West Pomeranian University of Technology
Szczecin

Climate change and impacts on European carp aquaculture - Lessons learnt from the CERES project

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5th International Carp Conference Onoldia Saal,
Ansbach,
4 – 6 September 2019

LONGLINE ENVIRONMENT

Military University of Technology

Cefas

Project overview

Budget 5.6 million €, 26 partners, 15 countries, 4 years (2016-2020)

https://ceresproject.eu

Assess relative **exposure, sensitivity, vulnerability and adaptive capacity** within the European fisheries and aquaculture sectors.

This project receives funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 678193.

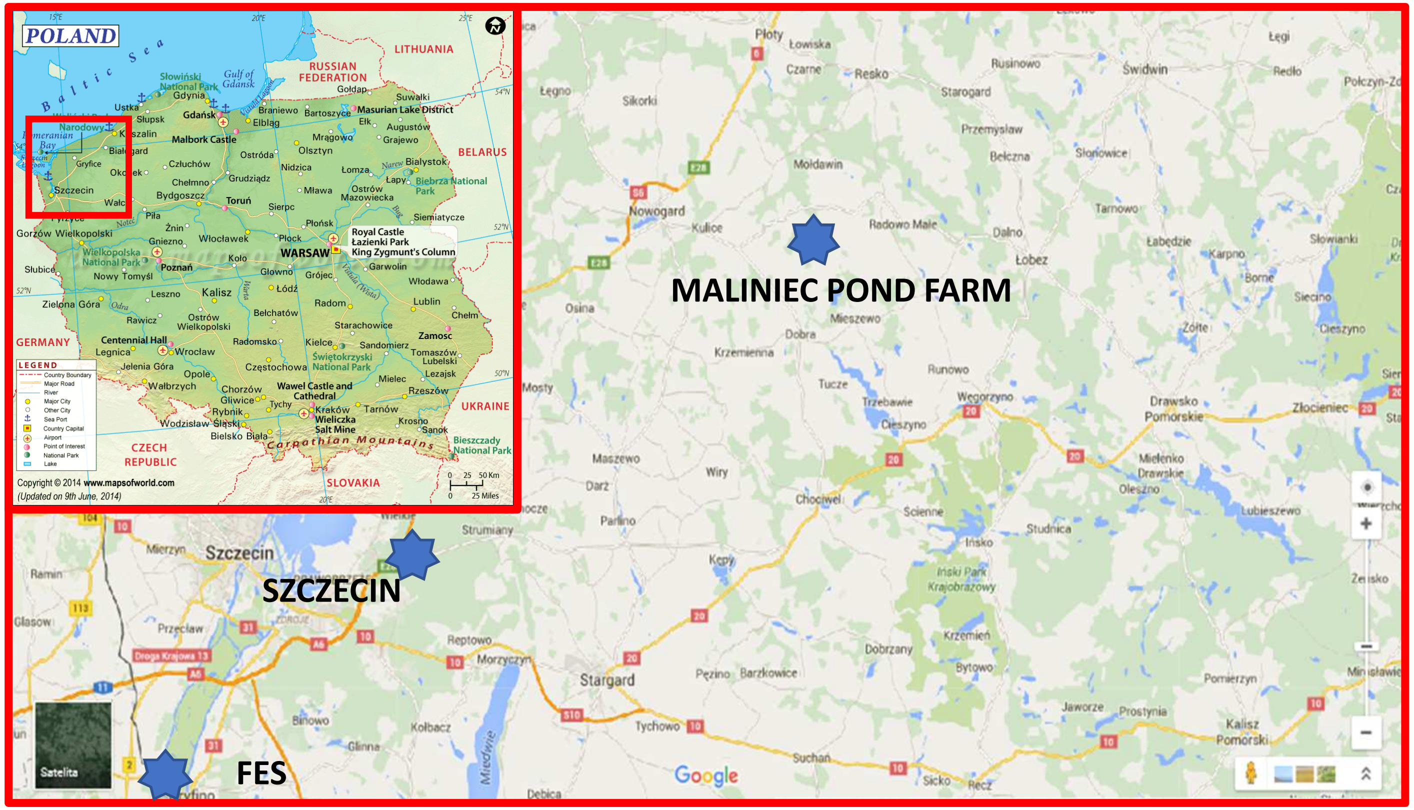
Carp production in Poland

- Temperate climate with relatively cold winters and warm summers, <u>at least it used to be</u>
- Carp require temperature of water in ponds at 20°C in 100 days/year for effective growth

Does climate-driven changes in physical factors have direct effects on productivity via physiology ?

