

BASELINE ASSESSMENT OF SOURCES AND MANAGEMENT OF LAND-BASED MARINE
POLLUTION IN THE BCLME REGION (PROJECT BEHP/LBMP/03/01)

APPENDIX A

DESKTOP ASSESSMENT OF AVAILABLE INFORMATION & INITIATIVES: SOUTH AFRICA

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EXECUTIVE SUMMARY

This report provides an inventory of the available information and data related to the management of marine pollution sources in South Africa, in particular land-based sources.

To conduct the desktop review and assessment within the time and budgetary constraints of this project, effort was focused on the main development nodes within the BCLME region in South Africa. It is envisaged that these will be the priority areas for which site-specific marine pollution management programmes need to be developed. The selected nodes to be addressed as part of this project are:

- St Helena Bay
- Saldanha Bay/Langebaan Lagoon
- Cape Peninsula (western section)
- False Bay
- Walker Bay (Hermanus)
- Mossel Bay
- Knysna Estuary.

Legislation controlling marine pollution in South Africa is primarily promulgated from a national level. As a result, the inventory and assessment of the legislative framework was compiled generically (Chapter 2).

The chapter on the legislative framework is followed by a chapter each on the seven development nodes that were selected for this project (refer to Chapter 1.3). Within each of these nodes the following are provided:

- Local management institutions already addressing marine pollution matters
- Inventory of marine pollution sources
- Overview of important marine ecosystems and beneficial uses of the marine environment
- Inventory of available environmental literature and data related to marine pollution
- Existing long-term monitoring programmes related to marine pollution.

Each chapter concludes with an assessment of the suitability of the existing information and initiatives within a particular node, for application in the proposed management framework.

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ACRONYMS, SYMBOLS & ABBREVIATIONS

<i>DWAF</i>	Department of Water Affairs and Forestry
<i>DEAT</i>	Department of Environmental Affairs and Tourism
<i>NEMA</i>	National Environmental Management Act
<i>UNOPS</i>	United Nations Office for Project Services
<i>SADCO</i>	Southern African Data Centre for Oceanography
<i>GPA</i>	Global Programme of Action for the Protection of the Marine Environment for Land-based Activities
<i>UNEP</i>	United Nations Environmental Programme
<i>MEPC</i>	Marine Environment Protection Committee
<i>BCLME</i>	Benguela Current Large Marine Ecosystem

1 INTRODUCTION

1.1 Scope of Work

The United Nations Office for Project Services ("UNOPS) commissioned the CSIR (Stellenbosch) to conduct a baseline assessment of sources and management of land-based marine pollution in the BCLME Region. This commission included a desktop assessment (review) for each of the countries in the BCLME region (namely, South Africa, Namibia and Angola) of existing data and information related to the management of marine pollution, again focusing on land-based sources. The desktop assessment (or review) had to include the following:

- Listing of existing acts, regulations (e.g. effluent standards), policies and guidelines that are related to the management and control of marine pollution, identifying possible shortcomings and gaps. These instruments should be assessed on international, national, regional and local levels, where applicable
- Listing and short description of marine pollution sources, focusing on land-based sources. Where information is available on other important sources of marine pollution in a particular area, these should also be highlighted. Estimates on the volume of waste disposed from different sources should be provided (where information is available). An inventory on the type of data that are available on inflow and pollutant concentrations for the listed sources should also be provided, identifying gaps in information.
- Listing and short description of important beneficial uses of the coastal zone should be provided, as well as important marine ecosystems that are particularly sensitive to pollution (where possible these should be mapped). Beneficial use areas that will be identified are:
 - Tourism and recreation areas
 - Marine aquaculture and important fisheries (including collection of seafood for human consumption)
 - Industrial uses of seawater (e.g. for fish processing and cooling water intake)
- Inventory of the type of data and information that are available on physical (sediment and hydrodynamics), biogeochemical, and biological aspects, identifying possible shortcomings and gaps in information.
- Listing and short description of existing management initiatives and long-term monitoring programmes related to the management of marine pollution, focusing on land-based sources. An evaluation of their compatibility with the proposed framework for the management of land-based sources of marine pollution should also be provided.

This report contains the desktop assessment for South Africa.

1.2 Overview on Proposed Management Framework

Key components to be addressed as part of a marine water quality management programmes include (Figure 1.1):

- Identification of legislative framework
- Establishment of management institutions and responsibilities
- Determination of environmental quality objectives
- Specification of marine pollution sources
- Scientific/engineering assessment studies
- Specification of critical limits and mitigation
- Design and implementation of long-term monitoring programmes.

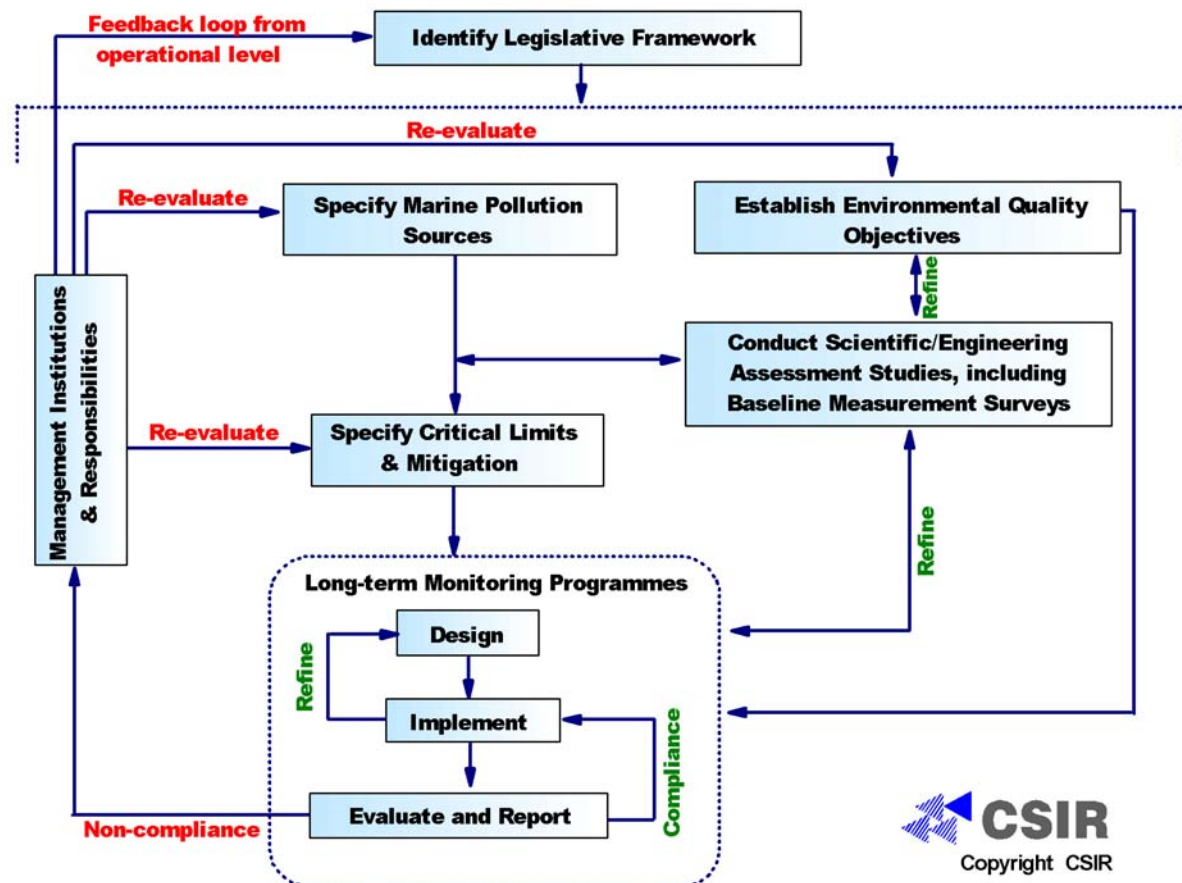


Figure 1.1: Proposed framework for the design and implementation of marine water quality management programmes in the BCLME region

1.3 Approach

To conduct the desktop review and assessment within the time and budgetary constraints of this project, effort was focused on the main development nodes in the BCLME region. It is envisaged that these will be the priority areas for which site-specific management programmes need to be developed. The proposed nodes to be addressed as part of this project for South Africa are (Figure 1.2):

- St Helena Bay
- Saldanha Bay/Langebaan Lagoon
- Cape Peninsula (western section)
- False Bay
- Walker Bay (Hermanus)
- Mossel Bay
- Knysna Estuary.



Figure 1.2: Proposed nodes of development in South Africa to be addressed as part of this project

The inventories of information, generated as part of the above-mentioned desktop assessment studies, have also been captured in the updatable, web-based information system (another deliverable on this project), accessible to users in the BCLME.

1.4 Structure of this Document

Legislation controlling marine pollution in South Africa is primarily promulgated from[or: initiated at] national level. As a result, the inventory and assessment of the legislative framework is generic, i.e. not per development node (Chapter 2).

The chapter on the legislative framework is followed by a chapter each on the seven development nodes that were selected for this project (refer to Chapter 1.3). Within each of these nodes the following are provided:

- Local management institutions already addressing marine pollution matters
- Inventory of marine pollution sources (these are categorised into the five main categories, namely land-based, atmospheric, dumping at sea, maritime transportation or offshore exploration, and production)
- Overview of important marine ecosystems and beneficial uses of the marine environment (beneficial uses are classified in terms of tourism and recreation, marine aquaculture and important fisheries (including collection of seafood for human consumption), and industrial uses)
- Inventory of available environmental literature and data related to marine pollution (within the time and budgetary constraints of this project the data inventory was limited to records captured in databases, e.g. SADC, or in published data reports)

In the case of the inventory of available literature, each entry is classified into one or more of the following disciplines, namely: 'physical', 'biogeochemical', 'biological' or 'management'

For the inventory of available data, the following types of data were targeted:

- Physical data (in particular data on the bathymetry, winds, waves, currents and geomorphology)
- Biogeochemical data (including chemical and microbiological data collected from sediments, the water column or from biological tissue)
- Biological data.

- Existing long-term monitoring programmes related to marine pollution, which are classified as either a source (i.e. monitoring of system performance and pollutant input related to a specific source) or environmental (i.e. monitoring of receiving marine environment) monitoring programmes.

Each chapter concludes with an assessment of the suitability of the existing information and initiatives, within a particular node, for application in the proposed management framework (as illustrated in Chapter 1.2).

2 SOUTH AFRICA: LEGISLATION FRAMEWORK

In South Africa, the legislative framework governing marine pollution is primarily initiated at national level.

Typically, human developments and activities potentially resulting in marine pollution can be subdivided into five broad categories, namely:

- Pollution or waste originating from land-based sources, including sewage effluent discharges, industrial effluent discharges, storm water run-off, agricultural and mining return flows, contaminated groundwater seepage
- Pollution or waste entering the marine environment through the atmosphere, e.g. originating from vehicle exhaust fumes and industries
- Dumping at sea, (e.g. dredge spoil and waste associated with marine aquaculture activities at sea)
- Maritime transportation (which includes accidental and purposive oil spills, and dumping of ship garbage, etc.)
- Offshore exploration and production (e.g. oil exploration platforms).

Within the scope of this project, the assessment primarily focuses on land-based marine pollution sources, although key legislation related to other categories of marine pollution is also highlighted.

2.1 Legislation related to Land-based Sources of Marine Pollution

To fulfill its legal obligation in terms of the management and control of land-derived wastewater under Section 21 of the *National Water Act 36 of 1998*, the national Department of Water Affairs and Forestry (DWAF) published the *Operational Policy for the Disposal of Land-derived Water containing Waste to the Marine Environment of South Africa* in 2004 (RSA DWAF, 2004a). This policy outlines the Department's new thinking in relation to disposal of land-derived wastewater to the marine environment, taking into account relevant international and national legislative obligations.

The aim of this operational policy is to provide practical *Principles* and *Ground Rules* as a framework within which land-derived wastewater disposal to the marine environment in South Africa should be assessed, managed and controlled. It also provides a *Management*

Framework within which to conduct such activities. This framework is similar to that proposed for the BCLME region as part of this project. The detailed operational policy for South Africa can be obtained from the Department of Water Affairs and Forestry (RSA DWAF, 2004a).

Key international strategies and conventions that were taken into account in the development of this operational policy included:

- Agenda 21. Agenda 21 is the internationally accepted strategy for sustainable development, decided upon at the United Nations Conference on Environment and Development held in Rio de Janeiro (1992) (www.un.org/esa/sustdev/agenda21text.htm). Agenda 21 is a plan for use by governments, local authorities and individuals to implement the principle of sustainable development contained in the Rio Declaration. This document has significant status as a consensus document adopted by about 180 countries.
- Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA). The GPA was adopted in November 1995 (www.gpa.unep.org/). The GPA is designed to assist states in taking action individually or jointly within their respective policies, priorities and resources that will lead to the prevention, reduction, control or elimination of the degradation of the marine environment, as well as to its recovery from the impacts of land-based activities. The GPA builds on the principles of Agenda 21. The GPA identifies the Regional Seas Programme of the United Nations Environmental Programme (UNEP) as an appropriate framework for delivery of the GPA at the regional level.
- 1996 Protocols to the London Convention 1972, as amended. South Africa is a signatory to the 1996 Protocols to the Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter 1972, as amended (London Convention) (www.londonconvention.org/London_Convention.htm). The Protocols define dumping, amongst others, as '*any deliberate disposal into the sea of waste or other matter from vessels, aircraft, platforms or other man-made structures at sea*'. In terms of the definition, the London Convention primarily deals with dumping of waste that occurs at sea, and does not explicitly list disposal of land-derived wastewater to coastal marine waters via a marine outfall or pipe as part of the definition of dumping. Nevertheless, towards achieving a unified and integrated approach to pollution control and waste management of South Africa's marine environment, it is important that the objectives and general obligations of these Protocols be considered.

Key national policies and legislation (South Africa) that were taken into account included:

- *White Paper: National Water Policy (April 1997)*. This policy lists 28 Fundamental Principles and Objectives that guide the process of revising the country's Water Law (www.polity.org.za/html/govdocs/white_papers/water.html).
- *White Paper on Environmental Management Policy (July 1997)*. The purpose of this White Paper is to inform the public of the government's objectives, how it intends to achieve its objectives on environmental management, and inform government agencies and state organs of their objectives and what they must do to achieve those objectives (www.polity.org.za/govdocs/white_papers/envir.html).
- *White Paper on Integrated Pollution and Waste Management for SA (March 2000)*. The White Paper outlines the government's new thinking in relation to pollution and waste management. This policy is a subsidiary policy of the overarching environmental management policy, as set out in the *White Paper on Environmental Management Policy for South Africa* (www.polity.org.za/html/govdocs/notices/2000/not0227a.html).
- *White Paper for Sustainable Coastal Development in South Africa (June 2000)*. This provides policy for the sustainable development of South Africa's coast (www.polity.org.za/html/govdocs/white_papers/coastal/index.html).
- *Constitution of the Republic of South Africa Act 108 of 1996*. The Constitution is relevant to pollution and waste management for two reasons. Firstly, the Bill of Rights (Chapter Two of the Constitution) contains a number of rights relevant to integrated pollution and waste management. To the extent that an act or particular statutory provision does not uphold these rights, it may be unconstitutional. Secondly, the Constitution provides the legal basis for allocating powers to different spheres of government, and is thus relevant to the institutional regulation of integrated pollution and waste management (www.polity.org.za/html/govdocs/constitution/saconst.html).
- *National Water Act 36 of 1998*. This act is currently the principle legislation for the management and control of land-derived wastewater disposal to the marine environment in South Africa. The act lists activities that are water uses, of which wastewater disposal is one and for which a licence needs to be obtained from the Department of Water Affairs and Forestry (www.polity.org.za/html/govdocs/legislation/1998/index.html).
- *Water Services Act 108 of 1997*. This act provides for the right of access to a basic water supply and the right to basic sanitation, both of which require sufficient water and an environment not harmful to human health and well-being (www.polity.org.za/html/govdocs/legislation/1997/act108.pdf).

- *National Environmental Management Act 107 of 1998 (NEMA)*. In essence, NEMA gives effect to the Section 24 right contained in the Constitution, to create an enabling framework for governance in the environmental sector and to give effect to the environmental principles in the White Paper on Environmental Management Policy (www.polity.org.za/html/govdocs/legislation/1998/index.html).
- *Environment Conservation Act 73 of 1989*. Although NEMA has repealed many of the provisions of the *Environment Conservation Act* the *Environmental Impact Assessment (EIA) regulations* remain in force until they are replaced by new regulations under the NEMA (DEAT, 1998) (www.elaw.org/resources/text.asp?ID=2339).
- *Marine Living Resources Act 18 of 1998*. Section 43 of this act gives the Minister of Environmental Affairs and Tourism the mandate to declare marine protected areas (www.polity.org.za/html/govdocs/legislation/1998/index.html).
- *Health Act 63 of 1977*. The *Health Act* deals with the control and management of waste mainly in respect of the protection of human health (www.iucnrosa.org.zw/elisa/Environmental%20Law/south_africa/health_act.html).
- *Minerals Act 50 of 1991*. This act contains the statutory requirements that enforce environmental protection and the management of impacts of mining, including coastal mining (www.lawsoc.co.za/members/legalresources/usefulleg/mineralsact.htm).
- *Hazardous Substances Act 15 of 1973*. The purpose of this act is 'to provide for the control of substances which may cause injury or ill health to or death of human beings by reason of their toxic, corrosive, irritant, strongly sensitising or flammable nature.... to provide for the prohibition and control of the importation, manufacture, sale, use, operation, application, modification, disposal or dumping of such substances and products...'. In this Act, human health, rather than environmental health, is the primary consideration (www.doh.gov.za/docs/legislation/acts/1973/act15.html).

2.2 Legislation Related to Other Sources of Marine Pollution

2.2.1 Atmospheric pollution

The Department of Environmental Affairs and Tourism (DEAT) has proposed a National Environmental Management: Air Quality Bill to introduce comprehensive air quality management for South Africa (www.info.gov.za/documents/bills/2003.htm). The bill would supersede the current *Atmospheric Pollution Prevention Act of 1965*, which focuses mainly on the control of industrial air emissions. The new legislation will address the protection of

the environment against air pollution as well as the cumulative impact of pollutants on the receiving environment. DEAT is faced with the challenge of trying to leap-frog from a 1960's control programme to a modern air quality management programme.

2.2.2 Dumping at sea

The *Dumping at Sea Control Act 73 of 1980* provides for the control of dumping of substances in the sea. This act gives legal effect in South Africa to an international convention, namely, the *London Convention for the Prevention of Marine Pollution by Dumping of Wastes and other Matter, 1972 (amended in 1978, 1980 and 1989)* (www.londonconvention.org/London_Convention.htm). 'Dump', in relation to any substance, means deliberately to dispose of at sea from any vessel, aircraft, platform or other man-made structure, by incinerating or depositing in the sea. It does not, however, include the disposal at sea of any substance incidental to, or derived from, normal operations of a vessel. Nor does it include legally depositing at sea any substance for a purpose other than its mere disposal.

In November 1996, the contracting parties to the London Convention of 1972 adopted the 1996 Protocol to the London Convention. South Africa was also a signatory to the 1996 Protocol that will eventually replace the current Convention. South Africa acceded to the 1996 Protocol in December 1998. The South African *Dumping at Sea Control Act* is currently being amended to bring it in line with the 1996 Protocol to the London Convention. The revised legislation may, however, take the form of a sub-chapter in NEMA, which is currently undergoing a substantial reform.

Schedule 1 of the act refers to "Prohibited Substances", which include organohalogenes, mercury, persistent plastics and high-level radioactive waste. Schedule 2 refers to "Restricted Substances" and includes arsenic, lead, cyanides, fluorides, scrap metal and ammunition. A general permit may be issued to authorize the dumping of any substance not mentioned in Schedules 1 and 2. The DEAT has also drafted a document on suggested levels of ANNEX I and ANNEX II substances under the London Convention, particularly aimed at dredge spoil dumping at sea (DEAT, unpublished document).

Marine aquaculture activities in South Africa, including the management of pollution from such activities, are governed by the Department of Environmental Affairs and Tourism under the *Marine Living Resources Act 18 of 1998* (www.info.gov.za/documents/acts/1998.htm).

2.2.3 Maritime transportation

In South Africa, the *International Convention for Prevention of Pollution from Ships Act 2 of 1986* gives legal effect to the *International Convention for the Prevention of Pollution from Ships 1973/78 (MARPOL)* in South Africa, as well as *Annex I (regulations on oil)* and *Annex II (regulations on noxious liquid substances in bulk)* of the Convention. This act is administered by the Department of Transport.

With regard to the disposal of garbage from ships, *Annex V of the International Convention for the Prevention of Pollution from Ships 1973/78 (MARPOL)*: 'Regulations for the Prevention of Pollution by Garbage from Ships', applies. Annex V prohibits any form of disposal of garbage, which it defines as 'All kinds of victual, domestic and operational waste, excluding fresh fish and parts thereof, generated during a normal operation of the ship and liable to be disposed of continuously or periodically except those substances which are defined or listed in other annexes to this present Convention'. South Africa is in the process of drawing up the necessary regulations to implement Annex V (CSIR, 1991a).

In 1991, the Marine Environment Protection Committee (MEPC) of the International Maritime Organisation adopted recommendations on International Guidelines for Preventing the Introduction of Unwanted Aquatic Organisms and Pathogens from Ship's Ballast Water and Sediment Discharges, as resolution MEPC 50(31). It is the intention that these guidelines form the basis for a new technical annex to the MARPOL Convention. The above guidelines acknowledge that '... port states and administrations have a responsibility to ensure that ballast water, loaded in their ports and harbours, does not contain plants, animals or pathogens that pose a threat to the waters of other states' (RSA DWAF, 1995).

At present, the authorities rely on the older act, i.e. *Prevention and Combating of Pollution of the Sea by Oil Act 6 of 1981*. This act provides for the protection of the marine environment from pollution by oil and other harmful substances, the prevention and combating of such pollution, and the determination of liability in certain respects for loss or damage caused by the discharge of oil from ships, tankers and offshore installations. This act gives the Minister of Transport wide-ranging powers regarding the prevention of oil pollution. However, any power, duty or function regarding the combating of pollution of the sea by oil has been assigned to the Minister of Environmental Affairs and Tourism with effect from 20 May 1986. The implication of this is that the DEAT is responsible for protection and clean-up measures

to be taken once oil has been released to sea (whereas oil within the confines of a ship is the responsibility of the Department of Transport).

In order to structure actions to be taken during the event of an oil spill, various plans have been compiled by the DEAT and Department of Transport, i.e.:

- Master Plan sets out the policies of the DEAT and the Department of Transport in respect of their responsibilities in preventing and combating oil pollution at sea.
- Plan of Control of Shipping Casualties sets out requirements of the Department of Transport with respect to any contemplated salvage.
- Plans for Combating Oil Spilled at Sea detail the response actions to be taken at sea by the DEAT and interrelates them to those to be taken in terms of the local coastal plans
- Plans for independent Installations detail the response actions to be taken in the event of an oil spill at or near a specific installation, e.g. offshore oil tanker discharge facilities, oil exploration sites, ports, harbours and yacht basins.
- Local Coastal Plans detail the actions to be taken when there is a threat of oil impacting the shoreline or when an impact has occurred. Local authorities in the different coastal zones play an important role in the execution of such plans and their tasks are detailed in the documents.

Legislation aimed at providing compensation if and when an oil spill has occurred is also adopted in the *Prevention and Combating of Pollution of the Sea by Oil Act 6 of 1981*. The chief international convention given effect in this legislation is the *Civil Liability Convention of 1969* (CSIR, 1991a).

Other acts that are aimed at preventing oil pollution at sea and that are administered by the Department of Transport include (CSIR, 1991a):

- The *International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Act 64 of 1987* which gives effect in South Africa to the *International Convention relating to Intervention on the High Seas in Cases of Oil Pollution, 1969 (The Intervention Convention)*.
- *Merchant Shipping Act 57 of 1951*
- *Marine Traffic Act 2 of 1986*.

Pollution in harbours is mainly regulated by the legal regime governing land-based sources of pollution as discussed earlier, as well as by legislation applying to a specific type of harbour, i.e. whether it is a commercial harbour, a fishing harbour or a naval harbour (Glazewski, 2000). Commercial harbours fall under the *Legal Succession to the South African Transport Services Act 9 of 1989* that repealed the *South African Transport Services Act 65 of 1981*. However, important regulations passed under this Act, e.g. the 'Harbour Regulations' (GN 5621, 26 March 1982) are specifically preserved by the 1989 Succession Act (Glazewski, 2000).

Legislation applying to harbour areas in general includes the *International Health Regulations Act 28 of 1974*, which requires that every seaport must be provided with a system for the removal and disposal of excrement, refuse, waste water, condemned food and other matter dangerous to health (Walmsley, *et al.*, 1999).

Fishing Harbours are jointly managed by the Department of Public Works and DEAT through the mandate provided in terms of the *State Land Disposal Act 48 of 1961* and the *Marine Living Resources Act 18 of 1998*, respectively. These harbours include: Lamberts Bay, Hermanus, St Helena Bay, Gansbaai, Saldanha Bay, Struisbaai, Laaiplek, Waenhuiskrans, Hout Bay, Still Bay, Kalk Bay, and Gordon's Bay. It was realized that better coordination between these two departments concerning the day-to-day affairs relating to fishing harbours could lead to improved service delivery through sharing of expertise, skills and resources. To address this situation, a joint Steering Committee for Fishing Harbours Management was appointed in 2001 *inter alia* to oversee the establishment of a single point of coordination for all harbour related activities and to improve the services provided by the State in Proclaimed Fishing Harbours. In order to promote the principle of a "one-stop shop" for fishing harbour services, it was decided that in future the Department of Public Works should serve as the primary role player in this field, with DEAT taking on a supportive role (www.wildlifepics.co.za/news/080501.html).

2.2.4 Offshore exploration and production

The control and management of offshore exploration and production along the South African coastline is under the jurisdiction of the Department of Minerals and Energy. Such activities are governed under the *Mineral and Petroleum Resource Development Act 28 of 2002*. (www.acts.co.za/mprd_act/index.htm). Regulations have also been promulgated under section 107(1) of this act (www.info.gov.za/regulations/2004/26275/).

2.3 Assessment of Current Situation in Legislation

Although the legislation related to marine pollution is quite extensive for South Africa, it is still sectoral (i.e. 'pollution category focused') as illustrated below:

SUB-CATEGORY	KEY AUTHORITY RESPONSIBLE
Land-based Sources	Department of Water Affairs and Forestry
Atmospheric Pollution	Department of Environmental Affairs & Tourism
Dumping at sea	Department of Environmental Affairs & Tourism
Maritime Transportation	Department of Environmental Affairs & Tourism (prevention)
	Department of Transport (clean-up)
Offshore Exploration & Production	Department of Minerals and Energy

Legislation is also fragmented, i.e. numerous acts need to be taken into account to establish legislative requirements related to specific activities or developments potentially causing marine pollution. This situation often hampers proper integrative management and control of marine pollution.

The development of the *Operational Policy for the Disposal of Land-derived Water Containing Waste to the Marine Environment of South Africa* (RSA DWAF, 2004) largely improved matters with regard to the management and control of land-based marine pollution in that it consolidated different legislative requirements into easily understandable and clear ground rules and implementation procedures. It is recommended that similar operational policies be developed for the other categories of marine pollution, e.g. dumping at sea and maritime transportation.

However, although activity (or category) specific operational policies are important building block for effective management of marine pollution, it is essential that these building blocks be interlinked in an overarching operational policy for the management and control of marine pollution in South Africa. Under the present fragmented legislative framework of South Africa this can only be achieved through effective cooperative governance.

