# NZ MARINE SCIENCES SOCIETY CONFERENCE

TE HUNGA MĀTAI MOANA O AOTEAROA

## HE TAI PARI | THE RISING TIDE

MARLBOROUGH | 7 – 10 JULY 2025

NZMSSCONFERENCE.CO.NZ

# Marlborough beneath the surface

## The Sounds is home to habitats that sustain amazing sea life which makes this area a national treasure.

A unique world lives beneath the surface. The strong currents and productive waters of the Sounds support a myriad of seafloor habitats that provide nurseries for a multitude of fish.

Sponges, algaes and anemones are just some of the species that make up this unique marine tapestry.

*Sponge – callyspongia ramose*

*Anemone – anthothoe sp.*

*Algae – lessonia variegata*

PHOTOS COURTESY OF ROB DAVIDSON

# CONTENTS

# SPONSORS

## GOLD SPONSOR

MARLBOROUGH DISTRICT COUNCIL

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Port Marlborough

## BRONZE SPONSORS

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## EXHIBITORS

SEQUENCH

Port Marlborough

imbros

BOXFISH ROBOTICS

## AWARDS & STUDENT PRIZE SPONSORS

AM TAMAKI PAENGA HIRA AUCKLAND WAR MEMORIAL MUSEUM

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Waipapa Taumata Rau University of Auckland

Greater Wellington Te Pane Matua Taiao

# WELCOME

## TĒNĀ KOUTOU KATOA
## GREETINGS

The NZMSS annual conference is the must-attend event for marine scientists, managers and students in Aotearoa/ New Zealand. The theme of the conference this year is He tai pari/ the rising tide.

The replenishing rising tides brings with it life, abundance, nourishment, and hope. Hope for prosperity, hope of healing and a hope of a better tomorrow. As the sea surges towards the shore, we too must join the rising tide, working together to bring about a better future for our marine environment.

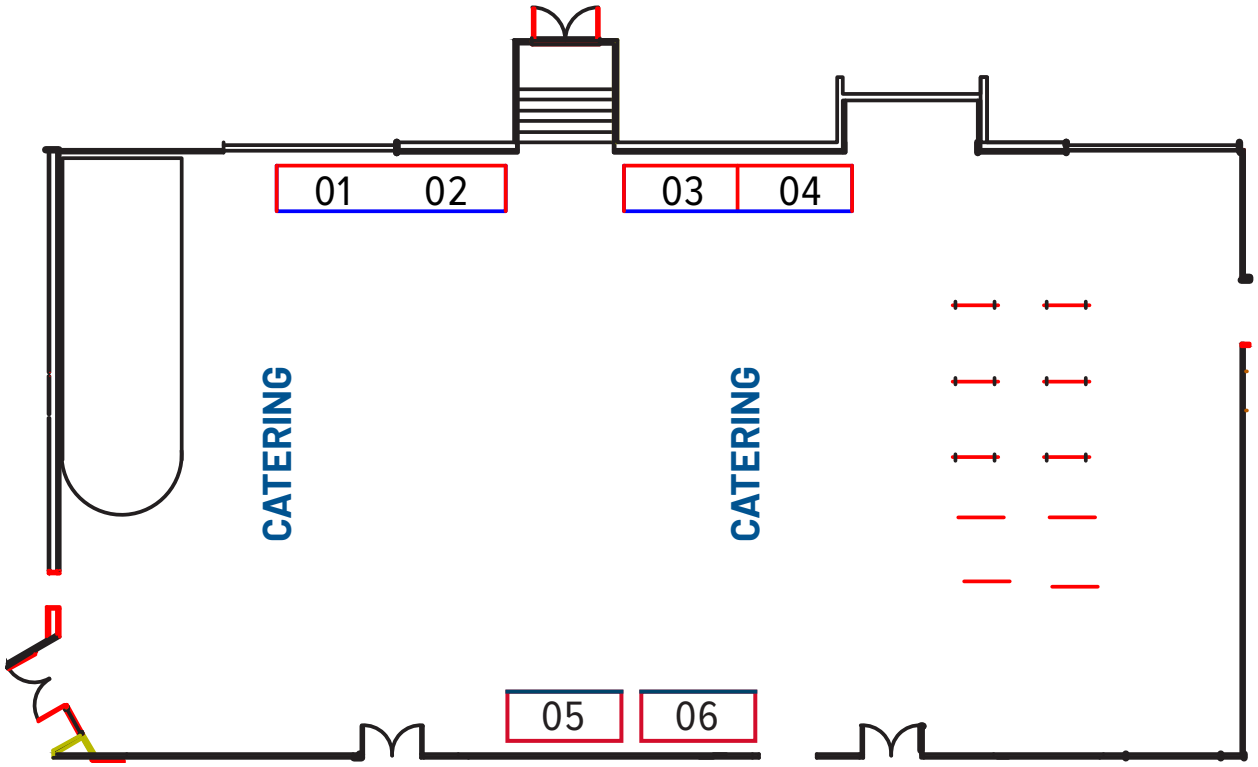
Nau mai haere mai, the region has plenty to offer with the beautiful Marlborough Sounds and many aquatic activities, we hope you will stay a while and have a look around. This is the first time that the NZMSS conference has been to Marlborough and we look forward to welcoming delegates from across Aotearoa/ New Zealand. The conference will be held at the Marlborough Events Centre, a great venue within the heart of Wairau/ Blenheim - close to local restaurants and within an easy walk from many hotels and motels.

Thanks to the organisations who have supported the conference as sponsors or trade exhibitors, please be sure to visit the exhibitors and show your support in return to our sponsors.

See you in Marlborough

Ngā mihi
**Oli Wade**
*Conference Chair*

# EXHIBITORS




## Exhibitors

**1/2.** Sequench (double)
**3.** Port Marlborough
**4.** Boxfish Robotics
**5.** Imbros
**6.** Ocean Wolf

## Key

Poster Boards

# GENERAL INFO

## REGISTRATION DESK

If you require any assistance throughout the conference please see the conference organisers at the Registration Desk (foyer).

## NAME TAGS

Delegates are requested to wear their name tags to all sessions and social functions.

## CELL PHONES

Please ensure that cell phones are turned off or on silent, during all presentations.

## CONFERENCE CONTACT

For assistance during the conference, please call Tracy Young from On-Cue Conferences on 021 164 7820

## TAXIS & SHUTTLES

**Blenheim Cabs:** 03 777 1072

**Marlborough Taxis:** 03 577 5511

## EXHIBITORS

Remember to visit and chat with the exhibitors.

## PRIZES

Visit the Imbros stand (5), scan their QR code and be in to win a $100 prezzy card

## MEALS

All catering will be in the Exhibition Area.

If you have advised us of your special dietary requirements, these have been forwarded to the caterers and will be available on a separate table individually marked.

At the Conference Dinner, please make yourself known to the wait staff and they will make the necessary arrangements for your special meal.

If you have any dietary requirements that we are not aware of, please see the Conference Organisers at the Registration Desk on arrival at the conference.

# MEDICAL & EMERGENCY INFO

## NEW ZEALAND EMERGENCY SERVICES

Ambulance, Fire and Police. Dial 111 from any public, private telephone or mobile phone in New Zealand.

## BLENHEIM POLICE

8 Main Street, Blenheim Central, Blenheim

## WAIRAU HOSPITAL

30 Hospital Road, Witherlea, Blenheim
03 520 9999

## MARLBOROUGH URGENT CARE CENTRE

30 Hospital Road, Witherlea, Blenheim 7201
**Phone:** 03 520 6377
**Hours:** 8am - 8pm

## CHEMIST/PHARMACY

Life Pharmacy Blenheim
101 A Market Street, Blenheim Central, Blenheim

**Phone:** 03 578 5228
**Hours:** 8:30am - 5pm

# GENERAL INFO

## LOADING PRESENTATIONS

Please take your presentation on a USB stick to the registration desk - this should be done at the start of the day that you are scheduled to present, and at least 2 sessions prior to your presentation time.

## POSTER PRESENTATIONS

The poster session will be on Tuesday in the exhibition hall as part of the welcome function.

Please put your poster up on arrival. Posters should remain up all week and be removed after lunchtime Thursday. Any posters remaining by 3pm will be removed.

## SOCIAL MEDIA

The NZMSS Conference Committee encourage sharing of knowledge across social media platforms.

Use of the following hashtag across all social media platforms will help to spread the word about this year's conference.

**#NZMSS2025**

## SESSION CHAIRS

Please can all session chairs be in their room prior to the start of the session. Please introduce yourself to the AV tech in the room

**It is very important that presentations do not run over their allocated time so please ensure presenters start and finish on time. Further chair guidelines will be avaliable in each room.**

# STUDENTS PRIZES & MAJOR AWARDS

| Sponsor | Student Prizes | Value |
|---|---|---|
| **NZMSS** | Best poster | $400 |
| **NZMSS** | Runner up best poster | $200 |
| **NZMSS** | Best talk | $500 |
| **NZMSS** | Runner up best talk | $300 |
| **NZMSS** | Best talk incorporating Mātauranga Māori | $500 |
| **NZMSS** | Runner up best talk incorporating Mātauranga Māori | $300 |
| **CSIG - Wellington Regional Council** | Best talk relating to coastal marine science and resource management | $300 |
| **University of Auckland** (IMS) | Dr Roger Grace Scientific Diving Award | $500 |
| **MPI - Fisheries NZ** | Best talk relating to aquaculture | $400 |

| Sponsor | NZMSS Major Awards |
|---|---|
| **NZMSS** | NZMSS Award |
| **Auckland Museum** | John Morton Medal |
| **Sponsor** | **Additional Awards** |
| **Hauraki Gulf Forum** | Hauraki Gulf Forum Research Awards |

# VENUE INFORMATION

## VENUE INFORMATION

Marlborough Events Centre, 42 Alfred st
Blenheim

## INTERNET

There is internet access all over the venue.

**Wifi name:** EC Guest

**Password:** events2025

## PARKING

There is a carpark in front of the theatre with parking fees between 9:00am and 5:00pm from Monday to Friday. The first hour is free and then $1.20/hour. Be aware that you are limited to 4 hours.

To activate the free hour, you need to enter your car registration number in the pay by plate terminal and follow the prompts on screen.

There is a public carpark building opposite to the theatre and accessed from Alfred Street.

It is $1.20/hour without time restriction or $4.80/day if you arrive before 9am and leave after 4pm.

You can also download and use the paymypark app to manage your parking.

## NO SMOKING

The Marlborough Events Centre is a non-smoking premise.

Smoking is only permitted outside in the area opposite the main front entrance.

## VENUE EMERGENCY INFORMATION

In the event of an evacuation alarm, there will be building wardens directing everyone out of the building to assembly points.

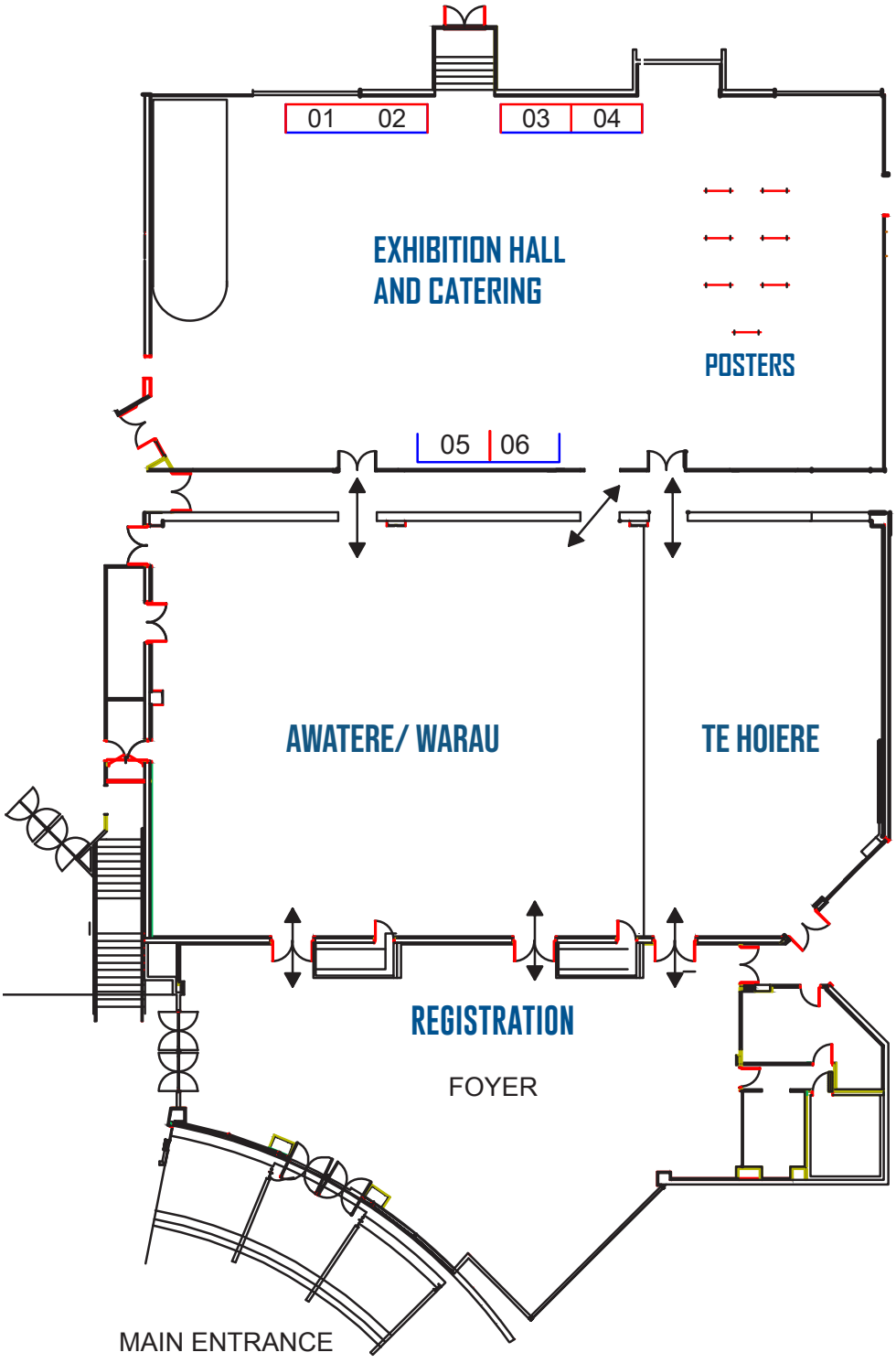
Please move outside to the carpark.

**Fire:** Continuous alarms will be activated throughout the building and all occupants should leave the building immediately.

**Earthquake:** In the event of an earthquake, stop, drop and cover. When the shaking stops, follow the instructions of the emergency wardens and make your way out of the building to the assembly point.

# VENUE MAP

## MARLBOROUGH EVENTS CENTRE




### Exhibitors

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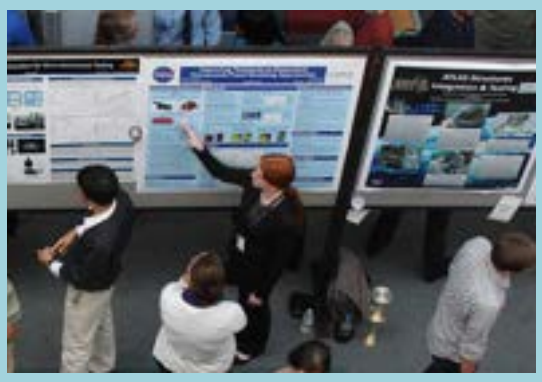
# SOCIAL FUNCTIONS



## WELCOME FUNCTION & POSTER SESSION

**Venue:** Trades Hall - exhibitor/poster space MEC
**Time:** Tues 8 July 4.30pm - 6.30pm

Enjoy networking, drinks and canapes while viewing and discussing poster presentations.

Ticket included with all Full Conference Registrations

## CONFERENCE DINNER AND AWARDS CEREMONY

**Dinner Theme:** Currents of colour

The rising tide brings us colours from the sunlit shallows to the glowing depths. This year we celebrate the return of NZMSS to Te Tauihu with a kaleidoscope of colours from our moana. Whether you're inspired by tide-dye pools or bioluminescent sea-quins, every colour tells a sea of stories - so show us yours!

**Venue:** Whitehaven Room
**Time:** Thursday 10 July 6:30 PM till midnight
**Tickets:** **$85+GST pp | If you haven't booked your ticket and want to join the dinner please check in at the registration desk.**

**Celebrate with colleagues and enjoy a family style buffet dinner at the** Whitehaven Room, Marlborough Events Centre, overlooking the Taylor River.

Get your dancing shoes ready! We will have local band 'A Minor Thing' playing after the dinner and awards ceremony.

**Prizes:** Best dancer and Best dressed / Best costume

# PROGRAMME

*V. 17 - CORRECT AT TIME OF PUBLICATION*

| | | |
|---|---|---|
| | Monday 7 July 2025 | |
| | Exhibitors and suppliers set up | |
| 4.00pm - 6.00pm | Pre-conference Registration - MEC Foyer | |
| | Tuesday 8 July 2025 | |
| | OPENING CEREMONY | |
| 8:30am- 9:15am | Mihi Whakatau and Karakia Timatanga - Society Welcomes - Welcome from the Mayor | |
| 9.15am - 9.45am | Kai whakanōa - *kindly sponsored by Coast and Catchment* | |
| 9.45am- 11.00am | **Keynote speakers**<br>**Raymond Smith,** Ngāti Kuia<br>**Kura Paul Burke,** Te Whare Wānanga o Waikato \| University of Waikato<br>Chair: Oliver Wade | |
| Location | Awatere/Wairau | Te Hoiere |
| Session Chair | Emily Giles | Rochelle Constantine |
| **Session 1** | **Marine Heatwaves and Temperature Stress** | **Charasmatic Critters** |
| 11.00am-11.15am | Environmental warming affects the metabolic expression in a soft sediment bivalve<br>*Orlando Lam-Gordillo, NIWA* | Biologging reveals sub-surface behaviours of Hector's dolphins potentially increasing their risk of bycatch<br>*Rochelle Constantine, The University of Auckland* |
| 11.15am-11.30am | Fishing and Warming Drive Opposing Trends in Densities of Two Spiny Lobster Species on Northern New Zealand Reefs<br>*Benn Hanns, The University of Auckland* | Monitoring Mangō: Community based marine monitoring<br>*Rob Lewis, University of Otago* |
| 11.30am-11.45am | Short-term sublethal heat stress impairs growth of the New Zealand cockle, *Austrovenus stutchburyi*<br>*Mira Stenman, The University of Waikato* | New Zealand southern right whales – the past, the present, and the future<br>*Leena Riekkola, The University of Auckland* |
| 11.45am - 1.00pm | Lunch Break + ECR & Student Networking | |

| Location | Awatere/Wairau | Te Hoiere |
|---|---|---|
| Session Chair | Rob Major | Harry Allard |
| **Session 2** | **Restorative Aquaculture**<br>**Session Sponsor: The Nature Conservancy** | **Climate Change** |
| 1.00pm-1.15pm | Applying the principles of restorative aquaculture in Aotearoa New Zealand<br>*Rob Major, The Nature Conservancy* | 21st Century Climate Change Implications for Physics, Biogeochemistry and Fisheries for New Zealand's Marine Environment<br>*Graham Rickard, Victoria University Wellington, te herenga waka* |
| 1.15pm-1.30pm | Flexing Their Mussels: Snapper Thrive in Shellfish Farm Habitats<br>*Ash Heaphy, The University of Auckland* | Advancing mCDR governance and science: The role of global scientific collaboration<br>*Linn Hoffmann, University of Otago* |
| 1.30pm-1.45pm | Has a decade of mussel farming helped restore degraded soft sediment habitats?<br>*Al Alder, Cawthron Institute* | How climate change will impact internal wave mixing around New Zealand – The I-Mix project<br>*Erik Behrens, NIWA* |
| 1.45pm-2.00pm | Not too late for Tio: recent research informing aquaculture and restoration of the native flat oyster *Ostrea chilensis* in New Zealand.<br>*Zoë Hilton, Cawthron Institute* | Species Distribution Models in future climate change scenarios: a management decision-support tool<br>*Melanie Hayden, NIWA* |
| 2.00pm-2.15pm | Research supporting shellfish aquaculture diversification in New Zealand: from fundamental biology to implementation considerations<br>*Jordan Elvy, Cawthron Institute* | Transforming coastal lowland systems threatened by sea-level-rise into prosperous communities<br>*Scott Stephens, NIWA* |
| 2.15pm-2.30pm | The benefits of fish feasting in mussel farms<br>*Lucy Underwood, The University of Auckland* | The effect of oil pollution and warming on anti-predator behaviour and physiology in coral reef fish<br>*Eleanor Kelly, University of Otago* |
| 2.30pm-2.45pm | Evaluating the nitrogen removal ecosystem service beneath mussel farms<br>*Drew Lohrer, NIWA* | Ngā Hua o Waita<br>*Lorraine Eade, Ngāti Rārua / Tokomaru Research Centre* |
| 2.45pm-3.00pm | Five star accommodation and room service for parore in mussel farms<br>*Andrew Jeffs, The University of Auckland* | |
| 3.00pm - 3.30pm | Afternoon Tea | |
| Location | Awatere/Wairau | Te Hoiere |
| Session Chair | Nick Shears | Scott Stephens |
| **Session 3** | **Kina and Kelp** | **Blue Carbon** |
| 3.30pm-3.45pm | Quantifying rocky reef biodiversity and barrens in Te Tauihu / Top of the South.<br>*Anna Berthelsen, Cawthron Institute* | Blue carbon stocks in Aotearoa New Zealand's coastal wetlands and prospects under rising sea levels<br>*Andrew Swales, NIWA* |
| 3.45pm-4.00pm | What Would Jasus Eat? Prey preferences of the spiny lobster (*Jasus edwardsii*) for two barren-forming sea urchin species, *Evechinus chloroticus* and *Centrostephanus rodgersii*<br>*Hayley Nessia, The University of Auckland* | Characterization of the regional and global divergence of *Macrocystis pyrifera* to better understand the role of giant kelp habitats as a blue-carbon sink<br>*Emily C Giles, Cawthron Institute* |
| 4.00pm-4.15pm | How do kina form barrens?<br>*Lily Hasshaw, The University of Auckland* | Marine protection as a tool for enhancing carbon cycle functionality in coastal soft sediment ecosystems<br>*Tegan Evans, The University of Auckland* |
| 4.15pm-4.30pm | Variable recovery of rimurimu forests across Tōtaranui-Queen Charlotte Sound following kina removal<br>*Nick Shears, The University of Auckland* | |
| 4.30pm - 6.30pm | Poster Session and Icebreaker/Welcome Function (drinks & canapes) - Exhibitor Hall | |

| | Wednesday 9 July 2025 | |
|---|---|---|
| 9.00 - 10.00am | **Panel Discussion: Marine Education across the Motu**<br>Facilitator: Al Alder | |
| 10.00am - 10.30am | Morning Tea - *kindly sponsored by the Marine Farming Association* | |
| Location | Awatere/Wairau | Te Hoiere |
| Session Chair | Katie Littlewood | Drew Lohrer |
| **Session 4** | **Restoration 1** | **Anthropogenic Impacts** |
| 10.30am-10.45am | Korikori Tuangi! The potential of cockles to enhance ecosystem functioning in degraded estuaries<br>*Natalie Prinz, The University of Waikato* | Ecological Implications of Human Induced Disasters: Evaluation of Sub-canopy responses at Astrolabe Reef/ Otāiti Post Rena Disaster<br>*Lizzie Thompson, The University of Waikato* |
| 10.45am-11.00am | Where to Settle? The Use of Substrate to Facilitate Juvenile Mussel Recruitment in Restored Green-lipped Mussel (Perna canaliculus) Beds<br>*Luke Johnston, The University of Auckland* | Freshwater inputs and desiccation regulate species replacement and rewiring processes underpinning intertidal community assembly<br>*Anthony Gillis, University of Canterbury* |
| 11.00am - 11.15am | Setting targets for ecological recovery of seagrass and other key habitats in Te Awarua-o-Porirua<br>*Rachel Parry, Greater Wellington Regional Council* | Physiological Responses of Benthic Epifauna to Organic Enrichment from Salmon Farming<br>*Rebecca McMullin, Cawthron* |
| 11.15am-11.30am | Turbid Waters Impact Shellfish Restoration<br>*Brandy Biggar, The University of Auckland* | Spatial variability of potential microplastics in an intertidal fish gut: a case study in Wellington, New Zealand<br>*Anna Resende, Victoria University of Wellington* |
| 11.30am-11.45am | Understanding germination triggers; The first steps towards improving seed-based seagrass restoration success rates in Aotearoa, New Zealand<br>*Eleanor Brettle, The University of Waikato* | Physiological Responses of Guam's Dominant Shallow-Water Corals to Nutrient Enrichment<br>*Ciemon Caballes, University Of Guam* |
| 11.45 - 1.00pm | Lunch + NZMSS AGM (Te Hoiere room) | |
| Location | Awatere/Wairau | Te Hoiere |
| Session Chair: | Flavio F. Ribeiro | Anna Madarasz-Smith |
| **Session 5** | **Aquaculture and Fisheries in a changing world**<br>**Session sponsor: Plant and Food Research** | **Soft Sediment Systems** |
| 1.00pm-1.15pm | Shellfish carbonate in sediments: assessing historical baselines, dissolution dynamics, and carbon storage beneath shellfish farms, Marlborough, New Zealand<br>*Sean Handley, NIWA* | Climate-related drivers of estuarine macrobenthic functional redundancy and resilience<br>*Drew Lohrer, NIWA* |
| 1.15pm-1.30pm | Fast-tracking finfish climate change adaptation<br>*Leteisha Prescott, Cawthron Insititute* | Aotearoa New Zealand's marine carbon cycle in a changing climate – current understanding and future directions<br>*Scott Nodder, NIWA* |
| 1.30pm-1.45pm | Developing mararī/butterfish (*Odax pullus* ) aquaculture: an herbivorous marine fish species with potential for aquaculture diversification in Aotearoa/New Zealand<br>*Flavio F. Ribeiro, The New Zealand Institute for Plant and Food Research* | National Benthic Health Models: a tool for estuary health assessment in Aotearoa<br>*Dana Clark, Cawthron Institute* |

