UNIVERSITY OF GDAŃSK

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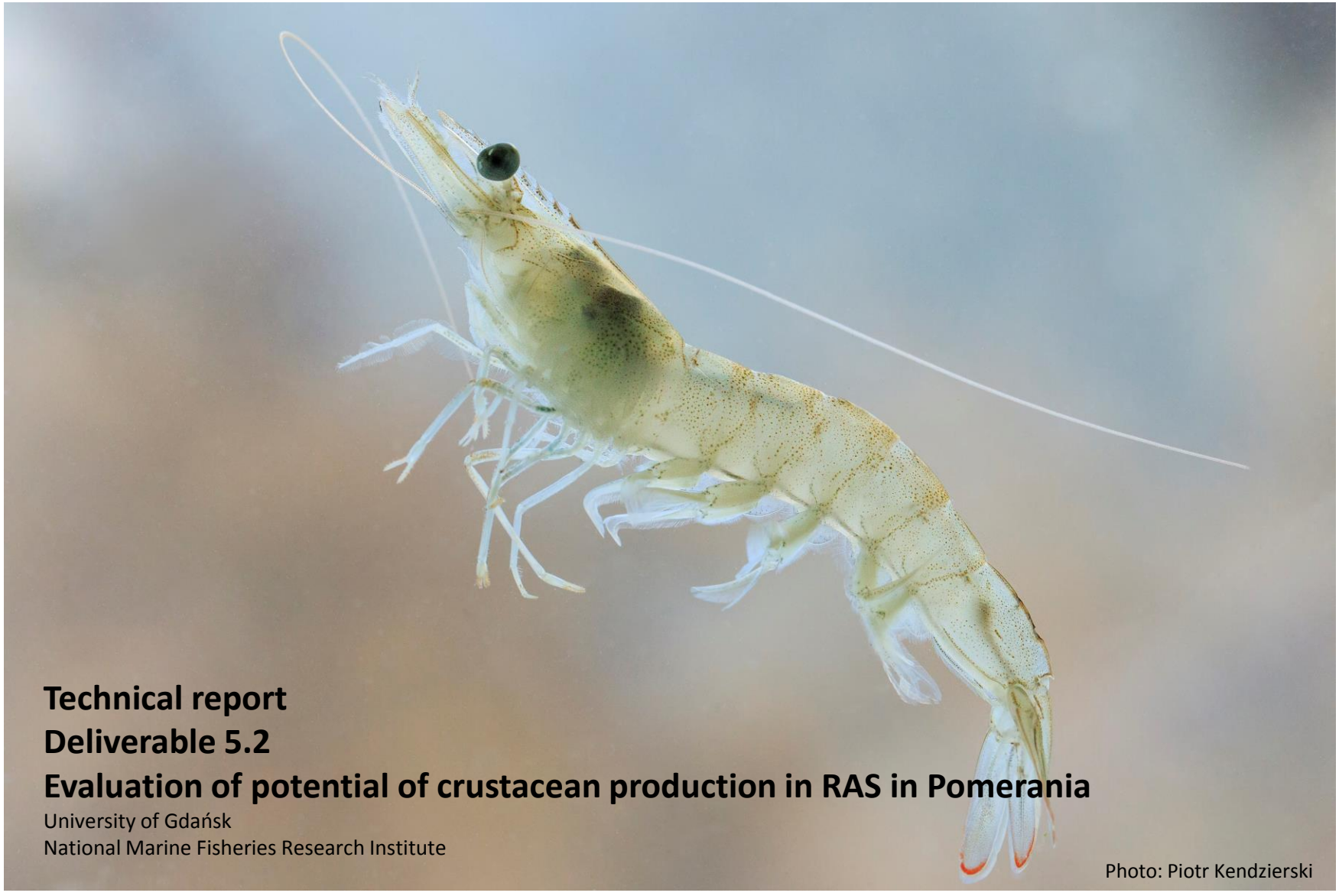
European Regional Development Fund

Growth and nutritional value of *Litopenaeus vannamei* from the small-scale laboratory culture

Halina Kendzierska, Ph.D.

17-20 V 2021, AquaVIP Gdynia summer school

SHRIMP HEALTH & WELFARE



Technical report
Deliverable 5.2
Evaluation of potential of crustacean production in RAS in Pomerania

University of Gdańsk
National Marine Fisheries Research Institute

Photo: Piotr Kendzierski

THE SHRIMP WELFARE (HEALTH STATUS) ANALYSIS

The welfare indicators (selected):

- cortisol,
- mortality rate,
- growth rate,
- disease rate,
- feed conversion ratio (FCR),
- and swim speed*

Charity Entrepreneurship

SHRIMP WELFARE

PRIMARY AUTHOR: V. COX

Review: K. Sarek, E. Hausen, M. St. Jules

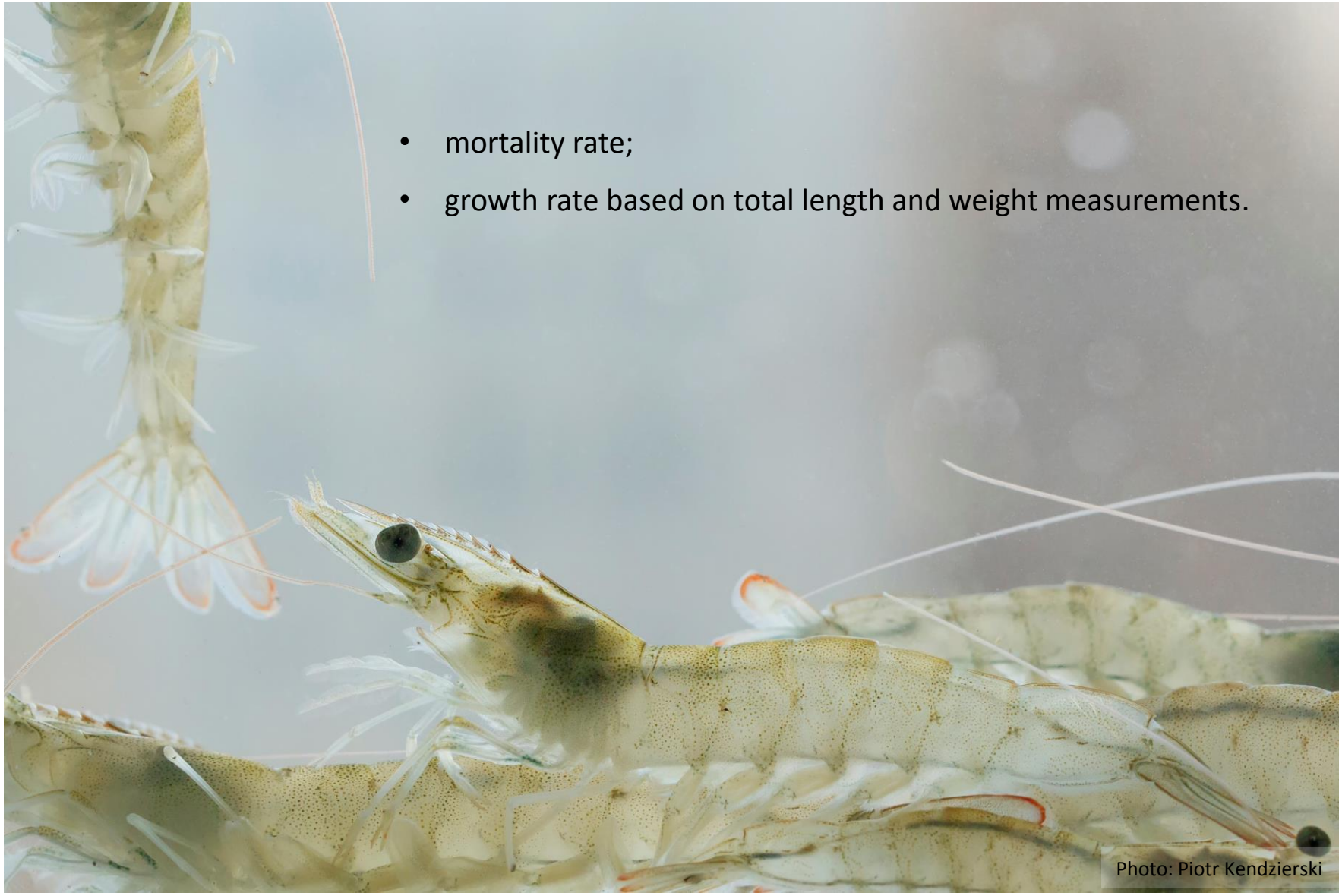
AUGUST 2020

RECOMMENDED

https://docs.google.com/spreadsheets/d/1oMnojolAd7Aja4Q0sse7HtZY4nSWUaz1F9hPJxIV2cI/edit#gid=0

