Summer Research Scholarship Programme
2019/2020
# Welcome

Welcome to the Summer Research Scholarship Programme 2019/20.

## Summer Research Scholarship recipients from 2018/19

<table>
<thead>
<tr>
<th>Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ariana Athy</td>
<td>7</td>
</tr>
<tr>
<td>Katherine Edwards</td>
<td>8</td>
</tr>
<tr>
<td>Jay Evans</td>
<td>9</td>
</tr>
<tr>
<td>Danielle Graham</td>
<td>10</td>
</tr>
<tr>
<td>Sarah Hall</td>
<td>11</td>
</tr>
<tr>
<td>Kristoffer Lavasi’i</td>
<td>12</td>
</tr>
<tr>
<td>Leah Newman</td>
<td>13</td>
</tr>
<tr>
<td>Valentina Papa</td>
<td>14</td>
</tr>
<tr>
<td>Nicola Paul</td>
<td>15</td>
</tr>
<tr>
<td>Sam Taaka</td>
<td>16</td>
</tr>
<tr>
<td>Rebecca Thompson</td>
<td>17</td>
</tr>
<tr>
<td>Chris Wang</td>
<td>18</td>
</tr>
<tr>
<td>Sarah Wilson</td>
<td>19</td>
</tr>
<tr>
<td>Aaron Wirepa</td>
<td>20</td>
</tr>
<tr>
<td>Ryan Bentham</td>
<td>21</td>
</tr>
<tr>
<td>Alice Buckingham</td>
<td>22</td>
</tr>
<tr>
<td>Casey Kennett</td>
<td>23</td>
</tr>
<tr>
<td>Kylee Nobilo</td>
<td>24</td>
</tr>
<tr>
<td>Dorothea Strauss</td>
<td>25</td>
</tr>
<tr>
<td>Manpreet Kaur Walia</td>
<td>26</td>
</tr>
</tbody>
</table>

## Waikato Management School

<table>
<thead>
<tr>
<th>Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthea Clarke</td>
<td>27</td>
</tr>
<tr>
<td>Scott Drabble</td>
<td>28</td>
</tr>
<tr>
<td>Julia Fuchs</td>
<td>29</td>
</tr>
<tr>
<td>Ahil Kalambukatt Shaji</td>
<td>30</td>
</tr>
<tr>
<td>Ashley Kowalewski</td>
<td>31</td>
</tr>
<tr>
<td>Robbie Maris</td>
<td>32</td>
</tr>
</tbody>
</table>

## Division of Arts, Law, Psychology and Social Sciences

<table>
<thead>
<tr>
<th>Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Te Pua Wānanga ki te Ao – the Faculty of Māori &amp; Indigenous Studies</td>
<td>33</td>
</tr>
<tr>
<td>Kyla Campbell-Kamariera</td>
<td>33</td>
</tr>
</tbody>
</table>

## Division of Health, Engineering, Computing and Science

<table>
<thead>
<tr>
<th>Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taereh Amin</td>
<td>34</td>
</tr>
<tr>
<td>Ben Cartner</td>
<td>35</td>
</tr>
<tr>
<td>Joshua Fellingham</td>
<td>36</td>
</tr>
<tr>
<td>Veronika Gerich</td>
<td>37</td>
</tr>
<tr>
<td>Yunjie (Lisa) Lu</td>
<td>38</td>
</tr>
<tr>
<td>Daniel Stokes</td>
<td>39</td>
</tr>
<tr>
<td>Benjamin Wheeler</td>
<td>40</td>
</tr>
<tr>
<td>Daniel Wheeler</td>
<td>41</td>
</tr>
<tr>
<td>Benjamin Wheeler</td>
<td>42</td>
</tr>
<tr>
<td>Dhafer Al Zulaqy</td>
<td>43</td>
</tr>
<tr>
<td>Fatemah Alqattan</td>
<td>44</td>
</tr>
<tr>
<td>Thomas Cook</td>
<td>45</td>
</tr>
<tr>
<td>Ahuroa Leach</td>
<td>46</td>
</tr>
<tr>
<td>Tiotio-Maximo Lockington</td>
<td>47</td>
</tr>
<tr>
<td>David McCauley</td>
<td>48</td>
</tr>
<tr>
<td>Shaira Mendoza</td>
<td>49</td>
</tr>
<tr>
<td>Hazel Burroughs</td>
<td>50</td>
</tr>
<tr>
<td>Courtney Davie</td>
<td>51</td>
</tr>
<tr>
<td>Varun Vartak</td>
<td>52</td>
</tr>
<tr>
<td>Akuhata Bailey-Winiata</td>
<td>53</td>
</tr>
<tr>
<td>Kaleb Batenburg-Jones</td>
<td>54</td>
</tr>
<tr>
<td>Taiawhio Bryers</td>
<td>55</td>
</tr>
<tr>
<td>Daisy Church</td>
<td>56</td>
</tr>
<tr>
<td>Olivia Dixon</td>
<td>57</td>
</tr>
<tr>
<td>Chelsea Grove</td>
<td>58</td>
</tr>
<tr>
<td>Jonathan Hogg</td>
<td>59</td>
</tr>
<tr>
<td>Mohammed Kariri</td>
<td>60</td>
</tr>
<tr>
<td>Bronwyn Kirby</td>
<td>61</td>
</tr>
<tr>
<td>Hannah Klaus</td>
<td>62</td>
</tr>
<tr>
<td>Alicia Laing</td>
<td>63</td>
</tr>
<tr>
<td>Leteisha Lamb</td>
<td>64</td>
</tr>
<tr>
<td>Michaela Lambert</td>
<td>65</td>
</tr>
<tr>
<td>Jenny Mason-Loveridge</td>
<td>66</td>
</tr>
<tr>
<td>Sam McCulloch</td>
<td>67</td>
</tr>
<tr>
<td>Jack McGarvie</td>
<td>68</td>
</tr>
<tr>
<td>Eleanor Milner</td>
<td>69</td>
</tr>
<tr>
<td>Grace Mitchell</td>
<td>70</td>
</tr>
<tr>
<td>Rachel Morrison</td>
<td>71</td>
</tr>
<tr>
<td>Tania Ng</td>
<td>72</td>
</tr>
<tr>
<td>Aysha Nusrath</td>
<td>73</td>
</tr>
<tr>
<td>Samuel Purdie</td>
<td>74</td>
</tr>
<tr>
<td>Marcus Richardson</td>
<td>75</td>
</tr>
<tr>
<td>Aidan Rowlingson</td>
<td>76</td>
</tr>
<tr>
<td>Krystal Ryan</td>
<td>77</td>
</tr>
<tr>
<td>Raskarn Singh</td>
<td>78</td>
</tr>
<tr>
<td>Deborah Smith</td>
<td>79</td>
</tr>
<tr>
<td>Erin Steed</td>
<td>80</td>
</tr>
<tr>
<td>Edie Thomas</td>
<td>81</td>
</tr>
<tr>
<td>Taylor Thomson</td>
<td>82</td>
</tr>
<tr>
<td>Courtney Tregurtha-Nairn</td>
<td>83</td>
</tr>
<tr>
<td>Bram van Gaalen</td>
<td>84</td>
</tr>
<tr>
<td>Gabi Villa</td>
<td>85</td>
</tr>
<tr>
<td>Melissa White</td>
<td>86</td>
</tr>
<tr>
<td>Henry Whyte</td>
<td>87</td>
</tr>
</tbody>
</table>
Welcome

Professor Neil Quigley
Vice-Chancellor

The University of Waikato Summer Research Scholarship Programme was established in 2006 to support and enhance research at the University of Waikato. The Programme provides exceptional students with the opportunity to experience the challenges and rewards of research.

Academic staff who supervise summer research projects gain the opportunity to choose exceptional and enthusiastic students to work on research projects that may lead to publications, opportunities to gain external funding, and which ultimately may enhance, or plant the seed to grow, relationships with external organisations. Summer research students also benefit from the opportunity to gain hands-on experience in a relevant research project, enhancing their skill-set and providing opportunities for future employment; for many the Programme provides the stimulus to undertake further postgraduate study.

The Programme also enables the University to provide research outcomes for our external stakeholders across the Waikato and neighbouring regions.

The future success of the Programme lies in collaboration with our external partners, and I look forward to enhancing our full and match-funded summer research scholarship opportunities in the future.

Professor Kay Weaver
Dean, Te Mata Kairangi School of Graduate Research

Just over 12 years ago, the University of Waikato launched the Summer Research Scholarship Programme. Since this time the Summer Research Scholarship Programme has successfully supported 925 students with over $4.7 million of funding. As Dean of the School of Graduate Research I have had the pleasure of seeing the Programme grow, and to be privy to exciting research outcomes from projects ranging from Sugar Stealing Sparrows to Māori astronomy, ritual and ecological knowledge to the ongoing effects of traumatic brain injury in children.

The Summer Research Scholarship Programme offers recipients a $6,000 scholarship, and the opportunity to undertake a research project with an expert over the summer (Trimester C). Students attend an orientation function, undertake research enquiry, learn poster presentation skills, and then have the opportunity to win a cash prize for the best student research project at the end function. All summer research students’ work with academic staff, and some also have the opportunity to partner with external organisations, providing valuable real-world experiences and outcomes that will be of immediate benefit to the wider community.

I look forward to the next 12 years of the Programme, and learning more from our students, staff and external partners.
Alisa Mihalia had never set foot in the Hawkes Bay… that is until she started a summer research project in the region. Looking at the relationship between fish abundance and habitat types, Alisa worked alongside the council to help them understand how fish populations are distributed through the Hawkes Bay estuary. An important piece of work that contributed to future planning by the council on estuary work locations.

The project saw Alisa make the sunny Hawkes Bay her home for three months, where, she spent her days outside measuring, recording and “in the estuary, dragging a seine net around.”

Alisa, who took on the summer research project in the year prior to starting her master’s degree, says the project was good preparation for taking the next step in her academic career.

“Often people start their master’s having never done academic research like this and that can be a steep learning curve at the beginning.”

“Although this was not a thesis, learning the process of real academic research and report writing before starting my masters really set me up well for the year ahead,” says Alisa.

But it wasn’t just the academic side of the project that was invaluable. Having supervisors from the Hawkes Bay Regional Council, Alisa says the project gave her real-life work experience in her field.

“Calling the estuary my ‘office’ most days in the middle of summer was lovely, but the best part of the project was being able to put my skills into practice in a real-life work environment.”

“Working with the council gave me lots of exposure to what it will be like to really work in the field once I complete my studies and the team were incredibly generous in sharing their expertise with me, filling me in on the things they were working on and even taking me out on-site visits to gain extra experience,” says Alisa.

Alisa says that the opportunity to network also made the experience incredibly useful and she took every opportunity to connect with as many industry professionals as she could while in the Hawkes Bay.

To others considering doing a summer research project, Alisa says “Absolutely do it.”

“You could spend your summer in a part-time retail or hospitality job, but it really is so much better to do something related to what you are studying.”

“Besides, it looks great on your CV,” says Alisa.
A Summer Research Scholarship project was the perfect way for Elizabeth Youard to further her research skills and learn more about the research process.

Engineering students’ opinions about teaching and learning in the School of Engineering at the University of Waikato was the focus of the project, which was part of a larger two-year study aimed at investigating student and staff learning-related perceptions, expectations and needs in the School.

Elizabeth focussed on student data, taking the interview and survey data and analysing and sorting through it to determine students’ thoughts on how the Engineering programmes are taught.

Students reported both positive and negative experiences of their Engineering learning, and provided suggestions on how learning could be improved.

“I found that students valued practical work, and were commenting on the cool experiences they’d had with practical projects and that they would like more,” Elizabeth says.

“Students also wanted learning that was relevant to the industry they intend to enter, and teaching that was interactive and engaging.”

“Lastly, the students also asked for assessments that are practical and relevant to becoming an engineer, and some felt there were too many assessments.”

Elizabeth’s findings helped the School and Dean of Engineering further understand the student experience, and the findings have led to teaching staff reviewing assessments, as well as initiating a project on assessment mapping.

The theme of relevance has also led to a further project by a new Summer Research scholar, who is interviewing Engineering alumni to explore whether they can see the relevance to the course, now they are working in the industry.

Elizabeth was not the typical Summer Research Scholarship student. After studying and working in speech language therapy, she started as a lecturer at Toi Ohomai in a teaching focussed role in the Health department.

“Because of my current role, I was looking to gain some knowledge on tertiary education to sit alongside my recently completed Postgraduate Certificate in Applied Professional Studies (Adult Teaching).”

When she saw this project advertised online she saw a good opportunity to grow her research skills and test the waters. After completing the Summer Research project, she’s now looking to complete a PhD.

“The Summer Research project was really valuable to me, and it gave me a taste of how to conduct research, providing great support to someone like me who was starting out in the field.”
Forensic psychology student, Jordan Tomkins, is driven to one day be a national leader in family violence prevention.

With a background in psychology, and having worked as a Senior Practitioner for Aviva Family Violence Services in Christchurch, Jordan understands the realities of family violence and is determined to make a positive change in this area.

“I am passionate about supporting victims of family violence and strongly believe this is one of New Zealand’s most critical social issues.”

Jordan is currently studying for a Master of Social Sciences in Psychology, and says it was the time she spent on the University of Waikato Summer Research programme that helped her segue into the degree.

“I worked on a project that looked at family violence around sporting events, and whether violence in the home increases when Super Rugby and All Black matches are taking place.

“There was anecdotal feedback that suggested violence in the home spikes as a result of big sporting games, and our intention was to find out whether there was any evidence to support this.”

Jordan says the Summer Research programme was extremely helpful, as it allowed her to undertake research full-time and gain an in-depth understanding of higher level study.

“The programme provides a platform to test out research before committing to a higher degree like a Masters. It also provides the opportunity to build working relationships with your supervisors, and those in the wider team.”

As part of her current Masters research, Jordan is investigating what risk factors may contribute to ongoing harm for high-risk victims of family violence, using data from the Integrated Safety Response (ISR) pilot.

Currently running in Waikato and Jordan’s hometown of Christchurch, ISR is a multi-agency approach to family violence that supports the safety of victims and works with perpetrators to prevent ongoing harm.

“I am focusing on about 150 cases where ISR have assessed there is a high risk of serious injury, mental trauma or death for the victim, and then tracking any further episodes of family violence experienced over a one-year period.

“The aim of this research is to identify common factors associated with repeat victimization, which can then inform prevention efforts to help improve victim safety.”

Jordan received a University of Waikato Research Masters Scholarship (worth $15,000) and an ALPSS Faculty Scholarship (worth $1,500) to help with her studies. Jordan is carrying out her work under the guidance of psychology Professor Devon Polaschek, who is also the Joint Director of the New Zealand Institute for Security and Crime Science.

“It is great to have a student of Jordan’s calibre working as part of my lab team. She brings background experience that complements that of my other students. The summer research scholarship gave Jordan a taste of what research is like, and allowed me to see her potential, as well as enabling her to decide that she wanted to commit to a substantial project,” says Professor Polaschek.

Once Jordan completes her Masters next year, she hopes to carry on her research and undertake a PhD in psychology.

“I want to be involved in family violence research that contributes meaningfully to the safety and wellbeing of people who have experienced abuse.”
How to get involved in the Summer Research Scholarship Programme

**Academic Staff**

Staff who want to be involved in the programme may apply for funding from the University. Alternatively, staff may use external funding (eg Marsden grant) and/or seek co-funding from partners. Academic staff are invited to submit project proposals for consideration for university funding by June each year. This includes applications for full-funded and co-funded projects. Each project needs to be research, and designed to be completed by one student over a maximum period of 10 weeks of full-time research from November to February.

When selecting projects, the panel will consider the subject area, external partnerships, and will be influenced by the University’s research strategy. If using external funding, staff may apply to have projects included on the programme up until the end of October.

**Students**

Students seeking a place on the Summer Research Scholarship Programme should:

- Keep an eye on the Scholarships Finder online at [waikato.ac.nz/scholarships](http://waikato.ac.nz/scholarships) from mid-August when the projects are advertised.
- Read the regulations and project offerings, ensuring eligibility, and that application documents are submitted on time.
- If possible, speak to potential supervisors to ensure the project is a good fit for you.

**External parties**

If you have a research idea and are interested in supporting a Summer Research Scholar then please contact scholarships@waikato.ac.nz.

Please note that the project must be research, not a work placement, and that all Summer Research Scholars are required to have an academic supervisor in place. We may be able to assist with meeting these requirements.

For more information on the Summer Research Scholarship Programme, email scholarships@waikato.ac.nz with ‘Summer Research’ in the title of your email.
A preliminary investigation of the geographical distribution of Family Violence In New Zealand

Ariana Athy & Devon Polaschek

Background

• Family harm is a serious problem in New Zealand, with New Zealand agencies receiving a family harm call-out every 4 minutes (Office of the Prime Minister’s Chief Advisor, 2018).
• To prevent family harm, we need to understand all of the relevant factors.
• For other types of crime such as street crime, geography is an important predictor (Weisburd, 2015).
• Crime concentration theory states that that crime tends to cluster geographically (Weisburd, 2015).
• However, geographical clustering has been rarely looked at for crime that occurs ‘behind-closed doors’, such as family harm.
• Therefore, we want to look at the locations of family harm calls to police, to understand whether locations cluster unevenly in the same way as for other types of (street) crime. This is a necessary first step in understanding how location may be a relevant factor.

Method

• There is no research on this topic in NZ. We chose to analyse Hamilton as a starting place.
• We used data from 5850 family harm police calls across the Hamilton region to make a hot-spot map on ArcGIS. This data was from 2019.

Results

• Figure 1 shows an uneven distribution of family harm police calls for service in Hamilton.
• Many areas across Hamilton had a low concentration of family harm calls for service. These are depicted in the lighter orange.
• However, certain areas in Hamilton had a higher concentration of family harm calls for service. These areas are depicted in red.
• Areas with a high density of police calls for service are clustered in the north east and north west of the city.

Conclusion and future research

• Overall, our results show that family harm is not distributed evenly across the Hamilton area. Instead, it is concentrated within some areas more than others.
• These results align with the work of two teams of international researchers, who have found that certain types of family harm are geographically concentrated (Gracia, López-Quílez, Marco & Lila, 2018; Paulsen, 2004).
• Future research should consider answering these questions:
  1. What characteristics of the locations or people living there predict family harm?
  2. Are there any differences in how family harm is distributed between a rural context and an urban context?
  3. Does family harm occur in the same areas as other crime, such as burglary?
  4. Are there any differences between how public and private family harm incidents are spatially distributed?

References


In common with street crime, a small number of places account for a large number of police calls for family harm

Figure 1. Geographic distribution of 5F (family harm) calls for service in Hamilton over 2019.

Research question

Are family harm calls for service geographically concentrated?
Katherine Edwards  
Division of Arts, Law, Psychology and Social Sciences

Applying the FEW nexus concept to promote sustainable living within an urban location

Author: Katherine Edwards, Supervisor: Dr Silvia Serrao-Neumann

CONTEXT
Cities and urban areas are areas of resource distribution, consumption, production and reuse where local supply typically draws on resources from outside the city boundaries causing environmental impacts which extend beyond the city borders (Zhang, et al., 2019). Sustainable living, food production and food security is therefore increasingly becoming a key component to addressing climate change issues. The Food-Energy-Water nexus has thus become an emerging framework with which to assess the complex and interrelated nature of our global resource systems.

Project Objective: To use this nexus to guide the transformation of an urban property into being an exemplar of urban sustainable living.

DEVELOPING A PLAN
Transforming a ¼ acre property into an exemplar of a sustainable urban household requires understanding, assessing and addressing household food waste and energy consumption whilst also encouraging food production and food security. Practices such as composting, crop production and the installation of energy-efficient appliances, renewable energy products and rainwater harvesting tanks are all components needed to live sustainably.

The process below illustrates the suggested development phases (taking into account available resources) and the required steps needed to transform the property into a sustainable household.

CONTRIBUTIONS TO FEW NEXUS
- Improved resource use efficiency across the three domains
- Improved water security and reuse
- Reduced dependence on municipal water and groundwater supply
- Improved food security
- Reduced dependence on imported food
- Reduced energy use through the installation of energy-efficient or renewable energy options
- Improved energy security
- Reduced negative environmental impacts extending beyond the city borders
- Reduced negative environmental impacts associated with large-scale agriculture production and transport

Food production contributes 19-29% of the global anthropogenic direct and indirect greenhouse gas emissions (FAO, 2011).

Food loss and food waste account for around one third of the global food supply (Kibler, et al., 2018).

Acknowledgements
I would like to thank the UoW Summer Research Scholarship programme and the Guthrie Smith Trust for providing me with this opportunity. John Timpson for his hospitality and my supervisor Dr Silvia Serrao-Neumann for the guidance.
The easier it feels for people to remember past experiences, the more likely they are to misjudge their remembering as being unintentional.

**METHOD**

Fluency Manipulation

- 10 unfamiliar items with photo: Fluent condition
- 20 unfamiliar items without photo: Disfluent condition

Judgement

- How did the memory come to mind?

**PREDICTED RESULTS**

We expect to replicate results of the previous study (Sanson et al., 2019)

- Making an experience of deliberate autobiographical memory retrieval feel more fluent leads people to judge that the memory was retrieved without their intending it.

**DISCUSSION**

- These results would suggest people draw on fluency to inform judgements about intent when retrieving autobiographical memories – just as they did when retrieving other types of information.
- The results would further expand the work showing that fluency affects judgement in a wide variety of domains (Alter & Oppenheimer, 2008, 2009).
- Research into voluntary and involuntary memory may benefit from considering the influence of fluency on self-reports of intent.

**REFERENCES**


Sanson, M., Cardwell, B. A., Rasmussen, A. S., & Garry, M. (2019). Evidence that “voluntary” versus “involuntary” retrieval is a fluency-based attribution. Psychological Reports, 0(0), 1-18.

**ACKNOWLEDGEMENTS**

With grateful acknowledgement to Dr. Marryanne Garry, Dr. Mevagh Sanson and members of the Garrylab for their support with this project.
The joint University of Waikato – University of Auckland Marsden Project focuses on examining the Māori and Samoan experiences of youth justice across three different settler-colonial criminal justice jurisdictions using qualitative social research methods and indigenous research frameworks.

The Project is attempting to build a deeper understanding of interactions between criminal justice processes, youth, whānau dynamics, wellbeing, cultural identity, and indigenous knowledge in the three jurisdictions.

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<th>Marsden Project</th>
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<th>Academic Publications</th>
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<td>The joint University of Waikato – University of Auckland Marsden Project focuses on examining the Māori and Samoan experiences of youth justice across three different settler-colonial criminal justice jurisdictions using qualitative social research methods and indigenous research frameworks.</td>
<td>The purpose of this research project is to develop a detailed annotated bibliography that will inform the development of a literature review for the Marsden Project. The focus is to identify the way in which Rangatahi Māori are represented in academic and governmental documents. This is done by analysing how Rangatahi Māori are “described” in the documents, the justification for focusing on Rangatahi Māori, and whether the document is focused on a social support or deficit model approach to describe Rangatahi Māori.</td>
<td>9 academic publications have been analysed so far. 2 publications I believe took a social support approach, 2 a deficit model approach and 5 either had elements of both or did not provide enough information for me to make an informed decision.</td>
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<td>8 governmental documents have been analysed so far. 1 document took a social support approach, 6 a deficit model approach and 1 had elements of both or did not provide enough information for me to make an informed decision.</td>
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I would like to thank the University of Waikato Summer Research Scholarship Team, and the Marsden Project Team for providing me with this exciting research opportunity.
When people repeatedly recall their memories, they likely fill in the gaps in those memories, leading them to become more coherent regardless of whether they are traumatic or non-traumatic.

**METHOD**

- **Random assignment**
- **Session 1**
  - Watch 2x negative videos
  - Rate coherence of memory for both videos
  - Describe target video
  - Rate symptoms of distress for both videos

- **Session 2**
  - Watch 2x traumatic videos
  - Rate coherence of memory for both videos
  - Describe target video
  - Plate symptoms of distress for both videos

- **Session 3**
  - Watch 2x positive videos
  - Rate coherence of memory for both videos
  - Describe target video
  - Plate symptoms of distress for both videos

**PREDICTED RESULTS**

- People should experience a reduction in symptoms of distress associated with both the control and target videos, due to the passing of time (James et al., 2016).
- This reduction in symptoms will likely be larger for the target video, as people fill in the gaps in their memories, and their memories become more coherent (James et al., 2016).