Do risk maps are able to predict carp growth and pathogen development in future ?

ZUT (FES) and ICR facilities



Experimental facility – ICR (Pond Farm Maliniec)

- 121.6 ha - total area
- 79 ha - water surface
- 44 fish ponds
- KHV and CEV free

- 3 experimental carp ponds
- dimensions 10 m x 5 m x 1 m
- 150 fish per pond
- approx. 80 g fish

Experimental facility – FRS (Power Plant Dolna Odra)

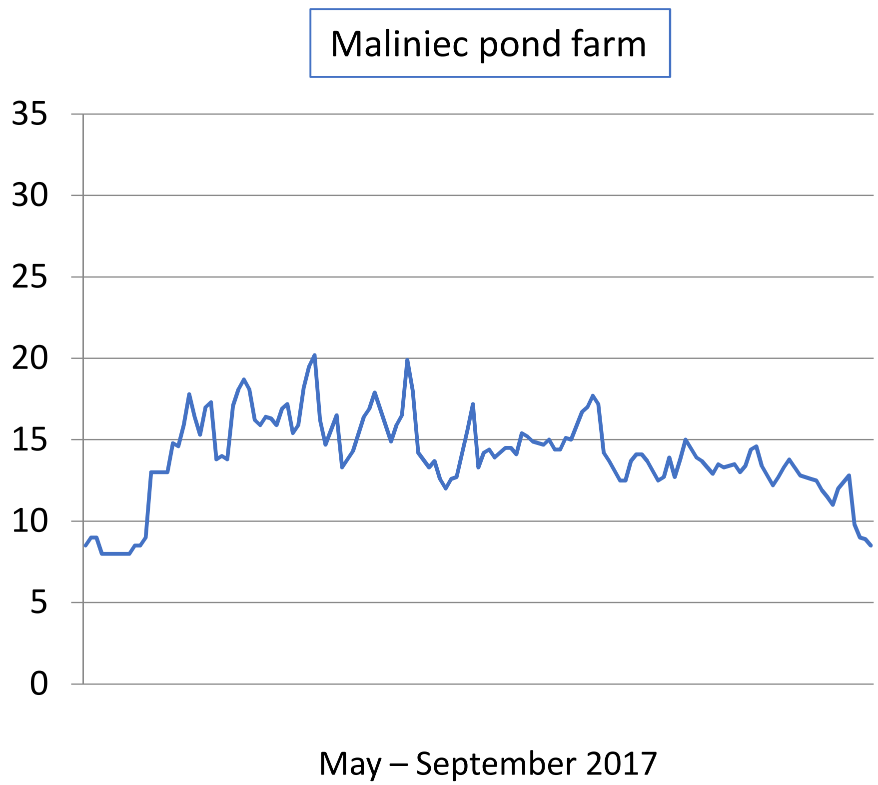
- hatchery
- indoor RAS
- 3 tents (900 m^2) with 5 independent RAS systems
- 120 cages (discharge channel)