Cox V., 2020, CE Research Report: Animal *Welfare - Shrimp Welfare*

THE FIRST EXPERIMENTAL SHRIMP FARM IN POLAND



- mortality rate;
- growth rate based on total length and weight measurements.

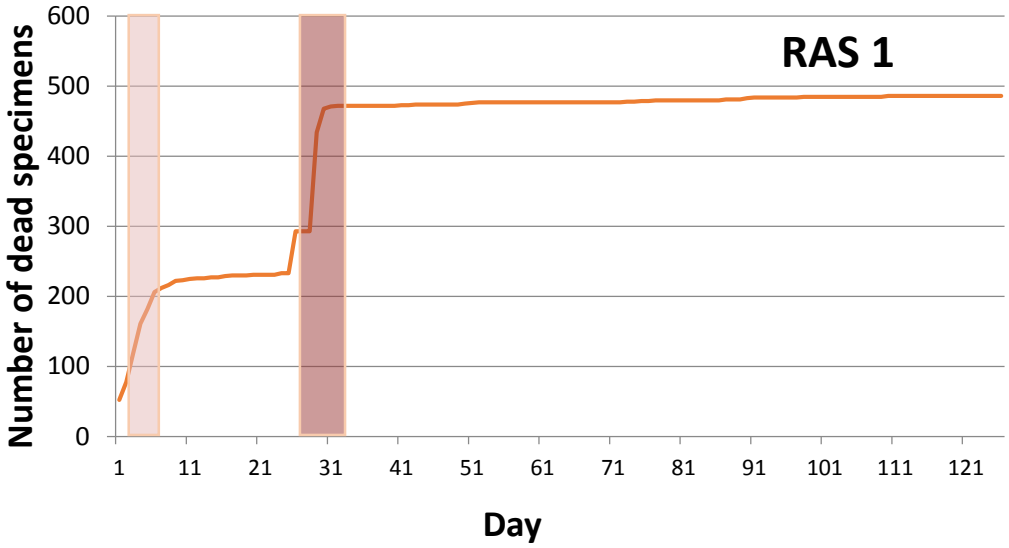
Photo: Piotr Kendzierski

MORTALITY / SURVIVAL RATE

The mortality rate (%) was calculated as percentage proportion of animal number at the end of the experiment compared to the number of all individuals placed in the tank.

- Shrimp survival rates (*SURV*) are defined as the volume of shrimp harvested as a percentage of what is expected at the end of the cycle.
- In the world shrimp sector, the natural survival rate is approximately 45 percent.
- Pond management - stocking density, seed quality, feed management, water quality management and sediment management.

Results - Mortality of Shrimps



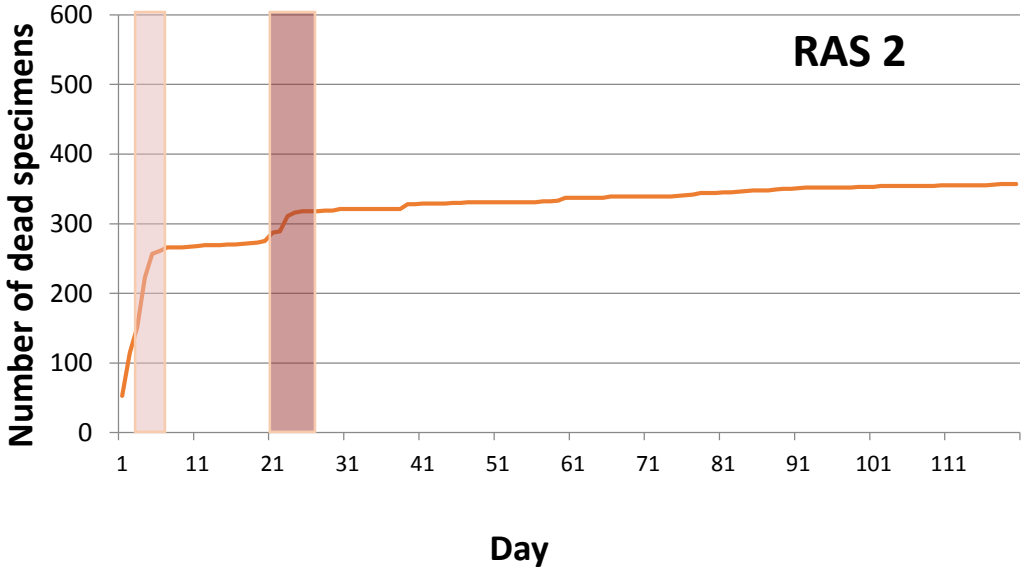
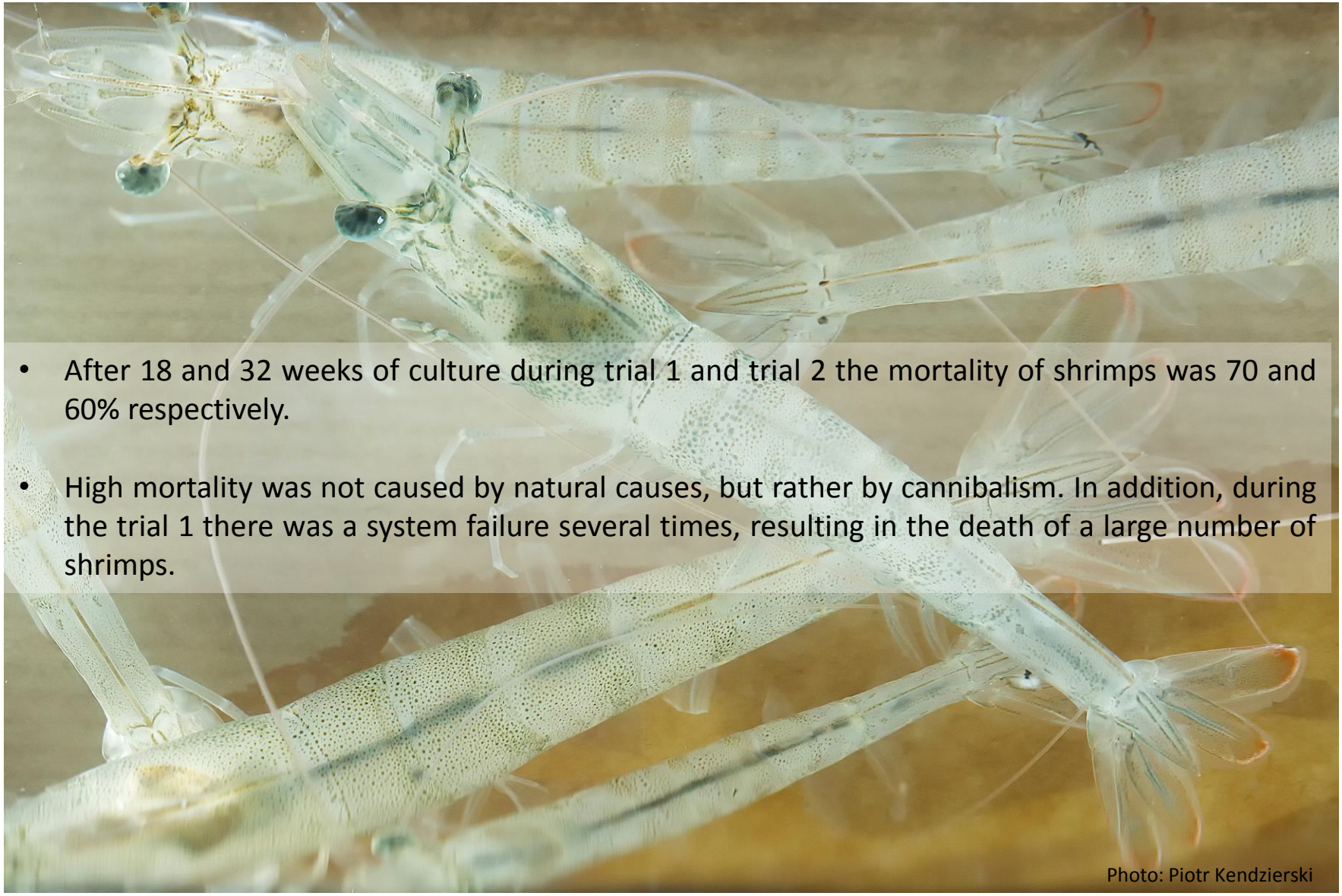



