



# State of Cockburn Sound



## 2009 Report



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COCKBURN SOUND  
MANAGEMENT COUNCIL

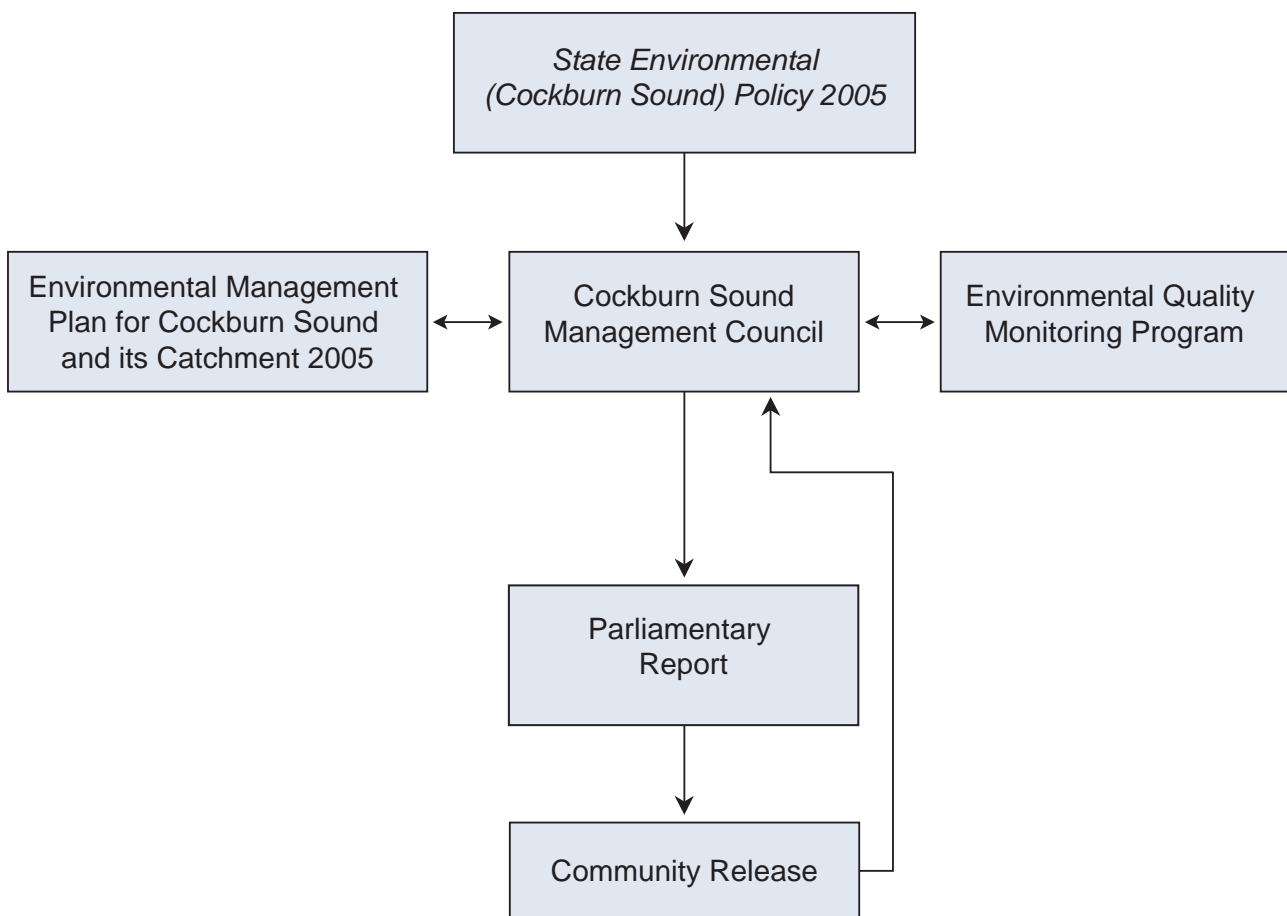
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A view towards the causeway looking from the old Palm Beach jetty (pre-2009)

## The role of the Cockburn Sound Management Council in implementing the *State Environmental (Cockburn Sound) Policy 2005*



This report was endorsed by the Cockburn Sound Management Council  
on 24 May 2010

# Foreword

Cockburn Sound experienced another year of overall good water quality in 2009, although unsatisfactory conditions were reported in several locations including, most notably, Jervoise Bay Northern Harbour. This year's monitoring identified a number of areas of improvement in water and sediment quality as well as some declines across a range of measured environmental parameters. While there have been local fluctuations from time to time, water quality in Cockburn Sound has maintained a level of stability over the past six years, and recently shown some signs of general improvement. This is a good result in the context of the Sound's severe degradation in the 1960s and 1970s when heavy industries were first established along its shores. During this period, the Sound lost close to 80% of its original seagrass meadows and was ecologically changed, leaving a more sandy, exposed and turbid environment and a disturbed ecosystem.

Since then, better management of the Sound has led to a higher level of public awareness and greater commitment by key stakeholders to protecting the Sound. Most importantly, improved industrial practices have resulted in more than 95% of environmentally damaging waste water discharges being eliminated from direct disposal into the Sound.

Contributing directly to Cockburn Sound's extraordinary resilience is the work of the Cockburn Sound Management Council with its capacity to facilitate improved practices, alert stakeholders to current and potential environmental threats, and bring responsible parties together to address problems.

Cockburn Sound provides a rich resource, not only to commercial and industrial interests but also to the wider community, as a very popular recreational, social and environmental asset.

Cockburn Sound is the largest snapper spawning and nursery area in Western Australia, outside of Shark Bay. It is also home to a large dolphin population, a colony of little penguins and a wide variety of other flora and fauna.

Cockburn Sound is increasingly used by the community for recreational fishing, boating and swimming along its beautiful southern beaches.

Expanding urban development and population growth, resulting in increased recreational activity,

places additional pressures on the environmental health of the Sound. High demand for recreational facilities has led to the recent environmental approval for the Port Rockingham Marina, and, in addition, the proposed Cape Peron Tourist Precinct Marina project is currently being progressed.

While the 2009 Report Cards provided in this report are reassuring in that they show stability over a range of environmental measures in Cockburn Sound, there are some areas of concern. On-going monitoring and research, along with appropriate planning and management of this ecosystem, needs to be maintained and, where possible, improved. This will become especially important as proposed large scale industrial harbour and marina developments are progressed and their impacts better understood. Surface water drainage and groundwater influx into Cockburn Sound also need to be considered.

Seagrass health continues to be a core focus of the Council. While this report demonstrates that existing meadows are generally healthy, declines at two sites, particularly at Mangles Bay, a critical fish nursery area, reinforce the need for vigilant management of this vitally important ecological resource. Seagrasses in Cockburn Sound do not naturally regenerate in areas where they previously grew. Retention and management of the remaining seagrass meadows is a high priority issue.

Through its proactive management and the commitment of Council members, staff and stakeholders, the CSMC has demonstrated its leadership in coastal catchment and marine management in Australia. The CSMC will continue to identify and pursue opportunities for improving the health of the Sound to ensure its sustainable future.

It is with pleasure that I submit this State of Cockburn Sound 2009 Report to the Minister for Environment on behalf of the Cockburn Sound Management Council. The report presents an assessment of the health of Cockburn Sound as well as outlining the Council's recent activities and its priorities for the year ahead.

Professor Kateryna Longley  
Chair, Cockburn Sound Management Council  
June 2010





**Cockburn Sound Management Council members and staff** (left to right) – Dr Tom Rose (Coordinator), Dr Boyd Wykes (Defence), Gino Valenti (Fremantle Ports), Paul Brown (DEC), Ian Briggs (Dept Mines and Petroleum), Glenn Dibben (WA Aquaculture Council – Mussel Producers Association), John Smedley (Cockburn Powerboat Association), Professor Kateryna Longley (Chair of CSMC), Bart Houwen (CommNet), Cr Ruth Alexander (Town of Kwinana), Dr Rod Lukatelich (KIC), John Polglaze (Community Rep) and Professor Phil Jennings (Conservation Council WA).

**Absent:** Cr Anne Prince (City of Rockingham), Cr Carol Reeves Fowkes (City of Cockburn), Dr John Keesing (CSIRO), Matt Gillett (RecFishWest), Leon Brouwer (Dept of Water), Guy Watson (Water Corporation), David Saunders and Vivienne Panizza (Dept of Planning) and Geoff Botting (CSMC Senior Environmental Officer) and Petra Kohn (CSMC Administration Officer).

# Contents

Foreword	1
Contents	3
Executive Summary	4
Setting the Scene	7
Key Achievements 2009	11
Strategic Planning	16
Environmental Quality Monitoring Program	17
Report Cards	23
Annual Report Card Comparison 2003–2009	36
Moving Forward	38
Annual Monitoring Programs 2008–09	42
References	45
Glossary	46
Table I – CSMC Membership	47
Table 2 – 2009 CSMC Summary of Issues	48



A local sculpture piece overlooking Owen Anchorage, Coogee.

# Executive Summary

Since 2000, when it was first established, the Cockburn Sound Management Council (CSMC) has been responsible for coordinating and undertaking a range of environmental monitoring programs to assess the environmental health of Cockburn Sound. The CSMC reports annually to the Minister for Environment, Parliament, the Environmental Protection Authority (EPA), and the wider public, on the state of the Sound and on whether the environmental values and objectives established for the Sound are being met, as defined in the State Environmental (Cockburn Sound) Policy 2005 (SEP).



Tiwest – Kwinana Industrial Area

The SEP and the CSMC's Environmental Management Plan 2005 (EMP) were endorsed by Parliament and Cabinet, respectively. This report is the fifth State of the Sound Report submitted to the Minister for Environment and Parliament. During 2009 eleven monitoring programs were accessed and analysed to determine ecosystem health in Cockburn Sound.

There are three levels of protection, set by the SEP – **High**, **Moderate** and **Low** – corresponding to established zones as marked on the maps provided later in this report. Their level of ecological health is indicated by a suite of monitoring results that in each case either meet the environmental quality 'standard' (EQS) or the less stringent 'guideline' (EQG), or exceed these.

These maps also indicate whether, in 2009, seafood was safe for eating, whether the waters were clean for swimming and boating, and whether relevant authorities were protecting the health of aquaculture species grown in the Sound.

Four of the five environmental values, defined in the SEP as needing protection, are reported on here. The CSMC does not report on the fifth value which is to ensure water supply from the Sound is suitable for industrial supply.

The 2009 Report Cards indicate that the marine environment of Cockburn Sound is generally healthy. Monitoring carried out at all sites in the Sound has shown that light attenuation, temperature, salinity and pH levels have met established guidelines. These are all key indicators of a healthy ecosystem.



Kwinana Wreck – Wells Beach, Kwinana

In 2009 ecosystem health parameters for the extensive **High Protection** areas in Cockburn Sound generally met either guidelines or standards, and light attenuation improved significantly. However, dissolved oxygen at two deep southern basin sites exceeded the guidelines.

Seagrasses were reported to be healthy along deep water transects, demonstrating that last year's poor light attenuation was not severe enough to impact on seagrasses in general. The health of seagrasses was considered acceptable for most of the Sound, except for two sites: Mangles Bay and Garden Island Settlement. The deterioration at Mangles Bay may be attributed to a number of human impacts while the decline at Garden Island Settlement may be due to natural variation.

Monitoring results for ecosystem health in areas of **Moderate Protection** outside Jervoise Bay Harbours demonstrated overall good health in these parts of the Sound. TBT levels were occasionally exceeded at industrial and commercial jetties and terminals but overall, median concentrations were considered to



be environmentally acceptable. In 2006 these areas, as well as High Protection areas, were in breach of environmental standards for levels of TBT induced imposex in marine snails.

TBT remains in the environment for long periods, and sedimentary data indicates that levels are generally decreasing except for areas within Jervoise Bay. Because TBT has been banned as an ingredient in marine paints, residual levels should decline over time. There is no available practical management action to speed up the natural degradation processes.



Coogee looking towards Woodman Point

Ecosystem health in **Jervoise Bay Northern Harbour** was problematic for chlorophyll 'a', light attenuation, and phytoplankton biomass. The first two measures exceeded environmental guidelines while phytoplankton biomass also exceeded the environmental standard. TBT concentrations in the sediments of the Northern Harbour exceeded environmental guidelines when last surveyed in 2006.

**Low Protection** areas are not monitored by the CSMC as they are 'mixing zones' that are regulated and managed by Environmental Licensing under the DEC.



Henderson Cliffs looking south

All measures for 'safe seafood for eating' and 'clean waters for swimming', as well as for the protection

of aquaculture species, were met, with the exception of the occasional presence of potentially toxic algal species in the Sound and elevated levels of bacteria in the shallow waters of Palm Beach. Criteria for bacteria were met for aquaculture purposes but, as noted above, levels remained too high at Palm Beach in Rockingham and exceeded environmental quality guidelines. The CSMC is pleased to report that bacteria levels are continuing to fall and that the City of Rockingham's drainage improvement plan appears to be helping to resolve this issue.

Key activities of the CSMC during 2009 fell into three broad categories: annual; strategic; and community-investigative. The CSMC undertook two major monitoring programs, one for water quality and one for seagrass, and accessed another eight programs to satisfy its annual reporting obligations on the health of the Sound.



Kwinana Bulk Jetty terminal buildings

The CSMC now has nine years of continuous reliable data as a foundation for understanding this complex marine environment and quickly identifying areas of concern. Drawing upon its growing store of knowledge and experience, the CSMC provided expert advice throughout 2009 to various stakeholders, including the State Government and the EPA, on development proposals, and to local governments on a wide variety of issues.

The CSMC held two community forums where it presented its environmental report cards and discussed management and environmental issues affecting the Sound and Owen Anchorage. As part of its communication strategy, CSMC staff also gave numerous talks and presentations to a range of stakeholders and community groups on environmental matters, policy and management, including two papers at the 5th WA State Coastal Conference in Fremantle in September 2009. The CSMC produced three editions of its newsletter, and

its publication *Sounding Out – a Way Forward*, a foundational document for facilitating multiple use of Cockburn Sound and Owen Anchorage, will soon be available.



Bulk carrier navigating through Owen Anchorage

At a strategic level, the CSMC provided advice on a large number of development proposals, including large scale port developments, as well as on Public Environmental Reviews and changes to Ministerial conditions under Section 45 of the *Environmental Protection Act 1986* (EP Act 1986). The CSMC has provided leadership for the Jervoise Bay Northern Harbour Working Group with the result that a draft management action plan to address the harbour's chronic water quality problems is being finalised.



A view of the Cruising Yacht Club, eateries along the boardwalk and southern end of Churchill Park, Rockingham

The CSMC progressed two long-term projects during 2009: the investigation of the grey sands in Owen Anchorage and the environmental sign and sculpture interpretation trail for Cockburn Sound and Owen Anchorage. The CSMC expects that sea sculptures will soon be established at four locations within Cockburn Sound and Owen Anchorage. A third major project, a multiple-use decision support framework, is also an important part of the CSMC's long-term planning.