**DISCUSSION**

- These findings would fit with the growing body of literature suggesting traumatic memories are just as coherent as other memories, and provide further support against the idea of a special process for traumatic memories.
- These findings will help us to understand the mechanism by which people’s memories cohere in therapy, and how victims of trauma come to experience fewer symptoms associated with extreme responses to trauma.

**References**


**Acknowledgements**

We are grateful for the support of the New Zealand Government through the Marsden Fund, administered by the Royal Society of New Zealand on behalf of the Marsden Fund Council.
Modernism: A Framework

“Modernism” describes a movement in art and literature that occurred around 1880–1914, which was spurred by great social and political change, particularly in the Global North. Modernist modes of expression reflected a shift in the conscious and material realities of people of the time. Marx had challenged the aspirations of capitalism, Freud had charted the inner psyche, and technology was rapidly evolving. This transformation gave rise to writers like Virginia Woolf and James Joyce, who began to experiment with formal techniques such as stream-of-consciousness, fragmentation and interior monologues. 

Modernism was for a long time almost exclusively applied to Europe and parts of America. In the post-war decades Modernist Academics began to identify Modernism not as a style associated to a particular time period or group but as a way of writing – “writing of modernity” – the notion of modernity as a cultural project was to be included in the idea that different groups, peoples and nations had their own forms of modernity and that even though their times were not in Europe during the early 1900s the approach of modernity – that self-reflection – was fundamentally present.


As the timeframe of Modernism expanded we saw the classification expand to include the ideas that different groups, peoples and nations had their own forms of modernity and that even though their times were not in Europe during the early 1900s the approach of modernity – that self-reflection – was fundamentally present.

The magazine was founded by Ulli Beier, a professor at UPNG and an advocate for Indigenous writing, who believed strongly in an original and authentic Papua New Guinean voice and literary canon coming from Papua New Guinean writers. Contributors were students from the University of Papua New Guinea.

Modernist modes of expression reflected a shift in the conscious and material realities of people of the time. Marx had challenged the aspirations of capitalism, Freud had charted the inner psyche, and technology was rapidly evolving. This transformation gave rise to writers like Virginia Woolf and James Joyce, who began to experiment with formal techniques such as stream-of-consciousness, fragmentation and interior monologues. Modernism was for a long time almost exclusively applied to Europe and parts of America. In the post-war decades Modernist Academics began to identify Modernism not as a style associated to a particular time period or group but as a way of writing – “writing of modernity” – the notion of modernity as a cultural project was to be included in the idea that different groups, peoples and nations had their own forms of modernity and that even though their times were not in Europe during the early 1900s the approach of modernity – that self-reflection – was fundamentally present.

Why a Modernist Approach?

Despite being of Western origin and having the inevitable issues that arise from being a Western frame on an Indigenous space, there is value in crossing Oceanian literary spaces through a Modernist lens. Academic discourse on Pacific literature has tended to revolve around questions of postcolonialism and indigeneity. These are unquestionably part of PNG’s literary greats. 

For the purposes of this thesis this research aims to apply a Modernist studies lens to what the writers and contributors were writing about. Modernism is often seen as an attempt to break away from the confines of traditional literature and to create a new form of writing. Modernist modes of expression reflected a shift in the conscious and material realities of people of the time. Marx had challenged the aspirations of capitalism, Freud had charted the inner psyche, and technology was rapidly evolving. This transformation gave rise to writers like Virginia Woolf and James Joyce, who began to experiment with formal techniques such as stream-of-consciousness, fragmentation and interior monologues. Modernism was for a long time almost exclusively applied to Europe and parts of America. In the post-war decades Modernist Academics began to identify Modernism not as a style associated to a particular time period or group but as a way of writing – “writing of modernity” – the notion of modernity as a cultural project was to be included in the idea that different groups, peoples and nations had their own forms of modernity and that even though their times were not in Europe during the early 1900s the approach of modernity – that self-reflection – was fundamentally present.

The Stream that Joins the River

In applying a Modernist studies lens we have looked to what the writers and contributors were writing about. Modernism is often seen as an attempt to break away from the confines of traditional literature and to create a new form of writing. Modernist modes of expression reflected a shift in the conscious and material realities of people of the time. Marx had challenged the aspirations of capitalism, Freud had charted the inner psyche, and technology was rapidly evolving. This transformation gave rise to writers like Virginia Woolf and James Joyce, who began to experiment with formal techniques such as stream-of-consciousness, fragmentation and interior monologues. Modernism was for a long time almost exclusively applied to Europe and parts of America. In the post-war decades Modernist Academics began to identify Modernism not as a style associated to a particular time period or group but as a way of writing – “writing of modernity” – the notion of modernity as a cultural project was to be included in the idea that different groups, peoples and nations had their own forms of modernity and that even though their times were not in Europe during the early 1900s the approach of modernity – that self-reflection – was fundamentally present.

This research opportunity is part of a wider endeavour of Dr Long’s in Oceanian Modernisms.
The use of illicit drugs in New Zealand is increasing. New Zealand has become targeted by international cartels due to the high prices we pay for illicit drugs especially methamphetamine. By the end of November 2019, customs had detected and seized over 100 times the methamphetamine discovered in 2009 (Flahive, 2019).

A wide range of literature was reviewed, including journals, scholarly articles, books and newspaper articles to examine the current knowledge around drug trafficking and interdiction strategies.

Recent methods used in attempts to smuggle methamphetamine and other illicit drugs have included concealing goods in ceramic tiles, wall plaques, vitamin pills, electrical motors and in golf cart batteries. Such methods are time consuming for customs officers to dismantle and inspect when searching for illicit drugs.

The primary method used to intercept and detect illicit goods moving through the sea cargo stream appears to be through x-ray scanning; however, less than 1 per cent of containers are scanned. Container scanning relies on intelligence to identify high risk shipments and officers to identify and detect anomalies. Additionally, the literature suggests the Pacific Islands play a role in the movement of illicit drugs used as a transit point before goods make their way to their final destinations, this is due to their vast sea borders and limited resources, both human and financial (Schloenhardt, 2007).

Research indicates that many methods are trialed when importing drugs. X-ray technology is rarely used for container scanning and provides those importing illicit drugs with a high chance of the goods successfully making it through Customs. The role of the Pacific Islands as a transit point for drugs prior to making their way to the final destination should be further researched, with the aim to look for a solution to enable more secure borders and further interdiction opportunities.

I would like to thank the UOW Summer Research Scholarship program and the Hamilton Police for providing me with this opportunity. A special thanks to Deane Searle and Zoë Gerrand of Waikato Police and UOW supervisors Patrick Barrett and Bill Cochrane.
Gestational diabetes mellitus (GDM) refers to glucose intolerance initially detected during pregnancy, usually resolving post-partum. In New Zealand, the risk of developing GDM is increasing, with approximately 8% of pregnant women developing this condition. GDM confers short and long-term risks to neonatal and maternal health, including increased likelihood for the development of type 2 diabetes later on in life. Suitable screening for diabetes in pregnancy is required to improve pregnancy outcomes and prevent long-term complications for the mother and child. However, studies show that ~58% of women do not adhere to screening guidelines. Therefore, this study aimed to identify barriers and enablers that impact on whether or not expectant mothers were screened for GDM.

Qualitative interviews were carried out with 18 women in the Waikato region, who were either pregnant (over 28 weeks of gestation) or had given birth in the last six months. Participants were recruited through a mail-out and social media. Women were asked about their experiences around GDM screening. Audio recorded interviews were transcribed and thematically analysed.

Overall, the midwife seemed to be the key factor leading to barriers or enablers to GDM screening. The most common themes in this study enabling and preventing women from being screened were women’s relationships with midwives and whether midwives believed screening to be important. Considering that the development of GDM cannot be predicted from pre-existing risk factors alone (≥35 yrs, obesity, family history of diabetes, previous miscarriages), all pregnant women should be encouraged to adhere to screening guidelines to ensure neonatal and maternal safety.

Acknowledgements

We would like to acknowledge and thank the University of Waikato Summer Research Scholarship Program, the Waikato Medical Research Foundation, Professor Ross Lawrenson and Dr Lynne Chepulis and Dr Shemana Cassim.

Figure 1. Midwife (orange) discussing GDM screening with patient (pink).
The Psychosocial Needs of Cancer Patients in the Waikato
Nicola Paul¹, Dr Tania Blackmore¹, Dr Lynne Chepulis¹, Vanessa Burrett², Jenny Mc Cleery², Professor Ross Lawrenson¹
¹University of Waikato; Hamilton, ²Cancer Psychological and Social Support Service, Waikato DHB; Hamilton

Background

Cancer is a leading cause of death in NZ with approximately 479,600 cases and 9,517 deaths per year. Māori experience 1.5 times more cancer incidence compared to non-Māori. Approximately 1 in 3 cancer patients will experience severe and persistent psychosocial distress as a result of a cancer diagnosis. If not addressed, psychosocial distress can persist, impact on quality of life and contribute to non-adherence to treatment. The Ministry of Health (MOH) acknowledges that psychosocial support is a vital component of cancer care. The Cancer Psychological and Social Support Service (CPSSS) is a MOH initiative that assists cancer patients from diagnosis through to end of treatment. The CPSSS operates in six District Health Boards with cancer centres, including the Waikato.

Aim

To evaluate the use of the CPSSS by cancer patients in the Waikato region and compare the characteristics of patients referred to psychosocial services with those not referred.

Method

Data was obtained from the NZ Cancer Register (NZCR) for the Waikato region between 2016 to 2018. The NZCR contains the clinical details of all patients diagnosed with cancer in NZ. Information about cancer patients referred for psychosocial support was gathered from the CPSSS from 2016 to 2018. Cancer patients referred for psychosocial support were identified from the CPSSS dataset and linked to the NZCR via their National Health Index (NHI) number. The characteristics of cancer patients on the NZCR were then compared to those referred to the CPSSS.

Results

![Figure 1. Percentage of cancer patients referred to the CPSSS by cancer type.](image1)

![Figure 2. Percentage of cancer patients referred to the CPSSS by ethnicity and sex.](image2)

![Figure 3. Percentage of cancer patients referred to the CPSSS by age.](image3)

Conclusion

The leading type of cancer in patients referred to the CPSSS was breast, which is a large contributor to why there are twice as many females that are referred to the CPSSS as there are males. Haematological cancers were the second most common cancer type referred to the CPSSS. Treatment options for haematological cancers tend to be more physically gruelling, and therefore have high psychosocial impact, which might explain the high referral rate. Across all cancers, females were more comfortable seeking psychosocial support than males. Despite well-documented inequalities in healthcare for Māori, there was no difference in the percentage of Māori compared to non-Māori referred to the CPSSS. Younger cancer patients were more likely to be referred to the CPSSS. This suggest that younger patients have greater psychosocial needs as a result of a cancer diagnosis compared to older patients. Psychosocial support services are an integral part of cancer treatment and should be accessible to all cancer patients.

Want to know more?

Contact me by email at nkp4@students.waikato.ac.nz

Acknowledgements

I would like to acknowledge and thank Dr Tania Blackmore and Dr Lynne Chepulis, Professor Ross Lawrenson, Vanessa Burrett and the University of Waikato Summer Research Scholarship program.
Coercive Control in Intimate Partner Violence in New Zealand

Samantha Taaka, Apriel Jolliffe Simpson & Devon Polaschek

Background
- In New Zealand, approximately 55% of women report experiencing intimate partner violence (IPV; defined as sexual, physical, or psychological violence perpetrated by a current or former intimate partner), in their lifetime (Family Violence Act 2018, s. 9).
- Controlling behaviour is often overlooked, but more than one in four New Zealand women report experiencing this form of harm (Fanslow & Robinson, 2011).
- Coercive control refers to the systematic and repetitive use of psychological violence toward a partner in order to establish or maintain control over them, or to dominate and restrict their lives. Control can occur through behaviours such as isolation, intimidation, or threats.
- In the United Kingdom, coercive control is now a criminal offence (Serious Crime Act 2015, s. 76). Although there is not yet a specific offense for coercive control in New Zealand, it is included in 2018 Family Violence Act (Family Violence Act 2018, s. 9).
- Coercive control may become a criminal offence in New Zealand in the future, so it is important to determine whether it is detected by police.

Research question
How much evidence is there of coercive control in reports recorded by police for IPV episodes in New Zealand?

Method
- Collected 446 police reports for IPV episodes in Waikato and Canterbury from November 2018.
- Coded the presence of 5 types of controlling behaviours: economic, threatening, intimidating, isolating, and emotional control.
- Conducted descriptive statistics.

Results
- We found evidence of coercive controlling behaviours in 45% of episodes in a sample of police reports of IPV

- Almost half (n=200, 45%) of episodes included evidence of at least one form of coercive control.
- The most common form of coercive control recorded by police was isolating control (n=127, 28.5%), followed by threatening (n=53, 11.9%), intimidating (n=41, 9.2%), emotional (n=39, 8.7%), and economic control (n=16, 3.6%).
- Three quarters of reports that included evidence of coercive control only included one type of control (n=148, 75%).

Conclusions and future research
- This research suggests police do record evidence of coercive controlling behaviours in their reports, which supports the idea police could prosecute perpetrators if coercive control becomes a criminal offence in the future.
- We found a higher prevalence of controlling behaviours in our sample of IPV police reports than Fanslow & Robinson (2011) in a random sample of women in New Zealand. Therefore, it is possible that people in police reports for IPV experience more coercive control than the general population.
- Future research should investigate what kinds of control police are more likely to detect and record, and develop training programs to help police identify less obvious forms of coercive control.

References
Rebecca Thompson
Division of Arts, Law, Psychology and Social Sciences

Maternal Filicide: Comparing mothers who kill different aged children
Rebecca Thompson & Devon Polaschek

Background

• When a parent kills their child, this is known as Filicide (Poteyeva & Leigey, 2018).
• Filicide is a rare phenomenon but a widely studied one due to the public horror and media coverage when it does occur (Putkonen et al., 2016).
• Literature often focuses on comparisons between maternal and paternal filicides or between psychiatric and correctional populations, but within maternal filicide, patterns can also be observed across the different ages of the victims (Friedman & Resnick, 2007; West, 2007). This literature review focused on those patterns.

What are the patterns of behaviour and circumstances in mothers who commit filicide when organised by victim age?

Conclusions/Future Research

These findings suggest that there are distinctive groups with different circumstances depending on victim age, which may suggest that specific interventions would be required for each group.

What are the current prevention efforts in New Zealand and do they reflect the different factors that are relevant for different ages of children?

Findings

Victims under a month old
• Most distinctive group
• Younger mothers (often teens)
• Nulliparous, attempt to conceal pregnancy and/or birth
• Little or no prenatal care
• Often single mothers with little or no education
• Predominantly unwanted child

Victims one month to 5 years old
• More likely to be fatal maltreatment (accidental death as a result of abuse)
• Often occurs in reaction to perceived negative behavior or abnormality of child
• Often substance and spousal abuse occurring as well

Victims 5-14 years old
• More likely to be misguided altruism (killing due to a belief that death is ‘saving’ the child)
• Older mothers (than other groups)
• Little or no attempt to hide what has been done
• Often coincides with mental illness
• More likely to have sought help prior to filicide event

References


Glucose monitoring and control is suboptimal in adult inpatients with diabetes in Waikato Hospital

Chris Wang1, Lynne Chepulis1, Ryan G. Paul1,2

1 Waikato Medical Research Centre, University of Waikato, Hamilton
2 Waikato Regional Diabetes Service, Hamilton

Introduction

Patients with diabetes have an increased risk of hospitalisation from diabetes-related complications such as infections, cancers, cardiovascular disease, renal and eye disease1. Blood glucose (glycaemic) control in these patients ideally should be monitored, as poor glycaemic control is associated with increased morbidity, mortality and a greater length of hospital stay2 because of the risks associated with both hypoglycaemia (glucose levels < 3.9 mmol/L) and hyperglycaemia (glucose levels > 10 mmol/L)3,4.

Consequently, international guidelines recommend monitoring of blood glucose levels (BGLs) in inpatients with diabetes mellitus (DM) at least four times per day, with the aim of maintaining BGLs within 4 – 10 mmol/L5,6. These targets are often difficult to achieve due to the stress response of illness, marked change in diet, reduced physical activity, and medications which directly affect glucose and insulin metabolism, such as glucocorticoids. However, we hypothesise that a major barrier to achieving good glycaemic control in inpatients with DM is low adherence to BGL monitoring guidelines.

Similarly, we also postulate that inpatients with type 1 diabetes mellitus are not having their capillary or blood ketones measured, which is necessary to determine their risk of diabetic ketoacidosis (DKA).

Aims and Objectives

1. To determine the effectiveness of glycaemic control and management in adult (≥15 years) inpatients with DM in Waikato Hospital.
2. To determine whether suboptimal glycaemic control and monitoring was associated with adverse outcomes.
3. To determine the frequency of ketone testing in adult inpatients with T1D.

Methods

Clinical records were reviewed of all inpatient whole admissions who are non-pregnant, with type 1 diabetes mellitus (T1D) and type 2 diabetes mellitus (T2D) in Waikato Hospital between July 1st 2017 to June 30th 2018 (n = 6950). Admission were excluded if the patient was less than 15 years of age (n = 57) or the admission was less than 24 hours (n = 1861). This resulted in 5032 whole admissions in the study with 3466 unique patients; with 278 T1D patients and 3188 T2D patients.

All dates of admission were included for any glucose measurements being analysed (n = 51937), while only full 24 hour calendar days of admission were included for analyses of 24 hour period data (n = 41873). The frequency, median and mean of BGLs were calculated for each 24 hour period. For the same 24 hour period, the count of number of hypoglycaemic events (<4 mmol/L), within target range (4 – 10 mmol/L), mildly hyperglycaemic (10.1 – 13.9 mmol/L), and hyperglycaemic (≥14 mmol/L) were also recorded. Mann-Whitney tests were completed when comparing the length of stay between different patient variables.

Results

• 99.1% of admissions had suboptimal glucose monitoring (<4 tests) for all whole 24-hour periods during the admission (see Figure 2).
• Patients with T2D (99.0%) were more likely than T1D (92.0%) to have suboptimal glucose testing in any 24-hour period (P < 0.001).
• 16.5% of all patients with diabetes mellitus (DM) did not have their blood glucose checked at any time during their admission.
• In those patients with diabetes who had their BGL measured during their admission, 34.3% of them had at least one hyperglycaemic episode and 9.6% at least one hypoglycaemic episode.
• The median percentage of BGLs outside of the target range was 66.2% for inpatients with T1D and 47.7% for inpatients with T2D (Figure 1, P < 0.001).
• 32.1% of T1D did not have their blood ketone levels checked at least once during their whole admission.
• Suboptimal 24-hour glucose monitoring compared with adequate monitoring (mean = 34.4 and 18.7 days, respectively) and glycaemia compared non-hyperglycaemia glycaemia readings (mean = 23.7 and 19.1 days, respectively) both had longer bed stay (P < 0.003).

Discussion

It is highly worrisome 99.1% of inpatients with DM had inadequate glucose testing for every whole 24 hour period of their whole admission. This is also worrying that 32.1% of inpatients with T1D did not have at least one ketone test throughout their whole admission. As well, only around 50% of inpatients with DM having a median BGL outside the target range at any given glucose test. Limitations of this study include the inability to capture the BGL monitoring from venous or arterial blood samples. This research demonstrates the need for a targeted intervention for inpatient teams to help with improving glycaemic monitoring and control.

Conclusions

• Glycaemic monitoring and control is suboptimal in inpatients with diabetes in Waikato Hospital and is associated with a longer hospital stay and increased risk of readmission
• Targeted interventions are required to improve the care of inpatients with diabetes

Acknowledgements

Thank you to the University of Waikato for providing the opportunity of the Summer Student Research Studentship.

References

Sarah Wilson  
Division of Arts, Law, Psychology and Social Sciences

Increasing the strength of emotions for future events  
Sarah Wilson  
University of Waikato

BACKGROUND
- When people experience traumatic events, sometimes Posttraumatic Stress Disorder (PTSD) symptoms follow. (Rubin, Boals & Berntsen, 2008)
- People report more PTSD symptoms about traumatic event they remember well. Specifically, when their memories are more: (Rubin, Dennis & Beckham, 2011)
  - Emotionally evocative – they evoke strong emotions;
  - Central – to people’s life story and identity;
  - Rehearsed – they are thought about more frequently.
- As well as remembering past events, people can imagine future ones—using similar mental processes. (Rubin, 2010)
  - Imagined future events can have similar characteristics. (Rubin, 2011)
  - People report PTSD-like symptoms about imagined future events. (Rubin, 2014)
- We want to know if increasing the emotional evocativeness, centrality and rehearsal of an imagined event will result in more PTSD-like symptoms about that event.
  - But first we need to test if we can increase these characteristics for an imagined future event.

RESEARCH QUESTION
When imagining a negative future event, to what extent does receiving an emotional description increase the emotional evocativeness of that event, compared to receiving a factual description?

PREDICTED RESULTS

E.g. While imagining this future event, the emotions that I feel are intense
E.g. I feel that this event would become a part of my identity
E.g. Since it happened, I have thought about this event

METHOD

Imagine being robbed: emotional description
Imagine being robbed: factual description

ORDER IS RANDOMISED

Rate emotional evocativeness of event
Rate centrality of event
Rate rehearsal of event

PREDICTED RESULTS

As if it were happening now
Not at all
Factualy Described
Emotionally Described
Totally disagree
As often as any event in my life
Not at all
Factualy Described
Emotionally Described
Totally agree

REFERENCES

Acknowledgements
I would like to thank my supervisors Dr. Sanson and Dr. Garry, the Garry Lab and the University of Waikato.
Background

- Between 2009-2016, fathers (biological and step) in New Zealand accounted for over two thirds of child homicide perpetrators [1]
- International studies have looked for patterns among fathers who kill their children [2, 3]
- Furthermore, some cases have found similar prevalence of child homicide perpetration among biological and step-fathers, despite step-fathers making up a minority of paternal caregivers [1, 4]

Research Questions

- What patterns exist among fathers who commit child homicide?
- Are there any differences between biological fathers and step-fathers?

Results From International Literature

Common circumstances in cases perpetrated by biological fathers
- Relationship breakdown or
- Recent threats of separation by mother
- Paranoid suspicions of partner infidelity
- Depression
- Familicide (killing of entire family)/Suicide

Homicide Type
- Sudden outburst of rage
- Weapon use
- Intentional

Common circumstances in cases perpetrated by step-fathers
- Domestic violence history (perpetrator)
- Previous neglect and maltreatment of victim
- Antipathy towards step-child
- Adverse life experiences in own childhood

Homicide Type
- Fatal abuse/excessive discipline
- Chronic physical maltreatment
- Often accidental (intended to harm the child but not to kill)

Biological fathers kill their children in different circumstances, for different reasons, and use different methods than step-fathers

Conclusions/ Future Research

International findings suggest that methods, behaviours and circumstances are different for step-fathers and biological fathers who kill their children. Interventions need to take these differences into consideration and separate interventions may be most effective in helping at risk families.

- Do fathers in New Zealand reflect the findings of international literature?
- Do current interventions in New Zealand appropriately focus on the differences between biological fathers and step-fathers?

References

We asked students if their sexuality education included gender or sexual diversity.

Less than half said yes.

**Preliminary Results**

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was sexual diversity a topic in your sexuality education?</td>
<td>46%</td>
<td>54%</td>
</tr>
<tr>
<td>Was gender diversity a topic in your sexuality education?</td>
<td>30%</td>
<td>70%</td>
</tr>
</tbody>
</table>

**Background**

- Previous research has highlighted how sexuality education that includes gender and sexual diversity is associated with lower reports of bullying and poor mental health (Proulx, Coulter, Egan, Matthews, & Mair, 2019).
- In New Zealand, sexuality education guidelines explicitly include gender and sexual diversity (Ministry of Education, 2015).
- However, these guidelines are open to interpretation, and schools, in consultation with their stakeholders, have control over what sexuality education topics they include (Ministry of Education, 2015).
- Therefore, students’ sexuality education experience and learning can vary widely between schools and may not be inclusive of gender or sexual diversity.

**Research Question**

Is gender or sexual diversity included in New Zealand school sexuality education?

**Acknowledgements**

- Te Whare Wananga o Waikato / University of Waikato.
- Te Mata Kairangi / School of Graduate Research.

**References**


**Discussion**

- These results suggest that sexuality education in New Zealand is not fully inclusive of gender and sexual diversity.
- Further research is needed to understand why gender and sexual diversity is not included in sexuality education.