| Location | Awatere/Wairau | Te Hoiere |
|---|---|---|
| Session Chair: | Flavio F. Ribeiro | Anna Madarasz-Smith |
| **Session 5 (cont'd)** | **Aquaculture and Fisheries in a changing world**<br>**Session sponsor: Plant and Food Research** | **Soft Sediment Systems** |
| 1.45pm-2.00pm | New Open Ocean Ecosystems: a multidisciplinary programme to explore novel biofouling management strategies for open ocean aquaculture.<br>*Peter Bell, The New Zealand Institute for Plant and Food Research* | Environmental drivers of *Atrina Zelandica* habitat suitability in Tauranga Harbour<br>*Brooke Ellis-Smith, The University of Waikato* |
| 2.00pm-2.15pm | Pilchards to pellets: The role of diet format and digestive performance of juvenile tāmure/Australasian snapper (*Chrysophrys auratus* )<br>*Erin Bell, The New Zealand Institute for Plant and Food Research* | Modelling spatial distribution of estuarine ecosystem function using a bathymetrically-informed Bayesian Network<br>*Grady Petersen, NIWA* |
| 2.15pm-2.30pm | Breaking BaD: cutting marine aquaculture pest and pathogen connections in coastal aquaculture<br>*Ben Knight, Cawthron Institute* | Organic and inorganic carbon stocks and potential vulnerability in marine sediments around Aotearoa NZ<br>*Scott Nodder, NIWA* |
| 2.30pm-2.45pm | Size-specific reduction in kelp consumption by kina exposed to lobster and blue cod predator cues<br>*Joseph Curtis, University of Otago* | Determining the relative contributions of Hawkes Bay Rivers to marine sedimentation following Cyclone Gabrielle<br>*Melanie Hayden, NIWA* |
| 2.45pm-3.00pm | An ecosystem approach in the Hauraki Gulf via fisheries plans: how far have we come?<br>*Martin Cryer, Hauraki Gulf Fisheries Plan Advisory Group* | Shell shocked: Anthropogenic stressors and their impact on the health of a key estuarine bivalve (*Austrovenus stutchburyi* )<br>*Lolita Rynkowski, The University of Waikato* |
| 3.00pm-3.30pm | Afternoon Tea | |
| Location | Awatere/Wairau | Te Hoiere |
| Session Chair | Sean Handley | Glenis Paul |
| **Session 6** | **Biosecurity** | **Virtual Reality (VR) Marine Experience** |
| 3.30pm-3.45pm | Development of a Submersible Dredge Planer (SDP) for large-scale and effective removal of exotic Caulerpa in Aotearoa New Zealand<br>*Derek Richards, Northland Regional Council* | |
| 3.45pm-4.00pm | Preparing for the rising tide of aquatic invasive species.<br>*Tim Riding, Biosecurity New Zealand* | |
| 4.00pm-4.15pm | Surveillance of *Sabella spallanzanii* using the Boxfish remote operated vehicle<br>*Oonagh Daly, Environment Canterbury* | **VR Marine Experience** - explore & connect to Aotearoa's diverse marine environments using VR technology.<br>*sign up for one of the 25 min sessions at the registration desk. Limited spaces available so be sure to sign up on arrival at conference .* |
| 4.15pm-4.30pm | Policy, management, and the 'Level of Fouling' scale to transform marine invasion risk reduction from recreational boats<br>*Kathy Walls, MPI* | |
| 4.30pm-4.45pm | In hot water - the potential for thermal treatment for controlling the highly invasive seaweed *Caulerpa brachypus* in New Zealand.<br>*Michele Rogalin Henderson, The University of Auckland* | |
| 4.45pm-5.00pm | Aquaculture Leading the Way in Marine Biosecurity: A National Perspective<br>*Dave Taylor - Aquaculture New Zealand* | |
| from 5.30pm | Free Evening - no scheduled events | |

| | Thursday 10 July 2025 | |
|---|---|---|
| 9.00am-10.00am | **Keynote Speakers**<br>**Dan Hikuroa,** Waipapa Taumata Rau \| University of Auckland - ***kindly sponsored by the NZ National Commission for UNESCO***<br>**Abby Smith,** Ōtākou Whakaihu Waka \| University of Otago<br>Chair: Emilee Benjamin | |
| 10.00am - 10.30am | Morning Tea - *kindly sponsored by Salt Ecology* | |
| Location | Awatere/Wairau | Te Hoiere |
| Session Chair | Silke Bieda | Katie Littlewood |
| **Session 7** | **Aotearoa and the UN Ocean Decade** | **Restoration 2** |
| 10.30am-10.45am | Halfway point: the UN Decade of Ocean Science and Kāhui Manaaki Tangaroa – the New Zealand National Decade Committee<br>*Dan Hikuroa, New Zealand National Commission for UNESCO* | Revitalising the Gulf: a guidance framework for marine habitat restoration in the Hauraki Gulf / Tīkapa Moana / Te Moananui ā Toi<br>*Al Alder, Cawthron Institute* |
| 10.45am-11.00am | Bringing the world to Aotearoa and taking Aotearoa to the world: Takeaways from the UN Ocean Conference in Nice, June 2025<br>*Anna Campbell, Yellow Eyed Penguin Trust* | Building for Biodiversity: The Role of Ecology in Seawall Design<br>*Jesse Burns, EOS Ecology* |
| 11.00am - 11.15am | Te Tautiaki Hoiho – Yellow-eyed Penguin Trust: Our Coastal Response to the Plight of Hoiho<br>*Anna Campbell, Yellow Eyed Penguin Trust* | Site and seasonal influence on transplantation success of adult seagrass<br>*Dan Crossett, Cawthron Institute* |
| 11.15am-11.30am | Should our ocean be part of the solution to Climate Change?<br>*Katherine Short, F.L.O.W. Collaborative Ltd* | Reviving the Seabed: Enriching biodiversity and habitat complexity with mussel shell material from aquaculture<br>*Emilee Benjamin, The University of Auckland* |
| 11.30am-11.45am | Advancing Ocean Literacy Through Connection, Collaboration and Recreation<br>*Patrick Burnham,*<br>*Sir Peter Blake Marine Education And Recreation Centre* | Mai i Whangamoa ki Horoirangi, mai i uta ki tai - working together for marine habitat mapping<br>*Harry Allard, Nelson City Council* |
| 11.45am - 12.00pm | The voice and rights of the ocean<br>*James Tremlett, Ocean Rights and Kinship Alliance* | Wakapuaka Co-restoration, Mai i Whangamoa ki Horoirangi, mai ki uta ki tai: A multi-agency inter-generational marine ecosystem restoration project supporting whānau values<br>*Dan Crossett, Cawthron Institute* |
| 12.00-1.00pm | Lunch + WOAA (Women of Aquaculture Aotearoa) meeting | |
| Location | Awatere/Wairau | Te Hoiere |
| Session Chair: | Al Alder | Ben Knight |
| **Session 8** | **He Tai Pari** | **Motion of the ocean** |
| 1.00pm-1.15pm | A collaboration of mātauranga Māori and western science for the monitoring of pipi (*Paphies australis* ) in Tauranga Harbour<br>*Tyla Kettle, Boffa Miskell* | Deep Water Renewal, Vertical Mixing and Oxygenation in a Temperate Fjord in Aotearoa / New Zealand<br>*Jackson Beagley, University of Otago* |
| 1.15pm-1.30pm | Working in partnership to explore seafloor habitats around Te Pātaka o Rākaihautū/Banks Peninsula<br>*Fiona Shanhun, Environment Canterbury* | Drivers of recent extreme upper-ocean warming on Campbell Plateau<br>*Cassidy Collier, University of Otago* |
| 1.30pm-1.45pm | Tiaki Moana: A Pacific Regional Dialogue on Marine Conservation and OECMs<br>*James Nikitine, Blue Cradle Foundation* | Glider Oceanography: Marine Research in Aotearoa with Autonomous Technology<br>*Alain de Verneil, NIWA* |
| 1.45pm-2.00pm | Hauraki Gulf/Tīkapa Moana Te Moananui-ā-Toi proposed marine protection monitoring — an update<br>*Emma Kearney, Department of Conservation* | Integrating Next-Generation Biophysical Models to Environmental Management of Marine Ecosystems<br>*Romain Chaput, Cawthron Institute* |

| Location | Awatere/Wairau | Te Hoiere |
|---|---|---|
| Session Chair: | Al Alder | Ben Knight |
| **Session 8 (cont'd)** | **He Tai Pari** | **Motion of the ocean** |
| 2.00pm-2.15pm | Metabarcoding and machine learning provide complementarity for biofouling community monitoring on open ocean aquaculture structures in Tasman Bay and Pelorus Sound | Population genetics and connectivity of a high-dispersal larvae marine invertebrate, the New Zealand Sand Dollar *Fellaster zelandiae* |
| | *Tian Tian, Plant and Food Research* | *Ian Dixon-Anderson, University of Otago* |
| 2.15pm-2.30pm | Time to Put BOFFFF to Bed: Why We Need to Stop Talking About Big, Old, Fat, Fecund Female Fish | Remote sensing of change in Aotearoa New Zealand coasts and oceans: satellites, aerial vehicles and AI |
| | *Armagan Sabetian, Auckland University Of Technology* | *Matt Pinkerton, NIWA* |
| 2.30pm-2.45pm | | Syndiniales Distribution along the Munida Time Series Transect |
| | | *Sajini Dissanayake, University of Otago* |
| 2.45pm-3.30pm | Afternoon Tea | |
| Location | Awatere/Wairau | Te Hoiere |
| Session Chair | Erin Bell | Dan Crossett |
| **Session 9** | **Finfish Aquaculture** | **Novel monitoring methods** |
| 3.30pm-3.45pm | A twisted tail: visualising early spinal deformities to improve mararī/butterfish aquaculture | Monitoring Temperate Reef Health: Harnessing Passive Acoustics to Assess Ecological Risks in Aotearoa |
| | *Ria Rebstock, Plant And Food Research* | *Fiona Chabbey, The University of Waikato* |
| 3.45pm-4.00pm | Acoustic conditioning of tāmure (snapper, *Chrysophrys auratus* ) and araara (trevally, *Pseudocaranx dentex* ) using a pūtātara, traditional Māori wind instrument | Enhancing environmental DNA detection of Aoteoroa New Zealand longfin and shortfin eels through targeted primer design |
| | *Warren Fantham, Plant And Food Research* | *Therese Miller, The University of Auckland* |
| 4.00pm-4.15pm | Building an aquafeed ingredient business for Aotearoa | CREST (Coastal Receiving Environment Scenario Tool) for Assessing How to Improve Ecological Health of Estuaries/Harbours |
| | *Damian Moran, Plant And Food Research* | *Mike Chen, DHI, NZ* |
| 4.15pm-4.30pm | Effects of formulated diets on the growth and health performance of sub-adult butterfish (*Odax pullus* ) in captivity | Fibre-optic cable interferometry monitoring in the southwest Pacific: Application to tsunami early warning |
| | *Charlie Barker & Nicole Jerez, Plant And Food Research* | *Bill Fry, GNS Science* |
| 4.15pm-4.30pm | The use of black soldier fly larvae meal (BSFLM) produced in New Zealand as an alternative ingredient in aquafeeds | Quantifying Interdependence of Anthropogenic and Subsea Activity via Ocean Currents using Acoustic Doppler Current Profilers (ADCPs) |
| | *Leonardo Magnoni, Plant And Food Research* | *Will Reis, Sonardyne International Ltd* |
| 4.30pm-4.45pm | **Karakia Whakamutunga \| Conference Close** | |
| 6.30pm-11.30pm | **Conference Dinner - Whitehaven Room, Marlborough Events Centre** | |

# KEYNOTE SPEAKERS

# RAYMOND SMITH
## NGĀTI KUIA

Ko Parororangi te maunga
Ko Tinui te awa
Ko Raukawakawa te moana
Ko Anamahanga te whenua
Ko Matua Hautere te tangata
Ko Ngai Te Mete te whanau
Ko Ngati Kuia, Rangitane, Ngati Apa, Rongomaiwahine toku iwi
Ko Raymond Smith taku ingoa. I am father of five & grandfather to 10 mokopuna.

We have an intergenerational association with the Marlborough Sounds and I live at Anamahanga/Port Gore whanau whenua.

Since achieving a bachelor degree in Iwi Environmental Management in 2002, I have worked on environmental matters for over 20 years and have deep skills and experience in the areas of; Te Reo Maori, Tikanga, Kaitiakitanga, Traditional Maori Environmental Knowledge, Managing Maori resources, Iwi management Planning, RMA Legislation, Communication, Research, Environmental Policy, Sustainable growth.

I have been a member of many important forums and processes across Te Tauihu/Top of the South including being the current chair of the Te Tauihu Fisheries Forum and vice chair of the Te Waipounamu Fisheries Forum, representing my iwi as a Tiriti o Waitangi negotiator and being one of the founding members of the Kotahitanga mō te Taiao alliance.

## PRESENTATION: IWI PARTICIPATION IN AQUACULTURE
## TUESDAY 8 JULY

Kaitiakitanga is a Maori framework for life management that allows Maori to understand and interact with the natural world based on realms and our traditions, it empowers us to stand against unjust policy.

When Ngāti Kuia applied for consent to participate in the evolving aquaculture industry based on our cultural association the local council denied us. We collectively took the issue to the Environment Court and won, instantly the Government legislated our rights away on behalf of all New Zealand.

We have seen the increased salmon farming industry grow against public opinion, divide communities and destroy/modify pristine marine ecosystem. Kaitiakitanga is the tool that continues to enable Maori to participate in aquaculture.

# PROFESSOR KURA PAUL-BURKE

## MARINE SCIENCE AND AQUACULTURE
## UNIVERSITY OF WAIKATO TE WHARE WĀNANGA O WAIKATO

Professor Kura Paul-Burke (Ngāti Awa, Ngāti Whakahemo, Ngāti Mākino, Ngāti Pūkeko, Irish) is a Māori marine ecologist with extensive pragmatic and successful experience combining mātauranga Māori (Māori knowledge) and marine science to assist kaitiakitanga (restoration, monitoring, management) priorities for marine taonga species and spaces with coastal hapū and iwi.

## PRESENTATION: IWI PARTICIPATION IN AQUACULTURE
## TUESDAY 8 JULY

This presentation provides an overview of a first of its kind mātauranga Māori and marine restoration project called Pou rāhui, pou tikanga, pou oranga: reigniting the mauri of Tīkapa Moana/ Te Moananui-a-Toi (Hauraki Gulf).

# DAN HIKUROA

## ASSOCIATE PROFESSOR MĀORI STUDIES

## WAIPAPA TAUMATA RAU-UNIVERSITY OF AUCKLAND

Dan Hikuroa (Ngāti Maniapoto, Ngaati Whanaunga, Ngāti Mahuta, Pākehā) is a father, surfer, paddle-boarder, gardener, loves the taiao and is an Associate Professor in Māori Studies, Waipapa Taumata Rau-University of Auckland.

Dan is an established world expert on weaving indigenous knowledge and science to realise the dreams of the communities he works with. Dan has been spearheading alternative ways of undertaking development and assessing sustainability, including braiding indigenous knowledge and epistemologies with science and into policies, assessment frameworks and decision-support tools.

Dan is UNESCO New Zealand Commissioner for Culture, member of Pou Herenga, Māori Advisory to the Climate advises national and regional government, communities and philanthropic trusts and is a member of several significant international research teams. He is member of Ngā Ara Whetū, Te Pūtahi o Pūtaiao and Te Ao Mārama, Research Centres at Waipapa Taumata Rau -University of Auckland.

## PRESENTATION: THINK LIKE A FISH - AN OCEAN-CENTRIC VISION

## THURSDAY 10 JULY

Novel governance experiments in Aotearoa New Zealand are transforming public, government and scientific understandings of rivers and mountains as being. Initiatives driven by Māori have created spaces for thinking about rivers and mountains differently, valuing them as holistic, historical and cultural entities with lives and rights of their own. These build upon relational understandings of rivers and mountains as entities that are more ancient and powerful than people, viewing rivers as the lifeblood of society and the land. Within those relational ways of knowing and being, rivers and mountains can simultaneously be an ancient kin, a revered elder, and a living entity.

As Māori perspectives conceptualize humans as part of living systems within innate relationships between people and rivers, land, forests and seas they offer prospect to reframe natural resource ownership, governance and management.

And more broadly in the ocean space, for many this is a reality – the physical ocean Te Moana Nui a Kiwa – the great ocean of Kiwa (masculine), with hoa rangatira (chiefly partner) Hinemoana (feminine) – the personification of the ocean.

In this talk I will explore the ideas laid out above, rising with the tide – he tai pari.

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Te Kōmihana Matua o Aotearoa

# PROFESSOR ABBY SMITH

## MARINE SCIENCE | TE TARI PŪTAIO TAIMOANA
## UNIVERSITY OF OTAGO | ŌTĀKOU WHAKAIHU WAKA

Abby Smith comes from New England in USA, where she grew up on the coast of Maine. Wading and poking around in tidepools sent her down a marine track early on. She majored in Biology and Geology (1982) at Colby College, Waterville, Maine, spending a semester at the Bermuda Biological Station, where she developed a great fondness for marine calcareous algae. She studied for a Master's degree in "Earth, Atmospheric and Planetary Sciences" in the joint programme at Woods Hole and MIT (1984). While she was there she made friends with some kiwis, one of whom she married. Later, they moved to Hamilton New Zealand, where Abby completed her DPhil at Waikato in 1991, just in time to shift to Dunedin, as her husband had taken up a lectureship in Zoology at Otago. She lectured and researched in the Department of Marine Science at the University of Otago for 33 years, and retired in May 2025. Alongside her work at the University, she served on the Ministerial Advisory Committee on Oceans Policy and chaired the Otago Conservation Board for several years, as well as having been the Treasurer of the International Bryozoology Association for more than two decades. Active in the New Zealand Marine Sciences Society, she was also the inaugural council chair of the New Zealand Ocean Acidification Community. Though she is still busy and productive, she has never let her scientific career get in the way of her other hobbies: knitting, making jam, and enjoying cricket.

## HISTORY AND EVOLUTION OF OPERATIONAL HYDROLOGY IN NEW ZEALAND
## THURSDAY 10 JULY

There are a variety of controls and influences on biomineralization in the marine environment. Phylogeny and evolution provide the blueprints, but the eventual result is affected by environment, ecology, growth, and development. Biomineralisation is common among invertebrates, who usually produce shells of calcium carbonate. $CaCO^3$ is unusual among carbonates in having numerous polymorphs, at least two of which are commonly precipitated by organisms. Since the 1950s we have been able to distinguish two calcium carbonate minerals (aragonite and calcite), and determine the level of Mg substitution in calcite, using x-ray diffractometry. The result is that we are able to place shells, species and higher taxa into different parts of biomineral space. Unexpectedly, the most diverse and most well-studied invertebrate phylum, in terms of mineralogy, are the bryozoans. This minor phylum of fairly simple colonial invertebrates creates complex and beautiful skeletal structures ranging from all aragonite or all calcite to mixtures of the two and/or mixtures of calcite with Mg contents. Over 50 species of bryozoans are bimineral, displaying at least three different modes: mostly aragonite, mostly calcite, and bi-calcific. These organisms expend a great deal of their energy on calcification, and marine calcifiers are important as ecosystem engineers, sediment-formers, and agents of change in the carbon cycle. As human activity alters aspects of carbon-cycling, marine calcifiers and marine carbonates are responding with less production, altered production, altered composition, and/or changes in energy budgets. While decades of research have provided a considerable inventory of marine invertebrate skeletal carbonate composition, we are still unable to place these data in a wider context. Information gaps include calcification mechanisms in many phyla, structural features that make shells disproportionately strong, and the various controls and influences on calcification, mineralogy, and dissolution.

Thank you for the NZMSS Award, and for 35 years enjoying marine science in Aotearoa.

# DISCUSSION PANEL

## MARINE EDUCATION ACROSS THE MOTU

### WEDNESDAY 9 JULY

The panel will be made up of a facilatator and panellists who work across the Education Sector. They will be discussing developments in Marine Education.

## AL ALDER - PANEL FACILITATOR

MARINE ECOLOGIST
CAWTHRON INSTITUTE

Al is a marine ecologist with the Cawthron Institute's Restoration Ecology Team, specialising in coastal and marine ecosystem restoration. Driven by a commitment to inform and engage communities, Al enjoys connecting science with people - much like the marine educators on this panel. Al is excited to guide this conversation to highlight the vital importance of marine education in our rapidly changing world.

## GLENIS PAUL

PROFESSIONAL PRACTICE FELLOW
NZ MARINE STUDIES CENTRE WHAKATŪ | NELSON
DEPT OF MARINE SCIENCE | UNIVERSITY OF OTAGO

Glenis has been teaching science in Aotearoa New Zealand and internationally for over 25 years.

She now delivers New Zealand Marine Studies Centre education programmes for Year 0 -13 ākonga across Te Tauihu o Te Waka-a-Māui. Glenis enjoys facilitating opportunities for people to make a connection with where they live, encourage their curiosity to ask questions, develop skills to critically analyse their world and be inspired to care for the whenua, rivers, estuaries, beaches and moana.

# TIM HAGGITT, PH.D

## MARINE ECOLOGIST

## UNIVERSITY OF AUCKLAND'S TE HĀWERE-A-MAKI/ GOAT ISLAND MARINE DISCOVERY CENTRE (GIMDC)

Tim is a marine ecologist and educator based at the University of Auckland's Te Hāwere-a-Maki/ Goat Island Marine Discovery Centre (GIMDC). He has a PhD in marine and environmental science and has spent much of the last quarter of a century above, below, and around the moana. His academic research focus has been based on rocky reef ecosystems, particularly kelp forests ecology and surveying key indicator species such as kōura (red rock lobster). He also has decades of technical experience, having established his own environmental consultancy in 1998.

Over the past seven years, Tim has shifted focus, channelling his passion for increasing ocean literacy in Aotearoa New Zealand as the manager of the GIMDC. To date the educational programmes run through the Centre have impacted over 30,000 students from across the country and around the world. When he is not in the GIMDC inspiring the next wave of marine scientists or out in the field, you can find him surfing, skateboarding, baking egg pies, making kelp fertiliser and growing hibiscus.

# GIANNA SAVOIE, PH.D

## OCEAN MEDIA INSTITUTE

Dr. Gianna Savoie is an award-winning documentary producer, writer, professor and National Geographic Explorer with two decades of experience in Science and Natural History filmmaking and a penchant for powerful storytelling that has led her to sink her teeth into some of the most critical conservation issues on the planet. Her Emmy-nominated work has been featured on National Geographic, PBS, NATURE, Discovery, and the BBC, as well as in theatrical documentaries and in print and web publications.

In 2015, Gianna founded the Ocean Media Institute, a non-profit global media collective that engages the public in ocean science and conservation through innovative, inclusive media and artistic approaches to ocean literacy. And in her quest to "pay it forward" and inspire the next generation of environmental storytellers, she teaches and mentors emerging filmmakers and science communicators.

# ROB LEWIS

## TEACHING FELLOW, ŌTĀKOU WHAKAIHU WAKA/UNIVERSITY OF OTAGO NEW ZEALAND MARINE STUDIES CENTRE

Rob Lewis is based at the New Zealand Marine Studies Centre as a teaching fellow and coordinator for various participatory science projects. His academic interests focus on the population dynamics and conservation of sharks, skates, and rays. His original foray into science education, community participation, and ocean literacy began in 2010 as part of his research where he recognised the importance of community understanding in achieving conservation objectives. Since then Rob has worked in multiple spaces of ocean literacy including private research, eco-tourism, and participatory science. His recent projects include the Shark Spy and Seasons of the Sea (plankton analysis project), as well as helping with the Yachting New Zealand's Moanamana project.

# VR MARINE EXPERIENCE

## WED 9 JULY | 3.30PM / 4.00PM / 4.30PM
## TE HOIERE

Glenis Paul, from the NZ Marine Studies Centre in Whakatū | Nelson, and a panellist from our 'Marine Education across the Motu' discussion panel, is leading some VR sessions on Wednesday afternoon. There are PICO VR headsets provided and Glenis will lead each group through a session, giving you an unforgettable marine experience.

Each session lasts 30 mins and there are 3 session times available.
Please note there are limited spaces for each session so please sign up at the registration desk to secure your place.

The kaupapa of this workshop is to showcase how inclusive VR can be as a tool to allow everyone the chance to experience being immersed in our moana and rivers, and therefore deepen their connection to their local environments.

** Please note that not all parts of the workshop may be suitable for those who experience photosensitivity or epilepsy.*

# POSTER LIST

## POSTER SESSION

| Paper No. | First Name | Last Name | Poster Title |
|---|---|---|---|
| 1 | Alain | de Verneil | Transport and mixing of energy and material in Cook Strait/Te Moana o Raukawa |
| 2 | Louis | Olsen | Deep-Sea biodiversity in the western Pacific Ocean: implications for managing human activities. |
| 3 | Sharon | De Luca | Marine Ecological Valuation Guidelines |
| 4 | Logan | Kallam | Do ray (whai repo) perturbations influence intertidal seagrass patch dynamics and resilience? |
| 5 | Mollie | Rickwood | Understanding the contribution of temperate mesophotic ecosystems to fish production |
| 6 | Paul | Wolf | Counting What Counts: How Inconsistent Taxonomic Resolution Skews Benthic Bioindicator Data |
| 7 | Paul | Wolf | Sex, Settlement, and Sessility: Adaptive Pathways in Marine Invertebrate Life Histories |
| 8 | Jordan | Elvy | Thermal Resilience of the Green-lipped Mussel Perna canaliculus is influenced by Parental Origin and Offspring Age |
| 9 | Holly | Adams | Increasing complexities in habitats draws in more marine life |
| 10 | Leteisha | Prescott | Fit Fish, Strong Hearts: Mitochondrial function underpins exercise-enhanced thermal tolerance |
| 11 | Benjamin | Shirey | Sorting strawberry squid: A systematic and ecological review the deep-sea squid family *Histioteuthidae* (Verrill, 1881) |
| 12 | Connor | Wallace | Consquidering Populations: Evaluating Population Connectivity in Aotearoa New Zealand's Arrow Squids, *Nototodarus sloanii* and *N. gouldi* (family *Ommastrephidae)* |
| 13 | Laura | Read | Filling the Gaps: Mapping Marine Habitats with Divers, Aerial Imagery, and Algorithms |
| 14 | Ben | Knight | Towards cost-effective spectral sensing of phytoplankton |
| 15 | Matt | Pinkerton | Zooplankton and microplastic in the Southern Ocean: Continuous Plankton Recorder sampling to 2023 with special focus on the Ross Sea sector |
| 16 | Tommaso | Alestra | Fabrication and trial of artificial rock pools at Lyttelton Port Company: a cost-effective approach for small-scale eco-engineering |
| 17 | Samuel | Clough | New investigations suggest ontogenetic diet and habitat change in the Angolan flying squid *(Todarodes angolensis)* |
| 18 | Kat | Cooper | An investigation into the diet of Elephant fish *(Callorhinchus milii)* in Aotearoa/New Zealand |
| 19 | Morgan | Puklowski | Feeding in Focus: A Behavioural and Machine Learning Approach to Larval Fish Nutrition Research |
| 20 | Samuel | Vander Velpen | AI-driven tool for invasive species data search and integration |

