MARINE BIOSECURITY TOOLBOX

Kia tirotiro mangōpare, arā ko ngā tai e whā
Look through the eyes of the mangōpare, observing in all directions

RESEARCH HIGHLIGHTS 2022



The Marine Biosecurity Toolbox is a 5-year (2019-24) research programme aimed at protecting New Zealand's marine environments from the impacts of non-indigenous species. The programme is jointly funded by the New Zealand Ministry of Business, Innovation and Employment (MBIE) and a unique group of science, Māori, regulatory and industry organisations. The programme's objective is to develop transformative 'tools' that empower regulators, industry, *Mana Whenua*, and the community to effectively manage risk pathways, prevent pest establishment, and detect and respond to new incursions.

The programme is built around four main research themes that target critical stages of the biological invasion process and support key elements of regional, domestic and international biosecurity management: PROTECT, DETECT, MANAGE & RESPOND and ECONOMICS & DECISION-SUPPORT.

Three years into the programme, we have made a great progress across all the workstreams. Here we present the key research highlights accomplished by 2022, along with the envisaged next steps towards the implementation of our science outputs.

Keeping marina pontoons fouling-free – one step closer!

Grant Hopkins, Nicholas Scott, Waikawa Marina, Port Marlborough, Bellingham Marine, Coastguard Nelson

Purpose of the study: Marina and port environments are widely known as hotspots for marine bioinvasions. Structures, like marina pontoons and wharf piles, are particularly prone to colonisation by non-native fouling organisms, including pest species that have become well-established in a region (e.g., Mediterranean fanworms, Pacific oysters). Once marine pests arrive and establish, they have proven to be very difficult to eradicate or control.

Earlier work undertaken during the Toolbox Programme has demonstrated that bubble streams can remove and prevent the settlement of early stages of biofouling. This project aims to develop and test prototype bubble stream systems that can be retrofitted to existing marina pontoon infrastructure and keep them fouling-free.

Brief description and main findings: We have developed a prototype that we believe will be highly effective in reducing biofouling accumulation on marina pontoons. The design consists of stainless-steel brackets that fix the diffusers to the marina pontoon, and 3D-printed clamps that allow the diffusers to be easily swapped out by divers (e.g., if the diffusers themselves become fouled) without the need for tools. This October we commenced a trial in Waikawa Marina, with the view to treat half a marina pontoon (and using the other half as an un-treated reference) during the spring/summer biofouling season. We then plan to treat marina structures at Westhaven Marina, as well as the drive-on pontoon structure used by the Coastguard vessel in Nelson.

Fig. 1. CAD drawing of diffusers retrofitted to a Bellingham Marine concrete pontoon.

Take-home messages: (1) Retrofitting systems to marina pontoons appears very feasible, (2) other structure types are amenable to treatment (e.g., boat docking systems), and (3) prototypes will be further refined and commercialised at the completion of the Toolbox Programme.

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Food for thought – can biocontrol work in temperate settings?

Grant Hopkins, Rebecca McMullin, Lauren Fletcher, Matt Miller

Purpose of the study: Our research has shown that native marine snails, including cat's eye (*kanohi pūpū*) and Cook's turban (*toitoi*), can be used to graze down and control populations of non-native biofouling on marina pontoons (= biological control, or biocontrol). The purpose of this study was to gain a better understanding of appropriate stocking densities for marina pontoons to ensure these native snails do not starve. Future field trials will also provide an opportunity to test and refine devices that aim to stop biocontrol agents escaping.

Brief description and main findings: This study provides the first attempt to match the dietary needs of a biological control agent to the food available in a biofouling control application. Using a NZ marina as a case study, we first aimed to establish a greater understanding of the nutritional composition of biofilm and biofouling communities on marina pontoons over timescales relevant to biocontrol applications, including periods of high (warmer months) and low (cooler) growth rates. This was accompanied by a review of the available information on the dietary requirements of cat's eye (and marine snails generally to identify any potential nutrient deficiencies.