View from Mangles Bay towards the Garden Island causeway

During 2009 the CSMC undertook a strategic planning review, resulting in a five year Strategic Plan (a one page summary is provided later in this report). The Plan has identified key strategies that will guide and drive the Council's activities as well as providing a clear framework for engaging governments, key stakeholders and the wider community in the CSMC's vision for Cockburn Sound and Owen Anchorage.

The CSMC provides this State of the Cockburn Sound Report 2009 to the Minister for Environment and to Parliament, as mandated by the State Environmental (Cockburn Sound) Policy 2005.



Rockingham Beach and foreshore, Cockburn Sound



# Setting the Scene

## Cockburn Sound

Cockburn Sound, located on the west coast of Australia and centred at 32°12'S, 115° 43'E, is a shallow coastal basin, lying between Garden Island to the west and the mainland to the east. It is 16 km long and covers an area of approximately 124 km<sup>2</sup>. The northern opening between Woodman Point and Garden Island is approximately 8 km wide. The southern opening, between Garden Island and Cape Peron, was originally 2 km wide but was partially closed by the construction of a causeway and two bridges in 1973 to provide vehicular access to the naval base on the island. The Sound is bounded in the north by Parmelia Bank, a shallow sand bank which extends eastwards from Woodman Point out to Carnac Island, leaving a north-west opening to the Sound (Challenger Passage) less than 10 m deep. Access for large vessels to the deeper Sound is via a dredged navigation channel through Parmelia Bank.

The relatively flat, deep-water central basin that comprises most of the Sound is 18 m to 20 m deep. There is a shallower 7 m to 9 m shelf (the Kwinana Shelf) in the north-east of the Sound that has been dredged in places for navigation and access to boat harbours and wharves along this section of the mainland coast. A large sand flat (Southern Flats) with depths of only a few metres forms the south-western part of the Sound and extends east from the northern portion of the causeway into the deeper southern basin. The south-eastern side (south of James Point) and western side (bordering Garden Island) of the Sound are characterised by narrow coastal margins less than 500 m wide whose shallow waters rapidly drop from a few metres to over 15 m.

The first comprehensive environmental study of the Sound, undertaken by the Western Australian Government between 1976 and 1979, identified a large variety of contaminants in industrial discharges entering the Sound. They were mainly composed of nutrients, and some metals. The study recorded the deterioration of water quality, and the loss of approximately 80% of the pre-1950 seagrass beds. Government and industry responded by working to reduce contaminant and nutrient discharges, particularly nitrogen, and by the mid 1980s water quality was much improved (CSMC, 2001).



Aerial photograph of the Sound using light penetrating film, March 2008

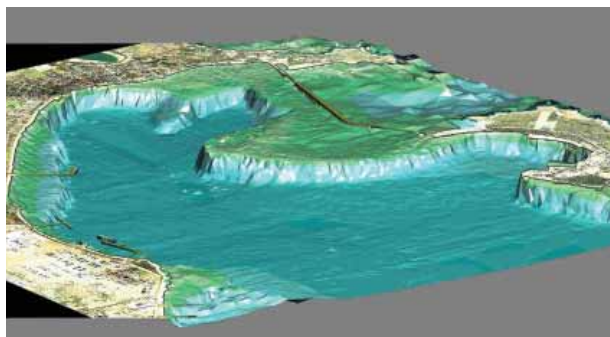
By the late 1980s water quality in the Sound had declined again, triggering a second comprehensive investigation by government – *Southern Metropolitan Coastal Waters Study* (1991–1994). This study found that although seagrass dieback had slowed considerably, nutrient-related water quality was only slightly better than in the late 1970s. Contaminated groundwater had replaced direct industrial pipeline discharge as the main nutrient (primarily nitrogen) input to the Sound.

A review of relevant studies in 2001 confirmed that a mix of cooperative and regulatory management had been successful in preventing further deterioration of the overall health of surviving seagrass meadows, with no significant losses related to water quality. Nutrient inputs from human activities had declined from an estimated 2000 t/yr in 1978 to approximately 300 t/yr of nitrogen in 2000, about 7% of which was estimated to be from groundwater and the remainder from surface drainage.

Nutrient reduction has been achieved through improved treatment trains, a reduction of industrial discharges, increased use of the Sepia Depression Ocean Outfall Line (SDOOL) and elimination of contamination sources. These strategies, combined with rigorous environmental industrial licensing, have been the mainstay for improving water quality. Now most large industrial complexes are working independently or in liaison with government to mitigate impacts on Cockburn Sound.

While recent monitoring programs show that water quality in Cockburn Sound is generally improving, seagrass coverage has failed to substantially increase. The seagrasses around Mangles Bay are highly stressed due to a range of factors, including restrictions in water circulation near the causeway, which slows water movement and encourages sedimentary and detrital deposition, phytoplankton and epiphytic growth, and generally reduces water quality. Yet these conditions have also contributed to making this area one of the most productive fish nursery areas in Cockburn Sound.

Factors that can help to account for the lack of regrowth of seagrasses include changed sedimentary and hydrodynamic conditions once seagrass was lost and the 'restrictive' and complex biology of the long-lived seagrass species that were lost and once dominated Cockburn Sound. To a lesser extent, it is also possible that historic and possibly current stormwater outflows and scouring of the seabed by poorly designed, unregulated and environmentally destructive moorings have made regrowth less probable in those areas affected. However, it must be emphasised that seagrass experts are generally not certain why seagrasses have not returned.



3D projection of the depth contours in the southern basin of Cockburn Sound, looking towards Southern Flats and the causeway

The facilitation of sustainable multiple use in Cockburn Sound and Owen Anchorage will require complex decision making based on responsible

foresight. There is a strong community expectation that all reasonable care will be taken to protect the remaining marine and coastal environments, all of which have undergone massive change since the first settlers arrived on these shores in 1829, a mere 181 years ago.

## Picture of Change

Prior to the early 1950s Cockburn Sound was a productive marine environment with healthy seagrasses, little foreshore development and abundant marine fauna. Over the last 10 to 15 years, the Sound has experienced incremental improvements in water quality. Remarkably, although it has retained only a little over 20 percent of its original seagrasses, the Sound remains a basically healthy marine environment.

In terms of management, the challenge now is to retain and increase areas of the remaining seagrass meadows and to work toward ensuring that the water quality and overall environmental health are good enough to allow the gradual return of seagrasses. This means ensuring that the multitude of activities that Cockburn Sound attracts and supports do not threaten its ecosystem health.

## Owen Anchorage

In 2004 the roles and responsibilities of the Cockburn Sound Management Council were expanded to include the waters of Owen Anchorage. A sub-committee of the CSMC, the Owen Anchorage Sub-Committee (OASC), began to build the foundations of a management strategy for Owen Anchorage, following the process used successfully for Cockburn Sound. The OASC developed the framework for an EMP for Owen Anchorage, based on up-to-date information on the condition of the environment and the pressures on it (current and potential). The OASC has been integrated into the full CSMC which will oversee the development of the EMP for Owen Anchorage.

The CSMC developed a document, *The State of Owen Anchorage A Pressure-State-Response Report, 2007*, that provided the baseline information required by the OASC. It follows the proposed EMP management structure of the various components affecting Owen Anchorage: marine, land, social and cultural and economic. The report identified areas where management responses could be

improved, and key information needed to improve management. Although stakeholder and community consultation was not the main purpose of the report, some consultation has been undertaken at annual community forums.



Woodman Point with Garden Island in the distance

Owen Anchorage did not experience the level of environmental degradation that occurred in Cockburn Sound from the mid 1950s to early 1980s as a result of nutrient and contaminant inputs. However, it was still adversely affected by domestic waste discharge up to 1964 and industrial discharge (mainly animal processing wastes) up to 1998. There have also been numerous physical alterations to Owen Anchorage. Modifications to the seabed have occurred by dredging for shipping channels by the Fremantle Ports, and for shell sand by Cockburn Cement Limited (CCL).

The shoreline has been extensively modified by coastal structures (e.g. Woodman Point groyne, WAPET groyne, South Fremantle Power Station groyne, Port Coogee and Ammunition Jetty) and beach re-nourishment. However, unlike Cockburn Sound, Owen Anchorage has not undergone a major loss of seagrass meadows due to nutrient enrichment. The seagrass losses that have occurred have been largely caused by dredging for sand mining: an estimated 280 hectares have been lost compared to Cockburn Sound's estimate of over 3000 hectares. Owen Anchorage retains over 2230 hectares of seagrass, about 2204 hectares of which are outside of those areas approved for shell sand dredging by CCL.

The Department of Environment Protection (now DEC) 1991–94 Southern Metropolitan Coastal Waters Study (DEP, 1996) was largely focussed on Cockburn Sound. However, the study also provided information on the state of Owen Anchorage. This study noted an improvement in the state of the environment of Owen Anchorage since the 1970s,

and attributed this to a reduction in nutrients, animal wastes and contaminant discharges. Nevertheless, there are still pressures on Owen Anchorage from activities that include maintenance dredging of shipping channels, sub-tidal sand mining, recreational and commercial uses and coastal developments (e.g. Port Coogee Marina).



Port Coogee Marina under construction in 2008 in Owen Anchorage. It is now almost completed with marina residential lots included

## Cockburn Sound Management Council

The CSMC was established in April 2000 by the State Government in response to increasing pressures on Cockburn Sound. Its purpose is to facilitate and coordinate ongoing environmental management of Cockburn Sound, Owen Anchorage and their catchments (CSMC, 2004).

The CSMC has an independent Chair and comprises up to 21 members. Community interests are represented by two community members and the Chair. The following organisations are also represented: Community Networking Inc.; Recfishwest; Conservation Council of Western Australia; Cockburn Power Boat Association; Kwinana Industries Council; Western Australian Fishing Industry Council; Department of Defence; CSIRO Marine; Department of Mines and Petroleum; Department of Environment and Conservation; Department of Water; Department of Fisheries; Fremantle Ports; Department for Planning and Infrastructure; Water Corporation; City of Rockingham; Town of Kwinana; and City of Cockburn. The CSMC is reviewing its membership to identify representation that has become less relevant while seeking to include the Dept of Health, LandCorp and an Indigenous representative (see Table 1).



## State Environmental Policy for Cockburn Sound

The State Environmental (Cockburn Sound) Policy 2005 is the guiding document for monitoring and management of the Environmental Quality Objectives (EQOs) and Environmental Values (EVs) for Cockburn Sound. Under the SEP, EQOs have been established for the following Environmental Values:

- ★ Ecosystem Health
- ★ Fishing and Aquaculture
- ★ Recreation and Aesthetics
- ★ Industrial Water Supply

Benchmarks, known as Environmental Quality Criteria (EQC), have been developed for Cockburn Sound and are used to determine whether the Environmental Values for Cockburn Sound are being protected. These Criteria are outlined in a companion document titled *Environmental Quality Criteria Reference Document for Cockburn Sound (2003–2004)*.



Foreshore activities, Rockingham Beach

This document outlines two main types of EQCs: Environmental Quality Guidelines (EQG) and Environmental Quality Standards (EQS). The methodology for collecting environmental quality information is clearly explained in the *Manual of Standard Operating Procedures for Environmental Monitoring Against the Cockburn Sound Environmental Quality Criteria (2003–2004)*, i.e. the S.O.P.

The CSMC's annual Report Cards on the environmental health of Cockburn Sound, presented in this report, are derived by comparing monitoring data with relevant EQC in accordance with these documents.

## Environmental Management Plan for Cockburn Sound

The CSMC's EMP (2005), which was endorsed by Cabinet, represents the first coordinated approach to addressing the health of Cockburn Sound in the context of its multiple uses. The EMP details the following five-point plan of action towards implementing the SEP and coordinating the environmental management of Cockburn Sound and its catchment:

1. Protecting the environmental values of Cockburn Sound.
2. Facilitating multiple use of Cockburn Sound and its foreshore.
3. Integrating management of the land and marine environments.
4. Coordinating research and investigations.
5. Monitoring and reporting on performance.



Winter view – foreshore dunes of Cockburn Sound

# Key Achievements 2009

The CSMC undertook a range of activities that are summarised below under the headings: Annual, Strategic and Community-Investigative.

## Annual

### *Monitoring and Reporting*

The CSMC's most high profile and publicly recognised activity is its provision of scientifically reliable monitoring and reporting on the health of Cockburn Sound from an independent position. The community, governments and industry take a very keen interest in the results of this work.

In 2009 the CSMC accessed 11 monitoring programs. However, it only used 10 of the programs to analyse environmental health. The 11th program related to Owen Anchorage water quality and while not used for analysis it was used as background data given that it is adjacent to northern Cockburn Sound.

With nine years of environmental data on Cockburn Sound and a growing database for Owen Anchorage, the CSMC now have an important continuous reliable data set that provides a foundation for understanding this complex marine environment and that can be built upon to allow tracking of long-term changes over time. It also assists in quickly identifying areas of improvement or deterioration. We can, for example, compare water quality in Cockburn Sound between 1978 and 2009 and track changes between 2000 and 2009. This data has been identified and used in the national marine database, Blue-Net, which is a Commonwealth Government and university initiative whose purpose is to develop high quality databases as national research and information resources.

Every year the CSMC carries out its own monitoring programs, focussing on water quality and seagrass health, in both Cockburn Sound and Owen Anchorage (two programs). To report on other indicators of environmental health, the CSMC works as a coordinating body in partnership with government departments, agencies and industries that have relevant monitoring programs. Contributors to this program include the Kwinana Industries Council (KIC), Department of Defence (DoD), Fremantle Ports, Department of Health (DoH), City of Rockingham (CoR), City of Cockburn (CoC), Department of Fisheries (DoF), Western Australian Mussel Producers Association (WAMPA), Department

of Environment and Conservation (DEC), Water Corporation, Cockburn Cement and LandCorp. The specific monitoring programs are listed later in this document. They include:

- ★ Monitoring of bacteria at local beaches by local government and the DoH (three programs)
- ★ Monitoring water quality and sediments around Fremantle Ports' jetties and bulk cargo facilities (one program)
- ★ Monitoring water quality, phytoplankton, bacteria and contaminants in or near mussel farms by the DoH and Fisheries (one program)
- ★ Monitoring water and sediment quality around Jervoise Bay Northern and Southern Harbours by LandCorp and the Department of Industry and Resources (one program)
- ★ Monitoring of bacteria and sediments around Garden Island by the DoD (one program)
- ★ Monitoring of water quality by the Water Corporation near their desalination plant outfall into Cockburn Sound (one program)

Whenever appropriate opportunities arise the CSMC utilises other monitoring data from industry and other parties, including universities and research organisations such as CSIRO. In 2008, for example, the CSMC reviewed and incorporated the findings of a Curtin University imposex study (Bird, 2007), the results of which were used to provide a comparison with an earlier imposex study undertaken by the CSMC in 2006–07.