# ATTENDEE LIST

| First Name | Last Name | Organization |
|---|---|---|
| Al | Alder | *Cawthron Institute* |
| Tommaso | Alestra | *Boffa Miskell Ltd* |
| Harry | Allard | *Nelson City Council* |
| Rebekah | Anderson | *Port Marlborough* |
| Bronwyn | Bain | *South Otago Forest and Bird* |
| Charlie | Barker | *Plant And Food Research* |
| Paul | Barter | *Cawthron Institute* |
| Jackson | Beagley | *University Of Otago* |
| Erik | Behrens | *NIWA* |
| Erin | Bell | *Plant And Food Research* |
| Peter | Bell | *Plant And Food Research* |
| Emilee | Benjamin | *The University of Auckland* |
| Anna | Berthelsen | *Cawthron Institute Institute* |
| Silke | Bieda | *New Zealand National Commission for UNESCO* |
| Brandy | Biggar | *University Of Auckland* |
| Eleanor | Brettle | *University of Waikato* |
| Vera | Bronza | *Boxfish Robotics* |
| Joe | Burke | *University Of Waikato* |
| Patrick | Burnham | *Sir Peter Blake Marine Education And Recreation Centre* |
| Jesse | Burns | *Eos Ecology* |
| Melanie | Burns | *Environment Canterbury* |
| Ciemon | Caballes | *University Of Guam - Marine Laboratory* |
| Anna | Campbell | *Yellow Eyed Penguin Trust* |
| Fiona | Chabbey | *University Of Waikato* |
| Romain | Chaput | *Cawthron Institute* |
| Mike | Chen | *DHI, NZ* |
| Dana | Clark | *Cawthron Institute* |
| Samuel | Clough | *Auckland University Of Technology* |
| Cassidy | Collier | *University Of Otago* |
| Rochelle | Constantine | *University Of Auckland* |
| Kat | Cooper | *Victoria University Of Wellington* |
| Dan | Crossett | *Cawthron Institute* |
| Martin | Cryer | *Hauraki Gulf Fisheries Plan Advisory Group* |
| Joseph | Curtis | *University Of Otago* |
| Oonagh | Daly | *Environment Canterbury* |
| Quentin | Davies | *Gascoigne Wicks Lawyers* |
| Sharon | De Luca | *Boffa Miskell Ltd* |
| Alain | De Verneil | *Niwa* |
| Sajini | Dissanayake | *University Of Otago* |

| | | |
|---|---|---|
| Karen | Douglas | *SLR Consulting* |
| Robyn | Dunmore | *SLR Consulting* |
| Lorraine | Eade | *Ngāti Rarua* |
| Debbie | Early | *Lincoln University* |
| Brooke | Ellis-Smith | *University Of Waikato* |
| Jordan | Elvy | *Cawthron Institute* |
| Tegan | Evans | *The University Of Auckland* |
| Warren | Fantham | *Plant And Food Research* |
| Laura | Fayerman | *Salt Labs* |
| Jessica | Feickert | *SLR Consulting* |
| Ashley | Flood | *Boffa Miskell* |
| Rich | Ford | *Fisheries New Zealand* |
| Bill | Fry | *GNS Science* |
| Jane | Gardiner | *Sustainable HB* |
| Suzanne | Garrett | *Imbros* |
| Emily | Giles | *Cawthron Institute* |
| Anthony 'AJ' | Gillis | *University Of Canterbury* |
| Tim | Haggitt | *University of Auckland* |
| Sean | Handley | *NIWA* |
| Benn | Hanns | *University Of Auckland* |
| Lily | Hasshaw | *University of Auckland* |
| Melanie | Hayden | *NIWA* |
| Ash | Heaphy | *University Of Auckland* |
| Nick | Hempston | *EOS Ecology* |
| Bob | Hickman | *Retired* |
| Dan | Hikuroa | *University of Auckland* |
| Jenny | Hillman | *University Of Auckland* |
| Zoe | Hilton | *Cawthron Institute* |
| Linn | Hoffmann | *University Of Otago* |
| Andrew | Jeffs | *The University of Auckland* |
| Nicole | Jerez | *Plant & Food Research* |
| Luke | Johnston | *University of Auckland* |
| Eric | Jorgensen | *Ocean Bay Farm* |
| Logan | Kallam | *University Of Waikato* |
| Emma | Kearney | *Department Of Conservation* |
| Eleanor | Kelly | *University of Otago* |
| Tyla | Kettle | *Boffa Miskell* |
| Ben | Knight | *Cawthron Institute* |
| Danielle | Kruger | *Waikato Regional Council / Top of the North Marine Biosecurity Partnership* |
| Orlando | Lam-Gordillo | *NIWA* |
| Hamish | Lass | *Bay of Plenty Regional Council* |
| Kaeden | Leonard | *Northland Regional Council* |
| Rob | Lewis | *University Of Otago* |
| Katie | Littlewood | *Marlborough District Council* |

| | | |
|---|---|---|
| Drew | Lohrer | *NIWA* |
| Anna | Madarasz-Smith | *PDP* |
| Leonardo | Magnoni | *Plant & Food Research* |
| Rob | Major | *The Nature Conservancy* |
| Rebecca | McMullin | *Cawthron Institute* |
| Alice | McNatty | *Hawke's Bay Regional Council* |
| Hannah | Mello | *Fisheries New Zealand* |
| Lisa | Miller | *University Of Otago* |
| Therese | Miller | *Cawthron Institute* |
| Damian | Moran | *NZ Institute for Plant & Food Research Limited* |
| Hazel | Needham | *University Of Waikato* |
| Hayley | Nessia | *Institute of Marine Science, University of Auckland/Envirostrat Ltd.* |
| Monica | Nevill-Jackson | *Northland Regional Council* |
| James | Nikitine | *Blue Cradle Foundation* |
| Scott | Nodder | *NIWA Taihoro Nukurangi* |
| Megan | Oliver | *Greater Wellington Regional Council* |
| Louis | Olsen | *NIWA* |
| Rachel | Parry | *GWRC* |
| Kura | Paul Burke | *Univiersity of Waikato* |
| Glenis | Paul | *University of Otago* |
| Grady | Petersen | *NIWA* |
| Dave | Pickering | *Waikato Regional Council* |
| Matt | Pinkerton | *NIWA* |
| Leteisha | Prescott | *Cawthron Institute* |
| Romany | Prevette-Stanaway | *Bay Of Plenty Regional Council* |
| Natalie | Prinz | *University of Waikato Tauranga* |
| Morgan | Puklowski | *Plant & Food Research* |
| Alex | Radley | *Kelp Helpers* |
| Laura | Read | *EnviroStrat* |
| Ria | Rebstock | *The New Zealand Institute for Plant and Food Research Limited* |
| Chris | Redhead | - |
| Will | Reis | *Sonardyne International* |
| Anna | Resende | *Victoria Wellington University* |
| Flavio F. | Ribeiro | *The New Zealand Institute for Plant and Food Research* |
| Derek | Richards | *Northland Regional Council* |
| Mollie | Rickwood | *Victoria University Of Wellington* |
| Tim | Riding | *Biosecurity New Zealand* |
| Leena | Riekkola | *University of Auckland* |
| Michele | Rogalin-Henderson | *University Of Auckland* |
| Lolita | Rynkowski | *University Of Waikato* |
| Armagan | Sabetian | *Auckland University Of Technology* |
| Gianna | Savoie | *Ocean Media Institute* |
| Becky | Shanahan | *PDP* |
| Fiona | Shanhun | *Environment Canterbury* |

| | | |
|---|---|---|
| Nick | Shears | *University of Auckland* |
| Benjamin | Shirey | *Aut Lab For Cephalopod Ecology & Systematics* |
| Katherine | Short | *F.l.o.w. Collaborative Ltd* |
| Apanui | Skipper | *University Of Waikato* |
| Herearoha | Skipper | *University Of Waikato* |
| Abby | Smith | *University of Otago* |
| Raymond | Smith | *Ngati Kuia* |
| Mira | Stenman | *University Of Waikato* |
| Scott | Stephens | *NIWA* |
| Leigh | Stevens | *Salt Ecology/University of Waikato* |
| Hugo | Sundberg | *Cawthron Institute* |
| Andrew | Swales | *NIWA* |
| Sam | Thomas | *Otago Regional Council* |
| Lizzie | Thompson | *University Of Waikato* |
| Tessa | Thomson | *NIWA* |
| Tian | Tian | *Plant & Food Research* |
| Michael | Townsend | *Waikato Regional Council* |
| James | Tremlett | *Ocean Rights And Kinship Alliance* |
| Karen | Tunley | *Fisheries New Zealand* |
| Lucy | Underwood | *The University of Auckland* |
| Samuel | Vander Velpen | *Sequench* |
| Oliver | Wade | *Marlborough District Council* |
| Kathy | Walls | *Biosecurity New Zealand* |
| Maren | Wellenreuther | *The New Zealand Institute For Plant And Food Research Limited* |
| Zoe | White | *Canterbury Regional Council* |
| Hannah | Williams | *Northland Regional Council* |
| Pete | Wilson | *SLR Consulting* |
| Paul | Wolf | *Ocean Wolf* |
| Nelli | Zaiko | *Sequench* |

**attendee list (excluding privacy requests) as at 19 June*

# ORAL ABSTRACTS

## SESSION 1: MARINE HEATWAVES AND TEMPERATURE STRESS
**Awatere/Wairau**

# Environmental warming affects the metabolic expression in a soft sediment bivalve

**Orlando Lam-Gordillo**[1], Emily Douglas[1], Sarah Hailes[1], Vonda Cummings[1], Andrew Lohrer[1]

[1]NIWA

Ocean surface temperatures and the frequency and intensity of marine heatwaves are increasing worldwide. Understanding how marine organisms respond and adapt to heat pulses and the rapidly changing climate is crucial for predicting responses of valued species and ecosystems to global warming. Here, we carried out an in -situ experiment to investigate sublethal responses to heat spikes of a functionally important intertidal bivalve, the venerid clam Austrovenus stutchburyi. We describe changes in metabolic responses under two warming scenarios (five days and seven days) at two sites (muddy and sandy). Tidal flat warming during every low tide for five days affected the expression of multiple functional metabolites within this species. The metabolic response was related to pathways such as metabolic energetics, amino acid and lipid metabolism, and accumulation of stress-related metabolites. There was some recovery after cooler weather during the final two days of the experiment. The degree of change was greater in muddy versus sandy sediments. Our findings provide new evidence of the metabolomic response of these important bivalve to heat stress, which could be used for resource managers when implementing strategies to mitigate the impacts of climate change on valuable marine resources.

# Fishing and Warming Drive Opposing Trends in Densities of Two Spiny Lobster Species on Northern New Zealand Reefs

**Benn Hanns**[1], Nick Shears

[1]University Of Auckland

Fishing and ocean warming are concurrent drivers of distributional change in marine species. Understanding the relative impact of each driver is critical for effective marine management. Long-term monitoring of north-eastern New Zealand reefs has revealed opposing trends in two spiny lobster species: the cool-water *Jasus edwardsii* and warm-water *Sagmariasus verreauxi.* Legal-sized *J. edwardsii* densities declined both inside and outside marine protected areas (MPAs) but remained consistently higher within MPAs. Sub-legal *S. verreauxi* densities significantly increased, particularly at fished sites in the outer Hauraki Gulf, suggesting *S. verreauxi's* rise may be aided by reduced competition with *J. edwardsii*. Supporting this, large-scale surveys in 2024 found sub-legal *S. verreauxi* were most abundant at inner Gulf sites where *J. edwardsii* were absent or rare. The relationship between sea surface temperature (SST) and lobster density was explored using time-lagged analyses. These models indicated thermal sensitivity in *S. verreauxi* populations in the outer Gulf, but not in the Eastern Coromandel region. Sub-legal *S. verreauxi* appeared to benefit from both immediate and lagged warm conditions, whereas SST effects on *J. edwardsii* were weaker and inconsistent. Collectively, these results suggest fishing is the primary driver of recent lobster redistributions, with warming acting as a secondary, region-specific modulator.

# Short-term sublethal heat stress impairs growth of the New Zealand cockle, *Austrovenus stutchburyi*

**Mira Stenman**[1], Hazel Needham[1], Andrew Lohrer[2], Emily Douglas[2], Joanne Ellis[4], Rebecca Galdstone-Gallagher[3], Conrad Pilditch[3]

[1]University Of Waikato, [2]NIWA, [3]University of Auckland, [4]University of Waikato: Tauranga Campus

Intertidal bivalves, integral in coupling water column and sediment processes, are adapted to temperature shifts and are therefore relatively robust to heatwaves. Although heatwaves may not cause mass mortality, they can cause subtle changes in physiology, indirectly reducing numbers and function. We explored how New Zealand cockles, *Austrovenus stutchburyi*, respond to sublethal heatwaves using a novel method combining laboratory and field experiments; exposing the cockles to heatwaves in the laboratory, dyeing them with calcein, then re-planting them into their natural habitat. Stressed cockles grew less than their control counterparts (juvenile: control = 0.37mm, heatwave = 0.25mm; adult: control = 0.11mm, heatwave = 0.08mm). Slower growth indicates that individuals spend longer being prey-sized and take longer to achieve reproductive size. Collectively, slower growth may also reduce water filtration and sediment reworking rates. This indicates that, as heatwaves become more frequent and prolonged, the ability of intertidal bivalves to maintain their functional roles could be compromised. Our findings highlight the potential for cascading effects on ecosystem functioning in the face of climate change. Continued research into the physiological and ecological impacts of sublethal heat stress will be crucial for predicting and mitigating the future consequences of climate change on intertidal environments.

## SESSION 1: CHARASMATIC CRITTERS
**Te Hoiere**

# Biologging reveals sub-surface behaviours of Hector's dolphins potentially increasing their risk of bycatch

**Rochelle Constantine**[1], Ilias Foskolos[1], Mark Johnson[1,2], Deanna Clement[3], Olga Belonovich[4], Simon Childerhouse[5], Anton van Helden[6], Darryl MacKenzie[7], Mike Ogle[6], Heloise Pavanato[3,7], Roger Williams[6]

[1]University of Auckland, [2]Aarhus University, [3]Cawthron Institute, [4]Belonovich Biology Consultants, [5]Blue Planet Marine, [6]Department of Conservation, [7]Proteus

Hector's dolphins risk bycatch in fishing gear due to fisheries overlap in coastal waters. Fishing restrictions, including Marine Mammal Sanctuaries, in inshore areas have substantially reduced bycatch in gillnets. There is little research on dolphin sub-surface habitat use and behaviour throughout most of their range which limits the understanding of the efficacy of protected areas. We tested a new approach to determine the sub-surface movements and foraging behaviour of 11 Hector's dolphins using high-resolution biologging tags. Tagged dolphins travelled well beyond the boundaries of the Cloudy Bay fishery exclusion zones, and regularly dove to the seafloor to forage at depth. During these dives, the dolphins did barrel rolls and some animals produced very few echolocation clicks while travelling close to the seafloor, potentially increasing their risk of negative interactions with fishing gear. These behaviours may make Hector's dolphins more vulnerable to bycatch than previously thought, highlighting the need to reassess the efficacy of current protection measures. We show the value of telemetry tools by collecting high-resolution, fine-scale data to rapidly inform more nuanced conservation management decisions to protect the dolphins in a changing ocean.

# Monitoring Mangō: Community based marine monitoring

**Rob Lewis**[1], Dr Sally Carson[1]

[1]University Of Otago

Monitoring Mangō is a participatory science project funded by an MBIE Unlocking Curious Minds grant and serves as a continuation to the Shark Spy project which has been coordinated by the New Zealand Marine Studies Centre since 2019. The objective of the project was to increase marine monitoring by aligning with the goals of different communities such as schools, iwi, sailing clubs, and trusts to facilitate continued use of monitoring equipment into the future. Here we present the overall outcomes of Monitoring Mangō based on scientific and educational outputs and demonstrate that project provided educational value, increased awareness, generated data to support shark conservation objectives, and allowed for incorporation of knowledge from a variety of sources. An example of how the data generated from Monitoring Mangō might be used for shark conservation objectives we assessed the accuracy of species identification from baited underwater video and public sightings data when reported on two online data platforms (Zooniverse and iNaturalist) which holds relevance to human shark interactions.

# New Zealand southern right whales – the past, the present, and the future

**Leena Riekkola**[1], Emma Carroll[1]

[1]University of Auckland

New Zealand's (NZ) southern right whales (SRWs) were once driven to the brink of extinction, and until recently, little was known about their migratory movements and foraging ground destinations beyond their winter breeding area in the sub-Antarctic Auckland Islands Maungahuka. Studying wide-ranging ocean species is notoriously challenging due to the difficulty of obtaining direct observations, however satellite telemetry offers a powerful solution. We deployed 25 satellite tags on SRWs at Auckland Islands in 2020-2022. Using movement models, we identified likely foraging behaviour from the tracking data and linked it to environmental variables to assess SRW habitat use in relation to key Southern Ocean oceanographic features. Finally, we developed habitat suitability models based on observed foraging locations and projected these into the future under two carbon emission scenarios. Contrary to expectations based on historical accounts, NZ SRWs travelled west, rather than east, to forage in waters south of Australia and they primarily foraged along the Subtropical Front, rather than in Antarctic waters. However, future projections suggested this key foraging region may become less suitable as ocean conditions change. How SRWs will respond to this emerging challenge remains unclear, highlighting the importance of continued monitoring and forecasting to support their recovery.

# SESSION 2: RESTORATIVE AQUACULTURE SESSION

**Awatere / Wairau**

*SESSION SPONSOR: THE NATURE CONSERVANCY*

## Applying the principles of restorative aquaculture in Aotearoa New Zealand

Heidi Alleway[1], **Rob Major**[1]

[1]The Nature Conservancy

Restorative aquaculture presents a unique opportunity to align food production with ecosystem regeneration. In Aotearoa New Zealand, The Nature Conservancy is working to developing a locally grounded framework to apply restorative aquaculture principles—focusing initially on shellfish farming. This work draws on TNCs global restorative aquaculture monitoring framework to assess ecosystem services such as water filtration, biodiversity enhancement, and habitat provision.
This presentation outlines our approach towards the development of a national framework that combines ecological science, Indigenous knowledge, and practical industry insights to support resilient marine ecosystems and sustainable coastal communities. Additionally, it will provide context for the session by outlining the foundational science and frameworks that underpin our collective efforts to advance restorative aquaculture in Aotearoa. It will set the stage for subsequent presentations by highlighting the rationale for a national approach, the opportunities for innovation, and the importance of collaboration to achieving the potential conservation outcomes through aquaculture.

## Flexing Their Mussels: Snapper Thrive in Shellfish Farm Habitats

**Ash Heaphy**[1], Darren Parsons[1 2], Andrew Jeffs[1]

[1]University Of Auckland, [2]National Institute for Water and Atmospheric research (NIWA)

Coastal shellfish farms may hold restorative potential by supporting higher abundances of certain fish species and improving their nutritional condition through enriched feeding opportunities. However, it remains uncertain whether these benefits translate into meaningful long-term effects, such as enhanced growth. This study examined whether Australasian snapper, (*Chrysophrys auratus*), grow faster when living within mussel farms in northern New Zealand compared to adjacent natural habitats. Otolith increments from 300 fish were measured and used to construct a growth model which showed that snapper within mussel farms have significantly greater growth at each year of life than those caught a minimum of 500m away from the farms. Furthermore, cohort variability in snapper growth indicates that the overall growth of snapper has been steadily declining over the past three decades. However, the environmental conditions which are suspected to be responsible for declining growth, such as density dependent effects and reduced food supplies, appear to be ameliorated for snapper inhabiting mussel farms. The results of this study suggest that mussel farms are an important contributor to the growth of snapper in this region, confirming the wider potential for aquaculture habitats to be contributing to fish productivity in coastal ecosystems.

# Has a decade of mussel farming helped restore degraded soft sediment habitats?

Leigh Howarth[1], Javier Atalah[1], Fabio Weiss[1], **Al Alder[1]**

[1]Cawthron Institiute

Shellfish reefs can support high levels of biodiversity by providing food and complex habitat. However, shellfish reefs are declining globally due to a suite of human impacts. Mussel aquaculture is the largest aquaculture sector in New Zealand, and their farms continually release shells and live mussels to the seafloor. Considering the scale of the industry, there is potential that mussel farming may be promoting the development of habitats and communities similar to those that have been lost in recent decades. To investigate the restoration potential of mussel farming, we collated and analysed 13 years of benthic monitoring data from mussel farms in the Top of the South. We then conducted a functional traits analysis to compare benthic ecosystem functioning over time under mussel farms compared to reference areas. Here, we try to answer whether mussel farms can contribute to national restoration goals and how monitoring can be improved to better capture restoration effects.

# Not too late for Tio: recent research informing aquaculture and restoration of the native flat oyster *Ostrea chilensis* in New Zealand

**Zoe Hilton**[1], Guillermo Rodriguez Piccoli[2], Anne Rolton[1], Farhana Muznebin[3], Stephen C. Webb[1], Andrew Fidler[4], Javier Atalah[1], Andrew Elliot[5], Andrea Alfaro[3], Kate Huston[1,6], Nick King[1], Jonathan Gardner[2], Peter A Ritchie[2]

[1]Cawthron Institute, [2]Victoria University of Wellington, [3]Auckland University of Technology, [4]AquaGeneNZ Ltd, [5]Kono Ltd, [6]James Cook University

The native Tio/flat oyster (*Ostrea chilensis*) Bluff oyster was once plentiful throughout Aotearoa New Zealand (NZ) but due to historic overfishing, habitat loss, and disease, now exists at very low numbers. The largest remaining population supports the oldest and most iconic wild fishery in NZ in Foveaux Strait, and our research has confirmed that this population is the ancestral population from which all NZ and Chilean Tio evolved. The last remaining significant wild populations are now under increasing threat from climate change and exotic diseases. This presentation summarises our recent research assembling the first annotated reference genome for *Ostrea chilensis*, comparing genomic variation within and across populations (Foveaux Strait, Chatham Islands and Manukau Harbour), and describing for the first time detailed disease progression and apparent variation in susceptibility in the novel *Bonamia ostreae-O. chilensis* host-parasite system, along with reductions in parasite prevalence and intensity associated with changes in farm husbandry. This work paves the way for effective selective breeding for disease resistance. Combined with appropriate husbandry, genetic management and site-selection, this may enable the reestablishment and growth of both aquaculture and wild populations of *O. chilensis*, protecting this species for generations to come.

# Research supporting shellfish aquaculture diversification in New Zealand: from fundamental biology to implementation considerations

**Jordan Elvy**[1]

[1]Cawthron

The New Zealand shellfish aquaculture industry is currently dominated by the green-lipped mussel (*Perna canaliculus*) and the Pacific oyster (*Crassostrea gigas*). The Cawthron Institute hosts the national Shellfish Aquaculture Research Platform (ShARP), which has a mandate to conduct collaborative research to support the growth and protection of this industry, while simultaneously enabling the emergence of other species to diversify the shellfish aquaculture portfolio in New Zealand. A diverse set of biological, technical, environmental, cultural, and strategic criteria have helped to identify and prioritise species considered within the ShARP. Each candidate species is evaluated independently, identifying knowledge gaps and opportunities, defining the research to be performed for each species. The scope of the research ranges from fundamental understanding of the species' biology and behaviour (e.g., ribbed mussels, *Aulacomya maoriana*), development of hatchery and farming technologies (e.g., geoducks, *Panopea zelandica*), environmental interactions (e.g., abalone, *Haliotis iris*), disease management and population connectivity (e.g., flat oysters, *Ostrea chilensis*), and farming and restoration considerations (e.g., scallops, *Pecten novaezelandiae*, and surf clams, *Paphies spp.*). The pathway to implementation is also species-specific, with some being relevant at the community level (customary Māori 'ocean gardening' restoration initiatives, small scale aquaculture), while others will either support existing industries (multispecies farming approach) or turn into industries in their own right, generating different levels of impact for New Zealand. This presentation will explore specific case studies, considering their unique challenges and the relevance of lessons learnt to the wider Oceania region.

# The benefits of fish feasting in mussel farms

**Lucy Underwood**[1], Andrew Jeffs[1], Amy van der Reis[1], Maria Mugica[1]

[1]University of Auckland

Restorative aquaculture seeks to maximise the ecosystem benefits from aquaculture activities to reach or exceed net negative outcomes. Mussel farming has been identified as having significant restorative potential, partially due to habitat provision. To quantify this potential, it is important to understand how the coastal ecosystem interacts with these artificial habitats, including how life history strategies of wild fish populations are impacted. The presence of fish in mussel farms may be a response to the available food resources, either from the cultured species, and/or the assemblage of biofouling that naturally colonise structures. This food availability may increase the nutritional condition of the fish, and subsequent productivity of the population. Using an abundant fish species in mussel farms, Australasian snapper (*Chrysophrys auratus*), this study investigated the gut contents in soft-sediment habitats within and outside of New Zealand green-lipped mussel farms in the Hauraki Gulf. Visual and DNA metabarcoding methods were used to assign the prey types, and proximate analyses measured total lipid, protein, carbohydrate and total calorific content. Prey groups identified from mussel farm snapper gut contents could be directly linked to species commonly present in the farms, especially cultured green-lipped mussels, blue mussels and barnacle biofouling. Snapper in mussel farms had double the dietary intake of lipids compared to those outside of farms. Overall, this study confirms for the first time the ecosystem benefits of shellfish aquaculture in provisioning nutritionally valuable prey to fish utilising aquaculture habitat.

# Evaluating the nitrogen removal ecosystem service beneath mussel farms

Emily Douglas[1], Jenny Hillman[2], **Drew Lohrer**[1], Michael Townsend[3]

[1]NIWA, [2]University of Auckland, [3]Waikato Regional Council

Mussel aquaculture may provide some ecological benefits through enhanced nitrogen removal by benthic mussels. This study aimed to assess the environmental conditions that influence benthic nitrogen cycling and ecosystem functioning beneath and adjacent to mussel farms. In particular, whether the presence of benthic mussels had the potential to enhance the nitrogen removal ecosystem service. We measured benthic oxygen and nutrient fluxes including nitrogen removal beneath and alongside two mussel farms in New Zealand assessing seasonal variability and the importance of environmental drivers including the density and biomass of benthic mussels. Sediments beneath farms with benthic mussels had higher rates of oxygen consumption and nutrient release than sediments outside farms without benthic mussels. Nitrogen removal rates were variable and context dependent. Benthic mussels were not an important driver of nitrogen removal and mussel count was negatively related to denitrification efficiency, indicating that aquaculture-associated benthic mussels are unlikely to provide eutrophication control benefits. Bivalve aquaculture consenting and environmental monitoring needs to acknowledge context dependency of both ecological benefits and effects, and may be influenced by farm age and cumulative effects on the benthos.

# Five star accommodation and room service for parore in mussel farms

**Andrew Jeffs**[1], Lucy Underwood[1]

[1]University of Auckland

A number of studies highlight marked increases in the abundance of some fishes utilising shellfish farms. It is thought that this elevated abundance is due to a combination of the protection offered by the aquaculture infrastructure and improved foraging opportunities. However, the relationship between fish and shellfish farming activities is poorly understood, but improved knowledge in this area is critical for maximising the ecological benefits from aquaculture activities, for what is commonly known as restorative aquaculture. In this study we examined the feeding biology of parore, a common coastal fish, which is found in increased numbers within mussel farms in the Hauraki Gulf. Gut content analyses using DNA metabarcoding and nutritional condition analysis of parore living inside and outside mussel farms provided some unique comparative insights of their short term and longer term feeding ecology. Diets of parore living in the farms was highly influenced by the biofouling on the mussel farm and this was reflected in the nutritional status of these fish. Overall, the results of this study identify the importance of shellfish aquaculture habitat in providing enhanced feeding opportunities for coastal fishes.

# SESSION 2: CLIMATE CHANGE

**Te Hoiere**

## 21st Century Climate Change Implications for Physics, Biogeochemistry and Fisheries for New Zealand's Marine Environment

**Graham Rickard**[1], Cliff Law[2 3], Matt Pinkerton[2]

[1]Victoria University Wellington, Te herenga waka, [2]NIWA, [3]Dept of Marine Sciences, University of Otago

Updated projections of future ocean properties are presented for a region of the south-west Pacific Ocean encompassing the New Zealand Exclusive Economic Zone under different climate change emission scenarios. These new projections show novel and distinct signatures associated with changes in circulation that confirm recent satellite and Argo float observations of a "Bounty Trough warm tongue" associated with distinct biogeochemical and biological changes. Analysis of archived output from three fisheries models also shows that total consumer biomass over the New Zealand marine domain will reduce in the future, with domain-average reductions of 25% to 51% by end-of-century when driven by RCP8.5/SSP585 forcing. Although a future reduced emission scenario SSP126 may lower future trajectories relative to the high emissions scenario RCP8.5/SSP585, the ocean state would still not return to that of present-day by the end-of-century. Indeed, the projections indicate a substantially modified southwest Pacific Ocean marine environment by end-of-century, physically, biogeochemically, and ecologically, which needs to be considered in future planning of fisheries, marine protection and potential marine carbon dioxide removal.