3 ST HELENA BAY

3.1 Existing Management Initiatives

NAME	PURPOSE	RESPONSIBLE INSTITUTION/AUTHORITY	PARTIES INVOLVED	PERIOD OPERATIONAL
St Helena Bay Water Quality Forum Trust	Voluntary organization comprising officials from local, and regional authorities, representative of all major industries in the area and other groups who have a common interest in maintaining acceptable water quality in St Helena Bay	No single authority - chairperson selected from parties involved	Municipality of Saldanha Bay Dept. of Water Affairs and Forestry Fishing Industries Members of Public	Constituted in 2001

3.2 Marine Pollution Sources

A map indicating the location of major potential marine pollution sources in St Helena Bay is provided in Figure 3.1. More details on these sources are provided below:

SOURCE	TYPE	DESCRIPTION	ESTIMATED VOLUME	POLLUTANT COMPOSITION	OWNER/MANAGER
Langville WWTW	Land-based	Municipal wastewater discharged to the surf zone at Langville	420 m ³ /day*	Bacteriological contaminants Suspended solids Inorganic nitrogen & phosphate Organic carbon & nitrogen	Saldanha Bay Municipality
Storm water run-off: Residential areas	Land-based	Storm water run-off enters the Bay and Berg River Estuary from residential developments such as Velddrif/Laaiplek and Port Owen	No data	Suspended solids Bacteriological contaminants Organic matter Trace metals Petroleum hydrocarbons Litter	Saldanha Bay Municipality
Storm water run-off: Industrial areas	Land-based	Storm water run-off also enters the St Helena Bay areas from industrial premises (mainly fish processing plants) and from the harbour areas	No data	Suspended solids Bacteriological contaminants Organic matter Trace metals Petroleum hydrocarbons Litter	Saldanha Bay Municipality
Sandy Point Fishing	Land-based	Effluent from a fish processing plant discharged to the surf zone	No data	Inorganic Nitrogen Bacteriological contaminants Organic Carbon and Nitrogen Suspended solids	Sandy Point Fishing
Suid Oranje Visserij	Land-based	Effluent from a pelagic fish processing plant discharged to the surf zone	3600 m ³ /day *	Inorganic Nitrogen Bacteriological contaminants Organic Carbon and Nitrogen	Suid Oranje Visserij

SOURCE	TYPE	DESCRIPTION	ESTIMATED VOLUME	POLLUTANT COMPOSITION	OWNER/MANAGER
				Suspended solids	
Drommedaris Fisheries	Land-based	Effluent from a fish processing plant discharged to the surf zone	560 m ³ /day *	Inorganic Nitrogen Bacteriological contaminants Organic Carbon and Nitrogen Suspended solids	Drommedaris Fisheries
West Point Fishing	Land-based	Effluent from a pelagic fish processing plant discharged to the surf zone	55 m ³ /day *	Inorganic Nitrogen Bacteriological contaminants Organic Carbon and Nitrogen Suspended solids	West Point Fishing
St Helena Bay Fishing	Land-based	Effluent from a pelagic fish processing plant discharged to the surf zone	18 000 m ³ /day*	Inorganic Nitrogen Bacteriological contaminants Organic Carbon and Nitrogen Suspended solids	St Helena Bay Fishing (Oceana Group)
Marine Products, Laaiplek	Land-based	Effluent from a pelagic fish processing plant discharging into the Berg River Estuary near the mouth	130 000 m ³ /day*	Inorganic Nitrogen Bacteriological contaminants Organic Carbon and Nitrogen Suspended solids	Marine Products
Hannasbaai/Jaloersbaai Fishing	Land-based	Effluent from a pelagic fish processing plant discharged to the surf zone	No data	Inorganic Nitrogen Bacteriological contaminants Organic Carbon and Nitrogen Suspended solids	Hannasbaai/Jaloersbaai Fishing
Berg River	Land-based	Large river catchment draining agricultural areas and urban developments.		Inorganic nutrients (N & P) Organic matter (C & N) Suspended solids Pesticides?	Dept. of Water Affairs and Forestry
Abalone farm (Britannia Bay)	Land-based	Effluent from an abalone hatchery discharged to the surf zone	No data	Organic matter (C & N)	
Oyster farm (Stompneusbaai)	Land-based	Effluent from a oyster farming operation discharged to the surf zone	No data	Organic matter (C & N)	
St Helena Bay Fishing Harbour (Sandy Point)	Maritime transportation	Activities causing marine pollution include cleaning of vessels, accidental oil spillages, dumping of blood water and other fish offal and littering	Not easily quantifiable	Suspended solids Organic matter (fish waste) Petroleum hydrocarbons Litter/Garbage	Dept. of Public Works/Dept. of Environmental Affairs and Tourism
Port Owen Yacht Harbour	Maritime transportation	Activities causing marine pollution include cleaning of vessels and accidental oil spillages	Not easily quantifiable	Petroleum hydrocarbons	Port Owen Yacht Club
Laaiplek Fishing Harbour	Maritime Transportation	Activities causing marine pollution include cleaning of vessels, accidental oil spillages, dumping of blood water and other fish offal and littering	Not easily quantifiable	Suspended solids Organic matter (fish waste) Petroleum hydrocarbons Litter/Garbage	Dept. of Public Works/Dept. of Environmental Affairs and Tourism

* Source: RSA DWAF, 2004c

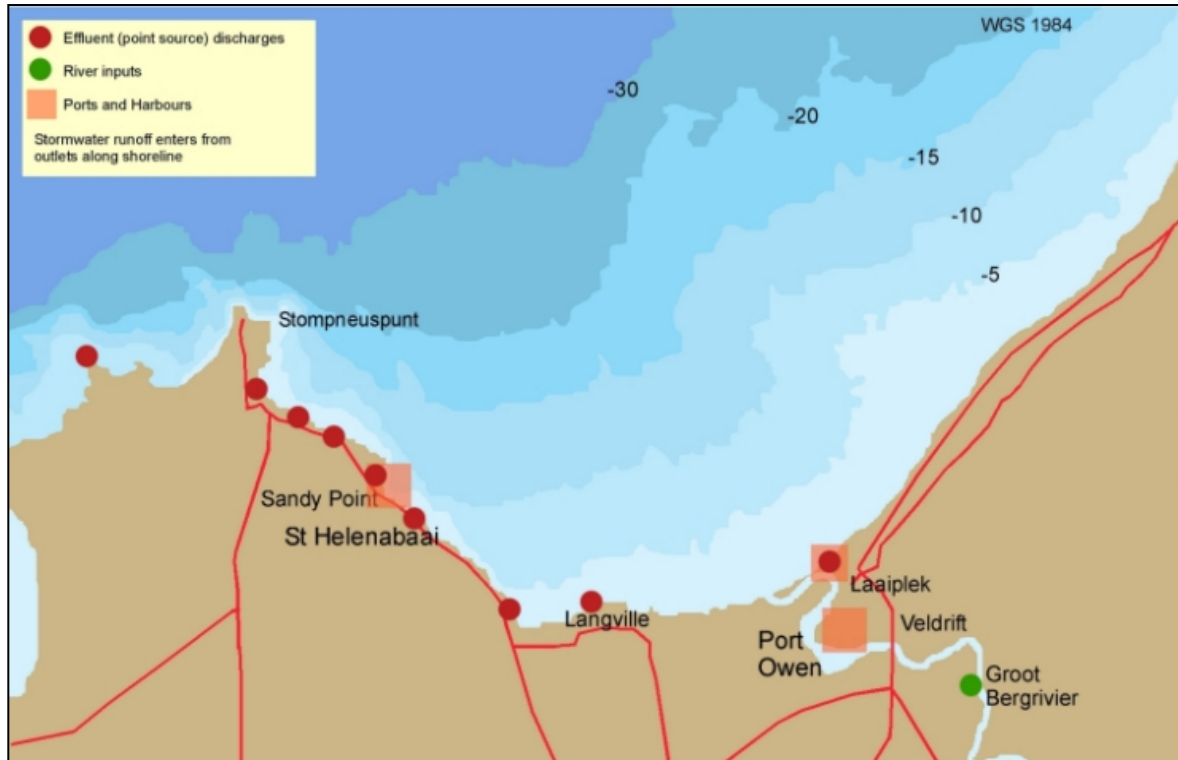


Figure 3.1: Potential marine pollution sources in St Helena Bay

3.3 Important Marine Ecosystems and Beneficial Uses

3.3.1 Important Marine Ecosystems

The Great Berg River Estuary, one of South Africa's largest and most important estuaries, enters the sea in St Helena Bay. As one of only a few estuaries along the west coast of South Africa, it is of particular important to fisheries and birds (Figure 3.2)

The following areas along the St Helena Bay coast have also been declared closed areas (rock lobster reserves) under the Marine Living Resources Act 18 of 1998:

- From Stompneus Point to beacons SHBE/DR on the remaining extent of Wilde Varkens Valley A (south of Doctor's Reef), extending six nautical miles seawards from the high-water mark. No rock lobster may be caught
- From Shell Bay Point to Stompneus Point, extending three nautical miles seawards from the high-water mark. No rock lobster may be caught.

3.3.2 Beneficial uses

i. Recreation (including tourism)

St Helena Bay and surrounds are increasingly being promoted and utilised as a tourist and holiday destination. Popular tourist and recreation areas within the Bay include:

- Dwarskersbos
- Berg River Estuary
- Langville
- Hannasbaai
- Shelley Point
- Britannia Bay (Golden Mile).

The Port Owen yacht harbour, situated inside the Berg River Estuary, is also considered as probably the best spot on the South African coast to spend the winter months, as well as an ideal departure port from South Africa.

ii. Marine Aquaculture and Important Fisheries (including collection of seafood for human consumption)

St Helena Bay is a popular and important fishing area along the South African west coast and supports commercial, subsistence and recreational fisheries. These activities occur throughout the Bay and in the Berg River Estuary. The area is particularly famous for its 'bokkoms' (a delicacy made from dried mullet). West coast rock lobster is also collected outside the closed areas.

Two marine aquaculture concerns, namely, an abalone hatchery (near Britannia Bay) and an oyster farm (near Stompneusbaai), are situated in St Helena Bay (Figure 3.2). These land-based operations take in seawater from the Bay adjacent to the farms.

iii. Industrial uses

Numerous fish processing factories take in seawater from the Bay for their operations, which are situated on land. These include Sandy Point Fishing, Suid Oranje Vissery, Drommedaris Fisheries, West Point Fishing, St Helena Bay Fishing, Hannasbaai/Jaloersbaai Fishing and Marine Products (Laaipelek).

Cerebos Salt Works, situated on the banks of the Berg River Estuary near Velddrif, also take in seawater for salt production.

Although numerous activities in the two fishing harbours at Sandy Point and Laaiplek could detrimentally affect marine water and sediment quality (as discussed earlier), they are also beneficial uses requiring a certain level of quality, e.g. waters should be free from objectionable matter that could result in mechanical interferences and damage to vessels.



Figure 3.2: Important marine ecosystems and beneficial uses of St Helena Bay

3.4 Available Environmental Literature

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION*	LOCATION OF DOCUMENT
2003	Simulated carbon and nitrogen flows of the planktonic food web during an upwelling relaxation period in St Helena Bay (Southern Benguela Ecosystem)	Touratier, F.; Field, J.G.; Moloney, C.L.	Progress in Oceanography, 58(1): 1-41	Biogeochemical Biological	Journal publication
2003	Sand transport along the Western Cape coast: gone with the wind?	Franceschini, G.; Compton, J. S.; Wigley, R. A.	South African Journal of Science, 99 (7/8): 317-318	Physical	Journal publication
2002	A summer feeding ground for right whales on the west coast of South Africa.	Best, P.B.; Mate, B.; Barendse, J.; Elwen, S.; Thornton, M.; Verheye, H.	Southern African Marine Science Symposium (SAMSS 2002): Currents Coasts Communities, Swakopmund (Namibia), 1-5 Jul 2002	Biological	Journal publication
2002	South African west coast: Ravaged by predatory hordes.	Hutchings, L.; Duncombe-Rae, C.; Mitchell-Innes, B.; Bailey, G.; Verheye, H.; Tanci, T.	Southern African Marine Science Symposium (SAMSS 2002): Currents Coasts Communities, Swakopmund (Namibia), 1-5 Jul 2002	Biological	Journal publication
2001	Open-water cultivation of Gracilaria in South Africa: Saldanha Bay or St. Helena Bay?	Anderson, R. J.; Boothroyd, C. J. T.; Kemp, F. A.; Rothman, M. D.	Proceedings of the 17th International Seaweed Symposium, Cape Town, South Africa, 28 January-2 February	Biological	Marine and Coastal Management, Cape Town
2001	Brown tides and mariculture in Saldanha Bay, South Africa	Probyn, T.; Pitcher, G.; Pienaar, R.; Nuzzi, R.	Marine Pollution Bulletin, 42 (5): 405-408	Biological	Marine and Coastal Management, Cape Town
2000	Interannual variation in the composition of the assemblages of medusae and ctenophores in St Helena Bay, Southern Benguela Ecosystem.	Buecher, E.; Gibbons, M.J.	Scientia Marina, 64 (Supplement 1), 123-134	Biological	Journal publication
2000	Simulation of a coastal jet retention process using a barotropic model.	Penven, P.; Roy, C.; Colin de Verdiere, A.; Largier, J.; Verdiere, A.C.D.E.	Oceanologica Acta, 23(5): 615-634	Physical	Journal publication
2000	Theme: Management and institutional affairs. The integration of water management tools to equip water institutions for their future role.	McConkey, G.E.; Ferguson, L.L.; Botes, W.A.M.; Maree, P.	WISA 2000 Biennial Conference and Exhibition, 28 May to 1 Jun 2000 : Sun City, South Africa	Management	Journal publication
2000	Dissolved Iodate and Total Iodine during an extreme hypoxic event in the Southern Benguela System.	Truesdale, V.W.; Bailey, G.W.	Estuarine, Coastal and Shelf Science, 50(6): 751-760	Biogeochemical	Journal publication
2000	Harmful algal blooms of the southern Benguela Current: A review and appraisal of monitoring from 1989 to 1997.	Pitcher, G.C.; Calder, D.	South African Journal of Marine Science, 22: 255-271	Biological	Journal publication
2000	The experimental cultivation of the South African kelp <i>Macrocystis angustifolia</i> (abstract only)	Harper, M.N.; Keats, D.W.; Anderson, R.J.	Journal of Shellfish Research, 19(1): 518	Biological	Journal publication
2000	Reserves for rock lobsters: Are they just a bureaucratic blunder?	Mayfield, S.; Atkinson, L. J.; Branch, G. M.	Southern African Marine Science Symposium: Land, Sea and People in the New Millennium, Wilderness, South Africa	Biological	University of Cape Town
2000	Simulation and quantification of an upwelling induced retention process using a barotropic model.	Roy, C.; Penven, P.; Verdiere, A. C. de; Largier, J.	Southern African Marine Science Symposium: Land, Sea and People in the New Millennium, Wilderness, South Africa	Physical	University of Cape Town
1999	Biological monitoring of the effects of fish-factory effluents: The Suid Oranje factory, St Helena Bay – 1997 (Confidential)	Bickerton IB; Brown AC; Smith CE	CSIR report ENV-S-C 98039	Biological	CSIR, Stellenbosch
1999	Changes in the composition of the non-copepod zooplankton assemblage in St Helena Bay (Southern Benguela Ecosystem) during a six day drogoue	Gibbons, M.J.; Gugushe, N.; Boyd, A.J.; Shannon,	Marine Ecology - Progress Series, 180: 111-120	Biological	Journal Publication

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION*	LOCATION OF DOCUMENT
	study.	L.J.; Mitchell-Innes, B.A.			
1999	Assessment of a potential thermal discharge in a coastal embayment using a three dimensional hydrodynamic model	Van Ballegooyen, R.C.; Luger, S.A.	In: Fifth International Conference on Coastal and Port Engineering in Developing Countries: Proceedings of the COPEDEC V, Cape Town, April 1999	Physical	CSIR, Stellenbosch
1998	Water quality modelling of estuaries	Slinger, J. H.; Taljaard, S.; Rossouw, M.; Huizinga, P.	Water Research Commission (WRC) Report No. 664/1/98	Physical Biogeochemical	Water Research Commission, Pretoria
1998	Computational modelling in coastal engineering and environmental assessments.	Mocke, G.; Smith, G.G.; Smit, F.; Luger, S.A.	South African Institution of Civil Engineers. Journal, 40(3): 21-29	Physical	CSIR, Stellenbosch
1997	A preliminary survey of coastal river systems on the South African west coast, Orange River - Groot Berg, with particular reference to the fish fauna	Harrison, T.D.	Transactions of the Royal Society of South Africa, 52(2): 277-321	Biological	Journal Publication
1997	Biological monitoring of the effects of fish-factory effluents: The St Helena Bay Fishing Industries factory, St Helena Bay - 1997 (Confidential)	Bickerton, I.B.; Brown, A.C.; Smith, C.E.	CSIR report ENV-S-C 98040	Biological	CSIR, Stellenbosch
1997	Biological monitoring of the effects of fish-factory effluents: The West Point Processing Plant, St Helena Bay (Confidential)	Bickerton, I.B.	CSIR report ENV/S-C 97039	Biological	CSIR, Stellenbosch
1997	Variation in surf-zone fish community structure across a wave-exposure gradient	Clark, B.M.	Estuarine, Coastal and Shelf Science, . 44(6): 659-674	Biological	Zoology Department, University of Cape Town
1996	Water quality modelling of estuaries. Field data collection for calibrating the Mike 11 water quality module on the Great Berg Estuary	Slinger, J. H.; Taljaard, S.; Visser, E.	CSIR data report EMAS-D 96004	Biogeochemical	CSIR, Stellenbosch
1996	Worst recorded marine mortality on the South African coast.	Matthews, S. G.; Pitcher, G. C.	International Conference on Marine Toxic Phytoplankton, Sendai (Japan), 12-16 Jul 1995	Biological	Marine and Coastal Management, Cape Town
1996	Long-term trends in the abundance and community structure of coastal zooplankton in the Southern Benguela System, 1951-1996.	Verheye, H.M.; Richardson, A.J.; Hutchings, L.; Marska, G.; Gianakouras, D.	South African Journal of Marine Science, 19: 317-332	Biological	Journal Publication
1996	Population growth, economic development and carrying capacity of the environment - are they compatible or in conflict?	Heydorn, A.E.F.	Suid Afrikaanse Tydskrif vir Natuurwetenskap en Tegnologie, 15(1): 39-43	Management	University of Pretoria
1995	Summer incidence of humpback whales on the west coast of South Africa.	Findlay, K.P.; Best, P.B.	South African Journal of Marine Science, 15: 279-282	Biological	Journal Publication
1995	Tide of death: Marine life in St. Helena Bay devastated by a naturally occurring event.	Matthews, S.	African Wildlife, 49(2): 14-20	Biological	Journal Publication
1994	Kusbestuursriglyne - Shellbaaipunt (St Helenabaai) [Coastal management guidelines - Shell Bay Point (St Helena Bay)] (Confidential)	Heinecken, T.J.E.	CSIR report EMAS-C 94062	Management	CSIR, Stellenbosch
1994	The fish community of the Berg River Estuary and an assessment of the likely effects of reduced freshwater inflows	Bennett, B. A.	South African Journal of Zoology, 29 (2): 118-125	Biological	Journal Publication
1994	Mussel rafts, what mysteries?	Heasman, K.G.; Hecht, T.	Third Congress of the Aquaculture Association of Southern Africa, 21 to 23 Sep 1994 : Berg-en-Dal, Kruger National Park, South Africa.	Biological	Water Research Commission, Pretoria
1994	Distribution of shorebirds at the Berg River Estuary, South Africa, in relation to foraging mode, food supply and environmental features.	Kalejta, B.; Hockey, P. A. R.	The Ibis, 136(2): 233-239	Biological	Journal Publication
1994	Mariculture and the environment. The Saldanha Bay system programme.	Monteiro, P.M.S.	Aquaculture Association of South Africa newsletter, (26)[pages?]	Biological	Water Research Commission, Pretoria
1994	Shell weakening in marine mytilids attributable to blue-green alga Mastigocoleus Sp. (Nostochopsidaceae)	Webb, S.C.; Korrubel, J.L.	Journal of Shellfish Research, 13(1): 11-17	Biological	CSIR, Stellenbosch
1994	Microplankton ETS measurements as a means of assessing respiration in the Benguela ecosystem.	Chapman, P.; Mitchell-Innes, B.A.; Walker, D.R.	South African Journal of Marine Science, 14: 297-312	Biological	Journal Publication

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION*	LOCATION OF DOCUMENT
1994	Preliminary investigation of seasonality in the Great Berg Estuary.	Slinger, J.H.; Taljaard, S.	Water S A, 20(4): 279-288	Physical Biogeochemical	Journal Publication
1994	Western Cape system analysis. Water requirements for the maintenance of the Berg River Estuary. Volume I: Report on work session. Final report.	Granger, S.	Technical report, Dept of Water Affairs (Pretoria) WPAM7508 WA006	Management	Dept. of Water Affairs and Forestry, Pretoria
1994	Western Cape system analysis. Water requirements for the maintenance of the Berg River Estuary. Volume II: Compilation of papers by consultants. Final report.	Granger, S.	Technical report, Dept of Water Affairs (Pretoria) WPAM7507 WA006	Management	Dept. of Water Affairs and Forestry, Pretoria
1993	Preliminary growth trials with <i>Gracilaria verrucosa</i> in tank culture at St Helena Bay	Probyn, T.A. (Comp.)	CSIR report EMAS-I 93006	Biological	CSIR, Stellenbosch
1993	Effects of dredging on the Berg River Estuary.	Van Wyk, A.C.	MSc thesis - University of Cape Town	Physical	University of Cape Town
1993	Factors affecting relative rates of growth in four South African mussel species.	Van Erkom Schurink, C.; Griffiths, C.L.	Aquaculture, 109(3-4): 257-273	Biological	CSIR, Stellenbosch
1992	Assessment of hydrodynamic and water quality aspects of the Berg River Estuary – 1989/990	Taljaard, S.; Slinger, J. H.; Skibbe, E.; Fricke, A. H.; Kloppers, W.S.; Huizinga, P.	CSIR data report EMAS-D 92006	Physical Biogeochemical	CSIR, Stellenbosch
1992	Managing artificial salt pans as a waterbird habitat: Species' responses to water level manipulation.	Velasquez, C.R.	Colonial Waterbirds, 15(1): 43-55	Biological	Journal Publication
1992	The Berg River Estuary	Hockey, P.A.R.; Velasquez, C.R.	Birding in Southern Africa, 44(4): 108-114	Biological	Journal Publication
1992	Sea surface heat exchange at St. Helena Bay and implications for the southern Benguela upwelling system.	Guastella, L.-A.M.	South African Journal of Marine Science, 12: 61-70;	Physical	Oceanographic Research Institute, Durban
1991	Evaluation of the discharge of selected fish factory effluents and the impact on the adjacent marine environment (Confidential)	Taljaard, S.; Skibbe, E.; Fijen, A.P.M.	CSIR report EMA-C 91171	Biogeochemical Biological	CSIR, Stellenbosch
1991	Short-term variability during an anchor station study in the Southern Benguela Upwelling System: Introduction.	Chapman, P.; Bailey, G.W.	Progress in Oceanography, [Special issue: Benguela Current anchor stations study], 28(1-2): 1-7	Physical Biogeochemical	Marine and Coastal Management, Cape Town
1991	Seasonal abundance, habitat selection and energy consumption of waterbirds at the Berg River Estuary, South Africa	Velasquez, C.R.; Kalejta, B.; Hockey, P.A.R.	Ostrich, 62(3): 109-123	Biological	Journal Publication
1991	Distribution, Abundance and Productivity of Benthic Invertebrates at the Berg River Estuary, South Africa.	Kalejta, B.; Hockey, P. A. R.	Estuarine, coastal and shelf science, 33 (2): 175-192	Biological	Journal Publication
1991	Short-term variability during an anchor station study in the Southern Benguela Upwelling System: Chemical and physical oceanography.	Chapman, P.; Bailey, G.W.	Progress in Oceanography, [Special issue: Benguela Current anchor station study], 28(1-2): 9-37	Physical Biogeochemical	Marine and Coastal Management, Cape Town
1991	Short-term variability during an anchor station study in the Southern Benguela Upwelling System: Nitrogen supply to the euphotic zone during a quiescent phase in the upwelling cycle.	Waldron, H.N.; Probyn, T.A.	Progress in Oceanography, [Special issue: Benguela Current anchor station study], 28(1-2): 153-166	Physical Biogeochemical	Marine and Coastal Management, Cape Town
1991	Short-term variability during an anchor station study in the Southern Benguela Upwelling System: A simulation model.	Cochrane, K.L.; James, A.G.; Mitchell-Innes, B.A.; Pitcher, G.C.; Verheye, H.M.; Walker, D.R.	Progress in Oceanography, [Special issue: Benguela Current anchor station study], 28(1-2): 121-152	Physical Biogeochemical Biological	Marine and Coastal Management, Cape Town
1991	Diel migration and feeding patterns of the chaetognath, <i>Sagitta friderici</i> , off the west coast of South Africa.	Stuart, V.; Verheye, H.M.	Journal of Marine Research, 49(3): 493-515	Biological	Journal Publication
1990	The Berg River Estuary : An important wetland for Caspian terns, <i>Sterna caspia</i> , in South Africa	Velasquez, C.R.; Kalejta, B.; Turner, E.	Marine ornithology, 18(1): 65-68	Biological	Journal Publication
1987	Passive transportation of pelagic system components in the southern Benguela area.	Nelson, G.; Hutchings, L.	South African Journal of Marine Science, 5: 223-234	Physical Biological	Marine and Coastal Management, Cape Town
1987	Field and analytical drogue studies applicable to the St Helena Bay area off South Africa's west coast.	Lamberth, R.; Nelson, G.	South African Journal of Marine Science, 5: 163-169	Physical	Marine and Coastal Management, Cape Town

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION*	LOCATION OF DOCUMENT
1987	Observations of low-frequency currents and continental shelf waves along the west coast of South Africa.	Holden, C.J.	South African Journal of Marine Science, 5: 197-208	Physical	Marine and Coastal Management, Cape Town
1987	The role of regeneration from the sediments in the supply of nutrients to the euphotic zone in the Southern Benguela System.	Bailey, G.W.	South African Journal of Marine Science, 5: 273-285	Biogeochemical	Journal Publication
1985	Coastal currents in the St. Helena Bay region.	Holden, C.J.	International Symposium on the Most Important Upwelling Areas off Western Africa, Barcelona (Spain), Volume 1: 201-204	Physical	Marine and Coastal Management, Cape Town
1985	South African ocean colour and upwelling experiment.	Shannon, L.V.	In: South African ocean colour and upwelling experiment; Shannon, L.V. (ed.) (ISBN: 0-621-07386-5)	Physical	Marine and Coastal Management, Cape Town
1985	Satellite observations of marine pollution and rip currents.	Shannon, L.V.; Walters, N.M.; Moldan, A.G.S.	In: South African ocean colour and upwelling experiment; Shannon, L.V. (ed.), pp. 239-250 (ISBN: 0-621-07386-5)	Physical Biogeochemical	Marine and Coastal Management, Cape Town
1985	Chapter 17. Satellite observations of marine pollution and rip currents.[Duplicate of above? See page numbers & ISBN.]	Shannon, V.L.; Walters, N.M.; Moldan, A.G.	In: South African ocean colour and upwelling experiment; Shannon, L.V. (ed.) (ISBN: 0-621-07386-5) pp. 239-250	Physical Biogeochemical	Marine and Coastal Management, Cape Town
1985	The nutrient status of the St Helena Bay region in February 1979.	Bailey, G.W.; Chapman, P.	In: South African ocean colour and upwelling experiment; Shannon, L.V. (ed.), pp. 125-146 (ISBN: 0-621-07386-5)	Biogeochemical	Marine and Coastal Management, Cape Town
1985	Currents in St Helena Bay inferred from radio-tracked drifters.	Holden, C.J.	In: South African ocean colour and upwelling experiment; Shannon, L.V. (ed.), pp. 97-109 (ISBN: 0-621-07386-5)	Physical	Marine and Coastal Management, Cape Town
1985	Mesoscale variations in summer winds over the Cape Columbine – St Helena Bay region, South Africa.	Jury, M.R.	South African Journal of Marine Science, 3: 77-78	Physical	Marine and Coastal Management, Cape Town
1985	Seasonal trends in the longshore distribution of surface temperatures off southwestern Africa 18-34 degree S, and their relation to subsurface conditions and currents in the area 21-24 degree S.	Boyd, A.J.; Agenbag, J.J.	International Symposium on the Most Important Upwelling Areas off Western Africa, Barcelona (Spain), Volume 1: 119-148	Physical	Marine and Coastal Management, Cape Town
1984	Preliminary chemical studies in four Cape estuaries	Eagle, G. A.; Bartlett, P.	CSIR report T/SEA 8307	Biogeochemical	CSIR, Stellenbosch
1983	Some features in two Cape bays as deduced from satellite ocean-colour imagery.	Shannon, L.V.; Walters, N.M.; Moldan, A.G.S.	South African Journal of Marine Science, 1: 111-122	Physical	Marine and Coastal Management, Cape Town
1983	Nutrient status of the surface waters of the Benguela Upwelling System.	Bailey, G.W.	South African Journal of Science, 79(4): 146 (summary only)	Biogeochemical	Journal Publication
1983	A pilot study of the flux of P.O.C. and P.O.N. in St. Helena Bay.	Bailey, G.W.	Fifth National Oceanographic Symposium, 24-28 January 1983, Rhodes University, Grahamstown	Biogeochemical	Marine and Coastal Management, Cape Town
1983	The physical oceanography of St. Helena Bay and the Cape Columbine region.	Holden, C.J.	Fifth National Oceanographic Symposium, 24-28 January 1983, Rhodes University, Grahamstown	Physical	Marine and Coastal Management, Cape Town
1982	Applications of satellite ocean colour imagery in the study of the Benguela Current System	Shannon, L.V.; Anderson, F.P.	South African Journal of Photogrammetry, Remote Sensing and cartography, 13 (3): 153-169	Physical	Marine and Coastal Management, Cape Town

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION*	LOCATION OF DOCUMENT
1982	Interactions between breeding seabird and pelagic fish populations in the Southern Benguela region.	Furness, R.W.; Cooper, J.	Marine Ecology: Progress Series, 8(2): 243-250	Biological	Journal Publication
1981	Distribution and availability of Horse Mackerel, <i>Trachurus trachurus</i> , off South Africa, 1964-1976.	Crawford, R.J.M.	FISH. BULL. S. AFR., 15(1): 1-41[title in full?]	Biological	Marine and Coastal Management, Cape Town
1981	An experimental study on iron accumulation in the Clam <i>Macra Lilacea</i> .	Beckley, L.E.	Marine Pollution Bulletin, 12(4), 138-139	Biological	Journal Publication
1981	Marinised trout are hatched and cultured in fresh water and adapted to sea water at St Helena Bay to yield a salmon pink gourmet product.	Anon	South African Shipping News and Fishing Industry Review, 36(11): 22-25	Biological	Journal Publication
1981	Seawater trout farmed in South Africa.	Stuttaford, M.	Fish Farming International, 8(4): 36,38	Biological	Journal Publication
1979	The CUEX I programme: an overview.	Shannon, L.V.; Nelson, G.	South African Journal of Science, 75(12): 564	Physical Biogeochemical	Marine and Coastal Management, Cape Town
1975	Dry offloading: boon or burden?	Anon	South African Shipping News and Fishing Industry Review, 30(4): 50-61	Management	Journal Publication
1970	Red water and mussel poisoning at Elands Bay, December 1966	Grindley, J.R.; Nel, E.A.	Fisheries bulletin (South Africa), 6:36-55	Biological	CSIR, Stellenbosch
1963	Berg River model investigation on proposed harbour facilities at the river mouth.	Anon	Report issued by Dept of Civil Engineering, Stellenbosch	Physical	University of Stellenbosch

3.5 Available Environmental Data

Although environmental data on St Helena Bay will also be listed in many of the above-mentioned documents and publications, existing oceanographic databases, such as those available at the CSIR, Stellenbosch, were also searched. The following data on the St Helena Bay were located:

Wind

POSITION	DEPLOYMENT PERIOD	TYPE OF OBSERVATIONS	OWNER/LOCATION OF DATA
Cape Columbine 32° 49.63'S; 17° 51.05'E	1990-01-01 to 1996-01-01	Temperature, Barometric Pressure, Relative Humidity, Wind Direction, Wind Speed (Average), Wind Speed (Maximum)	CSIR EDM database
Langebaanweg 32° 58.64'S; 18° 08.98'E	1994-10-01 to 1995-12-22	Temperature, Barometric Pressure, Relative Humidity, Wind Direction, Wind Speed (Average), Wind Speed (Maximum)	CSIR EDM database
Saldanha Bay Stn 2 32° 57.34'S; 17° 58.40'E	1995-03-03 to 2001-02-28	Temperature, Barometric Pressure, Relative Humidity, Wind Direction, Wind Speed (Average), Wind Speed (Maximum)	CSIR EDM database

Waves

POSITION	DEPLOYMENT PERIOD	TYPE OF OBSERVATIONS	OWNER/LOCATION OF DATA
32° 52.17'S; 17° 50.83' E (Noordwesbaai)	February to December 1983	Wave height and direction	CSIR EDM database, Stellenbosch

