Health of the Swan Canning Estuary

Overview of the Swan Canning Water Quality Improvement Plan and the Swan Canning Research and Innovation Program: outcomes and management implications

Jeff Cosgrove
National Approach – Coastal Hotspots
Partnership Approach

Department of Environment and Conservation
Department of Water
Department for Planning and Infrastructure
Department of Agriculture and Food

Australian Government
GeoCatch
Swan River Trust
Government of Western Australia
Perth Region NRM
WATER CORPORATION
WALGA
CCI Projects

- Predictive Modelling (DoW)
- Water Sensitive Urban Design (DoP, DoW and WALGA)
- Decision Support System and Rural Best Management Practices (DAFWA, DoW)
- Nutrient Offset Policy (SRT)

- Swan Canning Water Quality Improvement Plan (SRT)
Key Findings

Based on predictive modelling, the following key findings were:

- Current annual nutrient load to SC is 250t TN and 26t TP
- Maximum acceptable loads are 130t TN and 14t TP (requiring 49% and 46% reduction)
- Avon River contributes 69% TN and 43% TP *
- Ellen Brook contributes most nutrients from SC Sub-catchments (28%TN and 39%TP)
- Main TP source: farming activities (33%)
- Main TN source: residential (29%) and recreational (14%). Also Second highest for TP (22% and 12%)
- Septic Tanks contribute 18% TN and 8% TP (higher in some sub-catchments)
- ↑ Urbanisation will ↑ nutrient loads by 18% TN and 25% TP due to ↑ Runoff
- Climate change modelled to reduce nutrient loads (3-15% TN and 5-31% TP)

* Avon River was outside the scope of the SCWQIP and requires further investigation
Key Recommendations

Management measures to focus on:

• Use of WSUD in new developments
• Fertiliser efficiency in urban recreational areas
• Use of slow release, low soluble P fertilisers in rural areas
• Education in fertiliser efficiency – rural and urban
• Use of soil amendments for soils with low PRI
• Engineering modifications to intercept nutrients
• Sub-catchment nutrient management (Local WQIP’s)
• Nutrient point sources (primarily septic tanks)
Modelling Scenarios – TN Loads
Modelling Scenarios – TP Loads
Modelling scenarios – Bayswater MD
SCWQIP Implementation

- Steering Committee representation by key Govt agencies, WC, WALGA and PRNRM.
- $3.19m from WA Govt (2009 – 2011)
- $2.5m from Aust Govt (2010 – 2013)
- Projects to cover most recommendations
- Fertiliser Action Plan
- Infill Sewer Program
- Promotion of WSUD
Swan Canning Research and Innovation Program – SCRIP
Healthy Rivers Action Plan

- 8 integrated programs forming a ‘catchment to Coast’ approach
**SCRIP**

**Small Grants Scheme**
Open to:
- higher educational institutions,
- other research institutions (e.g. CSIRO), and
- other government organizations

17 Projects - $316,678

**Project-specific partnership arrangements**
Examples
- Dolphin population and health studies
- Trophic interactions in the Swan-Canning
- Development of an estuarine health index using fish community characteristics
- NNCP studies

- Endocrine disruption in urban drains
- Implications of Agricultural and urban runoff to crustaceans within Swan Canning catchments
- Fish Health in Claisebrook Cove

- Baseline studies of contaminants in the catchment
- Baseline study of contaminants in groundwater at 3 disused landfills
- Baseline study of contaminants in the estuary
- Preliminary ecotoxicological studies
Endocrine Disruption in Urban Drains

A/Prof Monique Gagnon & Dr Diane Webb – CURTIN UNIVERSITY

- Evidence of chronic exposure to EDCs at PASMD & BSMD
  - Shorter gonopodia
- Evidence of more acute exposure to estrogeneric EDCs at BWMD
  - More fish lacking gonopodial hook
Implications of Exposure by Agricultural and Urban Runoff to Crustaceans within Swan-Canning Catchments
Dr Diane Webb – CURTIN UNIVERSITY

- Shrimp from Swan-Canning catchment drains show evidence of health impacts including endocrine disruption

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<th>Ranking</th>
<th>Drain</th>
<th>ECOD Low flow</th>
<th>ECOD High flow</th>
<th>SDH Low flow</th>
<th>SDH High flow</th>
<th>Oxidative damage Low flow</th>
<th>Oxidative damage High flow</th>
<th>Score</th>
<th>Combined Score</th>
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- There was a strong bias towards females and intersex was above the normal incidence expected to be found in crustaceans.
Fish health in Claisebrook Cove
Dr Rawson et al. – CURTIN UNIVERSITY & DoW

<table>
<thead>
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<th>Biomarker</th>
<th>Description</th>
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<tr>
<td>CYP1A</td>
<td>Measure of exposure to PAHs/PCBs/Dioxins</td>
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<td>Biliary PAH Metabolites</td>
<td>Measure of Benzo-(a)-pyrene, Naphthalene and Pyrene</td>
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<td>sSDH</td>
<td>Measure of liver function</td>
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<td>Oxidative DNA damage (fish)</td>
<td>Measure of oxidative stress</td>
<td>Serum</td>
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<tr>
<td>Oxidative DNA damage (mussels)</td>
<td>Measure of oxidative stress</td>
<td>Whole animal</td>
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• Estuarine fish show evidence of enhanced exposure to organic contaminants
• Biomarkers for effect are harder to interpret
• Mussels in Claisebrook cove had higher levels of oxidative damage
  – Cause? ...metal contaminants? Hypoxic conditions?

Figure 2: Location of fish and mussels sampling sites in the Swan River estuary. Arrows represent the entry points of significant drains to the Swan River. M1 is Swan River – Claisebrook Main Drain inlet. M2 – Claisebrook Channel drain.
In General

• The Swan Canning catchment is an urbanised, multi-use catchment
  – Studies have shown the presence of a number of contaminant exceeding guideline levels (Zn, Pb, DDE, Se, Hg, dieldrin, PAHs)
  – Typical of other urban estuaries

• Preliminary studies indicate that a range of aquatic organisms show evidence of exposure to these contaminants
  – Further studies are required regarding the biological implications