**Method**

- We conducted an anonymous online survey collecting qualitative and quantitative data.
- We recruited a convenience sample of 16-19 year olds living in New Zealand through the social media platforms of youth organisations. These organisations included St Johns, Rainbow Youth, and YWCA.
- We asked participants 32 questions on topics related to:
  - When and what they were taught in sexuality education.
  - How inclusive of gender and sexual diversity their school is.
  - What they thought was done well, what was not taught, or what needed more time.

**Background**

- Previous research has highlighted how sexuality education that includes gender and sexual diversity is associated with lower reports of bullying and poor mental health (Proulx, Coulter, Egan, Matthews, & Mair, 2019).
- In New Zealand, sexuality education guidelines explicitly include gender and sexual diversity (Ministry of Education, 2015).
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**Research Question**

Is gender or sexual diversity included in New Zealand school sexuality education?

**Acknowledgements**

- Te Whare Wananga o Waikato / University of Waikato.
- Te Mata Kairangi / School of Graduate Research.
Emotion in the Learning of Science

Alice Buckingham¹, Maurice Cheng²
¹ Faculty of Science and Engineering, University of Waikato; ² Faculty of Education, University of Waikato

Aim
Our research aims to analyse and encapsulate the findings of major emotion research produced by four key science education journals. In doing so, we hope to produce a literature review that:
• Provides insight on knowledge gaps within current emotion research.
• Improves current education policies controlling the prescribed science curriculum.

Why Emotions?
As a discipline, science is often stereotyped by popular culture as being a field devoid of any emotional interaction. Whilst science remains a discipline heavily grounded in logic and unbiased reasoning, various science education researchers have found evidence indicating the existence of a complex relationship between emotions and scientific reasoning.

In addition, recent science education studies have revealed a continuous decline in the number of students choosing to study science. From an economic standpoint, this lack of new-entrance scientists has been described as a ‘serious threat to economic prosperity’. Moreover, with contemporary western society becoming increasingly dependent on scientific and technological advances to function in everyday life; this in turn, produces a societal level demand for more individuals with a high level of scientific and technological expertise and competence (Osborne et al., 2003, p. 1052).

As a result, this has provoked science education researchers to investigate emotions as a potential solution in remediating the lack of student interest towards science.

Methodology
Journal articles focusing on emotion were identified and extracted from the following science education journals (2000-2020):
• Journal of Research in Science Teaching
• International Journal of Science Education
• Science Education
• Research in Science Education

Analysis Process:
1. Identify relevant articles
2. Screen identified articles
3. Analysis Grid

Figure 1. (1) Journal articles were identified from the above journals based on the presence of the word ‘emotion’ in the title, abstract or keywords. (2) The corpus (n=80) is then screened manually to ensure relevance. (3) Each journal article is analysed manually using an analysis grid consisting of 45 questions, such as:

| What specific emotions were studied? | What are the main results related to emotions? |

Preliminary Findings
Currently two major findings have been observed in our preliminary analysis, these are:

| Cognition and emotion are inseparable concepts | Emotion influences most classroom interactions |

For many years, psychologists have agreed that emotion and cognition are entwined in numerous interactions. However, recently emotion researchers have described the concepts as minimally demarcated.

E.g., Current neuroscientific research has suggested that many of the cognitive processes recruited in schools, i.e. attention, memory, social functioning, and decision making, are dependent and subsumed within the processes of emotion (King et al., 2015).

Emotions, specifically emotion regulation, may have a substantial role in collaborative group activities during science lessons (Tomas et al., 2016).

Social interaction and scientific collaboration is an area of science education research often overlooked in preference to cognitive processes. However, the regulation of negative emotions is crucial in maintaining friendships and effects the ability to achieve a common goal.

Policy Implications
Given that science education research on emotion is relatively new, findings from recent emotion research are largely ignored in the currently prescribed science curriculum. Making a curriculum that attends to students’ emotions during their studies (e.g., provide explicit structures to support students in regulating their emotions in the classroom and remain focused on their learning) would pay dividends, both motivationally and academically (Tomas et al., 2016).

Acknowledgements:
We would like to thank the University of Waikato for providing us with the opportunity to work on the Summer Research Scholarship Program.
Background
Engineering students at the University of Waikato seek learning that is relevant in the workplace, according to research findings from our previous studies.

Aim
To probe these findings by investigating alumni perceptions about the relevance of their engineering degree to their current work.

Method

Participant Selection
Non-probability, purposive sampling

Data Collection
23 semi-structured, face-to-face interviews

Data Analysis
Thematic coding using NVivo software

Introduction

Introduction

Initial Findings

Cross-functionaluty
Progression
Situation Dependence

Relevance clarification

Perception change

Initial analysis indicates that there are 3 triggers that improve participants’ perceptions about the relevance of their degree. Participants also suggest how this relevance could be clarified to undergraduate students earlier.

Discussion

This initial finding suggests that engineering students could recognise the relevance of their studies sooner. For instance, if taught using practical examples.

Acknowledgments
Thank you to my supervisors, Nigel Robertson and Marcia Johnson; co-researchers, Lynne Parmenter and Sakiko Hirano; NVivo advisor, Debby Dada; and the School of Graduate Research.

Acknowledgments

Table: Engineering streams and their proportions
- Chemical & Biological: 26.1%
- Materials & Process: 26.1%
- Electronic: 17.4%
- Software: 8.7%
- Mechanical: 21.7%
- Electronic: 17.4%
- Materials & Process: 26.1%

Cross-functionaluty
Progression
Situation Dependence

Perception change

Relevance clarification

“Your job outside of university—you will interact with people that aren’t in your field”.

“A lot of what you learn is just to get you to that next step and then you take a more advanced paper”.

“I would count them as a broad study of the field, which is relevant depending on where you go”.

“What seemed like irrelevant studies became relevant in retrospect”.

“Moving away from theory and going into the practical is often when you realise which things are relevant”.

Figure 2: Participants represent the 5 engineering streams offered to past students.

Figure 3: Initial analysis indicates that there are 3 triggers that improve participants’ perceptions about the relevance of their degree. Participants also suggest how this relevance could be clarified to undergraduate students earlier.

Figure 4: Participant quotes illustrate the themes.
Exploring academic language and learning advisory practice

Kylee Nobilo / Laura Gurney / Vittoria Grossi

Introduction

This project focusses on the research that Laura Gurney (Waikato University) and Vittoria Grossi (Deakin University) have conducted based on exploring academic Language and Learning Advisory practice in Australasian Universities. Language and Learning Advisors (LLA) work in Universities to provide support and assistance to both domestic and international students studying at all levels, and across every academic discipline at a tertiary institution. Most universities in New Zealand have a similar unit to support students. The LLAs are represented by a professional organisation, and their work is published in a journal (see heading ‘LLA Journals’ for links). I was fortunate enough to become the research assistant for this project, with the expected outcomes aiming to improve understandings of LLAs’ professional practice, identity and needs, and to increase university administrators’ and academics’ awareness of LLA practice. The work I complete is supporting a publication on this project by L. Gurney and V. Grossi.

Method

For this project, I have completed literature reviews and an annotated bibliography, transcribed interviews between the researchers and Language and Learning Advisors, and analysed this data as a whole.

This socio-linguistic study demonstrated the idea that ‘writing’ and ‘talking’ are often seen as the main forms of communication, and that the benefits of using other modes such as ‘talking’ can be overlooked (De Fina, 2011). Through the use of an interview, the LLAs were able to discuss their thoughts on what they believe the main challenges they face in the profession, and offer some suggestions as to what they would change if they had the opportunity to improve the role of an LLA.

A common theme that was evident throughout the interviews was that the students at different universities are generally unaware of LLA support, and what LLAs do, as one interviewee stated “well, sometimes students come in the door, and they’re not sure what to expect of me, other than that they’ve come to me for help.” It seems that a common misconception is that the role of an LLA is to proofread and edit students’ work, rather than work collaboratively on improving and enhancing the English and Literacy skills of the student. This forms the question, ‘how did this oversight arise?’ Many interviewees hold the belief that there needs to be more awareness created in universities on the role of the LLA, and that through working more closely with academic staff, a wider group of students will become familiar with the LLA service on their campus.

Furthermore, after reading into the data, another challenge that was shared in the interviews was the lack of clarity in the role of an LLA. LLAs work across all academic discipline areas, thus they work with a wide range of academic teaching staff in all areas. This can create an element of difficulty due to differing expectations and understandings from both the academic staff and LLAs as to defining the role of an LLA, and what work they do. For some interviewees, they were aware of the tasks and the boundaries of an LLA, and could clearly articulate this. However, for others, this challenge was claimed to be a large and seemingly undefined domain of work which is misunderstood by many. For this reason, more research and discussion is needed to provide clarity to overcome this issue.

Conclusion

I have thoroughly enjoyed working in a team to complete this project. Working collaboratively encouraged the sharing of thoughts and ideas, and allowed me to ask questions. Through this process, I was involved in each of the steps required to complete a research study, and I look forward to continue working with the researchers on this publication.

The role of an LLA

LLA Journals

NZ: https://www.atloanz.org
Australia: https://www.aall.org.au

Reference


Acknowledgements

Thank you to the UOW Summer Research Programme for providing me with this opportunity, and to Laura Gurney and Vittoria Grossi for welcoming me into the research team, and for providing continuous help and support.
Teachers’ view of themselves as musical beings.
Reflections emerging from research exploring what can be learnt from a one-off musical story performance in ECE settings.
Dorothea Strauss, supervisor Dr. Bronya Dean

INTRODUCTION STORY
For this project three musicians and one storyteller offered a musical activity as a one-off experience to two kindergartens. Data was collected during follow-up interviews with the teachers and the musicians.

NOTICE
Analysing the teachers’ comments in the interviews I noticed that they do not view themselves as musical experts. While they acknowledge that music is happening in many different ways in their centres, they take a negative view of themselves as musical beings: “I am not a great singer”, “I am pretty monotone”. One teacher in each centre is considered the ‘musical one’. This attitude is reflected in their understanding of children’s innate musicality and making meaning while engaging in musical activities during this project.

RECOGNISE
As a second year student I was surprised that the teachers, who are all fully qualified and registered, did not appear to make links between children’s developing agency, social competency and identity as described in Te Whāriki.

RESPOND
Educators are viewed as the key resource in any ECE service (MoE, 2017). They are positioned as competent interpreters and implementers of Te Whāriki, possessing a wide range of content and pedagogical knowledge. This breadth of knowledge enables educators to consider their own and children’s approaches to learning, as well as identifying ways in which to engage with children. However, as Dockett (2019), points out, if educators lack confidence and/or competencies across the wide range of learning domains, children are unlikely to encounter meaningful and relevant experiences.

CHILDREN ARE MORE LIKELY TO DEVELOP DISPOSITIONS FOR LEARNING WHERE THEY HAVE THE ABILITY TO CHOOSE THEIR OWN LEARNING PARTNERS, ACTIVITIES AND EXPERIENCES AND WHEN EDUCATORS ARE ABLE TO INTEGRATE DOMAIN KNOWLEDGE INTO THE CURRICULUM (MOE, 2017). ALREADY, AFTER INITIAL DATA ANALYSIS, I ADVOCATE FOR A SUBSTANTIAL INCREASE IN PROFESSIONAL MUSICAL LEARNING PROGRAMMES IN THE BACHELOR OF TEACHING (ECE) DEGREE, TO SUPPORT EDUCATORS TO DEVELOP GREATER DOMAIN KNOWLEDGE AS WELL AS GREATER CONFIDENCE.

REFLECTIONS
Children are more likely to develop dispositions for learning where they have the ability to choose their own learning partners, activities and experiences and when educators are able to integrate domain knowledge into the curriculum (MoE, 2017). Already, after initial data analysis, I advocate for a substantial increase in professional musical learning programmes in the Bachelor of Teaching (ECE) degree, to support educators to develop greater domain knowledge as well as greater confidence.

IMPACT ON MY PRACTICE
How do I assert my developing identity as an emerging contemporary kaiako amidst a range of deficiency discourses that we see in ECE settings?
How much “control or “power” will I have over the construction of my professional identity? (Kamenarac, 2019).

ACKNOWLEDGEMENTS
Thank you to my academic supervisor Dr. Bronya Dean, our librarian Elsie Langdon and the UoW Summer Research Scholarship program.

REFERENCES
INTRODUCTION
The PRISM project was designed to uncover possible patterns of Masters students’ academic and personal experiences. We wanted to know how to best support students working at this level of postgraduate study. The overarching research question guiding the project is:

What are the experiences of international and domestic students in UoW Masters programmes and how do stressors they report impact on their academic progress and achievement?

STUDY OBJECTIVES
We wanted to capture Masters student’s academic study experiences, the impact of outside university responsibilities/relationships, their career motivations and levels of well-being, perceptions of high/low points of tension in their programmes, the nature of challenges they face and how they met them. Very few New Zealand studies are available in this area. Research indicates that student success at Masters level in this country includes how well they manage issues to ensure academic success, and how well they are supported during their course of study.

KEY INDICATORS
From prior discussion with individual postgraduate students and lecturers in the Division of Education, key factors that impact on the achievement of the Master’s students in the Division of Education include how students manage issues related to academic success and individual well-being during their time as a Masters’ candidate.

These indicators echo peer-reviewed findings. E.g. Yan and Berliner (2011) who indicate variables such as age, gender, field of study, length of stay and coping strategies, show significant influence on stress levels among international students. Are influences on domestic students similar?

METHOD
Emails of invitation were sent to Masters’ students through their university email. Students who agreed to participate were sent a second email to collect further information on their age, gender, enrolment part time/Full time, International/domestic and the focus group they feel most comfortable to participate in.

We are currently running both focus group and individual interviews of the male and female students who chose to participate. Up to four focus groups are being carried out during weeks starting Monday 20th & 27th January 2020 at the Division of Education, University of Waikato. The duration of the focus group will be between 40-60 minutes.

INITIAL FINDINGS
Students are reporting that undertaking Masters level study is very helpful for them to grow professionally and personally. However, part-time students who also work full time have mentioned that they face many challenges balancing their profession lives as teachers and student commitments. Students who are married with children in particular have mentioned that sometimes due to unexpected family circumstances they struggle to complete assignment work. Students appreciated the assistance given by lecturing staff for their understanding and support at these times.

Where to from Here
The evidence gather from this study will form the basis of a nationwide survey of Masters students currently studying at each of the New Zealand Universities.

Acknowledgement
We acknowledge the University of Waikato summer research scholarship programme to make the study possible.
Background
Zespri is a New Zealand industry leader and a world leading horticulture company with the distinction of being the global category leader in kiwifruit exports with exclusive export rights for all New Zealand grown kiwifruit to all markets (except Australia).

The Zespri business model is one of ‘corporatised co-operative’, owned by past and present kiwifruit growers, however, it does not ‘own’ anything of the fruit nor the orchard, packing facilities, distribution or sales channels. It is a marketing entity with the mandate to co-ordinate all parts of the kiwifruit pipeline, from orchard to tabletop.

Motivation
To stay ahead of the competition and to achieve its vision Zespri needs to be continually looking to how it can improve the quality of its current offerings and what new value it can add to the market, its consumers and its kiwifruit growers, that is how to continually transform a commodity into a premium product.

Innovation is a key enabler of this strategy. The aim of this project is to write a case study describing the current model of innovation at Zespri that can be used by Zespri to benchmark their current practices and by the University of Waikato Management School as a teaching resource.

Due to its structure, Zespri is able to support a scalable, co-ordinated research in an industry with a shared common purpose, that is, to create as much benefit as possible to the New Zealand kiwifruit industry. R&D is outsourced to specialists and the findings and benefits of the research are shared within the industry. Most kiwifruit production countries lack this critical mass as do most fruit industries worldwide.

References

Acknowledgements
I would like to thank my supervisors Tim Coltman (UoW) and Juliet Ansell (Zespri), also Zespri staff, for their help with this project and the UoW Summer research Scholarship for providing the opportunity.
Zespri is a New Zealand industry leader and a world leading horticulture company with the distinction of being the category leader in kiwifruit. Zespri has an understanding of the need for a proactive rather than reactive approach to achieve increased profits, long term sustainability and success. This proactive approach can only be maintained through a business strategy that allows new innovation ideas to be tabled with a view to potential benefits and growth of the company. The focus for Zespri falls on two key stakeholders, 1. Growers & 2. Consumers. Our aim was to prepare a case study that describes the Zespri innovation journey and future challenges. Answering the research question provided below would allow us to achieve the aim by providing suggestions that Zespri could take forward to future proof their business.

**Research Question:** How should Zespri confront its current challenges regarding innovation?

**METHODOLOGY**

The research was conducted in four parts.

Part one was to develop interview questions to guide the exploration of the research question.

Part two was an in-depth literature review to clarify what are the key points to be explored.

Part three involved the categorization and evaluation of the data collected from the completed interviews and the literature review.

Part four was to provide suggestions to key stakeholders at Zespri from our findings and to provide a case study that could be utilized by the University of Waikato business school to be used as a potential teaching resource.

**REFERENCES**


I would also like to thank my supervisor Tim Colman, The University of Waikato and Zespri and their staff.

**CURRENT PRACTICES**

Zespri is current a product based company.

- 1. Innovate from a ‘product-based business’ to a ‘product and service/solution-based’ business.
- 2. Health & nutrition innovation opportunities.
- 3. Supply chain innovation opportunities.
- 4. New cultivars innovation opportunities.
Rising health care costs increasingly challenge health service providers and policy makers. Although research on major service providers (e.g. hospitals) in New Zealand exists, the current cost structure of distributed health service providers is not fully understood yet. Policy makers need to know about changes in the cost structure of distributed health services to optimally allocate scarce funds.

This research project aims to identify changes in costs for several distributed health service groups.

**BACKGROUND**

Estimating the Costs of Distributed Health Services in New Zealand

**METHOD**

The study uses panel data from New Zealand Business Benchmarking Survey (NZBBS). The available data comprises measurements spread over eleven financial years, 2007 until 2017. Three groups of distributed health services are analysed:

<table>
<thead>
<tr>
<th>Health care service group</th>
<th>Number of distinctive businesses measured</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP &amp; Family medicine</td>
<td>180</td>
</tr>
<tr>
<td>Dentistry &amp; Orthodontics</td>
<td>160</td>
</tr>
<tr>
<td>Physiotherapy, Chiropractic &amp; Osteopathy</td>
<td>91</td>
</tr>
<tr>
<td>Total no. distinctive businesses in data</td>
<td>433</td>
</tr>
</tbody>
</table>

**FINDINGS**

- Employee and labour costs constitute by far the biggest share of total costs for distributed health services in New Zealand
- Second largest cost element is ‘purchases’, followed by occupancy expenses
- While the average wage paid per employee increases for GP businesses, the other health services show little change between 2011 and 2016.
- Occupancy costs rose over the last decade
- GP & family medicine businesses spent $40,000 more on occupancy in 2017 than in 2008

**CONCLUSION**

Changes in cost structure of distributed health services in New Zealand have been estimated to inform policy makers. Causes of change, such as a possible correlation with societal changes, should be investigated to answer questions like:

- How can policy makers support certain health service providers and attract the businesses to locations in need of additional health services?
- Can small and new health services afford to employ the needed staff at appropriate salary levels?

Furthermore, exploration of differences in costs between additional distributed health services, e.g. midwives, and between health services in different business locations could lead to additional valuable insights.

I would like to thank Professor Frank Scrimgeour and Dr Vijay Kumar for the opportunity to have this real life research experience!
Introduction

To mitigate institutional corruption, institutions around the world have started experimenting with digitalization of systems. For example, Government of India, in November 2016, introduced a major change in the economy by demonetizing 86.9% of its total currency value and promoting use of digital payment systems for daily financial transactions. One of the major aim of this intervention was to make India corruption free. Post demonetization, the government passionately pushed digital payment platforms in expectation of a corruption free cashless society.(1)

Research Questions

Utilizing unique event of demonetization and digitalization of Indian financial system we proposed to address the following questions:

- Does demonetization and digitalization of financial transactions reduce lower level institutional corruptions?
- Does digitalization and demonetization changes the mode of corruption?

Data

- Data is drawn from a publically available self-reported bribe website – ‘www.ipaidabribe.com’.
- The dataset consist of 26,168 observations with 11 different variables including bribe amount, department, story and so on. Following is an example of such report.

Research Strategy and Method

Exploratory data analysis pre and post demonetization and digitalization of financial system in India.

<table>
<thead>
<tr>
<th>Pre-Digitization</th>
<th>Post-Digitization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug 2016</td>
<td>Dec 2016</td>
</tr>
<tr>
<td>Sep 2016</td>
<td>Nov 2016</td>
</tr>
<tr>
<td>Oct 2016</td>
<td>Dec 2016</td>
</tr>
<tr>
<td>2016</td>
<td>2016</td>
</tr>
<tr>
<td>Pre-Demonetization</td>
<td>Post-Demonetization</td>
</tr>
</tbody>
</table>

Empirical Results

- Demonetization drastically decreased the total amount and the number of bribes.

Conclusions

- Demonetization along with digitalization leads to lowering of institutional corruption.
- Some actors involved in lower level institutional corruption changed their mode of corruption from cash to online.
- The change of the mode of corruption suggest need for policy interventional involving hard paternalistic measures.(2)

Acknowledgement

I would like to acknowledge the University of Waikato for providing the opportunity to work on this Summer Research Scholarship.

References

Blockchain is a newly introduced technology. It is recently starting to be accepted by the food industry. Blockchain technology refers to a decentralised and reliable database. It is in essence “a chain of blocks”. Each of them is in a linear chain formation and contains data segments from the whole transaction system. Block-chain systems have various distinctive features such as being decentralised, collectively maintained, trustless, anonymous and reliable. It creates a secure and trustless environment regarding information used in business activities, where data is unable to be tampered with.

There is an increasing interest in use of blockchain technology for the food supply chain traceability system. The objective of this study is to explore this emerging topic by an approach of literature reviewing.

A systematic literature review was conducted. The relevant articles were recognized by using the following key words: “blockchain based” and “food traceability system”. They were selected through ‘Google Scholar’ and ‘Waikato online library’. Overall, 16 articles were finally selected for in-depth analysis. A report was written to summarize research backgrounds and objectives, knowledge gaps, methods, key findings for each article.

**Findings**

- There is an increasing consumer concern towards food safety and authenticity.
- Many traditional traceability systems face problems related to the reliability or transparency for transmitting information that assures food quality and safety.
- Blockchain technology solves those problems from the traditional traceability systems by providing a decentralised, open and transparent platform which can guarantee the food quality and safety.

Relevant research topics are recognized for the block-based food traceability system. These include high transaction costs, speed, scalability, storage capacity, lack of guaranteed user privacy, issues with regulation, latency issues, and the lack of usage skills of blockchain technology.

**Conclusion**

Blockchain technology has a great potential for different organisations to use in their traceability systems. It has many benefits and solves several issues related to the food safety and quality-assurances for consumers. However, it is still embryonic as a new technology and therefore faces various challenges. However, it can properly be implemented into traceability systems in the agri-food supply chain.

There is a growing interest and number of literatures focusing on the usage of blockchain technology into the agri-food traceability system. Further, academics and other people are currently, and will in the future, investigate possible solutions to the current issues facing blockchain technology, with room for advancement in the level of knowledge surrounding the technology and possibilities for implementation.

**Acknowledgements**

This study is granted by the University of Waikato Summer Research Scholarship and supervised by Ou Wang.
Developing a Business Case for the Cultivation of *Ecklonia radiata*
Robbie Maris, Tim Coltman, Marie Magnusson

**BACKGROUND**
Globally, the seaweed industry is growing exponentially (Fig. 1). Domestically, aquaculture contributes $500 million to the NZ economy with a government target of growing this industry to $3 billion by 2035. Seaweed aquaculture is currently non-existent in NZ but could contribute to this goal. From a commercial perspective, a first step in developing domestic seaweed aquaculture is to build a business model around a target species. In this regard, *Ecklonia radiata* (Fig. 2) is a native species that has a diverse range of established applications and is already listed on 148 commercial fishing licenses.

**PROJECT AIM**
To deliver a business case for the cultivation of *E. radiata* in New Zealand. This involves developing a business model and assessing its economic feasibility.

**METHODOLOGY**
A business model was developed using the business model canvas. It is a useful framework that lays out a company’s nine core elements. Market research was carried out directly with 30 relevant stakeholders and 16 interviews.

In the final business model canvas (Fig. 3), green notes are relevant to mussel farmers and white for seaweed processors. If the note is in a plain font, it has not been changed. All other notes have arisen as a result of the following scientific method (Fig. 4).