Currents

POSITION	DEPLOYMENT PERIOD	INSTRUMENT DEPTH	WATER DEPTH	TYPE OF OBSERVATIONS/INSTRUMENT	OWNER/LOCATION OF DATA
Saldanha 32° 51,7' S 17° 49,9' E	1975-08-28 to 1975-08-31	47 m	44 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
Cape Desada 32° 21' S 17° 40,20' E	1982-07-07 to 1982-09-04	178 m	76 m, 151 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Paternosterbaai 32° 47.6' S 17° 38,50' E	1982-07-07 to 1982-08-13	195 m	169 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Olifantsbos 32° 43.8' S 17° 36,20' E	1982-12-02 to 1983-02-11	229 m	56 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 43.8' S 17° 36,20' E	1982-12-02 to 1983-02-23	255 m	154 m, 229 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 49.3' S 17° 37,60' E	1983-02-08 to 1983-05-18	201 m	96 m, 173 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 48.4' S 17° 39,20' E	1983-05-18 to 1983-08-12	181 m	155 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 45.8' S 17° 36,90' E	1983-08-19 to 1983-11-22	230 m	129 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 45.8' S 17° 36,90' E	1983-08-19 to 1983-11-21	236 m	210 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 46.0' S 17° 37,00' E	1983-12-07 to 1984-03-19	238 m	139 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
West of Cape Columbine 32° 46.5' S 17° 31,40' E	1983-12-08 to 1984-05-06	988 m	889 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 43.1' S 17° 40,30' E	1984-03-19 to 1984-08-21	183 m	157 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
West of Cape Columbine 32° 44.8' S 17° 31,30' E	1984-05-11 to 1984-08-22	997 m	897 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 42.9' S 17° 40,90' E	1984-08-21 to 1985-03-12	181 m	155 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Desada 32° 14' S 18° 02,70' E	1984-10-29 to 1985-03-27	116 m	49 m, 92 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Off Columbine 32° 47.60' S 17° 42,40' E	1984-10-30 to 1985-03-28	149 m	48 m, 87 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 43.10' S 17° 40,10' E	1985-03-28 to 1985-09-03	183 m	41 m, 84m 157 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine	1985-09-03 to 1986-04-12	180 m	38 m, 81m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal

POSITION	DEPLOYMENT PERIOD	INSTRUMENT DEPTH	WATER DEPTH	TYPE OF OBSERVATIONS/INSTRUMENT	OWNER/LOCATION OF DATA
32° 43.20' S 17° 40,50'E					Management & CSIR EMD database
Cape Desada 32° 20.10' S 18° 16,70'E	1985-09-03 to 1985-12-10	43 m	21 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Desada Coastal 32° 31.00' S 18° 11,60'E	1985-10-03 to 1985-12-11	46 m	25 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Desada Coastal 32° 31.30' S 18° 11,60'E	1985-10-03 to 1985-12-11	46 m	35 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Desada Coastal 32° 29.00' S 17° 55,70'E	1985-10-04 to 1985-12-10	83 m	32 m, 62 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Stompneus Coastal 32° 38.60' S 18° 02,90'E	1985-10-07 to 1985-12-11	31 m	20 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 43.2' S 17° 40,80'E	1986-04-12 to 1986-09-22	178 m	36 m, 79m, 152 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Lambert's Bay 32° 02.6' S 18° 15,00'E	1986-04-28 to 1986-06-19	59 m	29 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 42.90' S 17° 41,00'E	1986-09-22 to 1987-05-04	177 m	75 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 44.50' S 17° 42,00'E	1987-05-04 to 1987-12-10	177 m	155 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 48.20' S 17° 38,90'E	1988-04-30 to 1988-09-15	182 m	160 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 47.40' S 17° 39,60'E	1988-09-15 to 1989-04-04	173 m	152 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 47.30' S 17° 39,30'E	1989-04-04 to 1989-10-25	182 m	160 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 48.40' S 17° 4139,70'E	1989-10-25 to 1990-05-10	176 m	106 m, 159 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 46.60' S 17° 40,50'E	1990-05-10 to 1990-11-12	166 m	96 m, 149 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 45.80' S 17° 40,30'E	1990-11-12 to 1991-05-28	171 m	101 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 45.80' S 17° 40,30'E	1990-11-12 to 1991-05-28	171 m	154 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 44.90' S 17° 40,00'E	1991-04-30 to 1991-11-08	181 m	121 m, 164 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD

POSITION	DEPLOYMENT PERIOD	INSTRUMENT DEPTH	WATER DEPTH	TYPE OF OBSERVATIONS/INSTRUMENT	OWNER/LOCATION OF DATA
Cape Columbine 32° 44.00' S 17° 40,40'E	1991-11-08 to 1992-07-04	176 m	100 m, 154 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 44.30' S 17° 40,70'E	1992-07-04 to 1993-06-21	174 m	152 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 43.70' S 17° 41,10'E	1993-06-21 to 1994-01-12	166 m	91 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 43.70' S 17° 41,10'E	1994-01-12 to 1994-04-16	171 m	97 m, 149 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 43.90' S 17° 41,00'E	1994-04-16 to 1994-09-21	165 m	89 m, 143 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 43.50' S 17° 40,70'E	1994-09-21 to 1994-12-02	172 m	150 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
Cape Columbine 32° 43.50' S 17° 40,80'E	1994-12-02 to 1995-02-15	171 m	96 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database

Chemical data & Microbiological: Water column

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	DEPTH INTERVALS	OWNER/LOCATION OF DATA
1900 to 2005 (details available on request)	Details available on request	Temperature; Salinity	32S to 33S to 17.5E to 18.5E (~ 45 000 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Dissolved oxygen	32S to 33S to 17.5E to 18.5E (~ 23 000 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Nitrate	32S to 33S to 17.5E to 18.5E (~ 2900 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Nitrite	32S to 33S to 17.5E to 18.5E (~ 1500 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Phosphate; Phosphorus	32S to 33S to 17.5E to 18.5E (~ 47 500 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Silicate	32S to 33S to 17.5E to 18.5E (~ 2 800 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	pH	32S to 33S to 17.5E to 18.5E (~ 66 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Chlorophyll a	32S to 33S to 17.5E to 18.5E (~ 760 records)	Details available on request	CSIR SADCO Database
2001-05-03 to 2001-06-02	15 min	Temperature (Thermistor chain)	St Helena 32° 41.36 S 18° 01.19'E	1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21 m (water depth 25 m)	CSIR EMD database
2001-07-25 to 2001-11-12	180 min	Temperature (Thermistor chain)	32° 41.36 S 18° 01.19'E	1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21 m (water depth 25 m)	CSIR EMD database
2001-11-12 to 2002-05-02	60 min	Temperature (Thermistor chain)	32° 41.36 S 18° 01.19'E	1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21 m (water depth 25 m)	CSIR EMD database
2001 - 2004	Fortnightly	E coli; Faecal coliforms	27 stations along the St Helena Bay	Surface	St Helena Bay Water Quality Forum

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	DEPTH INTERVALS	OWNER/LOCATION OF DATA
			coast from Dwarskersbosto Cape St Martin		Trust/CSIR, Stellenbosch
1977-01-01 to 1980-01-01	Once-off	Cadmium, Copper, Iron, Lead, Manganese, Nickel, Zinc	32.7 to 32.8 S and 18.0 to 18.2 E (14 records)	Details available on request	SADCO Database, CSIR

Chemical: Sediments

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	GRAB/CORE SAMPLING	OWNER/LOCATION OF DATA
1977-01-01 to 1980-01-01	Once-off	Cadmium, Cobalt, Copper, Iron, Lead, Manganese, Nickel, Zinc	32.7 to 32.8 S and 18.0 to 18.2 E (65 records)	No data	SADCO Database, CSIR

Chemical: Biological tissue

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	OWNER/LOCATION OF DATA
1977-01-01 to 1980-01-01	Once-off	Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Zinc	32.7 to 32.8 S and 18.0 to 18.2 E (4 records 54 records)	SADCO Database, CSIR

3.6 Existing Monitoring Programmes

PROGRAMME	DESCRIPTION	MONITORING TYPE	DURATION	SAMPLING FREQUENCY	SAMPLING LOCATION	PARAMETERS MEASURED	OWNER/LOCATION OF DATA
Bacteriological Water Quality Monitoring Programmes	Monitor bacteriological quality in St Helena Bay	Environmental	2001 - ongoing	Fortnightly	27 stations along the St Helena Bay coast from Dwarskersbos to Cape St Martin	<i>E. coli</i> Faecal coliform	St Helena Bay Water Quality Forum Trust/CSIR, Stellenbosch
Marine Products, Laaiplek	Monitoring effluent quality	Source	2004 - ongoing	Fortnightly	Final effluent (if discharging)	pH; Salinity, Dissolved Organic Carbon; Total Kjeldahl Nitrogen; Total Ammonia, Fat, oil & grease; <i>E. coli</i> ; Faecal coliform	Marine Products
Suid Oranje Vissery	Monitoring effluent quality	Source	2004 - ongoing	Fortnightly	Final effluent (if discharging)	pH; Salinity, Dissolved Organic Carbon; Total Kjeldahl Nitrogen; Total Ammonia, Fat, oil & grease; <i>E. coli</i> ; Faecal coliform	Suid Oranje Vissery
St Helena Bay Fishing	Monitoring effluent quality	Source	2004 - ongoing	Fortnightly	Final effluent (if discharging)	pH; Salinity, Dissolved Organic Carbon; Total Kjeldahl Nitrogen; Total Ammonia, Fat, oil & grease; <i>E. coli</i> ; Faecal coliform	St Helena Bay Fishing, Oceana Group
West Point Fishing	Monitoring effluent quality	Source	2005 - ongoing	Fortnightly	Final effluent (if discharging)	pH; Salinity, Dissolved Organic Carbon; Total Kjeldahl Nitrogen; Total Ammonia, Fat, oil & grease; <i>E. coli</i> ; Faecal coliform	West Point Fishing
DWAF River Water Quality Monitoring Programme	Monitor river water quality in rivers	Source		Monthly	Berg River: Jantjiesfontein		Dept. of Water Affairs & Forestry

3.7 Suitability for Application in Management Framework

i. Management Responsibilities

The St Helena Water Quality Forum Trust, consisting of officials from local and regional authorities and representative of all major industries in the area and other groups, has been established to address the common interest of members in maintaining acceptable water quality in St Helena Bay (refer to Chapter 3.1). The forum is currently responsible for coordinating a number of monitoring programmes (mainly bacteriological) that are funded through contributions from the different members, a practice that supports the 'Polluter Pays' Principle.

To further its role as coordinating platform for marine water quality management, as per the proposed management framework, it is recommended that other important roleplayers also come to be included, such as:

- Department of Environmental Affairs and Tourism (as custodian of the natural environment and marine living resources)
- Department of Public Works (operations of fishing harbours)
- Cerebos Salt Works
- Local fishing communities
- Smaller-scale fisheries
- Property developers
- Tourist forums.

ii. Legislative Framework

An assessment of the South African legislative framework related to marine pollution is addressed in more detail in Chapter 2.

iii. Environmental Quality Objectives

Although this project provides a preliminary indication of important beneficial uses and marine ecosystems within this node, these have not been formally defined for St Helena Bay, e.g. through a proper stakeholder consultation process.

In addition, site specific environmental quality objectives need to be determined for the designated use areas and important marine ecosystems within the Bay, so as to express

water (and sediment) quality requirements in a quantifiable manner. The St Helena Bay Water Quality Forum Trust is considered an appropriate platform from which to coordinate such a process.

iv. Marine Pollution Sources

Effective implementation of the proposed management framework requires quantitative information on pollutant inputs into the marine environment. In the case of land-based sources, this refers to proper quantification of the volume and pollutant composition of different sources.

Through the St Helena Bay Water Quality Forum Trust, source monitoring programmes have recently been implemented to quantify pollutant inputs from a number of fish processing factories (refer to Chapter 5.6). However, these initiatives need to be extended to all land-based discharges into the Bay, including the monitoring of flow distribution patterns (volume).

DWAF, as part of its national water quality monitoring programme, is monitoring the water quality of the Berg River. At present, the closest point to the head of the estuary is at Jantjiesfontein. The programme monitors a range of parameters on a monthly basis, mainly physico-chemical variables and inorganic nutrients. It is, however, important to also monitor pollutants that may be catchment specific, e.g. the Berg River drains agricultural areas that may introduce pesticides. Although it is recognised that such additional measurements may be costly, it is nevertheless important to include such parameters in the monitoring programmes even if at lower sampling frequencies (e.g. quarterly).

Quantitative data on pollutant inputs from storm-water run-off (diffuse sources) are, however, very limited. It is recognised that such data are often difficult to obtain, but to ultimately assess cumulative and potential synergistic effects, it is necessary to acquire such data. Where these data cannot be obtained through routine monitoring, they could be derived from available literature. For example, for the South African situation, an overview of pollutant inputs from different types of storm-water run-off can be obtained from Pegram & Görgens (2001).

Quantification of inputs for other pollution sources, e.g. activities associated with the fishing harbour, will be more difficult. However, it is important to clearly identify such sources, as

well as their potential impact in relation to marine pollution, so as to implement the necessary controls (e.g. mitigating measures or contingency plans).

iv. Scientific Assessment Studies

Key to the scientific assessment studies, as per the proposed management framework, is a sound understanding of water circulation patterns and sedimentary processes (i.e. deposition/re-suspension of particulates) within a particular marine environment, so as to be able to quantify the transport, dispersion and fate of pollutants that enter that particular marine environment.

Although baseline studies have been undertaken to assess the status of marine pollution in St Helena Bay (refer to Chapter 3.5), these have not been linked to the water circulation patterns and sedimentary processes within St Helena Bay so as to properly define pollutant source/sink linkages.

A project, however, is currently underway in which this will be investigated (Dr P Monteiro, CSIR, Stellenbosch, pers comm.)

v. Critical limits and Mitigating Actions

With regard to land-based sources of marine pollution (in particular effluents from the fish processing industries), DWAF is in the process of setting critical limits (also referred to as standards). These will be based on the receiving water quality objectives approach (i.e. taking into account the quality requirements of the receiving marine environment and its beneficial uses) and will be incorporated to become part of licence agreements, issued under the *National Water Act 36 of 1998* (Wilna Kloppers, DWAF, pers. comm.).

vi. Monitoring Programmes

Through the St Helena Bay Water Quality Forum Trust, fortnightly source monitoring programmes on the final effluents from a number of the fish processing factories have been implemented since 2004 (to provide quantitative information on pollutant composition). It is important that such programmes be extended to all land-based effluent discharges in the node (refer to Chapter 3.2). Also important for application in the proposed management framework is the monitoring of flow distribution patterns of these effluent discharges.

In terms of environmental monitoring programmes, the St Helena Bay Water Quality Forum Trust has taken the initiative and launched a two-weekly monitoring programme of microbiological indicators along their coastline. Currently, the monitoring programme mainly assesses suitability for recreational use and collection of filter feeders (for a human health perspective), using target values as set out in the *South Africa Water Quality Guidelines for Coastal Marine Water* (RSA DWAF, 1995).

The environmental monitoring programme should, however, be expanded to also include change or impact, on a broader scale, relating to other beneficial uses and important marine ecosystem in the area. As with the current monitoring initiative, it is strongly recommended that such programmes be coordinated through the St Helena Bay Water Quality Forum Trust rather than by individuals, managers or authorities undertaking their own initiatives.

4 SALDANHA BAY

4.1 Existing Management Initiatives

NAME	DESCRIPTION	RESPONSIBLE INSTITUTION/AUTHORITY	PARTIES INVOLVED	PERIOD OPERATIONAL
Saldanha Bay Water Quality Forum Trust	Voluntary organization comprising officials from local, regional and national authorities, representative of all major industries in the area and other groups who have a common interest in maintaining water quality and ecosystem functioning so as to keep Saldanha Bay fit for all its designated uses	No single authority - chairperson selected from parties involved	Municipality of Saldanha Bay Dept of Environmental Affairs and Tourism Dept. of Water Affairs and Forestry National Ports Authority Local industries Other interested parties	Constituted in June 1996

4.2 Marine Pollution Sources

A map indicating the location of major potential marine pollution sources in Saldanha Bay is provided in Figure 4.1. Details of these sources are provided below:

SOURCE	SOURCE TYPE	DESCRIPTION	ESTIMATED VOLUME	POLLUTANT COMPOSITION	OWNER/MANAGER
Sea Harvest	Land-based	Effluent from a pelagic fish and white fish processing plant discharging into the nearshore	3 546 m ³ /day*	Inorganic Nitrogen ; Organic Carbon and Nitrogen; Suspended solids	Sea Harvest Corporation Ltd
Southern Sea	Land-based	Effluent from a pelagic fish processing plant discharging into the nearshore. Also includes cooling water discharge	7 307 m ³ /day *	Temperature; Inorganic Nitrogen; Bacteriological contaminants; Organic matter; Suspended solids	Southern Sea Fishing
SA Lobster Exporters	Land-based	Wash-water used in lobster processing (packing) factory	40 000m ³ /month**	Re-cycled seawater	SA Lobster Exporters (Marine Products)
Live Fish Tanks	Land-based	Wash-water used in lobster processing (packing) factory	No data	Re-cycled seawater	Live Fish Tanks (West Coast – Lusithania)
Bok River	Land-based	River discharging into the Bay that receives sewage effluent from the Saldanha Bay WWTW	50 000 m ³ /month** (inflow from WWTW into river)	Bacteriological contaminants; Suspended solids; Inorganic nitrogen & phosphate; Organic carbon & nitrogen	Dept. of Water Affairs and Forestry
Saldanha Bay: Residential storm-water	Land-based	Storm-water run-off from mainly residential areas entering the marine environment through numerous storm-water outlets along the shore.	291 336 m ³ /annum**	Suspended solids; Bacteriological contaminants; Organic matter; Litter	Saldanha Bay Municipality
Saldanha Bay: Industrial storm-water	Land-based	Storm-water run-off from the industrial zone entering the marine environment through numerous storm-water outlets along the shore.	39 308 m ³ /annum**	Suspended solids; Petroleum hydrocarbons; Trace metals; Litter	Saldanha Bay Municipality
Langebaan: Residential Storm-water	Land-based	Storm-water run-off from mainly residential areas entering the marine environment through numerous storm-water outlets along the shore.	565 245 m ³ /annum**	Suspended solids; Bacteriological contaminants; Organic matter; Litter	Saldanha Bay Municipality
Port of Saldanha: Storm-water	Land-based	Storm-water run-off entering the Bay from quays within the Port.	354 654 m ³ /annum**	Organic matter; Trace metals	Port of Saldanha (National Ports Authority)

SOURCE	SOURCE TYPE	DESCRIPTION	ESTIMATED VOLUME	POLLUTANT COMPOSITION	OWNER/MANAGER
Septic and Conservancy tanks	Land-based	Situated at various locations along the Saldanha Bay coast. Malfunctioning systems can cause marine pollution.	Not easily quantifiable	Inorganic nutrients; Organic matter Bacteriological contaminants	Saldanha Bay Municipality
Sewage pump stations	Land-based	Situated at various locations along the Saldanha Bay coast. Malfunctioning systems can cause marine pollution.	Not easily quantifiable	Inorganic nutrients; Organic matter Bacteriological contaminants	Saldanha Bay Municipality
Port of Saldanha: Operations	Maritime Transportation	Activities potentially causing marine pollution include ore dust fallout during ship loading operations, oil spillages, dredging operations and ballast water discharge.	Not easily quantifiable	Suspended solids; Trace metals Petroleum hydrocarbons	Port of Saldanha (National Ports Authority)
Port of Saldanha: Dredge spoil dumping	Dumping at sea	Dredge spoil material originating from harbour that is dumped at sea		Suspended solids; Trace metals Petroleum hydrocarbons	National Ports Authority
Saldanha Bay Fishing harbour	Maritime Transportation	Activities causing marine pollution include cleaning of vessels, accidental oil spillages, dumping of bloodwater and other fish offal and littering	Not easily quantifiable	Suspended solids; Organic matter (fish waste); Petroleum hydrocarbons; Litter/Garbage	Dept. of Public Works/Dept. of Environmental Affairs and Tourism
Yacht club, Saldanha Bay	Maritime Transportation	Accidental oil spillages	Not easily quantifiable	Petroleum hydrocarbons	Saldanha Bay Yacht Club
Yacht club, Langebaan	Maritime Transportation	Accidental oil spillages	Not easily quantifiable	Petroleum hydrocarbons	Langebaan Yacht Club
Yacht harbour, Club Mykonos	Maritime Transportation	Accidental oil spillages	Not easily quantifiable	Petroleum hydrocarbons	Club Mykonos
Military harbour, Donkergat	Maritime Transportation	Accidental oil spillages	Not easily quantifiable	Petroleum hydrocarbons	Dept of Defence
Mussel and oyster farms	Dumping at sea	Activities contributing to marine pollution include deposition of mussel faecal pellets under the rafts and dumping of non-commercial biomass from mussel farm production. Rafts also dampen the effect of waves and flow, creating areas of low turbulence which become vulnerable to deposition of fine organic material/cohesive sediments and onset of anoxia.	No data	Suspended solids; Organic matter	Blue Bay Aquafarm (Pty) Ltd Saldanha Bay Oyster Company (Pty) Ltd

* Sources: RSA DWAF, 2004c; ** Taljaard & Monteiro, 2002

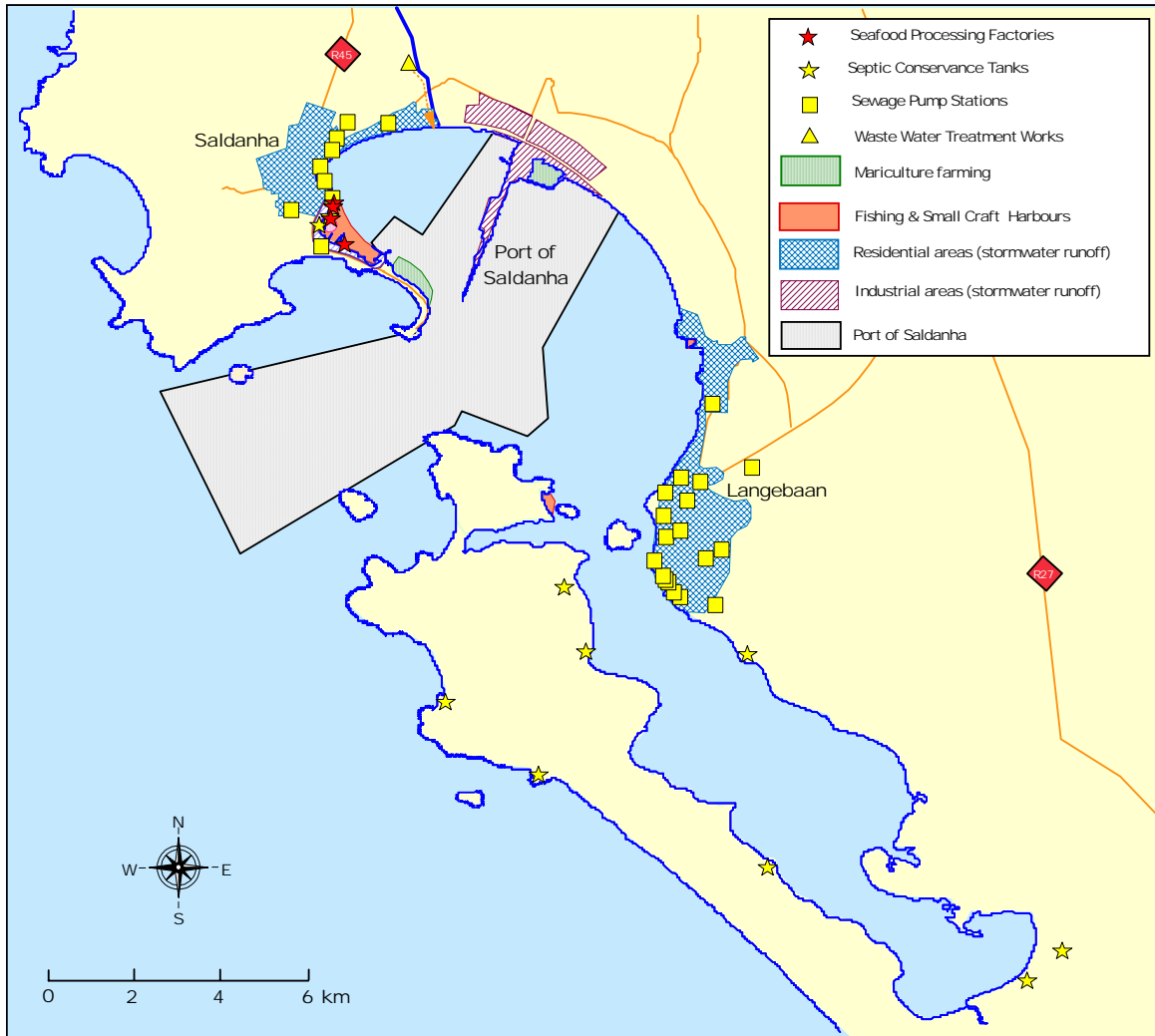


Figure 4.1: Potential marine pollution sources in Saldanha Bay/Langebaan Lagoon (Taljaard & Monteiro, 2002)

4.3 Important Marine Ecosystems and Beneficial Uses

4.3.1 Important Marine Ecosystems

The Saldanha Bay area includes a number of important marine ecosystems as illustrated below (Figure 4.2).

The Langebaan Lagoon was designated a Ramsar site (under Convention on Wetlands of International Importance), especially as a Waterfowl Habitat (RAMSAR). The Ramsar site includes the islands Schaapen, Marcus, Malgas and Jutten, Langebaan Lagoon and a section of Atlantic coastline. The Langebaan Lagoon is also included within the boundaries of the West Coast National Park.

There are also a number of marine protected areas declared under the Marine Living Resources Act 18 of 1998:

- Langebaan Lagoon Marine Protected Area
- Sixteen Mile Beach Marine Protected Area
- Malgas Island Marine Protected Area
- Jutten Island Marine Protected Area
- Marcus Island Marine Protected Area

Conservation areas of the Cape Nature Conservation Board include:

- An area within the military base, SAS Saldanha
- Vondeling Island.

4.3.2 Beneficial uses

i. Recreation (including tourism)

Statistics show that the Saldanha Bay municipal area about 500 000 visitors per year. A large proportion of tourists visit the area during the flower season in late winter/early spring, between July and September. During the summer months, from about October to April, visitors come to the area to fish and take part in a variety of water sports.

In the case of Saldanha Bay and Langebaan Lagoon, non-contact recreational use applies to the entire area, being a popular tourist destination to which people come from afar on sightseeing tours and holidays.

The main full-contact and intermediate contact recreation sites in the Saldanha Bay and Langebaan Lagoon area are indicated in Figure 4.2. Although the Langebaan Lagoon falls within the West Coast National Park, there are areas within the lagoon where full- and intermediate contact recreational activities are allowed, namely:

- *Zone A: Multipurpose recreational area*, where scuba-diving, windsurfing, skiing, boating, swimming, fishing (from boats and along the shore), bait collecting, and gill netting for harders are allowed
- *Zone B: Limited Recreational Area*, where only sailing, swimming and canoeing are allowed (netting for harders is also allowed to some extent)

- *Zone C*: Wilderness area, where the areas are closed to any water-related recreational or fishing activities.

The area also supports a number of small boat and yacht harbours:

- Yacht clubs at Saldanha Bay and Langebaan
- Yacht harbour at Club Mykonos
- Kraalbaai small boat harbour area.

ii. *Marine Aquaculture and Important Fisheries (including collection of seafood for human consumption)*

Marine aquaculture operations currently undertaken in Saldanha Bay and Langebaan Lagoon are:

- Mussel farming (Blue Bay Aquafarm Pty Ltd)
- Oyster farming (Saldanha Bay Oyster Company)
- Commercial harvesting of seaweed (*Gracilaria*) in Saldanha Bay (Taurus Saldanha Seaweed (Pty) Ltd)

Additional areas in Saldanha Bay have also been earmarked for future marine aquaculture operations (Figure 4.2).

South African National Parks has also initiated a project, in collaboration with the local community, to remove alien mussel species from the Langebaan Lagoon, selling these to local markets.

The commercial fishery in Saldanha Bay consists mainly of line-fishing from small boats and gill netting. Recreational fishing by rod and handline takes place from both small boats and from the shore.

iii. *Industrial uses*

Seafood processing industries that take in seawater for processing include:

- Sea Harvest Corporation Ltd (three intake points)
- Southern Seas Fishing (four intake points)
- SA Lobster Exporters (Marine Products) (one intake point)
- Live Fish Tanks (West Coast) (Lusithania) (one intake point).

Although there are numerous activities in harbours and ports that could detrimentally affect marine water and sediment quality (as discussed earlier), these also constitute use and

require a certain quality of the marine environment. Saldanha Bay and Langebaan Lagoon contain a number of commercial harbour areas, including:

- Port of Saldanha
- Small craft harbours (also under the jurisdiction of the NPA)
- Fishing harbours
- Military harbour and Military jetty (Donkergat).

Most ships take on water as ballast in order to increase stability at sea. In this way large volumes of coastal waters are transferred from one coastal area of the world to another. To minimize risk to the receiving marine environment it is important that the water inside harbours and ports, where the intake of ballast water occurs, is of acceptable quality.