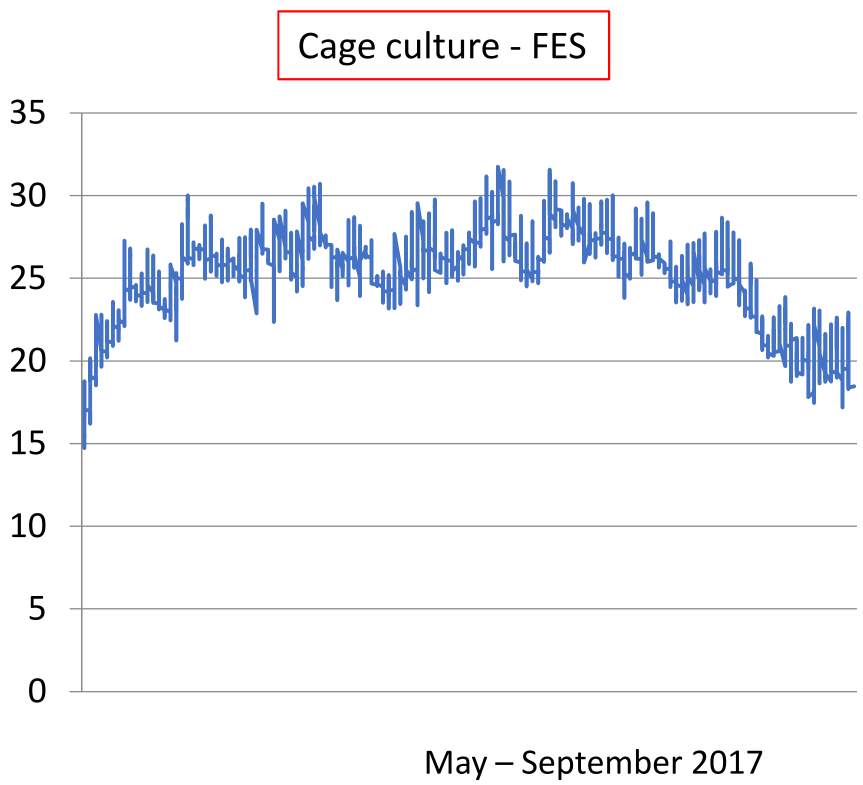
- 3 experimental cages
- volume 3 m^3
- 150 fish per cage
- approx. 80 g

Material and methods

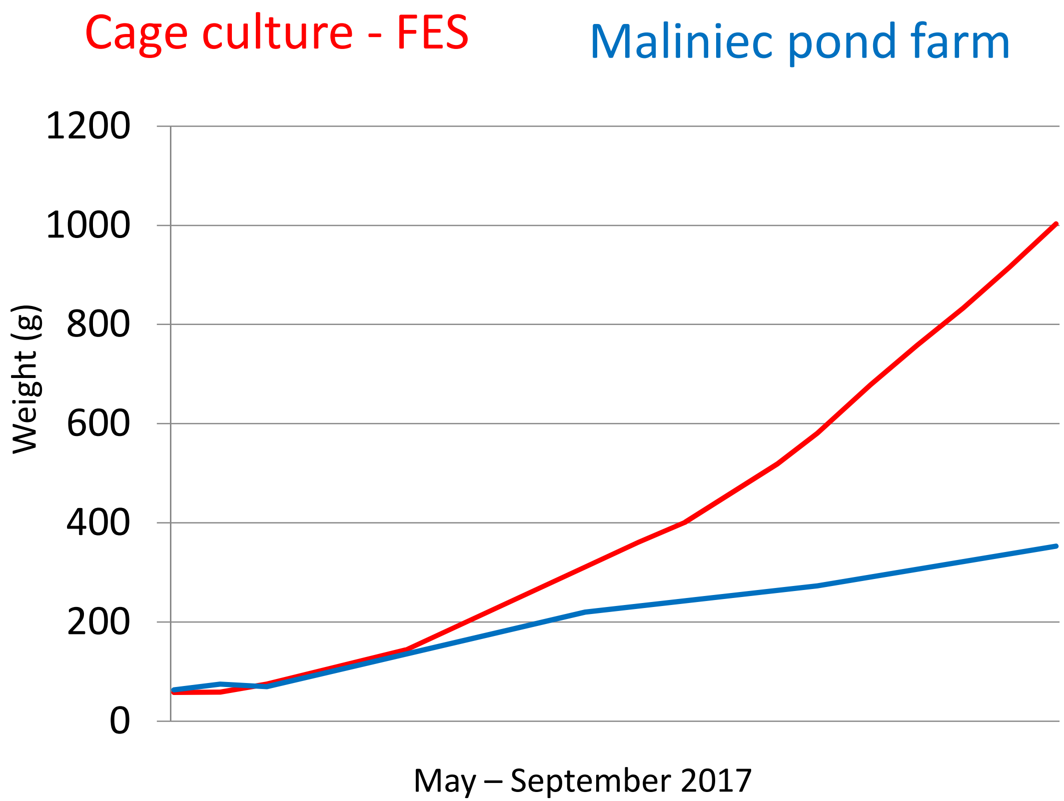
- Zootechnical parameters
- Hydrochemical data (Temperature, pH, O_2, total phosphorus, nitrogen)
- Gene expression of Hsp90