**ECONOMIC FEASIBILITY RESULTS**

<table>
<thead>
<tr>
<th></th>
<th>21 Years</th>
<th>25 Years</th>
<th>30 Years</th>
<th>35 Years</th>
<th>40 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue ($)</td>
<td>51,736</td>
<td>105,471</td>
<td>158,007</td>
<td>209,893</td>
<td>261,151</td>
</tr>
<tr>
<td>Operating Costs ($)</td>
<td>99,576</td>
<td>125,244</td>
<td>146,044</td>
<td>181,560</td>
<td>205,313</td>
</tr>
<tr>
<td>Value ($)</td>
<td>51,736</td>
<td>105,471</td>
<td>158,007</td>
<td>209,893</td>
<td>261,151</td>
</tr>
<tr>
<td>P&amp;L ($)</td>
<td>-48,840</td>
<td>-42,792</td>
<td>-35,544</td>
<td>-31,067</td>
<td>-30,184</td>
</tr>
<tr>
<td>Revenues (ton)</td>
<td>1.6</td>
<td>1.5</td>
<td>1.4</td>
<td>1.3</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Table 1. Economic indicators for the cultivation of *Ecklonia radiata*

Using the final business model and revenue estimates, an economic model was created (Table 1). The breakeven production scale is 45 x 100 m longlines. Above this, the model is economically feasible.

**RECOMMENDATIONS**
- Success requires a broad ecosystem (important to work with MPI to resolve regulatory barriers).
- Begin cultivation trials progressing to a commercial pilot (Fig. 5).
- Mapping of channel partners and vertical integration opportunities.
- Test assumptions to validate the economic model.

I would like to express my gratitude to both the University of Waikato and PriorityOne for funding this project. I would also like to thank my supervisors Marie and Tim.
**MAORI WRITING IN UNIVERSITY STUDENT MAGAZINES**

**HE AHA TE KAI O TE RANGATIRA?**

By Kyla Campbell-Kamariera. Supervised by Alice Te Puna Somerville.

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**INTRODUCTION**

He aha te kai o te rangatira? He kōrero, he kōrero, he kōrero. What is the food of the leader? It is knowledge, it is communication. This Māori proverb will form the spirit of this research project report.

This report will include an overview and background of this research project, comment on the research journey and the many challenges along the way, show highlights, make further inquiries and conclude by commenting on where to next.

The content and findings of this report will mostly be based on the questions asked in the project abstract.

Please note that the research compiled in this poster presentation is not of the complete time period as all of the material could not be obtained before the due date of this poster. Many of the following findings are from the time periods of 1900-1918 and 1970-1975 (this will become elaborated).

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**BACKGROUND**

The purpose of this project is to identify Māori people who published writing in NZ university student magazines between 1900-1975. The focus is on identifying the range of material that appeared in these publications by Māori writers. The task is to identify who was writing and what was being said.

The intention of this project is to give us an additional insight into the lives and perspectives of NZ university students through these years. For many, University is the bastion of critical conversation. These institutions have seen many a demographic of people boast academic traditions for centuries, therefore, students and staff naturally are leading the conversations.

---

**RESEARCH JOURNEY**

I would like to comment especially on my research journey as a novice independent researcher.

The first leg of the journey I was still figuring out the type of research I was. What environment I worked best in, how most efficiently I would collect my material and most importantly, how would I find what I needed to.

The next phase of my journey was difficult. I had found online archives of material relative to the project and was naturally deep into the research. What was difficult was not obtaining the desired results. I had started off reading the archived material in chronological order from 1900 and so on, but was not finding the results that I needed to find in terms of the project requirements. My solution to this was to fast-forward to the 1970-75 period and then work back in time. The results had mostly shifted.

What I did find in the archived material between 1900-1975 was a general understanding of the history of New Zealand as told by NZ university students at the time. Many of the times were student notices, letters to the editor, sports fixtures, recounts of events and anonymous satirical pieces. In short, it was keeping the student body in contact with the number of activities in which the students are engaged and truly reflected the societal times.

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**SOURCE**

At this stage my research findings have been determined by two major student magazines of the time: "Cracause" by the University of Auckland and "Salient" by Victoria University of Wellington.

For the purpose of this report, I would like to focus on the findings from "Salient" magazine during the years of 1970-75. Further research may alter the findings of this project but for the time being, these are some of the results:

**"SALIENT" 1900-75 CONT.**

"Salient" magazine is described as an Organ of Student Opinion at Victoria College, Wellington, N.Z. It was founded in 1938 and continues to publish student narratives, since the time of its conception.

---

**TE AOMARAMA**

Māori writing and poetry was not known or encouraged to be done within Māori environments. It was something that was not wanted or seen as acceptable. Survival was the motivator for writers to write in Māori. In the 1970’s, the environment for Māori writing began to change. Writers were now seen as writers. In the past they were seen as "Theā". There was a need now, a need to write, to tell our stories and experiences. Our writing was no longer the "Theā" Māori. We were seen as writers.

---

**CONCLUSION**

A lot of relevant material was gained from this magazine during 1970-75 and it was pleasing to be able to collect that data. Notable figures in te ao Māori (the Māori world) including the likes of Dr. Rangiāina Walker, Bev. Hevi Petahau and Poata Eruru have all contributed to this magazine over the years and have gone on to become literary figures if not already at the time. Hence where the title of this project comes from. It pays tribute to people like Dr. Rangiāina Walker, a leader in his own right, who ate knowledge and communicated to others so they too could partake in it.

**COMING NEXT**

Many of the pieces published in Salient during 1970-75 were recounts of current events that had to do with Māori, namely the 1972 Māori Language Petition and the 1975 Māori Land March. These events very much dictated the course of Māori student affairs at the time. Because Victoria University is essentially based at the foot of Parliament, these results were no surprise. The publications at this time were quite "political-heavy" as that was the scene of the surrounding environment.

Special mention must be made to the editors of the time who published magazines dedicated to te reo Māori during Māori Language Day. Week. Trailblazing literature which set the standard for the future of Salient.
Exploring Traffic Congestion in the Bay of Plenty

Author: Tahereh Amin
Supervisors: Chanelle Gavin, Jessica Turner, Shane Stuart

Motivation
In September 2018, data from Priority One showed a 5.7% increase in Tauranga traffic flow compared to a 3.9% increase nationwide [1].

Vehicle registrations in Tauranga correlate with a rapidly growing population with a 5.3% increase in private or company vehicle registrations [1].

Commuter Choice
65.6% of people in Tauranga commute by car, with only around 3% carrying passenger, meaning nearly all vehicles carry only the driver [2].

Nationally 59.5% of New Zealanders commute by car [2].

Alternative Transportation Options
From Figure 1, residents would prefer to use buses as transport. However, buses are considered as an unreliable option causing residents to resume private vehicle use. Residents also do not consider cycling a safe choice for transport, and the average walking distance is too great.

Public survey on Tauranga transport choices, 2019*

Objective
Investigate causes of the traffic congestion in Tauranga and identify most affected areas. Using Annual average daily traffic data and traffic modelling evaluate potential solutions.

Approach
This study included a literature review and investigated both technical aspects of traffic (e.g. Traffic volume, AADT) and the psychology behind human behaviour (e.g. Driver’s behaviour).

Work to Date
- Literature review
- Collected all required data
- Collected required equations for the traffic modelling

Future Work
Creating a small traffic model by focusing on one of the most congested roads using an existing XML model. It is expected that the outcome will visualise and predict traffic for the chosen road. This will then be compared with other models to evaluate the performance and to model possible solutions.

Thanks
This research was made possible thanks to the University of Waikato Summer Research Scholarship program and Priority One. I would like to thank my supervisors Chanelle Gavin and Jessica Turner from Waikato and Shane Stuart from Priority One for providing me with this great opportunity.

Reference

*Figure 1 Survey Question “How would you like to travel if you had the choice?” [3].
Improvement of NetworkML: enhanced libraries and extended features

Author: Ben Cartner ben.cartner@gmail.com  Supervisors: Abigail Koay, Brad Cowie, Richard Nelson

Introduction

- In a modern network, one typically doesn’t know what is running on the network. Poseidon and its plugin NetworkML are tools developed to categorise devices on a Software-defined network (SDN) and announce whether they’re behaving correctly.
- In this project I aimed to speed up processing time in NetworkML using C++ libraries developed at UOW.
- Some exploration into additional features of network traffic were also done.
- With later revisions of NetworkML they changed to Wireshark from TCPDUMP. I co-authored a patch to run Wireshark using parallel processing.

Problem and Motivation

- Poseidon and NetworkML are written in a slow, interpreted language. This poses an issue for training of the model and efficient monitoring of an existing network.
- The majority (4096/4104) of the features used in modeling devices are very similar in nature, it is possible to have more diverse features.
- Using a native compiled library for session analysis could speed up detection rates (normally 10x) and provide statistical features for use in detection about each flow.
- NetworkML was recently updated to use Wireshark for packet inspection. This imposed significant processing penalties, slowing processing rate by a factor of 20. Can we run wireshark in parallel to get a performance boost?

Methodology: Enhanced Library

- Modify example libprotoident tool for purpose, in particular, ip/aff (built for WEKA data format) to include data required by NetworkML (mac addresses, protocol number, IP address)
- Replace TCPDUMP/WIRESHARK with modified ip_aff and adjust access to the data structure received within NetworkML to reflect the new output
- Split data provided by Cyber Reboot for training/testing
- Train multiple models with combinations of available features from libprotoident aff tool
- Re-train model using original code base on the split data
- Compare results of modified models on test data with original model on same test data.

Methodology: Parallisation

- Identify components of NetworkML that can be run in parallel (no issues of concurrency)
- Abstract these components to spawn additional processes on a per network capture file level
- Work through the code any issues of compatibility that arise from having files processed in this manner.
- Compare training/testing times to non-parallel version of code.

<table>
<thead>
<tr>
<th>Metric</th>
<th>Modified Code</th>
<th>Original Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory</td>
<td>2700 psecs in 24 seconds</td>
<td>260 psecs in 1200 seconds</td>
</tr>
<tr>
<td>Total Data</td>
<td>2648.9 Mb</td>
<td>2642.9 Mb</td>
</tr>
<tr>
<td>Total Capture Time</td>
<td>8.7 hours</td>
<td>51.2%</td>
</tr>
<tr>
<td>Data Processing Rate</td>
<td>110 Mbps</td>
<td>2.256 Mbps</td>
</tr>
</tbody>
</table>

Results

- NetworkML using lib_protoident saw a 50 fold improvement in data processing rate compared to TCPDUMP version, and a 20 fold improvement with wireshark version (See Table 1).
- No drastic degradation in quality of predictions (See Graph 1)
- Increased accuracy for role ‘Printer’ which is argued to be a result of original code filtering out these particular PCAPs due to not meeting certain criteria for processing (Graph 1)
- Parallisation saw 50 fold improvement on data processing rate, caveat here is this is proportional to the number of cores available, 32 cores were used in the test server.
- The results of combined of Wireshark and libprotoident are not available at the time of this posters submission https://bit.ly/2QVRXWx

Discussion

- NetworkML has high performance in the domain of identifying devices on a network via packet capture analysis.
- Addition of application layer protocols may have had an positive impact on performance in some categories where data available is minimal (printers)
- Libprotoident out of the box didn’t pick up 1/7th of the flows that the classical implementation did, this may require re-implementing using a lower level API like libflowmanager
- Speed improvements were significant, and for a scaling project may become more relevant.
- Addition of statistical features was not productive. This may be due to primitive derivation of those features into ‘superflows’
- NetworkML utilised parallelism quite effectively and saw significant performance boosts with no loss in accuracy.

Thanks:
Warm thank you to Abigail, Brad, and Richard for their tremendous support in this project and ensuring I was on the right track.
Thank you to the University of Waikato for the scholarship opportunity. Thank you to the cyber reboot team for letting me work with them.
This lung awareness website entitled, “Hā Ora: Let’s talk lung health”, arose from a broader research project entitled Ha Ora: Improving early diagnosis of lung cancer for Māori and rural communities and was underpinned by a kaupapa Māori approach. The objective of the project was to explore the barriers to early diagnosis of lung cancer, experienced by Māori patients and whanau. The broader project involved four rural localities in the Midland region of New Zealand who each had high lung cancer rates, to identify what they consider barriers to early diagnosis. Four different interventions were designed in partnership with each community to help promote earlier diagnosis of lung cancer.

The website is a result of work with Opotiki. With the purpose to help and support whānau across Aotearoa with lung related conditions including lung cancer, to go and see the doctor as soon as they notice any symptoms or get worried about something not being right.

**INTRODUCTION**

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The website is a result of work with Opotiki. With the purpose to help and support whānau across Aotearoa with lung related conditions including lung cancer, to go and see the doctor as soon as they notice any symptoms or get worried about something not being right.

**DEVELOPMENT**

Development was completed using the Django REST Framework. Django is a free and open source web application framework, written in Python. A web framework is a set of components that helps to develop websites faster and easier. The simplified graphic below illustrates how the framework (Django) displays a website on a user’s browser.

**FEATURES**

- Easy to navigate Lung Ailment info page
- Lung questionnaire with tailored responses
- Editable calendar to record notes/dates
- Find support services in a specific region
- Each page shares a true/actual patient story

**ACKNOWLEDGMENTS**

This was made possible thanks to the UOW Summer Research Scholarship Program and the New Zealand Health Research Council. Also a special thank you to my supervisors Shemana, Lynne and Michael.
Veronika Gerich
Division of Health, Engineering, Computing and Science

We investigated readers’ perceptions of typographic presentation in dual language picturebooks. Our focus was language order and the impact of typographic variables including text size, bold weight, and italics in German & English dual language picture books.

Research Questions
We are presently statistically analysing the results relating to user perceptions of language order and language presentation.

DOES ORDER INFLUENCE READER PERCEPTION?

DOES BOLD INFLUENCE READER PERCEPTION?

DOES ITALICS INFLUENCE READER PERCEPTION?

DOES TYPE SIZE INFLUENCE READER PERCEPTION?

Results
We have tested with 50 people who do and don’t read German, who are range in age from 17 years old, with, an equal gender split.

Interesting insights to date are:
Participant x: “Uppercase is sort of screaming at you.”
Participant y: “I always see the first one since we read top to bottom.”

Want to know more?
Scan this code and follow the link to the video.
Or visit: https://youtu.be/zo4qt2OYoDM

Researcher: Veronika Gerich
Supervisors: Nicholas Vanderschantz, nic.vanderschantz@waikato.ac.nz, Nicola Daly, nicola.daly@waikato.ac.nz
Book Design and Writer: Vouchleang San
How Can Insulin Dosing Strategies for an Artificial Pancreas Be Made Robust to Missing Sensor Readings

Author: Yunjie (Lisa) Lu

Supervisors: Mike Mayo, Abigail Koay

Introduction

What is an Artificial Pancreas?
- A closed-loop insulin delivery system (Fig 1)
- Consists of a Continuous Glucose Monitor (CGM), a controller, and an insulin pump

CGM:
- Tracks users' blood glucose (BG) level
- Collects readings on every set interval (e.g. every 5 mins)

Goal:
- To reduce the time spent in normal BG level without increasing the risk of hypoglycemia by exploring and comparing the performance of different failure mode strategies

Method

A. Fuzzy logic controller
- To address different glucose circumstances based on glucose level, rate, and acceleration
- Much safer by using predetermined glucose management parameters

B. Failure mode strategies
- Pump off: Stop insulin infusion
- K*average, where average = average value for last one hour
  a. K=1
  b. K=0.5
  c. K=[0.5,1]
- Random choice: randomly choose one value from the past one hour

Problem & Goal

- Problem: Missing data from CGM readings while the insulin pump is still working may lead to severe hypoglycemia (low BG) and hyperglycemia (high BG)
- Goal: To reduce the time spent in normal BG level without increasing the risk of hypoglycemia by exploring and comparing the performance of different failure mode strategies

Results

- CGM vs BG vs Insulin (Pump off)
- CGM vs BG vs Insulin (0.5*average)

Conclusion

- Hypoglycemia may cause more risk than hyperglycemia does.
- Nonsevere hypoglycemia may lead to discomforts, such as anxiety or blurred vision, and the severe ones may even lead to coma or seizure. Hyperglycemia may increase the risk of long-term complications, for example, heart attack and kidney damage
- 0.5*average performs relatively better than all other strategies.
- In future, we can explore more strategies based on this idea. In addition, we can take the trend of the previous BG level into consideration so that we can make more accurate predictions.

References


Want to know more?
Scan this QR code, or visit: https://lisaluyunjie.shinyapps.io/website/ to view more data
Random Permutations
Random Permutations are a useful construct in many applications such as machine learning, video game development and random algorithms. A permutation is any reordering (shuffling) of a set of items that does not add or remove items from the set. There are n! distinct permutations of any given set of size n. An algorithm that generates random permutations randomly selects a permutation from the uniform distribution of all n! permutations for the input set.

Bijective Functions
A surprising observation is that a permutation is uniquely defined by a bijective function mapping the input set onto itself. The output of the function is the location in the ordering the item will take in the permutation. This is most obvious when the input is \( \{0,1, \ldots, n\} \) and the output of the function is the index the input element ends up at. This is particularly useful when the set is represented by an array of elements. In this situation the input to the bijective function is the index in the array and the output of the bijective function is the index in the output array the item will be written to.

The Algorithm
Our algorithm uses bijective functions to turn the process of generating random permutations into a highly parallel problem. The primary difficulty here is the inability to find a bijective function that can be adapted for all input sizes. To solve this we used an exclusive scan to exclude the values that end out of range.

With input buffer \( a \) and output buffer \( b \) both of size \( n \) and random bijective function \( f \) the algorithm goes as follows:
1) Find smallest \( m=2^b \) such that \( m \geq n \).
2) Launch \( m \) independent threads with thread ids \( i \) from range \( 0..m-1 \).
3) In parallel compute \( x = f(i) \) on each thread.
4) Perform an exclusive scan over \( g(x) \) into array \( s \), where \( g(x) = 0 \) if \( x \geq n \) and \( g(x)=1 \) if \( x < n \).
5) For all threads with \( x < n \) copy from \( a[s[i]] \) into \( b[x] \).

Random Bijective Functions
In order to generate random permutations using bijective functions we need a bijective function that can be modified to output different permutations every invocation. This is a difficult problem to solve efficiently in the general case. However, there are many that work for certain sizes, such as powers of two.

Linear Congruential Generator
One function we can use is based off the linear congruential generator (LCG). A LCG uses an equation of the form \( f(x) = (ax+b) \mod m \) to generate pseudorandom numbers. If \( a \) and \( m \) are coprime then \( f(x) \) is a bijective function for all \( x < m \). We can therefore randomly select an \( a \) and \( b \) to vary the output of \( f(x) \) and generate random permutations. In order to ensure \( a \) is coprime to \( m \) we choose \( m \) to be a power of two and choose an odd value for \( a \).

Feistel Network
In cryptography a block cipher is a function that maps a \( n \)-bit block to another \( n \)-bit block using a secret key \( K \). This function is invertible, but it is computationally indistinguishable from a random permutation without the secret key. This means a block cipher is a random bijective function which uses the key to determine what permutation should be generated. One common construction for creating a block cipher is a Feistel Network. In a Feistel Network the input is split into halves and the right half is combined with the round key \( K_i \) and fed through a round function \( F \). This is then XORed with the left half of the input. The left and right halves swap places and the process repeats.
Adding Features to the Waters Analyzer

Waters/Supremica is a tool for analysing finite-state automata for formal model verification. It provides two analysers - the Supremica Analyzer and the new Waters Analyzer. The analysers display several finite-state automata and allow the user to invoke various algorithms to transform or verify them. In this project, several features have been added to the Waters Analyzer so that it supports operations previously only available in the Supremica Analyzer, and provides access to various automata algorithms that were previously only accessible by programming.

**Workbench**

The workbench allows the user to experiment with Supremica’s synthesis algorithm. It is now also available in the Waters Analyzer.

**Event Hider**

The event hider allows the user to simplify an automaton by removing some of its events. This can now be achieved conveniently by dragging events between two lists.

**Simplifiers**

Waters contains many simplifiers that had not been made available in the interface. These are now available in the Simplifier dialog.

Several improvements have been made to the option system. The simplification and verification algorithms in Waters have numerous options which can now be readily edited using improved option dialogs.

The options are defined in a central place for each category and can be reused. For example, the 'Keep Original' option is used by all simplifiers, so changing it for one simplifier will change it for all. Options that are shared belong to an option page.

These new options have been integrated with the old option system, allowing both new and old options to function and be saved. The new simplifiers have had their new options added.
Purpose

IoT-based services in NZ, such as agri-tech, are reliant on cloud and edge systems.
However, this consumes energy in locations where renewable generation is limited.

Aim

This project aims to use energy-aware resource management to reduce energy consumption and maximise renewable energy utilisation.

Case study

This project uses an entity-counting application (“worker”) as a case study, taking frames from a video source and outputting annotations. Frames can be scaled down or dropped, reducing the overall workload.

Results

The graph (right) shows the reduction in queue length as a result of the number of workers, preventing the work queue from getting too large.
Adding Features to the Waters Analyzer

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Dhafer Al Zulayq

Division of Health, Engineering, Computing and Science

INTRODUCTION

During the process of 3D printing of concrete, a cementitious material is transferred from a container to a printing head nozzle, where it is located layer by layer in order to build an object.

Scientific Methodology

• Mainly two methods of 3D printing of concrete for analysis purposes; Extrusion of concrete & Powder deposition (D-shape).

In this research, the case of extrusion of fresh concrete was examined.

• In previous researches, flowability of concrete has been an important subject[1-2]. This is because, not every type of concrete is pump-able or printable. A study focused on adding superplasticizer in the mixture, which resulted in decrease in W/C ratio, increase in compressive strength and its flowability[1].

Another study focused on the fluidity, flow loss and compressive strength of concrete mixture using two different types of retarders, citric acid (CA) and sodium gluconate (SG) [2].

• A methodology of experimenting flowability as well as extrudability of 3D printing concrete mix is presented along with their mechanical properties.

MIX DESIGN

• Sand was, sieved using a 0.5 mm sieve.
• Two different types of chemical additives were used along with control sample.
• The plasticizer was added in all samples.
• The mixture was, added into 10 moulds after which it was placed in water tank for 7 days for compression and splitting tests.

EXTRUDABILITY

• The Extrudability indicates the ability of materials to be extruded continuously from the 3D printer head and to be transferred through pipes.
• It was measure by syringe test
• Intron machine for syringe test: measures extrusion pressure.

• Sand was, sieved using a 0.5 mm sieve.
• Two different types of chemical additives were used along with control sample.
• The plasticizer was added in all samples.
• The mixture was, added into 10 moulds after which it was placed in water tank for 7 days for compression and splitting tests.

Flow table test: measures the workability of fresh concrete.

The cone was, gently removed after 10 drops.

Diameter of the resulted mortar was, then measured. .

It is clear that more, the material can flow more, it can be extruded. That is evident from our results. For 0.7% of additive 2, flowability and extrudability are shown to be higher throughout the research period.

CONCLUSION

• It is clear that more, the material can flow more, it can be extruded. That is evident from our results. For 0.7% of additive 2, flowability and extrudability are shown to be higher.
• Maximum compressive strength was shown by 0.7% of additive 2, followed by 0.4 % of additive 2 and 3% of additive 1.
• Thus, Additive 2 proves to be better to be, used for 3D printing of Concrete as it has shown to increase flowability, extrudability as well as compressive strength.

Flowability for Additive 2 (0.7%)

REFERENCES


This study was made possible to the University of Waikato summer Research Scholarship program. I would like to acknowledge and thank Dr. Mostafa Seifan from the University of Waikato for his patience, guidance and advice throughout the research period.
Abstract

The mechanical properties and the microstructure of as-extruded pure-Ti and Ti-64 have been studied using tensile testing, optical microscope and heat treatment. Dog bone shape samples were tested by a tensile machine and the result showed that the Ti-pure has a good mechanical properties compared to Ti-64 because it has a plastic and elastic region whereas Ti-64 has only the elastic region. The microstructure of the samples was obtained by the optical microscope and the result was both Ti-pure and Ti-64 had a lamella (α+β) and alpha grain boundary structure. This study aims to test and understand the mechanical behaviour and the microstructure of industrially produced Ti and Ti-alloys extruded profiles for industrial applications.

Results

![Figure 1. Stress versus strain curves of as-extruded Ti and Ti-64 respectively.]