The 11 monitoring programs are outlined in the CSMC's Environmental Quality Monitoring Program 2008–09 and are discussed later in this report. Their data is analysed and compared against criteria and reference sites outlined in the SEP's companion EQC document. The CSMC ascribes a three colour 'traffic light' rating: green for good; amber indicating that environmental guidelines have been exceeded and that more work and investigation is needed; and red indicating that environmental standards have been exceeded and that urgent work is needed to identify the cause and seek a solution. The results of the monitoring programs underpin the annual Environmental Report Cards. The latest Report Cards were released in late 2009.

## ***Community Consultation***

The CSMC undertakes community consultation regarding issues that are relevant to Cockburn Sound and Owen Anchorage.

The 2009 Cockburn Sound Report Cards were presented in November 2009 at the CSMC's annual forums, where presentations were also made on the grey sands study in Owen Anchorage, the developing multiple-use framework, the eco-signage and sea sculpture project and the history of the CSMC. The forums provide an opportunity for the community to raise issues and suggest future directions for research and investigation. In 2009 discussion centred on large scale development proposals including marinas in Mangles Bay and Port Rockingham and industrial port facilities: Outer Harbour – Kwinana Quays and James Point.

In addition to the community forums, various formal presentations were made to a variety of bodies, including: the KIC – Community Industry Forums, WA Marine Science Institute, the Shire of Bowen from Queensland and university groups.

Three editions of the CSMC newsletter, *Sound News*, were distributed to a growing mailing list and the CSMC website provided an important source of information for the public. At the WA Coastal Conference in Fremantle, staff made two presentations on the CSMC and its work, and an article was published in the WA Planning Commission's *Coastlines Journal*, Summer edition 2009: 'Cockburn Sound Management Council working hard to improve the health of Cockburn Sound'.

The Chair was frequently called upon to provide information to the media regarding the activities of the CSMC or to comment on environmental aspects and management of Cockburn Sound and Owen Anchorage.

The CSMC's informative shop front window displays are very popular with the public, as are the information brochures provided from its office in Rockingham. The window displays include information relating to species found in the Sound as well as news relevant to fishing and boating, and announcements of environmental events. The display of the annual Report Cards attracts strong interest. More than 450 people visited the office over the past year to discuss issues, and at least another 200 made contact by telephone. In addition, more than 3000 people were recorded as dropping by to pick

up handouts or spend time reading information in the window display.

A list of issues brought up by community drop-ins to the office is provided in Table 2 at the end of this document.

## ***Provision of Advice on Proposed Developments***

CSMC advice is provided in the context of its constitution and guided by the principles of the SEP and CSMC's EMP (2005). It is based on a commitment to ensuring that potential environmental impacts are minimised, balanced multiple use is maintained, and the environmental values of the Sound, as set out in the SEP, are not compromised.

The CSMC regularly provides advice to the EPA and to the Minister for Environment. Because it is based on the specialist expertise and knowledge of the staff and individual Council members, and carefully considered by the multi-stakeholder membership, this advice represents a valuable resource.

CSMC advice can be considered on two levels: Strategic – high level; and Local – small scale.

### ***Local Advice***

Local advice has been provided in relation to:

- ★ Jetty maintenance in Palm Beach and Val Street Cruising Yacht Club jetty upgrade.
- ★ Review and development of the Wells Park – Kwinana Beach foreshore management plan.
- ★ Foreshore drainage upgrades in the City of Rockingham.
- ★ Vegetation, loss of foreshore amenity and other issues in relation to drainage into Bell Park near the CBH granary.
- ★ Palm Beach boat ramp upgrades and impacts on foreshore reserves.
- ★ Wells Park foreshore reserve rehabilitation.
- ★ Improved drainage management at the CBH granary, including painting of the grain terminal jetty.
- ★ Aquaculture applications, for example on oco-culture.
- ★ Garden Island causeway water pipe dewatering and maintenance work.
- ★ Algal blooms (for local government authorities (LGAs) and DoH).



- ★ Starfish and fish death incidents (for DoF).
- ★ Proposed foreshore vegetation clearing (for LGAs and KIC).

### ***Local Reports, Incidents and Officer Responses***

In 2009 staff dealt with over 35 incidents or complaints which required site investigations and follow up. These covered four kinds of issues:

#### **1. Pollution incidents, concerns, damage in Cockburn Sound, its foreshores or catchment.**

Twelve incidents of this nature were reported to staff mainly over dust, potential oil spills, water discolouration and slicks, illegal dumping or work near contaminated sites. Most of these reports were directed to relevant parties in the DEC, Water Corporation, Fremantle Ports and local governments.

#### **2. Reports of animal deaths or sick, injured or stranded animals.**

Sixteen incidents like this were brought to staff attention and immediately reported to DEC rangers and other relevant parties.

#### **3. Algal blooms.**

Five incidents were reported.

#### **4. Seagrass.**

Two reports were made over concerns about health or damage from moorings.

### ***Strategic Advice***

Strategic advice has been provided in relation to:

- ★ Two industrial port proposals for the Outer Harbour – Kwinana Quays and James Point Private Port – with regard to information coordination, policy considerations and issues to be addressed in order to assess potential environmental impacts. Input was also provided to the government's Optimum Planning Group on these proposals.
- ★ Public Environmental Reviews (PERs) and Section 45s of the Environmental Protection Act 1986 with regard to proposed marinas in Cockburn Sound, Owen Anchorage and Jervoise Bay Southern Harbour. Examples include Port Rockingham (Wanliss Street Marina) and dredging and land-backed wharf work in the Australian Maritime Complex, Southern Harbour Jervoise Bay.
- ★ Review of licence conditions for BAE Systems in the Southern Harbour Jervoise Bay.
- ★ Contributions to the development of a preferred option for the SDOOL duplication near Lake Richmond.

- ★ Site selection and other aspects of a future uni-modal transport hub being considered by LandCorp and deliberated by the Kwinana Industries Coordinating Committee as well as input on environmental matters affecting the Kwinana Industrial Area.

- ★ Input into the Latitude 32 Technical Group (LandCorp).

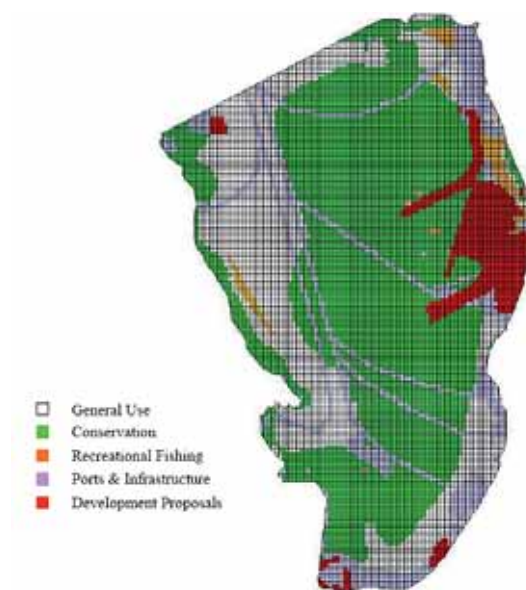
- ★ Contributions to Environmental Improvement Plans for Verve Energy – Kwinana Power Station.

- ★ Contributions to a potential regional climate change alliance in collaboration with the City of Cockburn.

- ★ Staff developed a draft Marine Algal Bloom Response Protocol, i.e. a plan to better coordinate responses and provide informative data on algal blooms that mainly occur during autumn in Cockburn Sound, Owen Anchorage or Warnbro Sound. The Protocol has been communicated to local governments and the DoH, with liaison with the DoH on this important matter. Follow up meetings, and sampling demonstrations are proposed for 2010.

### ***Multiple Use Facilitation***

The CSMC completed a comprehensive document entitled *Sounding Out* which provides a summary of the history of the multiple uses of the Sound and a compendium of references to publications and other resources relating to the Sound. The CSMC expects to have this report available to the public in 2010.



Example of MARZONE figure showing areas of use determined by setting decision rules and weightings to achieve a best fit outcome for a number of multiple uses that conflict with each other. This scenario was done in 2008.

The CSMC will investigate potential partnerships and funding sources for high quality decision support software tools for use in Cockburn Sound and Owen Anchorage. These include MARZONE and Management Strategy Evaluation (MSE), which have been developed to assist in planning and decision making in multiple use environments such as coastal parks and heavily used marine embayments.

### ***Owen Anchorage***

After completing and releasing to the community a pressure-state-response report, the *State of Owen Anchorage*, in 2007, the CSMC produced a draft environmental values and objectives paper, including an outline of possible environmental management zones. The paper defined a range of environmental, social and economic values and management objectives for this smaller but popular embayment to the north of Cockburn Sound and south of Fremantle, off Cockburn and Coogee.

In mid 2009 the CSMC received funds from CCL to finalise outstanding Ministerial and Environmental Commitments relating to shell sand mining in Owen Anchorage. The funds have been directed to a Draft Interim EMP for Owen Anchorage. This incorporated the previously developed draft environmental values and objectives paper. It will provide the basis for community input into the EMP later in 2010.

### ***Jervoise Bay Northern Harbour Working Group***

The Jervoise Bay Northern Harbour Working Group was established in early 2008 to address chronically poor water quality in this enclosed industrial boat building and recreational boating embayment. High nutrient levels and high concentrations of bacteria and potentially toxic micro-algae or phytoplankton have been recorded here since the Cockburn Sound Management Council began its environmental reporting. Furthermore, concentrations of metals, and in particular TBT, have been recorded in the sediments of the harbour as well as in marine snails when imposex was last surveyed in 2005–06. These problems led the CSMC to establish a multi-stakeholder Working Group to assess the causes and develop an action plan to address them.

The Working Group met twice in 2009 and is currently finalising a draft Action Plan. This includes possible outcomes and cost scenarios defined by a flushing study commissioned by LandCorp, Dept of Industry and Resources (DoIR) (now Department of Mines and Petroleum) and DPI. It is planned to

complete the Action Plan in late 2010 following feedback and discussion within the Working Group and its representative agencies and/or stakeholder bodies.

## **Community–Investigative**

### ***Preliminary Grey Sands Investigation***

In response to community concerns expressed at community forums in 2007, a grey sands investigation was initiated. This comprehensive study, undertaken over a two year period, included investigating potential origins and causes of the greying sands and comparisons with other Perth metropolitan beaches where sand colour changes have occurred.

Preliminary results indicate that discolouration of the sands is not caused by pollution. Organic contaminants were all below laboratory detection limits, with heavy metal concentrations being very low and below any environmental reporting guidelines. Draft report results indicate that the grey colouring is a natural aspect of the locally derived sands (i.e. is associated with coastal limestone outcropping fragments that originate from the Rottnest-Garden Island-Mewstone-Carnac Dune Ridge System). The study will be completed in 2010 and the report will be available on the CSMC website once reviewed and accepted by the Council.



Field work during Grey Sands Study

### ***Eco-signage and Interpretation Trail***

The sculpture component of the CSMC's eco-signage and sculpture interpretative trail project, initiated in 2007, has now been completed. The four sculptures are temporarily on display along the external walkways of the Naragebup Environment Centre. Once legal issues associated with liability



Sea kayaking in Mangles Bay, Rockingham

are clarified it is anticipated they will be installed in the ocean during the spring of 2010. An insight into the ecology, natural history and management of Cockburn Sound and Owen Anchorage will be provided through a foreshore interpretative trail with signs at 10 to 12 foreshore locations, from Point Peron to Coogee. This project is planned for completion in 2011.

***Meta-Project: Facilitating Study of Heavy Metals in Fish – Fish Biomarker – Contaminants in Water***

A funding application was submitted to the Australian Research Council (ARC) for a collaborative fish biomarker study with Curtin University, KIC and the CSMC. Although the application was unsuccessful, further opportunities will be sought for assessing fish biomarker levels and their significance.

The contaminant in water component, completed in 2008, is still relevant, and now provides background information for any future study. CSMC staff was involved in assisting the project managers of the study component which measured heavy metals in fish, run by DoH. CSMC staff have also provided

support through laboratory work in measuring and processing fish and shell fish samples so they could be analysed by the Chemistry Centre of WA, as well as attending and contributing to project management and strategy meetings. The results of this component will be available in a report likely to be released by the DoH in 2010.

***Developing Relevant Marine Indicators for Monitoring***

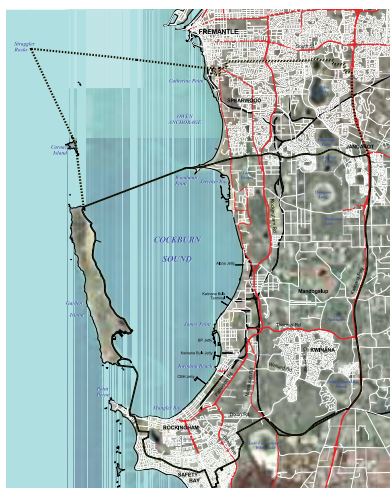
The CSMC has been involved with the Perth Natural Resource Management (NRM) (formerly known as the Swan Catchment Council) in developing cost effective and informative marine indicators that would help marine managers to better monitor and manage their marine environments. A comprehensive report was developed and provided to the Perth NRM and state agencies such as the DEC, CSMC, Swan River Trust (SRT), DoF and other related natural resource management bodies. A number of presentations were made on the results of the review, e.g. to the WA Coastal Conference. The Perth NRM has been organising workshops and implementation meetings to have the results incorporated into monitoring and reporting plans.



# Strategic Planning

The CSMC undertook a comprehensive strategic planning review starting in mid 2009. Following a workshop in September, the Council identified and developed its strategic priorities for the next five years. The primary strategies are summarised below.

## Cockburn Sound Management Council (CSMC) Strategic Plan 2010–2015



CSMC is a unique collaboration between industry, the government and the community. It was set up in response to intense community pressure in 2000 to address the threats facing the Sound.

It is charged with implementing the State Environmental (Cockburn Sound) Policy 2005.

The role of CSMC is to ensure coordination and facilitation of environmental planning and management of Cockburn Sound and Owen Anchorage to keep them healthy and sustainable into the future.

### Our Purpose



To keep Cockburn Sound and Owen Anchorage healthy and sustainable for the Western Australian community.



For us, a *HEALTHY SOUND* means *HEALTHY COMMUNITIES*.

### Our Vision

To be recognised as a world leader in coordinating successful multiple-use coastal marine management.