## Advancing mCDR governance and science: The role of global scientific collaboration

**Linn Hoffmann**[1], Adair Clark[1], Lennart Bach[2]

[1]University of Otago, [2]University of Tasmania

Despite efforts to reduce fossil fuel burning, global greenhouse gas emissions continue to rise, making the active removal of large amounts of $CO_2$ from the atmosphere unavoidable to keep warming below 2°C. Terrestrial Carbon Dioxide Removal (CDR) methods have the disadvantages that they store carbon for relatively short periods, compete with food production, and are prone to carbon losses through wildfires. Marine CDR (mCDR) methods could offer promising solutions and are therefore increasingly being considered. However, mCDR methods face their own challenges, including technological readiness, scalability, and the absence of international agreements on Monitoring, Reporting, and Verification (MRV). In order to accelerate the process to establish an internationally agreeable foundation for MRV standards for mCDR, we will report on progress from a global network of six continental nodes within the SOLAS framework. Further, we will present preliminary data from the New Zealand part of OAEPIIP, a standardised Ocean Alkalinity Enhancement (OAE) experiment that is run by 19 different labs worldwide. The resulting dataset has the potential to promote scientific consensus about the potential side effects of OAE on global plankton communities, which will support evidence-based political decision-making about the possible upscaling of this mCDR method.

# How climate change will impact internal wave mixing around New Zealand – The I-Mix project

**Erik Behrens**[1], Robert Smith[2], Craig Stevens[1], Charine Collins[1], Gemma Mason[1], Helen Macdonald[3]

[1]NIWA, [2]University of Otago, [3]Australian National University

New Zealand is a global hotspot for internal waves due to its extraordinary bathymetry, tides, coastal currents, and proximity to major undersea ridge systems. Internal waves and their associated mixing are considered important factors for the rich marine biodiversity around the country, as they affect nutrient supply and larval dispersion. The internal wave mixing is also assumed to provide a cooling effect against climate change, which might help explain regional differences in ocean temperature trends around New Zealand observed today.
This study investigates how the internal wave climate will change around New Zealand using in-situ observations and numerical models under present-day and future climate change conditions. Furthermore, this study uses satellite images and AI detection algorithms to map internal waves in space and time, providing a comprehensive present-day characterization of the internal wave climate around New Zealand.
Two case study regions have been selected (Northland and Southland), with contrasting projected future warming trends , to shed light on how climate change (stratification and circulation) will impact internal wave characteristics in these regions and to allow inferences on changes in biodiversity. Both case study regions are important fishing grounds (commercial and customary) and tourist hotspots due to their impressive biodiversity.

# Species Distribution Models in future climate change scenarios: a management decision-support tool

**Melanie Hayden**[1], Tom Brough[1], Matt Bennion[1], Enrique Pardo[2], Shane Geange[2]

[1]NIWA, [2]DOC

Species distribution models (SDMs) can be used to forecast species occurrence or abundance based on changing environmental conditions. Consequently, SDMs are regularly used to predict aggregations of species based on their relationship with their environment or prey. For example, NIWA have developed an expert-informed SDM framework to predict current and future distributions for a range of marine species potentially vulnerable to climate change impacts. The SDM framework has been applied to several invertebrate, macroalgae and marine mammal taxa. Recently, NIWA and DOC have worked together to apply the SDM framework to predict how distributions of eight macroalgal taxa potentially vulnerable to climate change impacts are likely to change under future climate trajectories. Using these predicted distributions, we tested relationships between some anthropogenic activities and future distributions of the eight macroalgal species. Results suggest impacts of climate change on macroalgae distribution are diverse, with species responses including range contractions and expansions. Further, results suggest significant overlap between anthropogenic activities and some future species distributions. We discuss how this approach can help inform climate change management responses, including mitigating the loss of sensitive habitats. Work is underway to apply these methods to a broad suite of marine taxa.

# Transforming coastal lowland systems threatened by sea-level-rise into prosperous communities

**Scott Stephens**[1]

[1]Niwa

The coastal lowlands of New Zealand's are the flat, low-lying areas adjacent to estuaries and coasts, which are economically productive but also contain nationally significant habitats. The viability of existing socio-economic lowland systems is now being increasingly threatened by sea-level rise. We present findings from our "Future Coasts Aotearoa" research programme, which is addressing these challenges. Our programme is creating methods that show how to transform land-use from that focused mainly on economic return to land-use that also recognises that values of the social, cultural and natural environment. In this talk we will share:

- New methods and assessments of groundwater rise
- Models of future estuarine habitat evolution
- Causal diagrams to help understand wellbeing in the Lower Waikato River, from a Maori and a Community perspective
- The development of an Adaptive Futures Serious Game and the choices people make when faced with tough decisions to adapt their lifestyle through time, as climate change increases the impacts from multiple hazards (flooding, groundwater and sea-level rise).
- The use of agent-based modelling and robust decision making to design adaptive plans for managing the forced transition from an economically centric landuse to a landuse that better balances the four well-beings.

# The effect of oil pollution and warming on anti-predator behaviour and physiology in coral reef fish

**Eleanor Kelly**[1], Dr Jodie Rummer[2], Dr Bridie Allan[1]

[1]University of Otago, [2]James Cook University

Globally, marine environments are subjected to multiple stressors including climate change and pollutants. Of particular concern is heavy crude oil, containing toxic compounds such as polycyclic aromatic hydrocarbons (PAHs). PAH exposure has been shown to negatively impact physiological and behavioural traits in marine organisms. Alongside this, is the increasing threat of marine heatwaves, where warming can exacerbate the toxicity of oil pollution to marine organisms.

This study investigates the impact of oil exposure and warming on coral reef fish using behavioural and physiological markers. Pomacentrus amboinensis (*ambon damselfish*) recruits were exposed to elevated temperature and oil. Fish were then individually acclimated to an arena where an electromagnet released a weight from above to stimulate a predator attack and induce escape behaviour. This assay was recorded in high-speed for kinematic analysis. Tissue samples were then analysed for lactate dehydrogenase and citrate synthase enzyme activity to investigate whether oil and warming has a metabolic cost on fish. This study will elucidate whether oil pollution and warming act synergistically and the effect this may have on coral reef fish. This data was collected at in December 2024 and has yet to be analysed, but results will be presented at the conference.

# Ngā Hua o Waita

**Dr Lorraine Eade**[1]

[1]Ngāti Rārua, Ngāti Toarangatira

Whakamana te puna mauri ora o Ngāti Rārua,  kia kaha pupuri ai ngā hekenga ā mauri muri ake tonu. Realise the wellspring of vital identity that is Ngāti Rārua to strengthen all the migrations yet to come.

Ngāti Rārua Poipoia Te Ao Tūroa Environmental Strategy (2021) and Ngāti Rārua Climate Change Strategy (2023) outline Ngati Rarua's commitment to protect, strengthen and enhance their taonga, assets and interest through the impacts of climate change.  In doing so, Ngāti Rārua continue to keep up to date with relevant climate science, information and mātauranga as the basis for resilience,  preparedness and planning for the immediate and longer term needs and aspirations of whānau, marae and iwi. Ngā Hua o Waita overlays scientific data with Ngāti Rārua Mātauranga that informs and mitigates the impacts of climate change for the iwi. One such project in (SfTi) partnership with Cawthron Institute involved the placing of NEST (Novel Environmental Sensor Technology) floats on a Ngāti Rārua marine farm based at Admiralty Bay,  enabling Ngāti Rārua to receive and utilise temperature (and other) data.

Ngāti Rārua will share their story of Climate Change, and what this means for the generations yet to come.

# SESSION 3: KINA AND KELP
## Awatere / Wairau

## Quantifying rocky reef biodiversity and barrens in Te Tauihu / Top of the South

**Anna Berthelsen**[1], Maureen Ho[1], Dan Crossett[1], Dana Clark[1]

[1]Cawthron Institute

Urchin barrens have been widely documented in northern parts of Aotearoa but are less studied in the South Island. In 2020 and 2023, Cawthron Institute led the collection of video footage from > 80 sites on natural reef (e.g., rocky) substrates across Te Tauihu / Top of the South. We quantified the reef biodiversity and barrens across six key areas: Golden Bay, Abel Tasman, Tasman Bay, D'Urville Island, Pelorus Sound and outer islands, and Queen Charlotte Sound. The videos, taken at a range of depths using an ROV and at times with a GoPro, were analysed and various biodiversity metrics were quantified including kina and mobile invertebrate abundance, seaweed cover and substrate type. Our key findings show barrens, often with high kina numbers, were present at most sites. We also saw high cover of brown canopy seaweeds at some sites. Our research provides insights into the baseline and current ecological conditions across Te Tauihu and can inform future management strategies and potential restoration efforts.

## What Would *Jasus* Eat? Prey preferences of the spiny lobster (*Jasus edwardsii*) for two barren-forming sea urchin species, *Evechinus chloroticus* and *Centrostephanus rodgersii*

**Hayley Nessia**[1], Professor Craig Radford[1], Dr Richard Taylor[1], Dr Nicholas Shears[1]

[1]Institute of Marine Science, University Of Auckland

The spiny lobster/kōura (*Jasus edwardsii*) is a critical predator of the endemic sea urchin/kina (*Evechinus chloroticus*), with overfishing of *J. edwardsii* contributing to the expansion of urchin-dominated habitats or 'kina barrens'. The long-spined urchin (*Centrostephanus rodgersii*) has historically held low densities in New Zealand but has recently been increasing and forming barrens. In Tasmania, *J. edwardsii* is the main predator of *C. rodgersii*, but it is unknown whether they prey on *C. rodgersii* in New Zealand, or to what extent. Kina and long-spined urchins in three different size classes (small, medium, large) were offered to large (>135 mm carapace length) male spiny lobsters in no-choice (single species) and preference (both species) aquaria trials. Lobsters showed a significant preference for kina over long-spined urchins, but the probability of consumption was predicted by the total diameter of an urchin (test diameter + spine canopy) rather than its species. This demonstrates limited predation of *C. rodgersii* in captivity by *J. edwardsii* and a clear preference for kina. However, further study is necessary to investigate the extent to which *J.edwardsii* consume both urchin species in the natural environment and how this varies with season, sex, and size of spiny lobsters in northeastern New Zealand.

# How do kina form barrens?

**Lily Hasshaw**[1], Nick Shears[1]

[1]The University of Auckland

Understanding how sea urchins form urchin barrens is important for managing the ecological effects of fishing on kelp forests. Some sea urchin species create dense 'feeding fronts' at the edge of kelp forests, while others form small patches within the forest that can coalesce over time into large barren areas. In Aotearoa New Zealand, urchin barrens are extensive in some regions but comparatively little is known about how kina (the common sea urchin *Evechinus chloroticus*) form barrens and the densities required to do so. Following recent kelp restoration efforts at Te Hauturu-o-Toi (Little Barrier Island), we have an ideal opportunity to examine barren formation as kina numbers increase within a restored kelp forest. After observing several barren patches emerge, we monitored six of them using photogrammetry and field surveys to track their expansion and associated kina densities over time. Patch sizes consistently and rapidly increased, and began coalescing over a four-month period. While high kina densities are needed to initiate patch formation, typically at barren margins, lower densities can sustain and expand these patches as mini 'feeding fronts' push outward. This patchwork formation suggests that kina barrens may form at lower densities than previously expected. These novel insights into kina barren dynamics will help guide future kelp forest restoration and management efforts.

# Variable recovery of rimurimu forests across Tōtaranui-Queen Charlotte Sound following kina removal

**Nick Shears**[1] , Dallas Lafont[1], Kelsey Miller[1], Caitlin Blain[1], Robyn Dunmore[2]

[1]The University of Auckland [2]SLR Consulting

Kelp and macroalgal (rimurimu) forests are under increasing pressure due to global and local stressors. Understanding the drivers of kelp loss and factors preventing kelp recovery is essential to informing kelp forest restoration and management. Kelp loss in Tōtaranui-Queen Charlotte Sound has been attributed to warming temperatures, sedimentation and sea urchin grazing. While urchin barrens are a dominant component of subtidal reefs across much of Tōtaranui, the relative importance of sea urchins and other environmental stressors in limiting kelp forests is unknown. To assess the importance of sea urchin grazing and potential for recovery of kelp forests, we removed sea urchins from large areas (~0.3 ha) of urchin barrens at four sites spanning a range of environmental conditions across Tōtaranui and monitored changes in macroalgal assemblages over 3 years following urchin removal. Macroalgal cover increased at all sites following urchin removal, but there was large variation in the magnitude and composition of macroalgal recovery among sites in relation to environmental conditions. The greatest recovery occurred at the most wave exposed site in the outer-Sound, with establishment of a dense forest of fucoids and giant kelp (*Macrocystis pyrifera*), whereas at the highly sheltered inner-Sound site, recovery was restricted to a shallow band of fucoids and the invasive kelp Undaria pinnatifida. Changes in understory and reef fish assemblages also followed recovery of canopy-forming species across sites. These results demonstrate that there is high potential for restoration of rimurimu across Tōtaranui, but the extent and composition of rimurimu forests will vary considerably with environmental conditions across the Sound.

## SESSION 3: BLUE CARBON

### Te Hoiere

# Blue carbon stocks in Aotearoa New Zealand's coastal wetlands and prospects under rising sea levels

**Andrew Swales**[1], Inigo Zabarte-Maeztu[1], Phoebe Stewart-Sinclair[1], Kevin Buffington[2], Joel Carr[3], Glenn Guntenspergen[3], Kely Carter[1], Reuben Hattingh[1], Iain MacDonald[1], Jochen Bind[4], Pieter Havelaar[4], Fraser Goodmanson[4], Sarah Hailes[1], Ken Krauss[5], Karen Thorne[2], Catherine Lovelock[6]

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Interest in the capacity of coastal wetlands to sequester atmospheric carbon (i.e., coastal blue carbon) and emerging application to climate-warming mitigation has grown rapidly in recent decades. Blue-carbon ecosystems include mangroves, seagrasses, salt marshes and supratidal habitats. In New Zealand, basic research and feasibility studies of blue carbon opportunities began only within the last decade. Most coastal wetlands are constrained to the intertidal zone above mean sea level due to physiological tolerances to hydroperiod. Consequently, coastal wetlands and the ecosystem services they provide are vulnerable as they must keep pace with sea level rise (SLR), by building substrate elevation via mineral and organic sediment accumulation. The effects of accelerating SLR, including salinisation and landward migration of coastal wetlands, are already apparent. The Future Coasts Aotearoa research programme will provide knowledge and tools to transform land use in New Zealand's coastal lowlands threatened by SLR in the most economically effective way that recognises social, cultural and natural-environmental values. The programme aims to determine how coastal wetlands will evolve with SLR over coming decades, inform adaption and restoration opportunities, including quantifying carbon-sequestration rates across a range of conditions, thereby informing blue carbon opportunities. We report key findings from the research to date.

# Characterization of the regional and global divergence of *Macrocystis pyrifera* to better understand the role of giant kelp habitats as a blue-carbon sink

**Emily C Giles**[1,2]

[1]Cawthron Institute, [2]Sequench

Kelp forests are crucial to many temperate marine ecosystems, providing habitat, enhancing biodiversity, and supporting coastal resilience. They are also recognized as potentially significant natural carbon sinks, yet intraspecific genomic divergence within the giant kelp *Macrocystis pyrifera* is still poorly understood. This knowledge gap limits our ability to place Aoteoroa New Zealand (NZ giant kelp) in a global metapopulation framework, clarify the mechanisms that drive divergence, and develop species-specific markers for tracing kelp-derived carbon. We analyzed whole-genomes of globally and locally distributed *M. pyrifera* populations to characterize heterogeneous divergence and to disentangle the roles of selection and neutral processes. Our results reveal the genetic distinctiveness of NZ giant kelp and lay the groundwork for designing environmental DNA (eDNA) based tools to trace kelp in natural habitats. We present a validated assay tested in healthy, declining, and historical kelp forest habitats, that reliably detects giant kelp eDNA along with associated algal communities. Together, these findings deepen our understanding of kelp forests' contribution to blue-carbon frameworks and provide critical insights for climate action, conservation policies, and sustainable marine resource management.

# Marine protection as a tool for enhancing carbon cycle functionality in coastal soft sediment ecosystems

**Tegan Evans**[1], Ines Bartl[1], Shahrokh Heidari[1], Rebecca Gladstone-Gallagher[1], Stefano Schenone[1], Patrice Delmas[1], Simon Thrush[1]

[1]The University of Auckland

Coastal soft sediment ecosystems can sequester and store large amounts of carbon. Similar to other blue carbon ecosystems such as seagrass, mangroves and saltmarshes, they have been heavily impacted by anthropogenic activities, particularly by demersal fishing. In addition to the impacts of trawling and dredging on biodiversity, these destructive fishing methods disrupt the physical and biogeochemical characteristics of the seafloor, and the resuspension of sediment from fishing gear releases $CO_2$. Marine protection can be used as a management tool to support the restoration of coastal environments, and while often centred around enhancing and conserving biodiversity, marine protection also has potential to enhance blue carbon. To support decision making for marine protection that enhances blue carbon potential, there is a need for local scale information on carbon cycling within coastal soft sediment environments. This study uses functional indicators to assess benthic carbon cycling across environmental gradients to explore the drivers of carbon cycle functioning and their vulnerability to seafloor disturbance. Our results demonstrate the importance of marine protection over multiple gradients to enhance blue carbon potential, providing important insights into the carbon cycling in coastal soft sediment ecosystems and a practical method to support evidence-based management of the marine environment.

## SESSION 4: RESTORATION 1
### Awatere/Wairau

# Korikori Tuangi! The potential of cockles to enhance ecosystem functioning in degraded estuaries

**Natalie Prinz**[1], Joanne Ellis[1], Timothy Thomson[1], Rebecca Gladstone-Gallagher[2], Lolita Rynkowski[1], Candida Savage[3], Conrad Pilditch[2]

[1]University of Waikato, [2]University of Auckland, [3]University of Otago

Natural recovery of disturbed ecosystems can take years, because long-lived, functionally important species are lost. We undertook two studies in Tauranga Harbour to determine whether adding the filter-feeding bivalve *Austrovenus stutchburyi* to degraded sediments could alter recovery of biodiversity and ecosystem functioning. Firstly, a single-site manipulative experiment, when *Austrovenus* were added to defaunated sediments, found that recovery of ecological functions (benthic metabolism, nutrient efflux, functional diversity) was faster than in non-addition plots.
In a second study, we transplanted large cockles (> 20 mm at 800 ind./m²) to ten sites positioned across a stressor gradient of increasing sedimentation, nutrient and heavy metal enrichment. Measures of ecosystem function (benthic metabolism, surface organic matter degradation rates) and sediment characteristics were then compared with non-addition plots after three months. Transplanted cockle survival (28-75%) was lower in more degraded sites but varied in medium-healthier sites. Sediment oxygen consumption was enhanced in transplant compared to control plots for all sites despite varied site health and survival. Yet, the difference was smallest in degraded sites. Combined, these studies illustrate that successful bioremediation of degraded soft-sediments by *Austrovenus* is possible but will depend on whether stressors have been reduced to a point that ensures sufficient rates of survival.

# Where to Settle? The Use of Substrate to Facilitate Juvenile Mussel Recruitment in Restored Green-lipped Mussel (*Perna canaliculus*) Beds

**Luke Johnston**[1,2], Dr Jenny Hillman[1], Dr Andrew Jeffs[1], Altan Ni Mhurchu[1,2], Dr Emilee Benjamin[1]

[1]University of Auckland, [2]NIWA

Green-lipped mussels (*Perna canaliculus*) are a taonga species that were once widespread but have been rendered locally extinct throughout many parts of New Zealand due to overfishing and habitat degradation. Restoration efforts have experienced promising results in terms of adult mussel survival and biodiversity enhancement. However, there has been an absence of juvenile mussel recruitment into restored beds, a factor critical to their sustainability and growth. Previous research on green-lipped mussel settlement has associated high densities of wild spat with complex filamentous macroalgae, which is lacking around current restoration sites. This study aimed to investigate facilitation of recruitment into restoration sites using substrate. Coir, a coconut fibre rope mimicking filamentous macroalgae, was suspended vertically, 1.5 metres above plastic trays on the seafloor containing treatments replicating both the restored beds (mud with adult mussels) and the seafloor without restoration intervention (mud only). Replicates from each treatment were retrieved at multiple time points. Counts and sizing of settled juveniles were conducted to identify recruitment patterns onto the various substrates of mud, adult mussels and coir, in each of the treatments across time. Results will further our understanding of the complex mussel recruitment pathways that are vital to successful mussel restoration in Aotearoa.

# Setting targets for ecological recovery of seagrass and other key habitats in Te Awarua-o-Porirua

**Rachel Parry**[1], Megan Oliver[1], Megan Melidonis[1]

[1]Greater Wellington Regional Council

Te Awarua-o-Porirua Harbour is a culturally and ecologically significant estuary facing pressures from urban and rural development. Greater Wellington Regional Council undertakes broad-scale mapping of key habitats in this estuary, including seagrass (*Zostera muelleri*) which provides critical ecosystem functions such as sediment stabilisation, carbon sequestration, and nursery habitat.

To build on this foundation, we trialled drone-based seagrass mapping methods adapted from the Coastal Special Interest Group (CSIG) guidelines. Our approach used a combination of remote sensing technology and ground truthing. Our trials highlighted the need for nuanced refinements to support more consistent classification and improve usability in patchy sea grass beds with sparse density and under variable tidal and weather conditions.

Limits to manage catchment impacts are being set through our regional plan change process, however, this work supports a shift—articulated through the Sustainable Seas National Science Challenge—from setting environmental limits to defining targets for ecological recovery. We aim to set coastal targets to connect catchment interventions and monitoring with the aspirations of mana whenua and the community to improve the health and extent of taonga species. This collaborative approach will offer a model for enabling marine restoration in estuarine systems nationwide.

# Turbid Waters Impact Shellfish Restoration

**Brandy Biggar**[1], Jenny Hillman[1], Andrew Jeffs[1]

[1]University Of Auckland

Coastal sediment inputs are escalating due to human activities, such as agriculture, deforestation, construction, and climate change, representing one of the greatest current threats to coastal ecology globally. Extreme weather events like cyclones can increase suspended ocean sediment by up to 100x. This rapid and severe change in turbidity can negatively affect bivalves by diminishing filter-feeding and respiration capacity, damaging organs, burying them by settling particles, and more. In New Zealand, juveniles of the green-lipped mussel (*Perna canaliculus*) have rudimentary structures for capturing and sorting food particles from the seston, which are prone to clogging and damage. We have conducted a series of studies to determine the effects of suspended sediment and sediment burial on juvenile green-lipped mussel behaviour, survival, feeding, growth, and condition. The presented results will highlight the general patterns, surprising findings, and how these findings can benefit bivalve restoration and aquaculture.

# Understanding germination triggers; The first steps towards improving seed-based seagrass restoration success rates in Aotearoa, New Zealand

**Eleanor Brettle**[1,2], Dr Hazel Needham[1], Dr Dana Clark[2], Dr Anna Berthelsen[2], Dr Joanne Ellis[1]

[1]University of Waikato, [2]Cawthron Institute

*Nanozostera muelleri*, Aotearoa New Zealand's sole seagrass species plays a vital role in maintaining coastal ecosystem functions. However, like seagrasses globally, it is declining in many locations. While traditional restoration efforts focus on transplanting adult plants, seed-based restoration remains largely unexplored in New Zealand due to a previous assumption that flowering is rare. However, recent observations of flowering meadows across the top of the South Island indicate the potential for exploration.

This study sought to advance understanding of germination triggers; environmental cues that signal seeds to break dormancy. Using a factorial design with repeated measures (N =1600 seeds) in controlled laboratory conditions, we manipulated three known triggers identified for other seagrass species: temperature, freshwater pulse and anoxic conditions. Seeds were kept in constant darkness to mimic natural burial. A 24-hour freshwater pulse was found to positively influence germination rates, with pulsed treatments averaging 14.63% germination compared to just 0.25% in non-pulsed treatments. Germination was highest under simultaneous exposure to all three triggers averaging 25%. These findings provide insights into the environmental conditions required to stimulate germination that lay a foundation for seed-based restoration and the potential for seagrass nursery development in Aotearoa New Zealand.

## SESSION 4: ANTHROPOGENIC IMPACTS

### Te Hoiere

# Ecological Implications of Human Induced Disasters: Evaluation of Sub-canopy responses at Astrolabe Reef/ Otāiti Post Rena Disaster

**Lizzie Thompson**[1]

[1]University Of Waikato

The MV Rena disaster at Otāiti/Astrolabe Reef in 2011 offers a unique opportunity to explore the ecological effects of multiple human-induced disturbances on marine ecosystems in the context of climate change. Located within the Motiti Island Archipelago, this shipwreck provides a 'natural' experimental opportunity to assess the impacts of contamination, sedimentation, storm events, and trophic shifts against a backdrop of climate change associated marine heatwaves. While it appears that macro-algal cover in the shipwreck affected area has recovered, sub-canopy dynamics remain unexplored.

This study examines long-term responses in sub-canopy ecology to the Rena grounding and associated pollution. This is achieved through species inventories, including taxonomic assignment and eDNA sampling, together with benthic cover dynamics. Reef-associated fish community changes were assessed using Baited Underwater Video surveys. Recruitment dynamics of sub-canopy species across *Carpophyllum spp.* and *Ecklonia radiata* habitats are being studied via clearance experiments near and distant to the wreck. Finer-scale rock scraping manipulations were conducted to assess short-term ecological succession across impact levels.

Preliminary observations suggest higher biodiversity at Astrolabe Reef compared to Motiti Island. Based on preliminary findings, it is hypothesised that biodiversity will differ between high and low impact sites, with higher impact areas exhibiting lower biodiversity.

# Freshwater inputs and desiccation regulate species replacement and rewiring processes underpinning intertidal community assembly

**Anthony 'AJ' Gillis**[1], Dani Carrasco-Hernandez[1], Derrick Gerber[1,2], Mads Thomsen[1,2], Jonathan Tonkin[1,3]

[1]School of Biological Sciences, University of Canterbury, [2]Marine Ecology Research Group, University of Canterbury, [3]Te Pūnaha Matatini Centre of Research Excellence, University of Canterbury

Despite their role in regulating species abundances and interactions, how environmental conditions modulate community assembly remains unclear, partly reflecting the context dependency of species movements. Due to limited mobility, stressor susceptibility, and accessibility for in situ measurements, intertidal macroinvertebrate and seaweed communities are ideal for examining the processes underpinning community assembly along highly dynamic estuarine gradients. We measured habitat-use and association interactions between organismal users, abiotic substrates, and biogenic habitat-formers, in the highly dynamic Avon-Heathcote estuary. Using network theory, we deconstructed the processes underpinning assembly into partner matching (rewiring) or species sorting (replacement) and determined whether each varied with salinity-freshwater input, desiccation-elevation, across space and through time. With decreasing freshwater input similarity, replacement and rewiring both increased along this gradient, though rewiring increased the most. Both processes increased as seaweed (e.g. *Gracilaria, Ulva*) and/or invertebrate users (e.g. *Notoacmea, Diloma*) were gradually added to the community becoming more prevalent further from freshwater. In contrast, only replacement increased with greater elevation distance as most species selected lower channel habitats compared to higher tidal flats. Our results show certain stressors can regulate assembly through simple (replacement alone) or complex compounding processes (replacement and rewiring), relying on gradient predictability and variability (e.g. floods).