Photo: Piotr Kendzierski

End of Trial 1:

c.a. 250 individuals for analysis

Mortality of Shrimps



- After 18 and 32 weeks of culture during trial 1 and trial 2 the mortality of shrimps was 70 and 60% respectively.
- High mortality was not caused by natural causes, but rather by cannibalism. In addition, during the trial 1 there was a system failure several times, resulting in the death of a large number of shrimps.

Photo: Piotr Kendzierski

Growth Rate and Weight Gain of Shrimps

Photo: Basia Dmochowska

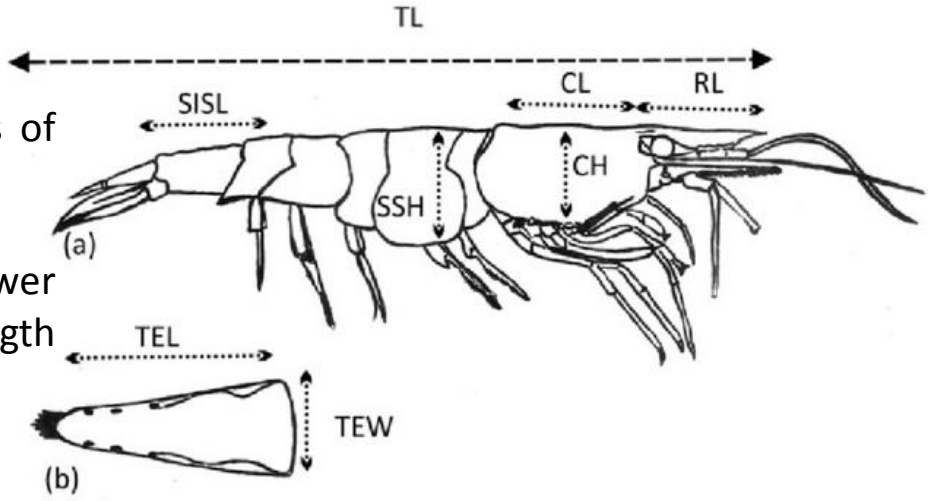
GROWTH RATE AND WEIGHT GAIN OF SHRIMPS

Length and fresh mass of shrimps should be determined during the cultivation (every 7 - 14 days) and at the end of experiment.

Randomly chosen shrimps should be measured (± 1 mm) from the rostrum to the end of telson.

After gently drying with paper towel the fresh mass of each shrimp should be determined (± 0.001 g).

Length-fresh mass relationship according to the power function $y = ax^b$, where y is fresh mass and x is length should be determined.

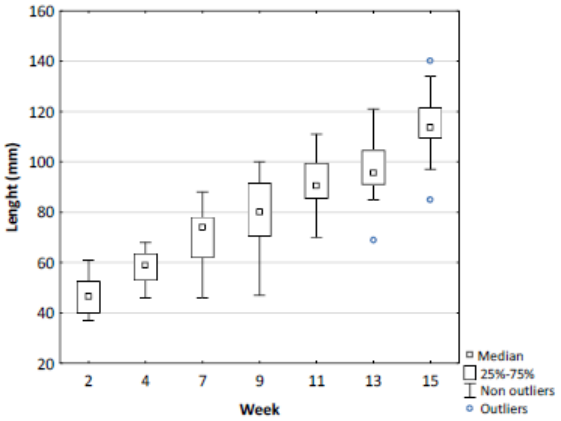


telson. TL: total length, CL: carapace length, CH: carapace height, RL: rostral length, SSH: second pleon segment height, SISL: sixth pleon segment length, TEL: telson length and TEW: telson width.

Dineshbabu et al., 2013. Methodologies for studying finfish and shellfish biology, CMFRI-NICRA publication No. 2, CMFRI, Kochi. 91 p.

RESULTS - GROWTH RATE AND WEIGHT GAIN OF SHRIMPS

TRIAL 1



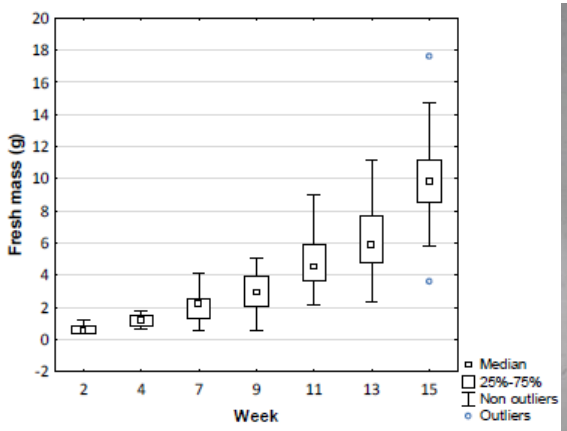
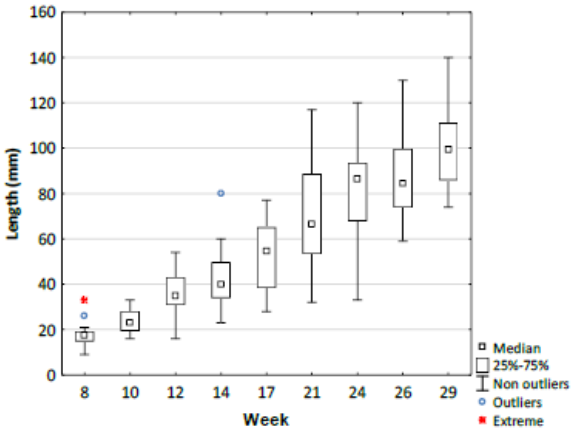
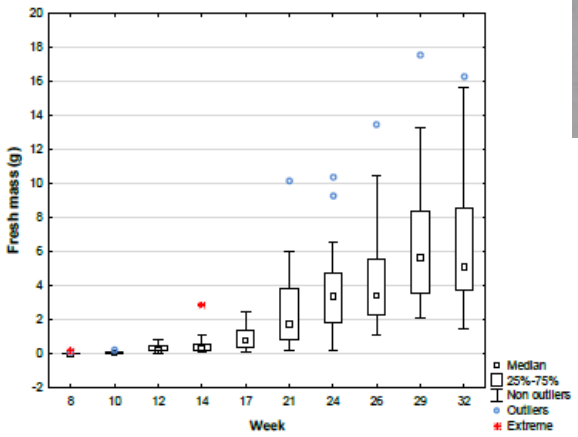


