

Norhed Report from PD of Aquaculture component:

Project title: Studies on effect of temperature and methionine in diet on juvenile cobia (*Rachycentron canadum*)

Project objective: The objective of this project is test to what extent elevated water temperatures increase the requirement for dietary methionine in juvenile cobia aquaculture.

Specific objective: The main objective of the present study is test to what extent elevated water temperatures increases the requirements for dietary methionine in cobia. The applied aspect is to generate the data that permits to maximize growth and N-retention in cobia. This will be done in two series of experiments with groups of cobia (juveniles) using different levels of dietary methionine and different temperature conditions.

Contents:

- *Effect of elevated water temperatures increase the requirement for dietary methionine on growth, body mass index, liver index, protein metabolism, lipid metabolism and feed efficiency cobia juveniles.*
- *Effect of elevated water temperature increase the requirement for dietary methionine on feed intake, expression of NPY and CCK in juvenile cobia.*

Methods: Details for methods have already presented in the approved research proposal.

Time schedule: This project included two experiments and on a survey of a status of cobia culture in the South, Central and North of Vietnam. The first experiment was carried out from May to October 2016. The second experiment also was carried out between March and May 2017. The survey for a status of cobia culture has been done in the North, Central of Vietnam and the South of Vietnam between August and October 2017.

Output:

- 01 Research proposal (done)
- 01 Annual report and final report (done)
- At least 01 paper will participate in the international conference (done)
- At least 02 paper will be published in ISI journal

Activities have been done

1. The research proposal was approved by supervisor and rector of Nha Trang University.
2. All experiment have been done. The publication related to Norhed project:

Publications on ISI journal:

1. **M.H Le**, K.V. Dinh, M.V. Nguyen, I. Rønnestad. 2020. Combined effects of a simulated marine heatwave and an algal toxin on a tropical marine aquaculture fish cobia (*Rachycentron canadum*). Aquaculture Research. Manuscript accepted: 31 January 2020. Version of Record online: 13 March 2020. <https://doi.org/10.1111/are.14596>

2. M. Yúfera, M.V. Nguyen, C. Navarro-Guillén, F.J. Moyano, A.-E.O. Jordal, M. Espe, L.E.C. Conceição, S. Engrola, **M.H. Le**, I. Rønnestad. 2019. Effect of increased rearing temperature on digestive function in cobia early juvenile. Comparative Biochemistry and Physiology, Part A, 230:71–80. DOI:10.1016/j.cbpa.2019.01.007.

3. Nguyen, M.V., Espe, M., Conceição, L.E.C., **Le, M.H.**, Yúfera M., Engrola, S., Jordal, A-E.O., Rønnestad, I. **2019**. The role of dietary methionine concentrations on growth, metabolism and N-retention in cobia (*Rachycentron canadum*) at elevated water temperatures. Aquaculture Nutrition; 25:495–507. DOI: 10.1111/anu.12875.

Manuscript is working and will be submitted to journals before May/June, 2020:

1. M.H. Le, M. Espe, L.E.C. Conceição, M.V. Nguyen, M. Yúfera, S.A.D. Engrola, A-E.O. Jordal, I. Rønnestad. 2020. Impact of feeding rations on growth performance and N-metabolism of cobia (*Rachycentron canadum*) at elevated temperature.

Presented papers at conferences:

1. Yúfera, M., M.V. Nguyen, C. Navarro-Guillén, F. Javier Moyano, A-E.O. Jordal, M. Espe, L.E.C. Conceição, S. Engrola, **M.H. Le**, and I. Rønnestad. 2018. Effect of rearing temperature on the digestive

function in Cobia fry. International Symposium of Fish Nutrition and Feeding, Las Palmas, Gran Canaria, Jun 3-7, 2018.

2. Navarro-Guillén, C., M.V. Nguyen, A-E.O. Jordal, M. Espe, L.E.C, Conceição, S. Engrola, **M.H. Le**, I. Rønnestad and M. Yúfera. 2018. Water temperature differentially affects food transit rates of stomach and intestine in Cobia fry. International Symposium of Fish Nutrition and Feeding, Las Palmas, Gran Canaria, Jun 3-7, 2018.

3. Nguyen, M.V., M. Espe, L. Conceição, **M.H. Le**, Yúfera, M., S. Engrola, A-E.O. Jordal, and I. Rønnestad. 2017. Growth, metabolism and N-retention in cobia at elevated water temperatures- the role of dietary methionine levels. Aquaculture Europe 2017, Dubrovnik, Croatia.

4. Nguyen, M.V., A-E.O. Jordal, M. Espe, L. Conceição, Yúfera, M., S. Engrola, **M.H. Le**, and I. Rønnestad. 2017. Feed intake and brain levels of appetite controlling neuropeptides in cobia is affected by elevated water temperatures. Aquaculture Europe 2017, Dubrovnik, Croatia.

