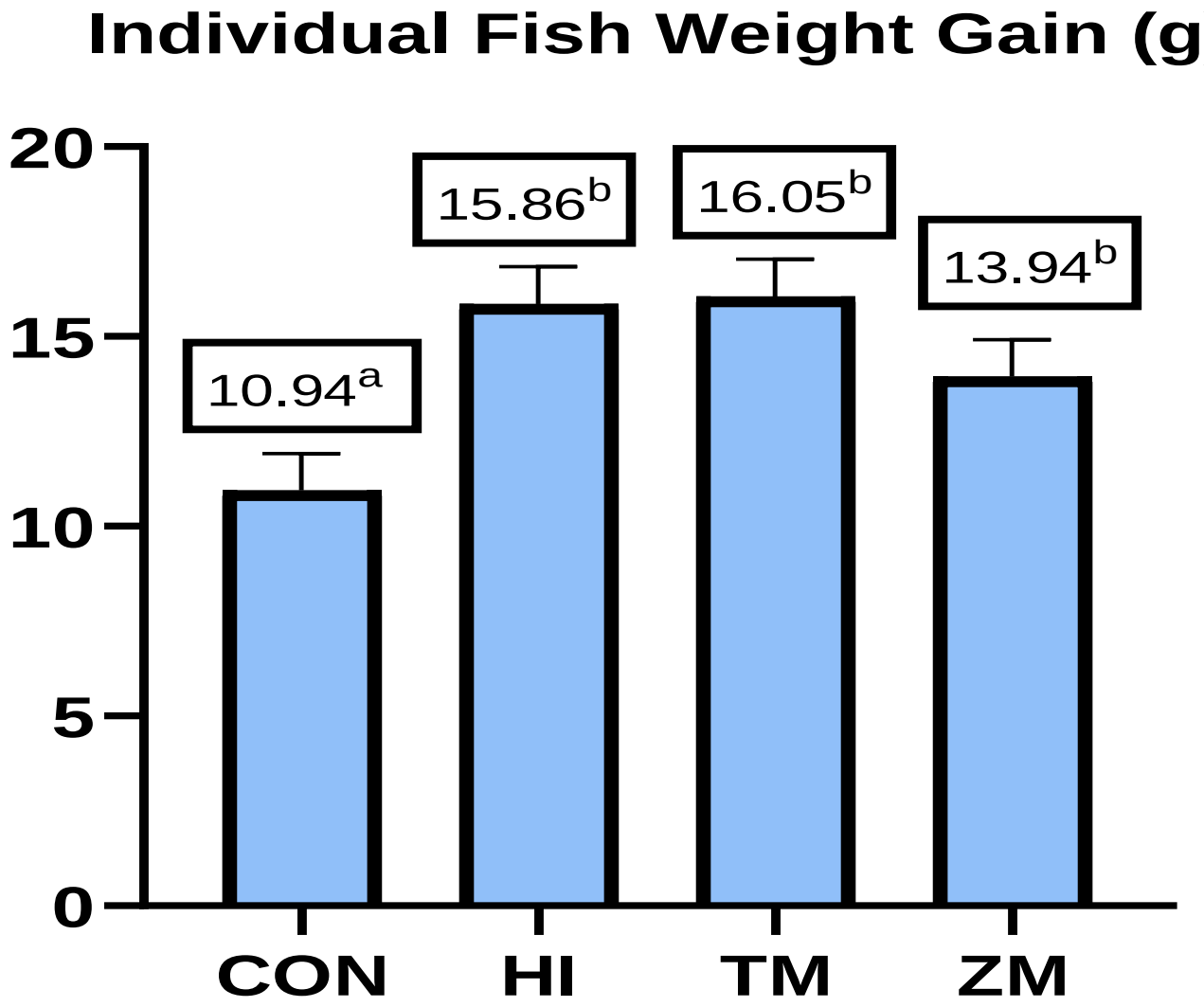
Ingredient (g kg^{-1})	Diets			
	CON	HI	TM	ZM
Fish meal	300	150	150	150
Red blood cells	90	90	90	90
Insect meal	0	200	200	200
Soy protein isolate	80	80	80	80
Wheat gluten	100	100	100	100
Wheat meal	125	125	125	125
Corn starch	196	155	186	201
Fish oil	61	50	15	0
Soybean lecithin	10	10	10	10
Premix [1]	15	15	15	15
Vitamin premix [2]	1	1	1	1
Choline chloride	2	2	2	2
Fodder chalk	20	22	26	26
Vitamin C [3]	0.5	0.5	0.5	0.5