Photo: Patrycja Nowakowska

TRIAL 2





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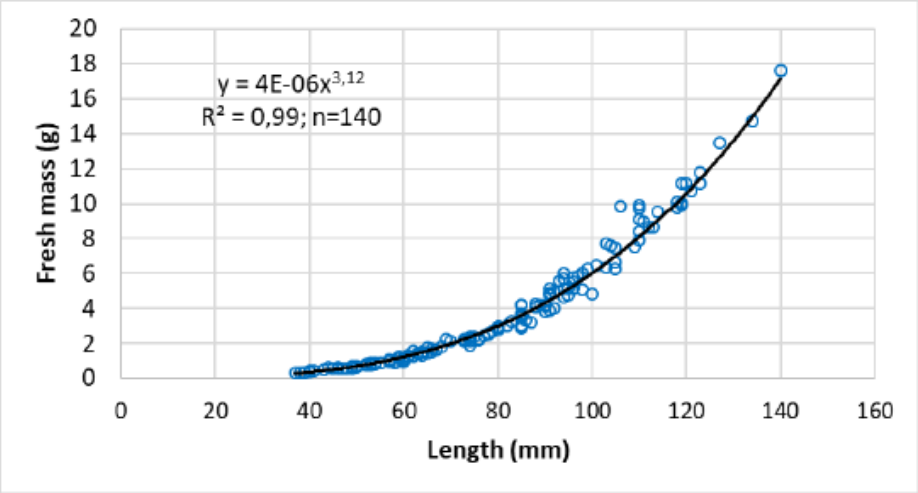
RESULTS - THE LENGTH-FRESH MASS RELATIONSHIPS

TRIAL 1



TRIAL 2

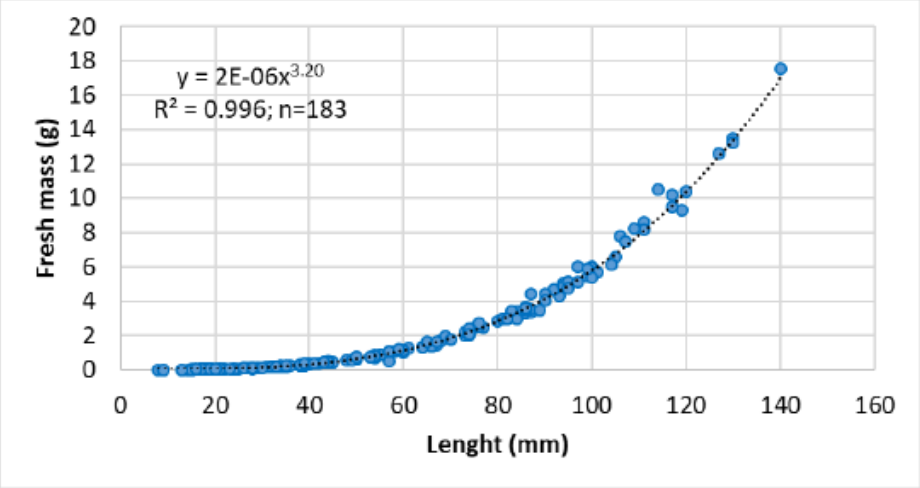


Photo: Halina Kendzierska

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THE FIRST EXPERIMENTAL SHRIMP FARM IN POLAND

The attempt to cultivate whiteleg shrimps under experimental conditions in recirculating aquaculture system (RAS) from post-larval stages to the commercial size specimens was successful: in both trials shrimps survived transport, acclimation period to laboratory conditions and reached commercial size.

Photo: Piotr Kendzierski

Is Shrimp Healthy? Nutrition, Calories and More - Healthline

Google

Which is healthier chicken or shrimp?

Why should you not eat shrimp?

Is it OK to eat shrimp every day?

Is shrimp good for weight loss?

http://babymarine.com

HEALTHY PINK GOLD

https://www.klaaspuul.com

https://www.medicalnewstoday.com

- ✓ low calories;
- ✓ high protein;
- ✓ essential vitamins and minerals – the group of vit. B, iodine, calcium, selenium, fluorine in smaller amounts, iron, magnesium and zinc;
- ✓ omega-3 fatty acids and the antioxidant astaxanthin.

IS SHRIMP HEALTHY?

Comparison of shrimp, egg and meat* on their cholesterol, saturated fatty acids and atherogenic index

Non-vegetarian food	SFA[@] (g/100 g)	Cholesterol[#] (mg/100 g)	Atherogenic index[$]
Shrimp	0.25	173	0.36
Egg	4.0	400	0.40
Chicken	6.0	100	0.50
Mutton	7.0	65	1.00
Beef	8.0	70	0.70
Pork	13.0	90	0.67
Health significance	Lowest in shrimp; good for health	Moderate in shrimp; but not harmful due to low SFA	Lowest in shrimp; good for health

*Dietary guidelines[24,25,30]. [@]Higher saturated fatty acids consumption increases blood cholesterol. [#]Cholesterol consumption should not be more than 300 mg (USA) per day. [$]Lower atherogenic index is good for a healthy heart.

Dayal, J. S., Ponniah, A. G., Khan, H. I., Babu, E. M., Ambasankar, K., Vasagam, K. K., 2013. Shrimps–a nutritional perspective. *Current science*, 1487-1491.

PINK GOLD

Crustacean shell waste

www.fis.com

Product	Use
Calcium carbonate (20-50 %)	Pharmaceutical, agricultural, construction and paper industries – including pigments, filters, soil treatments, rubber and plastics.
Chitin (15-40 %)	Nitrogen-rich chemicals for pharma-ceuticals, cosmetics, textiles, water treatment, household cleaners, soaps, carbon dioxide sequestration.
Protein (20-40 %)	Fertilizers and animal feeds.

Yan, N., & Chen, X. (2015). Sustainability: Don't waste seafood waste. Nature News, 524(7564), 155.

NUTRITIONAL VALUE

Nutritional value analysis:

- percentage content of tail muscles tissue to the whole animal,
- muscle water content,
- organic matter and ash content,
- energetic value (content),
- vitamin and protein content,
- CHN content, etc.

Photo: Piotr Kendzierski

Photo: Halina Kendzierska

WHAT DO THE NUMBERS ON SHRIMP MEAN?

The number indicate the range of shrimp per pound, e. g. 21/25 indicates there are between 21 and 25 shrimp per pound.

The larger the count, the smaller the shrimp!

www.kasturishrimps.com

WHAT DO THE NUMBERS MEAN ON SHRIMP?