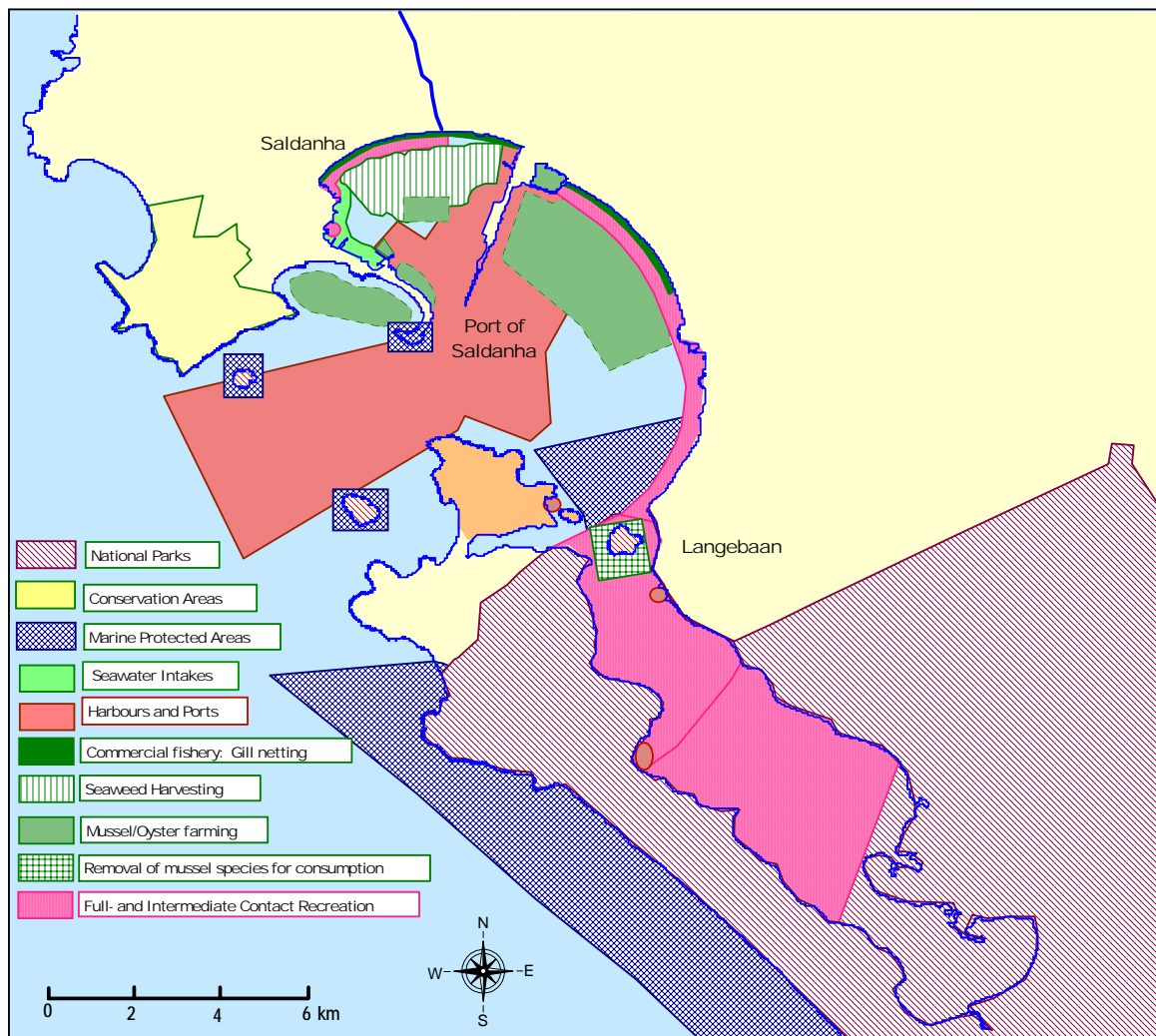


Figure 4.2: Important ecosystems and beneficial uses of Saldanha Bay/Langebaan Lagoon (Taljaard & Monteiro, 2002)

4.4 Available Environmental Literature

An inventory of available literature that is considered to be relevant to the management of marine pollution in the Saldanha Bay is listed below:

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
2004	The biogeochemical status of surface sediments in Saldanha Bay and Langebaan in 2004	Monteiro, P.M.S.; Joubert, W.R.; Pascall, A.; Brown, S.B.; Adonis, A.S.	CSIR report ENV-S-C 2004-080	Biogeochemical	CSIR, Stellenbosch
2004	Erosion of Langebaan Beach, Saldanha Bay.	Anon	African Wildlife, [Wildlife & Environment Society of South Africa:delete], 58(1): 40-41	Physical	South African Institute for Aquatic Biodiversity (SAIAB), Grahamstown
2004	Saldanha Bay bulk terminal keeps it clean	Anon	Maritime Reporter of Southern Africa, (Jan/February)[year?]	Management	South African Institute for Aquatic Biodiversity (SAIAB), Grahams Town
2004	Water quality management plan Saldanha Bay. Phase III: Setting of critical loads using a modelling-based ecosystem approach. Report to the Saldanha Water Quality Forum Trust.	Monteiro, P.M.S.; Kemp, A.C.	CSIR report ENV-S-C 2004-083	Biogeochemical	CSIR, Stellenbosch
2004	Saldanha Bay wave and wind recording annual summary report, March 2003 to Febraury 2004	Kuipers, J.J.; Pietersen, S.	CSIR report ENV-S-C 2004-016	Physical	CSIR, Stellenbosch
2003	Shoreline stability and sedimentation in Saldanha Bay	Schoonees, J.S.; Theron, A.K.; Von St Ange, U.; Schonegevel, L.; Davids, G.	CSIR report ENV-S-C 2003-081	Physical	CSIR, Stellenbosch
2003	Sand transport along the Western Cape coast: gone with the wind?	Franceschini, G.; Compton, J. S.; Wigley, R. A.	South African Journal of Science, 99 (7/8): 317-318	Physical	Journal publication
2002	Cape Peninsula mussel watch project.	Albertus, F.; Kiviets, G.	Southern African Marine Science Symposium: Currents Coasts Communities, Swakopmund (Namibia)	Biogeochemical	Marine and Coastal Management, Cpae Town
2002	?	Luger SA; Van Ballegooyen RC; Monterio PMS	CSIR report ENV-S-R 2003-109	Physical	CSIR, Stellenbosch
2002	Factors affecting dark(?) survival of the brown tide alga <i>Aureococcus anophagefferens</i> (Pelagophyceae)	Popels, L.C.; Hutchins, D.A.	Journal of Phycology, 38(4): 738-744	Biological	Journal publication
2002	Saldanha Bay Water Quality Mangement Plan. Phase I: Situation Assessment. Report to the Saldanha Water Quality Forum Trust.	Taljaard, S.; Monteiro P.M.S	CSIR report ENV-S-C 2002-115/1	Management	CSIR, Stellenbosch
2002	Saldanha Bay Water Quality Mangement Plan. Legal Opinion: Municipality's legislative and executive authority in respect of marine water quality within its jurisdiction. Report to the Saldanha Water Quality Forum Trust.	Smith, N.D.; Bowling, B.S.	CSIR report ENV-S-C 2002-115/2	Management	CSIR, Stellenbosch
2002	Reproduction, growth and migrations of sei whales <i>Balaenoptera borealis</i> off the west coast of South Africa in the 1960s.	Best, P.B.; Lockyer, C.H.	South African Journal of Marine Science, 24: 111-133	Biological	Journal publication
2002	Subtidal communities on anthropogenic structures in Saldanha Bay, with special emphasis on alien species.	Snyman, W.J.; Gibbons, M.J.	Southern African Marine Science Symposium: Currents Coasts Communities, Swakopmund (Namibia)	Biological	
2002	Invasion of Langebaan Lagoon, South Africa, by <i>Mytilus galloprovincialis</i> -	Robinson, T.B.; Griffiths,	African Zoology, 37(2): 151-158	Biological	Journal publication

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
	effects on natural communities.	C.L.			
2002	Invasion of sandflats in Langebaan Lagoon, South Africa, by the alien mussel <i>Mytilus galloprovincialis</i> : size, composition and decline of the populations.	Hanekom, N.; Nel, P.	African Zoology, 37(2): 197-208	Biological	Journal publication
2001	Application of crimp protocols to Saldanha Bay port baseline survey, with potential for replication in ports of eastern Africa.	Awad, A.	Western Indian Ocean Marine Science Association Scientific Symposium, Dar es Salaam (Tanzania), 22-25 Oct 2001	Biological	
2001	Possible introduction of alien phytoplankton via shipping ballast water: A South African perspective.	Marangoni, C.; Pienaar, R.N.; Sym, S.D.	South African Journal of Botany, 67(3): 465-474	Biological	Journal publication
2001	South African ascidians.	Monniot, C.; Monniot, F.; Griffiths, C.L.; Schleyer, M.	South African Museum. Annals, 108(1): 141	Biological	Journal publication
2001	Open-water cultivation of <i>Gracilaria</i> in South Africa: Saldanha Bay or St. Helena Bay?	Anderson, R.J.; Boothroyd, C.J.T.; Kemp, F.A.; Rothman, M.D.	Proceedings of the 17th International Seaweed Symposium, Cape Town, South Africa, 28 January-2 February	Biological	Marine and Coastal Management, Cape Town
2001	A snapshot of the circulation and hydrology of the southern and central shelf regions of the Benguela Current in winter 1999.	Iita, A.; Boyd, A.J.; Bartholomae, C.H.	South African Journal of Science, 97(5-6): 213-216	Physical	Journal publication
2001	Sediment Assessment Programme for the Port of Saldanha: 2001	Monteiro, P.M.S.; Scott, D.	CSIR report ENV-S-C 2001-096.	Biogeochemical	CSIR, Stellenbosch
2001	Brown tides and mariculture in Saldanha Bay, South Africa	Probyn, T.; Pitcher, G.; Pienaar, R.; Nuzzi, R.	Marine Pollution Bulletin, 42 (5): 405-408	Biological	Journal publication
2001	Slangkop farm Darling: 12-month wind monitoring programme: Data summary and wind data comparison report (Confidential).	Struthers, M.J.; Watt, L.	CSIR report ENV-S-C 2001-014	Physical	CSIR, Stellenbosch
2001	Die Saldanha Baai Water Gehalte Forum Trust: 'n instrument vir beplande geïntegreerde monitoring en bestuur van water gehalte.	Van Wyk, C. F.	MSc Thesis - University of Stellenbosch	Management	University of Stellenbosch
2001	Impact of mussel (<i>Mytilus galloprovincialis</i>) raft-culture on benthic macrofauna, in situ oxygen uptake, and nutrient fluxes in Saldanha Bay South Africa.	Stenton-Dozey, J.; Probyn, T.; Busby, A.	Canadian Journal of Fisheries and Aquatic Sciences, 58(5): 1021-1031	Biological	Journal publication
2001	The change in macroalgal assemblages through the Saldanha Bay/Langebaan Lagoon Ecosystem (South Africa)	Schils, T.; De Clerck, O.; Leliaert, F.; Bolton, J.J.; Coppejans, E.	Botanica Marina, 44(3): 295-305	Biological	Journal publication
2001	Holocene sea-level fluctuations inferred from the evolution of depositional environments of the southern Langebaan Lagoon salt marsh, South Africa.	Compton, J.S.	The Holocene, 11(4): 395-405	Physical	Journal publication
2000	Theme: Management and institutional affairs. The integration of water management tools to equip water institutions for their future role.	Mcconkey, G.E.; Ferguson, L.L.; Botes, W.A.M.; Maree, P.	WISA 2000 Biennial Conference and Exhibition, 28 May to 1 Jun 2000 Sun City, South Africa	Management	Water Research Commission, Pretoria
2000	Dredging-related turbidity and potential environmental concern/impacts in marine systems - two case studies.	Coles, S.	10 th Southern African Marine Science Symposium : Land, Sea and People in the New Millennium, Wilderness	Biogeochemical	
2000	Alien mussel invades the Langebaan Ramsar site.	Hanekom, N.; Nel, P.	South African Wetlands, 11. November 2000.	Biological	Journal publication
2000	Circulation and residence of water in small Mediterranean-climate estuaries.	Harcourt-Baldwin, J.L.	10th Southern African Marine Science Symposium : Land, Sea and People in the New Millennium, Wilderness	Physical	
2000	Tidal and residual circulation near the mouth of Langebaan lagoon.	Krug, M.; Largier, J	10th Southern African Marine Science Symposium: Land, Sea and People in the New	Physical	University of Cape Town

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
			Millennium, Wilderness		
2000	Stratification and baroclinic circulation in Saldanha Bay	Largier, J.	10th Southern African Marine Science Symposium: Land, Sea and People in the New Millennium, Wilderness	Physical	University of Cape Town
2000	Predicting changes to hydrodynamics, water quality, sediment transport and wave resonance characteristics in Saldanha Bay resulting from alternative port expansion layouts.	Luger, S.A.; Monteiro, P.M.S.; Van Ballegooyen, R.C.	10th Southern African Marine Science Symposium: Land, Sea and People in the New Millennium, Wilderness	Physical	CSIR, Stellenbosch
2000	Portnet Saldanha: Environmental impact assesement: Specilalist report on shipping traffic risks (Confidential).	Moes, J.	CSIR report ENV-S-C 2000-139	Physical	CSIR, Stellenbosch
2000	Saldanha Bay Water Quality Monitoring Programme 1999 - 2000 : Part 1: Monitoring of Physico-chemical Parameters; Part 2: Monitoring of Microbiological Parameters	Monteiro, P.M.S.; Warwick P.A.; Pascall, A.; Franck, M.	CSIR report ENV-S-C 99093B	Biogeochemical Biological	CSIR, Stellenbosch
2000	Simulation of eutrophication and particle dynamics in a bay system in order to predict the transport and fate of trace metals using the Def3D-flow and -WAQ models	Monteiro, P.M.S.; Luger, S.; Pretorius, P.J.; Van Ballegooyen, R.	10 th Southern African Marine Science Symposium: Land, Sea and People in the New Millennium, Wilderness	Physical Biogeochemical	CSIR, Stellenbosch
2000	Sediment Assessment Programme for the Port of Saldanha: 2000	Monteiro, P.M.S.; Scott, D.	CSIR report ENV-S-C 2000-118	Biogeochemical	CSIR, Stellenbosch
2000	Shelf waves as a control over the flow, temperature and nutrient supply in Saldanha Bay, South Africa	Nelson, G.	10 th Southern African Marine Science Symposium : Land, Sea and People in the New Millennium, Wilderness	Physical Biogeochemical	Marine and Coastal Management, Cape Town
2000	Harmful algal blooms of the southern Benguela Current: A review and appraisal of monitoring from 1989 to 1997	Pitcher, G.C.; Calder, D.	South African Journal of Marine Science, 22: 255-271.	Biological	Journal publication
2000	Physical processes contributing to harmful algal blooms in Saldanha Bay, South Africa	Probyn, T.A.; Pitcher, G.C.; Monteiro, P.M.S.; Boyd, A.J.; Nelson, G.	South African Journal of Marine Science, 22: 285-297	Biological	Journal publication
2000	Mykonos harbour breakwater: Photographic monitoring of the breakwater, April 2000 (Confidential)	Van Aswegen, W.J.; Phelp, D.T.	CSIR report ENV-S-C 2000-045	Physical	CSIR, Stellenbosch
2000	Expansion of the Port of Saldanha investigated.	Van Ballegooyen, R.; Luger, S.; Monteiro, P.; Schoonees, K.; Moes, H.	Civil Engineering, 8(10): 17-18	Physical	Journal publication
2000	Assessment of the DELFT3D-PART oil spill module: Simulation of the Hawaiian King oil spill in Saldanha Bay during September 1995 (Confidential)	Van Ballegooyen, R.; Diedericks, G.	CSIR report ENV-S-I 2000-23	Physical	CSIR, Stellenbosch
2000	Photographic and topographic monitoring of the Saldanha Bay spending beach breakwater - May and November 2000.	Vonk, ;R Phelp, D.T.	CSIR report ENV-S-C 2003-080	Physical	CSIR, Stellenbosch
2000	Langebaan Road Wellfield: Isotope data from the new boreholes (Confidential).	Weaver, J.; Talma, S.	CSIR report ENV-S-C 2000-082	Physical	CSIR, Stellenbosch
2000	Saldanha Bay General Cargo Quay dredging: Benthic macrofaunal monitoring: 1999 (Confidential)	Bickerton, I.B.	CSIR report ENV-D-C 2000-010	Biological	CSIR, Stellenbosch
1999	Upwelling and fish-factory waste as nitrogen sources for suspended cultivation of <i>Gracilaria gracilis</i> in Saldanha Bay, South Africa.	Anderson, R. J.; Smit, A. J.; Levitt, G. J.	Hydrobiologia, 398/399: 455-462	Biological	Journal publication
1999	Impact of mussel culture on macrobenthic community structure in Saldanha Bay, South Africa.	Stenton-Dozey, J.M.E.; Jackson, L.F.; Busby, A.J.	Marine Pollution Bulletin, 39(1-12): 357-366	Biological	Journal Publication
1999	Saldanha Bay Water Quality Monitoring Programme 1999 - 2000: Benthic Macrofaunal Monitoring	CSIR	CSIR report ENV-S-C 99104	Biological	CSIR, Stellenbosch
1999	Marine pollution pathogenic micro-organisms in shellfish.	Grabouw, W.O.K.; Van Der Veen, A. & De Villiers, J.C.	Water Research Commission Report No 411/1/99	Biological	Water Research Commission, Pretoria

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
1999	Integrating environmental opportunities and constraints into port planning, development and operation.	Heather-Clark, S. & Du Toit, W.	In: Fifth International Conference on Coastal and Port Engineering in Developing Countries: Proceedings of the COPEDEC V, Cape Town, April 1999, ed. by G.P. Mocke; Volume 3, pp. 2153-2163.	Management	CSIR, Stellenbosch
1999	The culture of <i>Mytilus galloprovincialis</i> in South Africa and the carrying capacity of mussel farming in Saldanha Bay.	Hecht, T. & Heasman, K.	World Aquaculture, 30(4): 50-55.	Biological	Journal publication
1999	Medium-term expansion of the Port of Saldanha into Small Bay: A modelling-based predictive study of hydrodynamics(?), water quality, sediment transport and wave resonance considerations of four alternative port layouts. Volume 1. Text, Volume 2.	Luger, S., Monteiro, P.M.S., Van Ballegooyen, R.C., Schoonees, J.S. & Moes, J.	CSIR report ENV-S-C 99050 A, B	Physical	CSIR, Stellenbosch
1999	Predicting and evaluating turbidity caused by dredging in the environmentally sensitive Saldanha Bay	Luger, S.A., Schoonees, J.S., Mocke, G.P. & Smit, F.	In: Coastal Engineering 1998: Proceedings of the 26th International Conference, June 1998, Copenhagen, Denmark, ed. by B.L. Edge, Vol. 3, pp 3561-3574.	Physical	CSIR, Stellenbosch
1999	Developing a framework for the identification, assessment and management of cumulative effects on marine water quality : Saldanha Bay and Langebaan Lagoon case study (Confidential).	Makhaye, S. & Heather-Clark, S.	CSIR report ENV-S-I 9918	Management	CSIR, Stellenbosch
1999	The potential for the introduction of alien phytoplankton by shipping ballast water: observations in Saldanha Bay.	Maragoini, C.	MSc Thesis (Botany)- University of the Witwatersrand	Biological	University of the Witwatersrand
1999	Saldanha Bay Water Quality Monitoring programme 1999 – 2000: The biogeochemical status of surface sediments In Saldanha Bay in 1999.	Monteiro, P.M.S., Pascall, A. & Brown, S.	CSIR report ENV-S-C 99093A	Biogeochemical	CSIR, Stellenbosch
1999	Thermal stratification in Saldanha Bay (South Africa) and subtidal, density-driven exchange with the coastal waters of the Benguela Upwelling System	Monteiro, P.M.S. & Largier, J. L	Estuarine Coastal and Shelf Science, 49(6): 877-890.	Physical Biogeochemical	Journal publication
1999	Sediment Assessment Programme for the Port of Saldanha: 1999.	Monteiro, P.M.S.	CSIR report ENV-S-C 99131	Biogeochemical	CSIR, Stellenbosch
1999	Assessment of a potential thermal discharge in a coastal embayment using a three-dimensional hydrodynamic model	Van Ballegooyen, R.C. & Luger, S.A.	Fifth International Conference on Coastal and Port Engineering in Developing Countries: Proceedings of the COPEDEC V, Cape Town, April 1999, ed. by G.P. Mocke; Volume 3, 2018-2027 (Conference Paper reprinted, CSIR report ENV-S-R 9916	Physical	CSIR, Stellenbosch
1999	Saldanha Bay beach profile monitoring (Confidential).	Van der Merwe, L.	CSIR report ENV-S-C 99046	Physical	CSIR, Stellenbosch
1999	Trace metal partitioning in Saldanha Bay sediments (Confidential)	Pretorius, P.J., Monteiro, P.M.S. & Pascall, A.	CSIR report ENV-S-I 9911	Biogeochemical	CSIR, Stellenbosch
1998	Predictive modelling of marine water quality	Luger, S.A., Monteiro, P.M.S., Van Ballegooyen, R.C. & Pretorius, P.J.	CSIR report ENV-S-R 9833	Physical Biogeochemical	CSIR, Stellenbosch
1998	Shellfish mariculture in the Benguela System: Water flow patterns within a mussel farm in Saldanha Bay, South Africa.	Boyd, A.J. & Heasman, K.G.	Journal of Shellfish Research.,17(1): 25-32	Physical Biological	Journal publication
1998	Saldanha Bay General Cargo Quay construction: monitoring of suspended sediment distributions generated by dredging in Small Bay	Carter, R.A. & Coles, S.	CSIR report ENV/S-C 98100	Physical	CSIR, Stellenbosch

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
1998	Shellfish mariculture in the Benguela System: a carbon budget for Saldanha Bay for raft culture of <i>Mytilus galloprovincialis</i>	Grant, J., Stenton-Dozey, J., Monterio, P., Pitcher, G. & Heasman, K.	Journal of Shellfish Research, 17(1): 41-49.	Biological	Journal publication
1998	Shellfish mariculture in the Benguela System: Raft culture of <i>Mytilus galloprovincialis</i> and the effect of rope spacing on food extraction, growth rate, production, and condition of mussels	Heasman, K.G., Pitcher, G.C., Mcquaid, C.D. & Hecht, T.	J. Shellfish Res., 17(1): 33-39[exp.title]	Biological	Journal publication
1998	Draft port development framework : Port of Saldanha	Heather-Clark, S. & Okore, P.	CSIR report ENV/S-C 97152 B.	Management	CSIR, Stellenbosch
1998	Computational modelling in coastal engineering and environmental assessments.	Mocke, G., Smith, G.G. , Smit, F. & Luger, S.A.	Journal of the South African Institution of Civil Engineers, 40(3): 21-29	Physical	Journal publication
1998	Shellfish mariculture in the Benguela System: Estimates of nitrogen-driven new production in Saldanha Bay using two physical models	Monteiro, P.M.S., Spolander, B., Brundrit, G.B. & Nelson, G.	Journal of Shellfish Research., 17(1): 3-13	Physical Biogeochemical Biological	Journal publication
1998	Shellfish mariculture in the Benguela System: Phytoplankton and the availability of food for commercial mussel farms in Saldanha Bay, South Africa	Pitcher, G. C. & Calder, D.	Journal of Shellfish Research, 17(1): 15-24	Biological	Journal publication
1998	Community perceptions of helminth infection in Langebaan, Western Cape.	Saito, T., Schoeman, S. , McIntosh, H., Evans, A.C. & Fincham, J.E	South African Medical Journal, 88(7): 891-892	Management	Journal publication
1998	Impact of mussel culture on macrobenthic community structure in Saldanha Bay, South Africa	Stenton-Dozey, J.M.E., Jackson, L.F. & Busby, A.J.	Marine Pollution Bulletin, 39(1-12): 357-366	Biological	Journal publication
1998	Saldanha Bay beach profile monitoring : Draft copy (Confidential).	Van Der Merwe, L., Schoonees, J.S. & Theron, A.K.	CSIR report ENV-S-C 97008	Physical	CSIR, Stellenbosch
1998	The Langebaan road aquifer: Modelling and animation of groundwater abstraction potential (Poster summary).	Van Der Voort, I., Conrad, J. & Jones, S.	WISA 98: Biennial conference and exhibition of the Water Institute of Southern Africa (WISA), May 1998, Cape Town, South Africa; Papers, Vol.1, Poster 56 ,	Physical	CSIR, Stellenbosch
1998	Langebaan road aquifer: Drilling and testing of new wellfield (Confidential)	Weaver, J. & Fraser, L.	CSIR report ENV/S-C 98042	Physical	CSIR, Stellenbosch
1998	Shellfish mariculture in the Benguela System: Estimates of nitrogen-driven new production in Saldanha Bay using two physical models	Monteiro, P.M.S., Spolander, B., Brundrit, G.B. & Nelson, G.	CSIR report ENV-S-R 9844	Biological	CSIR, Stellenbosch
1997	Saldanha Bay General Cargo Quay dredging: Benthic macrofaunal monitoring: 1996/1997 (Confidential).	Bickerton, I.B.	CSIR report: ENV/S-C 97054	Biological	CSIR, Stellenbosch
1997	Environmental impact assessment: proposed changes to oil transfer operations: SFF, Saldanha Bay. Comments report.	Crowther Campbell & Associates.	CSIR report ENV/S-C 97136	Management	CSIR, Stellenbosch
1997	Biological monitoring of the effects of fish-factory effluents: The Southern Seas Factory, Saldanha Bay (Confidential)	Bickerton, I.B. & Brown, A.C.	CSIR report ENV/S-C 97029.	Biological	CSIR, Stellenbosch
1997	Saldanha Bay General Cargo Quay dredging: Effects of underwater blasting on benthic invertebrates and fish (Confidential).	Bickerton, I.B. Heinecken, C.	CSIR report: ENV/S-C 97055	Biological	CSIR, Stellenbosch
1997	Variation in surf-zone fish community structure across a wave-exposure gradient.	Clark, B.M.	Estuarine Coastal and Shelf Science, 44(6): 659-674.	Biological	Journal publication
1997	Trace metal contamination of the sea surface microlayer in Saldanha Bay : the potential role of ore concentrate handling at the General Cargo Quay (GCQ) (Confidential)	Monteiro, P.M.S. & Carter, R.A.	CSIR report ENV/S-C 97087	Biogeochemical	CSIR, Stellenbosch
1997	Towards a marine geographic information system for coastal research and management in Saldanha Bay.	Hamman, R. & Butcher, S.	South African Journal of Geo-Information, 17(4): 105-111.	Physical	Journal publication

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
1997	A preliminary survey of coastal river systems on the south-west coast of South Africa, Cape Columbine - Cape Point, with particular reference to the fish fauna.	Harrison, T.D.	Transactions of the Royal Society of South Africa, 52(2): 323-344	Biological	Journal publication
1997	Investigation of bacterial epiphytes of the agar-producing red seaweed <i>Gracilaria gracilis</i> (Stackhouse) Steentoft, Irvine et Farnham from Saldanha Bay, South Africa and Luderitz, Namibia.	Jaffray, A.E., Anderson, R.J. & Coyne, V.E.	Bot. Mar., 40(6): 569-576[expand title]	Biological	Journal publication
1997	Erosion setback and bio-physical sensitivity study: Erf 2801, Langebaan (Confidential)	Lenhoff, L. & Burns, M.	CSIR report ENV/S-C 97020	Physical	CSIR, Stellenbosch
1997	Research highlights 1997/1998 Volume 7. Circulation patterns in Saldanha Bay 33. (Not in electronic format)	Marine and Coastal Management	Publication of MCM	Physical	Marine and Coastal Management
1997	Alpha Saldanha Cement Project: Environmental impact assessment. Specialist Study 4: Mariculture and nearshore coastal.	Monteiro, P.M.S.	CSIR contract report ENV/S-C 97107	Physical Biological	CSIR, Stellenbosch
1997	Delta 15N as a tool to demonstrate the contribution of fish-waste-derived nitrogen to an <i>Ulva</i> bloom in Saldanha Bay, South Africa	Monteiro, P.M.S., Anderson, R.J. & Woodborne, S.	South African Journal of Marine Science, 18: 1-9.	Biogeochemical	Journal publication
1997	Mykonos harbour breakwater bathymetric and photographic survey: May 1997 (Confidential)	Phelp, D.	CSIR report ENV-S-C 97074	Physical	CSIR, Stellenbosch
1997	The port of Saldanha : Saldanha beach erosion monitoring (Draft) (Confidential)	Van der Merwe, L.	CSIR report EMAS-D 96006	Physical	CSIR, Stellenbosch
1997	Trampling associated with bait-collection for sandprawns <i>Callinassa kraussi</i> Stebbing: effects on the biota of an intertidal sandflat	Wynberg, R.P. & Branch, G.M.	Environmental Conservation, 24(2): 139-148	Biological	Journal publication
1997	Saldanha Bay wave and weather recording. Annual summary report: March 1996 to February 1997 (Confidential)	Theron, H. & Coetzee, L.	CSIR report ENV/S-C 97065	Physical	CSIR, Stellenbosch
1996	Saldanha Bay oil spill modelling : Environmental impact assessment SFF Saldanha, Specialist study S4 In: Environmental impact assessment : Proposed changes to oil transfer operations SFF, Saldanha Bay. Specialist Studies report, Vol. 2 (i)	Rossouw, M. & Grundlingh, M.I.	CSIR report EMAS-C 96005 D	Physical	CSIR, Stellenbosch
1996	Environmental impact assessment: proposed changes to oil transfer operations: SFF, Saldanha Bay. Volume 1. Draft environmental impact report.	CSIR	CSIR report EMAS-C96005B	Management	CSIR, Stellenbosch
1996	Environmental impact assessment: proposed changes to oil transfer operations: SFF, Saldanha Bay. Volume 2 (ii). Specialist studies report.	CSIR	CSIR report EMAS-C96005D	Management	CSIR, Stellenbosch
1996	Environmental impact assessment: proposed changes to oil transfer operations: SFF, Saldanha Bay. Volume 2 (i). Specialist studies report.	CSIR	CSIR report EMAS-C96005D	Management	CSIR, Stellenbosch
1996	Experimental investigations for the mariculture of <i>Gracilaria</i> in Saldanha Bay, South Africa.	Anderson, R.J., Levitt, G.J. & Share, A.	Journal of Applied Phycology, 8(4 & 5): 421-430	Biological	Journal publication
1996	The characterisation of synoptic circulation patterns in Saldanha Bay	Builski, S.W.	MSc Thesis (PhysicalOceanography)- University of Cape Town	Physical	University of Cape Town
1996	Assessment of potential impacts of oil spills on the Langebaan and nearshore coastal ecosystems, Specialist study S8. In: Environmental impact assessment: Proposed changes to oil transfer operations SFF, Saldanha Bay. Specialist Studies report	Cooper, J.	CSIR report EMAS-C 96005 D	Biological	CSIR, Stellenbosch
1996	The state of oil transfer and storage at the SFF Skurwerug complex, Saldanha Bay, Specialist study S6. In: Environmental impact assessment: Proposed changes to oil transfer operations SFF, Saldanha Bay. Specialist Studies report.	Du Toit, J.	CSIR report EMAS-C 96005 D	Management	CSIR, Stellenbosch
1996	Risk assessment of oil transfer operations, Saldanha Bay, Specialist study S10. In: Environmental impact assessment: Proposed changes to oil transfer operations SFF, Saldanha Bay. Specialist Studies report.	Gilchrist, W.C.M & Borthwick, I.	CSIR report EMAS-C 96005 D	Management	CSIR, Stellenbosch
1996	The influence of oceanographic conditions and culture methods on the	Heasman, K.G.	MSc Thesis (Ichthyology)-	Biological	Rhodes University