TEMPERATURE FLUCTUATIONS

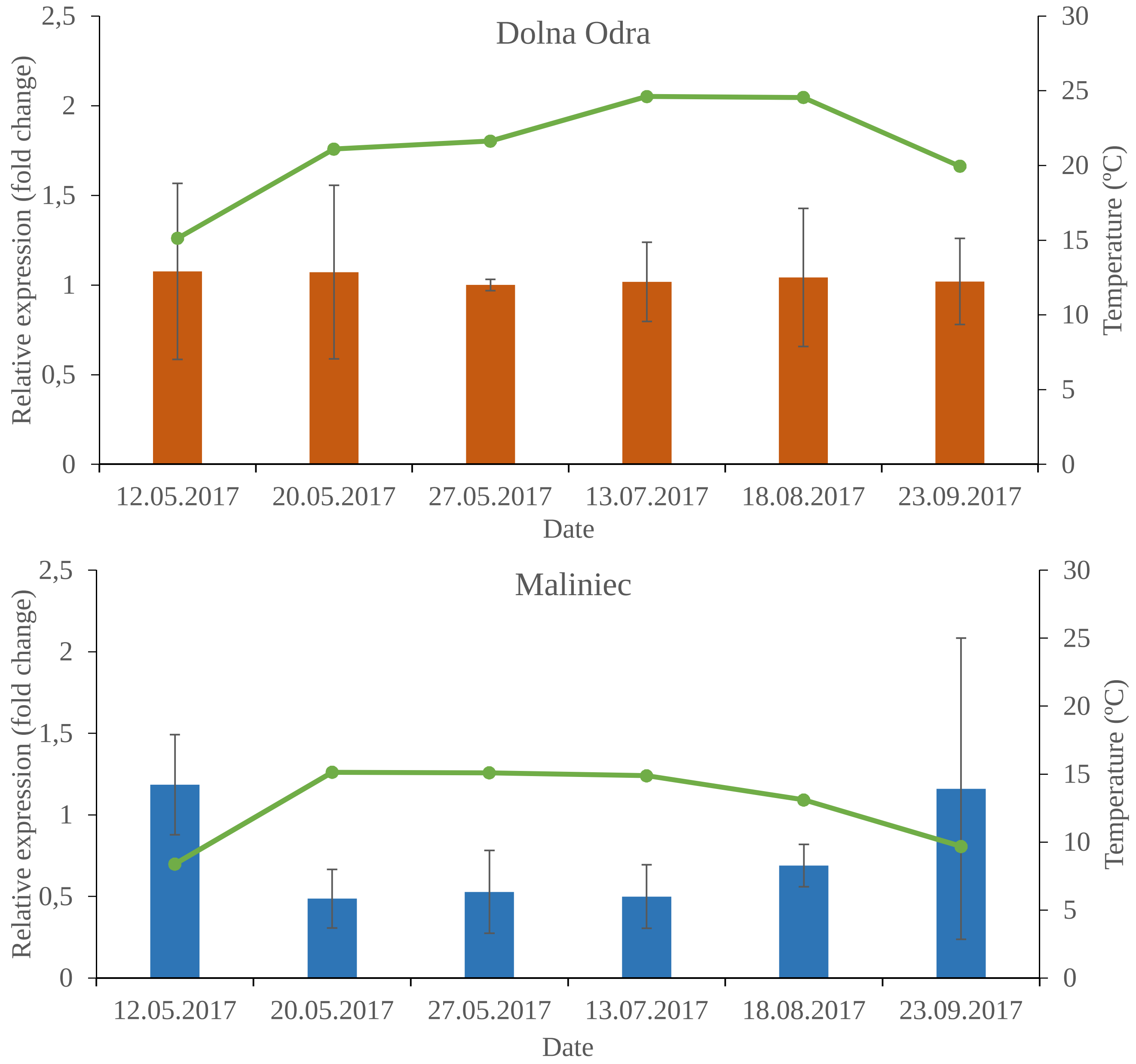




Growth rate


Cage culture - FES
Maliniec pond farm
1200
1000
800
600
400
200
0
Weight (g)
May – September 2017

