INSTITUTE PROFILE

Victoria University of Wellington's Coastal Ecology Laboratory—A Uniquely Situated Research Facility for Subtidal and Intertidal Biology

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Te Herenga Waka | Victoria University of Wellington's Coastal Ecology Laboratory is a center of marine biology research in Aotearoa New Zealand's capital city of Wellington. Te Herenga Waka's Coastal Ecology Lab (Māori name: Te Toka Tū Moana) comprises an 816 m^2 research space that includes 113 m^2 of science laboratories, 168 m^2 of wet laboratory facilities supplied with filtered and unfiltered flow-through seawater, and 161 m^2 of oceanfront office space for up to 30 research students, academics, and support staff. The lab provides a staging area for field-based research programs in the Wellington region and across New Zealand. The Coastal Ecology Lab was built on the site of a former shark liver oil processing plant. That original structure was constructed in the 1950s and operated by the Glaxo Company. The University acquired the factory and converted it to the university's first marine lab (the Island Bay Marine Lab) in the 1960s. The first marine lab remained relatively unchanged through 2007, when the buildings were demolished to make way for the new Coastal Ecology Laboratory (pictured in Fig. 1).

The Coastal Ecology Laboratory is located on the south coast of Wellington, Aotearoa's capital city. The Coastal Ecology Laboratory's adjacent marine ecosystems are temperate kelp forests and sandy bay ecosystems, situated within the Taputeranga Marine Reserve on the south coast of Wellington. The Taputeranga Marine Reserve was first established in 2008 and prohibits the take of marine organisms for recreational, commercial, or customary use (Eddy et al. 2008). This close proximity to the Taputeranga Marine Reserve is ideal for resident marine biologists, many of whom have studied the impacts of the reserve on resident biota (Eddy et al. 2014). The marine ecosystems on Wellington's south coast more broadly are comprised of rocky intertidal ecosystems that transition to subtidal kelp forests, deeper rocky mesophotic ecosystems, soft sediment ecosystems and a prominent submarine canyon. The rocky intertidal ecosystems are dominated by bare rock (mainly graywacke) with sparse covers of karengo (rhodophyte seaweeds *Porphyra* spp. and *Pyropia* spp.). Subtidal habitats between 0 and ~16 m are dominated by kelp forests of either Laminariales, or fucales kelp equivalents. The fucales *Carpophyllum* spp. and *Cystophora* spp. are dominant space holders in more wave-sheltered environments and in shallow waters. Kelps, including *Lessonia variegata* and *Ecklonia radiata,* are more abundant within wave-exposed and deeper habitats (Shears and Babcock 2007). Within these kelp forest ecosystems, other common space holders include green seaweeds (*Caulerpa* spp. and *Ulva* spp.), crustose and articulate coralline algae, and sponges. Mesophotic habitats extend to 50–60 m in some locations and are dominated by sponges and bryozoans, although the majority of the deeper habitats in this area eventually turn to bare cobble and soft sediments. These benthic habitats support a wide range of fish and invertebrate species of commercial, recreational and cultural importance, including pāua (abalone: *Haliotis iris* and *Haliotis australis*), kōura (rock lobster: *Jasus edwardsii*), marari (butterfish: *Odax pullus*),

FIG. 1. Exterior of the Te Herenga Waka | Victoria University of Wellington's Coastal Ecology Laboratory Te Toka Tū Moana. Photo credit: Jeff Shima.

FIG. 2. Blue cod (*Parapercis colias*) in front of The Coastal Ecology Laboratory on deeper cobble habitats. Photo credit: Christopher Cornwall.

rāwaru (blue cod: *Parapercis colias*, pictured in Fig. 2), and mōki (blue moki: *Latridopsis ciliaris*). The coastline and nearby harbor also have one of the most northern giant kelp (*Macrocystis pyrifera*) forests in Aotearoa (Fig. 3).

The Coastal Ecology Laboratory primarily supports marine researchers from the School of Biological Sciences, with additional researchers from Health Science, Geography, and Design. It generally hosts between 20 and 30 postgraduate students and between 5 and 8 staff at any one time. There are several key areas of research focus for staff at the Coastal Ecology Laboratory. These include a strong focus on climate change research (Micaroni et al. 2022; Krieger et al. 2023), population and community ecology (Shima and Swearer 2016; Carrington et al. 2021; Bell et al. 2022), and fisheries/marine protection (Eddy et al. 2014; Rogers et al. 2018; Durante et al. 2022). Although we are situated in the temperate zone, we also have a strong focus on coral reef biology, with most of our academics comparing temperate and tropical ecosystem trends in community ecology, eco-physiology, climate change impacts, and fisheries. The Coastal Ecology Laboratory serves as an important staging area for these more distant research programs. The Laboratory also supports an extensive research program focused on mesophotic ecosystems across New Zealand and hosts four small remotely operated vehicles.