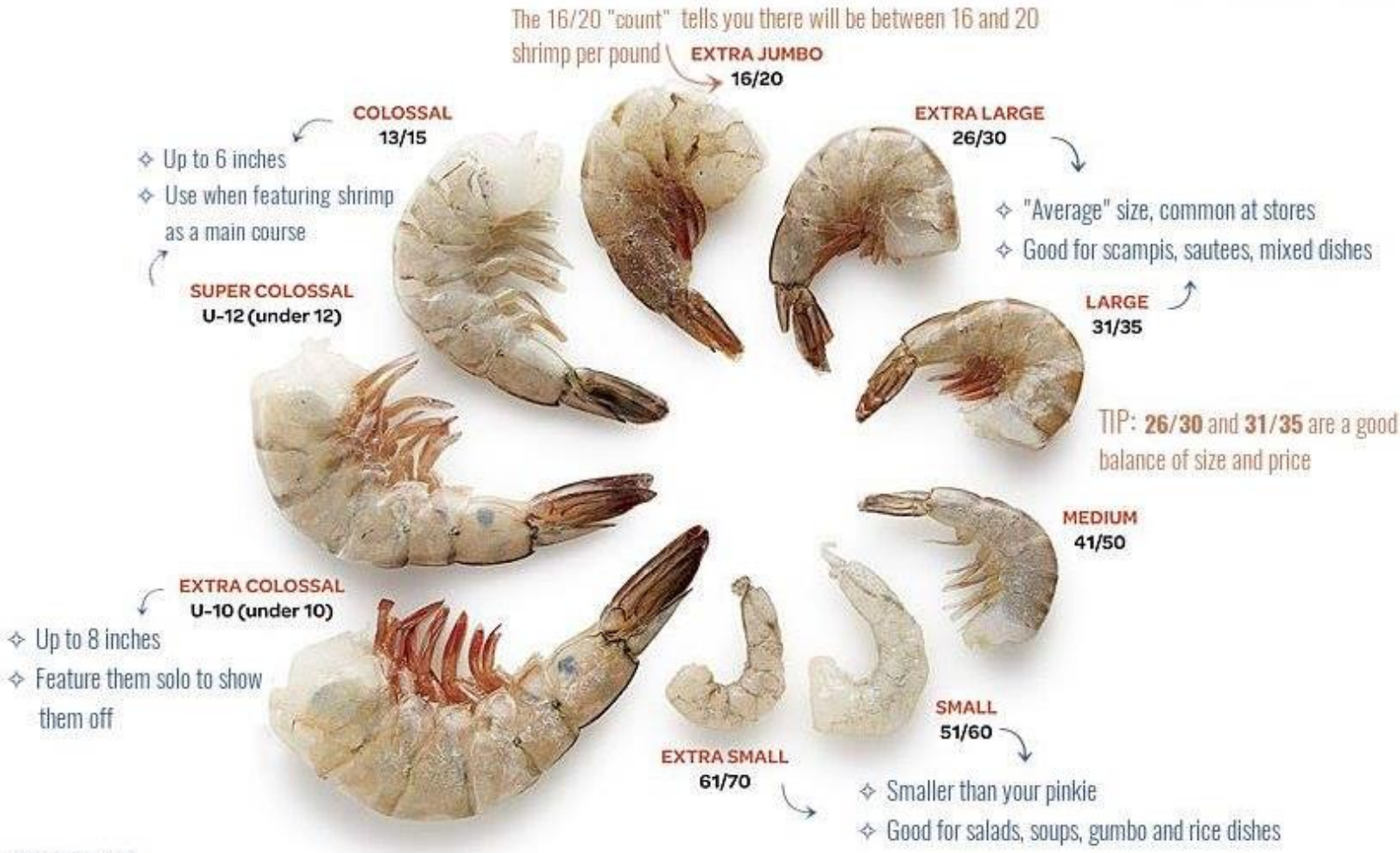
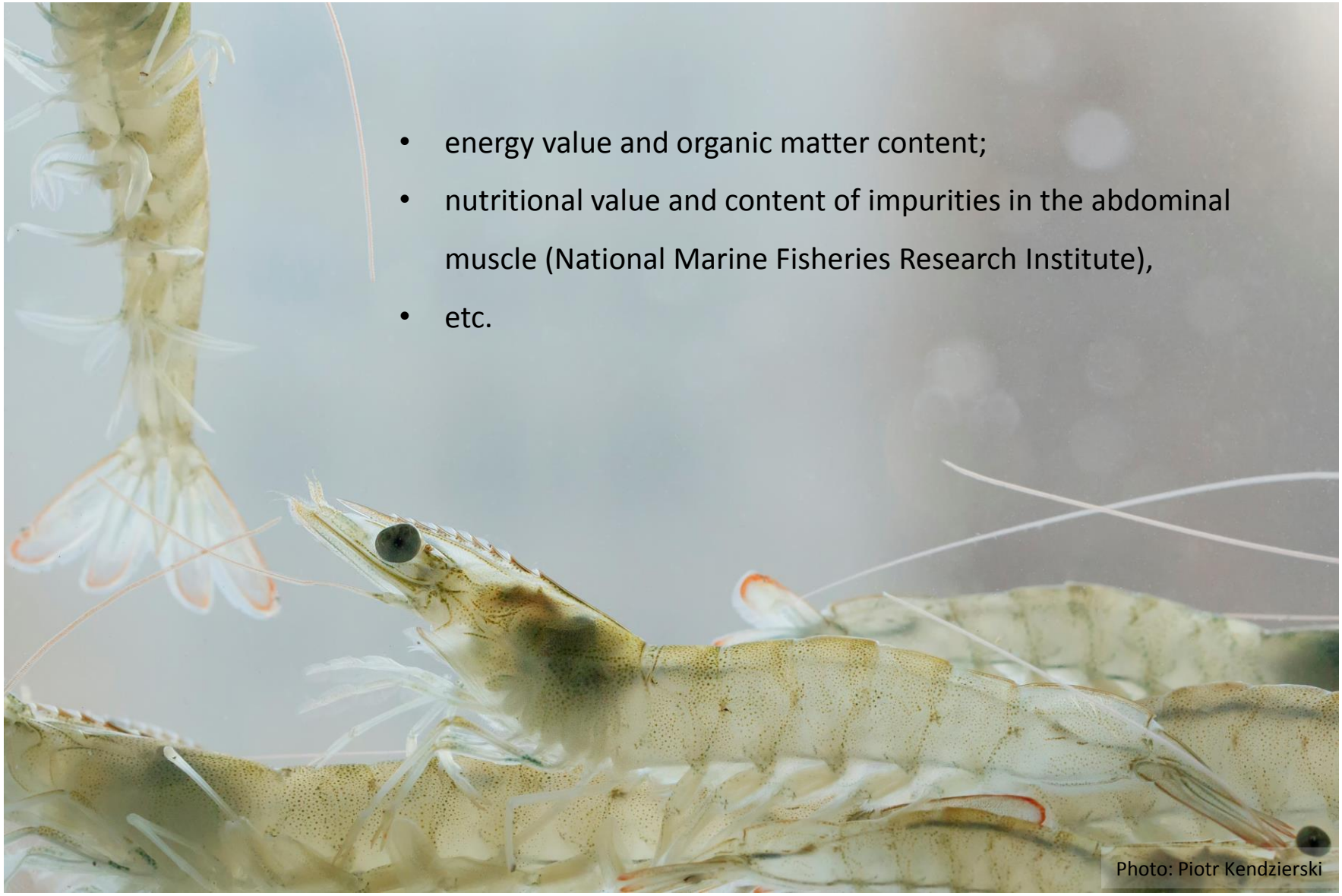


Image via FastCooking.com

THE FIRST EXPERIMENTAL SHRIMP FARM IN POLAND



- energy value and organic matter content;
- nutritional value and content of impurities in the abdominal muscle (National Marine Fisheries Research Institute),
- etc.