- As-extruded Ti has a better mechanical properties compared to as-extruded Ti-64.
- Both Ti and Ti-64 microstructure's illustrates a lamella and alpha grain boundary.

Conclusion

Methods

- As-extruded Ti has a better mechanical properties compared to as-extruded Ti-64.
- Both Ti and Ti-64 microstructure's illustrates a lamella and alpha grain boundary.

Acknowledgment

I would like to thank the UOW Summer Research Scholarship program for providing me with this opportunity as well as Dr. Leandro Bolzoni and Dr. Stella Raynova as my academic supervisors.
**Motivation**

New Zealand imported 250,000 tonnes of plastic resin in 2017, of which 60% is used to create packaging [1]. This will eventually need to be disposed of.

Most of New Zealand’s plastic waste is sent to landfills or offshore, as New Zealand does not have the facilities to recycle all of its plastic waste. The Basel Convention aims to reduce the amount of plastic waste sent to developing countries. Additionally countries that New Zealand currently sends plastic to are beginning to ban the importation of plastic recycling. Alternatives to recycling plastics is therefore required.

Foaming proteins is an option to make bio-degradable foam packaging as replacement for non degradable polystyrene.

**Aim**—To produce a protein foam, through freeze drying, that can be used as an alternative to existing foam packaging.

**Method**

Table 1: Foam combinations and length of time whipped for.

| Gelatine (g) | 15 | 10 | 10 | 10 | 10 | 5 |
| Olive Oil (g) | 0 | 0 | 2 | 2 | 3.5 | 0 |
| Seaweed (g) | 0 | 0 | 2 | 2 | 0 | 0 |
| Time (min) | 10 | 16 | 16 | 16 | 16 | 25 |

- Gelatine was dissolved in 100mL of water.
- Foam was created by whipping gelatine in a Breville cake mixer.
- Seaweed and gelatine were folded through once aerated.
- The Foam was frozen before freeze-drying for 24h.
- Density—volume taken using callipers and mass weighed.
- Compression testing occurred on an Instron at a rate of 1mm/min.

**Results**

Of the combinations made the 15g gelatine foam out performed the other foams. 15g Gelatine had a strength of 0.307 MPa compared to 0.615MPa for polystyrene [2]. The addition of seaweed caused the strength to weight ratio of the foam to decrease from 2.68x10^-3 Nm/kg for 10g Gelatine to 1.17x10^-3 Nm/kg.

**Conclusions**

- Gelatine was able to be foamed to produce a plastic foam using freeze drying. The foams had a texture similar to polystyrene and were white in colour.
- The 15g of foam had a strength to weight ratio of 5.27x10^-3 Nm/kg compared to polystyrene’s 6.74x10^-3 Nm/kg.
- Seaweed did not work well as a reinforcement as it decreased the strength to weight ratio of the foam.

**Future Considerations** - Use cross-linking agents to cross-link proteins to increase the mechanical properties of the foam.

**Acknowledgements**

I would like to acknowledge the University of Waikato Summer Research Scholarship Program for providing this opportunity. I thank my supervisors Chanelle Gavin and Mark Lay for their guidance.

**References**

Earthquake simulation within a VR environment

Authors: Ahuroa Leach, Salim Al Farsi
Supervisor: Alessandro Fascetti

Introduction
The use of VR for earthquake simulation is well established in the literature. However, the use of structural engineering models to simulate a real life earthquake scenario has not occurred. This project aims to use structural engineering models and theories in a VR environment to simulate a real-life earthquake scenario. This will be achieved within the following objectives:

Objective 1: Import BIM models into rendering engine
Objective 2: Import structural analysis results into rendering engine
Objective 3: Simulate real life earthquake based on structural analysis
Objective 4: Simulate earthquake effects for non-structural elements

Theoretical background
This project has focused on gaps in the creation of structurally meaningful VR models for the simulation of earthquakes. The research hypothesis on which the work was based is the following: commonly available structural analysis software can provide detailed information on the response of a given building to any known earthquake using well-established structural engineering models and theories. These tools, however, lack the visual impact of a truthful 3D representation of the built object, so that their results are only meaningful to trained structural engineers. The tools we are developing will bridge this gap, by defining rigorous algorithms for the acquisition of the information coming from such structural analyses, and then bringing this information in a user-friendly Virtual Reality interface.

Methodology
Objective 1: Import model into Unreal engine using Datasmith plugin for Revit 2020... and Unreal engine version 4.23.1 to
Objective 2: Implemented C+ script to retrieve data from SAP 2000 structural analysis and store data in unreal engine project
Objective 3: Divided model into elements based on behaviour during earthquake. Major structural elements included structural columns, floor slabs and curtain walls. Deformation of column elements was modelled using splines and spline mesh components. Displacement along spline was determined though use of linear elastic shape functions. Movement of floor slab elements was modelled as simple displacement of rigid objects. Destructible meshes were used to model curtain walls for which damage accumulation was due to relative displacement of adjacent floors.
Objective 4: The built-in physics engine was used to simulate the behaviour of loose non-structural elements such as furniture.

Results
Successfully imported BIM model and structural analysis results needed for earthquake simulation as beta version of Datasmith plugin does not currently support pivot points global position for selected elements needs to be extracted manually from Revit. Successfully modelled the effects of an earthquake on the structural and non-structural elements using linear elastic engineering models and inbuilt physics engine. Improvements include the replacement of rigid non deformable objects by deformable column elements. Internal wall elements yet to be developed.

Conclusion
The Research project suggests that:
• the use of structural engineering models and theories to simulate a real-life earthquake scenario is possible.
• the development of customised tools and software within this project will significantly reduce the time taken to develop working VR environments.

Acknowledgements
Thanks to Alessandro Fascetti, Simon Laing, and Bill Rogers for their continued support and supervision over the course of the project.
Thanks to the University of Waikato and the UOW summer research scholarship program for the opportunity.
One of the major unsolved problems in heat exchanger (HEX) design and operation is to prevent the build-up of unwanted deposits on heat exchanger surfaces. These deposits impede the performance of the HEEx while simultaneously increasing the costs of maintenance and carbon emissions from inefficiencies. This research was carried out to fill the gap in literature of the advancements of two newer on-line fouling mitigation methods and pave the way for future research.

Problem Statement

- HEExs are the components in plants used to heat or cool a process stream.
- They have a wide range of applications which include pasteurizing milk in dairy industries, or heating pressurized water by geothermal steam so that power may be generated via generators.
- Fouling occurs when the surface of the HEEx develops a layer of unwanted solid materials.
- Fouling happens via corrosion of metal surfaces, particulates forming, precipitation and chemical reactions resulting in a reduced heat transfer coefficient, higher costs to meet demands at lowered efficiency.

Thermal Shock

- **Advantages**
  - Does not require plant shut-down for maintenance.
  - Could potentially save money and time from repeated overhauls.
- **Disadvantages**
  - The technology has not been implemented in an industrial scale.
  - Little is known on the technology as the literature is also limited to experimental carried out as in the image above.

Ultrasound

- **Advantages**
  - Ultrasound technology could lower the rate of plant shut-down and costs for maintenance.
  - The use of ultrasound is known to enhance the heat transfer capability of the exchangers.
  - Ultrasound waves prevents the build up of deposits.
- **Disadvantages**
  - The technology is achievable in the laboratory scale, but not much advancements have been made for industries.
  - The current literature suggest that foulant cannot be fully removed via ultrasounds and mechanical methods still need to be used for complete clean.
  - The technique is limited to the type of heat exchangers i.e. only shell-and-tube or double pipe HEExs.

Solving the HEEx fouling problem in industries would lower the operational costs as well as plant down-time from repeated maintenance and refurbishments.

From the recent advancements, it can be argued that the two on-line techniques are close to being implemented in industrial scale with further developments and research.

One of the more important benefits of fouling removal is minimizing the carbon footprint of every plant from improved efficiency and lowered fuel use.

The abstract for this research has been submitted to the “23rd Conference on Process Integration, Modeling and Optimisation for Energy Saving and Pollution Reduction (PRES’20)” Xian-China.

References for all figures (*) are available in the report.
Background:
Due to the development of AI designed structures, advanced construction techniques are becoming preferable.

With the aid of robotic manipulators, automated construction allows for a dramatic improvement in efficiency, time and versatility.

The Droxel (block) is the result of years of research towards developing a revolutionary, interlocking brick. Whereby the mass determines the structural stability.

Project Achievements
Created the tools required to autonomously build a wide range of highly adaptable structures through the use of an ABB robotic arm.

Design of a pneumatic manipulator with a focus on simple mechanics and minimising active components allowing for the manipulation and placement of the droxels.

Development of a quick to learn program which allows for a direct translation between rational spatial coordinate concepts and the proprietary ABB language.

Results
The designed tools proved capable of assembling complex structures of droxels with a varying composition and mass.

With the assistance of basic software tools, a direct link has been made between rational movement and placement of droxels and the RAPID code.

Manipulation of the blocks has been achieved in a scalable manner.

Human / Machine
The droxel is a unique, multi-faceted block, specifically designed to maximize the dropping tolerances, while allowing for virtually any structural shape to be correctly materialized.

By extrapolating the shape variables, a pneumatic cup end-effector has been 3D printed allowing for a very efficient and scalable transport method.

ABB robotics utilises the RAPID programming language. As a simple derivative of C, this can be directly manipulated and uploaded to the arm, compiling in situ, immediately before execution.

Looking Forward
The advanced droxel shape will allow for efficient building designs to be constructed for short or long term relief as well as civil engineering projects.

Material studies, and the droxels response to forces will further improve this novel building technique.

Acknowledgements:
Big thanks to the UOW Summer Research Scholarship Program and Alessandro Fascetti for this opportunity.

Hin Lim, without your expertise.. I would still be stuck, as well as Adam Lai and all the guys at Praise Innovation for all your support!!
Concrete is the mostly widely used construction material in the world. However, the production of its primary component, cement, accounts for 8% of global man-made CO₂ emissions. This has led to research on several alternatives. One of the most prevalent additives are nanoparticles, particularly nano oxides, which can even produce stronger and more durable concrete. Moreover, in the efforts of developing more sustainable concrete, cement can be replaced with fly ash which is a massively produced industrial waste from coal plants.

Thus, the aim of this research is to utilise the particle magnetite (iron oxide/Fe₃O₄) and determine the effects of particle size and dosage on the properties of mortar containing fly ash.

**Methods**

Tests on compressive and splitting tensile strength, workability (fresh mixture), and water absorption were carried out on mortar samples. Screening study was conducted on samples where cement is replaced by 5%, 10%, & 15% nano-Fe₃O₄ (NF) and micro Fe₃O₄ (MF). Further study was performed on mortar with the optimum particle dosage and cement was replaced by 10%, 20% & 30% fly ash.

**Acknowledgement**

I gratefully acknowledge the University of Waikato for the Summer Research Scholarship Program and this research experience.
iCavuti vaka-vanua

iCavuti vaka-vanua is a mobile application intended to assist individuals during Fijian cultural practices. In particular, Yaqona (Kava) pouring ceremonies. A Cavuti is a spoken acknowledgment performed at the beginning of the ceremony, this acknowledgment involves knowledge of chiefly titles and entities. These particular titles are dependent on the individuals who are present at each ceremony and their heritage origins. iCavuti assists by helping users generate a correct Cavuti through a GIS data mapping selection process that corresponds with chiefly origin data. The final result is a scripted Cavuti displayed upon the mobile device screen to be read aloud.

Traditionally, Fijians have had the knowledge used for a Cavuti Memorised, however, with the more recent movement of written text records, this knowledge has unfortunately been slowly dissolved over the years. iCavuti is a mobile app that will help preserve this knowledge that people can have at their fingertips. The data provided for this app, was supplied by iTaukeu Affairs.

A low-fidelity wireframe was used to test the user flow and determine functionality and usability. Once the low-fi wireframe was tested and discussed, design decisions could be made. This involved iconography, colour and typeface considerations and the presentation of information on the screen. The colors chosen for the app were inspired by traditional Fijian Masi (Fijian art) and reflect the cultural relevance of the app and the mana (spiritual significance) it possesses. An easily readable typeface was chosen based on the targeted audience; Fijian people of all ages. Iconography based on traditional motifs are being prepared alongside Fijian artists ensure design decisions are culturally accurate and appropriate.

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INTRODUCTION

Injury in young girls and netballers is of concern (Fig 1). Netball is among the top 3 sports in NZ in terms of numbers of injuries.¹,² Neuromuscular warm-ups have been shown as effective in reducing injury rates in sports.³ ACC has developed the Netball Smart warm-up to reduce the prevalence of injuries in netball.⁴

AIM

Our aim was to examine and compare the acute effects of Netball Smart (NS) and a Generic (GE) warm-up in young netballers in a crossover study.

METHODS

After baseline and familiarization in session one (Fig 2), 15 youth (13.5 ± 1.4 y) netball girls were randomly allocated to NS or GE in session two, and the alternate warm-up in session three. Three injury risk screens were done Pre and Post warm-up: Landing Error Scoring System, Y Balance Test, and Weight Bearing Lunge.

RESULTS

There were no significant or meaningful change in any of the injury risk factors from Pre to Post (p ≥ 0.117), regardless of warm-up (p ≥ 0.312).

CONCLUSIONS

Our pilot study found no clinically meaningful acute effect of warm-up on injury risk factors related to knee and ankle injuries in netballers. Both NS and GE were ineffective in reducing injury risk factors acutely. Despite our findings, athletes should complete dynamic warm-ups pre-exercise for their reported immediate and longer-term physiological, neuromuscular, and injury prevention benefits.⁴,⁵

FUTURE DIRECTIONS

A larger cohort and longer-term intervention study with injury monitoring is required to confirm whether the Netball Smart warm-up effectively reduces injury risk factors and incidence in young girls.

REFERENCES

Comparing two treatment approaches for patients with type 1 diabetes during exercise

Varun Vartak1, Lynne Chepulis2, Matthew W. Driller1 and Ryan G. Paul2,3
1 Te Huataki Waiora, School of Health; 2 Waikato Medical Research Centre; 3 Waikato Regional Diabetes Service, Hamilton

Introduction

Type 1 Diabetes (T1D), once known as juvenile diabetes or insulin-dependent diabetes, is a chronic condition in which the pancreas produces little or no insulin, so insulin therapy is required for control of glucose levels and survival.1

Exercise is a cornerstone of management in T1D, but more than 60% of patients with T1D do not exercise due to their fear of hypoglycaemia (low glucose levels) or hyperglycaemia (high glucose levels).2

The two main treatment approaches recommended to ensure safe glucose levels around exercise are to either reduce the normal doses of prescribed insulin or to eat carbohydrates without insulin cover before exercise.3

Due to limited investigations, it is unclear as to which is the best approach for patients with T1D on either the effects on glucose levels or performance during aerobic exercise.

Aims

To determine whether reducing insulin (reducing insulin intervention) or eating carbohydrates without insulin cover (eating carbohydrate intervention) results in more glucose levels in target range (4-10 mmol/L), hypoglycaemia (≤ 3.9 mmol/L), and hyperglycaemia (> 10.1 mmol/L) during and post aerobic exercise (treadmill walk at 7.24 km.h⁻¹ for 45 min at 1% gradient).

A secondary aim was to evaluate performance and predicted VO₂ max by performing a 6-min walk test immediately post exercise.

Methods

Participants:

A total of seven men with T1D (mean age: 28.6 ± 11.9 years; mean BMI: 26.6 ± 2.4 kg.m⁻²) were randomised either on the reduced insulin or eating carbohydrates intervention and crossed over the following week (see Figures 1 & 2).

Design:

Figure 1: Flow chart illustrating the randomized, crossover design of interventions over two weeks (washout period = 1 week).

Exercise Session and Data Collection Process:

45 min walk + 6 min walk test
Continuous Glucose monitoring
Pre-exercise meal
Post-exercise meal

Figure 2: Exercise session design; time ~ 6 hrs/session (Capillary blood glucose was measured every 15 min during the exercise).

Results and Conclusion

1. The reduced insulin intervention spent more time in range and less time in significant hyperglycaemia (P < 0.03), but was more likely to experience hypoglycaemia than the eating carbohydrates intervention (see Figure 3).

2. There was no significant difference in predicted VO₂ max with 42.0 ± 7.6 mL.kg⁻¹.min⁻¹ and 43.7 ± 3.5 mL.kg⁻¹.min⁻¹ in the reducing insulin and eating carbohydrates interventions respectively (P = 0.53). However, 70% of participants perceived their performance to be better when on the reduced insulin intervention.

Conclusion:

Based on a study with a small sample size, reducing insulin is likely the best approach for patients with T1D during aerobic exercise, but need to be cautious of the risk of hypoglycaemia.

Key References


Acknowledgements

1 Te Huataki Waiora, School of Health; 2 Waikato Medical Research Centre; 3 Waikato Regional Diabetes Service, Hamilton

The University of Waikato
1. Introduction

Marae are a main focal point to Maori as it is an integral zone both historically and at present for Hui (discussions/meetings), Tangi (funerals) and as an individual's Turangawaewae (place where one feels connected to the land and their ancestors). Commonly, Marae were constructed nearer the coastline and rivers as they were a source of food and transport, but imminent sea level rise and increased storm surge events will result in these sites being inundated. The aim of this research was to map and collect data using GIS of Marae proximity to coastal and fluvial zones with data including distance, elevation and average slope. This research focussed on Marae within 2 kilometres of the New Zealand Coastline. There have been some localised studies looking into this such as that done by Tumanko, but there is a lack of data nationwide.

2. Methods

- **Data Collection**
  - Obtained from LINZ, Koordinates and Regional Councils of Marae location and Coastal Features.
  - Literature Review.
- **Data Input**
  - Using Near Function limits Marae to within 2km of Coast.
  - Select which Marae are closer to the coast or river.
- **Manipulating the Data**
  - DEM to Bm had to be taken from individual sections and merged together using mosaic.
  - Produced Near Points which are points along the coast or river which are closest to the marae using display x y data.
  - Then use x y to line to connect the two.
- **Analysis**
  - Calculate the elevation using extract multi values to points.
  - Calculate distance by using the near function and selecting distance.
  - Calculate the average slope by adding surface information and selecting "AvSlope".
- **Data Output**
  - Produced a map of NZ showing marae nearer the coast or river.
  - Produced bar graphs and Histograms of the selected variables.

Some key findings of this research is that:

1. 93% of coastal marae in New Zealand are within the North Island and only 6.3% are in the South Island.
2. Over 45% of coastal marae are within 200 meters of the coastline and 40% of marae closer to a river are within 200 meters of a river.
3. Around 70% of coastal marae are below 20 meters elevation (MSL).
4. Majority of marae used in this study had very low slope angles to the coast or river.

3. Results

- **Count of Marae at Various Slopes to the Coast**
- **Count of Marae at Various Slopes to a River**
- **Count of Marae Elevations Nearer a River**
- **Distance of New Zealand Marae to Rivers**
- **Distance of New Zealand Marae to the Coastline**

4. Conclusion

This research project was a first step in determining the proximity of coastal marae to the nearest waterbody both coastal and fluvial. From this we determined that under half of coastal marae are within 200 meters of the coastline and the same within 200 meters to a river. This information can be used as baseline data which can be used at a later stage to determine risk and vulnerability that marae around New Zealand may be at.

This would be valuable information to obtain in order to prepare these historical sites for the threats ahead such as sea level rise and the impacts of global warming.

5. Acknowledgements

I would like to thank John Stowell from the West Coast Regional Council for his assistance with data acquisition and application of the data. As well as the various online GIS help pages where other analyst’s detail how to perform various tasks and LINZ and Koordinates for the data used.
Kaleb Batenburg-Jones  
Division of Health, Engineering, Computing and Science

Development of Matrix Matched Standards for the Analysis of Metal Concentrations in European Goldfinch Feathers  
Kaleb Batenburg-Jones, Supervised by Dr Amanda French

Background

The European goldfinch is an introduced species distributed throughout New Zealand. A goldfinch’s distinct feather patterns are the result of biologically active pigments, the production of which can be altered by environmental exposure to metal contamination. Understanding of these correlations is necessary in order to mitigate the effects of anthropogenic metal pollution. In the Waikato, for example the soil contains high concentrations of cadmium due to the use of superphosphate fertilisers. Not only could these human impacts change the appearance of different bird species, but also the signals and behaviours associated with specific feather patterns.

Aim

• Create matrix matched standards for the analysis of metal concentrations in goldfinch feathers using Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS)  
• Develop methods for quantifying the size and pigmentation of goldfinch feather patterns

Method

1. Chicken feathers are frozen in liquid nitrogen  
2. Frozen feathers are ground into a fine powder  
3. Samples of powder are spiked at various concentrations; Blank, 0.17, 1.0, and 10 ppm  
4a. Spiked samples are acid digested for ICP-MS analysis  
4b. Spiked samples are made into discs using a hydraulic press and mounted to a slide with parafilm  
5. The discs are analysed using LA-ICP-MS  
6. Final results are analysed using Iolite v3.32 and Excel

Results

• Solution analysis confirms that spike additions were successful  
• Elements such as Mg, Fe, and Zn are exceptions as they occur in feathers at concentrations larger than the spikes  
• First attempt at LA-ICP-MS was unsuccessful  
• Parafilm used was too thick for the laser to penetrate an collect any standard disc material

Future Research

• Attempt LA-ICP-MS using a thinner layer of parafilm and different laser parameters  
• Create standard discs with higher spike concentrations to account for elements that are found in feathers at high concentrations  
• Develop methods for processing feather patterns to determine size and pigment before field work can be undertaken

Acknowledgements

A special thanks to Judy Fentress for providing us her expertise and goldfinch feathers from her bird sanctuary and rescue and a big thank you to the University of Waikato Summer Research Scholarship program and Amanda French for this formative experience.
Insect Biodiversity in New Zealand Production Forests
Taiawhio Bryers, Chrissie Painting, Carl Wardhaugh

SUMMARY
Insects hold a foundational role in the continuity of forest ecosystems and biodiversity. Production forests make up a quarter of our country's forest cover and support a number of native beetle species. The extent in which they support insect biodiversity is largely unknown. Throughout the summer period, insect sampling from plantation and remnant forest will occur. This is part of a long term goal to gain quantitative data of species composition to analyze and deepen our understanding of how biodiversity is supported in production forests.

OBJECTIVES
• Sample and measure insect composition between forest coverings.
• Establish a sequence library of species at each site to support future mass sequencing and analysis.
• Collaboratively develop forest management strategies that support threatened insect communities throughout forest rotations.

METHODS
• Insect samples will be collected from native remnant forests and surrounding 2nd and 3rd rotation *Pinus radiata* plantings on ex-native forest land. The site locations are scattered throughout Central North Island regions in forests such as Kinleith.
• Samples will be collected from the canopy, understory and forest floor strata. This will be repeated 3 times at each site. Traps will be left for approximately 2 weeks at a time.
• Pitfall traps will be used to collect ground dwelling insects. Flight intercept Traps (FIT’s) will be set up in the understory on waratahs and in the canopy with the assistance of ropes. These traps consist of a simple cross-halved plastic board and funnel design that is effective at capturing Coleoptera (beetle) species. Beetle species will be analysed and used as an indicator of biodiversity throughout the sites.

“But if we were to wipe out insects alone on this planet, the rest of life and humanity with it would mostly disappear from the land. Within a few months.”
Introduction
Sharks are diverse apex predators within marine environments. Species are mostly solitary, hugely migratory and occupy vast areas of ocean. Targeting the location of sharks can prove as an elusive task for scientists. Useful data can be gathered across wide spatiotemporal scales through citizen science. The findings can contribute towards scientific research, and allows a range of ecological questions to be investigated. This study utilises sightings of shark species reported by iwi, charter vessels, recreational fishers, divers and surfers in the Bay of Plenty. The intention is to use this information as a guide for site selection in applying Baited Remote Underwater Video Systems (BRUVS) as a means of investigating shark abundance and diversity in the region.

Methods
The survey ‘Sharks in the Bay’ was produced in Google Forms and released to the public on the 3rd of December, 2019. In the survey, a numbered grid was placed over a map of Tuhua, Motiti, Matakana and Motunau Islands. Participants were asked to identify what species of shark they had seen at each of the four island locations, and the grid number(s) in which they were found.

Results
Thirty seven responses were received, detailing a total of 135 shark sightings across nine species. Matakana Is. made up the greatest proportion of total sightings with 62 sharks across seven species, predominately composed of bronze whaler sightings (Figure 1). A Shannon-Wiener index of diversity score revealed Plate Is. had the greatest diversity of shark species sighted (H = 1.58).