FIG. 3. Giant kelp (*Macrocystis pyrifera*) forest in Wellington harbor, near the Coastal Ecology Laboratory. Also pictured is kina (sea urchin: *Evechinus chloroticus*). Photo credit: Valerio Micaroni.

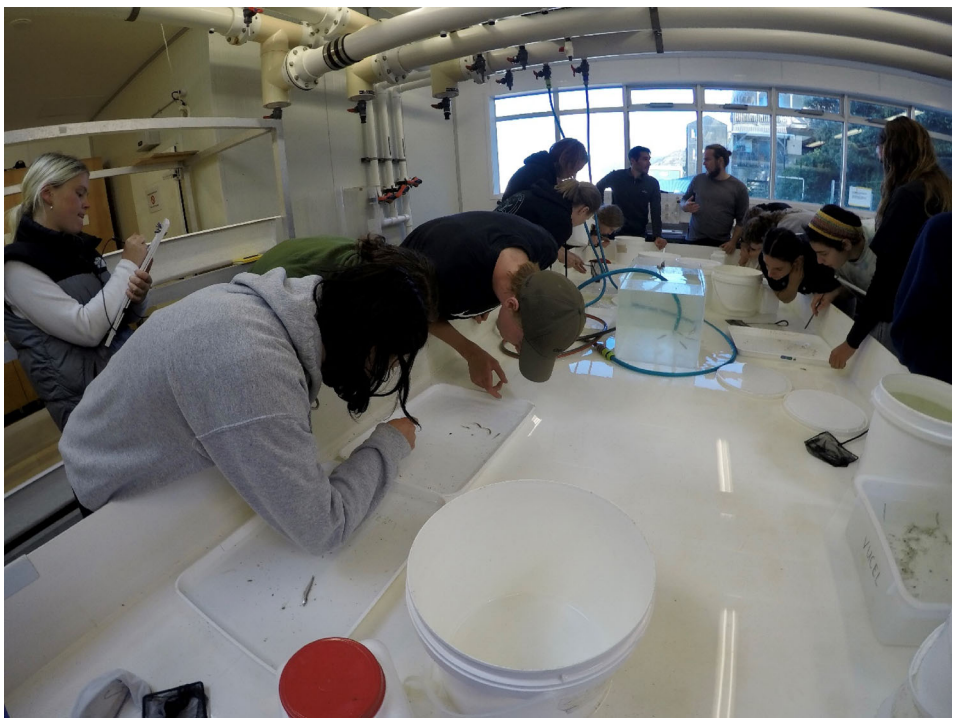

FIG. 4. Students and staff during one of the Coastal Ecology Laboratory's field courses, pictured using one of the wet laboratories. Photo credit: Jeff Shima.

The Coastal Ecology Laboratory has dry and wet laboratories for teaching, research, and outreach activities. One of the Laboratory's key advantages is its capacity to draw seawater directly from a kelp forest ecosystem. This seawater has relatively high natural variability in pH from the metabolic activity of resident seaweeds (up to 0.6 daily), thus facilitating laboratory-based experiments conducted under realistic pH regimes that occur within kelp forests (and not unnaturally low or constant pH regimes). The seawater system includes both raw and filtered supplies. The filtered supply passes through a sand-filter that removes particulates down to 10 μm. The Coastal Ecology Laboratory has a dry lab that can accommodate up to 30 students and is equipped with a dedicated microscopy suite. It also has a semi-automated Apollo Sci Tech titrator for total alkalinity that is capable of both rapid assessment and small volumes (Huang et al. 2012), the only titrator for total alkalinity in New Zealand with this capacity. The Coastal Ecology Laboratory hosts two undergraduate field courses per year, focused on intertidal ecology and subtidal ecology (*see* Fig. 4). These teaching and research programs are supported by three dedicated technical staff and four vessels. The 8.5-m tri-hull *Raukawa Challenger* is well suited to both local and distant uses. Our three 4.6-m aluminum StabiCraft vessels (the

Pipi, *Tuatua*, and the *Tipa*) support local research and teaching. The Coastal Ecology Laboratory also hosts an annual public open day to provide an opportunity for the public to interact with its researchers, including the use of virtual reality headsets so the public can view the nearby marine ecosystems.

The Coastal Ecology Laboratory welcomes new collaborations with other research institutes, and is uniquely positioned, being one of the only cool-temperate marine laboratories situated within a marine protected area that also draws seawater directly from a kelp forest ecosystem. The Coastal Ecology Laboratory can support postdoctoral candidates through The Royal Society Te Apārangi pathways or via international funding agencies. For more information, please see our website: https://www.wgtn.ac.nz/sbs/research-centres-institutes/wucel

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