To achieve our Vision, we need to address 5 strategic issues

1. Foresight

2. Knowledge

3. Connection

4. Positioning

5. Funding



### Our strategies

1. Plan now for the future of the Sound

2. Enhance our information database and decision-making

3. Strengthen connections with the community

4. Strengthen relationships with key government agencies and industry

5. Develop further sources of funding

# Environmental Quality Monitoring Program (EQMP)

## What did we do?

In 2008–09, the CSMC coordinated an EQMP to assess the health of Cockburn Sound. Data was collected for physical and chemical measures, direct and indirect biological measures, contaminants in sediments, biological contaminants, and chemical contaminants in seafood flesh.

## What did we find?

A summary of the findings in the 2009 Report Cards that are presented in this report is provided below.

### ***Ecosystem Health in Areas of a High Level of Protection (broader area of Cockburn Sound) (Figure 1)***

Most parameters met either the guideline (EQG) or the standard (EQS), indicating that this area is generally in good condition. Median light attenuation improved this year at the 18 monitoring sites assessed.

Chlorophyll 'a' met the EQG. However, micro-algae or phytoplankton densities were occasionally measured at high concentrations. Dissolved oxygen levels at two sites in the southern basin exceeded the EQG and at times slightly exceeded the EQS. Seagrass health in the High Protection area met the EQG. However, two sites – Mangles Bay and Garden Island Settlement – did not meet the EQG and were labelled red. Phytoplankton biomass was exceeded at Mangles Bay and was also labelled red. No sediment sampling was undertaken in this area this year, although when last measured in 2006 all samples were well below EQGs.

### ***Ecosystem Health in Areas of a Moderate Level of Protection (outside Jervoise Bay Harbours) (Figure 3)***

Results of monitoring from within the Moderate Protection area demonstrate that the overall health of this part of the Sound is good. The guidelines and standards were met for all parameters with the exception of historical TBT data. Some sites had individual samples which exceeded guidelines but median values for all samples met the EQG.

## Fremantle Ports

The Port of Fremantle is the biggest and busiest general cargo port in Western Australia. The port:

- ★ operates from two locations – Fremantle Inner Harbour and the Outer Harbour, 20 kilometres south at Kwinana
- ★ handles 76% by value of the WA's seaborne imports and 16% by value of WA's seaborne exports
- ★ handles more than \$25 billion in trade annually (27 million tonnes annually)

The Fremantle Inner Harbour handles most of WA's container trade (growth is almost 10% a year), cargoes such as vehicle imports and livestock, and cruise shipping and naval visits. The Kwinana Outer Harbour is one of Australia's major bulk handling ports.



Kwinana Bulk Jetty

Both the Inner Harbour and the Outer Harbour are a combination of Fremantle Ports' and privately operated facilities and services. Fremantle Ports provides and maintains shipping channels, navigation aids, common user cargo wharves, cargo wharves at leased terminals, the passenger terminal, road and rail transport infrastructure within the port area, moles and seawalls, buildings, water, power and public amenities.

Other services provided directly include overall port planning and coordination, ship scheduling and berthing allocation, port communications, mooring, security services, emergency response, hazardous cargo services and quarantine and waste disposal services. Fremantle Ports provides customer information and advice, trade facilitation and property services, and is responsible for pilot transport. Fremantle Ports also cooperates with the Commonwealth Government in facilitating customs, quarantine and Australian Maritime Safety Authority activities in the port area.

## Kwinana Industry

Kwinana industry is a major contributor to the success of Western Australia at national and international levels. The relationship between Kwinana industry and the local community is strengthened by a shared environment and a desire to be good corporate neighbours. Effectively balancing the needs of the community and the environment with those of an extensive industrial area makes Kwinana unique in the metropolitan area. The Kwinana Industrial Area (KIA) makes a major contribution to the wealth of the state of Western Australia and its people. It is also the major industrial area in the state that adds value to its industrial products rather than only exporting raw resources or materials.

The heavy and supporting industries of the KIA have added enormous value to the resources of the state and have provided direct and indirect employment opportunities for tens of thousands of people. The companies in the Kwinana Industrial Area:

- ★ Generate a combined annual output valued at \$16 billion per annum
- ★ Have direct sales of \$8.5 billion
- ★ Directly employ approximately 4800 people (64% live locally)
- ★ Provide indirect employment to approximately another 26,000 people
- ★ Commit hundreds of millions of dollars to capital expenditure every year
- ★ Actively fund and contribute time and talent to community activities
- ★ Sponsor independent research



Northward view towards CSBP and BP refinery off James Point

Growing environmental expectations have resulted in industry adopting innovative technologies to reduce environmental impacts. Many Kwinana companies demonstrate world's best practice in their environmental safeguards and management. Kwinana industry is unique in its efforts to move towards a more dynamic, sustainable and innovative future with the community and the environment.

## *Ecosystem Health in Areas of a Moderate Level of Protection (inside Jervoise Bay Harbours) (Figure 5)*

The median chlorophyll 'a' concentration for Jervoise Bay Northern Harbour did not meet the EQG. Water quality sampling did not occur in the Southern Harbour during 2008–09. Light attenuation in Northern Harbour sites exceeded the EQG. All sites met the EQG for dissolved oxygen, temperature, salinity and pH. High phytoplankton biomass was registered again in Jervoise Bay Northern Harbour. The median chlorophyll 'a' concentration exceeded the EQS and the report card was labelled red. Based on 2006 data, TBT median sediment concentrations met the EQG in the Southern Harbour but slightly exceeded the EQG in the Northern Harbour.

Harbours are traditionally associated with poorer water quality as they are nodes where vessel-based activities are concentrated, and they are often enclosed. This restricts the amount of flushing that can occur. Monitoring indicates that the water quality within these harbours requires further attention and action. It is the belief of the CSMC that good design and effective management can ensure good water quality around port facilities without impeding port operations.

## *Safe Seafood for Eating Report Card (Figure 7)*

The criteria for Thermo-tolerant Faecal Coliform levels in seafood flesh were met at all sites (Figure 8). It is important to note that the levels of bacteria in the flesh of mussels, as opposed to within the water column, met the EQG at all sites sampled.

All samples taken from the commercial mussel harvesting areas in Southern Flats and in proximity to the Kwinana Grain Terminal met the EQG for thermo-tolerant faecal coliform levels in water. Other guidelines, however, were not met at a number of non-commercial sites where water samples with elevated levels of phytoplankton that exceeded WASQAP/ ANZECC guidelines were recorded.

Exceedances of the EQG for the presence of potentially toxic algal species were recorded within the Jervoise Bay Harbours. The public needs to be reminded of the risk associated with the consumption of potentially contaminated seafood collected recreationally from within the Jervoise Bay Harbours.



### ***Clean Waters for Swimming and Boating (Figure 9)***

All parameters met the criteria with the exception of Bacterial *Enterococci* and toxic algae (Figure 10) which is the criterion for primary contact (swimming). All sites met the EQG for Bacterial *Enterococci* except for one site at Palm Beach. It is important to note that these exceedances are based on results of isolated high values over the past five years of summer monitoring. Positive indicators include the improvements noted between 2005–06 and 2006–08 for Bacterial *Enterococci* levels at the Rockingham Beach sites.

The recently completed Rockingham drainage improvement program has further improved water quality near beach drain outfalls. Also, phytoplankton sampling does not occur at swimming beaches and thus samples taken further out near mussel growing areas as part of WASQAP sampling are currently used as surrogates to determine the presence of high levels of potentially toxic species. No algal bio-toxins have ever been detected in these samples nor were there any reports of dermatitis from swimming for the year.

### ***Protecting the Health of Aquaculture Species (Figure 11)***

All parameters monitored met the criteria and there were no concerns noted.

## **Summary of Overall Health**

The 2009 Report Cards indicate that the marine environment of Cockburn Sound is generally healthy. Monitoring carried out at all sites in the Sound has shown that measures for dissolved oxygen, temperature, salinity and pH levels have generally met established guidelines. These are all key indicators of a healthy ecosystem.

Monitoring undertaken for this year's Report Cards detected only one important indicator that exceeded the EQS for a zone and required action. This resulted from excessive levels of Phytoplankton Biomass in the Northern Harbour Jervoise Bay. The historical exceedance of the EQS for TBT, based on data last collected by the CSMC in 2005–06, is also shown in the 2009 Report Cards.

Two sites exceeded the seagrass shoot density EQS. While they did not affect seagrass health for the High Protection Zone the CSMC has been working with Department of Defence and with university researchers on addressing these exceedances.

## **Department of Defence**

Garden Island has been owned by the Commonwealth since the early Twentieth Century but was not used as a large permanent defence base until planning for HMAS *Stirling* commenced in 1969. A 4.2 km long causeway linking the island with Cape Peron was completed in June 1973, followed by construction of wharves, workshops and accommodation, with the base being formally commissioned in July 1978.

The fragility of Garden Island and its environment was recognised by the Commonwealth from the outset of planning for HMAS *Stirling*, and management has included planting of some 50 000 trees and shrubs indigenous to the island to stabilise soil and enhance wildlife habitat.



Careening Bay, HMAS *Stirling*, Garden Island

Since its commissioning, HMAS *Stirling* has expanded enormously within its existing boundaries. The Submarine Escape Training Facility is one of only six in the world and the only one in the Southern Hemisphere.

The 314 m long two-level Diamantina Pier and the redeveloped Small Ships Harbour have vastly increased the wharf and berthing space available to surface ships and submarines. Other major additions have been the Helicopter Support Facility located on the southern end of Garden Island, extensions to the RAN Submarine Training and Systems Centre, an ammunition storage facility, the Training Centre-West complex and a trials, research and support facility.

HMAS *Stirling*'s primary purpose is to provide operational and logistics support to the RAN ships, submarines and naval aircraft based in WA.

Public access to Garden Island by private boat is permitted through an arrangement between the Commonwealth and the State which provides for a DEC ranger service to the DoD. Visiting boats are not permitted to land in Defence facility areas and must leave the island before nightfall. Attractions include pristine white beaches, pine forest walks, sheltered reefs and three picnic areas with toilets and BBQ facilities.

## Cockburn Sound Fisheries

Most of the commercial finfish that are harvested annually within Cockburn Sound are baitfish, taken by the West Coast Purse Seine Fishery, including scaly mackerel and pilchards. The remainder are taken by the Cockburn Sound (Fish Net) Fishery, mainly Australian herring and garfish, and the Cockburn Sound (Line and Pot) Fishery, mainly pink snapper and various skates and rays, with minor quantities also taken by the West Coast Beach Bait Fishery, blue sprat and whitebait.

Historically, the majority of the invertebrates harvested within Cockburn Sound have been taken by the Cockburn Sound (Crab) Fishery. The remainder have been harvested by the Cockburn Sound (Line and Pot) Fishery, mainly octopus and squid, and by aquaculture (mussels).



Pink snapper *Chrysophrys auratus*, a very popular recreational species caught in Cockburn Sound where the largest spawning aggregations in WA occur, outside Shark Bay

Cockburn Sound is a very popular recreational fishing area. Many of the species taken commercially in Cockburn Sound, including Australian herring, garfish, squid, blue swimmer crabs and pink snapper, are also targeted by recreational fishers. Recreational fishers also heavily target the various whiting species found in abundance between seagrass meadows and sand or on sandy bottoms.

Fishing methods employed in Cockburn Sound include handlines, squid jigs and unbaited octopus pots. The Cockburn Sound (Fish Net) Fishery uses gill and haul nets. Australian herring, pink snapper, tailor and blue swimmer crabs are among the main fishery target species in Cockburn Sound.

Since 1995, the total annual harvest by all commercial fisheries in Cockburn Sound, including finfish and invertebrates, has progressively declined. This reduction is largely due to declines in the landings of baitfish. The crab fishery was closed between December 2006 and December 2009 following low recruitment numbers.

Eight exceedances of the EQGs were noted that required further investigation. These included levels of Dissolved Oxygen at two sites in the southern basin of Cockburn Sound. Another two sites in the High Protection area also exceeded the EQG for Seagrass Shoot Density: Mangles Bay and Garden Island Settlement. Mangles Bay also exceeded the EQS but because ecological health for the high protection area is based on median values for all sites in the area this was not reported as an exceedance of the EQS. Exceedances were also detected for chlorophyll 'a' and the presence of algal species that can produce biotoxins, as well as poor Light Attenuation in Northern Jervoise Bay Harbour. TBT in sediments in 2006 around the Northern Harbour also slightly exceeded the EQG while levels of Bacterial *Enterococci* at one swimming beach in Palm Beach, Rockingham, exceeded the EQG, but also only slightly.

Based on the best available information, expert advice and the analysis of 11 monitoring programs we can report that there has been no significant deterioration in the overall health of Cockburn Sound since monitoring began in 2000.

## On-Going Action

The CSMC believes high phytoplankton biomass measurements at Mangles Bay are a feature of being located in the south leeward side of Point Peron and the Garden Island causeway. It will be working with the DEC and EPA to see if there are any practical management steps that can be taken to improve phytoplankton biomass at this site.

As a result of exceedances for Bacterial *Enterococci* between 2005 and 2009, the DoH continues to work with the City of Rockingham to find ways of reducing bacterial levels. It is important to note that bacterial levels have improved this year with only the EQG exceeded, and only slightly, at one site, Palm Beach. Further improvements are expected in 2010.

The WASQAP plan is in the process of being updated. This plan is to ensure that mussels harvested from the aquaculture area in Cockburn Sound are safe for human consumption and are of the highest quality. The CSMC will be advised of any changes once it is finalised, particularly with regards to revisions relating to levels of potentially toxic algal species.

## Action from 2009 Report Cards

In accordance with the requirements of the SEP, the CSMC has notified the Minister for Environment and

the EPA of the EQC exceedance of one of the EQSs noted in the 2009 Report Cards.

Actions have been taken to address previously exceeded standards and guidelines. Most of these actions have resulted in improvements or the development of plans for improvement.

The CSMC and the DoH have previously expressed concern about the risk associated with the consumption of recreational seafood that is potentially contaminated from Jervoise Bay Harbours.

In response to concerns raised by the CSMC relating to bacterial issues and the presence of toxic algae in Jervoise Bay Harbours, the DoH together with the City of Cockburn have installed signage to raise awareness of the danger of taking potentially contaminated seafood from the harbours.

The CSMC plans to undertake another survey to measure TBT and heavy metals in sediments from Northern and Southern Harbours, Careening Bay, and Kwinana Bulk Terminal as well as at several sites around all industrial ports including the Kwinana Bulk Jetty. This will depend upon finance being available.

The CSMC has liaised with the DEC about the ongoing TBT issues in specific areas and has discussed management actions to eliminate licensed premises as potential sources. Consideration has also been given to involving unlicensed premises, particularly around the AMC area.

The Council continues to meet and work with operators and government parties to improve management plans and actions and this has helped improve industry practices through the development of policies and procedures and new monitoring actions.