Conclusion
From this data, six sites at each island location were selected for the placing of BRUVS to maximize the chance of filming sharks and other marine species. The methods of the survey were successful in providing information on shark hot spots. However, the differences between islands for sighting frequencies were potentially biased towards accessibility and popularity of the site by the various user groups.

Figure 1. Total number of sightings of each shark species at the four surveyed locations within the Bay of Plenty.
Acoustic Monitoring of Long-tailed Bats in Northern Hamilton

Olivia Dixon
Supervised by Dr Clare Browne¹, Dr Grant Tempero¹ and Dr Kate Richardson²
¹School of Science, University of Waikato; ²Waikato Regional Council

Background

The long-tailed bat (Chalinolobus tuberculatus) (Fig. 1) is one of two native terrestrial mammals in New Zealand, and is classified as critically endangered. A range of factors including urbanisation, deforestation and predation have caused the populations to decline. Long-tailed bat populations have been observed in the southern edge of Hamilton City. However, comprehensive surveys have not been conducted north of Hamilton.

The aim of this project was to establish the spatial distribution of long-tailed bats in rural and peri-urban landscape of Hamilton City.

Methods

Automated bat monitoring devices (ABMs), which record the ultrasonic calls of long-tailed bats, were used to determine the presence of bats. A total of 53 ABMs (Fig. 2) were deployed at 41 locations around Hamilton’s northern rural surrounds. Significant Natural Areas (SNAs) and kahikatea remnants (Fig. 3) were prioritised for monitoring. Acoustic monitors were deployed for a minimum of 14 days.

Results

Of the 33 ABMs that have been analysed to date, bat activity was recorded at 7 locations (21.2%). Discrete bat activity ranged from 1 to 21 events at these locations, over the 14+ day period. The highest activity was recorded at site 33 (Fig. 4) with 21 events, with site 30 being the next highest activity producing 12 events. Other positive sites recorded ≤ 3 events over the monitoring period.

Conclusions

- Long-tailed bat activity around northern Hamilton appears to be low compared to the southern area of Hamilton.
- So far, bat activity was highest at sites near the Hakarimata Ranges (Fig. 5) and West of Hamilton City.
- Conversely, bat activity was not detected in proximity to the Waikato River.

Suggestions for Future Work

- Extensive acoustic monitoring around areas of higher activity to further inform how bats are using the landscape in this part of Hamilton.
- Predator control and protection of habitat at sites of confirmed bat activity will help secure long-tailed bat persistence in these parts of Hamilton.
- Deployment of bat boxes, which act as artificial roosts, may help promote bat activity in bat deficient areas.
- Increased advocacy and awareness of the presence of bats in this part of Hamilton, and support for landowners to adopt bat-friendly management.

Acknowledgements

I would like to thank Waikato Regional Council for funding this project. Special thanks to my supervisors and the UOW Summer Research Scholarship Program. Also, thank you to Titia Schamhart and Warren Powrie for being exceptional assistance in the field. Thank you to Project Echo members for their advice; in particular Hannah Mueller, Wea van der Zwan, Andrew Slyche (DOC) and Ben Wolff (WDC). Many thanks to all of the land-owners for allowing monitoring on their property's.

For more information on long-tailed bat research around Hamilton - scan the QR code or alternatively visit: http://www.waikatoregion.govt.nz/environment/natural-resources/biodiversity/project-echo
Introduction
Wood durability data has been collected over 60 years at Scion at 4 different locations, across New Zealand. This data tells us how long different types of wood can be used before ultimate failure due to decay and which type of wood would be suited for different purposes, such as, infrastructure, decking and fencing. "In-ground" wooden stakes, varying in species, preservatives, and coatings are placed partially in the ground, exposing it to the environment and soil conditions. They are tested every 6 months for extent of decay. A typical durability test can take from 2 years to 43 years to complete.

Hypothesis
This analysis sought to explore the connection between durability testing, climate change, and the New Zealand building industry. My hypothesis is that soil moisture content has a direct relationship with durability data, as well as the wood used for durability testing.

Data Collection
Data was collected by the following means:
• Basic searches through Scopus and Google Scholar to find any links between climate change and durability testing, limited research was available
• National Forestry Library
• Contact with Landcare and NIWA
• Waikato library databases
• Student thesis material
It is important to note, there was little to no information on the subject.

Results and discussion
With these optimum conditions for decay being constant, why was there a sudden rapidly increasing trend of decay across the data, despite soil and location differences?

Figure 2: Graph of Average decay vs year for 6.05 Tanalith retention of wood samples.

Figure 3: Map displaying the decrease in soil moisture after one year.

This is due to potential evaporation deficit (PED) or soil moisture content. This is a result of increasing temperature and precipitation variability. This are directly linked to climate change.

Figure 4: Graph displaying a weak relationship between PED and an increase in decay

- Increased crack propagation due to precipitation variability. Cracks leave inner, untreated wood exposed.
- Loss of translocation in seedlings and trees, high mortality, high economic loss
- Fungi can thrive in the optimal pH and humidity, despite the decreasing soil moisture content.

What now?
We have different problems now than we did 40 years ago. By the time a new preservative, or coating has been released, we are plagued by a new set of conditions. We need:
• Faster test that does not risk a product life-span
• Stronger, more resistant wooden house framing, decks and infrastructure
• A solution sooner than what the prescribed durability test can give us

A.I. is the future of wood durability. Using self-learning machinery to be able to produce simulation data, could be a very possible solution to the time-intensive durability process.

Acknowledgements
I would like to say a special thank you to Ian Simpson for all his expertise in durability testing, and thank you to Claire Miller and Sarah Davies for their help.

References

Chelsea Grove
Division of Health, Engineering, Computing and Science

Wood Durability testing and Climate change:
Designing wood durability tests to inform decisions in NZ housing industry

Author: Chelsea Grove (Chemical and Biological Engineering)
Supervisors: Mark Lay (The University of Waikato), Dina Wickers (Scion), and Sierra De Le Croix (Scion)
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BIOLOGICAL CONTROL OF GIANT WILLOW APHIDS
Jonathan Hogg, Chrissie Painting and Stephanie Sopow
University of Waikato, Hamilton and Scion, Rotorua

INTRODUCTION

- Giant willow aphids (Tuberolachnus salignus or “GWA”) were discovered in New Zealand in 2013 and quickly found to be a widespread invasive pest.
- They have a detrimental effect on their host plant (Salix spp. and occasionally Populus spp.). This can result in plant mortality and a decrease in land and riverbank stability.
- GWA create a thick honeydew substance that attracts many insects (including bees and pest wasps) and covers the plant. This can become a problem for apiarists as the honeydew causes honey to solidify in the comb. Sooty mould also grows on honeydew covered surfaces impacting photosynthesis and horticulturists.

INSECT REARING

Step One:
A mated pair of Pauesia nigrovaria are released into a fine mesh cage with a population of giant willow aphids (GWA).

Step Two:
The mated female then will scour the branch for GWA which it stings with it’s ovipositor, parasitising the host aphid. Testing has shown that these Aphidiinae wasps are highly specific and will only sting GWA.

Step Three:
Parasitized “mummy” aphids are ready to be collected ~10 days after first exposure. Mummies are stored in gel caps and a closed petri dish, so as to maintain biosecurity procedure.

Step Four:
Once Pauesia nigrovaria emerge from their aphid host, they are captured in a clear vial. They are given water and honey, and are kept at 12°C in a cooler, to prolong their life.

Step Five:
Two offspring from the previous generation are bred in a mating tube, to establish a new generation. A new cage with a new colony of GWA can then be built. The cycle then repeats.

THE FUTURE

As of the third of December 2019, the EPA has approved permission to release Pauesia nigrovaria. Mass rearing of the insect will begin early 2020, and releases will follow at key sites of interest. Monitoring will occur to see how successful the parasitoid is in the environment.

BIOLOGICAL CONTROL

Biological control is superior to chemical control methods, like pesticides. This is because biological control is a permanent solution and is more economically viable, as well as being better for the environment.

The goal is to further breeding procedures for the parasitoid wasp Pauesia nigrovaria, in biosecurity containment. This is to prepare for mass rearing and release at different sites across the North Island as a biological control for GWA.

Acknowledgements:
I would like to thank my supervisor Stephanie Sopow for her support and guidance. I would also like to thank my UOW supervisor Chrissie Painting, Carl Wardhaugh, Belinda Gresham and Taiawhio Waipoua-Bryers.
Background & Problem Statement

• GHG emissions from industries has a critical effect on the Earth planet, ecosystem and human health.
• Fossil fuels are used to generate heat in process industries.
• About 86% of the world’s energy is generated using fossil fuels which significantly produce GHG emissions.
• Process heat contributes to 35% of NZ energy consumption and around 55% of the process heat is supplied by using fossil fuels (e.g., natural gas and coal).
• Reducing the emission of greenhouse gases has become a worldwide issue, and over 77 countries including NZ have committed to Net Zero Carbon Emission by 2050 at Climate Summit.

Aim & Solution

• The aim of this work is to reduce GHG emissions in NZ industries to achieve Net Zero Carbon Emission target.
• Proposed solutions are:
  • Demand reduction:
    - Process Integration
      - Pinch integration.
      - Heat recovery.
      - Electrification (e.g., implementing heat pumps).
  • Supply change:
    - Change in energy from Natural gas/Coal to Renewable energy such as, solar, hydro and geothermal.
    - Electrification using renewable energy.
  • Fuel switching:
    - Natural Gas/Coal → Biomass/Biofuel

Industrial Case Study

• Wool scouring plants require a lot of heating processes in order to scour the wool.
  • Both natural gas (NG) and coal are used in the heating process of the scouring bowls, wool grease processing and wool dryer. (Burning NG and coal causes GHG emissions)
  • Energy and mass balance has been conducted for the wool scouring process in Figure 1.
  • Energy breakdown of wool scouring processing has been analysed and presented in the pie graph in Figure 2.
  • In order to reduce GHG emissions in wool scouring processing in NZ, demand reduction measures is shown in the table below.
  • Reducing the emission of greenhouse gases has become a worldwide issue, and over 77 countries including NZ have committed to Net Zero Carbon Emission by 2050 at Climate Summit.
Prochlorococcus marinus is the most abundant marine organism, making up 50% of the ocean’s chlorophyll, and fixing ~4 gigatons of carbon per atom. The strain MIT9312 contains more DNA modifying enzymes than other P. marinus strains, and we are working to characterize the additional enzymes, particularly DNA ligases, which contribute to DNA repair. Ligase function in P. marinus differs in comparison to other bacteria, and so is suspected to have a unique DNA repair pathway. Characterization of ligases is necessary to understand the function.

Of interest is Lig W, with surprisingly low activity compared to other P. marinus ligases. Lig W has been characterized, so this project focused on three adjacent proteins in the Lig W operon, and how they stimulate Lig W activity. To understand the function of this operon, the proteins were studied in vitro.

Key Findings

- The optimal conditions for expressing >P_mar_3 and 5 are using an MBP fusion tag, growing at 15°C and inducing with 0.5M IPTG.
- Further optimization of growth conditions is required for growing >P_mar_4.
- >P_mar_3 to date can successfully be purified up to removing the MBP fusion tag, with further purification success expected.

Future Steps: Carry out DNA binding and activity assays of the purified protein to assess its activities including: Ability to bind damaged DNA, nuclease and topoisomerase activity, and ability to stimulate Lig W activity.

Acknowledgements

I would like to thank the University of Waikato Summer Research program for providing me with this opportunity, my supervisor Adele Williamson for her teaching, guidance and support, as well as the University of Waikato Microbes and Proteins Laboratory.
Aim:
The aim of this project was to use Laser Ablation – Inductively Coupled Plasma – Mass Spectrometry (LA-ICP-MS) to analyse concentrations of elements across sections of bee brains.

Background information:
Bees are important for many reasons; they pollinate the majority of crops we rely on as humans, ranging from food to medicines and materials, such as cotton. Yet global bee health is declining, and the big question is ‘why?’ A number of stressors have been suggested – including disease, pesticides and lack of nutrition. An under-researched area is the effect of elements on bees; this includes required elements for nutrition, as well as toxic metals, such as lead. This research aims to give insight into the elements that are present in areas of the bee brain that could lead to the improvement in bee health. This is the first attempt to map elements within the bee brain.

Method:
1. Bees were collected from hives
2. Brains were dissected from the bees
3. The brains were preserved and frozen at -80°C
4. Sections of the brain were obtained using a cryostat
5. The sections of the brain were analysed by LA-ICP-MS
6. Data was processed and results were obtained

Pilot results:
The structures of the brain can be clearly observed in the thin-sections of the brain. Preliminary LA-ICP-MS data produced concentration data for some elements found in certain regions of the brain such as iron. These can be mapped to the sections of the brain to help determine which structures of the brain these elements accumulate in.

Impacts:
This research will lead to the development of the first 3D model with mapped elemental concentrations in the bee brain. There is potential to investigate the difference in concentrations of trace metals in bee brains across New Zealand. Elements that are found to be detrimental to bee health could be monitored in the environment. Likewise, elements that are found to be beneficial and essential to bee health can be added to commercial bee food sources to help improve bee health.

Future analysis:
Future analysis aims to refine the LA-ICP-MS techniques to generate 3D images of the brain and look for changes in the concentrations of different elements in the structures of the brain.

Acknowledgements:
We gratefully acknowledge the University of Waikato Summer Research Scholarship programme for providing this opportunity and the UoW Marsden Support Grant for funding this research.
Agrobacterium mediated transformation of Pinus Radiata D. Don

Alicia Laing
Supervisors: Charleson Pouovahia, Linda Peters

Project aim

There have been a number of genetic modification experiments performed on conifers and other tree species using both microprojectile bombardment and Agrobacterium tumefaciens mediated transformation methods on several different plant tissue types, however embryogenic tissues have been one of the most common tissues used for Agrobacterium experiments. The use of embryogenic tissues introduces some challenges to regenerating successful transgenic plants as the embryonal cells have to undergo several maturation steps before they can be used to generate plants and many of the transformed cells do not make it through that process.

The aim of this project is to develop a protocol for Agrobacterium-mediated transformation of Pinus radiata embryonic callus. This protocol will avoid hurdles associated with transformations that work with embryogenic tissue by using matured tissues for the initial transformation so that plant regeneration can be induced directly from the transformed callus.

Background

Conifers of the genus Pinus are the most widely commercially planted forest trees worldwide and in the Southern Hemisphere, particularly in New Zealand, Australia, and Chile. Pinus radiata (also known as radiata pine or Monterey pine) is the predominant tree used for plantation forestry.1-3 These trees are used for many purposes including soil conservation,1,7 construction, wind protection, construction, paper production, as a fuel source, and for landscape architecture.4

Conventional breeding programmes have made a significant contribution to plantation forestry by improving the growth and form characteristics of Pinus radiata; however this improvement is constrained by their long reproductive periods, and by the complex reproductive characteristics of most of these species, including self-incompatibility and high degree of heterozygosity.1,6 Genetic engineering offers opportunities for further improvement of forest trees with the ability to modify traits more precisely and in a shorter time frame than is possible with traditional methods while avoiding some major bottlenecks associated with traditional tree breeding.4,6

A key advantage of genetic engineering is the ability to introduce and express desirable traits that are not readily available in the breeding population and produce benefits such as improved wood quality through the modification of lignin and cellulose content and composition, improved durability, dimensional stability, hardness, control of flower development and sterility, improved growth characteristics and tolerance to stress, and resistance to pests, pathogens or herbicides.2,7

There are presently two main methods used for gene insertion in conifer: direct gene transfer (biolistic or particle gun methods), and Agrobacterium-mediated transfer (using A. tumefaciens or A. rhizogenes).2

Transformation using Agrobacterium has several advantages over the biolistic method; an Agrobacterium tumefaciens strain capable of the rare feat of natural inter-kingdom genetic transfer.7 It does this by transferring part of a bacterial plasmid, called the Ti plasmid, to a plant where it stably integrates into the plants nuclear DNA.2,7 Phenolic compounds released when a plant is wounded induce virulence in Agrobacterium by reacting with a protein kinase on the surface of the bacteria and inducing a phosphorylation cascade that activates the sinorhizus genes (VirG) of the A. tumefaciens Ti plasmid and initiating the transfer of the T-DNA (transfer-DNA) region into the plant cells where it is integrated into the host plants DNA.8,9 Agrobacterium can be utilised for controlled genetic transformation of plants by using disarmed A. tumefaciens strains with desired genes such as those that confer tolerance to selection pressures (e.g., antibiotic resistance) or that code for auxoyous enzymes (e.g., β-glucosidase (β-Gus)) added to the Ti plasmid so they can be transferred when the Agrobacterium infects plant cells.8

Agrobacterium

Agrobacterium tumefaciens (shown in Figure 1) is a gram-negative soil bacterium which is capable of the rare feat of natural inter-kingdom genetic transfer2. It does this by transferring part of a bacterial plasmid, called the Ti plasmid, to a plant where it stably integrates into the plants nuclear DNA.2,7 Phenolic compounds released when a plant is wounded, induce virulence in Agrobacterium by reacting with a protein kinase on the surface of the bacteria and inducing a phosphorylation cascade that activates the sinorhizus genes (VirG) of the A. tumefaciens Ti plasmid and initiating the transfer of the T-DNA (transfer-DNA) region into the plant cells where it is integrated into the host plants DNA.8,9 Agrobacterium can be utilised for controlled genetic transformation of plants by using disarmed A. tumefaciens strains with desired genes such as those that confer tolerance to selection pressures (e.g., antibiotic resistance) or that code for auxoyous enzymes (e.g., β-glucosidase (β-Gus)) added to the Ti plasmid so they can be transferred when the Agrobacterium infects plant cells.8

Transformation

Radiata stem explants were plated on a ¼ strength modified LP medium to encourage callus development. Axillary and apical meristematic callus was selected and replated on fresh media every 3 weeks. To transform the callus, Agrobacterium was first induced with acetoxyrosine for an hour before the callus was added to the induced Agrobacterium and shaken for 20 min to encourage infection. The callus was then drained of excess fluid and replated for 2 days of co-cultivation after which the callus was washed to remove the Agrobacterium. The callus was then replated on a selective ½ LP medium and a sample was taken for testing the GUS expression of the tissue.

Screening

Transformation success is measured by testing the plant tissues that have undergone the transformation process for the activity of the genes that will have been inserted into the plant genome if the transformation was successful. A selective medium is used for the cultivation of the transformed callus tissue to prevent the growth of tissue that does not contain the resistance gene that was contained in the plasmid. The tissues are also tested for the expression of the GUSPlus gene via histochemical GUS assay; this technique causes cells expressing the GUSPlus gene to be stained a distinctive blue colour, such as can be seen in Figure 5, allowing for easy visualisation of co-transformed tissues and quantification of the transformation success rate by comparison of transformed to un-transformed tissues.

Conclusions

This experiment is ongoing, as of yet we are unable to draw conclusions about the successfulness of our present method for the transformation of meristematic radiata callus. If the present method proves to produce a transformation of sufficient quality, we will look at the conditions used in the method such as growth media and co-cultivation time, to find a more effective transformation protocol. If our method does prove successful in the initial testing phase then the next step is to regenerate plantlets from the transformed callus, proving the methods viability as a protocol for producing transformed radiata plants.

Acknowledgments

We would like to acknowledge the University of Waikato summer research scholarship program and SCION for their contribution to this work.

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4. Peña, L. & Séguin, A. Recent advances in the genetic transformation of trees. 4

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9. There are presently two main methods used for gene insertion in conifer: direct gene transfer (biolistic or particle gun methods), and Agrobacterium-mediated transfer (using A. tumefaciens or A. rhizogenes).2

10. The Agrobacterium mediated transformation method results in high co-expression of introduced genes, and less fragmentation of the transgene than the biolistic method, and in addition, the introduced genes are transmitted to progeny in a Mendelian manner.2 This is in contrast to the biolistic method, which can be used for routine transformation of many coniferous species but has certain disadvantages such as the fragmentation and rearrangement of the introduced DNA, and the integration of many copies of the transgene of interest which can produce undesired effects such as fragmentation of genes or silencing of gene expression.2,6


13. Peña, L. & Séguin, A. Recent advances in the genetic transformation of trees. 4


17. Plant Cell. Tissue Organ Cult.


20. 63
Testing the Ancient Waters
Understanding natural $^{14}$C variation in estuarine shells
Leteisha J. Lamb | Supervisors: Dr. Fiona Petchey and Dr. Amanda French

Background:
$\delta^{13}$C and $\delta^{18}$O vary between shellfish taxa due to estuarine vs. marine conditions.

Research Focus:
$\delta^{13}$C and $\delta^{18}$O in shells from archaeological sites at Votua, Mago Is., Fiji, vs. Talasiu, Tongatapu Is., Tonga.

Methods:
- $\delta^{13}$C and $\delta^{18}$O isotope analysis
- AMS $^{14}$C dating

Discussion:
- Both islands have limestone bedrock.
- Shells may incorporate this ancient carbon.
- Estuarine shells are more often effected.
- Therefore marine shells are best for dating.

Conclusion:
Pinctada and Tridacna have marine signatures, so are most likely to provide good dates.

Learn more about the Waikato $^{14}$C Dating Laboratory here!
Michaela Lambert  
Division of Health, Engineering, Computing and Science

The lesser of two weevils: The role of pre- and post-copulatory traits in the New Zealand Giraffe Weevil

Author: Michaela Lambert  
Supervisor: Dr Chrissie Painting

**BACKGROUND**

Exaggerated traits such as weapons or ornaments (pre-copulatory traits) are often used by males to increase mating success. But what about after mating? When females mate with more than one male (polyandry), sperm competition occurs, leading to increased investment in testes size, and sperm morphology (post-copulatory traits). However, little is known about how pre- and post-copulatory traits interact to maintain variation in male reproductive success.

New Zealand giraffe weevils show great sexual dimorphism. Both sexes have an elongated rostrum which is used in males as a weapon during fights for access to females (Fig 1), and in females for drilling into trees before oviposition (Fig 2). Within the sexes, body size is highly variable, and male body length can be between 15 and 90mm, and females from 12 to 50mm. Female giraffe weevils are polyandrous suggesting sperm competition, and there is selection on weapon size in males (Fig 3). Thus, the presence of pre- and post-copulatory traits in this species makes them the ideal candidate for sexual selection research.

**RESEARCH QUESTIONS**

1. **How does the rate of polyandry vary among individuals?**
2. **What are the patterns of sperm utilization?**
3. **What are the predictors of male fitness?**

**METHODS**

Weevils will be observed at Maungatautari on a range of fallen, native trees. We will observe focal females and observe which males, and in what order, they mate to quantify rates of polyandry.

Antennal clippings will be taken from every female and male observed, and the fertilised egg extracted into Ethanol. Each antennal clipping and egg will be genotyped using microsatellite markers and paternity analyses to determine which male has sired the egg and what the patterns of sperm utilization are.

**SIGNIFICANCE**

- This research will be used to better understand and answer questions central to evolutionary ecology.
- The giraffe weevil has potential to become a flagship species for raising conservation awareness in New Zealand.
- Using the giraffe weevil as a focus for this research will increase New Zealand’s reputation for sexual selection research.

![Fig 1. A male giraffe weevil (note the antennae at the end of the rostrum)](image1.jpg)

![Fig 2. A female giraffe weevil (note the antennae closer to the thorax)](image2.jpg)

**Fig 3.** The relationship between body length (mm) and number of copulations in both male and female giraffe weevils

**Fig 4.** The size variation in male giraffe weevils

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Want to know more?  
Using your smartphone, open a QR reader.  
Scan this QR code to be taken to my twitter account for giraffe weevil updates!

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INTRODUCTION

Invertebrates are integral in the natural functioning of New Zealand forests; they are a key component of complex forest food webs.

The aim of this project was to assess how edge effects impact soil arthropod communities with increasing distance into forest habitats. I did this by identifying tens of thousands of specimens to order level during the summer to calculate changes to their relative abundance across an edge-to-forest interior gradient.

METHODS

Arthropod communities were sampled using Emergence Traps which collect insects after they emerge from belowground. Traps were left in-situ for 6 months at plots 20, 40 and 80m from the forest margins of 26 forest sites in the Waikato.

My project involved sorting 4 weeks of collections from 78 sampling plots to contribute to the assessment of arthropod community responses to a forest edge to interior transect. This involved identifying arthropod specimens to order level using taxonomic keys and expertise knowledge, with future efforts refining identifications to family.