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	dynamics of mussel farming in Saldanha Bay, South Africa.		Rhodes University		
1996	Population growth, economic development and carrying capacity of the environment - are they compatible or in conflict?	Heydorn, A.E.F.	Suid-Afrikaanse Tydskrif vir Natuurwetenskap en Tegnologie, 15(1): 39-43.	Management	Journal publication
1996	Development of an <i>in situ</i> assay to detect bacterial pathogens of the red alga <i>Gracilaria gracilis</i> (Stackhouse) Steentoft, Irvine et Farnham	Jaffray, A.E. & Coyne, V.E.	Journal of Applied Phycology, 8(4-5): 409-414.	Biological	Journal publication
1996	Proposed changes to Saldanha Bay oil transfer operations: cost-benefit analysis, Specialist study S9. In: Environmental impact assessment: Proposed changes to oil transfer operations SFF, Saldanha Bay. Specialist Studies report.	Leiman, A. & Van Horen, C.	CSIR report EMAS-C 96005 D	Management	CSIR, Stellenbosch
1996	Establishment of an erosion setback line along Erf 2802, Langebaan (Confidential).	Lenhoff, L. & Schoonees, J.S.	CSIR report ENV/S-C 96048	Physical	CSIR, Stellenbosch
1996	Saldanha Bay oil spill modelling. Phase 1.	Marx, C. & Rossouw, M.	CSIR report EMAS-C-9593	Physical	CSIR Stellenbosch
1996	Effects of proposed dredging activities on turbidity levels and shoreline stability in Saldanha Bay: Environmental impact assessment SFF Saldanha, Specialist study S 3 (i) In: Environmental impact assessment: Proposed changes to oil transfer operations SFF, Saldanha Bay. Specialist Studies report.	Mocke, G., Luger, S., Smit, F., Schoonees, J. & Theron, A.	CSIR report EMAS-C 96005 D	Physical	CSIR, Stellenbosch
1996	Technical feasibility of a single point mooring as an alternative to the Saldanha crude oil terminal, Specialist study S1. In: Environmental impact assessment: Proposed changes to oil transfer operations SFF, Saldanha Bay. Specialist Studies report.	Moes, J.	CSIR report EMAS-C 96005 D	Physical	CSIR, Stellenbosch
1996	Underkeel clearance requirements and mooring optimisation for VLCCs entering the Port of Saldanha Bay, Specialist study S2. In: Environmental impact assessment: Proposed changes to oil transfer operations SFF, Saldanha Bay. Specialist Studies report.	Moes, J.	CSIR report EMAS-C 96005 D	Physical	CSIR, Stellenbosch
1996	Harmful algal blooms and mariculture farming in Saldanha Bay	Pitcher, G., Calder, D., Davis, G. & Nelson C.	In: Aquaculture '94: Third Congress of the Aquaculture Association of Southern Africa, Kruger National Park, 21-23 Sep 1994, ed. by P. Cook and W. Uys (Proceedings of the Aquaculture Association of Southern Africa, No. 5) 1996	Biological	Marine and Coastal Management, Cape Town
1996	Saldanha Bay oil spill modelling, Specialist study S4. In: Environmental impact assessment: Proposed changes to oil transfer operations SFF, Saldanha Bay. Specialist Studies report.	Rossouw, M.	CSIR report EMAS-C 96005 D	Physical	CSIR, Stellenbosch
1996	Entrainment in Saldanha Bay	Spolander, B.J.	MSc Thesis (Physical Oceanography) – University of Cape Town	Physical	University of Cape Town
1996	The impact of oil transfer and storage on the seawater quality in Saldanha Bay, Specialist study S7 (ii). In: Environmental impact assessment: Proposed changes to oil transfer operations SFF, Saldanha Bay. Specialist Studies report.	Taljaard, S., Windt, C.N., Visser, E. & Carter, R.	CSIR report EMAS-C 96005 D	Physical Biogeochemical	CSIR, Stellenbosch
1996	Specialist study on groundwater, Specialist study S7 (i). In: Environmental impact assessment: Proposed changes to oil transfer operations SFF, Saldanha Bay. Specialist Studies report.	Weaver, J.M.C & Wright, A.	CSIR report EMAS-C 96005	Physical Biogeochemical	CSIR, Stellenbosch

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1996	The Saldanha Bay Mariculture - Environment programme: Marine science towards a sustainable growth of mariculture in Southern Africa	Monteiro, P.M.S., Pitcher, G., Brundrit, G.B., Carter, R., Nelson, G. & Attwood, C.	In: Aquaculture '94: Third Congress of the Aquaculture Association of Southern Africa, Kruger National Park, 21-23 Sep 1994, ed. by P. Cook and W. Uys (Proceedings of the Aquaculture Association of Southern Africa, No. 5) 1996, pp 16-24	Biological Management	CSIR, Stellenbosch
1996	Experimental investigations for the mariculture of Gracilaria in Saldanha Bay, South Africa.	Anderson, R.J., Levitt, G.J. & Share, A.	Journal of Applied Phycology, 8(4-5): 421-430	Biological	Journal publication
1995	The effect of localised eutrophication on competition between Ulva lactuca (Ulvaaceae, Chlorophyta) and a commercial resource of Gracilaria verrucosa (Gracilariaceae, Rhodophyta).	Anderson, R.J. Monteiro, P.M.S. & Levitt, G.J.	Hydrobiologia, 326-327: 291-296	Biological	Journal publication
1995	Thermal effluent: potential behaviour and ecological impact in Saldanha Bay (Confidential).	Carter RA Mocke GP Bickerton I Zoutendyk P	CSIR report EMAS-C 95008	Biogeochemical Biological	CSIR, Stellenbosch
1995	Environmental audit of Portnet and SFF Association operations and contingency plans: Saldanha (Confidential)	Cerff, E.C., Botha, W.F., Morant, P.D., Marx, C.S. & Bickerton, I.B.	CSIR report EMAS-C 95097.	Management	CSIR, Stellenbosch
1995	Trends of African penguin Spheniscus demersus populations in the 20th century	Crawford, R.J.M. Williams, A.J. Hofmeyr, J.H. Klages, N.T.W. Randall, R.M. Cooper, J. Dyer, B.M. & Chesselet, Y.	South African Journal of marine Science 16: 101-118	Biological	Journal publication
1995	Summer incidence of humpback whales on the west coast of South Africa.	Findlay, K.P. & Best, P.B.	South African Journal of marine Science, 15: 279-282.	Biological	Journal publication
1995	The occurrence and implications of settlement of the sea squirt, Ciona intestinalis, and mussel spat on commercial mussel rafts in Saldanha Bay, South Africa	Heasman, K.G., Hecht, T. & Mcquaid, C.D.	Aquaculture Association of South Africa Newsletter, 32: 6-7.	Biological	Rhodes University
1995	Research Highlights Volume 5 - 1995/1996. Determining the carrying capacity of Saldanha Bay for mussel farming http://www.environment.gov.za/mcm/support/reshil5.htm	Marine and Coastal Management	Publication of MCM	Biological	Marine and Coastal Management, Cape Town
1995	Ramsar site update	Marneweck, G.C. & Cowan, G.I.	South African Wetlands, 5: 8-10.	Management	Journal publication
1995	A study of the relationship between environmental conditions and salt marsh zonation on Langebaan lagoon.	Reaper, M.B.S.	MA (Environmental and Geographical Sciences) – University of Cape Town	Biological	University of Cape Town
1995	Prioritizing South African estuaries for conservation: a practical example using water birds.	Turpie, J.K.	Biological Conservation, 74: 175-185	Biological	Journal publication
1994	Proposed extension of the general cargo quay Port of Saldanha. Draft Environmental Impact Report	CSIR	CSIR report EMAS-C94095	Management	CSIR, Stellenbosch
1994	Saldanha Steel Project Phase 2. Environmental Impact Assessment. Appendix 13. Additional project information: A: Water requirement and water	CSIR	CSIR report EMAS-C 94017D	Management	CSIR, Stellenbosch

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	treatment, B: Materials handling - waste, C: Report on conceptual design and preliminary cost estimates.				
1994	Saldanha Steel Project Phase 2. Final Environmental Impact Report.	CSIR	CSIR report EMAS-C 94017C	Management	CSIR, Stellenbosch
1994	Dynamics of two harbours : Port Elizabeth and Saldanha Bay.	De Meillon, E.	MSc (Oceanography) – University of Port Elizabeth	Physical	University of Port Elizabeth
1994	Mussel rafts, what mysteries?	Heasman, K.G. Hecht, T.	Third Congress of the Aquaculture Association of Southern Africa (21 to 23 Sep 1994 : Berg-en-Dal, Kruger National Park, South Africa). Cook, P. and Uys, W. (Eds).	Management	
1994	Langebaan and the law	Hill, R.	African Wildlife, 48(5): 11,13,15-16.	Management	Journal publication
1994	Research Highlights Volume 4 - 1994/1995. Environmental factors affecting mussel farming in Saldanha Bay http://www.environment.gov.za/mcm/support/reshil4.htm	Marine and Coastal Management	Publication of MCM	Biological	Marine and Coastal Management, Cape Town
1994	Mariculture and the environment. The Saldanha Bay system programme	Monteiro, P.M.S.	Aquaculture Association of South Africa Newsletter, 26: 15-17	Management	University of Cape Town
1994	The Saldanha Bay mariculture-environment programme: marine science towards a sustainable growth of mariculture in southern Africa.	Monteiro, P.M.S.; Pitcher, G. Brundrit, G.B. Carter, R. Nelson, G. & Attwood, C.	Third Congress of the Aquaculture Association of Southern Africa (21 to 23 Sep 1994 : Berg-en-Dal, Kruger National Park, South Africa). Cook, P. and Uys, W. (Eds.)	Management	Marine and Coastal Management, Cape Town
1994	The saltmarsh vegetation of Langebaan Lagoon	O'Callaghan, M.	Bothalia, 24(2): 217-222	Biological	Journal publication
1994	Harmful algal blooms and mussel farming in Saldanha	Pitcher, G. Calder, D. Davis, G. Nelson, G.	Third Congress of the Aquaculture Association of Southern Africa (21 to 23 Sep 1994 : Berg-en-Dal, Kruger National Park, South Africa). Cook, P. and Uys, W. (Eds).	Biological	Marine and Coastal Management, Cape Town
1994	Mykonos harbour breakwater bathymetric and photographic survey : April 1994 (Confidential).	Roux, C. & Phelp, D.	CSIR report EMAS-C 94034	Physical	CSIR, Stellenbosch
1994	Nitrogenase activity in marine sediments from a temperate saltmarsh lagoon: modulation by complex polysaccharides, ammonium and oxygen.	Tibbles, B.J. Lucas, M.I. Coyne, V.E. & Newton, S.T.	Journal of Experimental Marine Biology and Ecology, 184(1): 1-20	Biological	Journal publication
1994	Characterization of nitrogen-fixing bacteria from a temperate saltmarsh lagoon, including isolates that produce ethane from acetylene	Tibbles, B.J. & Rawlings, D.E.	Microbial Ecology, 27(1): 65-80	Biological	Journal publication
1994	Saldanha Steel Project Phase 2. Environmental Impact Assessment. Appendix 5. Specialist study of groundwater.	Weaver, J. & Wright, A.	CSIR report EMAS-C 94017D	Physical	CSIR, Stellenbosch
1994	Shell weakening in marine mytilids attributable to blue-green alga <i>Mastigocoleus</i> Sp. (Nostochopsidaceae).	Webb, S.C. & Korrubel, J.L.	Journal of Shellfish Research, 13(1): 11-17	Biological	Journal publication
1994	Disturbance associated with bait-collection for sandprawns (<i>Callinassa kraussi</i>) and mudprawns (<i>Upogebia africana</i>): long-term effects on the biota of intertidal sandflats.	Wynberg, R.P.; Branch, G.M.	Journal of Marine Research ,52(3): 523-558	Biological	Journal publication
1993	Environmental management in the oil industry conference. Conference organised by International Executive Communications, Johannesburg, South Africa	Anon	CSIR report ECRU - S1407	Management	CSIR, Stellenbosch
1993	Late Pleistocene human remains from Sea Harvest site, Saldanha Bay, South	Grine, F.E. & Klein, R.G.	South African Journal of	Physical	Journal publication

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	Africa.		Science, 89(3): 145-152[expand title]		
1993	Trends in pelagic fish populations of the Saldanha Bay region, Southern Benguela Upwelling System, 1980-1990: a predator's perspective	Laugsch, R.C. & Adams, N.J.	South African Journal of Marine Science, 13: 295-307	Biological	Journal publication
1993	Floating boat jetty at Langebaan (Confidential).	Moes, J.	CSIR report EMAS-C 93105	Physical	CSIR, Stellenbosch
1993	Factors affecting relative rates of growth in four South African mussel species.	Van Erkom Schurink, C. & Griffiths, C.L.	Aquaculture, 109(3-4): 257-273	Biological	Journal publication
1993	The role of herbivores in the collapse of the Gracilaria resource at Saldanha Bay, South Africa.	Anderson, R.J.; Levitt, G.J.; Keats, D.W.; Simons, R.H.	Hydrobiologia, 260/261: 285-290;	Biological	Journal publication
1992	Longbeach dune and vegetation management plan (Confidential).	Burns, M.	CSIR report EMAS-C 92087	Physical	CSIR, Stellenbosch
1992	Mariculture in Saldanha Bay: Opportunities and constraints.	Carter, R.A.	CSIR report EMAS-C 92047	Biological	CSIR, Stellenbosch
1992	Environmental tolerances in culture and agar content of Gracilaria verrucosa (Hudson) Papenfuss (Rhodophyta, Gigartinales) from Saldanha Bay	Engledow, H.R. And Bolton, J.J.	South African Journal of Botany, 58(4): 263-267	Biological	Journal publication
1992	Marine invasive aliens on South African shores: Implications for community structure and trophic functioning.	Griffiths, C.L. Hockey, P.A.R. Erkom Schurink, C. Van & Le Roux, P.J.	South African Journal of Marine Science, 12: 713-722.	Biological	Journal publication
1992	The current status, future prospects, and environmental implications of mariculture in South Africa.	Hecht T. & P.J. Britz.	S. Afr. J. Sci., 88:335-342[expand title]	Management	Journal publication
1992	A checklist of birds of the Langebaan National Park.	Hockey, Par.	Percy FitzPatrick Institute of African Ornithology, University of Cape Town. Unpublished manuscript.	Biological	University of Cape Town
1992	The effect of recreational activities of tourists in and around the Langebaan Lagoon on the traditional fishing community.	Makka, S.J.	BA (Hons.) (Geography and Environmental Studies) – University of the Western Cape.	Management	University of the Western Cape
1992	Estimates of bacterial productivity in marine sediments and water from a temperate saltmarsh lagoon.	Tibbles, B.J. Davis, C.L. Harris, J.M. & Lucas, M.I.	Microbial Ecology, 23(3): 195-209	Biological	Journal publication
1992	Mussel survey of the Saldanha Bay ore jetty	Zoutendyk, P.	CSIR report EMAS-C 92004	Biological	CSIR, Stellenbosch
1992	Causes of damage to Saldanha sand breakwater.	Schoonees, J.S.; Kluger, J.W.J.; Zwamborn, J.A.	Proceedings 22nd Coastal Engineering Conference, The Netherlands, 1990, Volume 3, [ed.B.L.Edge]. New York: Society of Civil Engineers.	Physical	
1991	Monitoring of Saldanha Bay spending beach breakwater	Anderson, E.J. & Serdyn, J.	CSIR report EMA-C 9124	Physical	CSIR, Stellenbosch
1991	Wetlands enjoy high priority for protection.	Cowan, G.I.	South African Wetlands, 1: 4-7.	Management	Journal publication
1991	Human activities and factors affecting the distribution of macrobenthic fauna in Saldanha Bay.	Jackson, L.F. & Mcgibbon, S.	Southern African Journal of Aquatic Sciences, 17(1-2): 89-102	Biological	Journal publication
1991	Evaluation of the discharge of selected fish factory effluents and the impact on the adjacent marine environment (Confidential)	Taljaard, S. Skibbe, E. & Fijen, A.P.M.	CSIR report EMA-C 91171	Biogeochemical Biological	CSIR, Stellenbosch
1991	A note on wind-driven replacement flow of the bottom layer in Saldanha Bay, South Africa: implications for pollution.	Weeks, S.J. Monteiro, P.M.S. Nelson, G. & Cooper, R.M.	South African Journal of Marine Science, 11: 579-583	Physical	Journal publication
1991	An assessment of bait-collecting for Callianassa kraussi Stebbing in Langebaan Lagoon, Western Cape, and of associated avian predation	Wynberg, R.P. & Branch, G.M.	South African Journal of Marine Science, 11: 141-152	Biological	Journal publication
1990	Saldanha Bay, South Africa: Recovery of Gracilaria verrucosa (Gracilariales, Rhodophyta).	Rotmann, K.W.	Hydrobiologia, 204-205: 325-330	Biological	Journal publication
1990	Design and construction of pleasure craft harbour - Club Mykonos Langebaan.	Bosman, D.E. Retief, G.De F. Kapp, J.F Kloos, M. & Ridge, A.B.	In: Proceedings 22nd Coastal Engineering Conference. The Netherlands, 1990, Volume 3,	Physical	CSIR, Stellenbosch

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1990	Langebaan beachfront development.	Burns, M.	CSIR report EMA-C 9059	Physical	CSIR, Stellenbosch
1990	Interannual chlorophyll variability In South Africa's Saldanha Bay system, 1974-1979.	Monteiro, P.M. & Brundrit, G.B.	South African Journal of Marine Science, 9: 281-287.	Physical Biogeochemical Biological	Journal publication
1990	A decade of change in Saldanha Bay: Natural or anthropogenic?	Monteiro, P.M.S. Mcgibbon, S. & Henry, J.L.	South African Journal of Science, 86(7-10): 454-456.	Biogeochemical	Journal publication
1990	Causes of damage to Saldanha sand breakwater.	Schoonees, J.S. Kluger, J.W.J. & Zwamborn, J.A.	In Proceedings 22nd Coastal Engineering Conference, The Netherlands, 1990, Volume 3, (ed.B.L.Edge). New York: American Society of Civil Engineers. 3305pp. [In 3 Vols]. pp.2416-2429.	Physical	CSIR, Stellenbosch
1989	Commercial seaweeds in southern Africa: a review of utilization and research.	Anderson, R J, Simons, Rh & Jarman, Ng,	South African Journal of marine Science, 8: 277-299	Biological	Journal publication
1989	The effect of temperature, salinity and light intensity on the growth of <i>Gracilaria verrucosa</i> - South Africa	Engledow, H.R.	MSc (Botany) – University of Cape Town	Biogeochemical Biological	University of Cape Town
1989	Blinder Island causeway: Saldanha Bay impact assessment	Lord, D.A. Robertson, B.L. Talbot, M.M.B. & Prestedge, G.	Institute for Coastal Research, University of Port Elizabeth. 50 pp.	Management	University of Port Elizabeth
1989	Blinder Island causeway: Saldanha Bay environmental impact assessment (Confidential)	Robertson, B.L. Talbot, M.M.B. & Prestedge, G	University of Port Elizabeth, Institute for Coastal Research, Report C.7. Port Elizabeth. 58 pp.	Management	University of Port Elizabeth
1989	Composition, species richness and the similarity of ichthyofaunas in eelgrass <i>Zostera capensis</i> beds of southern Africa	Whitfield, A.K., Beckley, L.E., Bennet, B.A., Branch, G.M., Kok, H.M., Potter, I.C. & Van Der Elst, R.P.	South African Journal of marine Science, 8: 251-259	Biological	Journal publication
1988	Langebaan municipal holiday resort: development set-back analysis and management recommendations (Confidential).	Burns, M.E.R. & Barwell, L.	CSIR (Ad Hoc) report OX/C/CW16/10	Physical	CSIR, Stellenbosch
1988	Ocean outfall studies at Saldanha. Report no.9. Executive summary report: The feasibility of marine disposal for the Saldanha/Vredenburg region (Confidential)	CSIR	CSIR report C/SEA 8828	Management	CSIR, Stellenbosch
1988	Benthic diatom biomass, production and sediment chlorophyll in Langebaan Lagoon, South Africa.	Fielding, P.J. Damstra, K.S. & Branch, G.M.	Estuarine, Coastal and Shelf Science, 27(4): 413-426.	Biological	Journal publication
1988	An assessment of the role of the sand shark <i>Rhinobatos annulatus</i> as a predator in Langebaan Lagoon.	Harris, S A, Bennet, B A & Branch, G M	South African Journal of marine Science, 7: 153-159	Biological	Journal publication
1988	Ocean outfall studies at Saldanha. Report no.8. Dilution calculations and evaluation of effects (Confidential)	Fijen APM Toms, G.	CSIR report C/SEA 8827	Physical	CSIR, Stellenbosch
1988	Ocean outfall studies at Saldanha. Report no.9. Executive summary report : The feasibility off marine disposal for the Saldanha/ Vredenburg region (Confidential)	Anon	CSIR report C/SEA 8828	Management	CSIR, Stellenbosch
1987	The Benguela Ecosystem. Part IV. The major fish and invertebrate resources.	Crawford, Rjm, Shannon, Lv And Pollock, De.	Oceanography and Marine Biology Annual Review, 25: 353-505	Biological	Journal publication
1987	Langebaan to Agulhas: A coastal survey: A survey for the Flora Conservation Committee of the Botanical Society of South Africa.	Jeffery, D. & Moll, E.J.	Veld & Flora, 73(3): 102-107.	Biological	Journal publication

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1987	Moored ship studies at Saldanha Bay harbour : Field studies interpretation report.	Moes, J.	CSIR report C/SEA 8750.	Physical	CSIR, Stellenbosch
1987	Waders (Charadrii) and other waterbirds at Langebaan Lagoon, South Africa, 1975-1986	Underhill, L.G.	Ostrich, 58(4): 145-155	Biological	Journal publication
1986	Mykonos harbour breakwater bathymetric and photographic survey: April 1996 (Confidential).	Phelp, D.T., Roux, C. & Kloos, M.	CSIR report ENV/S-C 96032	Physical	CSIR, Stellenbosch
1986	Guide to water and waste water management in the pelagic fishing industry	Binnie & Partners	Water Research Commission Report TT28/87	Management	Water Research Commission, Pretoria
1985	Utilization by shorebirds of benthic invertebrate production in intertidal areas	Baird, D., Evans, P.R., Milne, H. & Pienkowski, M.W.	Oceanography and Marine Biology Annual Review, 23: 573-597	Biological	University of Port Elizabeth
1985	The Benguela Ecosystem. Part II. Chemistry and related processes	Chapman, P & Shannon, Lv.	Oceanogr. Mar. Biol. Ann. Rev., 23: 183-251	Biogeochemical	Journal publication
1985	Using LANDSAT, TIROS-N and texture data for vegetation mapping in the Langebaan area, South Africa.	Pendock, N. Add De Gasparis, A.A.	South African Journal of Photogrammetry, Remote Sensing and Cartography, 14(3): 189-199	Biological	Journal publication
1985	Ocean outfall studies at Saldanha. Report no.6. Physical data acquisition at Noordwesbaai. Vol.1. Description and analysis.	Botes, W.A.M. Van Niekerk, M. Buirski, J. Smith, C. Roux, C. Toms, G.	CSIR report C/SEA 8542/1	Physical	CSIR, Stellenbosch
1985	Ocean outfall studies at Saldanha. Report no.6. Physical data acquisition at Noordwesbaai. Vol. 2. Data Files.	Botes, W.A.M. Van Niekerk, M. Buirski, J. Smith, C. Roux, C. Toms, G.	CSIR report C/SEA 8542/2	Physical	CSIR, Stellenbosch
1985	Ocean outfall studies at Saldanha. Report no.6. Data Figures	Botes, W.A.M. Van Niekerk, M. Buirski, J. Smith, C. Roux, C. Toms, G.	CSIR report C/SEA 8542/3	Physical	CSIR, Stellenbosch
1985	Saldanha outfall studies. Report no.7. Wave climate at Noordwesbaai, February to December 1983.	Theron, A. Coetzee, L.	CSIR report C/SEA 8539	Physical	CSIR, Stellenbosch
1984	The influence of temperature variations and thermal pollution on various aspects of the biology of the prawn Palaemon pacificus (Stimpson).	Achituv, Y.; Cook, P.A.	Journal of Experimental Marine Biology and Ecology, 74(3): 291-302	Biological	Journal publication
1984	Coastal sensitivity atlas of southern Africa 1984	Jackson, L F & Lipschitz, S.	Publication for Dept of Transport, Pretoria	Management	Marine and Coastal Management, Cape Town
1984	Ocean outfall studies at Saldanha. Report no.5. A geophysical survey of North West Bay.	Martin, A.K.	CSIR report C/SEA 8438	Physical	CSIR, Stellenbosch
1983	Ore loading influences on heavy metal concentrations in Saldanha Bay	Henry, J.L. & Davis, G.	South African Journal of Science, 79(4): 162.	Biogeochemical	Journal publication
1983	Computation of ship motions with program Hansel (Confidential)	Moes, J.	NRIO Memorandum 8320	Physical	CSIR, Stellenbosch
1983	Dynamics of moored ships in Saldanha Bay: a feasibility study	Moes, J.	CSIR report C/SEA 8329	Physical	CSIR, Stellenbosch
1983	The Benguela upwelling area	Nelson, G. & Hutchings, L.	Progress in Oceanography, 12: 333-356	Physical Biological	Journal publication

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
1983	A survey on water and effluent management in the fish processing industry in South Africa	Binnie & Partners	Water Research Commission Report	Management	Water Research Commission, Pretoria
1982	Interactions between breeding seabird and pelagic fish populations in the Southern Benguela Region.	Furness, R.W. & Cooper, J.	Marine Ecology Progress Series, 8(2): 243-250	Biological	Journal publication
1982	Time series of tidal circulation and velocities in Saldanha	Huizinga, P	CSIR report T/SEA 8201	Physical	CSIR, Stellenbosch
1982	Ocean outfall studies at Saldanha. Report no.3. Follow-up biological and chemical survey off Noordwesbaai.	Eagle, G.A. Zoutendyk, P. Bartlett, P.D.	CSIR report C/SEA 8221	Biogeochemical	CSIR, Stellenbosch
1982	Ocean outfall studies at Saldanha. Report no.4. Toxicity testing with proposed effluent from Noordwesbaai outfall	Hennig, H.F.-K.O. Fricke, A.H. Eagle, G.A.	CSIR report C/SEA 8220	Biogeochemical	CSIR, Stellenbosch
1981	Lobster catch rates plummet: small fish dominate landings.	Anon	South African Shipping News and Fishing Industry Review, 36(7): 24	Biological	Journal publication
1981	An experimental study on iron accumulation in the clam <i>Mactra lilacea</i>	Beckley, L.E.	Marine Pollution Bulletin, 12(4): 138-139.	Biological	Journal publication
1981	Marine benthos near the Saldanha Bay iron-ore loading terminal.	Beckley, L.E.	South African Journal of Zoology, 16(4): 269-271.	Biological	Journal publication
1981	The living shores of southern Africa	Branch, G M, Branch, M & Bannister, A.	Cape Town: C Struik. 272 pp.	Physical Biogeochemical Biological	Journal publication
1981	Chapter 7. Primary production in Langebaan Lagoon	Christie, N.D.	In: Estuarine ecology, with particular reference to southern Africa. Day, J H (ed.). Cape Town: AA Balkema. pp 101-115.	Biological	University of Cape Town
1981	Chapter 14: Summaries of current knowledge of 43 estuaries in southern Africa	Day, J H.	In: Estuarine ecology with particular reference to southern Africa. Day, J H (ed.). Cape Town: AA Balkema. pp 251-329.	Physical Biogeochemical Biological Management	University of Cape Town
1981	The geology of Saldanha Bay.	De La Cruz, M.A. & Du Plessis, A	Bull Geol Surv S Afr, Issue 70;	Physical	Journal publication
1981	Chapter 8. Estuarine plankton.	Grindley, J.R.	In: Estuarine Ecology, with particular reference to southern Africa. Day, J H (ed.). Cape Town: AA Balkema. pp 117-146.	Biological	University of Cape Town
1981	Remote sensing applications in vegetation mapping, with special reference to the Langebaan area, South Africa.	Jarman, M.L.	MSc (Botany) – University of Cape Town	Biological	University of Cape Town
1981	Use of LANDSAT data in mapping vegetation at a semi-detailed scale in the Langebaan area, South Africa.	Jarman, M.L. & Jackson, A.	South African Journal of Photogrammetry, Remote Sensing and Cartography, 13: 25-37.	Biological	University of Cape Town
1981	Annual summer and winter fluctuations of Palaearctic and resident waders (Charadrii) at Langebaan Lagoon, South Africa, 1975-1979.	Robertson, H.G.	In: Cooper, J (ed). Proceedings on Birds of the Sea and Shore, 1979. Cape Town: Seabird Group. pp 335-345.	Biological	No data
1981	Chapter 13. The estuarine avifauna of southern Africa	Siegfried, W.R.	In: Estuarine ecology, with particular reference to southern Africa. Day, J H (ed.). Cape	Biological	University of Cape Town

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
			Town: AA Balkema. pp 223-250		
1981	Ocean outfall studies at Saldanha. Report no.1. Preliminary biological and chemical survey of Noordwesbaai (Confidential)	Zoutendyk P Fricke AH Bartlett PD Eagle GA	CSIR report C/SEA 8112	Biogeochemical Biological	CSIR, Stellenbosch
1981	Ocean outfall studies at Saldanha. Report no.2. Marine geological site investigations: North Head to Cape Columbine, February 1981.	Flemming, B.W. Engelbrecht, J.C.	CSIR report C/SEA 8149	Physical	CSIR, Stellenbosch
1980	Mathematical models of the Langebaan Lagoon ecosystem	Ansell, S.V.	MSc (Mathematical Statistics) – University of Cape Town	Physical	University of Cape Town
1980	Guide to the Cainozoic deposits of the Saldanha Bay Langebaan Lagoon area	Flemming, B. W.	CSIR report T/SEA 8002	Physical	CSIR, Stellenbosch
1980	An evaluation of Langebaan rock phosphate, calmafos phosphatic slag, and superphosphate with maize and pasture on various soil series	Heard, C.A.H.	MScAgric (Crop Science) – University of Natal (Pietermaritzburg)	Physical	University of Natal (Pietermaritzburg)
1980	Energy budgets of Curlew Sandpipers at Langebaan Lagoon, South Africa.	Puttick, G.M.	Estuarine and Coastal Marine Science, 11(2): 207-215	Biological	Journal publication
1980	Saldanha Bay: water quality simulation model. Report no.2. A 2-D finite model for hydrodynamical and water-quality computations.	Huizinga, P.	CSIR report C/SEA 8041	Physical	CSIR, Stellenbosch
1980	Saldanha Bay: water simulation model. Report no.4. Calibration of the hydrodynamic numerical model.	Huizinga, P.	CSIR report C/SEA 8042	Physical	CSIR, Stellenbosch
1979	The status of seabirds at the islands of Saldanha Bay, and recommendations for their management.	Cooper, J	Final report of research conducted January 1977 – December 1978. Rondebosch: Percy FitzPatrick Institute of African Ornithology, University of Cape Town.	Biological	University of Cape Town
1979	Phosphate occurrences on the western and southern coastal areas and continental shelves of southern Africa.	Fuller, A.O.	Economic Geology and the Bulletin of the Society of Economic Geologists, 74(2): 221-231.	Physical	Journal publication
1979	A preliminary analysis of bacterial numbers and biomass in Langebaan lagoon.	Mazure, H.G.F. & Branch, G.M.	Transactions of the Royal Society of South Africa, 44(1): 43-54.	Biological	University of Cape Town
1979	Some ecological, experimental and evolutionary aspects of the upwelling ecosystem.	Parsons T.R.	South African Journal of Science, 75: 536-540	Biological	Journal publication
1979	A look at South African port investment.	Stevens, B.	Dock and Harbour Authority, 60(706): 159-161	Management	Journal publication
1979	Geochemical and pollution studies on sediments from Saldanha Bay and Langebaan.	Willis, J.P. & Fortuin, H.H.G.	In: Geocongress (1979 : University of Port Elizabeth), CSIR Library: P01606	Physical	CSIR, Stellenbosch
1979	The construction of Saldanha Bay harbour.	Zwemmer, D. & Van't Hof, J.	Civil Engineer in South Africa, 21(10): 238-240	Physical	Journal publication
1979	Saldanha Bay water quality simulation model. Report no.1. Prototype data for model construction and calibration.	Zacks, J.	CSIR report C/SEA 7924	Physical	CSIR, Stellenbosch
1979	Saldanha Bay water quality simulation model. Report no.3. Comparison of alternative outfall locations.	Huizinga, P.	CSIR report C/SEA 7925	Physical	CSIR, Stellenbosch
1978	Marine geophysical and geological investigations in Saldanha Bay.	De La Cruz, M.A.	Bull Mar Geosci Group, Issue 9,	Physical	University of Cape Town