Photo: Piotr Kendzierski

NUTRITIONAL VALUE AND CONTENT IN THE ABDOMINAL MUSCLE

Photo: Olga Szulecka

Photo: Olga Szulecka

The analyzed batch of shrimps from trial 1

NUTRITIONAL VALUE AND CONTENT IN THE ABDOMINAL MUSCLE

- Energy value (Q) with use of modified Phillipson KMB-2 type microbomb calorimeter;
- The organic matter content in abdominal muscle (Gnaiger and Bitterlich, 1984);
- Lipids were extracted with dichloromethane : methanol solution ;
- Fatty acids were separated in a gas chromatograph (Agilent Technologies 6890N GC) using an RT-2560 capillary column (Restek, USA) and a flame ionization detector;
- Vitamins A and E were determined by fluorescence and vitamin D_3 with a UV detector.


Photo: Olga Szulecka


Photo: Halina Kendzierska

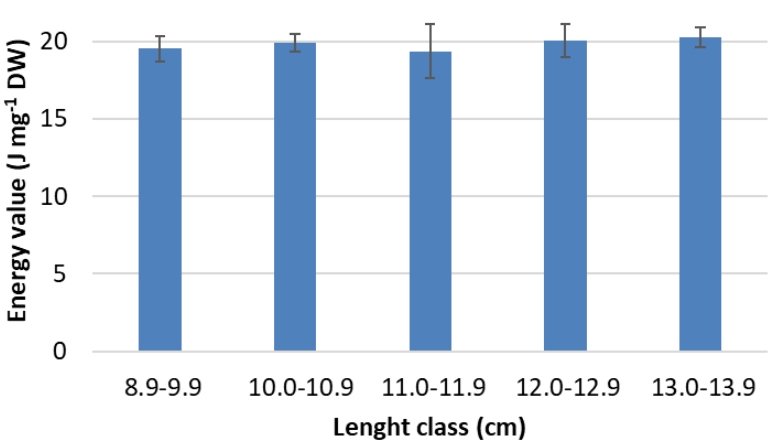
Feed **TRIAL 1** Gemma Diamond 0.8-1.5 mm (Scretting, Norway) , **TRIAL 2** CreveTec PL 1000 (Creve Tec, Belgium),

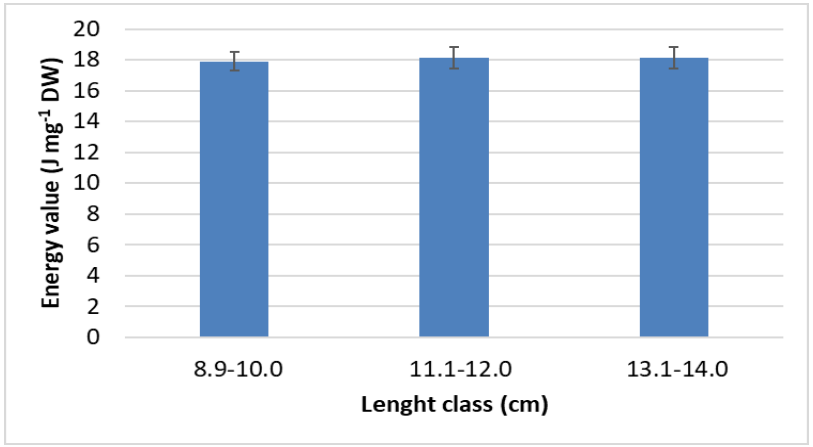
RESULTS - ENERGY VALUE AND ORGANIC MATTER CONTENT

TRIAL 1

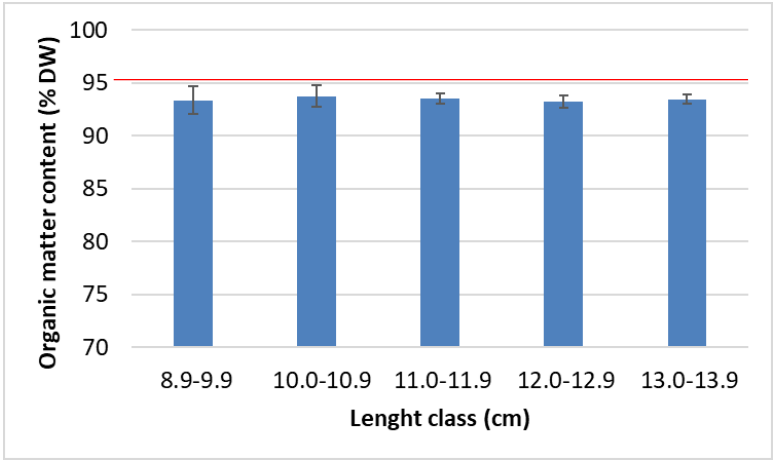
TRIAL 2

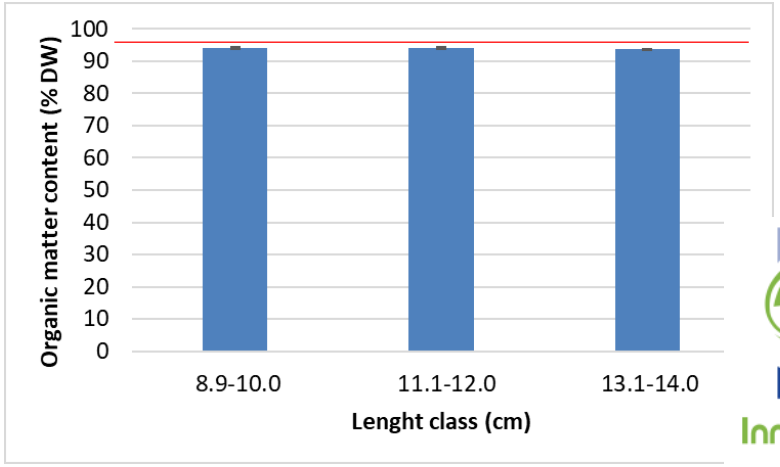
Mean (± SD) energy value of abdominal muscle of *L. vannamei*, in subsequent length classes





Mean (± SD) organic matter content in abdominal muscle of *L. vannamei*, in subsequent length classes