The Lissa, a privately owned coastal trader and home temporarily moored off Rockingham Beach

## Ecotourism

Rockingham Wild Encounters started in 1989 when the owners christened the company 'Rockingham Dolphins' and started a small 'one man show'. As interest grew, by word of mouth about this unique experience, the company also grew to become a major ecotourism business. Rockingham Dolphins won the ecotourism category of the Western Australian Tourism Awards for three successive years in 2001, 2002 and 2003. They went on to win a National Ecotourism Award in 2004 and were inducted into the WA Tourism Hall of Fame.

The company's Dolphin Watch Tour, Rockingham Dolphins, employs around 15 staff. More than 20 000 passengers a year participate in the Swim with Wild Dolphins and Dolphin Watch Tours.



CSMC staff having a dolphin experience with Rockingham Wild Encounters, on the Kwinana shelf (i.e. eastern shelf), Cockburn Sound

In 2005 the business further expanded with the purchase of Penguin & Seal Island Cruises, operating in the Shoalwater Islands Marine Park. A new 75 passenger ferry was launched to service Penguin Island and the business was renamed Rockingham Penguins.

The owners of Rockingham Wild Encounters contribute to raising the general public's awareness of conservation issues through their tours and also through projects such as the Keep Perth's Dolphins and Sea Lions Wild Envirofund Project.

Currently, Rockingham Wild Encounters are the only major ecotourism company to provide tours to observe dolphins, seals and penguins in Cockburn Sound.








# Report Cards 2009

## Legend for Report Cards overleaf


**M**  **Monitor:** below guidelines, continue monitoring.

 Hatched means data based on information greater than one year old.

**I**  **Investigate:** above guidelines; investigate and where necessary take precautionary action.

 Green hatched means data greater than one year old but was below guidelines and previously green.
























**A**  **Action Required:** Above standards; initiate management response.

 Red hatched means data greater than one year old and above standards.

**N/A**  No official rating can be applied.

# Report Card 2009

## Subject: Ecosystem Health in Areas of a High Level of Protection (Broader Area of Cockburn Sound)

Environmental Quality Indicators		Management Response	Comments
Physical and Chemical Measures	Chlorophyll 'a'	M 	All sites met the Environmental Quality Guidelines (the guidelines) except at two sites. Micro-algae or phytoplankton densities were occasionally measured at high concentrations. Median light attenuation met the guidelines.
	Light Attenuation	M 	
	Dissolved Oxygen	I 	Dissolved Oxygen levels at two sites in the southern basin exceeded the guidelines and at times slightly exceeded the Environmental Quality Standards (the standards), all other sites met the guidelines. All sites met the guidelines for temperature, salinity and pH (surface and bottom).
	Temperature	M 	
	Salinity	M 	
Direct Biological Measures	Phytoplankton Biomass (Activity)	M 	Chlorophyll 'a', as an indicator of phytoplankton biomass met the guidelines except for concentrations at Mangles Bay and at a Central Southern Basin Site, as they have done for the previous two years.
	Chlorophyll 'a'	M 	
	Seagrass	I 	All sites met the guidelines except at Mangles Bay and at Garden Island Settlement which were labelled red. It is believed that this is due to human and environmental factors influencing these two sites. All sites met the guidelines. In general, no significant reductions in the mean seagrass depth limit were detected. A trend of increasing depth distribution at Woodman Point was observed. The stable nature of the lower depth limit, suggests there has not been any regional decline in water clarity and light availability sufficient to cause a loss of seagrass meadows.
	Shoot density	I 	
Contaminants in Water	Depth limits	M 	No formal Contaminants in Water sampling occurring in the HPA in 2008-09. 2007-08 sampling indicated all sites met the guidelines or were below normal laboratory reporting limits.
	Metals and Metalloids	M 	
	Non-metallic Inorganics	M 	
	Organics	M 	
	Pesticides	M 	
	Herbicides and Fungicides	M 	
	Surfactants	M 	
	Hydrocarbons	M 	
Contaminants in Sediments	Miscellaneous/Others	M 	No TBT sediment sampling was done this year. Samples taken in 2007 were all well below the guidelines and graded green <sup>1</sup> .
	Organometallics (e.g. TBT)	M 	
	Sediment	M 	No formal sampling for imposex in snails has been done by CSMC since 2005-06 <sup>1</sup> .
	Imposex in Marine Snails	A 	
	Metals and Metalloids	M 	All sediment samples monitored to date (collected at 86 sites in March 2006) met the guidelines.
	Organics	M 	

<sup>1</sup> Limited sampling for imposex in snails occurred out of season (university study) in 2007. This study indicated a continued decline in TBT contamination in Perth coastal waters as measured through the degree of imposex. However, a number of sites assessed (including Colpoys Point, Garden Island and Jervoise Bay harbours) still have high levels of imposex, indicating that TBT contamination is still prevalent around industrial and naval harbours in the Sound. A significant reduction in imposex frequency was observed at Woodman Point, but sites at South Jervoise Bay and Colpoys Point have shown no significant change since the 2005 study (Bird, Matthew, Curtin University of Technology, *Assessment of Thais orbita as a biological indicator of tributyltin (TBT) contamination in Perth metropolitan waters*, 2007).

Figure 1



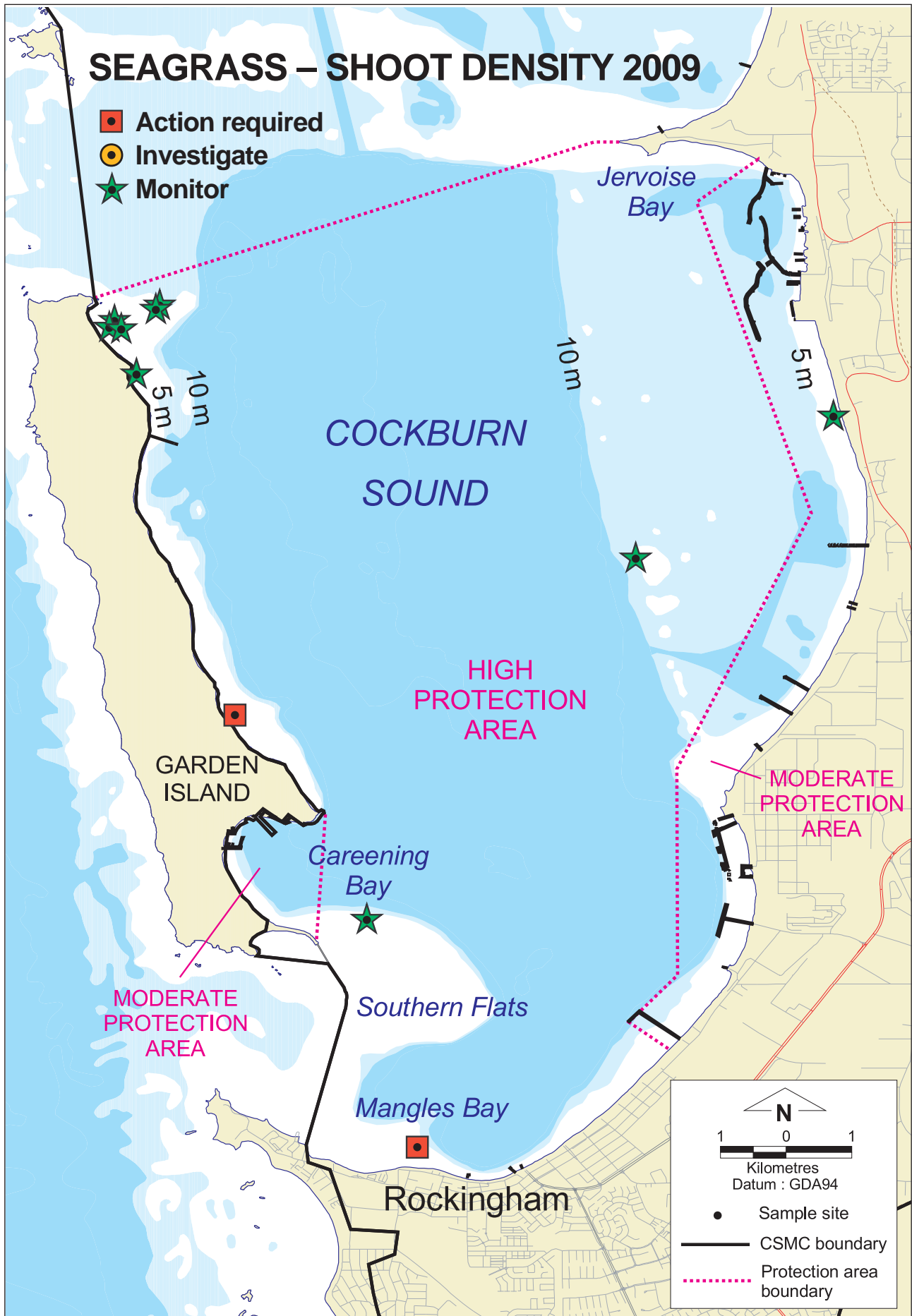
























Figure 2

# Report Card 2009

## Subject: Ecosystem Health in Areas of a Moderate Level of Protection (Outside Jervoise Bay Harbours)

Environmental Quality Indicators		Management Response	Comments
Physical and Chemical Measures	Chlorophyll 'a'	M 	Chlorophyll 'a' met the guidelines. Algal or phytoplankton densities were occasionally measured at high concentrations. The median light attenuation coefficient met the guidelines. All sites met the guidelines for dissolved oxygen, temperature, salinity and pH.
	Light attenuation	M 	
	Dissolved Oxygen	M 	
	Temperature	M 	
	Salinity	M 	
	pH	M 	
Direct Biological Measures	Phytoplankton Biomass (Activity)	M 	All sites met the guidelines for Phytoplankton Biomass (activity).
	Chlorophyll 'a'	M 	Seagrass shoot density met the guidelines. All sites met the guidelines. No significant reduction in the mean-seagrass depth limit was observed.
	Seagrass	M 	
Contaminants in Water	Metals and Metalloids	M 	Concentrations met the guidelines or were below laboratory reporting limits.
	Non-metallic Inorganics	M 	
	Organics	M 	
	Pesticides	M 	
	Herbicides and Fungicides	M 	
	Surfactants	M 	
	Hydrocarbons	M 	
	Miscellaneous/Others	M 	
Contaminants in Sediments	Organometallics (e.g. TBT)	M 	Limited sampling of contaminants in sediments (mainly around industrial and commercial jetties and terminals) met the guidelines. Results indicated some samples had concentrations which exceeded the guidelines but median values were below the guidelines. Two sites around industrial ports partially exceeded the guidelines; while these sites were individually coded amber the overall code was green.
	Sediment	M 	
	Imposex in Marine Snails (2006)	A 	No formal sampling for imposex in snails has been done by CSMC since 2005–06 <sup>1</sup> .
	Metals and Metalloids	M 	The guidelines for metals and metalloids were met with the exception of cadmium and mercury concentrations at one site and copper at another, which exceeded individual sample guidelines. Concentrations of organics met the guidelines with the exception of one site which is coded amber as it exceeded either one or both guidelines for most organics.
	Organics	M 	

<sup>1</sup> Limited sampling for imposex in snails occurred out of season (university study) in 2007. This study indicated a continued decline in TBT contamination in Perth coastal waters as measured through the degree of imposex. However, a number of sites assessed (including Colpoys Point, Garden Island and Jervoise Bay harbours) still have high levels of imposex, indicating that TBT contamination is still prevalent around industrial and naval harbours in the Sound. A significant reduction in imposex frequency was observed at Woodman Point, but sites at South Jervoise Bay and Colpoys Point have shown no significant change since the 2005 study (Bird, Matthew, Curtin University of Technology, *Assessment of Thais orbita as a biological indicator of tributyltin (TBT) contamination in Perth metropolitan waters*, 2007).

