



Bachelor of Science (Honours)

# Environmental Effects of Pollution Near a Coastal Smelter I

## SUPERVISORS

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## FIELD/S of STUDY

Marine Ecology, Environmental Science, Ecotoxicology, Pollution

## RESEARCH PROJECT

Port Pirie hosts the world's largest lead and zinc smelter, in constant operation for more than 120 years. Although discharges and emissions have reduced from the plant in recent years, there are elevated levels of metals such as zinc, lead, arsenic, manganese and copper in the surrounding marine system. As part of a larger project addressing how contaminants are affecting the marine ecosystem, a range of potential projects are available:

### a) **Measuring metal contamination in mangroves**

Mangrove forests are an important component of the marine ecosystem in the upper Spencer Gulf and significant stands are found surrounding the smelter at Port Pirie. This project will measure contamination in mangroves and estimate the total loads of metals sequestered within sediments (and trees) in mangrove stands and the effects on the mangroves and associated communities.

### b) **Measuring metal contamination in marine organisms**

This project will measure contamination in seagrass to determine the level of metal contamination in a live and dead (washed up, wrack) seagrass, which is an important ecological component of the marine system near Port Pirie. Similar projects could also measure metal levels in algae or a range of different animals near the Port Pirie smelter





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# Environmental Effects of Pollution Near a Coastal Smelter II

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## FIELD/S of STUDY

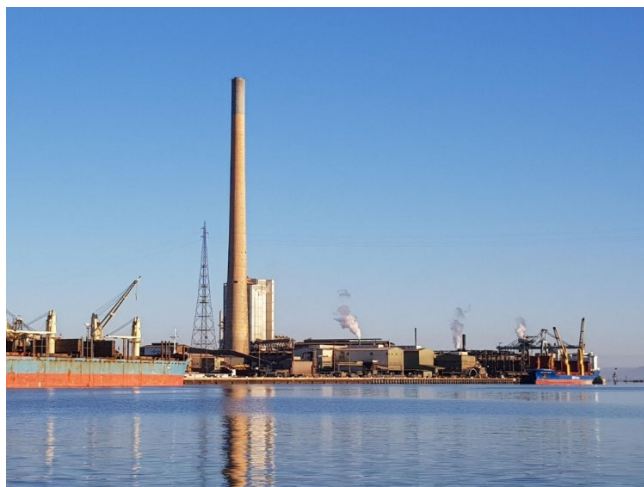
Marine Ecology, Environmental Science, Ecotoxicology, Pollution

## RESEARCH PROJECT

Port Pirie hosts the world's largest lead and zinc smelter, in constant operation for more than 120 years. Although discharges and emissions have reduced from the plant in recent years, there are greatly elevated levels of metals such as zinc, lead, arsenic, manganese and copper in the surrounding marine system. As part of a larger project addressing how contaminants are affecting the marine ecosystem, a range of potential projects are available:

### c) **Development of ecotoxicology tests for metal exposure in reverse estuaries**

Sometime in the near(ish) future the port at Port Pirie will need expanding, involving dredging of highly contaminated sediments. This project will build on work in our group to develop ecotoxicology assays to assess the potential impacts of dredging/metal liberation on different species, relevant to South Australian conditions. While a range of ecotoxicological tests exist for assessing the risk of metals, few are appropriate for South Australia (using local species) and almost none consider that the upper parts of our gulfs are hypersaline (i.e. salinity > 35 ppt). Most assays we use in our lab focus on reproduction and early development in marine invertebrates and algae, but we are also interested in developing survival assays for benthic invertebrates and colonial groups like bryozoans and ascidians.





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# Risk Assessment of Leachates from Woodchips

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## FIELD/S of STUDY

Marine Ecology, Environmental Science, Ecotoxicology, Pollution

## RESEARCH PROJECT

In the mid 1990s many 'bluegum' (*Eucalyptus*) forestry plantations were planted across southern Australia. Those trees are now maturing, leading to pressure for more port facilities to export wood chips. One concern is the potential chemicals that might leach into the marine environment when rainwater percolates through piles of woodchips piled next to docks. Little is known about what level chemicals might leach from woodpiles or how toxic these are. This project would identify the chemical risks associated with eucalyptus wood chip storage using a combination of chemical/experimental, ecotoxicological and risk assessment methods.