RESULTS

The most abundant order of arthropods we identified were flies (Diptera), making up the majority of biomass indicated. Diptera biomass declines with distance into the forests; however, average biomass remains similar, indicating that although fly biomass dominates samples near to the forest margin, with increasing distance from the edge the biomass of other arthropod orders increases. This reflects the stability provided by forest interiors for established communities, contrasting the tumultuous niches available in close proximity.

DISCUSSION

The most abundant order of arthropods we identified were flies (Diptera), making up the majority of biomass indicated. Diptera biomass declines with distance into the forests; however, average biomass remains similar, indicating that although fly biomass dominates samples near to the forest margin, with increasing distance from the edge the biomass of other arthropod orders increases. This reflects the stability provided by forest interiors for established communities, contrasting the tumultuous niches available in close proximity.
The toheroa pipi is a Maori delicacy that lives in beaches along the West Coast of the North Island, New Zealand. The 1970’s saw the implementation of a 2-day harvest season per year, introduced with the expectation that they would recover. Unfortunately, they remain economically extinct. Evidence indicates that beach traffic can cause toheroa mortality; directly by crushing or indirectly via exposure. Research suggests that low levels of beach traffic do not cause serious mortality of adult toheroa but can cause significant mortality in young toheroa. This research focuses directly on determining if and to what extent moving vehicles have on the growth rates of toheroa.

### DESIGN

1. Elevated pad
2. Top platform
3. Bottom platform
4. Load cell

**Key Feature Descriptions:**

The load cell platform is designed to mimic the sizing of a toheroa pipi. It incorporates 4 key features which work together to determine the total vertical force at various depths in the sand. Force is applied to the 28x28mm pad, which is elevated approximately 3mm above the top platform and mounted to the top of the 5kg load cell. The load cell is secured to the bottom platform, producing readings in kilograms based on total deformation observed on a horizontal plane. Total dimensions for the load cell platform equate to 100x50x35mm.

### RESULTS

Vertical forces at 0.1m and 0.25m are distributed outwards in a cone shape, radiating out from the initial impact area to the outer edges, displayed in figures below. Maximum force at 0.1m deep equated to 5.69N, where at 0.25m maximum force recorded was 0.77N. Significantly lower as expected.

I would like to extend a special thanks to everyone that helped with this research; UoW Summer Research Scholarship program for the opportunity and Mark lay, Rachael Tighe & Phil Ross for supervision and guidance throughout this project.
Overcoming antimicrobial resistance; new targets for antibiotic design in *Neisseria gonorrhoeae*

**Author:** Jack McGarvie  
**Supervisors:** Joanna Hicks, Annmaree Warrender

### Aims:

This summer research project is part of a much larger project to develop an effective antibiotic for *N. gonorrhoeae*. Two aims were developed for the summer:

1. Obtain Michaelis Menten kinetics of CysK to understand reaction mechanism
2. Crystallise CysK Protein to obtain enzyme structure

### Method development and Results:

**CysK purification:**

1. **Michaelis Menten Kinetics:**
   - An L-Cysteine standard curve was determined for later calculations of the L-Cysteine produced in reactions as seen in Figure 2.

   A series of stopped assays were run in 96 well plates to optimise the reaction of CysK producing cysteine as seen in Figure 3. This was done by varying the concentration gradient of CysK used to determine optimal enzyme concentration. From here, substrate concentrations of sulphide and O-acetylserine will be varied to optimise the reaction.

### Conclusion:

Overall, the hypothesis was accepted as the assays conducted proved the production of L-Cysteine when provided with Sulphur and O-acetylserine. Approximately 20 µM of L-Cysteine was produced. The promising crystal conditions will be optimised to obtain large enough crystals for X-ray diffraction to determine the 3-dimensional structure. Further research will be conducted to obtain full Michaelis Menten kinetics of the L-Cysteine synthesis. Combined this will enable a detailed understanding of CysK for future inhibitor design.

### Acknowledgements:

I would like to thank the University of Waikato Summer Research Scholarship programme for this opportunity, as well as Annmore Warrender, research assistant at the UoW who provided great insight and teaching as my direct supervisor and Joanna Hicks from the UoW as the project and academic supervisor.

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**Background:**

*Neisseria gonorrhoeae* is the causative agent of the sexually transmitted infection Gonorrhoea which causes an estimated 78 million cases annually across the globe and is an obligate human pathogen. It colonises and invades the epithelium of the urogenital tract causing localised inflammation and can cause more serious conditions. The ever-increasing number of strains that are resistant to current frontline antibiotics has made *N. gonorrhoea* a global health problem.

In many bacteria including *N. gonorrhoeae*, L-Cysteine biosynthesis is key to a variety of important cellular constituents and protein molecules as well as providing protection from oxidative stress encountered during infection of its host.

The L-Cysteine biosynthesis pathway *N. gonorrhoeae* utilises is unique to the species and is not present in humans making it a good target for antibiotic treatment.

*Neisseria* species have a specific isoform of the O-acetylserine sulfhydrolase enzyme annotated as CysK which can be seen in Figure 1, and is the focus of this Summer Research Project.

Our hypothesis is that the CysK enzyme will produce L-Cysteine when provided with sulphur in the form of sulphide and O-acetylserine.

---

**Aims:**

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**Figure 2. L-Cysteine Standard Curve**

A series of stopped assays were run in 96 well plates to optimise the reaction of CysK producing cysteine as seen in Figure 3. Concentration gradient of CysK used to determine optimal enzyme concentration. From here, substrate concentrations of sulphide and O-acetylserine will be varied to optimise the reaction.

**y = 1.8856x + 0.0164**

**R² = 0.9986**

**Figure 3. Stopped assay optimisation of CysK reactions (purple colour indicates Cysteine formation)**

**Figure 4. A: CysK Crystals formed in 2.5M Ammonium Sulphate, 6% PEG 400 and 0.1M HEPES**

**2. Crystallising CysK Protein**

Various fractions of the CysK protein were run through the 4 x 96 condition robot screens to find conditions that the protein may crystallise in. A few fine screens have been laid out and a promising condition was seen in Figure 4.

---

**Figure 1. N. gonorrhoea cysteine synthesis pathway. CysK Dimer from Salmonella typhimurium enzyme PDB code 1OAS**

**N. gonorrhoea cysteine synthesis pathway:**

The Mitchell-Menten kinetics of CysK will be obtained to understand the reaction mechanism. Two methods will be used:

1. Crystallising CysK Protein to obtain enzyme structure
2. Stopped assays to determine Michaelis Menten kinetics of CysK

**Figure 1. N. gonorrhoea cysteine synthesis pathway. CysK Dimer from Salmonella typhimurium enzyme PDB code 1OAS**

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**N. gonorrhoea cysteine synthesis pathway:**

The Mitchell-Menten kinetics of CysK will be obtained to understand the reaction mechanism.
SALINITY TOLERANCE OF ULVA SPECIES 1

Introduction
Seaweeds have been successfully used to remove excess nutrients in a range of water systems. Salinity tolerances vary between species of seaweed and can affect both their biomass productivity and bioremediation performance. This project conducted two experiments to investigate the salinity tolerance of Ulva sp. 1 (sea lettuce, Fig 1), to help inform whether the species would be suitable for commercial scale cultivation.

Methods

Experiment one: Tested short-term salinity tolerance under salinity treatments 0, 2, 4, 6, 8 & 10 ppt over a four day harvest cycle, with three harvests in total. Growth, and photosynthetic performance under dark and light conditions (Pulse Amplitude Modulation [PAM] fluorometry) was measured on each harvest, as well as daily light adapted PAM measurements.

As it was demonstrated that Ulva sp. 1 tolerates low salinities for at least 12 days, a 4 week experiment was conducted to quantify long term growth and photosynthetic performance.

Dry weight (DW) yield (g dw m2 day−2) was highest at harvest one in the short term experiment and then declined in both harvest two and three (Fig. 4). This was due to the algae still acclimatising and the initial growth was more dependant on the starting condition.

Growth was highest for salinities 10 & 15ppt demonstrating the algae prefer higher salinity but will still continue to grow at 5ppt.

Photosynthetic efficiency was not affected by salinity treatment (Fig. 9 & 10). There was no difference seen except for 0ppt which died.

Conclusions

• Ulva sp. 1 would be suitable for aquaculture and bioremediation at low salinities or brackish water.
• Ulva sp. 1 survives and grows for at least 12 days in very low salinities of 2ppt.
• Ulva sp. 1 is not suitable for aquaculture in freshwater.

Acknowledgements

Thank you very much to my supervisors Marie Magnusson and Rebecca Lawton for their support, knowledge and guidance. Thank you to Priority One for providing support and skills. To the Waikato University field station for the resources provided to complete the project. Finally, to the University of Waikato for this opportunity.
**Effect of Urban Forest Restoration on Soil Biodiversity**

**Introduction**

Soil organisms account for an enormous — yet often overlooked — proportion of terrestrial biodiversity. Important interactions take place between plant and soil communities that determine overall ecosystem structure and functioning, but we don’t yet understand how soil communities form after above-ground native forest planting. My summer project sought to sample soil over a chronosequence of restored urban forest sites across New Zealand. Later analysis will quantify macrofauna (Fig. 1), mesofauna, microorganisms and microarthropods (i.e. nematodes; Fig. 2) from each site to shed light on the reassembly of soil food webs over time since restoration (i.e.: total reconstruction of native forest).

**Field methodology**

- Soil cores sampled from 9 cities around New Zealand
- 8-11 restored forest sites per city
- Each site varied in age since restoration

**Lab methodology**

Nematodes are heavier than water. Over 72 hours, nematodes filter from the soil sample, down the Bayermann funnel hose, and into a vial for collection and taxonomic identification at a later date (Fig. 3).

**Expansion into MSc**

My MSc research will investigate the reassembly of microbial and microarthropod communities along an urban forest restoration chronosequence. Lab work will be completed at the iDiv Biodiversity Research Centre, Leipzig, Germany.

**Conclusion**

This research will shed light on links between the stage of native forest restoration and the reformation of soil organism communities. These insights can guide future efforts to restore soil communities to ultimately encourage successful forest regeneration.
The University of Waikato began a large 5-year project in 2018 working towards the development of a seaweed aquaculture industry in New Zealand. As part of this project, the university are targeting species of Ulva for cultivation in land-based aquaculture operations. However, Ulva spp. are potentially taonga (treasured) species in some regions of New Zealand, specifically where they are referred to as karengo (edible seaweed). A greater understanding of their traditional uses and value are vital. Therefore, the aim of this project was to identify which seaweed species are referred to as karengo around New Zealand, and to document their traditional and current as well as their value by iwi as detailed in written sources.

Research

Most research information on Karengo can be retrieved from doing literature searches. Much of the information on Karengo has been lost due European settlers, perceived insignificant importance of Seaweeds and indigenous knowledge (Thurstan, 2018). However, Seaweed, Mātauranga Māori (Māori traditional Knowledge) and Indigenous knowledge have been gaining more interest in recent years and they are finding their rightful place as very significant in the world of environmental science. There is still a lot of information to be re-discovered in the Te Ao Māori (the Māori World), Maori lore and oral traditions in relation to Karengo.


Figure 1 Pachymenia lusoria Sp. of Karengo retrieved from Auckland museum website, Figure 2 Porphyra columbina Sp of Karengo Photo: Wendy Nelson

Figure 3 different species of karengo, Figure 4 Karengo and crayfish meal Figure 5 shore line karengo collection, Figure 6 Hand pulling. Photos 3 & 4 retrieved from the internet 2019. Photo 3 & 6 from He Purapura Karengo by Everitt & Paea 1998
The University of Waikato

Tania Ng
Division of Health, Engineering, Computing and Science

The effects of soil fertility on *Leptospermum scoparium* (mānuka) flower timing and nectar production

**BACKGROUND**

The public interest and expansion of the mānuka industry has highlighted the lack of knowledge of the effects of soil fertility on flower timing, nectar production and quality, and in turn, honey quality. **Our aim** is to investigate the effects of soil fertility on the sugar content of nectar and the flowering behaviour of mānuka plants. **We hypothesized** there will be an increase of nectar production in plants growing in low soil fertility.

**METHOD**

Plants from two provenances (East Coast and West Port) are growing in soils with high and low nitrogen fertiliser treatments. **Flower counts** were recorded every 2-3 days by marking the new flowers open during the time of the count. To collect **nectar samples**, a branch with > 10 flowers of all ages were bagged for 24 hours and collected by water washing nectar from the flowers using 20 μl water. Sugar content of nectar was measured using a refractometer.

**RESULTS**

**CONCLUSION**

Our hypothesis was not supported by the results as there is no observed differences between the two treatment groups (fig. 3). Plants growing in high nitrogen soils yield more flowers than plants growing in low nitrogen soils (fig.1 and fig.2). This may be due to the plant having more nutrients to invest in plant growth. Future work on flowering intensity is needed to show if there is a difference in nectar production.

Acknowledgements:
This research was made possible thanks to the University of Waikato Summer Research Programme. Thank you to my supervisor, Mike Clearwater for the patience and guidance. A very special thank you to Stevie Noe, for allowing me to be part of this project and for being a motivation through data collection.
Aysha Nusrath  
Division of Health, Engineering, Computing and Science

The use of N-fixing plants in forestry
Author: A Aysha Nusrath  
Supervisors: Amanda Matson, Loretta Garrett, Jordan Goodrich

BACKGROUND

Biological nitrogen fixation is the process by which unreactive atmospheric nitrogen is taken up by symbiotic or free-living diazotrophic bacteria in root nodules (Figure 1) and transformed into available nitrogen (N) for plants to freely use. N-fixing plants can generate substantial quantities of N, from 24-300 kg N/ha/yr depending on the species. N is important for plants because:

- It is integral to the chlorophyll molecule, and therefore in photosynthetic production.
- It is a constituent of amino acids (for protein).

OBJECTIVES/METHOD

A recommendation on the most promising N-fixing plant for planted pine (Pinus radiata) forests in New Zealand focusing on Central North Island forest (pumice soils).

This was achieved through:

- A literature review on all applicable N fixation methods.
- Analysing, collating, reviewing and summarising both published and unpublished relevant literature.

MAIN FINDINGS

Common N-fixing species (legumes) include:

- Lupins
- Gorse and Broom
- Native species (Sophora microphylla – Kowhai)
- Actinorhizal plants

These are categorised further under symbiotic relationships or non-symbiotic relationships (free-living bacteria).

RISKS

- N leaching considerations – Excessive N may leach due to the lack of other macronutrients (phosphorus) needed for growth, restricting forest productivity.
  - Has a direct effect on:
    - Disproportionate nitrogen and magnesium ratios resulting in chlorosis of foliage
    - Premature needle drop and reduced tree vigour
  - Has an indirect effect on:
    - Interspecific competitive ability
    - Nutrient use efficiency

RECOMMENDED APPLICATION

200 kg N/ha/yr was effectively added by legumes

REFERENCES

Sexually dimorphic traits that affect reproductive fitness can experience directional selection. Tree wētā exhibit an extreme case of this, whereby males possess enlarged heads and mandibles referred to as "weapons." Although weapons can benefit the bearer through reproductive success, weapons can be costly to movement. The extent to which these inhibit wētā foraging behaviour is unknown. Therefore, we endeavoured to identify if head capsule size influenced male wētā feeding efficiency. We hypothesized that weapon size would be inversely proportional to both bite rate and volume of biomass consumed.

Methods
60 Auckland tree wētā (*Hemideina thoracica*) were collected from Lake Rotopiko, Maungatautari and Hammond Park (Fig 1). Wētā were weighed and measured from the top of the head to the tip of the left mandible then housed in captivity. Wētā were then placed in an experimental arena (Fig 2) with a standardized leaf disc (*Coprosma lucida*) and filmed overnight using infrared cameras. Leaf discs were weighed before and after to identify biomass consumed by the wētā and bite rate was recorded in 30 second periods.

Outcomes
This research will identify if total biomass of plant material consumed and bite rate of the wētā are negatively correlated with weapon size. Using these measurements, we will also identify if the rate of consumption is influenced by weapon size. The rate at which an animal consumes food may alter its susceptibility to predation. This is because it may spend more time exposed while feeding. Consequently, our findings may also have implications for understanding predation risk for wētā. Finally, this research will add to our understanding of sexual dimorphism in insects and the potential costs weaponry may have.

Acknowledgements
I would like to thank my supervisors Bridgette and Chrissie for their academic support and Maungatautari Ecological Island Trust, the National Wetland Trust, and Waipa District Council for facilitating the collection of wētā. Thanks to Bryce McQuillan for assisting with editing photos and Hannah Wedig for literary support. Finally, thanks to the Forest and Bird Valder Grant for providing this project with funding.

References

For a demonstrational video of the experimental procedure, use the link or QR code to take you directly to my YouTube channel! http://y2u.be/O3T4VgzPwLw
Author: Marcus Richardson; Supervisors: Robert Abbel, Mark Lay

Background & Objectives

Printed Electronics:
- Alternative to established solid-state semiconductor technology
- Reduces cost and enables new products
- Current inks made from non-renewable materials
- Goal of creating a bio-based, conductive ink based on lignin (figure 1)
- Challenge is to properly disperse fibres in water, find consistently printable formula

Materials & Methods

Table 1: Components of ink formulations

<table>
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<tr>
<th>COMPONENTS</th>
<th>PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon fibre</td>
<td>Pigment, Conductivity</td>
</tr>
<tr>
<td>Carbon black</td>
<td>Pigment, Conductivity</td>
</tr>
<tr>
<td>Cellulose Nano-crystals</td>
<td>Viscosity Modifier</td>
</tr>
<tr>
<td>Proteins</td>
<td>Dispersion Aid</td>
</tr>
<tr>
<td>Water</td>
<td>Solvent</td>
</tr>
<tr>
<td>Glycerol</td>
<td>Humectant</td>
</tr>
</tbody>
</table>

Ink Preparation

- Ingredients weighed out and combined, shaken vigorously to mix
- To properly disperse fibres inks were sonicated in an ultrasonic bath

Finished inks were characterised and tested:
- Viscosity tested as a function of shear rate
- Printing conditions – 61 cm⁻¹ thread count screen with test pattern (figure 2), 30 degree squeegee angle, constant light pressure
- Printed on regular copy paper, some inks tested on other papers
- Visual assessment of prints

Results & Discussion

Several series of inks were prepared to test different effects:
- Increasing solids content
- Increasing carbon black to carbon fibre ratio
- Increasing amyloid protein content

Test prints showed that:
- As solids content increases (figure 3) ink bleed is reduced
- Too high solids content small features cannot print, quality is reduced

Inks print most successfully on regular copy paper, struggling to stick to greaseproof paper, distorting when the screen is lifted from the print (figure 4).
Aidan Rowlingson
Division of Health, Engineering, Computing and Science

Dynamics of Beech (Nothofagaceae) Stands in the Lowland North Island

Introduction

- Southern beeches dominate the biomass of temperate forests in the southern hemisphere, and have been the heart of debate regarding the historical biogeography of the region.

- Southern beeches are light-demanding. In Chile beech can regenerate in small canopy gaps at high elevations and latitudes, resulting in persistent multi-aged stands. On warm lowland sites, dependence on large-scale disturbances results in even-aged stands.

- In NZ, studies of beech dynamics have focused on high latitudes and elevations. Beech is less common on warm lowland sites in NZ than Chile, and very little is known about dynamics of such stands.

We asked how beech persists on warm lowland sites in NZ

Figure 1. 8 plots across 6 sites were sampled.

Figure 2. Multi-aged stand of black beech (Fuscospora solandri) at Atene Skyline.

Figure 3. Diameter distributions from Atene; a multi-aged population of black beech (n = 118), top with the shrub Leucopogon fasciculatus (n = 33), bottom in understorey.

Figure 4. Scattered large red beech (Fuscospora fusca) emergent from tawa (Beilschmiedia tawa) canopy at Mangorewa.

Figure 5. Diameter distributions from Mangorewa. Top: Red beech (n = 4), Bottom: Beilschmiedia tawa (n = 166). Yellow dots are ages of 3 beech trees (see 2nd y-axis).

KEY FINDINGS

1. MULTI-AGED STANDS

- Beech dominates canopy and understorey (Fig. 2).
- Diameter distribution of beech (Fig. 3) reflects ongoing history of regeneration in small gaps ("gap-phase regeneration").
- Few competing species in understorey apart from small-leaved shrub Leucopogon fasciculatus (Fig. 2-3).
- Lack of competition from more shade-tolerant species enables beech to capture small gaps and persist at site without need for major disturbance.

2. EVEN-AGED STANDS

- Beech even-aged (Fig. 4) and often emergent over a canopy of other species. Currently few or no beech saplings (Fig. 4)
- Continually regenerating shade-tolerant species (e.g. Beilschmiedia tawa, Fig. 5) in the canopy and understorey
- Regeneration of beech dependent on destruction of competing vegetation by large-scale disturbances e.g. fire, windstorms.
- Window of opportunity post-disturbance is brief, as canopy closure curtails beech regeneration. Even-aged beech populations result (Fig. 3).

FEATURES

- At sites where shade-tolerant competitors are abundant, beech is unable to capture small canopy gaps, leaving its regeneration dependent on large-scale disturbances. The result is an even-aged population.
- Where climates and soils reduce the competitiveness of these other species, beech can persist without such disturbances, by capturing small gaps resulting from tree-falls. Hence a multi-age population results.

Conclusions

Acknowledgements

A.R. would like to thank his supervisors (C.L. and M.B.) for their support and advice, as well as the following for their help in the field; Clara Wilson, Selwyn June, Annette Rodgers, Steven Newcombe, Kirsty Vincent and Elizabeth Copeland. We also thank DOC, Brent O’Regan and Wairakei Pastoral Ltd for permission to access and work at sites.
Use of fertilizers over many years has led to overfed soil and contaminated groundwater. Ulva sp. 1, a common green algae, can often form dense blooms, creating public nuisances and issues to the surrounding ecosystem. However, this alga has been proven to be a useful addition to terrestrial soil ecosystems by stimulating and accelerating rooting and growth of plants. A fermentation process can be used to produce these various metabolite products for rooting through the microbes using the algae as a carbon source for metabolism.

The aim of this study is to investigate how the fermented products from three different starting broths impacts the rooting of tomato seedlings. The three different broths used in this study are Lactobacillus from a rice and milk ferment, a commercially available Scoby culture, and a commercial Lactobacillus supplement.

Lactobacillus was produced over 14 days by washing rice and incubating the wash solution with milk. Twenty capsules of a lactobacillus supplement were dissolved in a bucket to form the second broth. Scobys were rinsed and added into a bucket to form the third. Molasses and distilled water was added, to then be covered with a cloth overnight. Biomass from Ulva sp. 1 was milled and added into each broth and stirred daily for 7 days and fermented for 6 weeks.

40 Commercial tomato seedlings were washed and weighed with the adventitious roots cut off and allocated to one of eight treatment groups (n=5) as per Fig 3.

After 10 days, the plants will be weighed and roots measured and photographed for quantitative analysis of root architecture (XX). A time lapse video was created for visual representation, taking a photo every 10 minutes on a 12h/12h light dark schedule of a select few treatments (see QR code).

Main sources of error: Rice broth was accidentally shaken, disturbing the separation of the layers. Tomato plant seedlings not reaching significant size, so commercial seedlings were used.

I would like to thank Waikato University for generously gifting me this opportunity, Matilda Fransson for working alongside me so well this whole time, PriorityOne for their funding and Marie and Chris for being awesome and very supportive supervisors.

Want to know more?
Using your smart phone, open a QR code reader. Scan the code to the right and follow the link to the video. Or visit: https://www.youtube.com/watch?v=vaGrGsASJNC
Raskarn Singh  
**Division of Health, Engineering, Computing and Science**

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**Seaweed Dryer**

**Aim**  
To design and build a labour extensive drying unit that is easy to operate and can dry different species of seaweed for biomass purposes.

**Drying Tests**  
Designing a drying unit specifically for algae, required understanding of its characteristics and behavior during the drying process. To do so, drying tests were conducted on two different algae species, Ecklonia, a brown alga, and Ulva (sea lettuce). Both algae samples were dried at different temperatures, and results from these tests were used to plot drying curves and to come up with concepts.

The results showed a steep drop in moisture ratio during the early stages of the tests. This trend can be attributed to the rapid removal of surface and shallow sub-surface moisture in the seaweed. The data also showed that drying at higher temperatures resulted in a lower final moisture ratio; however, the difference in final moisture drop was not substantial.