Figure 3

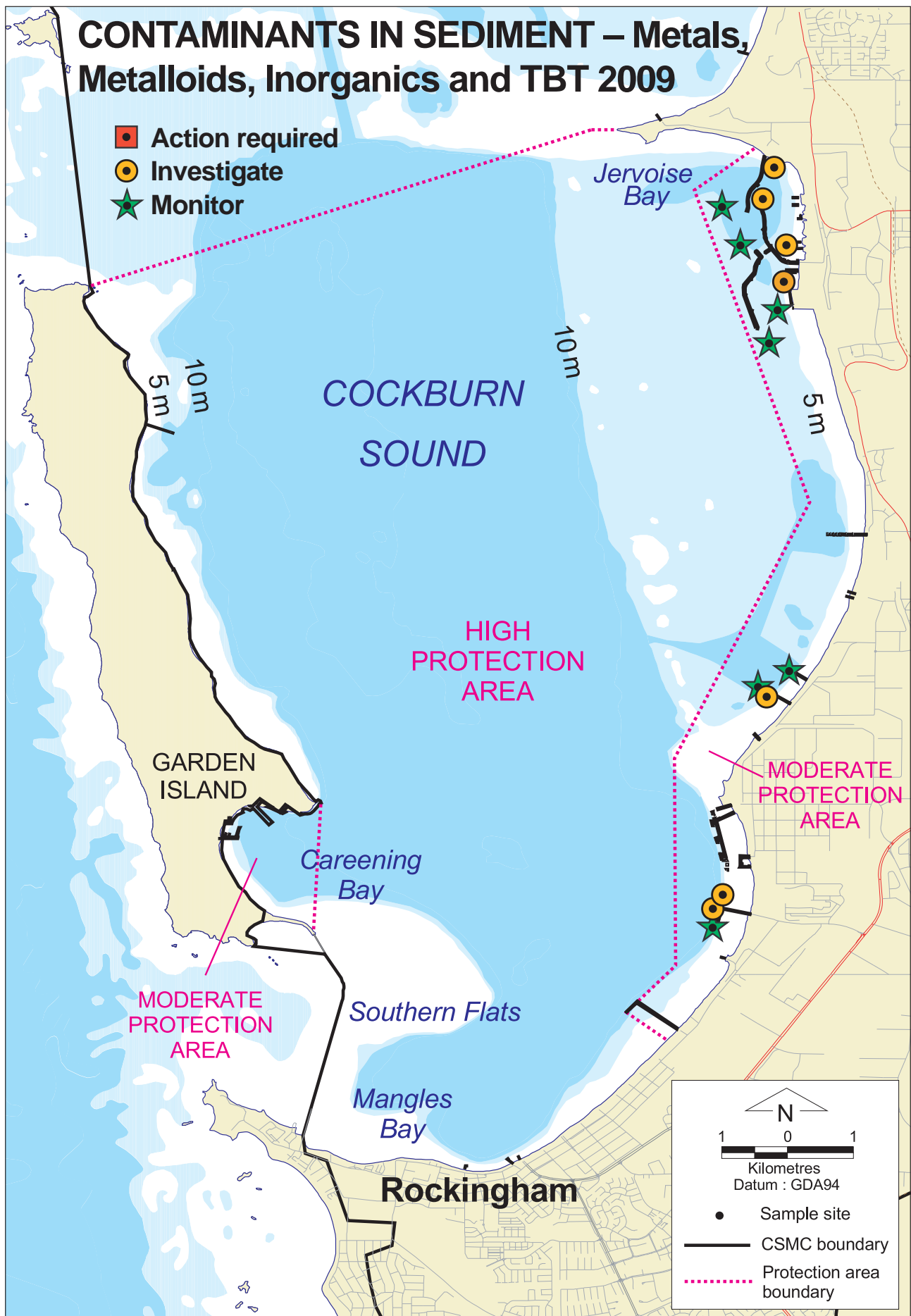








































Figure 4



# Report Card 2009

## Subject: Ecosystem Health in Areas of Moderate Protection (Jervoise Bay Harbours)

Environmental Quality Indicators			Management Response		Comments
			Northern Harbour	Southern Harbour	
Physical and Chemical Measures	• Chlorophyll ‘a’	I 	M 	The median chlorophyll ‘a’ concentration for Jervoise Bay Northern Harbour exceeded the guidelines. No sampling occurred in the Southern Harbour in 2008–2009.	
	• Light Attenuation	I 	M 	Light attenuation in Northern Harbour sites exceeded the guidelines. No sampling occurred in the Southern Harbour in 2008–2009.	
	• Dissolved Oxygen	M 	M 	Dissolved Oxygen, Temperature, Salinity and pH concentrations in Northern Harbour met the guidelines. No sampling occurred in the Southern Harbour in 2008–2009.	
	• Temperature	M 	M 		
	• Salinity	M 	M 		
	• pH	M 	M 		
Direct Biological Measures	<i>Phytoplankton Biomass (Activity)</i> • Chlorophyll ‘a’	A 	M 	Exceedance of a standard (high phytoplankton biomass) was registered again in Jervoise Bay Northern Harbour. The median chlorophyll ‘a’ concentration exceeded the standards. No sampling occurred in the Southern Harbour in 2008-2009.	
Contaminants in Water	<i>Metals and Metalloids</i>	M 	M 	No sampling for Contaminants in Water was undertaken in these areas in 2008–09.	
	<i>Non-metallic Inorganics</i>	M 	M 		
	• Organics	M 	M 		
	• Pesticides	M 	M 		
	• Herbicides and Fungicides	M 	M 		
	• Surfactants	M 	M 		
	• Hydrocarbons	M 	M 		
	• Miscellaneous/Others	M 	M 		
Contaminants in Sediments	<i>Organometallics (e.g. TBT)</i>	TBT in Sediment	I 	M 	Sampling for TBT contaminants in sediment took place at four sites each in the moderate protection area in the Northern and Southern Harbours. The TBT median concentrations in Northern Harbour exceeded the guidelines however Southern Harbour met the guidelines.
		Imposex in Marine Snails	A 	A 	No formal sampling for imposex in snails has been done by CSMC since 2005–06 <sup>1</sup> .
	<i>Metals and Metalloids Organics</i>		M 	M 	No sampling for organic contaminants in the Northern and Southern Harbours was undertaken this year.
			M 	M 	

<sup>1</sup> Limited sampling for imposex in snails occurred out of season (university study) in 2007. This study indicated a continued decline in TBT contamination in Perth coastal waters as measured through the degree of imposex. However, a number of sites assessed (including Colpoys Point, Garden Island and Jervoise Bay harbours) still have high levels of imposex, indicating that TBT contamination is still prevalent around industrial and naval harbours in the Sound. A significant reduction in imposex frequency was observed at Woodman Point, but sites at South Jervoise Bay and Colpoys Point have shown no significant change since the 2005 study (Bird, Matthew, Curtin University of Technology, *Assessment of Thais orbita as a biological indicator of tributyltin (TBT) contamination in Perth metropolitan waters*, 2007).

Figure 5

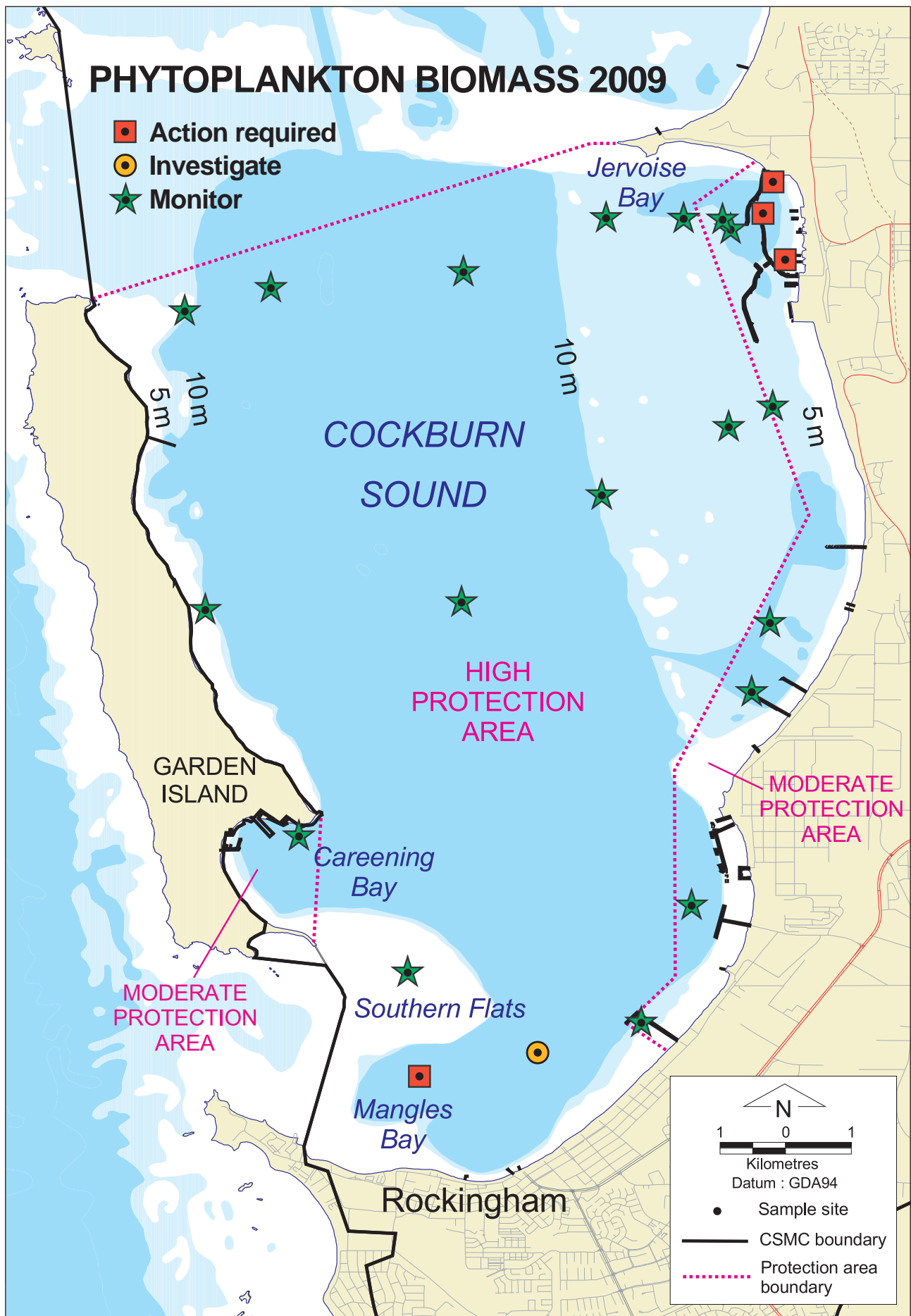


Figure 6

# Report Card 2009

## Subject: Safe Seafood for Eating






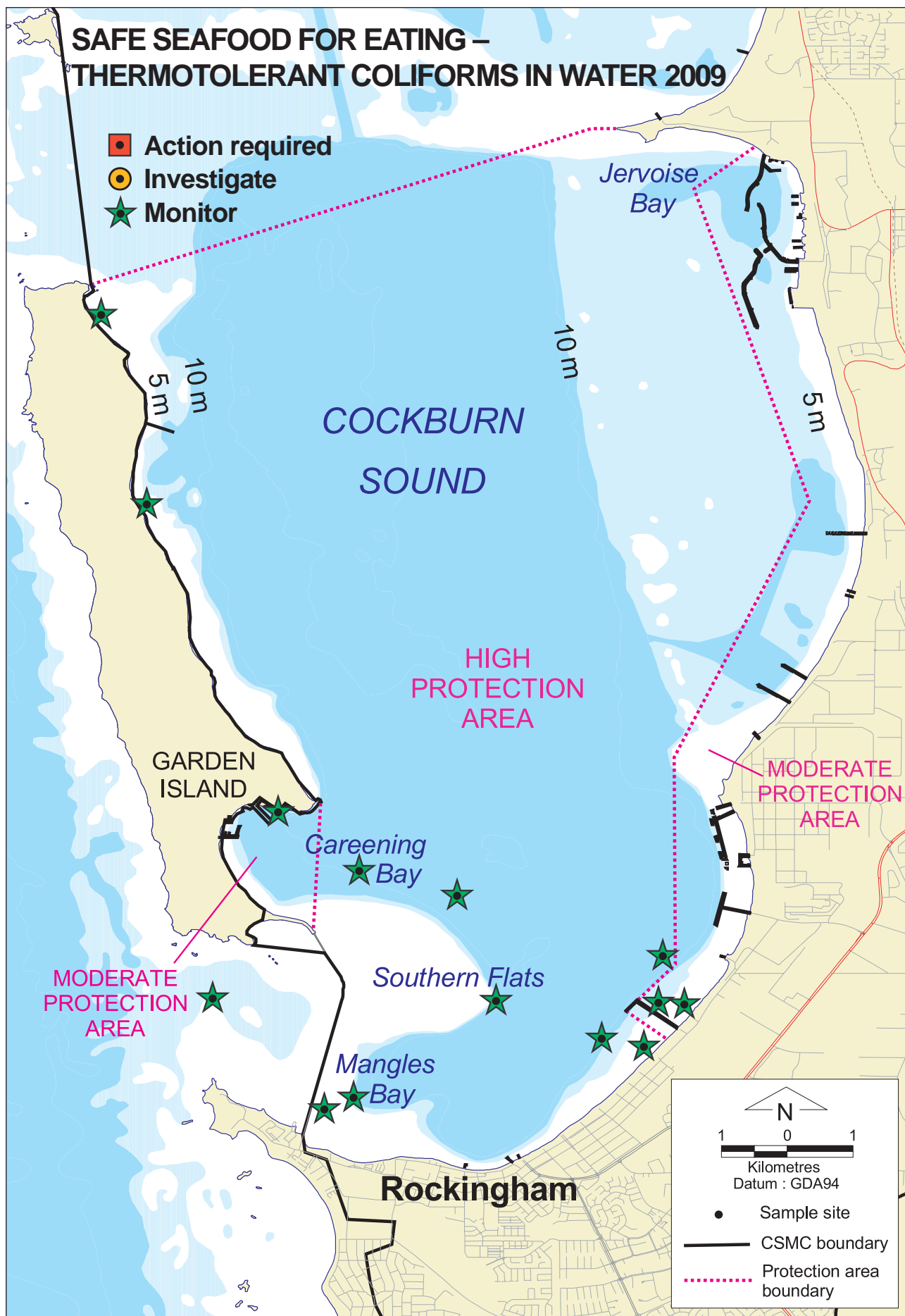
Environmental Quality Indicators		Management Response	Comments
Biological Contaminants	• Thermo-tolerant faecal coliform levels in water	M 	All sites met the guidelines.
	• Thermo-tolerant faecal coliforms in seafood flesh	M 	All sites met the guidelines.
	• Algal Biotoxins <ul style="list-style-type: none"> <li>– Presence of potentially toxic algae above guideline levels (e.g. &gt; 15 000 cells/mL)</li> <li>– Presence of algal bio-toxins in mussel flesh due to elevated levels of toxic algae</li> </ul>	I 	<p>Presence of potentially toxic phytoplankton algae exceeded WASQAP guidelines in a number of samples. However, the algae were not toxic. In response, when tested, no algal Bio-toxins were detected in the flesh of mussels. Seafood did not exceed WASQAP guidelines and was considered safe for eating. Whilst these species were present they did not produce toxins*.</p> <p>Under WASQAP, commercially farmed mussels in Cockburn Sound are subject to strict quality assurance processes to protect public health, including routine water quality and mussel sampling.</p> <p><i>*The public need to be aware of the risk associated with the consumption of potentially contaminated seafood collected recreationally outside of areas monitored by WASQAP, particularly in Jervoise Bay or around any jetties, piers and port related facilities. These shellfish are unmonitored and their quality cannot be assured.</i></p>
Chemical contaminants in seafood flesh	• Metals	M 	All sites met the guidelines for cadmium, copper, lead, zinc and mercury levels in mussels. Some natural heavy metals were detected but well below food and safety guidelines.
	• Organic Chemicals	M 	All sites met the guidelines. No problems were identified for aquaculture in the monitoring data. All organic chemicals were below laboratory reporting limits or were well below food and safety guidelines.

Figure 7





**Figure 8**

# Report Card 2009

## Subject: Clean Waters for Swimming and Boating










Environmental Quality Indicators		Management Response	Comments
Biological Measures	• Bacterial <i>Enterococci</i> (swimming)	I 	All sites, except one site in Rockingham, met the guidelines. Beach sites have greatly improved for bacteria contamination over the last three years. Levels are lower than last year, particularly in the Rockingham region. One site in Rockingham exceeded the guidelines, but only slightly.
	• Bacterial <i>Enterococci</i> (boating)	M 	All sites met the guidelines.
	• Toxic algae	I 	The standards for toxic algae were met, however high concentrations of potentially toxic species were occasionally recorded in deeper waters and although no algal toxins were detected, densities were often over recommended levels. No Phytoplankton sampling was undertaken at the beaches. WASQAP sampling results were used as they are only a short distance off-shore from many of the swimming beaches.
Physical Measures	• pH • Water clarity	M  M 	All sites met the guidelines.
Radiological Measures	• Gross alpha and beta activity	M 	Not sampled in 2009. The CSMC is considering discontinuing reporting on this measure on an annual basis as there is currently no identified reason for contamination to occur. There is an extremely low probability of this indicator being detected in Cockburn Sound.
Contaminants in Water	• Inorganic chemicals • Organic chemicals • Pesticides	M  M  M 	All sites met the guidelines. The CSMC's contaminants in water survey conducted in 2008 indicated a large majority of sites had concentrations below laboratory reporting limits including pesticides.