# Physiological Responses of Benthic Epifauna to Organic Enrichment from Salmon Farming

**Rebecca McMullin**[1], Emily McGrath[1], Matt Miller[1], John Pearman[1], Laura Biessy[1], Jess Ericson[1], Joanna Copedo[1], Natali Delorme[1], Holly Bennett[1]

[1]Cawthron Institute

As offshore finfish aquaculture expands in New Zealand, understanding how seafloor species respond to farm-derived organic enrichment is essential for sustainable management. This study, part of the Environmental Health Measures for Open Ocean Aquaculture project (funded by Fisheries New Zealand), examined physiological responses of three benthic species—horse mussels (*Atrina zelandica*), brachiopods (*Neothyris lenticularis*), and scallops (*Pecten novaezelandiae*)—to enrichment under controlled laboratory and in situ field conditions.

Over 3–5 months of exposure, we assessed respiration, fatty acid composition, gene expression, histological health, and oxidative stress. All species assimilated salmon waste, primarily via oleic acid, with associated shifts in nutritional markers. Respiration increased in *A. zelandica* and *N. lenticularis*, indicating elevated energy demands. Gene expression changes were stronger in the lab, highlighting stress-related biomarkers, while field effects were subtler. Histological analyses revealed parasite presence and tissue changes in mussels and scallops, but not in brachiopods. This research identified several biomarkers of physiological change in keystone species and will help to inform future stressor / response studies. These novel results will also be an important consideration in the development of environmental guidelines for sustainable offshore aquaculture.

# Physiological Responses of Guam's Dominant Shallow-Water Corals to Nutrient Enrichment

**Dr. Ciemon Caballes**[1], Mr. Xavier De Ramos[1], Ms. Zoe Ariellius[1], Ms. Mya Ngemaes[1], Dr. Heloise Rouze[1,2]

[1]University of Guam - Marine Laboratory, [2]Institut de Recherche pour le Developpement, MARBEC

Coral reefs are increasingly threatened by climate-driven marine heatwaves and local anthropogenic stressors, such as nutrient enrichment, with lasting consequences for reef health and resilience. On Guam, where reefs are exposed to both global and local pressures, understanding how nutrient loading influences coral physiology is critical for predicting reef responses under future climate scenarios. We investigated the physiological responses of three dominant shallow-water coral species—*Acropora pulchra, Pavona decussata*, and *Porites cylindrica*—at two reef flat sites on Guam's west coast, Luminao (low nutrients) and Tumon (high nutrients). Using a 12-month reciprocal transplant experiment, we measured changes in zooxanthellae density, chlorophyll content, and linear and aerial growth rates across species and sites. Preliminary findings reveal marked species-specific differences in zooxanthellae density and chlorophyll-a content, significant site-based differences in chlorophyll-$c^2$, and strong interactions between species and site in determining coral growth. These physiological patterns were accompanied by shifts in symbiont and microbiome community structure, suggesting a complex interplay between nutrient enrichment and coral health. Our results highlight the importance of understanding nutrient-thermal stress interactions and provide critical insights for improving coral reef management and restoration strategies in Guam and across the broader Pacific region.

# Spatial variability of potential microplastics in an intertidal fish gut: a case study in Wellington, New Zealand

**Anna Resende**[1], Dr Alice Rogers[1]

[1]Victoria Wellington University

The impacts of microplastic pollution on coastal environments and associated fauna is a major concern globally. While there are many factors influencing microplastic pollution, plastic waste is often higher in areas closer to urban environments. Microplastic distribution and accumulation can also vary in response to ocean currents. Increased amounts of microplastics in the environment can facilitate ingestion by fish and other organisms and quantifying microplastic occurrence in fish guts in natural populations is essential for understanding their impacts and consequences. Here, we quantify the abundance, composition and spatial variability of potential microplastics (PMP) ingested by the common intertidal fish, *Forsterygion lapillum*. We compare ingestion rates and types from fish in the Wellington Harbour, a semi-closed urban embayment with constant vessel movement, and on the Wellington South Coast, a high energy coastal area with urban proximity. We demonstrate that fish collected in the Wellington Harbour ingest significantly more PMP than fish from the Wellington South Coast. However, PMP were present in all fish samples and the most common PMP found were fibers and fragments. This research provides the first report of microplastic ingestion by marine fish in the Wellington region.

## SESSION 5: AQUACULTURE AND FISHERIES IN A CHANGING WORLD

*SESSION SPONSOR: PLANT AND FOOD RESEARCH*

**Awatere /Wairau**

# Shellfish carbonate in sediments: assessing historical baselines, dissolution dynamics, and carbon storage beneath shellfish farms, Marlborough, New Zealand

**Sean Handley**[1], Rachel Hale, Craig Smeaton, Andrew Swales, Ollie Kerr-Hislop

[1]NIWA

Inorganic carbon in the form of calcium carbonate formed by marine shellfish is an underappreciated component of estuarine and coastal sediment, that is under threat from multiple stressors due to the global decline of calcifying biogenic habitats. Depending on growing environment, biocalcification is potentially a net emitter of $CO^2$, however, shellfish $CaCO^3$ comprises an important sedimentary resource that provides a paleobiological record that can be analysed to inform historical pre-impact conditions. Shells also play a role in sediment geochemistry and an understanding of the rate of their preservation is important for setting historical baselines. In this study we use sediment cores collected beneath three ca.40-year-old green-lipped mussel *Perna canaliculus* aquaculture farms to evaluate the rate of shell deposition pre- and post-farm development. Green-lipped and fouling blue mussels dominated sedimentary deposits before and after the farms were developed in the late 1970s. Shells collected from pre-farm mud sediments were remnants of historic mussel reefs that were later fished beyond recovery to ca.3% of previous stocks. Following farm development, shell deposition increased on average to that of 8 times pre-farm rates. Analyses of mussel shell OC and IC content from the different time periods found significant differences between old and new shells.

# Fast-tracking finfish climate change adaptation

**Leteisha Prescott[1],** M. Scholtens[1], K.G. Dodds[2], R. Costilla[1], S. Clarke[2], G. Nicholson[1], C. Chamberlain[1], D. Roberts-Eisenhower[1], S.P. Walker[1], Z. Waddington[3], M. Wellenreuther[4], F. Ribeiro[4], L. Magnoni[4], G. Samuels[4], J. Fantham[4], J. Arinez[5], N.J. Kenny[5], A. Palstra[6], J.W.M. Bastiaansen[6], J. Symonds[1]

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Finfish are vulnerable to climate change and increases in sea surface temperatures have been associated with increased mortality in farmed Chinook salmon (*Oncorhynchus tshawytscha*). This has demonstrated the need for climate adaptation strategies. The "Fast-tracking finfish climate change adaptation" MBIE Endeavour programme is addressing this by delivering environmental resilience breeding and applying genomic methodologies to enable adaptation and provide the increased resilience that farmed finfish (Chinook salmon and snapper/tāmure *Chrysophrys auratus*) need to thrive in future environments. Combining research trials and on-farm evaluation, we are testing key production and environmental resilience phenotypes and assessing their potential for selection.

We have evaluated Chinook salmon families in three temperature challenges: tank-based exposure to (1) a high temperature (23.5°C), and (2) a moderate temperature (21.0°C) with lower dissolved oxygen, and (3) marine pen rearing at a warm water commercial salmon farm. Genetic parameters were estimated for survival traits for each challenge and revealed sufficient genetic variation to improve temperature tolerance through selection. Fifth generation selectively-bred snapper/tāmure families were used to test critical swimming speed, another important resilience trait. Our results highlight the potential for selective breeding to enhance resilience and performance in changing environmental conditions, contributing to sustainable aquaculture practices.

# Developing mararī/butterfish (*Odax pullus*) aquaculture: an herbivorous marine fish species with potential for aquaculture diversification in Aotearoa/New Zealand

**Flavio F. Ribeiro[1]**, Warren Fantham[1], Morgan Puklowski[1], Charlie Barker[1], Christopher Blake[1], Ioannis Papadaki[2], Poppy Underhill[3], Katrina Fletcher[3], Damian Moran[1], Matthew Wylie[1]

[1]Nelson Research Centre, The New Zealand Institute for Plant and Food Research Limited, [2]Hellenic Centre for Marine Research, [3]Food Industry Science Centre, The New Zealand Institute for Plant and Food Research Limited

Species diversification is becoming an essential strategy for resilient and responsible aquaculture development, especially in face of climate change. Species diversification opens new markets, boosting profitability and resilience of the aquaculture sector. In Aotearoa/New Zealand, mararī/butterfish (*Odax pullus)* has been identified as an interesting low-trophic and widely distributed marine species for sustainable aquaculture diversification. Here, initial results towards developing aquaculture technology for this native species are presented.
Butterfish gametes were strip-spawned from wild broodstock, captured in the Marlborough Sounds. Fertilised eggs were transported to the Finfish Facility, Plant & Food Research, Nelson. Upon arrival, fertilised eggs were incubated at 14°C and approximately 20,000 newly hatched larvae were stocked into a larval rearing tank. Larvae were reared under a standard green water rearing protocol and fed on zooplankton. Juveniles were successfully grown in captivity for 1.5+ years, under a mix of commercial and experimental diets, as well as a mix of fresh food supplementation and red seaweed. During the nursery and on-growing phase, very low mortalities were observed. However, a high incidence of deformities was detected. Butterfish aquaculture is still in its infancy, but promising results were obtained in this study.

# New Open Ocean Ecosystems: a multidisciplinary programme to explore novel biofouling management strategies for open ocean aquaculture

**Peter Bell**[1], Daniel Killeen, Mathew Cumming, Matthew Wylie, Benie Chambers

[1]Plant And Food Research

Open ocean aquaculture (OOA) creates new ecosystems by placing human-made structures and nutrient sources in new marine environments. The biofouling communities that will exploit these new ecosystems may pose challenges in terms of infrastructure maintenance and fish health. Here I introduce Plant & Food Research's New Open Ocean Ecosystems programme, which is exploring novel strategies for biofouling management in the context of open ocean finfish production. Underpinning the programme is the development of genetic, machine-learning models, and substrate-specific methods to better understand the composition and succession of biofouling communities in exposed locations on the types of materials used for finfish culture. This information supports other work aiming to manipulate biofouling succession using affordable, low-toxicity, plant-based coatings on farm structures. Other research is investigating the potential of employing a browsing herbivorous fish suited to high energy environments to graze on the net pen fouling and how the recovery of net pen fouling following cleaning could be exploited. This is a new bioresource we are investigating for a range of applications, from the production of hydroid chitins with special properties to feed stocks for insect production.

# Pilchards to pellets: The role of diet format and digestive performance of juvenile tāmure/Australasian snapper (*Chrysophrys auratus*)

**Erin Bell**[1], Leonardo Magnoni[1], Damian Moran[1], Ivan Kurtovic[3], Poppy Underhill[2], Katrina Fletcher[2]

[1]Plant And Food Research, [2]Plant And Food Research, [3]College of Food Science and Technology, Northwest University

Snapper evolved to eat fish, shellfish and crustaceans, which are mostly composed of water and can be quite large food items. In an aquaculture setting snapper are fed nutrient dense, almost dry pellets, which is ideal for farming as pellets can be generated from multiple ingredients, are resistant to degradation and are efficient to transport and distribute. We are interested in understanding how feeding and digestion differs between these very different food formats, and use this knowledge to improve feeding and diets in the aquaculture of snapper and other species. We conducted a study to examine the digestive dynamics of snapper fed pieces of pilchard versus aquaculture pellets. The gastrointestinal tracts of fish were dissected at various intervals after feeding and the stomach and intestine contents analysed. We found snapper fed wild type diets exhibited more rapid and complete digestion of proteins and faster emptying of the stomach compared to fish fed pellets. These findings led us to another study looking into the effect of hydration levels of pellets. Snapper fed pellets at low, medium and high hydration levels had very different feed intake profiles, and feeding behaviour was also noticeably different at low temperatures.

# Breaking BaD: cutting marine aquaculture pest and pathogen connections in coastal aquaculture

**Ben Knight**[1,2], Malcolm Smeaton[1], Kate Hutson[1], Ross Vennell[1], Craig Sherman[2], Grant Hopkins[1], Eric Treml[2,3]

[1]Cawthron, [2]Deakin University , [3]AIMS The Australian Institute of Marine Science

Increasing pressures on aquaculture from a wide range of pests and pathogen species present a growing bio-connectivity and dispersal (BaD) threat to this industry. This study used high-resolution hydrodynamic modelling of Te Tau Ihu (northern South Island), and particle tracking, to map dispersal networks in this key aquaculture area. Network analysis was used to identify key aquaculture sites by their network importance. Potential improvements in pest and pathogen management were then assessed through targeted breakages in the network, with increases in fragmentation of greater than 100% possible for targeted management of longer-dispersing species. However, network fragmentation for non-target species was less effective, highlighting the trade-offs that need to be considered when designing a surveillance and management network. A balanced dispersal strategy was investigated to improve multi-species protection, highlighting an alternative approach to improve broad-scale biosecurity in this important aquaculture region.

# Size-specific reduction in kelp consumption by kina exposed to lobster and blue cod predator cues

**Joseph Curtis**[1], Peter Dillingham[1], Stephen Wing[1]

[1]University Of Otago

Changes in sea urchin behavior following detection of chemical cues from predatory fishes may influence key ecological dynamics but have rarely been experimentally quantified. Here, we measured feeding rates on a habitat-forming macroalgae by two size classes of the New Zealand sea urchin (kina, *Evechinus chloroticus*) exposed to either ambient seawater or seawater carrying effluent from a predatory fish (rāwaru blue cod; *Parapercis colias*).
We created a Bayesian model that combined uncertainty in kelp growth rates and probability of urchin feeding to generate robust estimates of predator exposure effects on multiple feeding metrics. We compared our results to a similar experiment assessing behavioral responses of *E. chloroticus* to lobster cues (kōura, *Jasus edwardsii*). Larger urchins consumed ~40% less kelp in both predator treatments, exhibiting indistinguishable responses to blue cod and lobster despite being less susceptible to fish predation. Responses of smaller urchins to both predators were equivocal, though were more consistent with reduced feeding in the presence of lobster. Our findings provide new evidence for a suppression of kina feeding rates in the presence of direct predator cues from blue cod and lobster that can potentially reinforce the ecological role of these key predators in kelp beds of Aotearoa.

# An ecosystem approach in the Hauraki Gulf via fisheries plans: how far have we come?

**Martin Cryer**[1]

[1]Chair, Hauraki Gulf Fisheries Plan Advisory Group

In August 2023, the Minister for Oceans and Fisheries approved the Hauraki Gulf Fisheries Plan, Aotearoa New Zealand's first area-based fisheries plan and a key component of the government's Revitalising the Gulf strategy. The plan is designed to enable an ecosystem-based approach to fisheries management within the Hauraki Gulf Marine Park (HGMP). To guide development and implementation of the plan, a multi-stakeholder Hauraki Gulf Fisheries Plan Advisory Group was established in 2022, including commercial and recreational fishers, environmental NGOs, researchers, and officials from Auckland Council, Waikato Regional Council, Fisheries New Zealand (FNZ) and the Department of Conservation (DOC). The group meets quarterly, occasionally more frequently, and its ongoing roles include reviewing progress against the actions in the plan and advising FNZ on priorities for management and research. In this talk, I will summarise key areas of progress since the plan was approved. These include developing an ecosystem indicators programme, establishing a multi-stakeholder advisory group for the Coromandel scallop fishery, advising the Minister on further restricting bottom trawling and Danish seining within defined areas in the HGMP, working with DOC on the Hauraki Gulf / Tīkapa Moana Marine Protection Bill, and developing novel and integrated measures to address kina (urchin) barrens.

## SESSION 5: SOFT SEDIMENT SYSTEMS

### Te Hoiere

# Climate-related drivers of estuarine macrobenthic functional redundancy and resilience

**Drew Lohrer**[1], Orlando Lam-Gordillo[1]

[1]Niwa

Elevated anthropogenic carbon dioxide emissions are warming the planet, although our understanding of how climate-related changes manifest locally remains poor. Here, we used long-term data from six sites in a New Zealand estuary (all sampled quarterly for 22 years) to evaluate tidal flat macroinvertebrate community change and responses of five functional diversity metrics—Functional Richness, Evenness, Dispersion, Divergence, Redundancy—to shifting environmental conditions. Sea surface temperature (satellite SST records), tidal flat microphytobenthos abundance (sediment chlorophyll-a content) and bed sediment muddiness all increased significantly at all sites from 2000-2022. The individual effects of these environmental drivers on functional diversity metrics were mixed, but net trends in Functional Richness and Functional Redundancy indicated increasing levels of community resilience over time. Heat spikes can cause thermal stress, but gradual warming may elevate metabolic rates and accelerate reactions such as photosynthesis. The positive effects on increased food supply (chlorophyll-a) may have outweighed negative influences of increasing mud, generating the net trends in our data. Overall, the research provides evidence that some community types may be increasingly resilient and adaptable, rather than increasingly depauperate and functionally impacted, as climate change strengthens.

# Aotearoa New Zealand's marine carbon cycle in a changing climate – current understanding and future directions

**Scott Nodder**[1], Cliff Law[1 2], Erik Behrens[1], Sarah Bury[1], Antonia Cristi[1], Charine Collins[1], Kim Currie[1 3], Moira Decima[1 4], Alain De Verneil[1], Pablo Escobar-Flores[1], Denise Fernandez[1], Mark Gall[1], Andrés Gutiérrez-Rodríguez[1 5], Svenja Halfter[1], Helen MacDonald[1 6], Andrew Marriner[1], Matt Pinkerton[1], Graham Rickard[1 7], Karl Safi[8], Sarah Seabrook[1], Craig Stevens[1], Philip Sutton[1], John Zeldis[1]

[1]NIWA Taihoro Nukurangi, [2]Department of Marine Sciences, University of Otago, [3]NIWA-University of Otago Research Centre for Oceanography, [4]Scripps Institution of Oceanography, University of California, [5]Instituto Español de Oceanogr afíca Centro Oceanografico de Xixón , [6]Australian National University , [7]Victoria University of Welington Te Herenga Waka

Marine systems play critical roles in the global climate cycle as a major control of atmospheric carbon dioxide ($CO^2$). Marine primary production (photosynthesis) and remineralisation of organic carbon (respiration, degradation) determine the amount of $CO^2$ sequestered in marine sediments and deep-water environments. The stocks and fluxes of the marine carbon cycle are susceptible to impacts from global climate change and other anthropogenic activities that modify key processes. Oceanographic studies of the marine carbon cycle in Aotearoa New Zealand's Exclusive Economic Zone (NZ EEZ) and Territorial Seas over past decades have provided broad knowledge across a complex and dynamic seascape, but fundamental knowledge gaps remain that limit identification of, and response to, present and future anthropogenic threats. Notably, some areas of the NZ EEZ are under-sampled thus limiting our capacity to establish baselines and variability of the marine carbon cycle. It is recommended that new observational technologies and ocean modelling applications are utilised to ensure robust predictions of our ocean's response to human-induced perturbations. Furthermore, a future focus on nature-based solutions to accelerate oceanic $CO^2$ uptake will require improved knowledge of the marine carbon cycle in NZ's EEZ, particularly as new marine carbon dioxide removal (mCDR) techniques are proposed and implemented.

# National Benthic Health Models: a tool for estuary health assessment in Aotearoa

**Dana Clark**[1], Joanne Ellis[2], Conrad Pildtich[3], Judi Hewitt[3]

[1]Cawthron Institute, [2]University of Waikato, [3]University of Auckland

The National Benthic Health Models (BHMs) provide a nationally consistent approach to assessing estuary health in Aotearoa New Zealand. These models use information about benthic (seafloor) animal communities to generate a score that reflects the relative health of estuarine sites in response to two key coastal stressors: sedimentation (Mud BHM) and heavy metal contamination (Metals BHM). By offering a national-scale tool, the BHMs allow environmental managers to assess the condition of their estuaries in a broader context and avoid the high costs associated with developing site-specific or regional models. The stressor-specific nature of each BHM also supports targeted management, enabling prioritisation of mitigation actions based on the dominant pressure at a site. Since their development in 2020, National BHM scores have been calculated for more than 2,000 site/times across Aotearoa New Zealand. The Mud BHM has also been adopted as a national indicator of estuarine health on the Land, Air, Water, Aotearoa (LAWA) website. This presentation will explain how the BHMs work, what the scores indicate about estuary condition, and how users can generate National BHM scores using a newly developed script for use in PRIMER.

# Te Tautiaki Hoiho – Yellow-eyed Penguin Trust: Our Coastal Response to the Plight of Hoiho

**Anna Campbell**[1]

[1]Te Tautiaki Hoiho – Yellow-eyed Penguin Trust

Called into action by the plight of the hoiho, Te Tautiaki Hoiho Yellow-eyed Penguin Trust was founded in 1987 to restore the biodiversity of coastal ecosystems. Collaborating with a number of community and government groups, we manage the conservation of the hoiho across the coast of Te Waipounamu and Rakiura, responding to a wide range of threats and risks in changing environments.
To provide a safe haven for hoiho to nest and raise their young, we are converting pasture to native forest. Reforesting with native plants enables biodiversity to strengthen and provide resilience in the face of changing environmental conditions. Through our kaupapa, we have found that the conservation of hoiho requires a holistic approach to include the rehabilitation of other taoka species, te moana, and te taiao.
We are called into action by the plight of the yellow-eyed penguin to reforest landscape and seascape for a cooler planet, with penguins. We are committed to building biodiversity for resilience against the impacts of climate change, ocean warming and acidification.
We look forward to being able to share some of this work and to engage conference participants with this kaupapa.

# Should our ocean be part of the solution to Climate Change?

**Katherine Short**[1], Cliff Law[2], Karen Scott[3], Adrienne Paul[4], Caroline Saunders[5], Anna Berthelsen[6]

[1]F.L.O.W. Collaborative Ltd, [2]NIWA and University of Otago, [3]University of Canterbury, [4]Auckland University of Technology, [5]Lincoln University, [6]The Cawthron Institute

The ocean has absorbed one-third of all the carbon dioxide we've emitted to date and, with the current low ambition on reducing emissions, there is considerable international interest (and finance) in enhancing this marine sink. Our large EEZ represents a potential opportunity to make a meaningful commitment to the Paris Agreement goals, whilst also reducing expenditure and reliance on offshore carbon credits and forestry. However, marine Carbon Dioxide Removal (mCDR) techniques, including coastal Blue Carbon, open ocean fertilization and liming, have inherent risks and also challenges of scaling up and permanence. Consequently, a carefully considered national strategy is required to assess their pros and cons, so maximising the use of NZ research, funding and resources, whilst reducing atmospheric carbon dioxide and maintaining marine ecosystem resilience.

# Environmental drivers of *Atrina zelandica* habitat suitability in Tauranga Harbour

**Brooke Ellis-Smith**[1], Hazel Needham[1], Fabrice Stephenson[2], Jenny Hillman[3], Drew Lohrer[4], Conrad Pilditch[3]
[1]School of Science, University Of Waikato, [2]School of Natural and Environmental Sciences, Newcastle University, [3]Institute of Marine Science, University of Auckland, [4]National Institute of Water and Atmospheric Research

Fan shells (Family Pinnidae) have high ecological importance in marine soft sediments but are facing global declines including in New Zealand. Given the scarcity of data regarding the degree of these losses, understanding current population spatial extents and distributional drivers is needed for restoration management. In Tauranga Harbour, a subtidal towed underwater camera survey was conducted at 62 sites to elucidate *Atrina zelandica* population extent. We observed sparse populations (occurrences at 12 sites, with densities ranging from < 1 - 88 ind. 100 m-2), indicating harbour-wide declines compared to historical records. Habitat suitability modelling was used to identify possible environmental drivers influencing *Atrina* and predict areas suitable for restoration. The model predicted large areas of high habitat suitability (probability of occurrence > 0.6). Predicted habitat suitability was driven by sediment mud content, maximum current speed, sediment organic matter and turbidity. The absence of *Atrina* from areas of high predicted habitat suitability and historical occupancy indicates other factors are restricting recovery. Ongoing seafloor disturbance, alongside Allee effects may be hindering natural recovery, necessitating the need for active restoration and stressor reduction to reestablish populations.

# Modelling spatial distribution of estuarine ecosystem function using a bathymetrically- informed Bayesian Network

**Grady Petersen**[1 2], Fabrice Stephenson[3], Richard Bulmer[4], Ashley Rowden[2 5], Drew Lohrer[1]
[1]National Institute of Water and Atmospheric Research, [2] Victoria University of Wellington, [3]Newcastle University, [4]Tidal Research, [5]National Institute of Water and Atmospheric Research

Sea-level rise is forecast to increase by up to 1 m by 2100. This increase in sea level is likely to negatively impact the functioning and health of coastal estuarine and marine environments. Sea-level rise will modify the intertidal extent of ~300 estuaries throughout New Zealand and alter the important ecosystem functions associated with these diverse and ecologically valuable habitats.

Bayesian Network (BN) models are increasingly common tools used for modelling and understanding complex relationships between multiple driver and response variables. In BN models, conditional probabilities are assigned to define relationships between environmental drivers (e.g., sediment characteristics) and ecosystem response variables (e.g., biodiversity). Spatial adaptation of a BN model can be used for modelling the distribution and variation of response variables throughout an ecosystem.

Utilising a combination of expert opinion and quantitative data, we have modified an existing estuarine BN model to include the influence of bathymetry, and thereby sea-level rise, on both the intertidal and subtidal components of an estuary. Here we present the spatially partitioned estuarine BN model, the steps taken to inform the ecological relationships, and how this model can be used to forecast interactive impacts of sea-level rise and multiple stressors in a North Island estuary.

# Organic and inorganic carbon stocks and potential vulnerability in marine sediments around Aotearoa NZ

**Scott Nodder**[1], Sally Watson[1,2], Sam Davidson[1], Grace Frontin-Rollet[1], Susi Woelz[1], Richard Bulmer[3], Dana Clark[4], Rachel Hale[5], Sean Handley[5], Daniel Leduc[1], Carolyn Lundquist[6], Katie Maier[1 7], Alan Orpin[1], Sarah Seabrook[1], Andrew Swales[6], Sebastiaan van de Velde[1 8], James Williams[1], John Zeldis[1], Geoffroy Lamarche[9]

[1] NIWA Taihoro Nukurangi, [2]University of Auckland, [3]Tidal Research, [4]Cawthron Institute, [5]NIWA Taihoro Nukurangi, [6]NIWA Taihoro Nukurangi, [7]Pacific Northwest National Laboratory, [8]Department of Marine Science, University of Otago, [9]Parliamentary Commissioner for the Environment

Marine sediments are one of the largest repositories of organic (OC) and inorganic carbon (IC) on Earth and play vital roles in regulating climate change by modulating oceanic $CO^2$ uptake. A compilation of marine sediment OC and IC data has been undertaken to enable sedimentary carbon stocks to be estimated for the first time across the Aotearoa New Zealand Exclusive Economic Zone (EEZ). Statistical methods (LASSO Generalised Linear Models) derived correlations between %OC and other sediment parameters to expand the OC database. As a first-order approximation, OC stocks in the top 10 cm of EEZ marine sediments are 1890±250 Mt OC, and as much as 2240 ±290 Mt OC, mostly in deep-water sediments (66% >1500 m). IC stocks may be up to five times higher than these values. Shallow embayments, such as the Firth of Thames and Fiordland fjords, host the highest OC contents and densities. A vulnerability index for OC to bottom trawling was developed that emphasises regions in the EEZ most susceptible to potential OC remineralisation. Such environments also play host to many natural and cumulative anthropogenic activities that disturb the seabed and potentially OC and IC stocks (i.e., storms, currents cf. bottom trawling, seabed mining, dredging, anchoring).

