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Building Biodiversity

BUILDING SEAWALLS TO SUSTAIN INTERTIDAL BIODIVERSITY IN ALTERED AND URBANIZED ESTUARIES

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Effect of Rock Type on Artificial Boulder Fields

Many seawalls in Sydney Harbour are decades old and the sandstone blocks from which they are constructed have collapsed and eroded. Some local councils aim to reconstruct seawalls in an ecologically sensitive manner; to provide, not only stability, but also better intertidal habitat. It is common for Councils to wish to place boulders at the base of intertidal seawalls as a means of dissipating wave energy and reducing erosion.

Boulder-fields are less common than other intertidal habitats but are important ecologically. They are unique and complex habitats which support a large number of animals. The top sides of boulders support a similar assemblage to that of rocky shores. The undersides and the substrata beneath boulders, however support a great number of species which are not normally found



Sampling at Rozelle Bay

in other intertidal habitats, including many rare species. The geology of the Sydney basin is sedimentary and consists of 2 main rock types: the Hawkesbury Sandstone and Ashfield Shale. Natural boulders are mostly sandstone. It is becoming popular for artificial boulder-fields at the base of the walls and the walls themselves, to be constructed using igneous boulders such as basalt or granite, as they are harder and denser. It is unknown what effect, if any, the rock type of these boulders will have on intertidal biodiversity, although initial assessments have shown that there are differences between the organisms living in sandstone boulder-fields and those living in basalt boulder-fields. I tested whether the same organisms that recruit to sandstone also recruit to basalt boulders, by placing boulders of both types into basalt and sandstone boulder-fields and sampling them over time.

Overall, sandstone boulders accumulated more algae but fewer tube worms than basalt boulders and mobile organisms were more abundant on sandstone boulders. This indicates more research is necessary before we can advise on what material should be used to build seawalls.

DANNIELLE GREEN, EICC HONOURS STUDENT

Seawall Research Impresses at International Conference

I have recently returned from Plymouth (UK), where I presented a paper describing research from this Linkage Project plus some of our earlier results from studies of seawalls in Sydney Harbour to the "Changes in Aquatic Ecosystems" conference. The talk was very well received because there is increasing concern throughout Britain, Europe and North America about the impact that artificial shorelines, including walls, groynes and offshore coastal defences, are having on marine animals and plants. Most work overseas is still focussed on measuring changes to assemblages and the spread of invasive species. There are still few studies on effects of such changes on ecological interactions (i.e. functional rather than structural effects). No-one else in

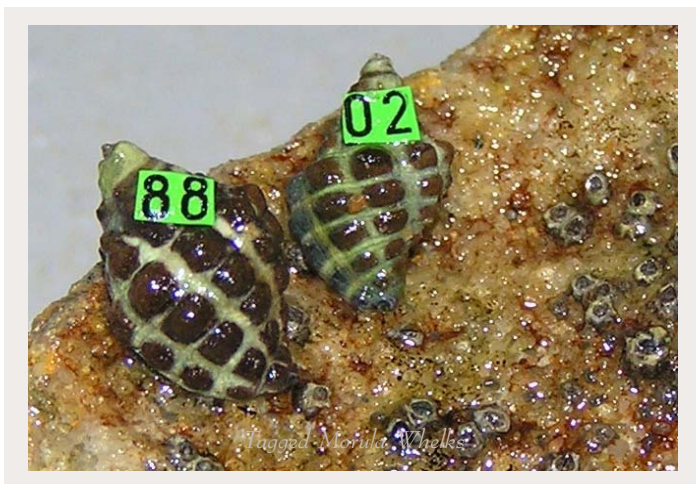
the world is addressing ways of enhancing biodiversity on artificial shorelines with such diverse and novel approaches as we are achieving in this project. Many participants in the conference wanted extra information to take back to their authorities, or simply stated "You are lucky. We would not be able to do that", to which I replied "How do you know until you try?". There is no doubt that this project is at the forefront of this focus of research and all partners in the project have a right to feel very pleased with that. So, once again, I thank you all for your participation and hope that we can get more new projects underway in the remaining time for which there is available funding.

GEE CHAPMAN, PROFESSOR OF MARINE ECOLOGY

Predatory Whelks on Intertidal Seawalls

In Sydney Harbour, seawalls are widespread. They fragment and replace the natural shoreline and form an extensive alternate habitat for intertidal organisms. Although seawalls are often constructed of material similar to that of natural shores, they differ in numerous ways (such as slope, texture, surface heterogeneity). A variety of plants and animals inhabit seawalls, but in a different mix of abundances from those assemblages found on natural rocky shores. In addition, some types of animals (e.g. anemones, starfish, predatory snails) are apparently absent from or rare on many seawalls. These differences in presence and abundance of species can affect the ecological function of the habitat. On rocky shores the mulberry whelk is a common and important predator that can alter numbers of prey considerably. Knowledge of how and why populations of predators differ on artificial substrata is essential to the understanding of these habitats. Preliminary observations suggested that this whelk was absent from or rare on seawalls.

This project investigated how densities and sizes of whelks differed between natural rocky shores and seawalls and sought reasons for these differences. Surveys of whelks indicated that abundances and sizes of individuals were very variable among locations. The whelk was absent from or rare on most seawalls. On some seawalls, however, where the Sydney rock oyster was abundant, densities of whelks were similar to those on rocky shores. Whelks were larger where there were many oysters.



I used individually tagged whelks to study whether differences in growth or survivorship could explain the differences in densities or sizes. There was some evidence that greater survival of whelks in habitats with many oysters could explain differences in density. On seawalls but not on rocky shores, slower growth could help explain the smaller size of whelks where there were few oysters. This information is important if we are to appreciate how artificial substrata affect the biodiversity and ecological function of urbanised environments and is useful both for the management of existing surfaces and for construction of further seawalls.

ANGUS JACKSON
POST-DOCTORAL RESEARCH FELLOW

Biodiversity in Remnants of Natural Habitat in Sydney Harbour

Much of the natural habitat in Sydney Harbour has been lost or separated into remnant habitats by the construction of seawalls. This process is known as 'fragmentation' and results in areas of natural habitat which are small and separated by large distances from one another, often by less suitable habitat. Habitat fragmentation is globally recognised as a threat to biodiversity because there are fewer resources (e.g. space and food) in smaller habitats and when habitats are far apart, organisms must move larger distances over inferior habitat to gain resources.

Rocky shores in Sydney Harbour are naturally patchy and separated either by seawalls or other natural habitats such as mangrove forests and beaches. The presence of seawalls is likely to change the natural connectivity of the coastline. By mapping the length of seawalls and natural habitat in most of the Harbour, we found that more patches of rocky shore were bordered by seawalls than by other natural habitats. Patches of rocky shore bordered by seawalls ('complete fragments') were significantly smaller than those bordered by other natural habitat ('natural patches'). Complete fragments were also further apart from one another than natural patches, because seawalls were generally longer than natural habitats. So, rocky shores in Sydney Harbour are, indeed, fragmented.

We compared the biota on complete fragments and natural patches to test if patterns of diversity in Sydney Harbour match those that we expect when habitats are fragmented, i.e. from currently accepted theory. The number of taxa, number of unique taxa and variability in the number of taxa were all greater in natural patches than in complete fragments, although not all analyses were statistically significant. This research shows that the composition and configuration of 'seascapes' is more important to the ecology of marine organisms than previously thought. By understanding the ways in which organisms use or don't use fragmented landscapes we can ensure effective management of existing fragments.

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