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
1978	Marine geophysical and geological investigations in Saldanha Bay.	De La Cruz, M.A.	MSc (Geology) – University of Cape Town	Physical	University of Cape Town
1978	A study of the effects of dredging on the benthic macrofauna in Saldanha Bay.	Moldan, A.	South African Journal of Science, 74(3): 106-108.	Biological	Marine and Coastal Management, Cape Town
1978	The diet of the Curlew Sandpiper at Langebaan Lagoon, South Africa.	Puttick, G.M.	Ostrich, 49: 158-167	Biological	Journal publication
1978	Early archeological evidence for shellfish collecting.	Volman, T.P.	Science, 201(4359): 911-913	Management	Journal publication
1977	Phosphorites from the Saldanha Bay region.	Birch, G F	Transactions of the Royal Society of South Africa, 42(3-4): 223-240.	Physical	Journal publication
1977	The vegetation of the Langebaan area, South Africa.	Boucher, C. & Jarman, M.L.	Transactions of the Royal Society of South Africa, 42(3 and 4): 241-272	Biological	Journal publication
1977	Distribution of benthic macrofauna in Langebaan Lagoon.	Christie, N.D.; Moldan, A.	Transactions of The Royal Society of South Africa, 42(3-4): 273-284.	Biological	Journal publication
1977	Effects of fish factory effluent on the Benthic macrofauna of Saldanha Bay.	Christie, N.D.; Moldan, A.	Marine Pollution Bulletin, 8(2): 41-45.	Biological	Journal publication
1977	Summaries of current knowledge of 43 estuaries in southern Africa.	Day, J H	In: Estuarine ecology with particular reference to southern Africa. Day, J H (ed.), Cape Town: AA Balkema. pp 251-329	Physical Biogeochemical Biological Management	
1977	Marine geophysical and geological investigations in Saldanha Bay.	De La Cruz, M.A.	Tech. Rep. Univ. Cape Town Mar. Geol. Prog, No 10. In: Marine Geology Programme - progress reports for the year 1977. pp. 43-50	Physical	University of Cape Town
1977	The bedrock basement in Saldanha Bay.	De La Cruz, M.A.	Tech Rep Mar Geol Programme S Afr Natl Comm [Rondebosch]; Issue 9. pp 136-143.	Physical	University of Cape Town
1977	Geophysical investigations in Saldanha Bay.	Du Plessis, A. & De La Cruz, M.A	Transactions of the Royal Society of South Africa, 42(3-4): 285-302.	Physical	Journal publication
1977	Larval development settlement and growth of the black mussel <i>Chloromytilus meridionalis</i> in the Saldanha Bay region.	Du Plessis, A.J.	Transactions of the Royal Society of South Africa, 42(3-4): 303-316.	Biological	Journal publication
1977	Langebaan Lagoon: a mixed carbonate-siliciclastic tidal environment in a semi-arid climate.	Flemming, B. W.	Sedimentary Geology, 18(1-3): 61-95.	Physical	Journal publication
1977	Depositional history of Saldanha Bay sediments interpreted by scanning electron microscopy.	Flemming, B. W.	Proceedings of the Electron Microscopy Society of Southern Africa, vol 7, p 77 CSIR, Stellenbosch Library (R/SEA 7801)	Physical	CSIR, Stellenbosch
1977	Depositional processes in Saldanha Bay and Langebaan Lagoon.	Flemming, B. W.	CSIR research report 362.	Physical	CSIR, Stellenbosch
1977	Distribution of recent sediments in Saldanha Bay and Langebaan Lagoon.	Flemming, B. W.	Transactions of the Royal Society of South Africa, 42(3 and 4): 317-340.	Physical	Journal publication
1977	Depositional processes in Saldanha Bay and Langebaan Lagoon.	Flemming, B. W.	PhD (Geology) – University of Cape Town	Physical	University of Cape Town
1977	The zooplankton of Langebaan Lagoon and Saldanha Bay.	Grindley, J.R.	Transactions of the Royal	Biological	Journal publication

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
			Society of South Africa, 42(3-4): 341-370.		
1977	Phytoplankton production in Langebaan Lagoon and Saldanha Bay.	Henry, J.L. & Mostert, S.A.	Transactions of the Royal Society of South Africa, 42(3-4): 383-398.	Biological	Journal publication
1977	Spatial and temporal variations in inter-tidal animal distribution at Langebaan Lagoon, South Africa.	Puttick, G.M.	Transactions of the Royal Society of South Africa, 42(3-4): 403-440	Biological	Journal publication
1977	Physical and chemical characteristics of water in Saldanha Bay and Langebaan Lagoon.	Shannon, L.V. & Stander, G.H.	Transactions of the Royal Society of South Africa, 42(3-4): 441-460	Physical	Journal publication
1977	The algal flora of Saldanha Bay.	Simons, R.H.	Transactions of the Royal Society of South Africa, 42(3-4): 461-482	Biological	Journal publication
1977	Distribution abundance and energy relationships of waders (<i>Aves charadrii</i>) at Langebaan Lagoon.	Summers, R.W.	Transactions of the Royal Society of South Africa, 42(3-4): 483-494	Biological	Journal publication
1977	A preliminary report on the geochemistry of recent sediments in Saldanha Bay and Langebaan Lagoon.	Willis, J.P., Fortuin, H.H.G. & Eagle, G.A.	Transactions of the Royal Society of South Africa, 42(3 and 4): 497-509	Biogeochemical	Journal publication
1976	South African Marine Pollution Survey Report 1974-1975.	Cloete, C.E.; Oliff, W.D.	South African National Scientific Programmes Report, No 8	Biogeochemical	CSIR, Stellenbosch
1976	Iscor cooling water no threat to Saldanha Bay.	Anon	Scientiae, 17(2): 1976.	Management	Journal publication
1976	Surficial sediments of Saldanha Bay and Langebaan Lagoon.	Birch, G F	Trans Geol Soc S Afr 79(3): 293-300	Physical	Journal publication
1976	Conservation of coastal habitats of waders in the south-western Cape, South Africa.	Cooper, J, Summers, R W & Pringle, J S.	Biol. Conserv., 10: 239-247	Biological	Journal publication
1976	A shallow seismic survey in Saldanha Bay.	De La Cruz, M.A	Tech Rep Mar Geol Programme S Afr Natl Comm, Issue 8. pp 12-17.	Physical	University of Cape Town
1976	Metals in organisms from Saldanha Bay and Langebaan Lagoon prior to industrialization.	Fourie, H.O.	South African Journal of Science, 72(4): 110-113	Biogeochemical Biological	Journal publication
1976	A further account of the marine littoral diatoms of the Saldanha Bay Lagoon, Cape Province, South Africa.	Giffen, M.H.	Botanica Marina, 11(6): 379-394.	Biological	Journal publication
1976	The planning of small craft harbours and marina developments.	Nicol, S.M.	First Interdisciplinary Conference on Marine and Freshwater Research in Southern Africa, Port Elizabeth, 5-10 July 1976	Management	
1976	Saldanha Bay: feasibility study and recommended approach for the modelling of Saldanha Bay and Langebaan Lagoon. Vol.1.	Russell, K.S.	CSIR report C/SEA 7620/1	Physical	CSIR, Stellenbosch
1976	Saldanha Bay : the assessment of field data, the mathematical model and the physical model. Vol.2.	Russell, K.S. Kluger, J.W.J. Huizinga, P.	CSIR report C/SEA 7620/2	Physical	CSIR, Stellenbosch
1976	The circulation and thermal stability of the atmosphere over the Saldanha Bay development area.	Halliday EC Venter GPN	CSIR report SMOG 11	Physical	CSIR, Pretoria
1975	An account of the littoral diatoms from Langebaan, Saldanha Bay,	Giffen, M.H.	Botanica Marina, 18(2): 71-95.	Biological	Journal publication
1974	Elands Point, Saldanha Bay: Progress report no.10. (Wind analyses March 1971 to February 1974).	Kluger, J.W.J.	CSIR report C/SEA 7404 (74/4).	Physical	CSIR, Stellenbosch
1974	Die graniete van Langebaan, K.P.	Leygonie, F.E.	MSc (Geology) – University of Stellenbosch	Physical	University of Stellenbosch

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
1974	The Palaearctic wader population of Langebaan Lagoon.	Pringle, J.S. & Cooper, J.	Ostrich, 46: 213-218.	Biological	Journal publication
1974	Saldanha Bay heat dispersion 1. Field measurements and literature survey. 2. Heat exchange between water surface and the environment. 3. Mathematical model.	Finlayson, G.D. Johannsen, A. Kutt, H.R. Laurie, D.P. Rosel, R. Viljoen, E.	CSIR contract report C/SEA 7413	Physical	CSIR, Stellenbosch
1974	Saldanha Bay heat dispersion based on excess temperature (& Addendum).	Finlayson, G.D.	CSIR report: C/SEA 7413 / 2 & Addendum	Physical	CSIR, Stellenbosch
1974	Environmental studies in Saldanha Bay and Langebaan Lagoon. Vol. 1. Trace metal concentrations in selected molluscs and algae	Watling, R.J. & Watling, H.R.	CSIR special report FIS 70	Biogeochemical	CSIR, Pretoria
1973	Saldanha Bay	Anon	South African Shipping News and Fishing Industry Review, 28(3): 22-25, 29.	Management	Journal publication
1973	Iron ore loading terminal at Saldanha Bay. Volume 1: Text. Volume 2: Figures.	Bosman, D.E. & Van Tonder, A.H.	CSIR report ME 1183-1 and ME 1183-2	Physical	CSIR, Stellenbosch
1972	Preliminary report on black mussel culture in the Langebaan Lagoon.	Mostert, S.A.	South African Shipping News and Fishing Industry Review, 27(9): 59, 61, 63	Biological	Journal publication
1970	Ondersoek na die benutting van die riviermonde, strandmere en vleie in die Republiek van Suid-Afrika. Volume 1. Saldanhaabaai - Langebaanstrandmeer.	CSIR	CSIR Library P03059	Management	CSIR, Stellenbosch
1966	Seasonal use of sandflats and saltmarshes by waders at low and high tide at Langebaan Lagoon, South Africa.	Summers, R.W. & Kalejta-Summers, B.	Ostrich, 67(2): 72-79	Biological	Journal publication
1959	The biology of Langebaan Lagoon: A study of the effect of shelter from wave action.	Day, J.H.	Transactions of the Royal Society of South Africa, 35(5): 475-547	Biological	University of Cape Town
1958	The birds of Langebaan Lagoon.	Liversidge, R. Broekhuysen G.J. & Thesen, A.R.	Ostrich, 29: 95-106.	Biological	Journal publication

4.5 Available Environmental Data

Although environmental data on Saldanha Bay will also be listed in many of the above-mentioned documents and publications, existing oceanographic databases, such as those available at the CSIR, Stellenbosch, were also searched. The following data could be located on the area:

Wind

POSITION	DEPLOYMENT PERIOD	TYPE OF OBSERVATIONS	OWNER/LOCATION OF DATA
Cape Columbine 32° 49.63'S; 17° 51.05'E	1990-01-01 to 1996-01-01	Barometric Pressure, Wind Direction, Average Wind Speed	CSIR (from SAWS), CSIR EDM database
Langebaanweg 32° 58.64'S; 18° 08.98'E	1994-10-01 to 1995-12-22	Barometric Pressure, Wind Direction, Average Wind Speed	CSIR (from SAWS), CSIR EDM database
Saldanha Port Control 33° 01.70'S; 17° 57.76'E	1994-10-10 to 2005-02-28	Average Air Temperature, Barometric Pressure, Wind Direction, Average Wind Speed, Maximum Wind Speed	National Ports Authority, CSIR EDM database
Saldanha Bay Stn 2 32° 57.34'S; 17° 58.40'E	1995-03-03 to 2001-02-28	Average, Min, Max Air Temperature, Fog, Rainfall, Relative Humidity, Wind Direction, Average Wind Speed, Maximum Wind Speed	Anglo American Corp. of SA (Ltd), CSIR EDM database

Waves

POSITION	DEPLOYMENT PERIOD	TYPE OF OBSERVATIONS	OWNER/LOCATION OF DATA
Noordwesbaai 32° 52.17'S; 17° 50.83' E	February to December 1983	Wave height and Direction (Waverider Bouy)	CSIR
Saldanha Bay 33° 03.00'S; 17° 58.40' E	May 1981 to March 2005	Wave height and Direction (Waverider Bouy)	National Ports Authority

Currents

POSITION	DEPLOYMENT PERIOD	INSTRUMENT DEPTH	WATER DEPTH	TYPE OF OBSERVATIONS/INSTRUMENT	OWNER/LOCATION OF DATA
Saldanha Bay 33° 03,7'S 17° 54,6'E	1974-08-28 to 1974-09-01	48 m	45 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR, CSIR EMD database
Saldanha Bay 32° 51,7'S 17° 49,9'E	1975-08-28 to 1975-08-31	47 m	44 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR, CSIR EMD database
Langebaan Lagoon 33° 05,0'S 18° 01,0'E	1978-11-29 to 1978-12-13	56 m	6 m, 10m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR, CSIR EMD database
Langebaan Lagoon 33° 05,0'S 18° 00,6'E	1978-11-29 to 1978-12-13	56 m	6 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR, CSIR EMD database
Abrahamskraal 33° 15,0'S 17° 45,5'E	1982-07-07 to 1982-08-29	173 m	71 m, 147 m	Current speed & direction; Water temperature; Aanderaa RCM4	MCM, CSIR EMD database
Marcus Island 33° 02,12'S 17° 58,03'E	1984-02-04 to 1984-03-31	8 m	6 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR, CSIR EMD database
Saldanha Bay 33° 01,40'S 17° 57,90'E	1990-08-06 to 1990-08-10	13 m	7 m	Current speed & direction; Water temperature; Aanderaa RCM4	MCM, CSIR EMD database
Saldanha Bay 33° 01,50'S 17° 58,70'E	1990-08-06 to 1990-08-10	30 m	24 m	Current speed & direction; Water temperature; Aanderaa RCM4	MCM, CSIR EMD database
Saldanha Bay 33° 01,60'S 17° 59,30'E	1990-08-06 to 1990-08-10	15 m	10 m	Current speed & direction; Water temperature; Aanderaa RCM4	MCM, CSIR EMD database
Mid-Saldanha Bay 33° 03,20'S 17° 58,60'E	1991-03-18 to 1991-03-23	28 m	22 m	Current speed & direction; Water temperature; Aanderaa RCM4	MCM, CSIR EMD database
Hospital Rock 33° 02,90'S 17° 57,90'E	1991-03-18 to 1991-03-23	17 m	11 m	Current speed & direction; Water temperature; Aanderaa RCM4	MCM, CSIR EMD database
Saldanha Bay mouth 33° 03,90'S 17° 54,80'E	1993-07-20 to 1993-09-22	48 m	36 m	Current speed & direction; Water temperature; Aanderaa RCM4	MCM, CSIR EMD database

POSITION	DEPLOYMENT PERIOD	INSTRUMENT DEPTH	WATER DEPTH	TYPE OF OBSERVATIONS/INSTRUMENT	OWNER/LOCATION OF DATA
Saldanha Bay mouth 33° 04,00'S 17° 54,80'E	1993-09-22 to 1994-01-13	45 m	32 m	Current speed & direction; Water temperature; Aanderaa RCM4	MCM, CSIR EMD database
Saldanha Bay mouth 33° 04,00'S 17° 54,80'E	1994-01-13 to 1994-04-15	49 m	37 m	Current speed & direction; Water temperature; Aanderaa RCM4	MCM, CSIR EMD database
Saldanha Bay mouth 33° 04,80'S 17° 55,70'E	1994-04-15 to 1994-07-16	50 m	38 m	Current speed & direction; Water temperature; Aanderaa RCM4	MCM, CSIR EMD database
Saldanha Bay mouth 33° 03,52'S 17° 55,70'E	1994-09-21 to 1994-12-02	52 m	40 m	Current speed & direction; Water temperature; Aanderaa RCM4	MCM, CSIR EMD database
Saldanha Bay 33° 03,80'S 17° 54,80'E	1994-12-02 to 1995-02-15	50 m	26.5 m	Current speed & direction; Water temperature; Aanderaa RCM4	MCM, CSIR EMD database

Chemical & Microbiological data: Water column

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	DEPTH INTERVALS	OWNER/LOCATION OF DATA
1900 to 2005 (details available on request)	Details available on request	Temperature; Salinity	32.75 S to 33.25 S and 17.75 E to 18.25 E (~ 6000 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Dissolved oxygen	32.75 S to 33.25 S and 17.75 E to 18.25 E (~ 2900 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Nitrate	32.75 S to 33.25 S and 17.75 E to 18.25 E (~ 700 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Nitrite	32.75 S to 33.25 S and 17.75 E to 18.25 E (~ 190 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Phosphate; Phosphorus	32.75 S to 33.25 S and 17.75 E to 18.25 E (~ 6 400 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Silicate	32.75 S to 33.25 S and 17.75 E to 18.25 E (~ 690 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	pH	32.75 S to 33.25 S and 17.75 E to 18.25 E (~ 230 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Chlorophyll a	32.75 S to 33.25 S and 17.75 E to 18.25 E (~ 20 records)	Details available on request	CSIR SADCO Database
1993-07-20 to 1993-07-29	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0 m, 8 m (water depth 11 m)	MCM, CSIR EMD database
1993-08-06 to 1993-08-16	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0 m (water depth 11 m)	MCM, CSIR EMD database
1993-08-16 to 1993-08-25	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0 m, 8 m (water depth 11 m)	MCM, CSIR EMD database
1993-08-31 to 1993-09-10	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0 m, 8 m (water depth 11 m)	MCM, CSIR EMD database
1993-08-31 to 1993-09-10	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0 m, 8 m (water depth 11 m)	MCM, CSIR EMD database
1993-09-11 to 1993-09-21	60, 180 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0, 0.1, 1, 2, 3, 4, 5, 6, 7, 8, 8.1, 9, 10 m (water depth 11 m)	MCM, CSIR EMD database
1993-09-24 to 1993-10-04	60, 180 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0, 1, 2, 3, 4, 5, 5.1, 6, 7, 8, 8.1, 9, 10 m (water depth 11 m)	MCM, CSIR EMD database
1993-10-05 to 1993-10-14	60, 180 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0, 1, 2, 3, 4, 5, 5.1, 6, 7, 8, 8.1, 9, 10 m (water depth 11 m)	MCM, CSIR EMD database
1993-10-16 to 1993-11-11	60, 180 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0, 0.1, 1, 2, 3, 4, 5, 6, 7, 8x2, 8.1, 9, 10 m (water depth 11 m)	MCM, CSIR EMD database

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	DEPTH INTERVALS	OWNER/LOCATION OF DATA
1993-11-12 to 1993-12-08	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0.8x2, 1, 2, 3, 4, 5, 5.1, 6, 7, 8, 8.8x2, 9, 10 m (water depth 11 m)	MCM, CSIR EMD database
1993-12-10 to 1994-01-04	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0.8x2, 1, 2, 3, 4, 5, 5.1, 6, 7, 8, 8.8x2, 9, 10 m (water depth 11 m)	MCM, CSIR EMD database
1994-01-05 to 1994-02-21	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	(0.8x2, 1, 2, 3, 4, 5, 5.1, 6, 7, 8, 8.8x2, 9, 10) by 2 (water depth 11 m)	MCM, CSIR EMD database
1994-02-22 to 1994-03-08	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	1, 2, 3, 4, 5, 5.1, 6, 7, 8, 9, 10 (water depth 11 m)	MCM, CSIR EMD database
1994-03-10 to 1994-03-21	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	1, 2, 3, 4, 5, 5.1, 6, 7, 8, 8.8, 9, 10 (water depth 11 m)	MCM, CSIR EMD database
1994-03-24 to 1994-06-14	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	(0.8x2, 1, 2, 3, 4, 5, 6, 7, 8, 8.8x2, 9, 10) by 2 (water depth 11 m)	MCM, CSIR EMD database
1994-06-14 to 1994-07-11	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0.8x2, 1, 2, 3, 4, 5, 6, 7, 8, 8.5, 9, 10 (water depth 11 m)	MCM, CSIR EMD database
1994-07-12 to 1994-09-04	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0.8x2, 1, 2, 3, 4, 5, 6, 7, 8, 8.1, 9, 10 (water depth 11 m)	MCM, CSIR EMD database
1994-09-07 to 1994-09-19	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0.8, 1, 2, 3, 4, 5, 6, 7, 8, 8.1, 9, 10 (water depth 11 m)	MCM, CSIR EMD database
1994-09-26 to 1994-10-20	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	8, 8.8 (water depth 11 m)	MCM, CSIR EMD database
1994-10-23 to 1994-11-22	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0.8x2, 1, 2, 3, 4, 5, 5.1, 6, 7, 8, 8.8x2, 9, 10 (water depth 11 m)	MCM, CSIR EMD database
1994-11-24 to 1994-12-20	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0.8x2, 1, 2, 3, 4, 5, 5.1, 6, 7, 8, 8.1, 8.8, 9, 10 (water depth 11 m)	MCM, CSIR EMD database
1994-12-23 to 1995-01-16	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0.8x2, 1, 2, 3, 4, 5, 5.1, 6, 7, 8, 8.1, 8.8, 9, 10 (water depth 11 m)	MCM, CSIR EMD database
1995-01-19 to 1995-01-30	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0.8, 1, 2, 3, 4, 5, 6, 7, 8, 8.1, 8.8, 9, 10 (water depth 11 m)	MCM, CSIR EMD database
1995-02-01 to 1995-03-05	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0.8x2, 1, 2, 3, 4, 5, 6, 7, 8, 8.1, 8.8x2, 9, 10 (water depth 11 m)	MCM, CSIR EMD database
1995-03-08 to 1995-04-06	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0.8, 1, 2, 3, 4, 5, 6, 7, 8, 8.1, 8.8x2, 9, 10 (water depth 11 m)	MCM, CSIR EMD database
1995-04-08 to 1995-04-19	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0.8, 1, 2, 3, 4, 5, 6, 7, 8, 8.1, 8.8, 9, 10 (water depth 11 m)	MCM, CSIR EMD database
1995-04-21 to 1995-08-08	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	0.8x2, 1, 2, 3, 4, 5, 6, 7, 8, 8.1, 8.8x2, 9, 10 (water depth 11 m)	MCM, CSIR EMD database
1995-08-12 to 1995-11-13	60 min	Water temperature, pH, salinity, Dissolved oxygen; Aanderaa YSI	Saldanha Bay Small Bay North Buoy 33° 01,00'S 17° 58,20'E	1, 2, 3, 4, 5, 6, 7, 8, 8.1, 9, 10 (water depth 11 m)	MCM, CSIR EMD database
1999-02-15 to 1999-09-28	30 min	Temperature profile (thermistor chain)	Saldanha Bay 33° 03,00'S 17° 58,7'E	1, 2, 3, 4, 5, 6, 7, 8, 9, 10 m (water depth 23 m)	CSIR, CSIR EMD database
1999-11-10 to 2000-05-03	30 min	Temperature profile (thermistor chain)	Saldanha Bay 33° 03,00'S 17° 58,7'E	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 m (water depth 23 m)	CSIR, CSIR EMD database
2003-01-15 to 2003-01-31	5 min	Temperature profile (thermistor chain)	Saldanha Bay 33° 03,00'S 17° 58,7'E	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 m (water depth 23 m)	CSIR, CSIR EMD database
1974-10-22 1980-02-01	Once off	Cadmium, Copper, Iron, Lead, Mercury, Nickel, Zinc	32.8 S to 33.1 S and 17.8E to 18.2 E (98 records)	Details available on request	CSIR SADCO database

Chemical and Microbiological data: Sediments

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	GRAB/CORE SAMPLING	OWNER/LOCATION OF DATA
1975-10-13 1983-10-19	Once off	Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Nickel, Zinc	32.8 Sto 33.1 S and 17.8E to 18.2 E (224 records)	No data	CSIR SADCO database

Chemical and Microbiological data: Biological tissue

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	OWNER/LOCATION OF DATA
1981-01-21 1984-02-26	Once-off	Cadmium, Chromium, Copper, Iron, Lead, Nickel, Zinc	32.8 Sto 33.1 S and 17.8E to 18.0 E (884 records)	CSIR SADCO database

4.6 Existing Monitoring Programmes

PROGRAMME	DESCRIPTION	MONITORING TYPE	DURATION	SAMPLING FREQUENCY	SAMPLING LOCATION	PARAMETERS MEASURED	OWNER/LOCATION OF DATA
Saldanha Bay WWTW Monitoring	Effluent quantity and quality	Source		Daily (flow) Monthly (quality)	Final effluent	Flow; Conductivity; pH; Settleable solids; Suspended solids; Oxygen absorbed; Chemical oxygen demand (COD); Dissolved oxygen Kjeldahl nitrogen; Ammonia; Nitrate and nitrite; Coliform; <i>E. coli</i>	Saldanha Bay Municipality
Bacteriological Water Quality Monitoring Programme	Suitability of waters for recreation and shellfish collection	Environmental		Fortnightly	15 stations along the shores of Saldanha Bay and Langebaan Lagoon	<i>E. coli</i> ; Faecal coliform	Saldanha Bay Water Quality Forum Trust
Saldanha Bay Sediment Sampling Programme	Assess potential accumulation of trace metals and organic matter in sediments	Environmental	1999 - ongoing	Every 5 years	Comprehensive baseline survey (1999) covered 30 stations. Thereafter only focused on most sensitive low shear stress areas (where deposition is likely to occur), i.e. 5 sites in Saldanha Bay and 6 sites in Langebaan Lagoon.	Trace metals; Particulate organic carbon and nitrogen	Saldanha Bay Water Quality Forum Trust/CSIR, Stellenbosch
Port of Saldanha: Sediment Assessment Programme	Requirements under London Convention for trace metals and hydrocarbons - Provide a prediction of likely impact of dumping these sediments into the coastal zone.	Environmental	1999 - ongoing	Annually	15 sampling stations in Port	Trace metals; Particulate organic carbon and nitrogen	Port of Saldanha
Mussel Watch Programme	Assess long-term trends in metal accumulation along coast	Environmental		6- monthly	5 stations in the Bay	Trace metals	Marine and Coastal Management (DEAT)
Toxic algal blooms	Determine presence of toxic algal blooms	Environmental		Weekly	Samples collected from farming area	Harmful algae	Blue Bay Aquafarm
Phytoplankton and chlorophyll monitoring		Environmental		Daily	Samples collected from farming area	Plankton Chlorophyll a	Blue Bay Aquafarm
Faecal coliform counts in mussel tissue	Assess potential bacteriological contamination	Environmental		Weekly	Sub-sample of mussel tissue from harvest	Faecal coliform	Blue Bay Aquafarm

4.7 Suitability for Application in Management Framework

The Saldanha Bay Water Quality Forum Trust was constituted in 1996 and has since been fulfilling the role of a local management institution with a common interest in maintaining an acceptable water quality for Saldanha Bay, involving all the key role players

In 2002, the Trust commissioned a study to assist it in preparing a Marine Water Quality Management Plan for Saldanha Bay (including the Langebaan Lagoon). As part of this study, the following were determined for the area (which are in full alignment with the management framework proposed for the BCLME region as part of this project) (Taljaard & Monteiro, 2002):

- Legislative requirements and framework
- Important marine ecosystems and beneficial uses (including a preliminary identification of environmental quality objectives)
- Identification of marine pollution sources - where data were available, volumes and pollutant concentrations were also provided.

In 2004, a scientific assessment study was commissioned by the Trust to assist it in setting critical limits (volume and composition) for wastewater discharges from the fish processing industries in the area (Monteiro & Kemp, 2004). This information will be used, for example, by DWAF to determine effluent standards for these industries, as part of their licence agreements under the National Water Act 36 of 1998.

Recommendations to further enhance the effective implementation of the management framework in the area include:

- ***Routine monitoring of discharges from all land-based pollution sources.*** Routine monitoring programmes to quantify flow and pollutant composition should be implemented at all effluent discharges (refer to Chapter 4.2). It is envisaged that such routine monitoring will become a legal requirement to be included in the licence agreement issued by DWAF under the National Water Act 36 of 1998.
- ***Consolidation of sediment monitoring programmes.*** To ensure optimal utilization of resources and to prevent possible duplication, it is recommended that the respective sediment monitoring programmes undertaken for the Saldanha Bay Water Quality Forum Trust and the Port of Saldanha be consolidated into a single sediment monitoring programme for the entire area (refer to Chapter 4.6).

- **Consolidation of other environmental monitoring programmes.** In alignment with the *Operational Policy for the disposal of land-derived wastewater* (RSA DWAF, 2004a), it is envisaged that the licence agreements for the different land-based effluent discharges will also, in future, include requirements related to (receiving) environmental monitoring programmes. It is strongly recommended that such programmes not be undertaken as individual initiatives by different industries or municipalities, but that these be optimized and coordinated through the Saldanha Bay Water Quality Forum Trust.