Gene expressaion of Hsp90



RISK MAPS

Carp growth and pathogen development

	Minimum Temperature (°C)	Maximum Temperature (°C)	Reference
Carp Edema Virus, CEV	15	25	Way et al. 2017
Koi Herpes Virus, CyHV-3	18	23	Lida & Sano 2005
Spring Viraemia of Carp, SVC	10	17	Thrush & Peeler 2012

Journal of Fish Diseases 2017, **40**, 319–325

Carp edema virus in Polish aquaculture – evidence of significant sequence divergence and a new lineage in common carp *Cyprinus carpio* (L.)

M Matras[1], E Borzym[1], D Stone[2], K Way[2], M Stachnik[1], J Maj-Paluch[1], M Palusińska[1] and M Reichert[1]

212, Bull. Eur. Ass. Fish Pathol., 32(6) 2012

Horizontal transmission of koi herpes virus (KHV) from potential vector species to common carp

J. Kempter[1], M. Kiełpiński[1], R. Panicz[1*], J. Sadowski[1], B. Mysłowski[1] and S. M. Bergmann[2]

The Israeli Journal of Aquaculture - Bamidgeh 62(1), 2010, 28-37

Detection of KHV in Freshwater Mussels and Crustaceans from Ponds with KHV History in Common Carp (*Cyprinus carpio*)

Maciej Kielpinski[1*], Jolanta Kempter[1], Remigiusz Panicz[1], Jacek Sadowski[1], Heike Schütze[2], Stefanie Ohlemeyer[2], Sven M. Bergmann[2]

Methodology – air to water temperature

- $WST = 0.8142 \times LST + 2.996$, where:
    - WST: Water Surface Temperature;
    - LST: Land Surface Temperature

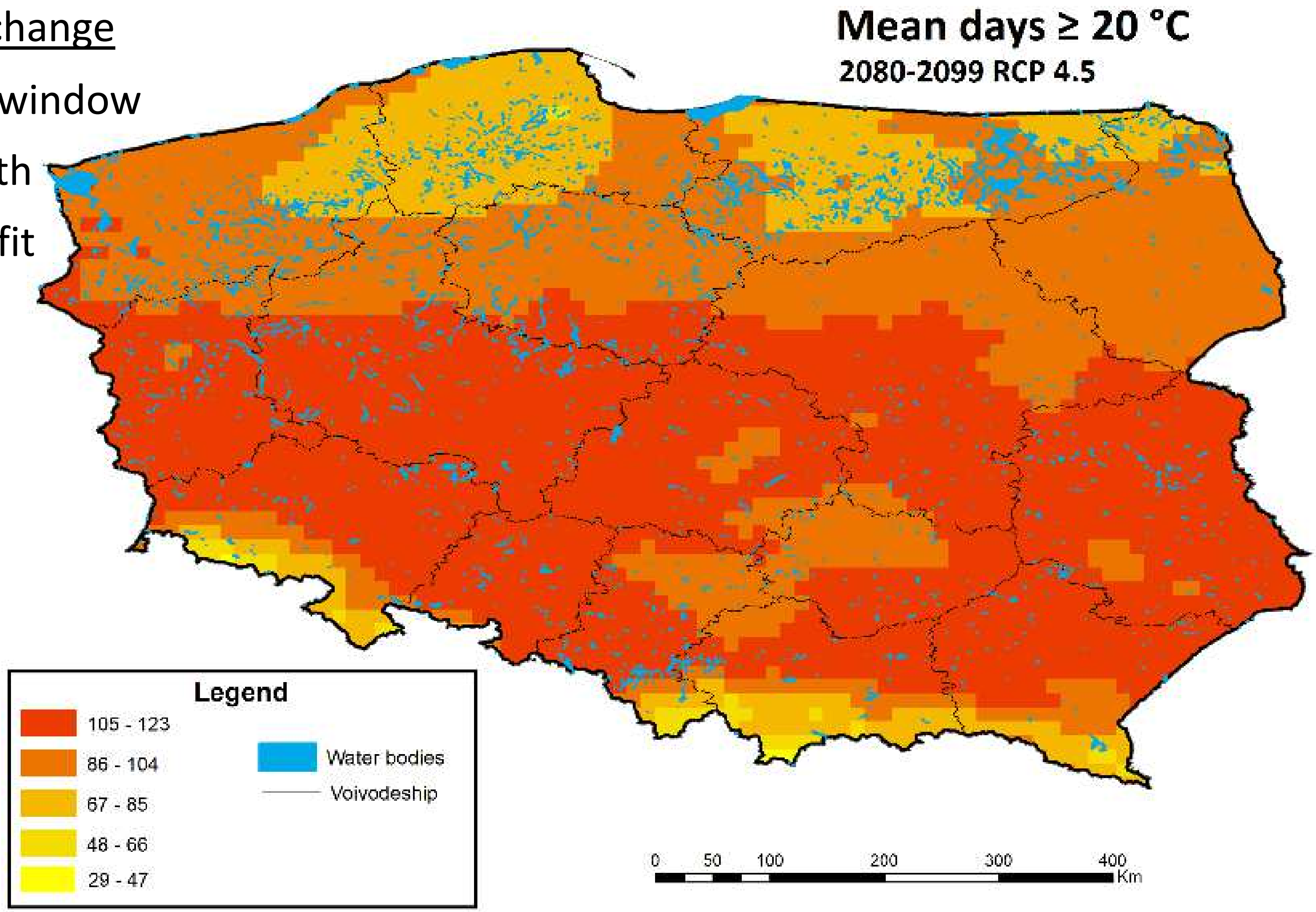
- Climate model data from PML with complete LST values for Poland, was used to develop the maps for 6 distinct scenarios:
    - Conservative (RCP 4.5) and extreme (RCP 8.5) scenario(s) for each of the time slices:
        - Present (2000-2019);
        - Mid-term (2040-2059);
        - Long-term (2080-2099).