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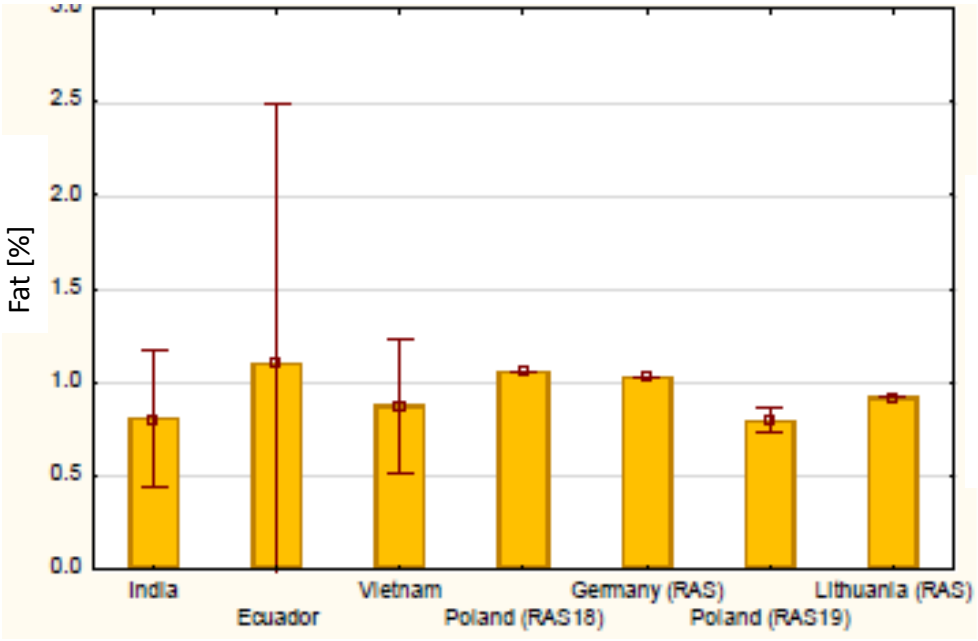
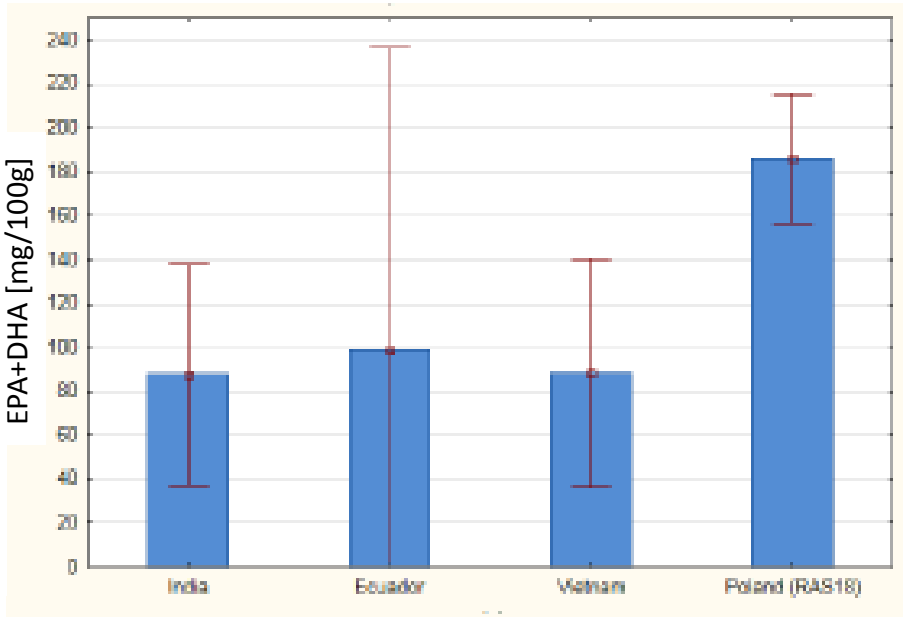
FAT AND FATTY ACIDS CONTENT



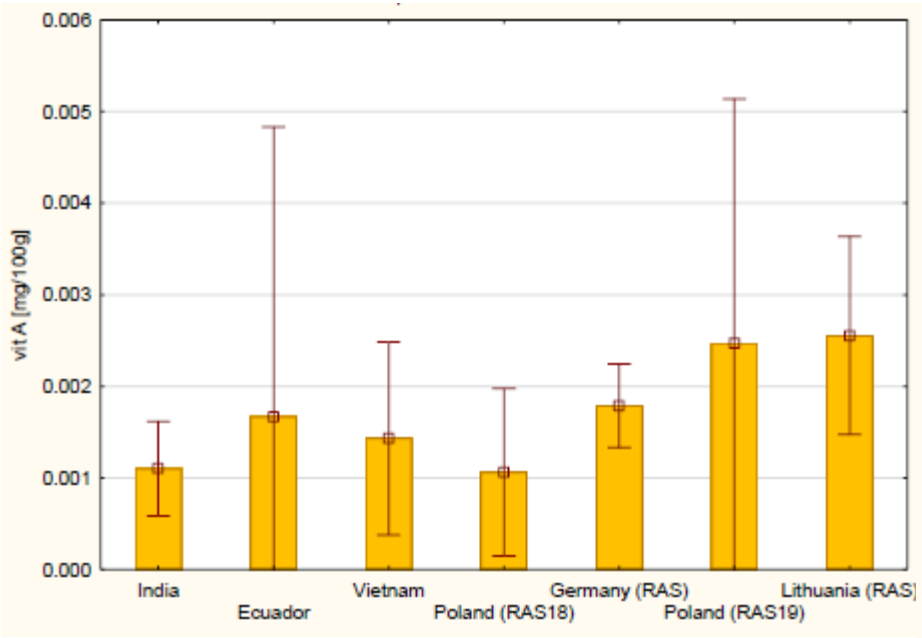
Fat content in *L. vannamei* collected from the Polish market and from RAS.



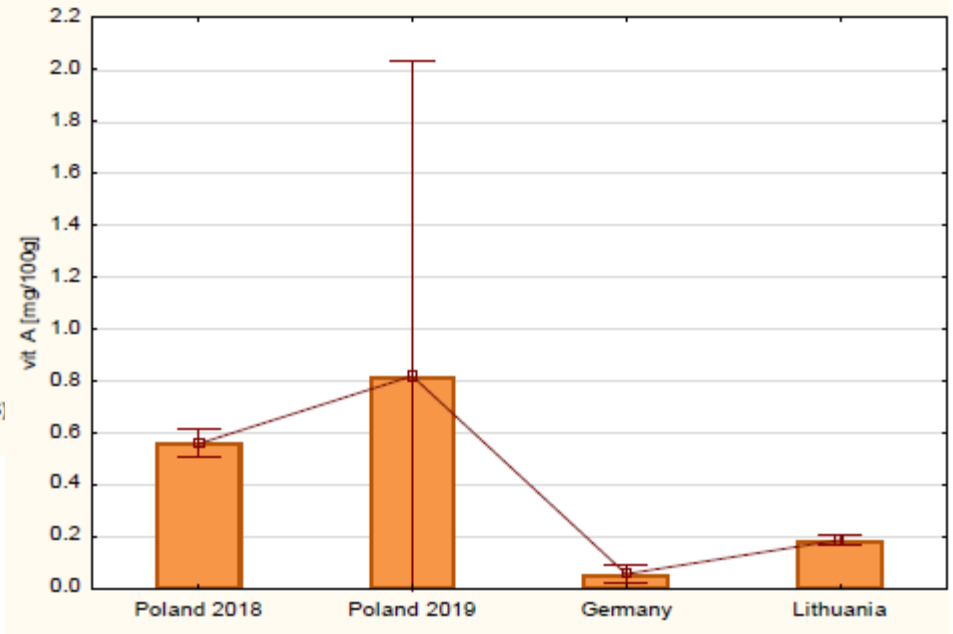
Fatty acids (DHA and EPA) concentration in *L. vannamei* collected from the Polish market and from RAS.

The daily requirement for EPA and DHA for prevention of heart diseases is 500 mg.

LEVELS OF VITAMIN A IN *L. VANNAMEI* AND FROM FEED

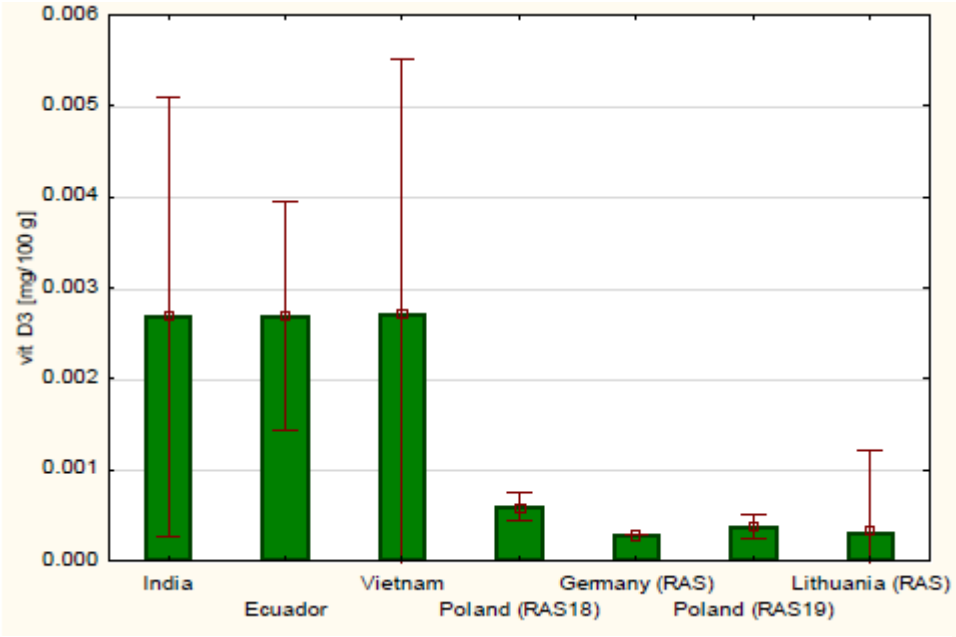


Levels of vit. A in *L. vannamei* collected from the Polish market and from RAS.