# Determining the relative contributions of Hawkes Bay Rivers to marine sedimentation following Cyclone Gabrielle

**Melanie Hayden**[1], Andrew Swales[1], Greg Olsen[1], Sean Handley[1]

[1]NIWA

In February 2023, intense rainfall and flooding associated with Cyclone Gabrielle in Tairāwhiti/Gisborne and Te Matau-a-Māui/Hawkes Bay catchments resulted in severe soil erosion and sedimentation in river valleys and offshore marine habitats. In the aftermath of the Cyclone, Fisheries New Zealand commissioned NIWA to undertake an initial investigation to identify the contributions of seven maor Gisborne and Hawkes Bay rivers to recent marine sedimentation. Subsequently, an additional five Hawkes Bay rivers have been evaluated for source contributions for Hawkes Bay Regional Council. Key results from this work are presented. River mouth sediment deposits from a total of 13 catchments were sampled, and sediment from 12 of these were analysed to determine river source contributions to marine sedimentation along several coast-to-shelf transects. This investigation employed NIWA's Compound Specific Stable Isotope (CSSI) sediment-source tracing technique. Isotopic signatures of plant-derived fatty acid biomarkers were applied in a mixing model to apportion source contributions to sediment mixtures. The initial analysis confirmed the recent terrigenous origin of these mud-rich deposits and identified specific riverine sources and far-field deposition of fine sediment remote from specific river sources. The results of this work will be used to inform decisions about future catchment management in the Hawkes Bay.

# Shell shocked: Anthropogenic stressors and their impact on the health of a key estuarine bivalve (*Austrovenus stutchburyi*)

**Lolita Rynkowski**[1], Dr Hazel Needham[1], Natalie Prinz[2], Associate Professor Joanne Ellis[2], Professor Conrad Pilditch[3]

[1]University of Waikato, [2]University of Waikato, [3]University of Auckland

Shellfish play a key role in estuarine processes and provide humans with crucial ecosystem services. However, marine bivalves are being impacted by multiple stressors and populations are in decline worldwide. In Aotearoa, sedimentation, eutrophication and heavy metal contamination are some of the most prominent stressors affecting bivalves. To investigate the impacts of multiple stressors on the health of the New Zealand cockle (tuangi), a field survey was conducted at 20 sites along a spatial gradient of mud content, nutrient enrichment and heavy metal contamination within Tauranga Harbour. Preliminary data, comparing one of the least and one of the most impacted sites, showed no difference in contaminant levels (copper, lead, zinc) in tuangi tissue. However, the condition (ash-free dry weight : shell volume), density (N = 1744 $m^2$) and average length (18.8 mm) of tuangi was significantly higher ($p < 0.001$) in the less impacted compared to the more impacted site (15.9 mm length, N = 79 $m^2$). We will present findings from the entire stressor gradient and examine the cumulative effects of stressor interactions (e.g. synergisms and antagonisms) on tuangi health. These findings can be used to inform effective management of stressors and aid restoration of this taonga species.

# SESSION 6: BIOSECURITY

## Awatere/Wairau

## Development of a Submersible Dredge Planer (SDP) for large-scale and effective removal of exotic *Caulerpa* in Aotearoa New Zealand

**Derek Richards**[1], Andrew Johnson[2], Dr Ian Davidson[3], Dr Lauren Fletcher[3], Dr Kaeden Leonard[1], Monica Nevill-Jackson[1], Dr Louise Bennett-Jones[1], Aless Smith[1], Hannah Williams[1]

[1]Northland Regional Council, [2]Johnson Brothers Ltd, [3]Cawthron Institute

Exotic *Caulerpa* has been a focal point for marine incursion response in Aotearoa New Zealand since the detection of two species – *Caulerpa brachypus* and *C. parvifolia* – in July 2021. Effective and industrial-scale tools and methods are needed to tackle the large extent of established exotic *Caulerpa*. Several novel techniques have been funded by central and local government agencies and are currently under development to tackle this issue. Mechanical suction dredging promises to be one of the most effective approaches that can achieve large-scale removal of above- and below-sediment biomass. Two phases of tool and method development for mechanical suction dredging have already been completed. Phase I created a tailor-made dredge head for exotic Caulerpa removal, operated from a long-reach excavator on a barge with 2,000 m² of seafloor treated. Phase II created new robust solutions for dredge spoil classification, capture, and handling such that 22,300 m² of affected seafloor was treated. The proposed phase III project aims to deliver a Submersible Dredge Planer (SDP) that has the potential to achieve the next order-of-magnitude improvement for mechanical dredging by creating a dredge that operates remotely on the seafloor to deliver single-pass removal of exotic *Caulerpa*.

## Preparing for the rising tide of aquatic invasive species

**Tim Riding**[1], Scott Sinclair[1], Effie Fan[1], Baukje Lenting[1]

[1]Biosecurity NZ

Predicting what the next aquatic invasive species (AIS) might be, or when and where it might arrive is highly uncertain. Consequently, preparing for future AIS incursions is inherently challenging. Despite this, we need to develop and embed incursion response management systems that are capable of effectively and efficiently responding to new incursions of AIS, where outcomes like eradication of AIS incursions is not just possible, but likely. To do this, we need to identify the most likely AIS taxon that may arrive on our shores, understand what readiness and response work has been done globally, identify the gaps in our knowledge and management of these organisms, and then aim to fill these gaps with well reasoned 'readiness for response' science and management approaches.

In this presentation, we will outline the Aquatic Readiness Prioritisation Framework, which the newly formed Biosecurity New Zealand Aquatic Readiness Team has used to rapidly assess our current state of readiness for high-threat AIS. We will present the frameworks outputs and briefly outline the national-level preparedness work that Biosecurity New Zealand is currently beginning for AIS.

# Surveillance of *Sabella spallanzanii* using the Boxfish remote operated vehicle

**Oonagh Daly**[1], Dr Leigh Tait[2], Terri Huxtable[1]

[1]Environment Canterbury, [2]National Institute of Water and Atmospheric Research

The invasive Mediterranean fanworm, *Sabella spallanzanii*, was first detected in the Port of Lyttelton in 2008 as a new-to-New Zealand marine non-indigenous species. As *Sabella* was exclusively restricted within the Inner Harbour area of the Port of Lyttelton, an eradication campaign was undertaken in Whakaraupō/Lyttelton Harbour in 2008/09 after the initial detection. This campaign suppressed populations of *Sabella* for several years, however, since 2019 occasional incursions into the wider harbour have occurred leading to a regular surveillance and control programme. The Christchurch earthquake sequence in 2010/ 2011 rendered some port structures derelict, impacting the ability to undertake safe diver operations under and around these structures. Environment Canterbury partnered with the National Institute of Water and Atmospheric Research to conduct a surveillance campaign using the Boxfish remote operated vehicle (ROV) to quantify *Sabella* on derelict structures using artificial intelligence technology and test the capability of the manipulator arm to remove *Sabella* from piles.
This work presents a pathway to conduct biosecurity surveillance in areas that are otherwise too dangerous to undertake safe diver operations. Fieldwork will commence in May with results to follow.

# Policy, management, and the 'Level of Fouling' scale to transform marine invasion risk reduction from recreational boats

**Kathy Walls**[1], S Hucker[1], I Davidson[1], M Gammon[1]

[1]Biosecurity NZ, MPI

Categorical scales have a rich history in environmental management, providing pragmatic means to assess ecological phenomena when full quantification is not feasible or necessary. The Level of Fouling (LOF) scale was developed 20 years ago to facilitate biosecurity policies that reduce the spread of marine invasive species by recreational boats. Applications of the six-category scale have since varied, and divergent implementation practices may undermine its value for marine biosecurity. To support researchers and practitioners to maintain accuracy and precision when applying the scale, we provide a review of LOF-based research and management and updated guidance on its implementation. Focussing on underwater observations and percentage cover metrics (rather than above water observation and species richness) can reduce uncertainty and error. To support users when applying the scale we provide an online application – LOFeR – which features: (i) thousands of underwater vessel images for training and self-assessment, and (ii) an LOF Calculator that can be used in the field to automatically calculate whole-vessel LOF ranks from multiple ranks applied to different underwater surfaces. The LOF scale has been used most extensively in New Zealand to establish biological thresholds and underpin regulations and monitoring for biosecure boating. New Zealand's three-tier approach to managing boat biofouling addresses boats arriving at the border from overseas, traveling within and between different regions, and visiting marine protected areas. Over 47,000 LOF-based vessel surveys in recent years support New Zealand's approach, which provides a roadmap for other jurisdictions toward managing this large and unwieldy transfer mechanism.

# In hot water - the potential for thermal treatment for controlling the highly invasive seaweed *Caulerpa brachypus* in New Zealand

**Michele Rogalin-Henderson**[1], Jessica McLay, Andrew Jeffs

[1]University Of Auckland

A number of seaweed species in the genus *Caulerpa* are characterised as some of the most invasive marine species in the world. Unfortunately, there are a limited range of interventions for dealing with incursions of exotic *Caulerpa* species, that have acceptable ecological impacts. This initial study assessed the potential to use heated seawater to kill fragments of *C. brachypus*, a recent invader of concern in Aotearoa - New Zealand. In the laboratory *Caulerpa* fragments were exposed to heated seawater treatments of 30 to 80 °C in 5 °C increments for each of four experimental treatment durations of either 5, 10, 30 or 60 seconds and then cultured for one week in stable conditions. At 50 °C or higher for 5 seconds or more, and at 45 °C or higher for 30 seconds or longer, all fragments died, whereas below these treatment combinations most fragments remained alive, with 100% survival in the control with only a sham treatment handling. These results clearly indicate the potential to use heated seawater for the control of *C. brachypus*, which should be confirmed through a field experiment.

# Aquaculture Leading the Way in Marine Biosecurity: A National Perspective

**David I. Taylor**[1]

[1]Technical Director, Aquaculture New Zealand

New Zealand's aquaculture industry is proactively addressing the national challenge of marine biosecurity, driven by core values of sustainability and environmental protection. Recognizing the country's global connectivity through ocean transport, the industry is actively fostering a national biosecurity awareness in collaboration with government, regional councils, and other marine stakeholders.

Through a strong partnership with Biosecurity New Zealand under the Government-Industry Agreement (GIA), Aquaculture New Zealand is aligning the industry's readiness and response activities for critical pests and diseases. This includes comprehensive strategies for high-risk pathway management, surveillance protocols, and proactive planning initiatives. The aquaculture industry's A+ biosecurity standards continue to lead the way for a cohesive national approach to marine biosecurity, fostering collaboration across government, councils, and industries. The operationalization of the industry's A+ biosecurity standards is achieved through comprehensive Biosecurity Management Plans (BMPs), supported by standardized templates detailing national and facility-level controls. These plans encompass crucial elements such as staff training, record-keeping, risk-specific controls, surveillance and contingency protocols, annual review processes, and compliance verification. Our vision is for marine biosecurity to become an ingrained practice, supported by solid science, driving continuous improvement under our A+ Sustainability Framework.

# SESSION 7: AOTEAROA AND THE UN OCEAN DECADE

## Awatere/Wairau

## Halfway point: the UN Decade of Ocean Science and Kāhui Manaaki Tangaroa – the New Zealand National Decade Committee

**Dan Hikuroa** [1,2]

[1]New Zealand National Commission for UNESCO, [2]University of Auckland

With the UN Decade of Ocean Science for Sustainable Development 2021–2030 at its halfway point, the NZ National Decade Committee, Kāhui Manaaki Tangaroa, is taking stock of progress made in supporting the goals of the Ocean Decade and is identifying key priorities for the next five years. Established by the NZ National Commission for UNESCO in 2021, the Decade Committee represents a range of cultural and multidisciplinary interests and embraces multiple knowledges, disciplines and sectors through an ocean kinship approach to the Decade. This tailored approach aims to place indigenous knowledge at its core – alongside science to truly recognise our unique, diverse and rich cultural and natural seascapes. Guided by the Barcelona Statement, the strategic ambition setting process of Vision 2030 and the findings of the independent mid-term evaluation of the Decade, the Decade Committee will continue to support strengthening the Decade's impact, including by facilitating Decade Actions, reinforcing collaboration nationally and internationally, and prioritising our links and connections within the Pacific and beyond. We look forward to being able to share some of this work, to engage conference participants with the Decade, and to connect with researchers and organisations to ensure we can link and profile work underway.

## Bringing the world to Aotearoa and taking Aotearoa to the world: Takeaways from the UN Ocean Conference in Nice, June 2025

**Anna Campbell**[2], Silke Bieda[1]

[1]New Zealand National Commission for UNESCO, [2]Yellow Eyed Penguin Trust

The NZ National Commission for UNESCO and other organisations from Aotearoa were represented at the 2025 UN Ocean Decade Conference in Nice in June to support the implementation of Sustainable Development Goal 14. During the high-level UN Conference, the National Commission presented on panels, co-hosted side events and collaborated with delegates from Aotearoa and the Pacific, such as the Yellow-eyed Penguin Trust, the Pacific Community (SPC) and others. Our engagements have increased Aotearoa's visibility internationally and built on the momentum gained through recent international engagements like the Ocean Decade Conference in Barcelona last year and the Pacific Islands Conference (PICOSOM). Participation reaffirmed NZ's commitment to the vision of the Ocean Decade and our role as an advocate for indigenous knowledge systems to be recognised and valued alongside science. There has been growing respect for Aotearoa's leadership in advocating for the recognition and key role of all knowledge systems in the Ocean Decade. Aotearoa has had a big part to play in the paradigm shift noticeable at international meetings. We need to ensure we continue to create opportunities for New Zealand on the international stage to manifest this respect. The presentation looks into engagements at UNOC and outcomes from the conference.

# Advancing Ocean Literacy Through Connection, Collaboration and Recreation

**Patrick Burnham**[1]

[1]Sir Peter Blake Marine Education And Recreation Centre

In Aotearoa New Zealand, no one lives more than 130 km from the coast, and over 75% of us live within 10 km of the sea. Yet, despite this proximity, studies show ocean literacy remains low globally, with only 1 in 5 people able to identify key issues facing our marine environments. At the Sir Peter Blake Marine Education and Recreation Centre and through Seaweek, we are addressing this gap by fostering stronger connections between people and the ocean. Our aim is to build ocean literacy through recreational experiences and strategic educational initiatives, including the creation of An Ocean Literacy Guide for Aotearoa Educators, and our UN Ocean Decade-endorsed Seaweek celebration every March. To amplify the voices of marine scientists, indigenous knowledge holders and community leaders, our NZ National Commission for UNESCO-sponsored series Ngā Kōrero, offers insight into marine research, mātauranga and ways to turn knowledge into action. These in-person and online events invite broad public engagement to celebrate our collective relationship with the ocean. We will share our journey, impact, and next steps, demonstrating how collaboration and storytelling can inspire stewardship and deepen ocean connection for future generations.

# The voice and rights of the ocean

**James Tremlett**[1]

[1]Ocean Rights and Kinship Alliance

As we complete the first quarter of the 21st century, most national and global ocean governance frameworks remain fundamentally utilitarian, based on philosophical notions of '*mare nullius*' and an essential separation between people and 'nature'. These frameworks have not been successful in reversing any of the major environmental crises afflicting the ocean. However, historical and contemporary cultural relationships with the ocean in Aotearoa and Te Moananui a Kiwa demonstrate that other forms of ocean governance are possible. We discuss the policy and governance implications of these relationships, with a focus on the opportunities and risks of innovative legal concepts including environmental personhood and the rights or voice of nature. We argue for the centrality of protecting and reviving cultural relationships with the ocean, and discuss what taking these relationships seriously would mean for the practice of marine science during the UN Ocean Decade.

## SESSION 7: RESTORATION 2
### Te Hoiere

# Revitalising the Gulf: a guidance framework for marine habitat restoration in the Hauraki Gulf / Tīkapa Moana / Te Moananui ā Toi

**Al Alder**[1]

[1]Cawthron Institute

The Revitalising the Gulf Strategy (the Strategy) underscores the urgent need for effective actions to enhance the ecological health of the Hauraki Gulf Marine Park (Tīkapa Moana / Te Moananui-ā-Toi). This presentation introduces the marine habitat restoration framework for the Strategy, which involves a set of guidelines developed to support active marine habitat restoration within the Gulf. These guidelines integrate foundational ecological principles, and international best practices from the Society for Ecological Restoration (SER) to support ongoing and future work. Key components of these guidelines will be discussed that includes setting ecological objectives using reference ecosystems, understanding ecosystem functions and services, navigating active and passive restoration approaches, the critical role of diverse knowledge systems, stakeholder engagement and monitoring, addressing the challenges of scaling, and the importance of adaptive management. This framework aims to empower practitioners, researchers, and iwi partners to undertake effective and culturally informed marine restoration initiatives that contribute to the goals of the Revitalising the Gulf plan.

# Building for Biodiversity: The Role of Ecology in Seawall Design

**Shelley McMurtrie**[1], Nick Hempston[1], Jesse Burns[1], Caroline van Halderen[2], Jeremy Walters[2], Kirsty Thorpe[2], Andrew Burns[3], Simon Cager[4], Derek Wilshere[5]

[1]EOS Ecology, [2]Stantec, [3]McIndoe Urban, [4]Hutt City Council, [5]Community liaison

As sea levels rise and extreme weather events become more frequent, upgrades to existing man-made coastal structures are being increasingly considered to defend vulnerable coastal communities. Seawalls are commonly employed to protect coastal infrastructure, but these typically provide limited habitat value to rocky shore species. The need to upgrade 4.4 km of existing seawall around Wellington Harbour, as part of a larger Eastern Bays Shared Path project, provided an opportunity to look at resolving this conundrum. Coastal ecologists, Hutt City Council, and coastal engineers and landscape architects worked collaboratively to develop a 'Seawall & Revetment Habitat Plan', which presented design features to improve the habitat values of the structures, increase the potential for benthic colonisation, and provide opportunities for the local community to interact with the intertidal zone. The features included a bespoke design for a curved seawall texture and constructed rockpools suitable for vertical surfaces and incorporating into rock revetments. Shortly after construction began, intertidal species began to colonise the new textured surfaces, indicating that primary succession was underway. This project highlights the value of effectively engaging ecologists on coastal protection projects, and demonstrates the advantages that can be realised through the implementation of ecologically focused seawall design features.

# Site and seasonal influence on transplantation success of adult seagrass

**Dan Crossett**[1], Jess Barr[1,2], Alba Cervantes-Loreto[1], Irisa Hudson[1,3], Anna Berthelsen[1], Dana Clark[1]

[1]Cawthron Institute, [2]University of Birmingham, [3]University of Auckland

Seagrasses are important ecosystem engineers that live at the land / sea interface. Their meadows create nursery habitat for fish, support high biodiversity, enhance water quality and store carbon. However, seagrasses are declining globally and in many places in Aotearoa New Zealand. Shoot-based restoration, via transplantation of adult seagrass plants, is one approach to combat seagrass loss. We tested the success of transplanting 150 mm² plugs of intact adult seagrass from two meadows differing in age and environmental conditions to nearby mud habitat and across two seasons (summer vs winter). Transplant success was determined by number and length of blades. The study was carried out over two years in Nelson Haven estuary, NZ. We found that both site and season influenced transplantation success. Seagrass plugs had greater success when transplanted from an 'older' meadow that had less fine sediment accumulation and shorter tidal exposure than from a 'newer' meadow with high fine sediment and longer exposure. Plugs transplanted in winter had greater success than those transplanted in summer. For example, we observed growth from twelve to 377 blades at the older site and after winter transplantation. Learnings from this study give key insights to guide future seagrass restoration efforts.

# Reviving the Seabed: Enriching biodiversity and habitat complexity with mussel shell material from aquaculture

**Emilee Benjamin**[1], Andrew Jeffs[1], Sean Handley[2], Rachel Hale, Jenny Hillman[1]

[1]The University of Auckland, [2]National Institute of Water and Atmospheric Research

Coastal habitats around the world have been devastated from anthropogenic stressors, causing a loss of biodiversity. In places with large aquaculture industries, such as New Zealand and Chile, mussel shell material can be utilized to increase habitat complexity, restore the seabed, and boost benthic biodiversity and productivity. Placing oyster shells in coastal habitats have also shown great benefits in oyster restoration initiatives. Despite the opportunity for ecological gains from returning shell material to the marine environment, large quantities of bivalve shells are disposed in landfill each year. To better understand how to utilise mussel shell for benthic restoration, a series of experiments were undertaken at the top of the South Island of New Zealand. These experiments aimed to test how the provision of substrate in the form of shell material helped newly-transplanted green-lipped mussels, *Perna canaliculus*, to establish. The experiments also assessed the wider biodiversity benefits of installing shell reefs compared to adjacent degraded soft sediment habitats. The results of these studies provide new insight for using mussel shells to maximize ecological benefits through boosting coastal biodiversity and productivity and increasing prospects for future coastal restoration efforts.

# Mai i Whangamoa ki Horoirangi, mai i uta ki tai - working together for marine habitat mapping

**Harry Allard**[1], Dayveen Stephens[2], Anaru Stephens[2], Stew Robertson[3], Enrique Pardo[3], Monique Ladds[3], Tom Brough[4], Sean Handley[4], Debs Martin[5], Aneika Young[5], Rob Major[6], Emilee Benjamin[8], Dan Crossett[7], Brad Cooper[9], Jean Davis[10], Vikki Ambrose[10], Karen Tunley[10], Fraenzi Furigo

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Mana whenua, central and regional government and research bodies created the Wakapuaka Governance Group to direct research, restoration and conservation actions in the coastal area surrounding the Wakapuaka Taiāpure and Horoirangi Marine Reserve, Nelson/Whakatū . The multi-partner group was formed around the HYPLAN multibeam survey undertaken by LINZ in 2023, and identified opportunities to augment the multibeam results to better understand seabed habitats in the area. The fieldwork was carried out over 14 days in 2025, utilising drop camera work, baited underwater video (BUV), and Ponar sediment grab sampling to inform terrain modelling, a fine scale benthic habitat map, and species distribution models. The study area covered ~42km² around Pepin Island, including both the Marine Reserve and Taiāpure. The fieldwork and post-analysis identified extensive biogenic habitats with diverse invertebrates and a range of piscivorous fishes, and relocated horse mussel beds identified in the early 2000s. The 'Mai i Whangamoa ki Horoirangi, mai i uta ki tai' project demonstrates broad collaboration between different stakeholders in the marine space, identifying synergies and addressing data gaps for all parties involved. Additionally, the project has provided valuable learnings to inform local efforts to restore biogenic habitats in the Wakapuaka Taiāpure.

# Wakapuaka Co-restoration, Mai i Whangamoa ki Horoirangi, mai ki uta ki tai: A multi-agency inter-generational marine ecosystem restoration project supporting whānau values

**Dan Crossett**[1], Dayveen Stephens[2], Anaru Stephens[2], Te Puoho Stephens[2], Stew Robertson[3], Enrique Pardo[3], Mon Ladds[3], Tom Brough[4], Sean Handley[4], Debs Martin[5], Aneika Young[5], Rob Major[5], Harry Allard[6], Jean Davis[7], Vikki Ambrose[7], Karen Tunley[7], Brad Cooper[8], Fraenzi Furigo[9], Emilee Benjamin[4],[10]

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The Wakapuaka Taiāpure, within Tasman Bay in Te Tauihu, is an area which historically hosted a biodiverse marine ecosystem providing abundant kaimoana. Today there is little left, with rocky reefs now degraded to barrens, koura and blue cod populations in decline, and minimal rimurimu (seaweed) and kūtai as habitat to help recover this ecosystem. As kaitiaki, the Wakapuaka whānau wish to restore and maintain ecological integrity in their rohe. This project is a collaborative effort between a multitude of organisations to determine opportunities for interventions to bring balance back to this rohe. Leveraging extensive mapping and baseline work previously completed in the Taiāpure, four 5000 m² sectors were set up in April 2025. In two of these sectors, kina were culled, testing the feasibility of removing kina as a habitat restoration technique in this rohe. Next steps are to maintain kina-culled zones and investigate habitat enhancement through the transplantation of kūtai and rimurimu to encourage natural recruitment of these important ecosystem foundation species. The results of this project will shed light on the potential to undergo co-restoration on rocky reef habitats as well as the individual impact of each restoration intervention to aid in rehabilitation of important ecosystem services.

# SESSION 8: HE TAI PARI

## Awatere/Wairau

## A collaboration of mātauranga Māori and western science for the monitoring of pipi (*Paphies australis*) in Tauranga Harbour

**Tyla Kettle**[1], Ashley Flood[1]

[1]Boffa Miskell

Between October 2015 and July 2016, dredging in Tauranga Harbour for the Port of Tauranga's shipping channel expansion removed approximately 95 m² of subtidal shell bank from Te Paritaha, a culturally significant pipi harvesting site. As a condition of consent, a Te Paritaha Monitoring Plan (TPMP) was developed to assess long-term changes in pipi populations and habitat. In 2022, Boffa Miskell, in collaboration with the Port of Tauranga and Tauranga Moana Iwi Customary Fisheries Trust, began implementing the TPMP, which incorporated mātauranga Māori into site selection and methodology. Initial 2022 surveys revealed a decline in adult pipi and high intertidal juvenile abundance, prompting expansion of the TPMP in 2023. Survey effort increased to 430 benthic cores across subtidal and channel-edge sites. Since 2022, six monitoring rounds have been completed with iwi and hapū involvement. Pipi numbers have varied (827–16,267), with a shift from recruit-dominated to juvenile-dominated populations, and gradual adult recovery. Sediment grain size has remained stable; contaminants have stayed below guideline values, though elevated PAHs were detected in pipi flesh in May 2024 following a hydrocarbon spill. Continued biannual monitoring is recommended to track ecological trends and uphold cultural values associated with Te Paritaha.

## Working in partnership to explore seafloor habitats around Te Pātaka o Rākaihautū/Banks Peninsula

**Fiona Shanhun**[1], Davina McNickel[1], Rik Tainui[2], Robin Wybrow[3], Tom MacTavish[4], Monique Ladds[4]

[1]Environment Canterbury, [2]Ōnuku Rūnanga, [3]Wairewa Rūnanga, [4]Department of Conservation

On a global, regional and local scale, knowledge of seafloor habitats is limited. The Iongairo project around Te Pātaka o Rākaihautū / Banks Peninsula is a collaborative partnership between mana whenua rūnanga and regional and central government agencies to better understand seafloor habitats and drivers of change in this culturally, ecologically, and economically important area.

The project built on Toitū Te Whenua Land Information New Zealand's hydrographic survey work, surveying additional areas and undertaking extensive ground truthing. Broad scale habitat maps that predict the distribution of hard substrate (e.g. reef, boulders), soft sediment features (e.g. sand, shell, mud) and biological community types (e.g. algae, sponges) were developed. Changes in land surface elevation across Te Pātaka o Rākaihautū over the past 40 years were also explored, providing insights into vegetation change over this period. Outputs from this work have transformed our ability to make informed coastal planning and environmental management decisions. We will highlight the importance of a partnership-focused approach that honours and incorporates tikanga and māturanga Māori, and share the value of working together to bring about a better future for our marine environment. We will also share key outputs that will inform environmental management decisions for years to come.

# Tiaki Moana: A Pacific Regional Dialogue on Marine Conservation and OECMs

**James Nikitine**[1]

[1]Blue Cradle Foundation

Held in French Polynesia in March 2025, Tiaki Moana was a regional summit and workshop that gathered over 200 participants from 35 countries and 22 Pacific Island nations to explore the future of marine protection across the Pacific. The event focused on the intersection of Indigenous knowledge, scientific innovation, and policy dialogue, with particular attention to the role of Other Effective area-based Conservation Measures (OECMs) in achieving the 30x30 global biodiversity target. Designed as a bottom-up, unconference-style gathering, the programme featured thematic workshops across five key areas: OECMs, Indigenous knowledge, existing tools, innovation, and governance. 44 Young Pacific Leaders joined experts and practitioners in co-creating recommendations for regional action. Supported by the governments of French Polynesia, the United States, and France, alongside Pew, and co-organised with the Rahui Centre, SPREP, IUCN, and the Ocean Knowledge Action Network, the initiative will culminate in a published report and documentary film presented at UNOC3 in France. More than a workshop, Tiaki Moana became a movement-building process—restoring connections with the ocean, uplifting local leadership, and strengthening regional collaboration. This presentation will share key outcomes and reflect on how this approach can inform evolving marine conservation efforts across Aotearoa New Zealand and the wider Pacific.