5 CAPE PENINSULA (WESTERN SECTION)

5.1 Existing Management Initiatives

NAME	DESCRIPTION	RESPONSIBLE INSTITUTION/AUTHORITY	PARTIES INVOLVED	PERIOD OPERATIONAL
Cape Metropolitan Coastal Water Quality Committee	A voluntary association of senior officials from local, provincial and national government and civil society who joined efforts in managing the marine water quality within the boundaries of the Cape Metropolitan Area	City of Cape Town	City of Cape Town (including various Departments and Branches) Department of Water Affairs and Forestry Department of Environmental Affairs and Tourism Provincial Department of Environmental Affairs (W-estern Cape)	
Catchment Management Team: South	Catchment along the southern section of this coast; Steer compilation, implementation and review of catchment and river management plans; review coastal and river water quality data and recommend corrective actions; coordinate stormwater and river-related capital and maintenance programmes	City of Cape Town	Catchment Management Department Representatives from line functions affected, e.g. Stormwater, Wastewater and Health	Since 2003
Catchment Management Team: Central	Catchment along the central section of this coast; Steer compilation, implementation and review of catchment and river management plans; review coastal and river water quality data and recommend corrective actions; coordinate stormwater and river-related capital and maintenance programmes	City of Cape Town	Catchment Management Department Representatives from line functions affected, e.g. Stormwater, Wastewater and Health	Since 2003
Catchment Management Team: North	Catchment along the northern section of this coast; Steer compilation, implementation and review of catchment and river management plans; review coastal and river water quality data and recommend corrective actions; coordinate stormwater and river-related capital and maintenance programmes	City of Cape Town	Catchment Management Department Representatives from line functions affected, e.g. Stormwater, Wastewater and Health	Since 2003

5.2 Marine Pollution Sources

A map indicating the location of major potential marine pollution sources in the western section of the Cape Peninsula (Table Bay to Cape Point) is provided in Figure 5.1. Details on these sources are provided below:

SOURCE	SOURCE TYPE	DESCRIPTION	ESTIMATED VOLUME	POLLUTANT COMPOSITION	OWNER/MANAGER
Atmospheric sources	Atmospheric	The main sources are exhaust fumes from cars and trucks (particularly poorly maintained diesel vehicles), but also wood fires and burning tyres.		Nitrogen; Sulphur dioxide; Petroleum hydrocarbons	City of Cape Town
Koeberg Nuclear Power Station	Land-based	Cooling water discharge	No data	Temperature; Chlorine	Eskom
Robben Island WWTW	Land-based	Effluent from a WWTW discharged through an offshore pipeline (0.45 km) in 8 m water depth	550 m ³ /day*	Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants	City of Cape Town
Green Point Outfall	Land-based	Municipal effluent discharged through an offshore marine outfall (1.7 km) in 27 m water depth	34 856 m ³ /day*	Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants; Trace metals	City of Cape Town
Camps Bay Outfall	Land-based	Municipal effluent discharged through an offshore marine outfall (1.35 km) in 24 m water depth	3 846 m ³ /day*	Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants; Trace metals	City of Cape Town
Hout Bay Outfall	Land-based	Municipal (including industrial wastewater) effluent discharged through an offshore marine outfall (0.61 km from the shore) in 27 m water depth	6 724 m ³ /day*	Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants; Trace metals	City of Cape Town
Llundudno WWTW	Land-based	Effluent from a WWTW discharged into the surf zone	283 m ³ /day*	Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants; Trace metals	City of Cape Town
Diep River & Potsdam WWTW	Land-based	River discharging into Table Bay that receives effluent from the Potsdam WWTW near the mouth (into Rietvlei)	44 126 m ³ /day* (discharged from WWTW)	Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants; Trace metals; Harmful algal blooms	Dept. of Water Affairs and Forestry & City of Cape Town
Wildevoelvlei and WWTW at Kommetjie	Land-based	River discharge receiving effluent from a WWTW	11 577 m ³ /day* (discharged from WWTW)	Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants; Trace metals; Harmful algal blooms	Dept. of Water Affairs and Forestry & City of Cape Town
Caltex Refinery, Milnerton	Land-based	Wastewater from a petroleum refinery discharged through an offshore marine outfall (0.5 km from the shore) in 11 m water depth	3 185 m ³ /day*	Suspended solids; Discolouration; Trace metals; Petroleum hydrocarbons	Caltex Oil (SA) (Pty) Ltd
Melkbosstrand: Stormwater run-off	Land-based	Stormwater run-off entering the marine environment through numerous storm-water outlets draining mainly residential areas	No data	Suspended solids; Organic matter; Trace metals; Petroleum hydrocarbons; Bacteriological contaminants; Litter	City of Cape Town
Bloubergstrand: Stormwater run-off	Land-based	Stormwater run-off entering the marine environment through numerous storm-water outlets draining mainly residential areas	No data	Suspended solids; Organic matter; Trace metals; Petroleum hydrocarbons; Bacteriological contaminants; Litter	City of Cape Town
Milnerton: Stormwater run-off	Land-based	Stormwater run-off entering the marine environment through	No data	Suspended solids; Organic matter;	City of Cape Town

SOURCE	SOURCE TYPE	DESCRIPTION	ESTIMATED VOLUME	POLLUTANT COMPOSITION	OWNER/MANAGER
		numerous storm-water outlets draining mainly residential areas		Trace metals; Petroleum hydrocarbons; Bacteriological contaminants; Litter	
Paarden Eiland: Stormwater run-off	Land-based	Storm-water run-off entering the marine environment through numerous storm-water outlets draining mainly industrial areas	No data	Suspended solids; Organic matter; Trace metals; Petroleum hydrocarbons	City of Cape Town
Cape Town: Stormwater run-off	Land-based	Storm-water run-off entering the marine environment through numerous storm-water outlets draining mainly residential and commercial areas	No data	Suspended solids; Organic matter; Trace metals; Petroleum hydrocarbons; Bacteriological contaminants; Litter	City of Cape Town
Black River	Land-based	Heavily polluted river receiving effluent from numerous WWTW as well as contaminated storm-water run-off	No data	Suspended solids; Organic matter; Inorganic nutrients (P & N); Trace metals; Petroleum hydrocarbons; Bacteriological contaminants; Litter	Dept. of Water Affairs and Forestry
Port of Cape Town: Stormwater run-off	Land-based	Stormwater run-off entering the marine environment from numerous stormwater outlets into the Port of Cape Town. Some of these outlets drain areas in Cape Town (commercial areas)	No data	Suspended solids; Trace metals; Petroleum hydrocarbons	City of Cape Town & National Ports Authority
Port of Cape Town: Dredging	Dumping at sea	Dredge spoil material originating from harbour that is dumped at sea		Suspended solids; Trace metals; Petroleum hydrocarbons	National Ports Authority
Port of Cape Town: Operations	Maritime Transportation	Activities potentially causing marine pollution include ship loading operations, oil spillages, dredging operations and ballast water discharge.	Not easily quantifiable	Suspended solids; Trace metals; Petroleum hydrocarbons	National Ports Authority
Strip development from Sea Point to Bakoven: Stormwater run-off	Land-based	Stormwater run-off entering the marine environment through numerous stormwater outlets draining mainly residential and commercial areas	No data	Suspended solids; Organic matter; Trace metals; Petroleum hydrocarbons; Bacteriological contaminants; Litter	City of Cape Town
Hout Bay harbour	Maritime Transportation	Activities causing marine pollution include cleaning of vessels, accidental oil spillages, dumping of bloodwater and other fish offal and littering	Not easily quantifiable	Suspended solids; Organic matter (fish waste); Petroleum hydrocarbons; Litter/Garbage	Dept. of Public Works/Dept. of Environmental Affairs and Tourism
Hout Bay River	Land-based	Polluted river receiving run-off from informal settlement area	No data	Suspended solids; Organic matter; Bacteriological contaminants; Litter	Dept. of Water Affairs and Forestry
Hout Bay: Stormwater run-off	Land-based	Stormwater run-off entering the marine environment through numerous storm-water outlets draining mainly residential and commercial areas	No data	Suspended solids; Organic matter; Trace metals; Petroleum hydrocarbons; Bacteriological contaminants; Litter	City of Cape Town
Llundudno: Stormwater run-off	Land-based	Stormwater run-off entering the marine environment through numerous storm-water outlets draining mainly residential areas	No data	Suspended solids; Organic matter; Trace metals; Petroleum hydrocarbons; Bacteriological contaminants; Litter	City of Cape Town

* Source: RSA DWAF (1995c)



Figure 5.1: Potential marine pollution sources in the Cape Peninsula (western section)

5.3 Important Marine Ecosystems and Beneficial Uses

5.3.1 Important Marine Ecosystems

Important and/or sensitive marine ecosystems within this node include (Figure 5.2):

- Milnerton Lagoon and Rietvlei, with a wide diversity of habitats and species, particularly relating to birds. At present, Rietvlei Wetland Reserve is a Protected Natural Environment (P.N.E.). Future plans include having it declared a Provincial Nature Reserve (<http://home.worldonline.co.za/~friendsofrietvlei/>)
- Rock Lobster Reserve, stretching from Melkbos Point (beacon MB1) to Die Josie (near Chapman's Peak - beacon MB2), extending 12 nautical miles seawards from the high-water mark. No rock lobster may be caught (declared under the Marine Living Resources Act 18 of 1998)
- Cape of Good Hope Closed Area, stretching from Schuster Bay (Scarborough) to the Cape Point lighthouse, extending 500 m seawards from the high-water mark (declared under the Marine Living Resources Act 18 of 1998). No fish may be caught or any

aquatic plants removed (the exception is from Hoek van Bobbejaan to the Cape Point lighthouse where shore angling is allowed and rock lobster and abalone may be collected)

- Table Mountain (formerly Cape Peninsula) National Park Marine Protected Area which includes all of the coastal waters around the Cape Peninsula, from Mouille Point in the west to Muizenberg in the east. The Cape Peninsula is in a unique position in that the coastal environment lies at the junction of two major southern African marine (biogeographic) provinces, namely: the cool Namaqua Province on the west coast and the warmer Agulhas Province on the east coast. Cape Point forms the boundary between these two provinces and, because of this, the biology of the marine area surrounding the park is tremendously diverse. Many of the species found here are endemic to Southern African waters. Of the 2 008 marine invertebrate and vertebrate species identified along the southern African coastline from Namibia to Mozambique, 33% occur on the Peninsula (www.cpnnp.co.za/).

5.3.2 Beneficial uses

i. Recreation (including tourism)

The coastal area of the Cape Peninsula is one of the great tourist attractions of Cape Town. In addition to its scenic beauty, there are numerous popular beaches that are intensively used for bathing, surfing and other beach-based recreation. Some of the most popular beaches are indicated in Figure 5.2. Where, in the past, recreational activities primarily occurred close to shore (e.g. surfing and swimming), the introduction of water sports, such as windsurfing and kite surfing, has extended the boundaries of recreational use to much further offshore, particularly in the area between Melkbosstrand and Milnerton.

ii. Marine Aquaculture and Important Fisheries (including collection of seafood for human consumption)

The exploitation of natural resources along the Cape Peninsula coastline is an important source of recreation, employment and food. The most popular fishing areas are located between Silwerstroomstrand and the Port of Cape Town.

Collection of mussels for human consumption, both white mussels (found along sandy beaches) and black mussels (found along the rocky shores), occurs at various locations along this stretch of coast. Popular areas used for this purpose are indicated in Figure 5.2.

iii. Industrial uses

The Koeberg Nuclear Power Plant is situated along the northern extreme of this node and takes in cooling water from the sea, which requires seawater of an acceptable quality (Figure 5.2).

Although there are numerous activities in harbours and ports that could detrimentally affect marine quality, these areas are increasingly becoming popular tourist destinations which, in turn, have certain aesthetic quality requirements. The port and harbours within this node include:

- Port of Cape Town
- Hout Bay Fishing Harbour.

Most ships take on water as ballast in order to increase stability at sea. In this way, large volumes of coastal waters are transferred from one coastal area of the world to another. To minimize risk to the receiving marine environment it is important that the water inside harbours and ports, where the intake of ballast water occurs, is of acceptable quality (e.g. free of nuisance algae).



Figure 5.2: Important ecosystems and beneficial uses of the Cape Peninsula (western section)

5.4 Available Environmental Literature

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
2003	Coastal Zone Management Strategy.	City of Cape Town	Publication of the City of Cape Town (Environmental Department) ISBN: 0-9584352-9-4	Management	City of Cape Town
2003	Final environmental impact report - proposed expansion of the container terminal stacking area at the port of Cape Town.	Fortuin HHG; Heather-Clark S	CSIR report ENV-S-C 2003-110B	Management	CSIR, Stellenbosch
2003	Environmental Impact Assessment: Proposed expansion of the container terminal stacking area at the port of Cape Town.	Fortuin HHG	CSIR report ENV-S-C 2003-110	Management	CSIR, Stellenbosch
2003	Sand transport along the Western Cape coast: gone with the wind?	Franceschini G.; Compton J S; Wigley R A	South African Journal of Science, Academy of Science 99 (7/8): 317-318	Physical	Journal Publication
2002	Seagull pollution at Hout Bay and its impact on microbiological water quality of the lagoon.	Vulindlu M; Fortune A	Biennial WISA Conference and Exhibition. Abstracts (19 to 23 May 2002 : ICC, Durban, South Africa)	Biological	City of Cape Town
2002	Environmental aspects. Surf-zone water quality. (Poster paper)	Engelbrecht JFP	Biennial WISA Conference and Exhibition. Abstracts (19 to 23 May 2002 : ICC, Durban, South Africa)	Biological	CSIR, Stellenbosch
2001	City of Cape Town: State of the coast: Coastal zone strategy development - Phase 1. First edition.	Audouin MA; Taljaard S; Dunkley EC; Lochner PA; Le Maitre DC; Theron A; Schoonees JS; Rabie A; Van Zyl H	CSIR Contract report ENV-S-C 2001-071	Physical Biogeochemical Management Biological	CSIR, Stellenbosch
2001	Shoreline response to harbour developments in Table Bay.	Smith GG; Dunckley E; Soltau C	CSIR report ENV-S-R 2001-11	Physical	CSIR, Stellenbosch
2001	Port of Cape Town: Oil spill prediction system.(Confidential)	Rossouw M Van Ballegooyen RC	CSIR report ENV-S-C 2001-051	Physical	CSIR, Stellenbosch
2001	Factors influencing the growth rate of juvenile rock lobsters, <i>Jasus lalandii</i> .	Hazell, R.W.A.; Cockcroft, A.C.; Mayfield, S.; Noffke, M.	Marine and Freshwater Research, 52 (8): 1367-1373	Biological	Marine and Coastal Management
2000	Caltex marine outfall, Milnerton: Field exercises for the determination of achievable dilutions: Main report. (Confidential)	Botes WAM; Taljaard S	CSIR report ENV-S-C 2000-105 A	Physical	CSIR, Stellenbosch
2000	Caltex marine outfall, Milnerton: Follow-up chemical and biological investigations in the mixing zone and adjacent marine environment done in January 2000: Main report. (Confidential)	Taljaard S; Bickerton I	CSIR report ENV-S-C 2000-076 A	Biogeochemical Biological	CSIR, Stellenbosch

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
2000	Caltex marine outfall, Milnerton: Follow-up chemical and biological investigations in the mixing zone and adjacent marine environment done in January 2000: Executive Summary. (Confidential)	Taljaard S; Bickerton I	CSIR report ENV-S-C 2000-076 B	Biogeochemical Biological	CSIR, Stellenbosch
2000	Caltex marine outfall, Milnerton: Field exercises for the determination of achievable dilutions: Executive Summary. (Confidential)	Botes WAM; Taljaard S	CSIR report ENV-S-C 2000-105 B	Physical	CSIR, Stellenbosch
1999	Environmental impact assessment (EIA) for the commercialisation of the SFF Milnerton Tank Farm. Specialist study report S1. Table Bay oil spill modelling. (Draft) [Confidential]	Rossouw M; Grundlingh ML	CSIR report ENV-S-C 99023	Physical Biogeochemical	CSIR, Stellenbosch
1999	Environmental impact assessment (EIA) for the commercialisation of the SFF Milnerton Tank Farm. Specialist study S6. Potential impact on marine water quality in Table Bay : Draft report. (Confidential)	Taljaard S; Rossouw M	CSIR report ENV-S-C 99038	Physical Biogeochemical	CSIR, Stellenbosch
1999	Environmental impact assessment for the commercialisation of the SFF Milnerton tank farm: Specialist study reports. (Confidential)	Davies SJ; Burns MER	CSIR report ENV-S-C 99024	Biological	CSIR, Stellenbosch
1998	SFF Milnerton installation: Environmental data for the feasibility study of an SPM in Table Bay. (Confidential)	Moes J	CSIR report ENV/S-C 98013	Physical	CSIR, Stellenbosch
1998	Table Bay wave refraction study. (Confidential)	Schonegevel LY; Smit F	CSIR report ENV/S-C 98092	Physical	CSIR, Stellenbosch
1998	Seabird responses to long-term changes of prey resources off southern Africa.	Crawford, R.J.M.	22 International Ornithological Congress (IOC), Durban, 1998, ed. by N.J. Adams and R.H. Slotow, pp688-705	Biological	Marine and Coastal Management, Cape Town
1998	Estuaries of the Cape: Part 2: Synopses of available information on individual systems. Report no. 29: Hout Bay (CW 27).	Grindley, S.A.	CSIR research report 428	Biological Physical Biogeochemical Management	CSIR, Stellenbosch
1998	SFF Milnerton installation: Report on geophysical and bathymetrical surveys. (Confidential)	Lenhoff L	CSIR report ENV-S-C 97146	Physical	CSIR, Stellenbosch
1997	A preliminary survey of coastal river systems on the south-west coast of South Africa, Cape Columbine - Cape Point, with particular reference to the fish fauna.	Harrison TD	Transactions of the Royal Society of South Africa, 52(2): 323-344	Biological	Journal Publication
1997	Table Bay sediment study: Phase III : 1997: A quantitative assessment of the impact of land based discharges of organic matter and trace metals on the sediment characteristics in Table Bay, Cape Town. (Confidential)	Monteiro PMS	CSIR report ENV/S-C 97085	Biogeochemical	CSIR, Stellenbosch

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
1997	Memorandum: Robben Island, Murray's Bay numerical wave refraction study. (Confidential)	Smit F; Van Tonder A	CSIR report ENV/S-C 97177	Physical	CSIR, Stellenbosch
1996	Responses of African penguins to regime changes of sardine and anchovy in the Benguela System.	Crawford, R.J.M.	South African Journal of Marine Science, 19: 355-364	Biological	Journal Publication
1996	Environmental baseline study of microbiological quality in surf-zone water. (Paper No 75).	Engelbrecht, J.F.P.; Tredoux, G.	Biennial Conference and Exhibition of the Water Institute of Southern Africa (WISA). Volume 2. (20 to 23 May 1996, Port Elizabeth, South Africa)	Biological	CSIR Stellenbosch
1996	Living conditions and environmental health status in two informal settlements in the Cape Peninsula.	Mathee, A.; Von Schirnding, Y.E.R.	Development Southern Africa, 13(1): 129-139	Management	CSIR, Pretoria
1996	Comparison of predicted secondary dilutions to measured field data and the determination of prototype diffusion coefficients.	Botes, W.A.M.; Taljaard, S.	Water Research Commission Report 675/1/96 (ISBN: 1-86845-256-5)	Physical	Water Research Commission, Pretoria
1996	First record of the sea anemone <i>Metridium senile</i> from South Africa.	Griffiths, C.L.; Kruger, L.M.; Smith, C.E.	South African Journal of Zoology, 31(3): 157-158	Biological	University of Cape Town
1995	A study of the environmental health status, living conditions and basic needs of an informal settlement community in the Cape Peninsula.	Mathee, A; Von Schirnding, Y.E.R.	Southern African Journal of Epidemiology and Infection, 10 (1):8-11	Management	CSIR, Pretoria
1995	Investigation into the toxicity of the water in Table Bay harbour, with particular reference to possible leakage of hydrocarbons from the quay walls. (Confidential)	Smith, C.E.; Brown, A.C.; Hughes, P.	Report published by the Dept of Zoology in 1995	Biogeochemical	Univeristy of Cape Town (also available form CSIR, Stellenbosch)
1995	Coastline stability and erosion problems at Milnerton (Confidential).	Marx, C.S.R.; Schoonees, J.S.	CSIR report EMAS-C 95068	Physical	CSIR, Stellenbosch
1995	Dilution studies on three marine outfalls in South Africa.	Botes, W.A.M.; Kapp, J.F.	Water Science and Technology, 32(2): 297-304	Physical	CSIR, Stellenbosch
1995	Hout Bay sea outfall for disposal of sewage. First impact assessment report, November 1994.	Taljaard, S. Botes, W.A.M.	CSIR report EMAS-C 95061	Biogeochemical Biological	CSIR, Stellenbosch
1994	Evaluation of directional wave measurements: a comparative field exercise.	Van Tonder, A.; Davies, J.	Hydro-Port '94: International Conference on Hydro-Technical Engineering for Port and Harbour Construction, 19-21 October 1994, Yokosuka, Japan. Proceedings, pp143-164 (EMAS-R 9407)	Physical	CSIR, Stellenbosch
1994	Dilution studies on large offshore pipelines.	Botes, W.A.M.	Water Research Commission Report 364/1/94 (ISBN: 1-86845-127-5)	Physical	CSIR, Stellenbosch
1993	Hout Bay sea outfall for disposal of sewage: Environmental studies baseline report. (Confidential)	Taljaard, S.; Engelbrecht, J.F.P. Botes, W.A.M.; Tredoux, G.	CSIR report EMAS-C 93079	Biogeochemical Biological	CSIR, Stellenbosch

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
1993	Table Bay, Cape Town, South Africa: synthesis of available information and management implications.	Quick, A.J.R.; Roberts, M.J.	South African Journal of Science, 89(6): 276-287	Biological Physical Biogeochemical Management	Marine and Coastal Management, Cape Town
1993	Detection of Salmonella in shellfish grown in polluted seawater.	Kfir, R.; Burger, J.S.; Idema, G.K.	Water Science and Technology, 27(3-4): 41-44	Biological	CSIR, Pretoria
1993	Aspects of abalone aquaculture.	Featherstone, S.	Conserva, 8(6): 12-14	Biological	CSIR, Pretoria
1993	The influence of septic tank systems on river water quality, Hout Bay. (Poster paper).	Pearce, M.W.	Africa Needs Ground Water: An International Ground Water Convention. Vol 2 (6 to 8 Sep 1993 Johannesburg, South Africa).	Biogeochemical Biological	Water Research Commission, Pretoria
1993	Comparative field tests of a datowell directional waverider and an electromagnetic current meter / pressure sensor instrument.	Van Tonder, A.; Davies, J.	CSIR report EMAS-T 93003	Physical	CSIR, Stellenbosch
1992	Water quality status of the Rietvlei/Milnerton Lagoon system. (Diep River Estuary)	Taljaard, S, De Villiers S, Fricke, A H, Kloppers, W S	CSIR data report EMAS-D 92007	Biogeochemical	CSIR, Stellenbosch
1992	Pollution assessment of several beaches along the south-western Cape Coast	Skibbe, E.	CSIR research report 702	Biogeochemical Biological	CSIR, Stellenbosch
1992	Marine invasive aliens on South African shores: Implications for community structure and trophic functioning.	Griffiths, C.L.; Hockey, P.A.R.; Erkom Schurink, C. van; Le Roux, P.J.	South African Journal of Marine Science, 12: 713-722	Biological	Journal Publication
1990	On the distribution, diet and possible impact of the invasive European shore crab <i>Carcinus maenas</i> (L.) along the South African coast.	Roux, P.J. le; Branch, G.M.; Joska, M.A.P.	South African Journal of Marine Science, 9: 85-93	Biological	Journal Publication
1989	Urban stormwater run-off : a water quality study.	Kloppers, W.S.	CSIR research report 685	Biogeochemical	CSIR, Stellenbosch
1989	Heavy metals, carbon and hydrocarbons in the sediments of Table Bay Harbour.	Henry, J.L.; McGibbon, S.; Davis, G.; Mackay, R.M.; Moldan, A.G. S.	Sea Fisheries Research Institute Special Report: 4 ISBN: 0-621-11161-9	Biogeochemical	Marine and Coastal Management
1988	Table Bay: Summary of measured wave conditions, 1985 to 1987. (Confidential)	Van Tonder, A.	CSIR report EMA-C 88112	Physical	CSIR, Stellenbosch
1988	Estuaries of the Cape. Part II: Synopsis of available information on individual systems. Report No 28: Rietvlei (CW24) and Diep Estuary(CW 25).	Grindley, J.R.; Dudley, S.; Heydorn, A.E.; Morant, P.D.	CSIR research report 427	Physical Biogeochemical Biological Management	CSIR, Stellenbosch

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
1988	Estuaries of the Cape. Part II: Synopsis of available information on individual systems. Report No. 29: Hout Bay [CW 27].	Grindley, S.A.	CSIR research report, 428	Physical Biogeochemical Biological Management	CSIR, Stellenbosch
1988	Measurements of initial dilution of a buoyant effluent.	Toms, G.; Botes, W.A.	Water Research Commission 160/1/88 or CSIR Report C/SEA 8766	Physical	CSIR, Stellenbosch
1986	FEDMIS ocean outfall at Milnerton: effluent dilution calculations and seabed profile variation predictions.	Toms G Moller JP	CSIR report C/SEA 8604	Physical	CSIR, Stellenbosch
1986	Chemical inputs to Table Bay -- a mass balance study.	Bartlett, P.D.	Water S A, 12(2): 67-72;	Biogeochemical	Journal Publication
1986	Hout Bay outfall studies. Report no.1: Physical data acquisition. Vol.1: Measurements techniques and presentation of data.	Toms, G. Botes, W.A.M. Van Niekerk, M. Smith, C.J. Roux, C. Buirski, J.	CSIR report C/SEA 8603/1	Physical	CSIR, Stellenbosch
1986	Hout Bay outfall studies. Report No.1: Physical data acquisition. Vol.2: Daily observations 1984.	CSIR	CSIR report C/SEA 8603/2	Physical	CSIR, Stellenbosch
1986	Hout Bay outfall studies. Report No.1: Physical data acquisition. Vol.3: Daily observations 1985	CSIR	CSIR report C/SEA 8603/3	Physical	CSIR, Stellenbosch
1986	Hout Bay outfall studies. Report No.2: Physical data interpretation and summaries.	Toms, G.	CSIR report C/SEA 8611	Physical	CSIR, Stellenbosch
1986	Hout Bay outfall studies. Report No.3: Dilution calculations for preliminary diffuser design.	Toms, G.	CSIR report C/SEA 8612	Physical	CSIR, Stellenbosch
1986	Hout Bay outfall studies. Report No.4: Summary and recommendations (1982-1985).	Toms, G.	CSIR report C/SEA 8613	Physical	CSIR, Stellenbosch
1985	The Benguela ecosystem. Part II: Chemistry and related processes.	Chapman, P. Shannon, L.V.	Oceanography and Marine Biology Annual Review, 23:183-251	Biogeochemical	Marine and Coastal Management, Cape Town
1985	Suitability of the Agarophyte <i>Suhria Vittata</i> (L.) J. Ag. (Rhodophyta: Gelidiaceae) for mariculture: Geographical distribution, reproductive phenology and growth of sporelings in culture in relation to light and temperature.	Anderson, R.J.; Bolton, J.J.	South African Journal of Marine Science, 3: 169-178	Biological	Journal Publication

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
1985	The fourth pollution monitoring survey of Hout Bay beach.	Taljaard, S.; Bligh, D.P.; Dixon, C.T.; Eagle, G.A.	CSIR report T/Sea 8503	Biogeochemical	CSIR, Stellenbosch
1985	The dynamics of Hout Bay estuary end beach.	Fromme, G.A.	CSIR report T/Sea 8508	Physical	CSIR, Stellenbosch
1985	Application of the report 'Water quality criteria for the South African coastal zone' to the Hout Bay outfall proposal.	Toms, G.	CSIR report T/Sea 8504/2	Biogeochemical	CSIR, Stellenbosch
1985	Table Bay : A marine chemical study.	Bartlett, P.D.; Hennig, H.F.; Eagle, G.A.	CSIR research report 565	Biogeochemical	CSIR, Stellenbosch
1985	Table Bay harbour: marine chemical studies.	Barlett, P.D.	CSIR report T/SEA 8502	Biogeochemical	CSIR, Stellenbosch
1985	Table Bay chemical inputs: An overview and mass-balance study.	Bartlett, P.D.	CSIR report T/Sea 8518	Biogeochemical	CSIR, Stellenbosch
1984	Model harbour seiching compared to prototype data.	Botes, W.A.M.; Russell, K.S.; Huizinga, P.	Proceedings of 19th Coastal Engineering Conference, Houston, Texas, 3-7 September 1984, vol.1, [ed.B.L.Edge] . New York: American Society of Civil Engineers. pp.846-857	Physical	CSIR, Stellenbosch
1983	Effects of sewage effluent on the colony growth rate of <i>Eirene Viridula</i> (Hydrozoa).	Borchardt, T.	CSIR research report 555	Biogeochemical Biological	CSIR, Stellenbosch
1982	Bathymetry, solid geology and Quarternary sedimentology of Table Bay.	Woodborne, M.W.	Document available from CSIR, Stellenbosch (ECRU - CW 26)	Physical	CSIR, Stellenbosch
1982	The behaviour of sewage from the Green Point sewage outfall and its effect on Table Bay: a preliminary report.	Eagle, G.A.; Bartlett, P.D.; Long, M.V.	CSIR researchreport 552	Biogeochemical	CSIR, Stellenbosch
1981	The third pollution monitoring survey of Hout Bay beach.	Bartlett, P.D.	CSIR report T/SEA 8113	Biogeochemical	CSIR, Stellenbosch
1981	Preliminary pollution surveys around the south-western Cape Coast. Part 4: Salt River Mouth, Table Bay.	Orren, M.J.; Eagle, G.A.	South African Journal of Science, 77(4) 183-188	Biogeochemical	Journal Publication
1981	Distribution of trace metals in the water column and sediments surrounding a marine sewage outfall.	Eagle, C.A.; Bartlett, P.D.	Int. Conf. Heavy Metals in the Environment, Amsterdam, Sept. 1981, Edinburgh, CEP Consultants Ltd., 1981, pp. 367-370	Biogeochemical	CSIR, Stellenbosch
1980	Application of digital time series analysis on a resonance study of Table Bay harbour.	Botes, W.A.M.	CSIR report T/SEA 8006	Physical	CSIR, Stellenbosch
1980	The second pollution monitoring survey of Hout Bay beach.	Eagle, G.A.; Bartlett, P.D.; Hennig, K.F.	CSIR report ?/Sea 8008	Biogeochemical	CSIR, Stellenbosch
1980	Table Bay harbour development. Report No.6: Physical model tests. Vol.1.	Toms, G.	CSIR report C/SEA 8001	Physical	CSIR, Stellenbosch
1980	Table Bay harbour development. Report No.7: Physical	Toms, G.	CSIR report C/SEA 8008	Physical	CSIR, Stellenbosch

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
	model tests. Vol.2.				
1980	Table Bay harbour development. Report No.8: Harbour resonance study calibration of the numerical model.	Botes, W.A.M.	CSIR report C/SEA 8023	Physical	CSIR, Stellenbosch
1980	Table Bay harbour development. Report No.9: Physical model : field wave measurements and an investigation of prototype wave conditions.	Toms, G.	CSIR report C/SEA 8009	Physical	CSIR, Stellenbosch
1980	Table Bay harbour development. Report No.10: Physical model tests. Volume 3. Concluding.	Toms, G. Mynhardt, M.G. Bosman, D.E. Rossouw, J.	CSIR report C/SEA 8009	Physical	CSIR, Stellenbosch
1980	Variation in structure and biomass of kelp communities along the south-west Cape coast.	Field, J G Griffiths, C L, Griffiths, R J Jarman, N Zoutendyk, P Velimirov,B	Transactions of the Royal Society of South Africa, 44: 145-203	Biological	CSIR, Stellenbosch
1980	Table Bay harbour development. Report No.11: Harbour resonance study : application of thenumerical model to the proposed harbour layout. (Confidential)	Botes, W.A.M.	CSIR report C/SEA 8037	Physical	CSIR, Stellenbosch
1980	Table Bay harbour development. Report No.12: Physical model: spur breakwater: design and stability tests.	Kluger, J.W.J.	CSIR report C/SEA 8038	Physical	CSIR, Stellenbosch
1980	Table Bay harbour development. Report No.13: Physical model tests on final accepted layout.	Bosman, D.E. Mynhardt, M.G.	CSIR report C/SEA 8120	Physical	CSIR, Stellenbosch
1979	Table Bay harbour development. Report No.5: Harbour resonance study : recording and analysis of prototype long-wave data.	Botes, W.A.M.	CSIR report C/SEA 7938	Physical	CSIR, Stellenbosch
1979	The development of Table Bay harbour.	Campbell, N.P. Russell, K.S. Toms, G.	CSIR report R/SEA 7917	Physical	CSIR, Stellenbosch
1979	Table Bay harbour development. Report No.4: Physical model calibration and wave refraction studies.	Zacks, J.	CSIR report C/SEA 7926	Physical	CSIR, Stellenbosch
1979	Preliminary pollution surveys around the south-western Cape coast. Part 3: Hout Bay.	Fricke,A.H.; Eagle,G.A.; Gledhill,W.J.; Greenwood,P.J.; Orren,M. J.	South African Journal of Science, 75(10), 459-461	Biogeochemical	