Figure 9

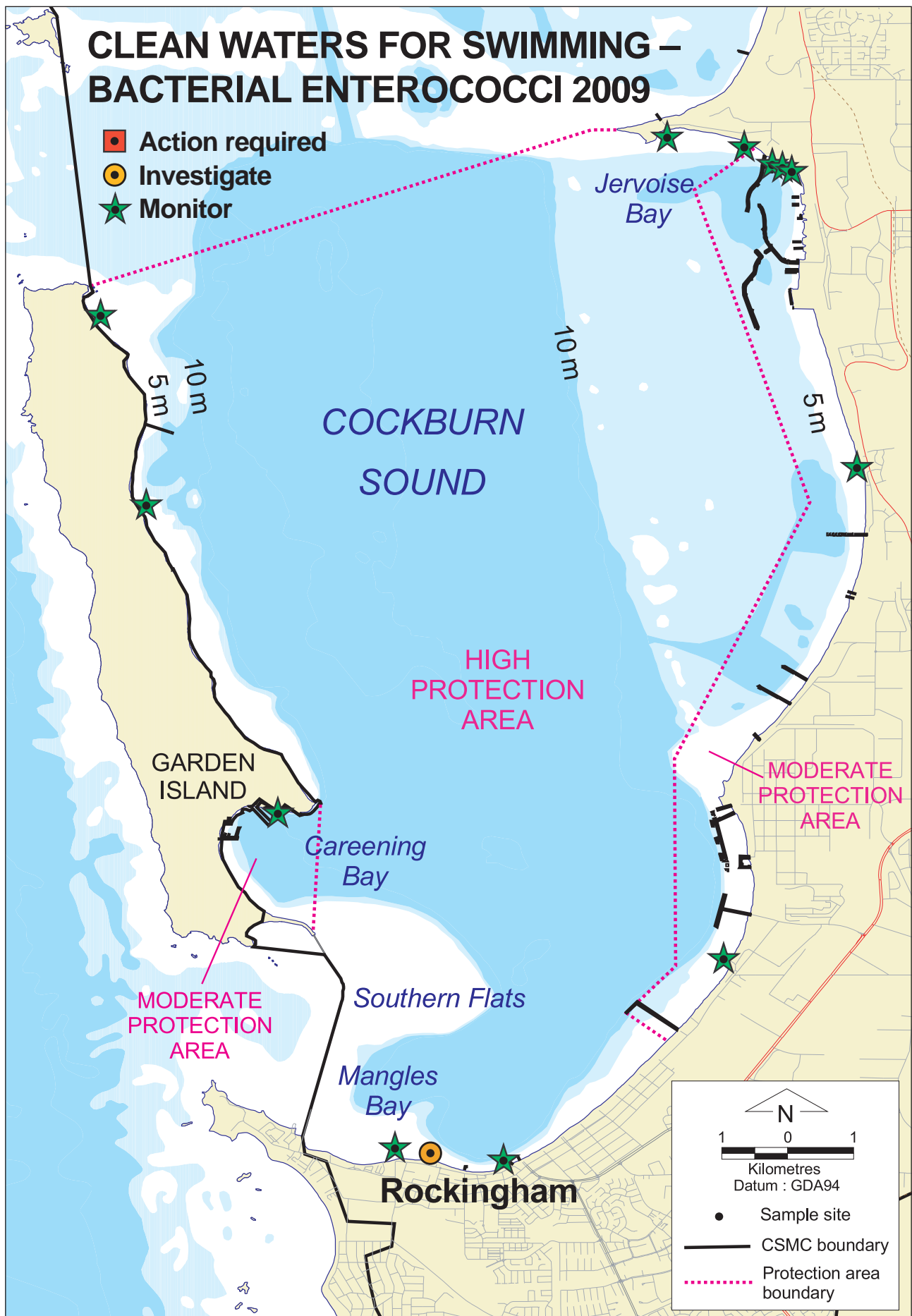







Figure 10



# Report Card 2009

**Subject:** Protecting the Health of Aquaculture Species

Environmental Quality Indicators		Management Response	Comments
Physico-Chemical Stressors	<ul style="list-style-type: none"> <li>Dissolved Oxygen</li> <li>pH</li> </ul>	M  M 	All sites met the guidelines.
Contaminants in water	<i>Metals and Metalloids</i>  <i>Non-metallic inorganic chemicals</i> <ul style="list-style-type: none"> <li>Organic Chemicals</li> <li>Pesticides</li> </ul>	M   M  M 	All sites met the guidelines. Contaminants in water at all sites were either below laboratory reporting limits or measured at very low levels, well below any guidelines or trigger values.

**Figure 11**

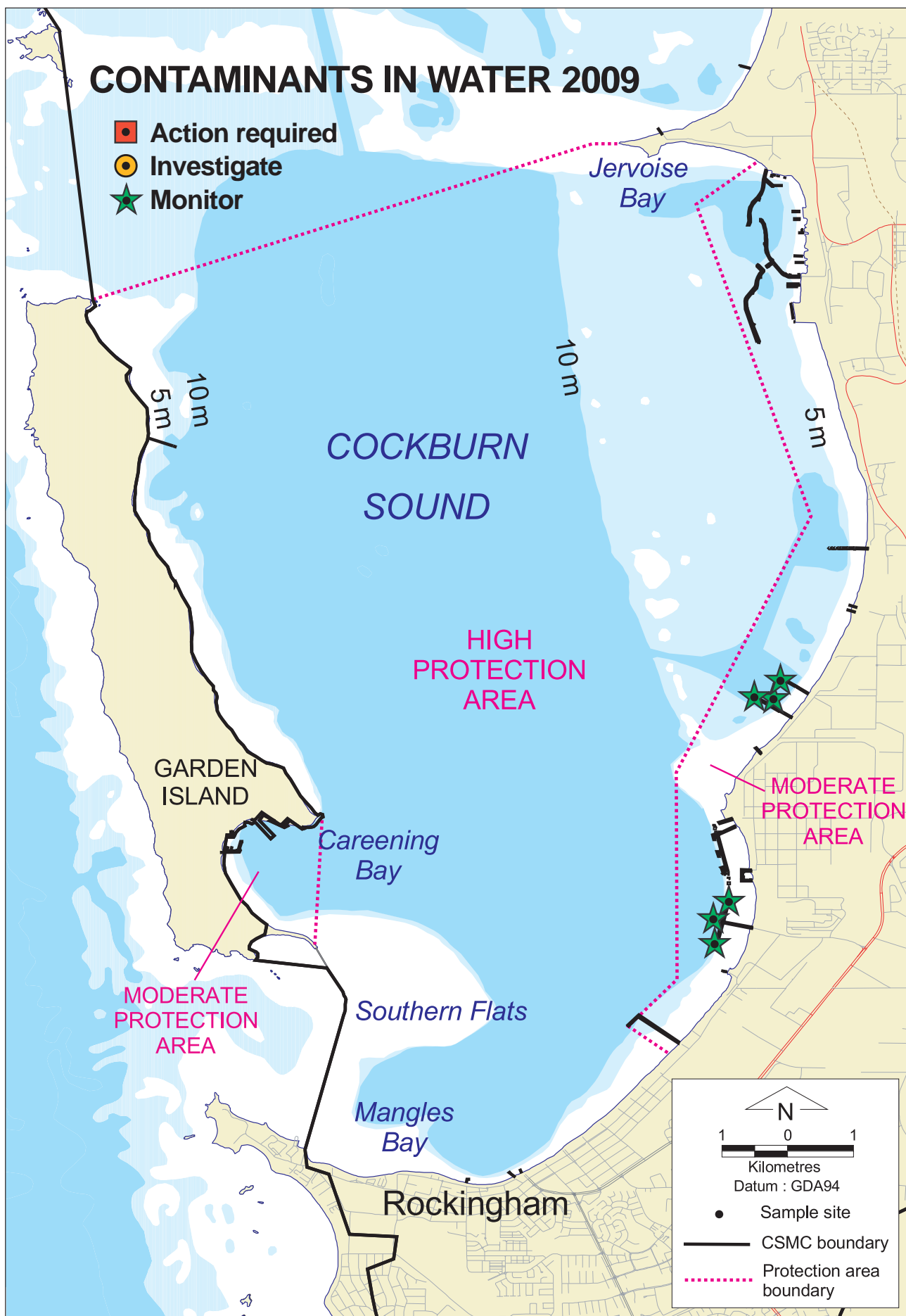


Figure 12

# Annual Report Card Comparisons – 2003–2009

Area	Parameter	2003	2004	2005	2006	2007	2008	2009	Status
High Protection Area	Light Attenuation	I	I	M	I	N/A	I	M	Good
	Dissolved Oxygen	M	M	M	M	M	M	I	Detection of low oxygen in deep basins
	Seagrass Shoot Density	I	I	I	M	M	M	I	Mangles Bay and one GI site a concern
	Safe Seafood for Eating – Presence of potentially toxic algae	M	M	I	I	I	M	I	Presence of potentially toxic SPP have not produced toxins
	Clean Waters for Swimming – Potentially toxic algae Primary Contact	M	M	M	M	I	I	I	Unknown as unmonitored Use WASOAP data as surrogate
	Clean Waters for Swimming – Enterococci Primary Contact	M	M	A	A	I	I	I	Improving
	Imposex – TBT (All areas)	N/A	N/A	N/A	A	A	A	A	Unknown (was poor)
Moderate Protection Area	TBT Sediment	A	I	M	A	I	M	M	Improving
Northern Harbour (Moderate)	Light Attenuation	N/A	N/A	I	I	N/A	I	I	Poor
	Chlorophyll 'a'	I	I	I	I	I	I	I	Poor
	Phytoplankton Biomass	A	A	A	A	A	A	A	Poor and of concern
	TBT Sediment	A	I	I	A	I	I	I	Poor
Southern Harbour (Moderate)	TBT Sediment	A	I	I	A	I	M	M	Improving







# Moving Forward

The CSMC is proud of its contribution to the environmental improvements that have been achieved during its nine years of operation. During this time, the water quality and general environmental health of the Sound have stabilised. Many traditional pollution activities are now better managed, much reduced and licensed, while others have waned or are no longer relevant.

Cockburn Sound and Owen Anchorage continue to face a range of pressures. These now fall into three broad categories: the first is related to over-use, and to the increasing popularity of its relatively calm and productive waters by recreational fishers and boaters; the second relates to proposed new large scale port and marina developments; and the third relates to various forms of drainage, including the gradual run down of historically contaminated groundwater, residential drainage and the waste and thermal discharges that are emitted from those industries that are still licensed for emissions into Cockburn Sound.

## *Strategic Directions*

The CSMC will work to consolidate its position as a national leader in multi-stakeholder marine management. It has won this reputation on the basis of its well established partnerships with key stakeholders and through the trust and respect it has earned in the wider community. As it enters its tenth year the CSMC is keen to commence a number of initiatives and progress objectives identified during the strategic planning process undertaken this year.

## *Projects*

The CSMC plans to enter into a three way partnership with industry and a university during 2010 to support a targeted PhD scholarship for a high priority research project in CSMC and/or Owen Anchorage.

A number of long-term projects currently underway will be progressed further during 2010. We expect two of these, the grey sands investigation and the interpretative signage and sea sculpture project, to be largely completed in 2010. Two other major projects, however, will continue.

One of these relates to the development of a Multiple Use Framework and, in particular, a decision support 'tool box' for assessing multiple use conflicts and

cumulative impacts.

The second project is the development of an Owen Anchorage EMP.

The task of developing a new EMP for Cockburn Sound is a longer term project. It is anticipated that it will take several years to revise the current EMP to capture the desires and expectations of the community and Government and yet meet and extend the objectives and dictates of the State Environmental (Cockburn Sound) Policy 2005, as well as incorporating Owen Anchorage. A central component of the review of the EMP will be a comprehensive assessment, to detect and understand environmental trends in the data collected in Cockburn Sound and, in turn, Owen Anchorage. Because a pressure-state-response report for Owen Anchorage was produced in 2007, the review of its environmental data is not as urgent as for Cockburn Sound which was last reviewed in 2000.



A view to Jervoise Bay harbours through Rip Rap or irregular armouring of breakwaters, Australian Marine Complex

## *Multiple Use Framework*

The CSMC's first milestone in the development of a multiple use framework is the production of the major resource document titled '*Sounding Out – a Way Forward*', which will be published in 2010. This document provides valuable information on the many historical and current uses of Cockburn Sound. If it proves to be financially feasible, the CSMC will pursue partnerships it has been exploring to utilise appropriate decision support software that can assist with building a robust framework for assessing future uses of the Sound. MARZONE software has already been successfully trialled, using the Sound as

a test case, and there is also a potential opportunity to develop a MSE application, adapted specifically for the Sound and Owen Anchorage, in partnership with CSIRO. An effective multiple use framework that utilises these advanced decision support ‘tools’ would be invaluable for governments, industry and the community.

### ***Confronting Climate Change***

Since climate change is an issue that presents potential threats to the health of the Sound and, in particular, to its environmental assets, the CSMC needs to be well positioned to coordinate relevant information and advice with stakeholders in Cockburn Sound and Owen Anchorage. This is to ensure that the marine environment can be managed and protected to allow its natural systems to adapt to any changes. The CSMC will continue exploring opportunities with a range of its stakeholders that also have responsibilities to address climate change so that we can collaborate with them to improve our collective knowledge base. In this way, the responses can be coordinated rather than fragmented and we will therefore be better prepared and able to deal more efficiently and cost-effectively with this challenge.

### ***A Resource for the Community***

The CSMC will continue to provide a one-stop-shop for information and expert advice for the local community, backed by an increasing body of data and a growing network of partner organisations. The CSMC’s annual Community Forums on Cockburn Sound and Owen Anchorage will continue to provide an opportunity for reporting the results of our monitoring programs through the annual Report Cards and for open discussion on community issues relating to these heavily used and greatly valued embayments.

### ***The Future***

The 2009 Strategic Planning process highlighted a range of activities and projects that would allow a deeper understanding of Cockburn Sound and Owen Anchorage and therefore a higher level of protection for their future.

While it is not possible for the CSMC to extend its activities to include these projects under current budgets and staffing constraints, they will inform the CSMC’s vision, aspirations and planning for the future of these waterways, and partnerships will be actively sought to progressively undertake them:



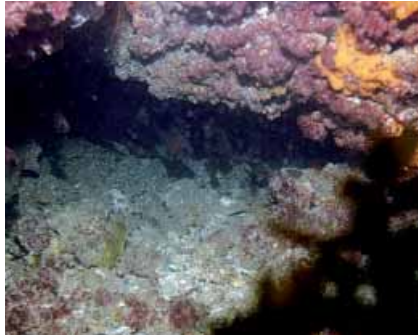
Top – View towards Kwinana Bulk terminal warehouse, Second Top – Cockburn Cement Limited jetty, Owen Anchorage, Middle – Quandong fruits or coastal sandalwood found in foreshore vegetation, and Bottom – Port Coogee becoming established.



