



FELLOWSHIP SUMMARY REPORT

- Your name: *Brauge Thomas*
- The subject title and theme number of your research fellowship: *Innovative approach to remove seafood pathogens along the seafood chain (Theme I and II)*
- Your host institution: *Flinders University and Agriculture and Agri-Food Canada*
- The name of your host collaborator: *Dr. Sophie Leterme (Flinders University) and Dr. Timothy Ells (AAFC)*
- The dates of your fellowship: *From 2 January 2023 to 30th June 2023*
- Your consent to your report being posted on the Co-operative Research Programme's website, or alternatively, a short paragraph about your fellowship which could be used anonymously.
I consent to having my report posted on the Co-operative Research Programme's website

1. What were the objectives of the research project? Why is the research project important?

*The objective of this project was to enhance the food safety in the seafood industry by implementing an innovative approach to combat biofilms of seafood pathogens *Vibrio parahaemolyticus* and *Listeria monocytogenes*, based on combined biological and physical methods. For this purpose, three objectives were identified:*

- Screening a panel of *V. parahaemolyticus* and *L. monocytogenes* strains for biofilm production and selecting highly biofilm-producing strains.*
- Evaluating the impact of an innovative biological treatment using ovotransferrin and phosphodiesterase coupled with UV-C light or bacteriophage treatment to eliminate biofilms of *V. parahaemolyticus* and *L. monocytogenes* on abiotic surfaces. This involves assessing the capacity of ovotransferrin and phosphodiesterase to remove biofilms of *V. parahaemolyticus* and *L. monocytogenes* and evaluating the synergistic or antagonistic effect of UV-C light and lytic bacteriophages on the action of ovotransferrin and phosphodiesterase.*
- Assessing the virulence of *V. parahaemolyticus* and *L. monocytogenes* cells after biofilm treatment with ovotransferrin and phosphodiesterase coupled with UV-C light or bacteriophage treatment through in vitro tests on cultured human cells.*

2. Were the objectives of the fellowship achieved?

Or are they on the way to being achieved?

If not, for what reasons? (The data or research is still ongoing or being analysed; technical reasons (e.g. equipment not working, adverse weather conditions, unexpected results, etc.; other reasons?)

*The objectives have been partially achieved. Due to various constraints, the investigations focused on studying the impact of natural molecules, ovotransferrin and phosphodiesterase, on the biofilms of *V. parahaemolyticus* and other *Vibrio* species problematic for human and animal health. In total, six molecules were tested (four types of ovotransferrin and two types of phosphodiesterase) on *in vitro* tests from four *Vibrio* species: *Vibrio parahaemolyticus*, *Vibrio alginolyticus*, *Vibrio harveyi*, and *Vibrio cholerae*.*

3. What were the major achievements of the fellowship? (up to three)

This grant has allowed us to achieve several significant accomplishments:

- *Establish three new international partnerships with Flinders University, Agriculture Agrifood Canada, and the University of Göteborg.*
- *Demonstrate that ovotransferrin and phosphodiesterase have no impact on the biofilms of *Vibrio parahaemolyticus*, *Vibrio alginolyticus*, *Vibrio harveyi*, and *Vibrio cholerae*.*





Highlight that residues from a commonly used surface disinfectant along the seafood chain can lead to an overproduction of Vibrio biofilms, thereby promoting their proliferation and persistence as pathogenic Vibrio on surfaces throughout the seafood chain

4. Will there be any follow-up work?

- Is a publication envisaged? Will this be in a journal or a publication? When will it appear?

Two publications are planned. The first joint publication among all partners on the overproduction of Vibrio biofilms in the presence of disinfectant residues is currently being drafted and will be submitted before the end of 2023. A collaborative review involving the fellow, the University of Göteborg, and Agriculture Agrifood Canada (AAFC) has also been written and submitted to Comprehensive Reviews in Food Science and Food Safety in July 2023.

Furthermore, these findings will be presented in an oral presentation at the AQUACULTURE EUROPE 2023 international conference, which will take place from September 18th to 21st, 2023, in Vienna, Austria.

- Is your fellowship likely to be the start of collaboration between your home institution and your host?

The grantee has expressed the desire to organize a workshop on bacterial biofilms by 2024 and to invite their Australian, Canadian and Sweden partners to participate in this event. Additionally, we are considering the possibility of co-financing a thesis between Flinders and ANSES, as well as submitting a joint application for a grant between Australia and France. These initiatives will further strengthen our scientific collaboration.

- Is your research likely to result in protected intellectual property, novel products or processes?