# Hauraki Gulf/Tīkapa Moana Te Moananui-ā-Toi proposed marine protection monitoring — an update

**Emma Kearney**[1], Mathilde Richer De Forges[1], Jordi Tablada[1], Greig Funnell[1], Monique Ladds[1]
[1]Department Of Conservation

The Revitalising the Gulf Strategy (RTG strategy) sets out the marine-based actions the Government will take, working alongside tangata whenua, stakeholders, and local communities, to restore the health of Hauraki Gulf/Tīkapa Moana Te Moananui-ā-Toi. The Hauraki Gulf/Tīkapa Moana Marine Protection Bill is one of these actions and is currently progressing through the legislative process. The Bill seeks to address the decline of the gulf's marine environment by creating new marine protected areas. This includes the establishment of two marine reserve extensions, 12 high protection areas (HPAs), and five seafloor protection areas (SPAs). Collectively these areas will nearly triple the current protected area in the Gulf from just over 6% to approximately 18%. The legislation is unique for several reasons, including the requirement for the Department of Conservation (DOC) to report on research or monitoring within new protections every 5 years, with a 20-year review. Here, we outline DOC's approach for long-term outcome monitoring of the proposed protections. We also describe the integration of these protections with other components of the RTG strategy, including fisheries management and habitat restoration, to ensure a holistic approach to marine conservation.

# Metabarcoding and machine learning provide complementarity for biofouling community monitoring on open ocean aquaculture structures in Tasman Bay and Pelorus Sound

**Tian Tian**[1,2], Xavier Pochon[1,3], Peter Bell[1], Maren Wellenreuther[1,2]

[1]Plant & Food Research, [2]The University of Auckland, [3]Cawthron Institute

Biofouling has a pronounced negative impact on the profitability of mariculture. With the advent of increasing aquaculture production and the transition of mariculture towards offshore locations, biofouling challenges are anticipated to escalate. To minimise this, anti-fouling approaches such as chemical coatings and physical removal have been applied. However, many of these pose risks for the aquaculture species and the environment. To optimise mitigations and identify alternatives, this talk will discuss the usage of novel techniques to facilitate effective monitoring of biofouling communities to inform management. Specifically, this talk will mainly explore the utility of metabarcoding and machine learning (ML) models for molecular and image analysis to qualify and quantify the biofouling communities on the aquaculture structures in Tasman Bay and Pelorus Sound, New Zealand. These tools were employed to analyse biofouling growth patterns on different aquaculture materials in exposed and sheltered sites, and at different depths, at regular sampling times throughout winter and summer. Significant effects from seasons and exposures have been found. The ML models for occlusion estimation and species identification have been developed and validated.

# Time to Put BOFFFF to Bed: Why We Need to Stop Talking About Big, Old, Fat, Fecund Female Fish

**Dr Armagan Sabetian**[1], Dr Jingjing Zhang[1,2], Dr Julian Lilkendey[1,3]

[1]Auckland University Of Technology, [2]The New Zealand Institute for Plant and Food Research Limited, [3]Leibniz Centre for Tropical Marine Research (ZMT)

The BOFFFF hypothesis—asserting that older, larger female fish are the keystones of population sustainability due to their superior reproductive output—has enjoyed a long and often unquestioned tenure in fisheries science. Our recent work on Snapper (*Chrysophrys auratus*) and Giant Kōkopu (*Galaxias argenteus*) using fatty acid biomarkers finds no compelling evidence that maternal age correlates with superior provisioning of essential lipids during reproduction. This aligns with already established empirical research demonstrating that reproductive performance is not a simple function of size and age, but rather a complex interplay of ecological, physiological, and genetic factors. The reality? Older fish are not magical baby-making machines, and clinging to this outdated idea oversimplifies the dynamics of fish reproduction. Effective conservation and fisheries management should focus on maintaining diverse age structures rather than placing the burden of population survival on grandmothers. It's time to move on from BOFFFF and embrace a more nuanced, evidence-based approach to sustaining fish populations.

# SESSION 8: MOTION OF THE OCEAN
## Te Hoiere

## Deep Water Renewal, Vertical Mixing and Oxygenation in a Temperate Fjord in Aotearoa / New Zealand

**Jackson Beagley**[1,2], Robert Smith[1], Chris Moy[2], Gael Arnaud[3], Gary Wilson[4], Richard Kinsey[5]

[1]Marine Science, University Of Otago, [2]Geology, University of Otago, [3]MetOcean, [4]University of Waikato, [5]Department of Conservation

Fjords are global hotspots for carbon burial. Hydrodynamics play an important part in fjordic carbon burial as they govern transport of sediment and influence dissolved oxygen concentrations in deep water that can affect carbon remineralisation. Fiordland removes a similar magnitude of $CO^2$ to that produced nationally, but despite its significance and the importance of oceanographic processes, controls on deep water properties in these fjords are currently poorly understood. Deep water renewal (DWR) has been suggested to occur annually during winter, however it hasn't been directly observed and sources and processes responsible for DWR are unknown.

We investigate DWR processes using a combination of in-situ time series together with 1D and 2D numerical models in a silled (130 m) fjord – Patea / Doubtful Sound. This study provides the first direct observations and quantitative characterisation of renewal frequency in a New Zealand fjord. Renewal is annual, occurring episodically over up to four months during winter and increases oxygen content in deep basins. We describe a novel process producing dense water for DWR through deepening, cooling and densification of the coastal winter mixed layer. Our insights provide critical information for predicting future evolution of the deep basin conditions for these critical environments.

## Drivers of recent extreme upper-ocean warming on Campbell Plateau

**Cassidy Collier**[1], Dr Robert Smith[1], Dr Philip Sutton[2]

[1]University Of Otago, [2]National Institute of Water and Atmospheric Research

The ocean over the Campbell Plateau, within New Zealand's SubAntarctic Zone, constitutes a significant portion (~20%) of the country's Exclusive Economic Zone (EEZ), supporting rich fisheries and diverse marine ecosystems. Although typically among the coolest waters in the EEZ, this region recently experienced an intense (>2.5°C anomaly) and prolonged (288-day) "marine heatwave" throughout much of 2023. A quasi-stationary Argo float, positioned on the Campbell Plateau for the past eight years (2016-2024), offers a novel opportunity to investigate the physical drivers of these recent extreme upper-ocean temperatures in the region. This study uses data from the Argo float in combination with reanalysis and satellite-derived datasets to construct a mixed-layer heat budget, enabling a mechanistic analysis of the drivers of the recent extreme warming event. We find that the event was primarily driven by anomalous warming from air-sea heat fluxes. This presentation will discuss the oceanic and climate drivers of this event in the context of broader seasonal to interannual variability in mixed layer temperatures over Campbell Plateau. While the ecological consequences of this recent extreme warming event remain uncertain, identifying the physical drivers provides essential insight into their potential impacts and the conditions likely to arise under continued anthropogenic climate change.

# Glider Oceanography: Marine Research in Aotearoa with Autonomous Technology

**Alain de Verneil**[1], Joe O'Callaghan[2], Jasmin McInerney[1], Craig Stevens[1,3], Cassandra Elmer[1], Eleanor Haigh[1], Charine Collins[1]

[1]NIWA, [2]Oceanly Science, [3]University of Auckland

Over the past two decades, gliders have become an established sampling platform in the global oceanographic research community. As autonomous robots that can be out at sea for weeks in harsh weather conditions, they provide an opportunity to fill critical data gaps where in situ sampling by a human being would be either too hazardous or expensive. Additionally, as over time gliders have been adopted and become more established, there is a greater diversity of instruments being adapted for glider deployment, including but not limited to biological optics, oxygen, acoustics, particle spectra, turbulence, and carbon chemistry (e.g. pH and DIC). Here we present the past ten years' worth of glider deployments in Aotearoa, consisting of 36 deployments, with a cumulative 37,500 profiles over 864 days at sea. Highlighted results include the propagation of low-salinity eddies, turbulent mixing in the Cook Strait. We demonstrate the utility of gliders in establishing seasonal baselines necessary for gauging future climate impacts, a role especially critical in coastal waters where global Argo float data are missing. We finish with suggestions for future work, in particular biogeochemical applications, of gliders in Aotearoa's coastal waters.

# Integrating Next-Generation Biophysical Models to Environmental Management of Marine Ecosystems

**Romain Chaput**[1], Benjamin Knight[1], Malcolm Smeaton[1], Andrew Jeffs[2], Ross Vennell[1]

[1]Cawthron Institute, [2]University of Auckland

Biophysical models are essential tools for understanding populations connectivity, forecasting marine pest dispersal, and visualizing pollutant transport. However, their practical application in coastal management has been constrained by computational inefficiencies, often limiting simulations to coarse, low-resolution scale that fail to capture the complexity of coastal ocean dynamics. While high-resolution oceanographic models now exist, few biophysical models can leverage them effectively due to performance limitations. To address this gap, we developed OceanTracker—a next-generation, Lagrangian particle-tracking model optimized for speed and scalability that can take advantage of unstructured grids. Its computational efficiency enables the simulation of hundreds of millions of particles, supporting robust statistical analyses relevant to marine management. In this presentation, we demonstrate OceanTracker's versatility through three case studies: (1) evaluation of connectivity among wild shellfish beds to support conservation and fisheries management, (2) identification of optimal sites for collecting or producing green-lipped mussel spat to enhance aquaculture operations, and (3) a forecasting system to assess the risk of harmful algal blooms in the Marlborough Sounds. Finally, we highlight how OceanTracker's portability and efficient processing allow seamless integration into websites and interactive tools, enabling on-the-fly visualization of model predictions for real-time decision support.

# Population genetics and connectivity of a high-dispersal larvae marine invertebrate, the New Zealand Sand Dollar *Fellaster zelandiae*

**Ian Dixon-Anderson**[1], Ceridwen Fraser[1], Miles D. Lamare[1]

[1]University Of Otago

New Zealand marine hydrological processes and geographic patterns are particularly influenced by the Cook Strait, separating the North and South Islands, with fast tidal flows and deep bathymetry influencing biogeographic disjunctions on the upper South Island in several marine taxa. This oceanographic separation has been seen to cause differentiation of population structures in Hector's and Maui dolphins, and so the Cook Strait area may be the epicentre of genetic breaks. This central location may also have the most genetic mixing from recent recolonization efforts of these different populations. Shorter larval development windows of some species can result in genetic isolation between stretches of coast in New Zealand, while species with longer larval stages show an absence of population subdivision across New Zealand. These differences raise questions about how ubiquitous the influences of abiotic and ecological forces are versus hydrological and geographic factors in shaping biodiversity in New Zealand. All previous ecological work has assumed the uniformity of *Fellaster zelandiae* without considering population dynamics, phenotypic plasticity or genetic diversity. Here, we set out to test the questions how homogeneous is the genetic structure of *Fellaster* across the country and do classical population breaks seen in coastal taxa apply to *Fellaster*?

# Remote sensing of change in Aotearoa New Zealand coasts and oceans: satellites, aerial vehicles and AI

**Matt Pinkerton**[1], Mark Gall[1], Francois Thoral[1,2], Philip Sutton[1], Simon Wood[1], Tilmann Steinmetz[1], Graham Rickard[3], Daniel Price[4], Scott Nodder[1]

[1]NIWA, [2]School of Science, University of Waikato, [3]Victoria University of Welington Te Herenga Waka, [4]Kea Aerospace

We present updated 'State of the Environment' indicators of ocean temperature, marine heatwaves, primary productivity, coastal attenuation and turbidity based on satellite observations. Since 1981, the oceans round Aotearoa New Zealand have become hotter and the pace of warming has accelerated since 2000, outstripping the global average threefold in some areas and bringing more marine heatwaves. In northern Subtropical waters warming has led to reduced primary production likely by inhibiting vertical mixing and reducing macronutrient supply to the photic zone. This reduced productivity has been somewhat offset at the EEZ scale by increased productivity in southern Subantarctic waters, where the mixed layer has shoaled, increasing average mixed-layer irradiance. However, since 2019 chlorophyll-a concentrations have fallen in all ocean areas maybe indicating a crossed threshold. In coastal areas, satellite observations show reducing turbidity at the shelf-scale with localised increases likely connected to sediment runoff and resuspension. Coastal environmental changes are harder to observe remotely than oceanic changes due to optical complexity and higher variability. We discuss how long-endurance, high-altitude, unmanned aircraft could be a game-changer for remote sensing of New Zealand's coastal seas and how Artificial Intelligence may unlock 3-dimensional, high-resolution, wide-area observations of coastal conditions.

# Syndiniales Distribution along the Munida Time Series Transect

**Sajini Dissanayake**[1], Linn Hoffmann[1], Tina Summerfield[1]

[1]University Of Otago

Plankton are the foundation of the marine food web, and they play a significant role in shaping marine ecosystems. Among these, Syndiniales are a dominant group of dinoflagellates, that occupy all marine habitats. These organisms are exclusively parasitic and capable of infecting and killing a wide range of hosts, including harmful bloom-forming dinoflagellates. Rising ocean temperatures have shown to positively influence Syndiniales, potentially enhancing their growth and distribution. Given their ecological importance, understanding how environmental factors affect their distribution is essential. In this study, we investigate how temperature and other environmental parameters influence the abundance and distribution of Syndiniales. Our primary sampling site is the Munida Time Series transect, the longest running time series for ocean carbon chemistry in the Southern Hemisphere, which is located off the coast of Otago, New Zealand. This transect crosses three different oceanic water masses (neritic, sub-tropical, and sub-Antarctic), and a key oceanographic boundary named, the Southland Front. This offers an unprecedented opportunity to investigate environmental and biological controls on parasite-host interactions, and plankton community structure. We will discuss how collected data improves our understanding of parasitic plankton dynamics and their potential impacts on future plankton communities under climate change.

## SESSION 9: FINFISH AQUACULTURE
### Awatere/Wairau

# A twisted tail: visualising early spinal deformities to improve mararī/butterfish aquaculture

**Ria Rebstock**[1], Nicola Shaw[1], Charlie Barker[2], Robert Woolley[3], Matthew Wylie[2], Flavio Ribeiro[2]

[1]The New Zealand Institute for Plant and Food Research Limited, [2]The New Zealand Institute for Plant and Food Research Limited, [3]University of Otago

New Zealand's aquaculture industry currently relies on a single finfish species (Chinook salmon), limiting both resilience and market diversity. Mararī/butterfish (*Odax pullus*) presents a promising opportunity for aquaculture diversification and premium product development. During early juvenile development in captivity, several external deformities have been identified. This study used image analytical tools such as micro-computed tomography (micro-CT) and X-ray to characterise bone malformations in early juvenile specimens sampled during captive rearing. Cartilage and bone staining techniques were also used to visualise the mineralisation process in larval butterfish and key timepoints where spinal abnormalities such as vertebral fusions and axial bends were identified.
Body deformities likely serve as early indicators of environment and/or nutritional suboptimal conditions, leading to health, welfare and performance impairment. This study contributes towards the establishment of a visual and potentially quantifiable "deformity index," enabling the characterisation and quantification of deformities in mararī/butterfish. Alongside with skeletal development timepoints, these results form the baseline for the refinement of larval rearing protocols to produce healthy fingerlings for on-growing farming. While the imaging is visually striking, its real power lies in transforming fish health diagnostics into a proactive aquaculture strategy.

# Acoustic conditioning of tāmure (snapper, *Chrysophrys auratus)* and araara (trevally, *Pseudocaranx dentex)* using a pūtātara, traditional Māori wind instrument

**Warren Fantham**[1], Craig Radford[2], Liam Hegarty[1], Morgan Puklowski[1], Maren Wellenreuther[1 3], Hemi Cumming[1], Ribeiro Flavio[1]

[1]Plant And Food Research, [2]Institute of Marine Science, [3]School of Biological Sciences

With increasing labour costs and the need to improve animal welfare, innovative ways are needed to improve aquaculture husbandry protocols. A method to passively move fish populations to perform specific tasks such as health and performance monitoring, would be a useful for fish husbandry. Classical Pavlovian conditioning involves training an individual or a group of individuals to respond towards a conditioned stimulus, such as acoustic cues, coupled with an unconditioned stimulus, such as food. Following the removal of the unconditioned stimulus, the individuals or group would still respond to the conditioned stimulus. In the present study, we aimed to identify if the complex sound of a pūtātara (Māori wind instrument) can be used to train both snapper and trevally to move and accumulate fish a feeding zone. Tāmure and araara took 9 and 11 days, respectively, to be conditioned using the pūtātara sound. After 50% of the population was replaced with 50% naive fish, it took 24 hours before both naive snapper and trevally started entering the zone following the acoustic cue. This study shows that fish can be conditioned using acoustic sound, a technique with the potential to improve animal welfare and facilitate fish husbandry.

# Building an aquafeed ingredient business for Aotearoa

**Damian Moran**[1], Abby Albright[2], Katrina Fletcher[3], Mark Jarvis[1], Lee M Huffman[3]

[1]NZ Institute for Plant & Food Research Limited, [2]NZ Institute for Plant & Food Research Limited, [3]NZ Institute for Plant & Food Research Limited

Finfish production is likely to increase significantly over the next 10-20 years as new farm sites, production technology and investment becomes available for salmon and other species. This offers an opportunity for New Zealand to develop an aquafeed industry to underpin the sector, and ensure our farms have access to high performance feeds optimised for our species that is built upon a secure and sustainably sourced ingredient base. Currently almost all the feeds used in New Zealand aquaculture are imported from overseas. This reality leaves our farmers vulnerable to long and complex supply chains and sees a large proportion of farm expenditure head offshore. In this presentation we will discuss our research into developing aquafeed ingredients that can be produced at commercial scale in New Zealand. New Zealand leads in extracting proteins in the dairy industry and we are applying our similar experience and understanding to develop aquafeed ingredients and feeds from forage crops used for dairy, sheep and beef farming. In addition, we are researching aquafeed ingredients derived from insects reared on mussel and grape byproducts, as well as side streams from our seafood and horticulture industries.

# Effects of formulated diets on the growth and health performance of sub-adult butterfish (*Odax pullus*) in captivity

**Charlie Barker**[1], **Nicole Jerez**[2], Poppy Underhill[2], Katrina Fletcher[2], Flavio Ribeiro[1], Matthew Wylie[1]

[1]Nelson Research Centre, The New Zealand Institute for Plant and Food Research Limited, [2]Food industry Science Centre, The New Zealand Institute for Plant and Food Research Limited

Mārari/butterfish (*Odax pullus*) show potential as a novel aquaculture species in Aotearoa-New Zealand because of their low-trophic feeding habits, cultural significance, and potential to control biofouling on marine farming structures. This study presents results from a three-month feeding trial aimed at evaluating the effects of five different formulated diets on the growth and health performance of sub-adult butterfish raised in captivity.

Each diet was tested in triplicate (n= 3 tanks per diet; 47 fish per 800-L tank), with fish at initial body weight of 85.60 ± 0.88 g. Temperature was maintained at 17°C throughout the trial. Treatments included a commercial carnivorous control diet, and four experimental diets formulated in-house with varying fibre and carbohydrate sources, including sustainable and locally available ingredients such as Greenshell™ mussel powder and native seaweed flours.

Key performance indicators measured included specific growth rate (SGR), feed conversion ratio (FCR), survival, and proximate and fatty acid composition of both fish and diets. Results are the first steps towards the development of nutritionally balanced aquafeeds for butterfish, and support the ongoing development of broodstock husbandry protocols for this species.

# The use of black soldier fly larvae meal (BSFLM) produced in New Zealand as an alternative ingredient in aquafeeds

**Leonardo Magnoni**[1], Erin Bell[1], Damian Moran[1], Amira Mahmoud[2], Zhongyi (Jay) Liu[2], Federico Fabisik[2], Jane Symonds[3], Katrina Fletcher[2]

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The development of alternative protein sources for NZ aquafeeds is an important factor to consider in light of the projected growth in NZ aquaculture. The insect ingredient industry is becoming increasingly relevant worldwide and could play a significant role in NZ as a source of high-quality protein with a steady supply and low carbon footprint. We are currently exploring the use of black soldier fly (*Hermetia illucens*) larvae meal (BSFLM) as a potential ingredient in aquafeeds for Australasian snapper (*Chrysophrys auratus*) and Chinook salmon (*Oncorhynchus tshawytscha*). We have developed the capability to produce BSLFM from BSFL reared in our insect bioconversion facility and to design, manufacture, and test species-specific aquafeeds.
We conducted a palatability trial in juvenile Australasian snapper and found that, compared with a reference diet, the inclusion of 30% defatted BSFLM produced in our facilities did not significantly affect feed intake or feed conversion ratio. We are currently planning to implement growth trials using commercial defatted BSFLM (Veolia Entomeal) as an alternative ingredient in juvenile Chinook salmon aquafeeds to explore whether this or an equivalent product could be used in the feed formulation without affecting growth, feed conversion ratio, or health status.

## SESSION 9: NOVEL MONITORING METHODS
### Te Hoiere

# Monitoring Temperate Reef Health: Harnessing Passive Acoustics to Assess Ecological Risks in Aotearoa

**Fiona Chabbey**[1]

[1]University Of Waikato

Effective conservation of Aotearoa/New Zealand's temperate reef ecosystems hinges on access to reliable, timely data to address growing threats —yet marine environments remain logistically challenging and costly to monitor. Passive acoustic monitoring (PAM), increasingly adopted internationally, remains underutilised in New Zealand, despite its potential to enhance ecological surveillance across the vast exclusive economic zone. This study presents a case for the use of PAM as a tool in informing species shifts and furthering marine reserve management. Using visual reef health assessments concurrently with PAM, this study aims to ascertain presence, abundance, and potential impacts of sea urchin, *Centrostephanus rodgersii*, on Otāiti/Astrolabe Reef (Motiti Protection Area) and Motiti Island. Preliminary findings confirm *C. rodgersii* has steadily expanded its range southward, now inhabiting reefs within the Motiti Protection Area. High densities have been recorded in association with barren habitats. Accurate, current data on *C. rodgersii*'s expansion is crucial for understanding and mitigating its potential threat to reef ecosystems, with PAM offering a valuable early warning system to detect outbreaks. The expansion of *C. rodgersii* along eastern Tasmania led to substantial ecological and economic losses. Without action, New Zealand risks facing a similar crisis—underscoring the urgent need for enhanced monitoring and management strategies.

# Enhancing environmental DNA detection of Aoteoroa New Zealand longfin and shortfin eels through targeted primer design

**Therese Miller**[1 2], Julia Barth[3], Alexandre Che[4], Emily Giles[2], Chrysa Gubili[5], Hannah Hampton[2], Andrew Jeffs[1], Robert Jehle[6], Michael Matschiner[7], Ezgi Ogutcen[8], Amandine Sabadel[4], Robert Schabetsberger[8], Xavier Pochon[1 2]

[1]University Of Auckland, [2]Cawthron Institute, [3]University of Basel, [4]Auckland University of Technology, [5]Fisheries Research Institute, [6]University of Salford, [7]Natural History Museum, University of Oslo, [8]Paris Lodron University of Salzburg

Freshwater eels (genus: Anguilla) are a highly valued fishery, particularly to Māori, and an important symbol of environmental health. However, the spawning sites and larval dispersal of Aotearoa taonga longfin (*A. dieffenbachii*) and shortfin (*A. australis schmidtii*) eels are unknown. To address this, we aligned 344 complete mitochondrial genomes, covering all known Anguilla taxa, and assessed target amplicons in silico using AssayID software for cross-reactivity among Pacific Anguilla species to design species-specific droplet digital PCR (ddPCR) assays. Outputs returned primer and probe sets on 14 genes for *A. dieffenbachii* and on 12 genes for *A. australis schmidtii*. Assays were ranked by inter- and intra-genetic distance, melting temperatures, GC content, and Shannon entropy. Subsequently, end-point PCR with tissue samples of Pacific Anguilla species verified amplification specificity and detected little cross-species reactivity. Laboratory tests confirmed that primers for mitochondrial ATP6 and NADH5 successfully amplify the two target species, although further refinement is needed to fully prevent cross-reactivity within assays. These primers and probes will be used with ddPCR to detect and quantify environmental DNA (eDNA) from New Zealand longfin and shortfin eels in seawater, advancing our ability to track and conserve these culturally and ecologically important species during their marine migrations.

# CREST (Coastal Receiving Environment Scenario Tool) for Assessing How to Improve Ecological Health of Estuaries/ Harbours

**Mike Chen**[1], Ben Tuckey[1], John Oldman[1]

[1]DHI water and environment

The Coastal Receiving Environment Scenario Tool (CREST) is a digital online system which allows users to visualize individual sources and sinks of contaminants for an estuary/harbour, run what-if load change scenarios, and provide the user with an understanding of the connectivity between catchments and the coastal receiving environments. The connectivity allows decision-makers to use CREST's scenario manager to assess the most appropriate and cost-effective targeted mitigation to improve water quality in receiving waters. CREST is underpinned with a coupled catchment-coastal hydrodynamic model to predict the transport and fate of terrestrial sourced contaminants, including nutrients, sediment, bacteria and heavy metals. CREST has a feature which allows the user to present the full spatial and temporal model data and extract a time series from anywhere in the model domain for any focus contaminant. With its user-friendly interface, the solution facilitates collaboration and stakeholder engagement anytime and anywhere. Previous approaches in New Zealand have focused on meeting contaminant targets within freshwater and then determining the outcome in the marine receiving environment. CREST provides an integrated approach to this process and quantifies the potential outcomes of targeted load reductions in terms of the ecological health. CREST has been applied in nine New Zealand estuaries.

# Fibre-optic cable interferometry monitoring in the southwest Pacific: Application to tsunami early warning

Fry, Bill[1], Grand, Johan[2], Marra, Giuseppe[3], Tamussino, Max[3],Gusman, Aditya[1], **Kellett, Richard**[1]

[1]GNS Science Te Pū Ao

[2]Measurement Standards Laboratory, New Zealand

[3]National Physical Laboratory, U.K.

The global tsunami monitoring network currently does not have the ability to achieve the detection and forecasting goals presented by the UN-IOC Tsunami Programme within the Ocean Decade. This is largely due to our real-time inability to directly measure ocean height over most of the worlds ocean basins. The New Zealand DART network of ocean-bottom pressure sensors represents one of the global golden standards of direct tsunami observation, yet it is hindered by the relative sparsity of its 12 stations. Ultra-stable fibre-optic cable interferometry is a strong candidate to augment sparse DART measurements, giving us the possibility of achieving the 2030 Ocean Decade forecasting targets. In the Pacific's first deployment of this technology, the U.K National Physics Laboratory, NZ's Measurements and Standards Laboratory and GNS Science have joined forces to establish a test of the capability of interferometry for providing improved tsunami monitoring and early warning for the southwest Pacific. In this talk, we will present the physical principles of the method, the format of the experiment and preliminary results applied to the largest earthquake and tsunami the experiment has recorded to date. We will further highlight future ocean monitoring possibilities for the wider community.