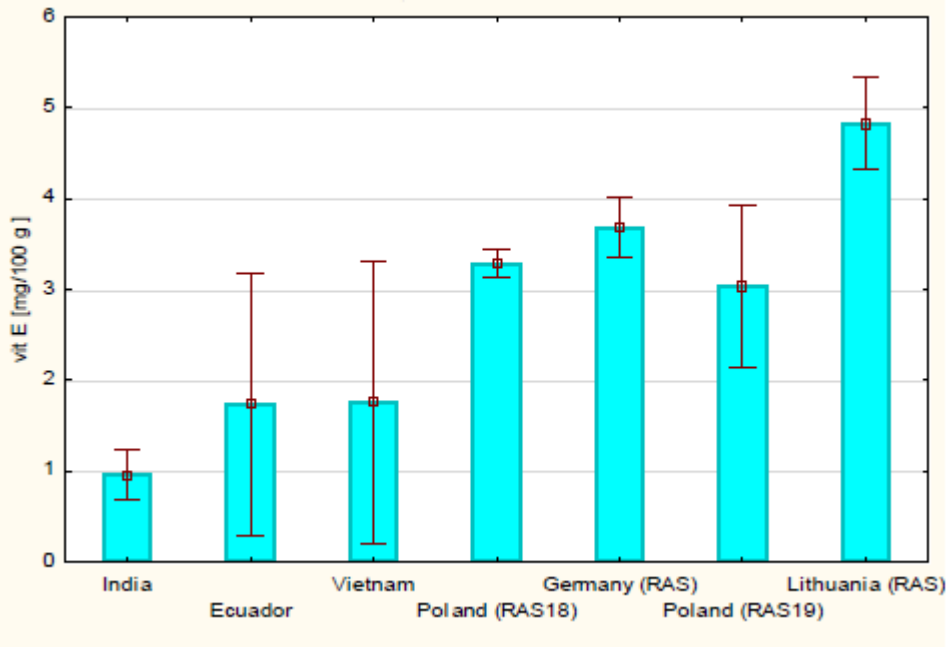


Levels of vit. A in feed for *L. vannamei* farmed in RAS system

LEVELS OF VITAMINS IN *L. VANNAMEI* COLLECTED FROM THE POLISH MARKET AND FROM RAS



Levels of vit. D_3 in *L. vannamei* collected from the Polish market and from RAS.



Levels of vit. E in *L. vannamei* collected from the Polish market and from RAS.

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THE FIRST EXPERIMENTAL OF WHITELEG SHRIMP CULTIVATION IN POLAND

- The organoleptic analysis showed that the shrimps from the experimental RAS culture achieved good quality indicators.

- The analysis of elemental composition showed that the shrimps from the recirculating aqua-culture system were characterized by :
  - ✓ similar level of nutrients as the shrimp of the same species originated from Asia;
  - ✓ higher level of EPA and DHA than the shrimps available on the market, allowing the placement of a nutritional health claim on a product.

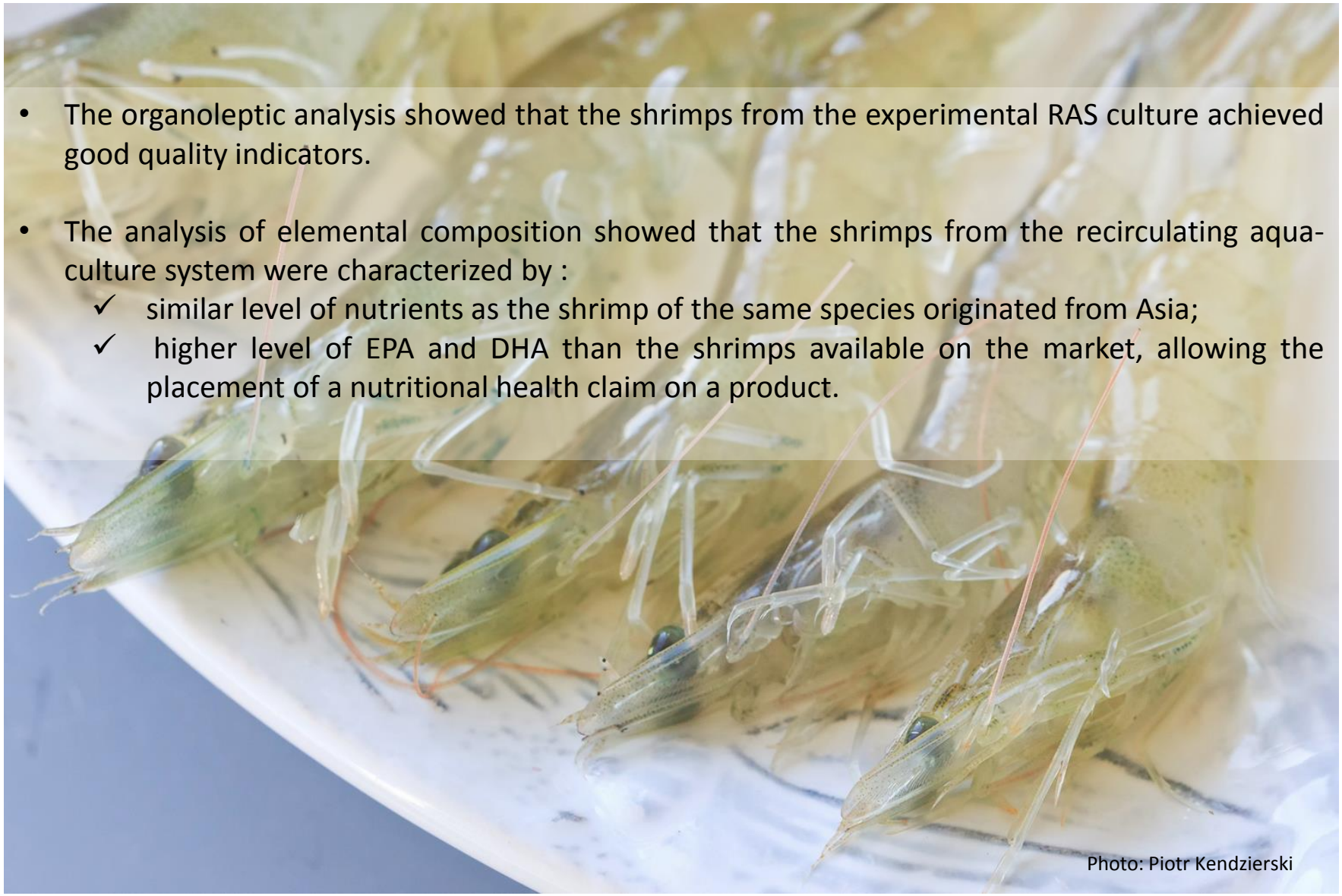

Photo: Piotr Kendzierski

http://aquavip.edu.pl

Zdjęcie: Piotr Kendzierski