1. Monitor the health of more areas of seagrass and aspects of their growth and biology.
2. Monitor phytoplankton in the water to provide public health surveillance for the DoH and local governments.
3. Monitor sediments for contaminants in a more comprehensive and reliable way around ports, navigation channels and marina facilities to assess potential impacts on the biota of Cockburn Sound and Owen Anchorage.
4. Monitor Owen Anchorage water quality annually (it was monitored for 6 weeks in 2009).
5. Establish environmental report card methodologies and a report card system for Owen Anchorage.
6. Undertake an environmental risk assessment relating to contaminants that pose a high risk of damaging the environment.
7. Monitor benthic (bottom sand and mud) and zooplankton populations (little animals in the water) including larval fish and crabs to better evaluate the environmental health of the Sound's food chain, recruitment and status of its important juvenile predators (once every three years).
8. Undertake occasional but regular surveys of the number of marine birds, including penguins, and dolphins.
9. Monitor boat numbers, their activities and impact.
10. Monitor water quality in winter once every three to five years to better understand winter conditions, what is being discharged into Cockburn Sound and how this may affect summer conditions.
11. Monitor groundwater plumes that are known to carry potentially damaging pollutants to estimate the extent and timing of the risk they pose.
12. Develop an integrated ecological model that emulates natural processes and the ecology of the system, and use it to determine thresholds and risks. Collaborate to establish a climate model that allows climate change impacts to be better understood and adaptation strategies to be developed.
13. Undertake multiple use modelling to further develop MARZONE and MSE and develop the capacity to maintain and improve the use of these models.
14. Establish a restoration fund to extend seagrass meadow coverage, improve habitats and help re-vitalise remaining foreshore areas, as well as reducing weed and other environmental threats to adjacent inland vegetated and wetland catchment areas.



Water Corporation Real-time Water Quality Monitoring Buoy





# Annual Monitoring Programs 2008–09

A detailed report outlining the monitoring programs undertaken in Cockburn Sound is available from <http://csmc.environment.wa.gov.au>. The following is a list of the programs undertaken in 2008–09 including the parameters measured. Programs denoted with an asterisk contribute data for the development of the Cockburn Sound Report Cards.

## Cockburn and Warnbro Sounds Water Quality Monitoring Program\*

This program is coordinated by the CSMC and receives financial assistance from the KIC and DoD.

**Objective:** to coordinate monitoring under the SEP and implement the EMP.

### Parameters measured

**Water:** temperature, salinity, dissolved oxygen, light attenuation, Secchi depth, pH, total nitrogen, total phosphorus, ammonia, nitrate-nitrite, phosphate (FRP), chlorophyll 'a', total suspended solids (for 6 weeks).

**Phytoplankton:** species present but samples are stockpiled and stored. No analyses are undertaken.

## Jervoise Bay Northern and Southern Harbour Monitoring Program\*

This program is coordinated and funded by LandCorp.

**Objective:** to fulfil Ministerial Conditions and environmental approvals for the construction of Southern Harbour. The program also meets requirements under the Operation Environmental Management Plan for Southern Harbour.

### Parameters measured

**Water:** temperature, salinity, dissolved oxygen, Secchi depth, light attenuation coefficient, total nitrogen, ammonium, nitrate-nitrite, total phosphorus, ortho phosphate, chlorophyll 'a', 'b' and 'c'.

**Sediment:** heavy metals (As, Cd, Co, Cr, Cu, Pb, Hg, Ni, Sn and Zn), total Kjeldahl nitrogen, total phosphorus, total organic carbon, butyltin

compounds (Mono-MBT, Di-DBT and Tri-TBT), polycyclic aromatic hydrocarbons (PAH).

**Sentinel mussels:** Ag, As, Cd, Cr, Cu, Pb, Hg, Ni and Zn. Mussels were taken but are not measured now.

**Phytoplankton:** species present.

## Fremantle Ports Marine Quality Monitoring Program\*

This program is coordinated and funded by Fremantle Ports.

**Objectives:** to determine whether water and sediment quality monitoring meets the Environmental Quality Criteria set out in the *State Environmental (Cockburn Sound) Policy 2005*. Further objectives are to monitor the overall health of those areas of the port that are at risk of being adversely affected by port-related activities and to monitor specific areas of environmental concern associated with historical activities, in order to identify possible requirements for management responses.

### Parameters measured

**Water:** temperature, salinity, conductivity, dissolved oxygen, pH, Secchi depth, total suspended solids, total nitrogen, total phosphorus, ammonium, nitrate-nitrite, free reactive phosphorus, dissolved organic carbon, alkalinity, chlorophyll 'a', 'b' and 'c' and phaeophytin, dissolved copper.

**Sediment:** total nitrogen, nitrate, nitrite, total phosphorus, total organic carbon, heavy metals (As, Cd, Cr, Cu, Pb, Hg, and Zn), organotins (TBT, DBT, MBT), polycyclic aromatic hydrocarbons (PAH).

**Mussels:** metals (As, Cd, Cr, Cu, Pb, Hg, and Zn), organotins (TBT, DBT and MBT), polycyclic aromatic hydrocarbons (PAH).

## Annual Survey of Selected Seagrass Meadows in the Fremantle–Warnbro Sound Region\*

This program is coordinated and funded by the CSMC with assistance from the DEC.

**Objective:** to monitor seagrass health under the SEP.



#### *Parameters measured*

**Seagrass:** dominant seagrass species, epiphyte characteristics, rhizome mat, colonising species, videography, seagrass shoot density; seagrass shoot height, seagrass species, depth.

### Environmental Waters Microbiological Monitoring Program\*

This program is coordinated and funded by the DoH.

**Objectives:** to undertake water quality monitoring in recreational areas within Cockburn Sound to establish the degree of microbiological contamination; to identify trends in the microbiological quality of recreational waters within Cockburn Sound and to provide advice to the public on microbial water quality.

#### *Parameters measured*

**Bacteria:** Bacterial *Enterococci* (confirmed).

### City of Cockburn Microbiological Monitoring Program\*

This program is coordinated and funded by the CoC.

**Objectives:** to monitor the recreational water quality of Jervoise Bay and ensure compliance with the ANZECC *Australian Water Quality Guidelines for Fresh and Marine Waters 1992*; to identify trends in the microbial water quality of recreational waters within Cockburn Sound and provide advice to the public on microbial water quality.

#### *Parameters measured*

**Bacteria:** Thermo-tolerant coliforms (presumptive), *Enterococci* (confirmed).

### City of Rockingham Microbiological Monitoring Program\*

This program is coordinated and funded by the CoR.

**Objectives:** to undertake water quality monitoring in recreational waters within Cockburn Sound to establish the degree of contamination and identify trends in microbial quality; advise stakeholders on microbial water quality and gather data to assist decision making on initiatives to improve coastal waters for users.

#### *Parameters measured*

**Bacteria:** Bacterial *Enterococci* (confirmed).

### Defence Microbiological Monitoring Program\*

This program is coordinated and funded by the DoD in conjunction with the DoH.

**Objectives:** to safeguard people who come into frequent and direct contact with the water during activities such as swimming.

#### *Parameters measured*

**Bacteria:** Thermo-tolerant coliforms (presumptive), bacterial *Enterococci* (confirmed).

#### *Parameters measured*

**Mussel flesh:** TBT, heavy metals (Cu, Zn, As, Cd, Pb, Hg, Sn).

### Western Australian Shellfish Quality Assurance Program\*

This program is coordinated and funded by the DoF and the DoH together with the WAMPA.

**Objective:** to ensure compliance with the WASQAP for the commercial harvest of aquacultured bivalve molluscs.

#### *Parameters measured*

Phytoplankton in water and algal biotoxins: species present and presence of toxin.

**Mussel flesh:** algal biotoxins, *E.coli*, salmonella, inorganic arsenic, copper, zinc, cadmium, lead, mercury, organo-chlorines, organo-phosphates, pesticides, polychlorinated biphenyls.

**Water:** total coliforms, thermo-tolerant coliforms, *E. coli*.

### Owen Anchorage Water Quality Monitoring Program

This program is coordinated and funded by the CSMC. In previous years it was funded by Cockburn Cement.

**Objective:** to coordinate monitoring under the SEP and implement the EMP, in general.



A tug at work in Cockburn Sound

**Water:** temperature, salinity, dissolved oxygen, light attenuation, Secchi depth, pH, total nitrogen, total phosphorus, ammonia, nitrate-nitrite, phosphate (FRP), chlorophyll 'a', total suspended solids (for 4 weeks).

### Perth Seawater Desalination Plant Water Quality Monitoring Program

This program is coordinated and funded by the Water Corporation.

**Objective:** to fulfil Ministerial Conditions set to ensure protection of the water quality of Cockburn Sound, and to ensure that the discharge complies with the requirements of the SEP and the EQC Reference Document (Cockburn Sound).

#### *Parameters measured*

**Water:** turbidity, total suspended solids, salinity,

total dissolved solids, dissolved oxygen, pH, temperature, light attenuation, Secchi depth, total nitrogen, nitrate, nitrite, ammonia, total phosphorus, ortho-phosphate, total organic carbon, metals (Al, As, Cd, Cr, Cu, Fe, Pb, Mn, Mo, Hg, Ni, Se, V, Zn) chlorophyll 'a', phaeophytin, phytoplankton species, fluorescence.

**Sediments:** Metals: (Al, As, Cd, Cr, Cu, Fe, Pb, Mn, Mo, Hg, Ni, Se, V, Zn)

**Phytoplankton:** species, fluorescence.

**Sediment habitat:** habitat and benthos, species number, abundance of macrofauna.

**Meteorological observations:** wind (direction and speed), water levels (hourly intervals), estimated Swan River out-flow data.

**Brine:** toxicity testing (done once in 2006).

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Alfresco dining along the Rockingham Beach foreshore

# Glossary

AMC	Australian Marine Complex (Henderson)
CoC	City of Cockburn
CoR	City of Rockingham
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSMC	Cockburn Sound Management Council
DEC	Department of Environment and Conservation
DoD	Department of Defence
DoF	Department of Fisheries
DoH	Department of Health
DPI	Department for Planning and Infrastructure
DoIR	Department of Industry and Resources
DoW	Department of Water
EMP	Environmental Management Plan for Cockburn Sound and its Catchment 2005
EPA	Environmental Protection Authority
EQC	Environmental Quality Criteria
EQG	Environmental Quality Guideline
EQMP	Environmental Quality Monitoring Program
EQO	Environmental Quality Objectives
EQS	Environmental Quality Standard
EV	Environmental Values
KIC	Kwinana Industries Council
MARZONE	Maritime Zone boundaries software based on MARXAN zonation package for marine multiple use planning
MCA	Mooring Control Area
MSE	Management Strategy Evaluation
OASC	Owen Anchorage Sub-Committee
SEP	<i>State Environmental (Cockburn Sound) Policy 2005</i>
SRT	Swan River Trust
TBT	Tributyltin (a common ingredient in anti-fouling paint pre 1992 recreational vessels/ 2003 in commercial vessels)
ToK	Town of Kwinana
WAMPA	Western Australian Mussel Producers Association
WASQAP	Western Australian Shellfish Quality Assurance Program



# Table I – CSMC Membership

Member	Designation	Representation	Occupation	Appt	Expiry
Professor Kateryna Longley	Chairperson	Independent	Retired Pro-Vice Chancellor Murdoch University	July 2005	Dec 2011
John Polglaze	Member	Community	Senior Principle Environmental Scientist – URS	July 2000	Dec 2011
Bob Goodale	Member	Community	Freelance Naturalist	July 2005	Dec 2011
Bart Houwen	Deputy Chairperson	Community-Com Net Inc	Business Manager Bendigo Bank		
Professor Philip Jennings	Member	Conservation Council	Professor of Energy Studies Murdoch University and President of the Conservation Council		
Matt Gillett	Member	Recfishwest	Committee member		
John Smedley	Member	Cockburn Powerboat Assoc	Ex Commodore Cockburn Power Boat Association		
Jim Turley	Member	WA Veg Growers Assoc	Chief Executive Officer WA Vegetable Growers Association		
Glenn Dibben	Member	WA Mussel Producers Assoc	Chair – WA Mussel Producers Association		
Dr Rodney Lukatelich	Member	KIC	Environmental Manager – BP Kwinana Refinery		
Cr Carol Reeve-Fowkes	Member	City of Cockburn	Councillor – City of Cockburn		
Cr Ruth Alexander	Member	Town of Kwinana	Councillor – Town of Kwinana		
Cr Ann Prince	Member	City of Rockingham	Councillor, City of Rockingham		
Dr Boyd Wykes	Member	Dept of Defence	Senior Environmental Manager, Defence Support Group WA,		
Dr John Keesing	Member	CSIRO	Head of Marine Research CSIRO		
Ian Briggs	Member	Dept of Mines and Petroleum	General Manager Strategic Policy		
Peter Dans	Member	DEC	Director Regional Services		
Gino Valenti	Member	Fremantle Ports	General Manager Strategy and Planning		
Laurie Caporn	Member	Dept of Fisheries	Principal Management Officer		
Vivienne Panizza	Member	Dept for Planning	Team Leader Coastal Planning		
Guy Watson	Member	Water Corporation	Manager Operations, Environmental Branch		
Leon Brouwer	Member	Dept of Water	Regional Manager Kwinana-Peel		

# Table 2 – 2009 CSMC Shopfront – Customer Inquiries – Summary of Issues

- ★ Port Rockingham Marina Public Environmental Review
- ★ Blue Swimmer Crab fishing ban
- ★ SIMP
- ★ Mangles Bay Marina
- ★ Penguin Island/brochures
- ★ Mooring control and gazettals
- ★ Mangles Bay swimming safety
- ★ Starfish washed up on beach
- ★ Palm Beach Jetty
- ★ Algal blooms
- ★ Magpies
- ★ Crows in Nursing Home
- ★ Wasps in Foreshore Park
- ★ Seagrass at dog beach
- ★ Sub-Antarctic Fur Seals
- ★ Snakes/removal
- ★ Pink Snapper
- ★ Fishing
- ★ Bag limits
- ★ Cockburn Sound
- ★ Garden Island
- ★ TBT
- ★ Silver Gull deaths
- ★ CBH drain discharges
- ★ Boats on beaches and adrift
- ★ Oil spills from moored and anchored boats
- ★ Dolphin mortalities
- ★ Seagrass anchor damage
- ★ Little Penguin boat strikes
- ★ Foreshore car parking and storm damage
- ★ Palm Beach Jetty redevelopment
- ★ Palm Beach boat ramps
- ★ Foreshore rehabilitation and weed control



Boating at Palm Beach, Rockingham







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## COCKBURN SOUND MANAGEMENT COUNCIL

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Department of  
**Environment and Conservation**

*Our environment, our future*