<https://www.theadvocate.com.au/story/6278671/storm-the-woodchip-pile-cancelled-after-police-intervention/>



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# Developing Protocols for Remote Operated Vehicle Surveys of Coastal Infrastructure

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## FIELD/S of STUDY

Marine Ecology, Environmental Science, Environmental Monitoring

## RESEARCH PROJECT

Jetties are iconic in South Australia and important economically in regional areas as a focus for coastal tourism and fishing. With lots of hard surfaces underwater to colonise, jetties are effectively artificial reefs, albeit usually quite shaded and harbouring different assemblages to adjacent reef areas. While jetties provide habitat, probably attract fish and are important for people, their wider ecological role(s) in nearshore coastal systems are not well understood. Resolving this requires better understanding of what lives on/near jetties and how this varies spatially and temporally. Normally we would use divers to collect such data, but diving is expensive and sometimes hazardous, so we are looking at whether we could instead monitor using remotely operated vehicles (ROV).

We have a small observation-class ROV, underwater cameras etc. and can access a range of jetties, including some areas with limited public access. This project would collect pilot data on a) invertebrate and algal cover on piles, b) seagrass and benthic invertebrate abundances, c) fish and use these to statistically assess different sampling strategies (effort, transect length, taxonomic resolution etc.) and the effects these factors have on precision and statistical power of monitoring to detect changes across jetties or over time.





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## Cryptic Species Within an Invasive Estuarine Worm

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### FIELD/S of STUDY

Marine Ecology, Environmental Science, Introduced Marine Species

### RESEARCH PROJECT

*Ficopomatus enigmaticus* is a tube building Serpulid worm found in estuaries around the world. Individuals aggregate and small reefs can form from the worms' calcareous tubes, which in turn have significant effects on estuarine ecosystems. The species has become a nuisance biofouling organism in many places, causing environmental and economic harm. Not much is known about its distribution in South Australia, but it has become abundant in the Murray mouth over the last 20 years. Although Australia has been suggested as a place of origin for the species, its native range remains unclear (hence the species name 'enigmaticus'). In a previous study we used genetic markers to try to unravel the population genetic structure of this species across southern Australia (Styan et al., [Aquatic Invasions 17: 53-65](#)). To our surprise, we found evidence of at least two distinct genetic groups living together across Australia. Subsequent work has found a similar pattern across introduced populations in California. This project will use a range of tests/markers to further assess genetic groupings found within this species (are they separate species?) by using cross-fertilisation tests to assess reproductive isolation and test for small scale differences in the distribution of groups along salinity and depth gradients within estuaries. Because the species reproduces over summer, this project is best suited to someone starting in SP5.





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## Intertidal Reefs that Rock 'n Roll

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### FIELD/S of STUDY

Marine Ecology, Environmental Science, Biodiversity

### RESEARCH PROJECT

Rhodoliths are free-living crustose coralline (red) algae (CCA) that, in aggregation, form beds of moving, hard substrate in otherwise soft sediment habitats. Typically spherical (but with complex branching or foliose structure; see below) and ranging in size up to ~ 10cm, rhodoliths form when a piece of CCA breaks off an existing rhodolith or other CCA, or can develop from spores settling onto a small rock or shell. They then grow slowly, forming their spherical shape and free-living nature only in areas with low sedimentation and enough currents and/or waves to ensure rotation (leading to their rounded shape and exposing all surfaces to light). Globally, rhodolith beds are an important habitat, commonly found in deeper (mesophotic) waters. But their importance often goes unrecognised and beds are easily destroyed by activities like trawling or dredging. Rhodoliths also provide an important habitat for many other organisms, often supporting very diverse assemblages of invertebrates and other algae. There are few records of rhodoliths in South Australia, but we have recently come across some places in upper Gulf St. Vincent where patches are found in the intertidal zone, something not recorded in southern Australia. This project will use field surveys to determine the distribution, abundance (and taxonomic) composition of intertidal rhodoliths and potentially investigate the diversity within invertebrate assemblages found in beds.





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## Impact Monitoring of Coastal Developments

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### FIELD/S of STUDY

Marine Ecology, Environmental Science, Impact Assessment and Monitoring

### RESEARCH PROJECT

There are currently several proposals to develop energy and resources projects in the upper parts of the gulfs in South Australia, including a copper mine and a hydroelectricity plant. Some baseline work has been done to consider how the developments might affect the adjacent marine environment and to mitigate impacts where possible. But such assessments are predictions and so if/when the developments start, monitoring will be required to test whether any impacts have occurred. Sometimes, however, the monitoring programmes put in place for these sorts of developments are not designed with enough or appropriately located replication to be able to detect anything other than the most extreme of impacts; i.e. monitoring may be almost pointless because it is not statistically powerful enough to detect small or moderate changes that we might be concerned about. Focussing on one of the intertidal systems near a proposed development, this project will collect/collate pilot (pre-impact) information on populations/assemblages at various spatial and temporal scales and then do statistical modelling to help inform cost-efficient and informative impact monitoring programmes.