5. Yúfera, M., M.V. Nguyen, S. Engrola, L. Conceição, A-E.O. Jordal, **M.H. Le**, M. Espe, P.Q. Hung, I. Rønnestad. 2016. Cobia exhibits a permanent gastric acidity as digestion strategy. Aquaculture Europe 2016 – Edinburgh, Scotland.

Education:

Supervised 01 master student in Aquaculture who has successfully defended her master thesis and graduated

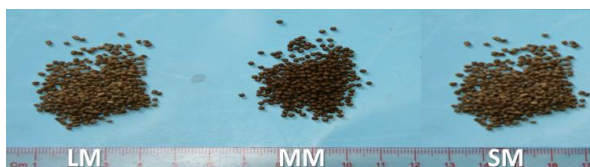
3. Several pictures that related to the Norhed project.



Feed preparing for experiment



Experimental system for high temperature



Feed after preparing as required experiment



Juvenile cobia feeding



Experimental system for control temperature



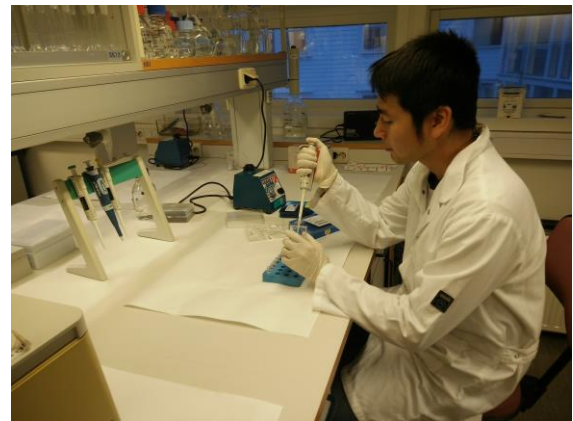
The experiment sampling



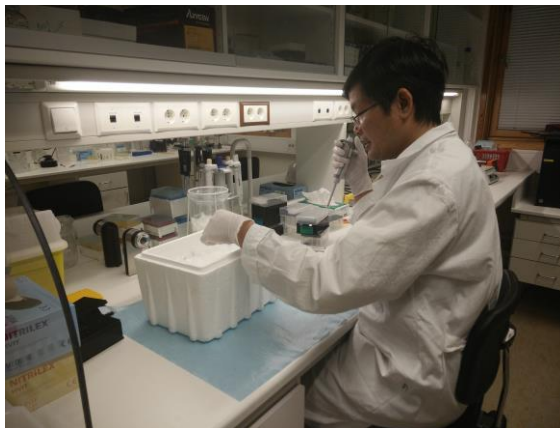
Samples of the experiment for package



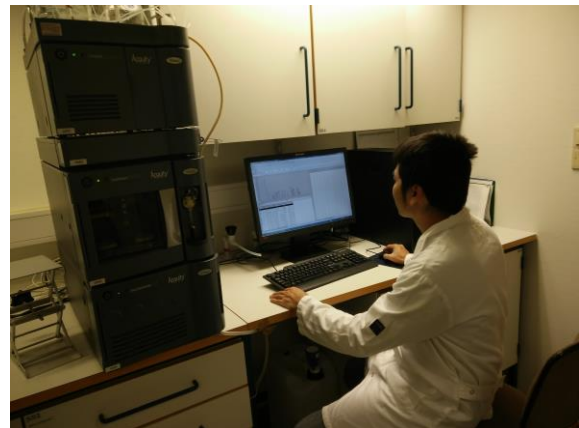
Best poster award related to Norhed project



Samples preparing analysis in Norway (biochemical)



Samples preparing analysis in Norway (PCR)



Samples preparing analysis in Norway (biochemical)

4. Budget

- 4.1. Scholarship used as following the research proposal (57,600NOK; 153,000,000 VND)
- 4.2. Material and supply used as following the research proposal (205,608NOK; 546,900,000VND)
- 4.3. Tool and equipment used as following the research proposal (320,370NOK; 852,159,269VND)
- 4.4. Domestic travel used as following the research proposal (31,388NOK; 83,490,000VND)
- 4.5. Data analysis used as following the research proposal (24,061NOK; 64,000,000VND)
- 4.6. International travel will be transferred to University (**43,200NOK**; 114,908,544VND). Because I have no plan to use this money.

Tentative Activities in 2020

1. Manuscript preparing for submitting to ISI journal which used the data from the second experiment.
2. Submitting remained manuscript as first author to ISI journal, revising as following reviewers and journal.

Manuscript is working and will be submitted to journals before May/June, 2020: M.H. Le, M. Espe, L.E.C. Conceição, M.V. Nguyen, M. Yúfera, S.A.D. Engrola, A-E.O. Jordal, I. Rønnestad. 2020. Impact of feeding rations on growth performance and N-metabolism of cobia (*Rachycentron canadum*) at elevated temperature.

PD candidate



Le Minh Hoang