CON—diet with 300 g of fish meal per kilogram and no insect meal; HI—diet with 150 g of fish meal and 200 g of *Hermetia illucens* meal per kilogram; TM—diet with 150 g of fish meal and 200 g of *Tenebrio molitor* meal per kilogram; ZM—diet with 150 g of fish meal and 200 g of *Zophobas morio* meal per kilogram; [1] Premix–containing: vitamin D3 200,000 IU, vitamin A 1,000,000 IU, vitamin K 0.2 g, vitamin E 1.5 g, vitamin B1 0.05 g, vitamin B2 0.4 g, nicotinic acid 2.5 g, vitamin B12 0.001 g, D-calcium pantothenate 1.0 g, inositol 35 g, folic acid 0.1 g, choline chloride 7.5 g, methionine 150.0 g, lysine 150.0 g, Mn 6.5 g, Fe 2.5 g, Cu 0.8 g, Zn 4.0 g, Co 0.04 g, and J 0.008 g per 1 kg; [2] Vitazol AD3EC, BIOWET Drwalew, Poland–containing: vitamin D3 5000 IU, vitamin A 50,000 IU, vitamin C 100.0 mg, vitamin E 30.0 mg per 1 kg; [3] Stay C, DSM Nutritional Products Ltd., Mszczonów, Poland.

Results and Discussion

II. Result (Growth and Feed Utilization Parameters)

Fig 1: Individual Body weight Gain (g)

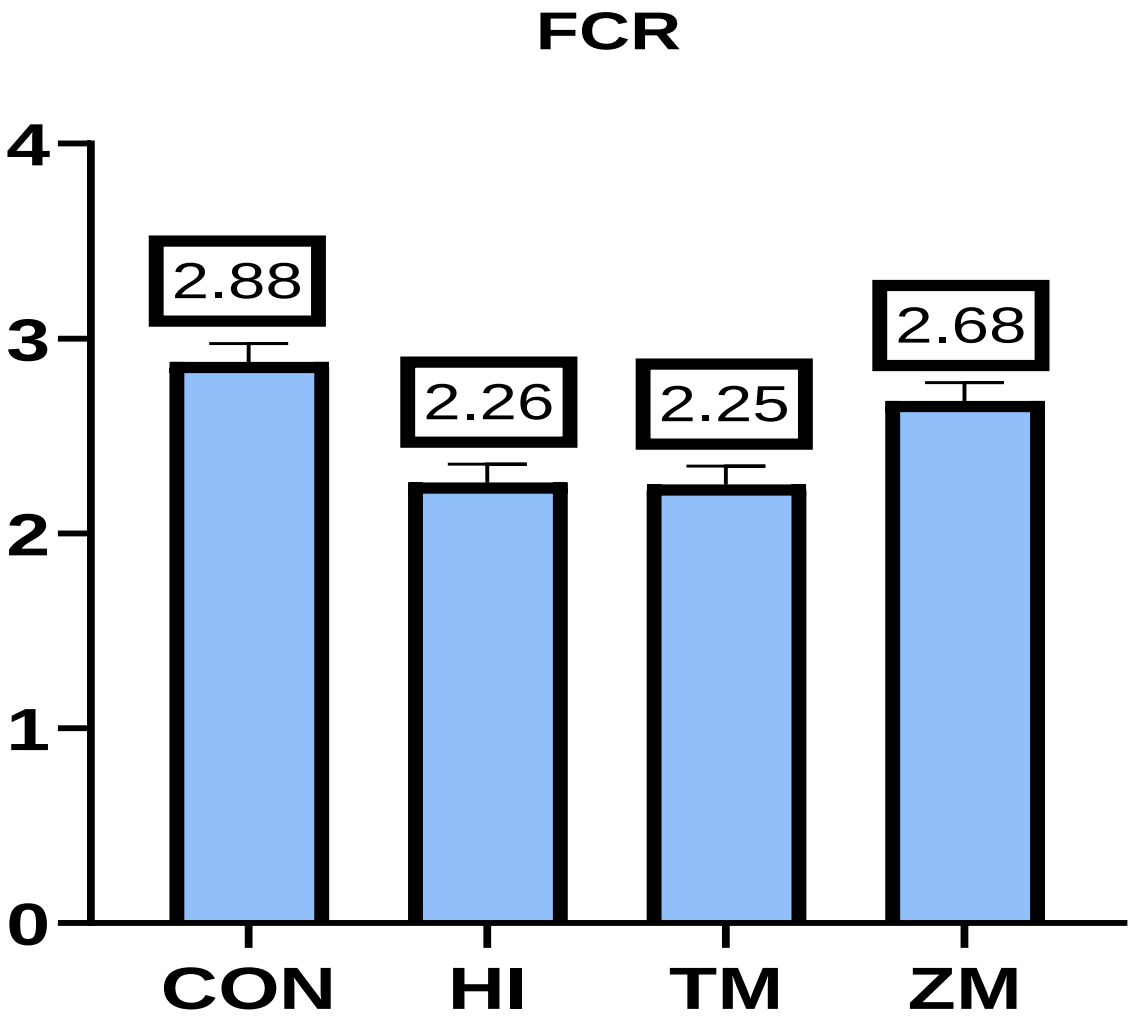


Significantly better than the control treatment group.