No

5. How might the results of your research project be important for helping develop regional, national or international agro-food, fisheries or forestry policies and, or practices, or be beneficial for society?

Please express this in terms of environmental/food security/food safety/economic/health (human and livestock and plant) benefits, etc.

In our project, we made an important discovery: residues of a disinfectant widely used along the seafood chain, both by professionals and individuals, can lead to an overproduction of Vibrio biofilms on surfaces. This fosters the proliferation of this pathogen and may result in cross-contamination of food.

These findings could be of significant importance for regional, national, or international competent authorities. They could serve as a basis to develop new recommendations for cleaning and disinfection procedures in the seafood industry. Additionally, these recommendations could specifically target individual users of this disinfectant in domestic kitchens.

By implementing these new recommendations, we could contribute to enhancing food safety and reducing the risks of Vibrio contamination in the seafood sector. These preventive measures would be beneficial for public health and the entire food industry.

6. How was this research relevant to:

- The objectives of the CRP?
- The CRP research theme?

Relevance to CRP Theme I Objectives: The proposed research focused on the thematic areas of the CRP "Aquaculture and Fisheries" and "Integrated Agricultural Production Systems." To remain a viable enterprise, aquaculture must be sustainable, necessitating optimization of inputs and outputs throughout the production and supply chain. To achieve this, aquaculture production and processing must employ cost-effective and environmentally friendly means to enhance productivity and safety. Existing surface disinfection methods in the seafood industry are not environmentally friendly and are losing effectiveness each year due to the spread of





antimicrobial resistance, leading to severe economic and health consequences. Pathogens such as Vibrio and L. monocytogenes evade normal purification processes but may be susceptible to natural molecules such as ovotransferrin or phosphodiesterase coupled with UV-C light and bacteriophage treatments, which have previously been shown to kill other Gram-negative bacteria (E. coli or Pseudomonas).

Relevance to CRP Theme II Objectives: The proposed research also addresses the thematic areas of the CRP "Food Safety" and "Antimicrobial Resistance" by proposing new approaches for producing valuable and safe products in the agri-food sector of seafood products, which could have long-term impacts throughout the food production chain. It focuses on the development of a new technique for treating abiotic surfaces that can be colonized by persistent pathogens (V. parahaemolyticus and L. monocytogenes), two of the most common bacterial contaminants in seafood products worldwide. The proposed technique would provide a valuable, safe, and cost-effective alternative to the use of synthetic disinfectants and time-consuming disinfection procedures. The proposed research also addresses the CRP themes of "Emerging Diseases" and "Climate Risk for Production" through the study of V. parahaemolyticus. These pathogens represent an emerging risk due to long-term climate changes that can affect food safety in agricultural systems.

7. Satisfaction

- Did your fellowship conform to your expectations?

Yes, the OECD Co-operative Research Programme fellowship will increase my career opportunities both directly and indirectly. Directly, it provides me with valuable research experience and international collaborations, which enhance my qualifications and expertise. Indirectly, being associated with such a prestigious program boosts my professional profile, making me more competitive for future career opportunities

- Will the OECD Co-operative Research Programme fellowship increase directly or indirectly your career opportunities? Please specify.

Yes, the OECD Co-operative Research Programme fellowship will undoubtedly increase both my direct and indirect career opportunities. The fellowship provides me with the chance to collaborate with renowned international research institutions and experts, which will significantly enhance my network and visibility within the scientific community. This exposure could lead to potential future collaborations, invitations to participate in conferences and workshops, and even joint research projects.

- Did you encounter any practical problems?

Yes, I encountered some administrative issues between my home laboratory and the host laboratories. These problems were related to paperwork, communication, and coordination, which caused some delays and challenges during the fellowship. However, we were able to address and resolve these issues, and the overall experience was still highly valuable and rewarding.

- Please suggest any improvements in the Fellowship Programme.

One potential improvement for the Fellowship Programme could be the introduction of a standardized model of cooperation agreement between the home and host laboratories. This model could outline the responsibilities and expectations of both parties, making it easier to handle administrative matters and ensure smooth collaboration. By providing a clear framework, the administrative process could be streamlined, reducing potential delays and challenges that may arise during the fellowship. This standardized agreement could serve as a helpful tool for participants and promote a more efficient and effective exchange of researchers within the OECD Co-operative Research Programme.

8. Advertising the Co-operative Research Programme

- How did you learn about the Co-operative Research Programme?

French Embassy in Australia

- What would you suggest to make it more "visible"?

Participation in international congresses

- Are there any issues you would like to record?

Nothing