## Quantifying Interdependence of Anthropogenic and Subsea Activity via Ocean Currents using Acoustic Doppler Current Profilers (ADCPs)

**Will Reis**

Sonardyne International

Quantifying interdependence of anthropogenic and subsea activity through oceanic currents requires an understanding of current parameters across the full range of ocean depths. Acoustic Doppler Current Profilers (ADCP) provide a means to record such parameters. Integrating acoustic modems allow near-real-time data transmission and associated decision-making. We present two contrasting deployments where anthropogenic activity has potential to impact the natural environment and vice versa with action taken as a result.

Shallow-water Origin 600 ADCP units were deployed at the Australian Institute of Marine Science ReefWorks testbed area in NE Queensland. Dredging operations have potential to swamp the Great Barrier Reef with sediment in this area. We present 5 months of data from various sea states and storm conditions enabling the National Sea Simulator to plan operations while mitigating environmental impact. Deep-water Origin 65 ADCP/PIES units were deployed alongside University of Rhode Island systems to monitor the Gulf of Mexico Loop Current System. The LCS has potential to amplify hurricane systems prior to landfall as well as disrupt oil & gas operations. We present findings from the first 6-month tranche of data recovered acoustically by Unmanned Surface Vehicles including nutrient transfer and associated echoes thought to be from fish, shrimp or squid.

# POSTER ABSTRACTS

*Poster abstracts are sorted alphabetically by presenter surname

## Fabrication and trial of artificial rock pools at Lyttelton Port Company: a cost-effective approach for small-scale eco-engineering

**Tommaso Alestra**[1], Crystal Lenky[2], Gabe Ross[1], Rory Gray[1], Kirsty Brennan[2], Charlotte Jones[2]

[1]Boffa Miskell Ltd, [2]Lyttelton Port Company

Marine ecological engineering (eco-engineering) is increasingly used to promote more sustainable marine built environments. Marine eco-engineering solutions, despite not representing a substitute for natural systems, have provided encouraging results so far, but biodiversity benefits have been shown to be context-dependent, and applications have been limited to a few geographical hotspots. Here we present one of the first marine eco-engineering applications in Aotearoa New Zealand: a small-scale trial of artificial tidal pools at Lyttelton Port, in Whakaraupō / Lyttelton Harbour. While there are several proprietary tidal pool designs available, these are typically very expensive and require sophisticated casting facilities. In contrast, the tidal pools in use at Lyttelton Port are based on a relatively simple design that allowed the construction of the pools in-house using recycled materials and a bit of Kiwi ingenuity (including the use of a range of perishable elements to produce fine-scale surface texturing). This shows that there are ways to make marine eco-engineering relatively affordable and low-tech. In addition to details of the fabrication process, we will present preliminary results from the monitoring program measuring biodiversity within and outside the pools, one of the first assessments of the performance of marine eco-engineering features in Aotearoa New Zealand.

## New investigations suggest ontogenetic diet and habitat change in the Angolan flying squid (*Todarodes angolensis*)

**Samuel Clough**[1], Dr Amandine Sabadel[1,2], Emily Fitzgerald[1], Darren Stevens[2], Dr Heather Braid[1], Dr Sarah Bury[2], Josette Delgado[2], Dr Kathrin Bolstad[1]

[1]School of Science, Auckland University of Technology, [2]National Institute of Water and Atmospheric Research

Cephalopods are an influential trophic link from low-level consumers to apex predators and an important vector of nutrients between different marine habitats. Despite the important role they play within marine ecosystems, 90% of cephalopod trophic ecologies remain unknown and few studies utilise more than one method to investigate their diets. To fill this knowledge gap, this research uses morphology and DNA barcoding to identify prey items in the stomach contents of the Angolan flying squid (*Todarodes angolensis*). However, this only provides data on the specimens' most recent meals and is biased to prey with indigestible parts; longer term comparative data can be obtained using bulk stable isotope analysis (SIA) of carbon and nitrogen. Squid beaks are chitinous structures that are formed in layers over their lives and SIA values of carbon and nitrogen are indices for habitat use and trophic position. Therefore, by sub-sampling their beaks at three different locations, representing different life stages, and measuring the corresponding stable isotopic values, we can infer habitat and trophic changes throughout the squids' lives. Dietary and SIA data for *Todarodes angolensis* suggest there is an ontogenetic descent and widening of their trophic niche, with adults becoming demersal predators.

## An investigation into the diet of Elephant fish (*Callorhinchus milii*) in Aotearoa / New Zealand

**Kat Cooper**[1], Brit Finucci[1], Ashley Rowden[1 2]

[1]Victoria University Of Wellington, [2]NIWA

Chondrichthyans are increasingly understood to be an important part of ocean ecosystems, but this ecological role is still unclear. The Elephant fish (*Callorhinchus milii*) is a chimaera species endemic to New Zealand and southern Australia, found at depths up to 200 m. Little is known about Elephant fish, including its trophic ecology, despite being targeted across much of its range. This study used stomach content analysis to generate a more comprehensive understanding of the diet of Elephant fish, and to identify biological and/or environmental predictors that may explain variation in diet. Crustaceans, in particular pagurids and brachyurans, were the most important prey type for the Elephant fish examined, with a relative importance of 56%, followed by molluscs, with a relative importance of 30%. The single most important prey species was *Leucosiidae spp*., which occurred in nearly half of all stomachs. Depth was found to be the greatest predictor of variation in Elephant fish diet, with samples taken from greater depths containing more bivalve molluscs and polychaetes, and those from shallower depths containing more gastropod molluscs and brachyuran crabs. Location and sex were also found to influence Elephant fish diet variation. These findings were consistent with studies of other chimaera species.

## Marine Ecological Valuation Guidelines

**Sharon De Luca**[1], Tommaso Alestra

[1]Boffa Miskell Ltd, [2]Tonkin & Taylor

In 2015 the EIANZ (Ecological Institute of Australian and New Zealand) published 'Ecological Impact Assessment: Guidelines for use in New Zealand: terrestrial and freshwater ecosystems. Addendum Module 1 to these Guidelines, 'Assigning Ecological Value to Marine Benthic Habitats' introduces marine ecosystems to the Ecological Impact Assessment. The guidelines provide a hierarchy of ecosystem characteristics set against a hierarchy of ecological values ranging from Negligible to Very High values. This module was largely prepared by Drs Sharon De Luca and Tommaso Alestra (Boffa Miskell Ltd.) and a number of Tonkin & Taylor Ltd. ecologists, along with input from several external reviewers. The key attributes of broad-scale and fine-scale characteristics soft shore and hard/rocky shores that could be considered in a marine ecology assessment were summarised and independently peer reviewed. This agreed-to set of attributes and values for marine ecologists across New Zealand to refer to also will help Resource Managers to ensure that marine assessments are being consistently approached in a clearly understandable and repeatable manner. The Marine Values Guidelines work best hand-in-hand with expert opinion, and do not replace, expert marine opinion and experience.

## Transport and mixing of energy and material in Cook Strait / Te Moana o Raukawa

Craig Stevens[1 2], **Alain de Verneil**[1], Peter Russell[3], Arnaud Valcarcel[4 1 3], Joe O'Callaghan[4], Graham Rickard[5 1], Helen MacDonald[8 1], Khush Jhugroo[2 1], Jasmin McInerney[1], Eleanor Haigh[1], Alice Overend[1 2], Casandra Elmer[1], Ata Suanda[6 3], Cynthia Bluteau[7]

[1]NIWA, [2]Uni. Auckland, [3]Uni. Otago, [4]Oceanly, [5]Victoria Uni. Wellington, [6]Univ North Carolina, [7]Dept Fisheries and Oceans , [8]ANU

Here we synthesize the last two decades of work looking at scales of transport and mixing in Cook Strait/Te Moana o Raukawa. While the strength and complexity of the tides in the region have long been known, recent advances in technology have enabled better exploration as to how the tides, and the not inconsiderable wind-forcing, influence the energy cascade and flow-on effects. The work has focused on aspects such as identifying residual fluxes, determining scales of mixing, the role and persistence of upstream stratification, interacting boundary-layers and the influence of sharp topography. Technology includes ocean gliders, turbulence profiling (and the combination of these two) along with more traditional instrumented mooring and tracked drifters. These data underpin modelling treatments of the system. The combination of these knowledge-streams informs work on topics like biological connectivity, tidal energy, transport and ocean warming.

## Thermal Resilience of the Green-lipped Mussel *Perna canaliculus* is influenced by Parental Origin and Offspring Age

**Jordan Elvy**[1]

[1]Cawthron

Increasing seawater temperatures coupled with intense and frequent heatwaves pose an increasing threat to marine species. In this study, the New Zealand mussel, *Perna canaliculus*, was used to investigate the effect of genetics and ontogeny on thermal resilience. Six selectively-bred families and four different ages, from juveniles (6, 8, 10 weeks post-fertilisation) to sub-adults (52 weeks post-fertilisation), were used for experimentation. At each age, each family was exposed to a three-hour heat challenge, followed by recovery, and survival assessments. Gill samples from sub-adults were collected to quantify hsp70 gene expression. Results showed that genetics, ontogeny and size influence thermal resilience in *P. canaliculus*, with LT50 values between 31.3-34.4°C for all studied families and ages. Juveniles showed greater thermotolerance compared to sub-adults, while the largest individuals within each family/age class tended to be more heat sensitive than their siblings. Sub-adults differentially upregulated hsp70 in a pattern that broadly correlated to net family survival following heat challenge, reinforcing the perceived role of inducible HSP70 protein in molluscs. This study provides insights into the complex interactions of age and genotype in determining heat tolerance of a key mussel species. As marine temperatures increase, equally complex selection pressure responses may therefore occur in the wild.

## Do ray (whai repo) perturbations influence intertidal seagrass patch dynamics and resilience?

**Logan Kallam**[1], Dr. Hazel Needham[1], Dr. Julia Mullarney[1]

[1]University of Waikato

Seagrass meadows are key habitats in coastal systems that provide many ecosystem services to humankind . Meadows are known to be intrinsically patchy, but what governs patch development at different temporal and spatial scales is not well understood. Natural disturbances are inherent, modifying elements of these systems. The disturbances can positively or negatively influence patch structure and persistence at both local and seascape scales. Concurrent and increasing anthropogenic stressors further alter the response of meadows to such perturbations. In many New Zealand estuaries, whai repo (stingrays and eagle rays) disturb seagrass patches when feeding on shellfish. This project aims to quantify the impacts of whai repo feeding on seagrass patch dynamics in Whangamata Harbour (Coromandel Peninsula) and evaluate the influence of these perturbations on seagrass resilience. Here we combine fine-scale, post-feeding field measurements of whai repo pit infilling and seagrass removal with estuary-scale
drone surveys to estimate sediment turnover and feeding frequency. Sediment metrics and seagrass density will be evaluated to explore within and between patch variation. Measurements of seagrass regrowth, morphometry and patch recovery will give insight into the longer-term responses to disturbance.

## Towards cost-effective spectral sensing of phytoplankton

**Paul Barter**[1], **Ben Knight**[1], Anne Vigner[1], Kirsty Smith[1]

[1]Cawthron

Cawthron scientists are developing new tools to detect and predict microalgal community change and mitigate the risk of harmful algal blooms (HABs) in Aotearoa. In-water sensors are crucial to supplement remote sensing satellite observations of the ocean, which can be limited by cloud cover and turbidity.

We report on the development and preliminary results of a cost-effective 18-band spectroscopy sensor covering ultraviolet, visible, and near-infrared spectra. The long-term goal is to create a robust in-water instrument which can be mounted to a buoy or platform and can provide real-time updates of water colour changes. We provide an update on the progress of initial stage of our prototype sensor and benchtop trials on pure algal cultures from Cawthron's Aquaculture Park.

## Increasing Complexities in Habitats Draws in More Marine Life

**Holly Adams**[1]

[1]Nelson College for Girls / Earthminds

Tasman Bay has been overrun with pollutants and toxic algae, reducing the stable habitat for native species. However, is the marine life present now enough to fight back? As part of the Earthminds youth conservation program, our group looked into the state of marine health in Nelson. We carried out field research at Rocks Road during low tide to find what marine life was already established, and how we could increase this. Closer to the shore there were fewer and smaller mussels, oysters, and barnacles than further out. We discussed increasing complexity in the habitat and encouraging more growth as shellfish need texture to hold onto, especially in shallow waters with stronger currents. We conducted an experiment by wrapping natural fibre ropes around support poles at Rocks Road and documented what grew or latched onto them. After two weeks, small sea snails were using the ropes as resting points when the tide was low. These results lead us to believe the additional complexity and water retention in the ropes attracted more organisms to the habitat. Continuation of our project would be further research in a citizen's research paper documenting similar experiments around the Tasman area.

## Deep-Sea biodiversity in the western Pacific Ocean: implications for managing human activities

S Mills[1], M Clark[1], N Davey[1], D Dong[2], O Anderson[1], J Beaumont[1], J Bilewitch[1], C Chin[1], L Gong[2], Q Kou[2], D Leduc[1], **Louis Olsen**[1], A Rowden[1], K Schnabel[1], R Tang[2], Y Tang[2], N Xiao[2], Y Xu[2], J Zhang[2]

[1]NIWA, [2]Chinese Academy of Sciences

The deep sea remains largely unexplored yet plays a vital role in sustaining ocean ecosystems. New Zealand has long-established deep-sea research programmes driven by the need to manage its offshore fisheries and understand threats such as the future impacts of climate change on its marine estate. China has recently undertaken several deep-sea surveys on seamounts and trenches in the central West Pacific Ocean. Over the last decade New Zealand and Chinese institutions, the National Institute of Water and Atmospheric Research (NIWA) and the Institute of Oceanology, Chinese Academy of Sciences (IOCAS), have hosted workshops and taxonomic exchanges to develop a strategic and enduring level of collaboration, culminating in a joint dataset of seafloor video imagery and specimen collections from seamounts. This joint dataset, compiled over the last three years and supplemented by data from the Ocean Biodiversity Information System, was analysed to investigate biodiversity patterns across the western Pacific. This work showcases the benefits of international collaboration and large datasets to reveal hidden patterns of deep-sea biodiversity across vast oceanic scales. Data produced from this project can be used to address major ecological questions and environmental management issues.

# Zooplankton and microplastic in the Southern Ocean: Continuous Plankton Recorder sampling to 2023 with special focus on the Ross Sea sector

**Matt Pinkerton**[1], Svenja Halfter[1], Karen Robinson[1], Kazuto Senga[3], Marianne Nyegaard[3], Jack Fenaughty[4]

[1]NIWA, [3]Sanford Ltd, [4]Silvifish Resources

Zooplankton are crucial for maintaining ecosystem resilience in the Ross Sea region of Antarctica. For more than 15 years, zooplankton and microplastics have been collected between New Zealand and the Ross Sea using the Continuous Plankton Recorder. This poster describes the key findings to date:

1) The Ross Sea region is unusual: phytoplankton and zooplankton are more abundant in the Ross Sea sector than generally in the rest of the Southern Ocean.

2) Phytoplankton and zooplankton communities are changing, with a decreasing trend in phytoplankton, primary production and total zooplankton abundance in the Ross Sea sector between 2008 and 2023. However, trajectories of change differed between taxonomic groups of zooplankton, with some increasing.

3) Microplastics are increasing. The mean number of plastic pieces in near-surface seawater between New Zealand and the Ross Sea increased 11-fold between late 2009 and 2023. Almost all of the plastics were microfibres. Plastic had a statistically-significant and negative association with the abundance of many zooplankton groups, especially at higher plastic concentrations. It's not known if this relationship is causal.

This research helps support New Zealand's strategic commitment to sustainable stewardship of the Ross Sea region, including supporting the Ross Sea region Marine Protected Area.

# Fit Fish, Strong Hearts: Mitochondrial function underpins exercise-enhanced thermal tolerance

**Leteisha Prescott**[1 2 3 4], T. Le[4], E. Seppä nen[5], T. Henttinen[4], A. Ekströ m[6], J. Haverinen[7], K. Anttila[4]

[1]Cawthron Institute, [2]Institute for Marine and Antarctic Studies, University of Tasmania, [3]Blue Economy Cooperative Research Centre, [4]Department of Biology, University of Turku, [5]Natural Resources Institute Finland (Luke) , [6]Department of Biological and Environmental Sciences, University of Gothenburg, [7]Department of Biology, University of Finland

Mortalities in finfish aquaculture are increasingly reported during summer months due to climate change. There is an urgent need for adaptive strategies to enhance survival of farmed fish under heat stress. As the heart is the first organ failing during heat stress, it presents a target for improving thermal tolerance. Cardiovascular performance during heat stress can be enhanced through exercise training, and our team has recently demonstrated this in farmed rainbow trout. Building on this, our project aims to uncover the physiological mechanisms underpinning exercise-enhanced thermal tolerance, beginning with mitochondrial performance. We hypothesised that increased mitochondrial function efficiency may contribute to improved cardiac performance under heat stress. To test this, we reared two groups of farmed rainbow trout under standard aquaculture conditions: a control group exposed to standard water flow (0.5 body lengths per second; bls) and an exercise-trained group exposed to increased flow (0.5–1.3 bls) for six-hours daily over six-weeks. We measured mitochondrial ATP production efficiency in cardiac tissue at optimal (17 °C) and cardiac arrhythmia-inducing (23 °C ) temperatures.
Our results demonstrate that exercise enhances mitochondrial function efficiency at critical temperatures, highlighting exercise-training as a promising, non-invasive tool to improve thermal performance and summer survival in farmed finfish.

## Feeding in Focus: A Behavioural and Machine Learning Approach to Larval Fish Nutrition Research

**Morgan Puklowski**[1], Flavio Ribeiro[1], Hemi Cumming[1], Damian Moran[1], David Ashton[1], Bodhi Bettjeman[1], Warren Fantham[1]

[1]Nelson Research Centre, The New Zealand Institute for Plant and Food Research

The replacement of live feed with inert microdiets during early larval development in altricial fish species remains a significant challenge in aquaculture. Substantial research has focused on nutrition and feed formulation, quantifying actual feeding behaviour and predation success has received less attention. This study proposes a novel, integrative approach using behavioural video tracking, manual annotation, and machine learning to investigate feeding dynamics in *Chrysophrys auratus* (Australasian snapper) larvae.

A purpose-built experimental setup involving three 15L tanks was used to house 3 larvae per tank from 18 to 30 days post-hatch (dph) . Larvae were fed enriched *Artemia nauplii* (live and frozen) , and their behaviour was recorded using DSLR and high-framerate cameras. Footage was manually annotated to identify key behavioural events. Selected video segments are currently being analysed through a Python-based ML pipeline to generate detailed data on larval movement, including 2D swim speed, position, and angle of movement. The resulting dataset will enable the investigation of behavioural trends associated with feeding activity. While analysis is ongoing, this approach shows promise in identifying proxies for feeding events and enhancing our understanding of larval fish behaviour. Ultimately, it may contribute to the development of more effective and species-specific feeding strategies in hatchery systems.

## Filling the Gaps: Mapping Marine Habitats with Divers, Aerial Imagery, and Algorithms

**Laura Read**[1], Dr Hayley Nessia[1]

[1]EnviroStrat

ORA Reefs is a new programme of work looking to undertake reef restoration in the Hauraki Gulf/Tīkapa Moana. As part of this, we aim to explore mapping methodologies to broadly assess biodiversity before and after interventions. While dive surveys can provide high-resolution data including species composition and physical characteristics of the subtidal environment, they are relatively expensive and only cover small amounts of area. Conversely, satellite imagery can provide data over a significantly larger area at relatively little cost, but it may not accurately depict biodiversity and physical traits of subtidal marine habitats. Here, we aim to combine satellite imagery with diver surveys using machine learning algorithms to interpolate habitat data of the entire dive site. By using satellite spectral signature values, we aim to model the relationship between observed canopy cover and spectral response conditioned by depth. We use these linked variables to train a spatially explicit model (Random Forest, Kriging that predicts kelp canopy cover across unsurveyed areas. It is anticipated that this method will produce habitat data at a wider scale to better describe the entire marine landscape of a discrete location, offering a scalable and cost-effective tool for subtidal marine habitat assessments and marine spatial planning.

## Understanding the contribution of temperate mesophotic ecosystems to fish production

**Mollie Rickwood**[1], Dr Alice Rogers[1], Professor James Bell[1], Dr Sarah Bury[1]

[1]Victoria University Of Wellington

In Aotearoa, kaimoana (food from the sea) not only represents an essential source of protein, fatty acids and vitamins but also holds cultural and spiritual significance for coastal Māori. Regrettably, like many fisheries globally, declines in landings and the trophic level of catch have been observed in New Zealand's fisheries. Temperate mesophotic ecosystems (TMEs) around New Zealand's coasts are understudied and unprotected habitats that may be supporting fish production. To examine this concept, we will firstly identify the TME-associated prey items of commercially and culturally important fish species using a simple diet study and fatty acid analysis. Subsequently, the contribution of the identified TME-associated prey will be quantified using a combination of bulk and compound specific stable isotope analyses. These results will support the development and parameterisation of a multi-species size spectrum model (MSSM), which will be used to explore and predict the contribution of TMEs to fish production. The results of this work could have important implications in fisheries management including the inclusion of habitat in management and promoting the protection of TMEs around Aotearoa with co-occurring benefits for the suite of biodiversity that relies upon them.

## Sorting strawberry squid: A systematic and ecological review the deep-sea squid family Histioteuthidae (Verrill, 1881)

**Benjamin Shirey**[1]

[1]AUT Lab For Cephalopod Ecology & Systematics

The deep-sea strawberry squids (family Histioteuthidae) are globally distributed and ecologically important. Species in this family make up the majority of the diet of important large predators, while the feeding ecology of histioteuthids themselves remains poorly known. However, resolving their taxonomy is a vital first step to understanding ecological interactions. Therefore, the purpose of the present study is to use integrative taxonomy (morphology and genetics) to resolve the taxonomic status of three local species: *Histioteuthis aff. bonnellii, H. aff. eltaninae,* and *H. aff. atlantica* and to understand the overall systematics and ecology of the family at large. This will be accomplished through three aims. First, the three species from Aotearoa will be described using integrative taxonomic methods. Second, a stable isotope analysis of the beaks, combined with descriptions and regression equations, will be undertaken for species that have a sufficient sample size. Third, stomach contents will be analysed using genetics for opportunistically encountered samples. Properly identifying and understanding the distribution and role that histioteuthids play in the oceanic trophic web, as both predator and prey, is the first step required to monitor the health of the ecosystem as the ocean is faced with anthropogenic pressures.

## AI-driven tool for invasive species data search and integration

**Samuel Vander Velpen**[3], Mengjie Zhang[1], Bing Xue[1], Anastasija Zaiko[1], Julian Maclaren[1]

[1]Sequench, [2]Nelson AI, [3]Victoria Univerity of Wellington

Global proliferation of invasive marine species poses a significant threat to aquatic ecosystems, disrupting ecological processes and impacting biodiversity, resource utilization, and human activities dependent on these environments. In response, the EU initiated GuardIAS, a collaborative project leveraging advanced technologies such as AI, environmental DNA, satellite imagery, and robotics to detect and mitigate spread of invasive species.
A primary challenge within GuardIAS is the lack of coherence in invasive species data, characterized by inconsistencies across databases and limited access to usable information. To address this, we are developing an interactive Python-based web tool that features an AI trained to query other AI tools. This web tool will facilitate the setup of queries to gather, extract, and format information on invasive species. Relevant information, as specified in the query or determined by AI training, will focus on data critical for monitoring and managing invasive aquatic species, including ideal living conditions, migration methods, reproduction rates, and known prevention strategies. The extracted data will be delivered in formats such as CSV and GeoTIFF and uploaded to GBIF and EASIN to create a more uniform database. This poster will present the conceptual framework, development process, preliminary findings, and potential future applications of this tool.

## Consquidering Populations: Evaluating Population Connectivity in Aotearoa New Zealand's Arrow Squids, *Nototodarus sloanii* and *N. gouldi* (family Ommastrephidae)

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Two arrow squid species (family Ommastrephidae, *Nototodarus sloanii* and *N. gouldi*) comprise the largest squid fishery in Aotearoa, New Zealand. This fishery is of substantial economic and sustenance value for people, with an average total annual catch of ~30500 tonnes valued at 140 million dollars (NZD). Aotearoa's arrow squids are also ecologically significant, being consumed by many species including the endangered pakake, New Zealand sea lion (Phocarctos hookeri). Although these squids are generally found in distinct geographic areas, the Ministry for Primary Industries (MPI) manages both species under a shared Total Allowable Commercial Catch (TACC) limit. This fishery spans nearly the entirety of Aotearoa's exclusive economic zone (EEZ).

This study will be the first to investigate population structure in Aotearoa's arrow squids using simple sequence repeats (SSRs) and single nucleotide polymorphisms (SNPs). By sequencing specimens from both species throughout their range, haplotype maps, observed and expected heterozygosity, genetic clustering and population differentiation will be determined. These measures will help detect the presence or absence of sub and meta-population dynamics, which will inform sustainable fisheries management. Comparisons will also be made between the utility of SSRs and SNPs as population genetic markers for arrow squids, another first in cephalopod research.

## Counting What Counts: How Inconsistent Taxonomic Resolution Skews Benthic Bioindicator Data

**Paul Wolf**[1]

[1]Ocean Wolf

Invertebrates react differently to environmental gradients such as salinity, temperature, desiccation, and pollution, which makes them effective bioindicators. Opportunistic taxa like Capitella often dominate disturbed habitats, signaling environmental degradation. Similarly, polychaetes from the genus *Prionospio* play a vital role in estuarine monitoring throughout New Zealand. However, inconsistent taxonomic resolution—especially within *Prionospio*—can introduce significant bias in biodiversity assessments.

Although nearly 20 described and undescribed *Prionospio* species exist in New Zealand, monitoring programs often identify only a few species, grouping others as *Prionospio spp*. Based mainly on gill morphology. This characteristic is environmentally variable, easily damaged, and unreliable for accurate identification. Inconsistent species-level resolution within *Prionospio* may artificially inflate diversity indices or obscure environmental patterns, particularly when related genera like *Paraprionospio*—known for their distinct ecological responses—are overlooked. Other taxa are frequently recorded only to the family or order level, further distorting diversity metrics. This poster illustrates how variable taxonomic resolution can obscure actual biodiversity patterns and ecosystem health. Therefore, this presentation advocates for a standardized, integrative approach that combines morphological and molecular tools in collaboration with international experts. Enhancing taxonomic consistency is crucial for reducing bias and improving the reliability of estuarine bioindicators in New Zealand.

## Sex, Settlement, and Sessility: Adaptive Pathways in Marine Invertebrate Life Histories

**Paul Wolf**[1]

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Sessile marine invertebrates exhibit remarkable evolutionary adaptations in their reproductive and developmental strategies, shifting our traditional models of sexual and larval evolution. Contrary to the ancestral traits of gonochorism and brooding in polychaetes and molluscs, many sessile species utilize broadcast spawning and various forms of hermaphroditism. Notably, the phenomenon of alternating sexuality—where individuals can change sex multiple times—has been observed in oysters and is proposed for polychaetes like *Spirobranchus cariniferus*. This reproductive plasticity seems to be an evolutionary response to the constraints and opportunities associated with a permanent attachment to the benthos.

Moreover, larval development in these taxa reflects adaptations to sessility. Extended planktotrophic stages and the capacity to delay or possibly reverse metamorphosis enable larvae to respond flexibly to environmental cues and optimize their chances of successful settlement. In *S. cariniferus*, metamorphosis occurs in two distinct phases—habitat and physiological—highlighting the significance of developmental plasticity in securing suitable settlement sites. These traits enhance recruitment in patchy and competitive benthic environments. This poster presentation will explore how the evolution of reproductive modes and larval dynamics supports life on the substrate, advocating for an integrated perspective that links larval biology, ecology, and evolutionary theory in sessile marine invertebrates.