p-value <0.0267

II. Result (Growth and Feed Utilization Parameters)

Fig 2: Feed conversion ratio

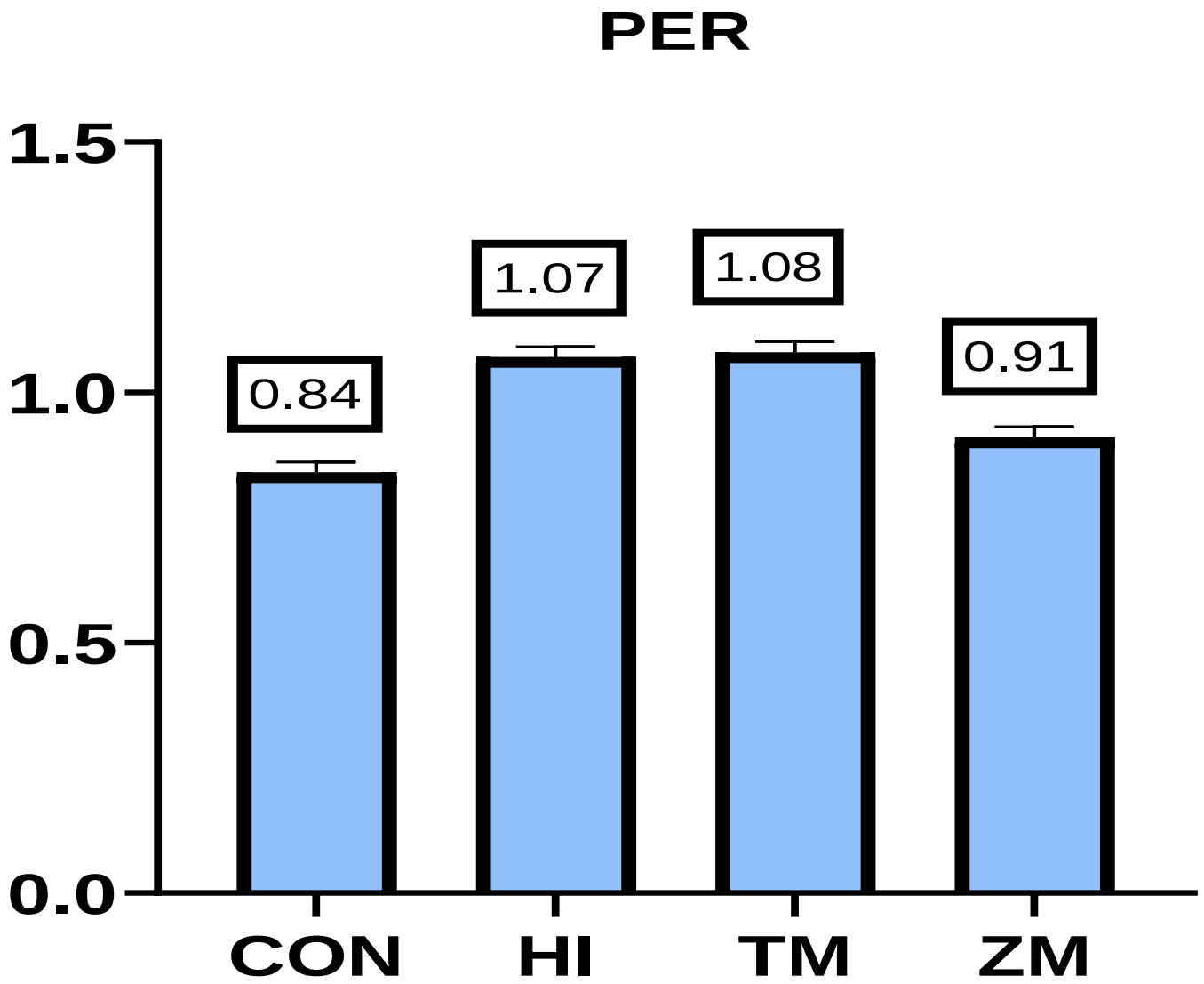


All the insect species gave favorable results.

p-value <0.5611

II. Result (Growth and Feed Utilization Parameters)

Fig 3: Protein efficiency ratio



The highest increase in protein efficiency ratio was observed in the HI and TM groups, while the lowest values were observed in the ZM and CON groups.

p-value <0.3111

Conclusion and Future Studies

- The growth performance results for chub juveniles from all experimental groups were satisfactory which supports the inclusiveness and potential of insect meals in *Leuciscus cephalus* diets.

FUTURE STUDIES

➔ The effects of these insect meals on the gastrointestinal tract development and digestibility coefficients of chub juveniles.

➔ Effects of different levels of incorporation of these insect meals on the growth performance of chub juveniles so that maximum level of incorporation can be established.

THANK YOU FOR YOUR ATTENTION

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