Main findings: Experimental panels (375 x 500 mm) deployed in Nelson Marina during summer months had visible biofouling within two weeks (Fig. 1), developing into substantial fouling biomass after approx. two months (Fig. 2). Biofouling included the usual culprits: barnacles, hydroids, colonial ascidians, bryozoans, tubeworms, and algae. The contrast between summer and winter biofouling accumulation rates was large, with only a small smattering of macrofouling (e.g., barnacles, ascidians, tubeworms, and bryozoans) observed within the biofilm over the deployment period

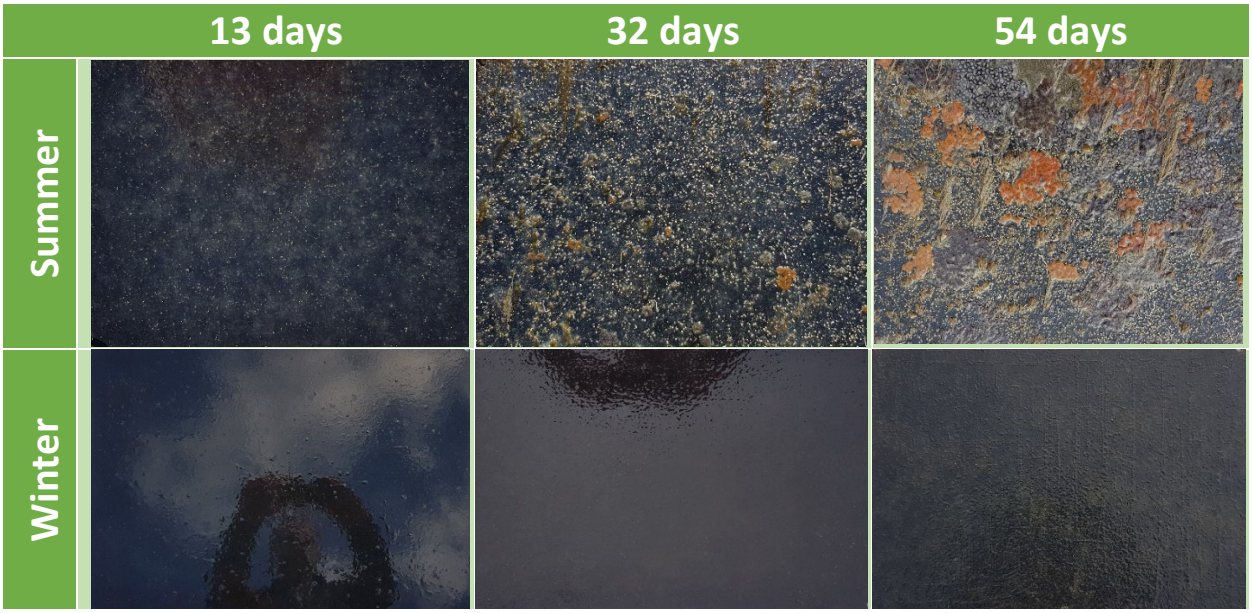

Fig. 1. During summer months, food looks to be plentiful for control agents (top row), but during the cooler winter months, very little fouling growth was observed.

Fig. 2. Average (+1SE) biofouling dry weight following three deployment periods over summer and winter months. Summer deployments had near exponential growth, while winter fouling biomass remained low (<2 g dry weight).

Take-home messages: (1) there are strong seasonal differences in biofouling accumulation rates on artificial surfaces, (2) we expect that, based on our preliminary findings and the literature review, marina fouling should provide a nutritious food supply for control agents during the warmer months, however food supply is likely to be limiting in the cooler, winter months. This is likely to pose a considerable challenge around maintaining appropriate stocking densities on structures in temperate marinas. Control agent responses to periods of low food supply should be investigated, along with other potential strategies (e.g., supplementing food supply in leaner months, adjusting densities based on season).

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