**Key observations:**  
- Seaweed being a low thickness material dries considerably quickly without exposure to high temperatures.
- Some seaweed, such as Ecklonia, tends to stick to the drying trays if it stays stationary for too long inside the dryer.

**Concepts**  
Concepts were designed based on the design criteria given by the client and the observations made during the tests.

**Key design criteria include:**  
- Must be able to dry different species of seaweed.
- Must not be labour-intensive.
- Easy to operate.

**Concept 1**  
A concept consisting of a “triangular prism cage” with mesh walls rotating around a shaft with the help of a pulley drive. One of the mesh sides is a hinged door allowing easy loading and unloading of the product.

**Concept 2**  
A design based on a concrete mixer and a rotary dryer. The seaweed is loaded from the front of the drum and is dried as the drum rotates. Heat source can be added to the drum to speed up the drying process. Once dried, the product can be tipped using the lever located on the side.

**Final Design**  
The final design under development is based on concept 1, with minor improvements made to it.

**Acknowledgments**  
- Christopher Glasson and Marie Magnusson for supporting and supervising the project.
- Terry Mcintosh from Mount Rewinds for providing components and valuable feedback for the dryer.
- Ralf Schlothauer for his feedback on the project.

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**Summer Research 2020**
Manual observations vs trail camera detection of hihi at supplementary feeders

Deborah Smith1 Supervisors: Janelle Ward2, Kate Richardson1, Mhairi McCready4, Clare Browne1, Grant Tempero1, Kiri Wallace1

1School of Science, University of Waikato; 2Maungatautari Ecological Island Trust; 3Waikato Regional Council; 4Hihi Conservation Charitable Trust

Introduction

Hihi (Notiomystis cincta) (Figure 1), also known as Stitchbird, is an endemic bird species to the North Island that disappeared from the mainland due to predation and habitat loss. Hihi populations are now restricted to predator-free sanctuaries and offshore islands. Translocations of hihi to Maungatautari Sanctuary Mountain occurred in 2009-11 with support of supplementary sugar water feeders (Figure 2). Research has shown that hihi consuming the supplementary feed produce more offspring. The feeding stations also facilitate behavioural observations and monitoring of the hihi population.

Our primary research aim was to compare the reliability of manual observations to automated camera recordings of hihi approaches to supplementary feeders.

Method

Video footage from Bushnell trail cameras installed within the Southern Enclosure at Sanctuary Mountain Maungatautari, were analysed for hihi visitations to the feeder stations (labelled A, B & C) (Figure 3) and compared to the 30-minute manual observations recorded, once to twice per day. Leg bands on hihi were noted where possible for individuals.

Results

In total, 68% of hihi activity was captured by both methods. 8% of hihi visits were missed by the observer but captured by camera, whereas 24% of visits by hihi were missed by the camera but detected by the observer. *Based on interim results

<table>
<thead>
<tr>
<th>Missed by camera</th>
<th>Both detected</th>
<th>Missed by observer</th>
</tr>
</thead>
<tbody>
<tr>
<td>8%</td>
<td>52%</td>
<td>24%</td>
</tr>
</tbody>
</table>

• The majority of hihi visitations to supplementary feeders were recorded by both the trail camera and the observer.

• Trail cameras were more likely to fail to record a hihi visitation compared to manual observations, even when operating correctly, most likely due to slow trigger speed or short visits from hihi.

• Trail cameras are able to operate for longer periods and under more adverse environmental conditions than manual observers, but are still limited by trigger speed, battery life and memory storage capacity.

Conclusion

Acknowledgements: I would like to thank the staff & volunteers at Maungatautari Sanctuary Mountain, Maungatautari Ecological Island Trust, Waipa District Council and Ngāti Koroki Kahukura, Raukawa, Ngāti Hauā, Waikato-Tainui
Wilding pines (*Pinus contorta*) are an invasive, exotic tree species that grow and spread rapidly, and threaten to drastically alter New Zealand’s native ecosystems. Herbicide application is a powerful tool used to fight the wilding invasion. This research aims to find the most efficient method of controlling wilding pines in New Zealand.

**Aims**
- Research the efficacy of different spray formulations.
- Reduce spray volumes by increasing concentration.

**Methods for Dose Response Trial**
- 11 treatments with fluorescent dye.
- 0.25µl drop onto both sides of pine needles from *Pinus contorta* trees.
- Needles dried for an hour then photographed under UV light.
- The area that the drops spread over was measured by digitally analyzing the images, revealing which spray treatment spread over the pine needles the most.

**UAV Spray Trial**

**Aims**
- Research the deposition of different droplet sizes and volumes of spray from a UAV to apply this information to herbicide application.
- Droplet size, wind speed and wind direction were measured to see how these factors influenced deposition.

**Setup & Methods**
- Six plots with grids of 65 stainless steel plates below (figure 3, 4).
- The UAV used was the XAG P20 (figure 1). It hovered 1.5m centered over each sampling plot. Wind speed or direction may skew the distribution and location of the spray.
- Six spray treatments made up of two different spray formulations.
- Wind speed, wind direction, and humidity were measured. The sprayed plates will be washed, and the absorbance of the wash-off measured using a spectrophotometer. This will determine the distribution and location of the spray.

**Granular Trial**

**Aims**
- Dose response trial determining the efficacy of granular herbicide to control wilding pines. Spot applications of granules by UAV can be used instead of spray.

**Methods**
- Two dose regimes, dose relative to height, and dose relative to canopy area. Three doses, 0.5, 1, and 1.5 g/unit.
- 33 wilding pines 0.1 – 8.5 m tall per treatment.
- Herbicide used was Tordon 2G Gold (figure 6). Picloram is the active ingredient.
- Application occurred when substantial rain was forecast to facilitate herbicide uptake into the roots (figure 8).
- Monitoring of the percentage of discolouration will occur after six months and a year.

**Table 1. Results of spread tests showing different treatments and the average spread area**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Volume L/ha</th>
<th>Triticap g/ml</th>
<th>Dicamba g/ml</th>
<th>Average 0.25µl drop area (mm²)</th>
<th>Adaxial</th>
<th>Abaxial</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 TD equiv</td>
<td>400</td>
<td>0.045</td>
<td>0.0125</td>
<td>4.3</td>
<td>2.4</td>
<td>6.0</td>
</tr>
<tr>
<td>3 Quarter</td>
<td>200</td>
<td>0.0225</td>
<td>0.0083</td>
<td>5.0</td>
<td>2.5</td>
<td>7.5</td>
</tr>
<tr>
<td>4 Eighth</td>
<td>200</td>
<td>0.0113</td>
<td>0.0031</td>
<td>5.1</td>
<td>2.8</td>
<td>7.4</td>
</tr>
<tr>
<td>5 Half</td>
<td>100</td>
<td>0.09</td>
<td>0.025</td>
<td>4.5</td>
<td>2.1</td>
<td>7.0</td>
</tr>
<tr>
<td>6 Half</td>
<td>50</td>
<td>0.18</td>
<td>0.05</td>
<td>4.5</td>
<td>2.2</td>
<td>6.7</td>
</tr>
<tr>
<td>11 Mix</td>
<td>50</td>
<td>0.045</td>
<td>0.0125</td>
<td>38.5</td>
<td>23.9</td>
<td>33.2</td>
</tr>
</tbody>
</table>

**Acknowledgements**
Thank you to Soon and the Summer Research Student Scholarship team for providing me with this opportunity. Thank you also to my supervisors Vanessa Cotterill and Karsten Zegward, and the Pest Management team at Scion.
A worldwide study of pesticide distribution in honey
Edie Thomas, supervised by Dr Megan Grainger

Introduction
• Commonly used classes of pesticides include neonicotinoids, carbamates, and pyrethroids.
• Foraging honey bees pick up pesticides from the nectar and pollen of plants.
• The pesticides can accumulate in honey.
• Pesticides in honey can be analysed by gas chromatography-mass spectrometry, which is able to detect low concentrations.
• Sugars, lipids and sterols in the honey matrix must be removed before analysis. This is done using the QuEChERS sample preparation method.
• The pesticide content in honey can be used as an environmental indicator, since bees forage over a wide area (up to 4km radius).

Aim
To identify and quantify pesticides present in New Zealand and international honey samples.

Method
- Extract honey sample into solvent, add internal standard
- Extraction salts remove polar interferences such as sugars
- PSA and C18 remove lipids, sterols and long chain fatty compounds
- Evaporate solvent to concentrate sample. Resuspend in methanol
- Analyse by GC-MS

Results
The matrix was successfully cleaned up, but few pesticides were found, and only at trace levels.

Further Steps
Analyze more honey samples using the developed method to build a wider database. Multi-residue standards will be used to quantify pesticide concentrations in NZ and international honey samples.
Investigating climate dynamics at the end-Permian Mass Extinction

Throughout Earth’s history, reverse weathering has likely been responsible for numerous substantial baseline shifts in pCO₂ levels. Depending on the ecological success of siliceous ecosystems and their impact on dissolved Si levels, these ecosystems may exert a prevailing control on the reverse weathering flux of CO₂ in the atmosphere. The largest environmental crisis in Phanerzoic history was brought about by global warming within the end-Permian period. Earth’s climate dramatically shifted, resulting in over 90% of marine species and 75% of terrestrial species becoming extinct. No other time in history have we seen the initial pace of warming be comparable to the preceding half-century.

This project tested the idea that enhanced rates of reverse weathering tied to siliceous ecosystem collapse could have played a significant role in driving the irregular climate behaviour at the end-Permian. Our prediction — as the total global chart decreased, total clay increased.

METHOD:

- Rock samples are collected at varying depths under the surface
- Samples are crushed using a rock mill
- Samples are analysed for bulk mineralogy and clay mineralogy using XRD technology
- XRD output is interpreted to identify mineral composition

RESULT:

Unfortunately, as this is an ongoing process we do not have results to share at this stage, but here is what we do know…

- The University of Oxford is currently analysing bulk mineralogy of both our Svalbard and Japanese samples

CONCLUSION:

Our observations can contribute to the world’s understanding of the impact reverse weathering – as a result of siliceous ecosystem collapse – had on irregular climate behaviour during the end-Permian period.

If our prediction is correct, we will be able to identify when areas chart deposition crashed in the geologic timeline.

Clay specific data will showcase what types of clays amplified in quantity during the climatic event, allowing us to further develop our reverse weathering hypothesis.

Reverse Weathering - The in-situ formation of marine silicate clay minerals.

End-Permian period – The boundary between the Permian and Triassic geological periods, approximately 251 million years ago. A time that saw rapid temperature rise >10°C – consequently creating an inhospitable environment subverted by the decline of marine Go.

XRD: X-ray diffraction. In this instance, used to identify the composition of our samples.
Courtney Tregurtha-Nairn
Division of Health, Engineering, Computing and Science

What is a Regional Biodiversity Hub?

Courtney Tregurtha-Nairn
Supervisors: Dr Kiri Joy Wallace (UoW), Prof. Charles Daugherty (BHB), Mark Mitchell (HBRC)

Definition of a Hub

“A community-based entity that holds a conservation vision for a defined geographic extent, whose purpose is to drive and support a multitude of groups to help deliver this vision”.

- Department of Conservation

Conclusion

- A hub should have a physical presence in a central location, such as a regional council office to be able to:
  - Support the operation of a hub & management of conservation projects.
  - Accommodate gatherings/meet-ups.
- It should have a good interactive online interface that can facilitate both the needs of the general public & active conservation members.
- Work closely with DOC to establish a hub, standardise monitoring methods & acquire funding.
- Network with main stakeholders like tangata whenua, regional & district councils, local businesses and major conservation project entities such as PF2050 & QEII National Trust.
- Improved resolution of spatial information before the EP layer is released to the public will make it more reliable for use in the real world.

Acknowledgments

I would like to thank Dr Kiri Joy Wallace for awarding me this opportunity, Prof. Charles Daugherty, Sarah Reddish and Mahesh Nathan from Biodiversity Hawke’s Bay for their wisdom and guidance Mark Mitchell for his feedback, Kelisa Hadha for her help with ArcGIS and Bea Fohrle for taking me out on ground truthing expeditions, and the rest of the team at the HBRC.
Across the globe, the diverse range of dung beetles play an essential role in several important ecosystem functions (Nichols et al., 2008). These ecosystem functions are essential to New Zealand because the removal of excess dung is a major problem (Forgie, Paynter, Zhao, Flowers, & Fowler, 2018). Dung beetles remove excess dung by burying it for larval consumption and growth (Forgie et al., 2018). Native species of dung beetle are not able to process large amounts of mammalian dung due to evolving without mammals present.

As a result of the lack of native species that can effectively remove the cow dung three species of non-native dung beetle species were introduced in 2010 to assist in the reduction of livestock dung (Forgie et al., 2018). This introduction of non-native species has raised several questions in terms of the impacts on ecosystem functioning.

**INTRODUCTION**

For this experiment we analyzed how introduced species of dung beetle are able to improve ecosystem functions. We hypothesized that when dung beetles are present there will be an improvement in the level of ecosystem functions, particularly bioturbation and nutrient cycling.

- The study was conducted on a farm with established dung beetle populations in Otorohanga.
- Forty three mesocosm (59cm x 59cm) and three controls were set up in a field located on the farm (see figure 2).
- Mesh nets were secured over the mesocosms to ensure that no unwanted insects entered the mesocosms.
- To ensure that no livestock interfered or damaged livestock the experiment was fenced off.
- Four treatments were used (see figure 1).
- This experiment will measure bioturbation and nutrient cycling.

**FIELD METHOD**

**KEYWORDS**

**CONCLUSION**

The main goal of this summer research was to use experimental manipulation of ecological systems to observe the effects of dung beetles on important ecosystem functions. The results that this experiment will likely bring forward is that in mesocosms with dung and beetles present the rate of bioturbation will be higher.

**REFERENCES**

Results

1. Create bacterial suspension and antibiotic dilutions
2. Combine them in a 96 well plate
3. Incubate overnight and then add resazurin
4. Measure fluorescence

Discussion

The MIC for each strain was very similar, with a value of around 0.125 micrograms/ml for polymyxin B, and 0.25 micrograms/ml for vancomycin, as shown on figure 1. There does not appear to be any sort of phenotypic clustering, or linear pattern, as shown by figures 2 and 3. Instead, the data is randomly scattered. We can therefore conclude from these results that there is no association between antibiotic resistance and 16s and ITS2 rRNA sequences. However, there were a few factors that could have affected the results. There was not an extremely wide antibiotic range, as only two antibiotics were used. The experiments were also only conducted once, so there is the possibility of human error. Finally, only a select number of strains from the phylogenetic tree were tested against. To increase accuracy, future experiments should contain all the strands of Thermus filiformis.

Acknowledgements

I would like to thank The University of Waikato Scholarship research programme for giving me the opportunity to take part in this project. I would also like to thank my supervisor Huw Richards, as well as Gamaliel for all of their help and support.

Figure 1: high fluorescence indicates the presence of living cells. As the antibiotic concentration increases, fluorescence decreases as cell life is inhibited. 1a represents the antibiotic polymyxin B, and 1b represents the antibiotic vancomycin. Each line represents a different strain.

Figure 2: the 16s (2a) and ITS2 (2b) phylogenetic trees are shown above. Next to them is a heat map of the minimum inhibitory concentration (MIC) of antibiotic needed to kill the bacteria, with the concentration increasing as we move from purple to yellow.

Figure 3: phylogenetic distance on the x axis indicates how genetically related strains are to each other, based on either their 16s sequences (left) or ITS2 sequences (right). Each dot represents an individual strain. The MIC of each strain is plotted on the y axis.
Background

Rapid progression of climate change is largely due to anthropogenic emissions of greenhouse gases, primarily carbon dioxide. Climate is expected to progress at a rate faster than natural evolution can proceed, thus limiting the ability of organisms to adapt and adjust to new conditions. Native species which may be locally adapted or have limited ranges are particularly susceptible to climate change and must be prioritized to prevent significant loss. The aim of this project is to begin identifying key information such as how future climate will vary locally and what affect it may have on native and exotic forest tree species.

Methods

- Reading background information for initial understanding.
- Use of databases and search engines to gather sources e.g. Google scholar, Scopus and Pure.
- Use of search techniques such as Bayesian methods.
- Review of literature to extract key information and data.
- Data compilation through creation of summary documents and tables.

Results and Discussion

I. Local climate change – New Zealand

Local climate change varies depending on location and interactions of environmental factors with different aspects of topography.

Future climate predictions for New Zealand show a increase in annual temperature (figure 2) of 1.3°C by 2040 and 3.6°C by 2090 is expected under the A2 emission scenario (table 2). Daily temperatures increase gradually with more frequent extremes such as temperatures over 25°C and below 0°C. Seasonal variation in warming is expected due to circulation changes, with rates being highest in summer and autumn and lowest in winter and spring.

Annual growth cycles of forest trees may be out of sync with changing climates in the future due to warmer seasonal temperatures altering timing of phenological events and impacting possible success rates. Increasing seasonal temperatures may cause events to begin early or possibly delay events if requirements such as chilling and forcing are not met such as seen in Beech. Distributions may shift due to decreased productivity from conditions such as drought (table 1).

Future climate predictions for New Zealand show a increase in annual temperature (figure 2) of 1.3°C by 2040 and 3.6°C by 2090 is expected under the A2 emission scenario (table 2). Daily temperatures increase gradually with more frequent extremes such as temperatures over 25°C and below 0°C. Seasonal variation in warming is expected due to circulation changes, with rates being highest in summer and autumn and lowest in winter and spring.

Table 2. Effects of change in seasonal and phenological events (Frank et al., 2017).

<table>
<thead>
<tr>
<th>Scenario</th>
<th>APR</th>
<th>JUN</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>0.4</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>A2</td>
<td>1.6</td>
<td>1.3</td>
<td>1.3</td>
<td>1.3</td>
<td>1.3</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Table 3. Available data for native and exotic forest species in New Zealand incl. genetic and key adaptive traits.

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Available information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pinus radiata</td>
<td>Monterey pine</td>
<td>Growth rate, provenance, disease resistance, heritability, genetic diversity, photosynthesis, temperature</td>
</tr>
<tr>
<td>Nothofagus menziesii</td>
<td>Mountain beech</td>
<td>Optimum photosynthesis, genetic parameters including QST, FST, and hereditability.</td>
</tr>
<tr>
<td>Dacrycarpus eucalyptoides</td>
<td>Umbellata</td>
<td>Frost resistance4.</td>
</tr>
<tr>
<td>Phyllocladus coulteri</td>
<td>Miro</td>
<td>Frost resistance1, optimum photosynthesis temperature1, genetic distance correlation1, Frost resistance4 and provenance3.</td>
</tr>
<tr>
<td>Podocarpus hallii</td>
<td>Pohutukawa</td>
<td>Genetic distance correlation4.</td>
</tr>
<tr>
<td>Dacrydium dacrydioides</td>
<td>celery pine</td>
<td>Frost resistance4.</td>
</tr>
<tr>
<td>Dacrydium ferrugineae</td>
<td>Hall's totara</td>
<td>Frost resistance1, optimum photosynthesis temperature1, genetic distance correlation1, Frost resistance4 and provenance3.</td>
</tr>
<tr>
<td>Agathis australis</td>
<td>PIton</td>
<td>Frost resistance4.</td>
</tr>
<tr>
<td>Allocasuarina baileyi</td>
<td>blue gum</td>
<td>Frost resistance4.</td>
</tr>
<tr>
<td>Eucalyptus robusta</td>
<td>Mountain marri</td>
<td>Frost resistance4.</td>
</tr>
<tr>
<td>Podocarpus totara</td>
<td>Huon pine</td>
<td>Frost resistance4.</td>
</tr>
<tr>
<td>Schizymena umbellata</td>
<td>Umbellata</td>
<td>Frost resistance4.</td>
</tr>
<tr>
<td>Allocasuarina macropodina</td>
<td>Blue mountain</td>
<td>Frost resistance4.</td>
</tr>
<tr>
<td>Dacrydium ferrugineae</td>
<td>Hall's totara</td>
<td>Frost resistance1, optimum photosynthesis temperature1, genetic distance correlation1, Frost resistance4 and provenance3.</td>
</tr>
<tr>
<td>Dacrydium dacrydioides</td>
<td>Umbellata</td>
<td>Frost resistance4.</td>
</tr>
<tr>
<td>Podocarpus hallii</td>
<td>Pohutukawa</td>
<td>Genetic distance correlation4.</td>
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</tr>
<tr>
<td>Agathis australis</td>
<td>PIton</td>
<td>Frost resistance4.</td>
</tr>
<tr>
<td>Allocasuarina baileyi</td>
<td>blue gum</td>
<td>Frost resistance4.</td>
</tr>
<tr>
<td>Eucalyptus robusta</td>
<td>Mountain marri</td>
<td>Frost resistance4.</td>
</tr>
<tr>
<td>Podocarpus totara</td>
<td>Huon pine</td>
<td>Frost resistance4.</td>
</tr>
<tr>
<td>Schizymena umbellata</td>
<td>Umbellata</td>
<td>Frost resistance4.</td>
</tr>
<tr>
<td>Allocasuarina macropodina</td>
<td>Blue mountain</td>
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</tbody>
</table>
Background

- Estuaries serve as high gradient conduits between fluvial and marine ecosystems providing a valuable setting for a broad range of biogeochemical processes [1]
- In NZ’s ~300 estuaries, benthic fauna health is impacted by anthropic pollution and sedimentation [2] as estuarine geological processes facilitate the capture of particulate matter and heavy metals
- Residence time (RT) (the time taken by any parcel of estuarine water to be diluted by 63% by extra-estuarine water) has been linked directly to water quality [3] due to exposure reduction
- A direct causal link between RT and benthic fauna health, much of which is considered kaimoana or taonga, is not well established

Methodology

- In 2013, fifty sites across the southern portion of the well flushed barrier enclosed lagoon of the ~200km² Tauranga Harbour were sampled for benthic macro-fauna and associated sediment characteristics
- Ten 13cm diameter cores extending 15cm into the sediment were taken at each sampling site with contents sieved onto 1mm mesh to allow for macrofaunal identification
- Ten 2cm diameter cores from the same locations were composited to yield data on physio-chemical variables
- RT is considered the bulk integrative measure for an initial concentration (e.g. 1mg/l) released uniformly over the model to dilute to a set threshold of 0.37 established through the use of the DHI Water and Environment MIKE3 FM HD hydrodynamic model
- Correlations of shellfish size/density and mean/max RT were calculated for A. stutchburyi, M. liliana and Tellina sp

Results

No significant correlation between density and either max or mean RT was demonstrated for any of the sampled species

<table>
<thead>
<tr>
<th>Species</th>
<th>R² values</th>
<th>Mean RT</th>
<th>Max RT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. stutchburyi</td>
<td>0.101</td>
<td>0.098</td>
<td></td>
</tr>
<tr>
<td>M. Liliana</td>
<td>0.007</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>Tellina sp</td>
<td>0.000</td>
<td>0.000</td>
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</tbody>
</table>

Conclusions

- Local environmental conditions (e.g. substrate or cohabitants) may be impacting abundance to a greater degree than RT
- Larger sample sizes may demonstrate correlations

Next steps

- Multivariate analysis using Primer or DistLM may yield results of significance as a range of variables could be considered
- A distinction between flushing of the harbour by marine vs fluvial water sources may need to be drawn

References


Acknowledgements: Joanne Ellis, Shari Gallop and Caine Taiapa for their guidance and support, Ben Stewart and Karin Bryan with respect to project set up and provision of key data all underpinned by support from the BOPRC

Residence time and kaimoana in southern Tauranga harbour/Te Awanui

Author: Henry Whyte
Supervisors: Joanne Ellis, Shari Gallop, Caine Taiapa

Mean RT and sampling site location

<table>
<thead>
<tr>
<th>Location</th>
<th>Residence Time (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>1. Upper harbour</td>
</tr>
<tr>
<td></td>
<td>2. Ta Puna</td>
</tr>
<tr>
<td></td>
<td>3. Inside mainland</td>
</tr>
<tr>
<td></td>
<td>4. Mid Region</td>
</tr>
<tr>
<td></td>
<td>5. Welcome bay</td>
</tr>
<tr>
<td></td>
<td>6. Waikareno estuary</td>
</tr>
<tr>
<td></td>
<td>7. Harbour entrance</td>
</tr>
<tr>
<td></td>
<td>8. Waikareno River</td>
</tr>
</tbody>
</table>

Tauranga harbour residence time seasonality

A. stutchburyi. Photo credit: UofWaikato
WHERE THE WORLD IS GOING
TE AHUNGA O TE AO