

# SUMMER RESEARCH 2024/25

## PROJECT ABSTRACT



THE UNIVERSITY OF  
**WAIKATO**  
*Tē Whare Wānanga o Waikato*

### PROJECT # TBC

<b>SUPERVISOR/S:</b>	Dr Nadia Trent & Dr Minh Kieu
<b>PROJECT TITLE:</b>	Biosecurity risk screening based on ocean vessel voyages: A big data, machine learning approach
<b>FIELD:</b>	Machine learning, maritime transport, biosecurity
<b>DIVISION/SCHOOL:</b>	WMS - School of Management & Marketing
<b>PROJECT LOCATION:</b>	Hamilton

### PROJECT ABSTRACT:

New Zealand's economy is heavily reliant on maritime trade. Being an island nation with a high level of endemism and an important primary industry sector, New Zealand is intent to protect its values from the impacts of invasive species. Vessels moving from port to port can, unintentionally, introduce invasive marine species to an area through one of two transport mechanisms: biofouling or ballast water. The potential biosecurity risk vessels pose to New Zealand is influenced by their voyage history, including the climatic conditions and sequence of the ports visited en route, the speed at which the vessels travel between ports, timing and duration of port visits, and other factors. Traditional 'risk profiling' frameworks for international vessel arrivals require manual interrogation of voyage and maintenance history and have limited accuracy. There is a need for 'big data' based, automated tools that can screen vessel arrivals and provide management authorities with an estimate of relative risk.

This project will analyse, using unsupervised machine learning algorithms, the voyage history of all vessels that called at ports in Aotearoa New Zealand during 2023. The results will indicate which itinerary characteristics could pose the greatest biosecurity risk. A risk quantification protocol will be proposed that could guide the Ministry of Primary Industries in selecting vessels to screen for invasive species. Future projects could test the efficacy of the tool using empirical data of past screenings. The supervisors will write a conference paper or peer-reviewed journal article based on the outputs of this study. The student will be a co-author on the publication.

### STUDENT SKILLS:

- Competent in Python coding (essential)
- Experience in implementing machine learning algorithms and interpreting outputs (essential)
- Experience in data cleaning and formatting (recommended)
- Strong academic writing skills (recommended)

### PROJECT TASKS:

1. Clean and process data previously downloaded by supervisors from Starboard Maritime Intelligence (1 week)
2. Conduct literature review and develop research questions (2 weeks)
3. Design and code machine learning pipeline (2 weeks)
4. Execute pipeline, analyse results, refine pipeline (iterative process) (2 week)
5. Develop draft risk quantification protocol (1 week)
6. Design poster and write research report (2 weeks)

### EXPECTED OUTCOMES:

- Student's Research Poster (as per clause 6 of the [Scholarship regulations](#))
- Cleansed vessel movement dataset
- Functional, validated machine learning pipeline