- Empirical data on water temperatures in ponds was used to calibrate the algorithm;

Growth of carp under climate change

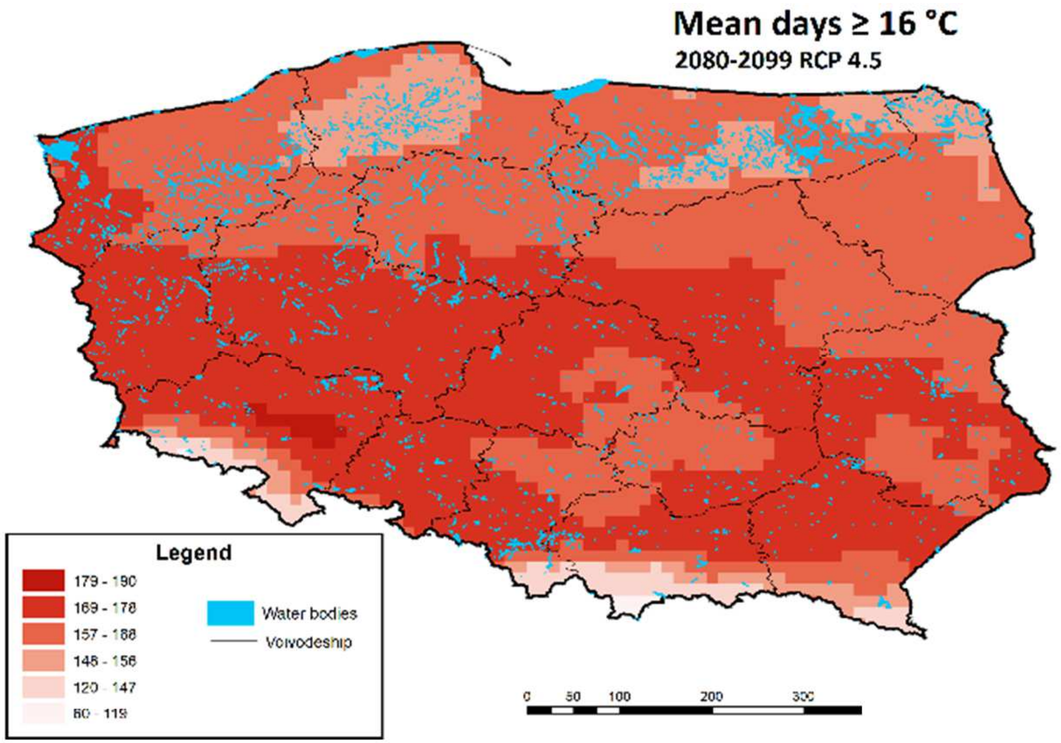
<u>Conservative change</u>

- Better time window
- Better growth
- Sector benefit

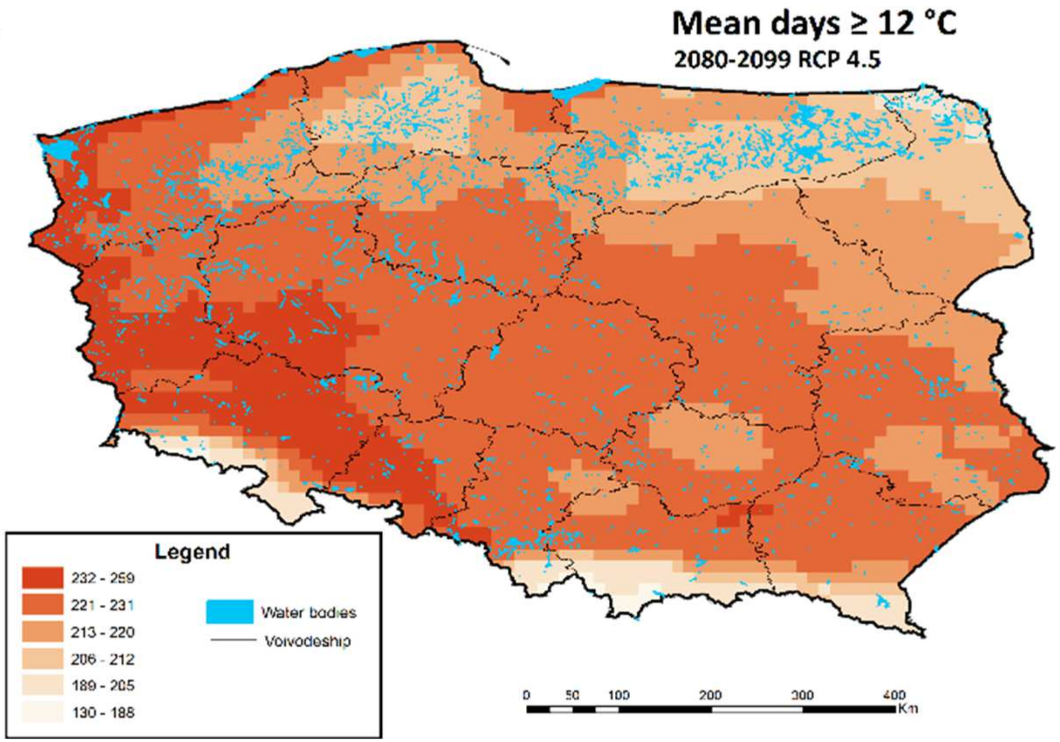


This approach can be used to assess the suitability of a region for aquaculture, as well as provide a risk assessment of potential impacts of climate change.

Risk assessment for both viruses



Spring Viraemia (bottom right) will negatively impact carp farming (South); temperature change also affects trout production in the north.



Koi Herpes (top left) predicted to increase in the south, but carp growth also improves.

Change in areas at risk can be quantified using GIS.

Conclusions

- A range of potential factors (e.g. direct) could cause different levels of productivity, environmental, and economic impact
- Temperature and seasonality shifts will change the number and intensity of disease outbreaks - impact on productivity
- Disease risk models can be used to provide risk assessment of potential impacts of climate change

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Faculty Of Food Sciences And Fisheries

CERES

SEAFOOD TOMORROW

https://seafoodtomorrow.eu

New feed compositions

Fish fortification (Se, I, PUFA)

Fish products for different target groups

Q&Q DNA barcoding

GAIN

Green Aquaculture Intensification

https://www.unive.it/pag/33897/

Aquaculture ecointensification

Valorisation of by-products and by-streams

New feed compositions

Carp in aquaponic systems

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Thank you for your attention !

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