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
1979	Table Bay harbour development. Report No.3: Physical model measurement and analysis techniques.	Toms, G.	CSIR report C/SEA 7910	Physical	CSIR, Stellenbosch
1978	Table Bay harbour development. Report No.1: Physical model construction.	Toms, G.	CSIR report C/SEA 7813	Physical	CSIR, Stellenbosch
1978	Table Bay harbour development. Report No.2: Harbour resonance study : the numerical model.	Russell, K.S. Botes, W.A.M.	CSIR report C/SEA 7815	Physical	CSIR, Stellenbosch
1978	Sea temperature fluctuations due to local wind forcing.	Bain,C.A.R.	Transactions of the Royal Society of South Africa, 44(1): 130-131	Physical	Journal Publication
1977	Temperature acclimation in Actinia equina L. (Anthozoa).	Griffiths, R. J.	Journal of Experimental Marine Biology and Ecology, 28(3),: 285-292	Biological	Journal Publication
1977	Reproductive cycles in littoral populations of <i>Choromytilus meridionalis</i> (Kr.) and <i>Aulacomya ater</i> (Molina) with a quantitative assessment of gamete production in the former.	Griffiths, R. J.	Journal of Experimental Marine Biology and Ecology, 30(1): 53-71	Biological	Journal Publication
1974	Observations on the effects of crude oil pollution on the sandy beach snail <i>Bullia</i> Gastropoda Prosobranchiata.	Brown, A.C.; Baissac, P.; Leon, B.	Transactions of the Royal Society of South Africa, 41(1): 19-24	Biological	Journal Publication
1974	Observations on the effect of ammonium nitrate solutions on some common marine animals from Table Bay.	Brown, A. C.	Transactions of the Royal Society of South Africa, 41(2): 217-223	Biogeochemical Biological	Journal Publication
1972	A leopard seal from Hout Bay, South Africa.	Best, P.B.	Zoologica Africana, 6,(2) 177-17	Biological	Journal Publication
1971	Hydrology of Table Bay.	Van Ieperen, M.P.	Document available at CSIR, Stellenbosch (P01140)	Physical	CSIR, Stellenbosch
1971	The ecology of the sandy beaches of the Cape Peninsula, South Africa. Part I: Introduction.	Brown, A.C.	Transactions of the Royal Society of South Africa, 39(3): 247-79	Biological	Journal Publication
1970	Green Point outfall investigation. Final Report.	Atkins, G R	Report published by the Marine Effluent Research Unit, University of Cape Town	Physical Biogeochemical Biological	University of Cape Town
1964	Effect of hydrogen sulphide on <i>Bullia</i> Gastropoda	Brown, A. C.	Nature, 203(4941): 205-206	Biological	Journal Publication
1928	Mean sea level and other tidal phenomena in Table Bay, South Africa.	Dommissie, J.	Transactions of the Royal Society of South Africa, 17(2): 117-119	Physical	Journal Publication

5.5 Available Environmental Data

Although environmental data will be listed in many of the above-mentioned documents and publications, existing oceanographic databases, such as those available at the CSIR, Stellenbosch, were also searched. The following data could be located on the Cape Peninsula (western section):

Wind

POSITION	DEPLOYMENT PERIOD	TYPE OF OBSERVATIONS	OWNER/LOCATION OF DATA
Hout Bay 34° 02.73'S; 18° 21.08'E	1990-06-13 to 1995-12-01	Wind Direction, Wind Speed (Average), Wind Speed (Maximum)	CSIR, CSIR EMD Database
Robben Island 33° 48.83'S; 18° 22.00'E	1992-12-11 to 1996-01-31	Wind Direction, Wind Speed (Average)	CSIR, CSIR EMD Database
Cape Point 34° 21.35'S; 18° 29.76'E	1994-04-01 to 1997-02-28	Wind Direction, Wind Speed (Average)	DEAT, CSIR EMD Database
Liesbeeck Park 33° 56.00'S; 18° 29.00'E	1995-09-15 to 1995-11-24	Average Temperature, Minimum Temperature, Maximum Temperature, Wind Direction, Wind Speed (Average), Wind Speed (Maximum)	Olympic Bid, CSIR EMD Database
Roman Rock 34° 21.88'S; 18° 27.66'E	1995-10-04 to 1995-12-01	Average Temperature, Minimum Temperature, Maximum Temperature, Wind Direction, Wind Speed (Average), Wind Speed (Maximum)	Olympic Bid, CSIR EMD Database
Simonstad_IMT 34° 11.02'S; 18° 26.05'E	1995-09-12 to 1995-12-01	Average Temperature, Relative Humidity, Wind Direction, Wind Speed (Average), Wind Speed (Minimum), Wind Speed (Maximum)	Olympic Bid, CSIR EMD Database
Table Bay 33° 52.50'S; 18° 23.57'E	1995-10-03 to 1995-11-16	Wind Direction, Wind Speed (Average), Wind Speed (Maximum)	Olympic Bid, CSIR EMD Database
Table Bay Port 33° 54.25'S; 18° 25.85'E	1995-12-02 to 2005-02-28	Wind Direction, Wind Speed (Average), Wind Speed (Maximum)	National Ports Authority CSIR EMD Database
Hout Bay Harbour 33° 03.15'S; 18° 20.77'E	1996-03-19 to 1996-12-31	Average Temperature, Minimum Temperature, Maximum Temperature, Relative Humidity, Wind Direction, Wind Speed (Average), Wind Speed (Maximum)	CSIR, CSIR EMD Database
Ben Schoeman 33° 52.50'S; 18° 23.57'E	1997-11-11 to 2005-03-31	Wind Direction, Wind Speed (Average), Wind Speed (Maximum)	Olympic Bid, CSIR EMD Database

Waves

POSITION	DEPLOYMENT PERIOD	TYPE OF OBSERVATIONS	OWNER/LOCATION OF DATA
Cape Point 34° 12.24'S; 18° 17.20' E	June 1994 to March 2005	Wave Height and Direction (Waverider)	CSIR, CSIR EMD Database
Granger Bay 33° 41.00'S; 18° 24.20' E	September 1993 to June 1994	Wave Height and Direction (Waverider)	CSIR, CSIR EMD Database
Granger Bay 33° 41.00'S; 18° 24.20' E	July 1994, Feb to Aug 1995	Wave Height and Direction (Waverider)	CSIR, CSIR EMD Database
Koeberg 33° 41.00'S; 18° 24.20' E	November 1977 to January 1985, May 1992	Wave Height and Direction (Waverider)	CSIR, CSIR EMD Database
Robben Island 33° 47.50'S; 18° 22.90' E	July to November 1996	Wave Height and Direction (Waverider)	CSIR, CSIR EMD Database
Slangkop	February 1976, October 1978 to May 1993	Wave Height and Direction (Waverider)	CSIR, CSIR EMD Database

POSITION	DEPLOYMENT PERIOD	TYPE OF OBSERVATIONS	OWNER/LOCATION OF DATA
34° 07.60'S; 18° 10.60' E			
Table Bay 33° 53.30'S; 18° 25.40' E	May 1985 to October 1992	Wave Height and Direction (Waverider)	CSIR, CSIR EMD Database
Table Bay 33° 41.00'S; 18° 24.20' E	June 1993 to December 1995	Wave Height and Direction (Waverider)	CSIR, CSIR EMD Database
Table Bay 33° 41.00'S; 18° 24.20' E	December 1993 to March 1994	Wave Height and Direction (Waverider)	CSIR, CSIR EMD Database
Table Bay 33° 53.30'S; 18° 25.40' E	May to August 1990	Wave Height and Direction (Waverider)	CSIR, CSIR EMD Database

Currents

POSITION	DEPLOYMENT PERIOD	INSTRUMENT DEPTH	WATER DEPTH	TYPE OF OBSERVATIONS/INSTRUMENT	OWNER/LOCATION OF DATA
Cape Point Valley 34° 15.40'S 18° 09.90'E	1978-11-02 to 1978-11-29	253 m	203 m, 233 m	Current speed & direction; Water temperature Aanderaa RCM4	SFB, CSIR EMD Database
Cape Point Valley 34° 18.30' S 18° 10,30'E	1980-07-02 to 1980-08-07	250 m	227 m	Current speed & direction; Water temperature Aanderaa RCM4	MCM, CSIR EMD Database
Cape Point Valley 34° 19.90' S 18° 10,20'E	1980-08-07 to 1980-11-23	274 m	252 m	Current speed & direction; Water temperature Aanderaa RCM4	MCM, CSIR EMD Database
Oudekraal 33° 58.40' S 18° 19,00'E	1980-12-02 to 1981-03-04	65 m	49 m	Current speed & direction; Water temperature Aanderaa RCM4	MCM, CSIR EMD Database
West of Peninsula 33° 50.30' S 18° 00,90'E	1981-07-01 to 1981-09-19	168 m	118 m, 149 m	Current speed & direction; Water temperature Aanderaa RCM4	MCM, CSIR EMD Database
West of Duikerpoint 34° 00.60' S 18° 08,50'E	1981-10-15 to 1982-01-07	168 m	45 m, 99 m, 153 m	Current speed & direction; Water temperature Aanderaa RCM4	MCM, CSIR EMD Database
Slangkop 34° 08.60' S 18° 06,10'E	1982-08-03 to 1982-09-16	205 m	169 m	Current speed & direction; Water temperature Aanderaa RCM4	MCM, CSIR EMD Database
West of Bokpunt 33° 40.60' S 18° 01,10'E	1984-03-26 to 1984-06-06	146 m	43 m, 119 m	Current speed & direction; Water temperature Aanderaa RCM4	MCM, CSIR EMD Database
Springfontein 33° 40.00' S 18° 14,30'E	1984-03-26 to 1984-06-06	79 m	36 m, 57 m	Current speed & direction; Water temperature Aanderaa RCM4	MCM, CSIR EMD Database
Bokpunt 33° 36.10' S 18° 18,30'E	1984-12-06 to 1985-02-12	40 m	24 m	Current speed & direction; Water temperature Aanderaa RCM4	MCM, CSIR EMD Database
Olifantsbos 34° 17.10' S 18° 18,40'E	1985-01-08 to 1985-05-10	35 m	76 m	Current speed & direction; Water temperature Aanderaa RCM4	MCM, CSIR EMD Database
Oudekraal Coastal 33° 57.10' S 18° 17,50'E	1985-01-08 to 1985-06-10	81 m	42 m, 63 m	Current speed & direction; Water temperature Aanderaa RCM4	MCM, CSIR EMD Database
Oudekraal Coastal 33° 57.60' S 18° 16,90'E	1985-12-11 to 1986-04-13	81 m	42 m, 63 m	Current speed & direction; Water temperature Aanderaa RCM4	MCM, CSIR EMD Database
34° 10.30' S 18° 30,00'E	1989-09-28 to 1989-11-22	? m	32 m	Current speed & direction; Water temperature Aanderaa RCM4	CSIR, CSIR EMD Database

Chemical & Microbiological data: Water column

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	DEPTH INTERVALS	OWNER/LOCATION OF DATA
1980-07-08 to 1980-09-17	Once off	Cadmium, copper, Iron, Lead, Manganese, Nickel, Zinc	33.8S to 33.9S and 18.4E - 18.5E (132 records)	Details available on request	CSIR SADCO Database
1900 to 2005	Details available on	Temperature; Salinity	33.5S to 34.42 S and 18E to 18.5 E	Details available on request	CSIR SADCO Database

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	DEPTH INTERVALS	OWNER/LOCATION OF DATA
(details available on request)	request		(~ 19 000 records)		
1900 to 2005 (details available on request)	Details available on request	Dissolved oxygen	33.5S to 34.42 S and 18E to 18.5 E (~ 10 000 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Nitrate	33.5S to 34.42 S and 18E to 18.5 E (~ 5 300 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Nitrite	33.5S to 34.42 S and 18E to 18.5 E (~ 380 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Phosphate;Phosphorus	33.5S to 34.42 S and 18E to 18.5 E (~ 19 000 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Silicate	33.5S to 34.42 S and 18E to 18.5 E (~ 5 200 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	pH	33.5S to 34.42 S and 18E to 18.5 E (~ 180 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Chlorophyll a	33.5S to 34.42 S and 18E to 18.5 E (~ 170 records)	Details available on request	CSIR SADCO Database

Chemical and Microbiological data: Sediments

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	GRAB/CORE SAMPLING	OWNER/LOCATION OF DATA
1977-03-22 to 1979-11-05	Once off	Cadmium, Cobalt, Copper, Iron, Lead, Manganese, Nickel, Zinc	33.9S to 34.0S and 18.4E to 18.4E (55 records)	No data	CSIR SADCO Database

Chemical and Microbiological data: Biological tissue

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	OWNER/LOCATION OF DATA
1982-02-15 to 1984-08-31	Once off	Cadmium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Zinc	33.8S to 34.3S and 18.3E to 18.5E (79 records)	CSIR SADCO Database

5.6 Existing Monitoring Programmes

PROGRAMME	DESCRIPTION	MONITORING TYPE	DURATION	SAMPLING FREQUENCY	SAMPLING LOCATION	PARAMETERS MEASURED	OWNER/LOCATION
Robben Island Outfall*	Physical inspection of marine outfall scheme	System Performance		Annually	Along pipeline route	Physical observations and Video recording	City of Cape Town
Robben Island Outfall*	Test for compliance with critical limits specified for effluent	Source		Weekly	Final effluent	pH; Suspended solids; Chemical Oxygen Demand; Ammonia; Total Kjeldahl Nitrogen; total P; Soap; Oil & Grease, etc.	City of Cape Town
Robben Island Outfall*	Assess any potential impact on receiving environment	Environmental		Bi-annually: Biological & chemical Fortnightly: Bacteriological	Selection of sediment and water column sampling stations in proximity of outfall	Sediments: Selection of biological and chemical parameters Water column: Bacteriological contaminants	City of Cape Town
Potsdam WWTW	Test for compliance with critical limits specified for effluent	Source		Monthly	Final effluent	pH, Suspended solids, Chemical Oxygen Demand; Ammonia; Total Kjeldahl Nitrogen; Soap; Oil & grease	City of Cape Town
Green Point Outfall*	Physical inspection of marine outfall scheme	System Performance		Bi-annually	Along pipeline route	Physical observations and Video recording	City of Cape Town
Green Point Outfall*	Test for compliance with critical limits specified for effluent	Source		Weekly: Other parameters Monthly: Trace metals	Final effluent	pH; Suspended solids; Chemical Oxygen Demand; Ammonia; Total Kjeldahl Nitrogen; Phosphate; Trace metals	City of Cape Town
Green Point Outfall*	Assess any potential impact on receiving environment	Environmental		Bi-annually: Biological & chemical Weekly: Bacteriological	Selection of sediment and water column sampling stations in proximity of outfall	Sediments: Selection of biological and chemical parameters Water column: Bacteriological contaminants	City of Cape Town
Camps Bay Outfall*	Physical inspection of marine outfall scheme	System Performance		Annually	Along pipeline route	Physical observations and Video recording	City of Cape Town
Camps Bay Outfall*	Test for compliance with critical limits specified for effluent	Source		Weekly: Other parameters Monthly: Trace metals	Final effluent	pH; Suspended solids; Chemical Oxygen Demand; Ammonia; Total Kjeldahl Nitrogen; Phosphate; Trace metals	City of Cape Town
Camps Bay Outfall*	Assess any potential impact on receiving environment	Environmental		Upon request	Selection of sediment and water column sampling stations in proximity of outfall	Sediments: Selection of biological and chemical parameters Water column: Bacteriological contaminants	City of Cape Town
Hout Bay Outfall*	Physical inspection of marine outfall scheme	System Performance		Bi-annually	Along pipeline route	Physical observations and Video recording	City of Cape Town

PROGRAMME	DESCRIPTION	MONITORING TYPE	DURATION	SAMPLING FREQUENCY	SAMPLING LOCATION	PARAMETERS MEASURED	OWNER/LOCATION
Hout Bay Outfall*	Test for compliance with critical limits specified for effluent	Source		Weekly: Other parameters Monthly: Trace metals	Final effluent	pH; Suspended solids; Chemical Oxygen Demand; Ammonia; Total Kjeldahl Nitrogen; Phosphate; Trace metals	City of Cape Town
Hout Bay Outfall*	Assess any potential impact on receiving environment	Environmental		Bi-annually: Biological & chemical Weekly: Bacteriological	Selection of sediment and water column sampling stations in proximity of outfall	Sediments: Selection of biological and chemical parameters Water column: Bacteriological contaminants	City of Cape Town
Llundudno WWTW	Test for compliance with critical limits specified for effluent	Source		Monthly	Final effluent	pH, Suspended solids, Chemical Oxygen Demand; Ammonia; Total Kjeldahl Nitrogen; Soap; Oil & grease	City of Cape Town
Caltex Refinery Outfall*	Test for compliance with critical limits specified for effluent	Source		Weekly: Other parameters 3-monthly: Trace materials		Electrical conductivity; pH, Ammonia; Phenol; Cyanide; Sulphide; Trace materials	Caltex Oil SA (Pty) Ltd
Caltex Refinery Outfall*	Test for compliance with critical limits specified for effluent	Environmental		3-yearly	9 sediment sampling stations in proximity of outfall (initial study included 27 stations)	Trace metals Phenol Benthic fauna Organic matter (C & N)	Caltex Oil SA (Pty) Ltd
Coastal Bacteriological Monitoring Programme*	Determine fitness for use for recreation and collection of filter feeders for human consumption	Environmental		Fortnightly	28 stations along the coast	Faecal coliform <i>E. coli</i> <i>Enterococci</i> (since 2004)	City of Cape Town
Coastal Mussel Watch Programme	Monitor trace metal accumulation in biota along coast	Environmental		Six-monthly		Trace metals	Marine and Coastal Management (DEAT)
Port of Cape Town; Sediment Monitoring	Monitor sediment quality for dredging purposes as required under the London Convention	Environmental		Annually	Selection of stations within the Port of Cape Town	Trace metals Petroleum hydrocarbons Organic C & N Particle size distribution	National Ports Authority

* Cape Metropolitan Coastal Water Quality Committee (2003)

5.7 Suitability for Application in Management Framework

i. Management Responsibilities

The Cape Metropolitan Coastal Water Quality Committee (refer to Chapter 5.1), to a large degree, already fulfils the role of a local management institution in this node. In this case, senior officials from local, provincial and national government and civil society joined efforts to manage marine water quality within the boundaries of the Cape Metropolitan Area. To meet the full requirements of a local management institution, as per the proposed management framework, it is recommended that representation on this Committee also be explicitly extended to other key stakeholders, such as:

- National Ports Authority, in particular their environmental section
- Industries that discharge to the marine environment, e.g. Caltex Oil Refinery, Koeberg Nuclear Power Station
- Tourism forums (if not already included).

ii. Legislative Framework

An assessment of the South African legislative framework related to marine pollution is addressed in more detail in Chapter 2.

iii. Environmental Quality Objectives

Important marine ecosystems and beneficial uses within this node have been summarized before (Quick and Roberts, 1993) and a preliminary assessment of the current situation is provided in Chapter 5.3.

There are numerous initiatives through which important marine ecosystems and beneficial use areas are being decided upon within the Cape Peninsula, such as:

- Closed and Marine Protected areas proclaimed by the Department of Environmental Affairs and Tourism (refer to Chapter 5.3)
- Coastal Zone Strategy for the City of Cape Town (City of Cape Town, 2003)
- Planning and Development within the Port of Cape Town (National Ports Authorities).

It is important that proper integration and communication takes place between the above-mentioned initiatives so as to synthesize a common set of management and environmental quality objectives for the coastal area within this node and also to manage any potential conflicts. The Cape Metropolitan Coastal Water Quality Committee could be the suitable

platform from which to coordinate such communication, provided that other key role players (as mentioned earlier) are included.

iv. Marine Pollution Sources

Within this node, pollutant input from land-based sources, in particular point sources, are to a large extent, well quantified (refer to Chapter 5.2). However, quantitative data on pollutant input through river and storm-water run-off (diffuse sources) are, very limited. It is recognized that such data are often difficult to obtain, but to ultimately assess cumulative and potential synergistic effects, it is necessary that such data be available. Where these data cannot be obtained through routine monitoring (e.g. due to resource constraints), they could be derived from available literature. For example, an overview of the type of pollutant input from storm-water run-off, originating from different source areas, is provided in Pegram & Görgens (2001).

Quantification of pollutant input for other pollution sources in this node, e.g. activities associated with the Port of Cape Town and Hout Bay Harbour, will also be difficult. However, it will be important to list these so as to identify activities for which controls (e.g. critical limits and/or mitigating measures) need to be specified to minimize or limit impacts on beneficial uses and important marine ecosystems. It is also necessary to assess ultimately cumulative or potential synergistic impacts.

iv. Scientific Assessment Studies

Based on the inventory of available environmental literature, a number of scientific and engineering studies related to the management of marine pollution sources have already been conducted within this area. However, these appear to be source specific, e.g. studies conducted for the Green Point outfall or Caltex outfall, rather than addressing issues on an integrated, ecosystem scale (i.e. considering potential cumulative and synergistic effects from different pollution sources).

Taking into account the complexities of the physical, biogeochemical and biological processes of the marine environment in this area, as well as the multitude of marine pollution sources, such integrated assessment studies could best be undertaken through the application of sophisticated numerical modelling techniques. To ensure that these types of studies are undertaken in a cost-effective manner and to prevent duplication of effort, it is recommended that a local management institution dealing with marine pollution matters (e.g.

the Cape Metropolitan Coastal Water Quality Committee) be used as a platform from which to plan and coordinate integrated, ecosystem scale scientific assessment studies.

v. Critical limits and Mitigating Actions

DWAF has already specified, or is in the process of specifying, critical limits for municipal (WWTW) and industrial effluent discharges in the area. These will be included in licence agreements issued under the National Water Act 36 of 1998 (Wilna Kloppers, Department of Water Affairs and Forestry, Bellville, pers. comm.).

As far as could be established, mitigating (or corrective) actions to prevent pollution from catchment (river) and urban storm-water run-off are addressed mainly through the Catchment Management Teams (Cape Metropolitan Council Coastal Water Quality Committee, 2003).

vi. Monitoring Programmes

Routine source monitoring programmes are undertaken at most of the point source discharges within this node, as part of licence agreements issued under the National Water Act 36 of 1998. At the offshore marine outfall schemes, these include regular system performance monitoring programmes.

Means should, however, be investigated to quantify pollutant inputs from contaminated river and storm-water run-off. Routine monitoring programmes at the rivers and selected stormwater outlets could be implemented to assist in this process.

In terms of environmental monitoring programmes, numerous initiatives are presently undertaken within this node (refer to Chapter 5.6). These include:

- Bacteriological monitoring programme (City of Cape Town)
- Mussel Watch Programme (Marine and Coastal Management)
- Individual environmental monitoring programmes of the marine outfall schemes in the area
- Sediment monitoring programme in the Port of Cape Town, related to dredging activities (National Ports Authorities).

Although each of these programmes fulfils a particular purpose (refer to Chapter 5.2), it is recommended that opportunities be investigated to integrate some of these into larger, ecosystem-based programmes. Again, the Cape Metropolitan Coastal Water Quality Committee is considered the most suitable platform from which to undertake such investigations, provided that other key role players (as mentioned earlier) are included.

6 FALSE BAY

6.1 Existing Management Initiatives

NAME	DESCRIPTION	RESPONSIBLE INSTITUTION/AUTHORITY	PARTIES INVOLVED	PERIOD OPERATIONAL
Cape Metropolitan Coastal Water Quality Committee	A voluntary association of senior officials from local, provincial and national government and civil society that joined efforts in managing the marine water quality within the boundaries of the Cape Metropolitan Area	City of Cape Town	City of Cape Town (including various Departments and Branches) Department of Water Affairs and Forestry Department of Environmental Affairs and Tourism Provincial Department of Environmental Affairs (Western Cape)	
Catchment Management Team: South	Catchment along the western section of False Bay; Steer compilation, implementation and review of catchment and river management plans; review coastal and river water quality data and recommend corrective actions; coordinate stormwater and river related capital and maintenance programmes	City of Cape Town	Catchment Management Department Representatives from line functions affected, e.g. Stormwater, Wastewater and Health	Since 2003
Catchment Management Team: East	Catchment along the eastern section of False Bay; Steer compilation, implementation and review of catchment and river management plans; review coastal and river water quality data and recommend corrective actions; coordinate stormwater and river related capital and maintenance programmes	City of Cape Town	Catchment Management Department Representatives from line functions affected, e.g. Stormwater, Wastewater and Health	Since 2003

6.2 Marine Pollution Sources

A map indicating the location of major potential marine pollution sources in False Bay is provided in Figure 6.1. Details on these sources are provided below (information mainly sourced from Taljaard *et al.*, 2001, Cape Metropolitan Coastal Water Quality Committee, 2003 and RSA DWAF, 2004):

SOURCE	SOURCE TYPE	DESCRIPTION	ESTIMATED VOLUME	POLLUTANT COMPOSITION	OWNER/MANAGER
Atmospheric sources	Atmospheric	The main sources are exhaust fumes from cars and trucks (particularly poorly maintained diesel vehicles), but also wood-fires and burning tyres.		Nitrogen; Sulphur dioxide; Petroleum hydrocarbons	City of Cape Town
Buffels (Wes) River	Land-based	Catchment largely falls within National Park (Catchment area: 7.75 km ²)		Not considered to be polluted	Dept. of Water Affairs & Forestry
Elsies River	Land-based	Catchment largely drains residential developments		Suspended solids; Bacteriological	Dept. of Water Affairs & Forestry

SOURCE	SOURCE TYPE	DESCRIPTION	ESTIMATED VOLUME	POLLUTANT COMPOSITION	OWNER/MANAGER
		and therefore carries storm-water run-off (Catchment area: 18 km ²)		contaminants; Litter	
Miller's Point WWTW	Land- based	Effluent from a WWTW discharged into the surf zone	No data	Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants	City of Cape Town
Simon's Town Harbour	Maritime Transportation	Activities potentially causing marine pollution include: accidental and illegal oil spillages, cleaning of vessels, and dredging operations.	Not easily quantifiable	Suspended solids; Trace metals; Petroleum hydrocarbons	Department of Defence (Navy)
Simon's Town WWTW	Land- based	Effluent from a WWTW discharged into the surf zone	2 632 m ³ /day*	Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants	City of Cape Town
Kalk Bay harbour	Maritime Transportation	Activities causing marine pollution include: cleaning of vessels, accidental oil spillages, dumping of bloodwater and other fish offal, and littering	Not easily quantifiable	Suspended solids; Organic matter (fish waste); Petroleum hydrocarbons; Litter/Garbage	Dept. of Public Works/Dept. of Environmental Affairs and Tourism
Silvermine River	Land-based	Catchment largely drains residential developments and therefore carries storm-water run-off (Catchment area: 21 km ²)		Suspended solids; Bacteriological contaminants; Litter	Dept. of Water Affairs & Forestry
Sand River	Land-based	Catchment consists of forestry, low density residential area and highly urbanised areas (Catchment area: 96 km ²)		Suspended solids; Organic matter; Inorganic nutrients (N & P); Trace metals Petroleum hydrocarbons; Bacteriological contaminants	Dept. of Water Affairs & Forestry
Zeekoe Canal (including Cape Flats WWTW)	Land-based	Catchment has been extensively modified and drains large urban and agricultural areas (Catchment area: 82 km ²). Effluent from a WWTW discharged into the Zeekoe canal that ultimately discharges into the surf zone	194 439 m ³ /day* (discharged from WWTW)	Suspended solids; Organic matter; Inorganic nutrients (N & P); Trace metals Petroleum hydrocarbons; Pesticides; Bacteriological contaminants	Dept. of Water Affairs & Forestry/City of Cape Town
False Bay coast: Storm-water Run-off	Land-based	The coastline of False Bay is largely occupied by residential or commercial developments from which numerous smaller stormwater outlets drain into False Bay		Suspended solids; Trace metals; Petroleum hydrocarbons; Bacteriological contaminants; Litter	City of Cape Town
Coastal Park landfill site	Land-based	Leachate from the landfill site could reach the marine environment through groundwater seepage	No data	Inorganic nutrients (N & P); Trace metals Petroleum hydrocarbons; Pesticides; Bacteriological contaminants	City of Cape Town
Mitchell's Plain WWTW	Land- based	Effluent from a WWTW discharged into the surf zone	43 513 m ³ /day*	Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants	City of Cape Town
Mitchell's Plain East Storm-water Drain	Land-based	Large storm-water outlet about 1.5 km to the east of Mnandi Beach that drains a large part along the western section of Mitchell's Plain (Catchment area: 17 km ²)	~ 1 x 10 ⁶ m ³ /annum**	Suspended solids; Trace metals; Petroleum hydrocarbons; Bacteriological contaminants; Litter	City of Cape Town
Mitchell's Plain West Storm-water Drain	Land-based	Large storm-water outlet about 1 km to the west of Mnandi Beach that drains a large part along the western section of Mitchell's Plain (Catchment area: 18 km ²)	~ 5 x 10 ⁶ m ³ /annum**	Suspended solids; Trace metals; Petroleum hydrocarbons; Bacteriological contaminants; Litter	City of Cape Town
Monwabisi Storm-water Drain	Land-based	Large storm-water outlet about 1 km to the east of Monwabisi Resort that drains a large part of Khayelitsha (Catchment area: 17.8 km ²)	~ 5 x 10 ⁶ m ³ /annum**	Suspended solids; Trace metals; Petroleum hydrocarbons; Bacteriological contaminants; Litter	City of Cape Town
Kuils/Eerste River (including Macassar WWTW)	Land-based	Catchment has been extensively modified and drains large urban and agricultural areas. A number of WWTW also discharge into this river system further upstream (Catchment area: 600 km ²). Effluent from a WWTW	54 494 m ³ /day* (discharged from WWTW)	Suspended solids; Organic matter; Inorganic nutrients (N & P); Trace metals Petroleum hydrocarbons; Pesticides; Bacteriological contaminants	Dept. of Water Affairs & Forestry/City of Cape Town

SOURCE	SOURCE TYPE	DESCRIPTION	ESTIMATED VOLUME	POLLUTANT COMPOSITION	OWNER/MANAGER
		discharged into the Eerste River Estuary			
SOMCHEM Discharge	Land-based	Acidic effluent from a chemical industry discharged to the surf zone near Somerset West	Varies, unknown	pH; Nitrate; Suspended solids; Organic matter	SOMCHEM
Lourens River	Land-based	Drains a catchment which consists of forestry, agricultural, residential areas and light industries (Catchment area: 92 km ²)		Suspended solids; Trace metals; Petroleum hydrocarbons; Pesticides; Bacteriological contaminants	Dept. of Water Affairs & Forestry
Gordon's Bay harbour	Maritime Transportation	Recreational harbour where activities causing marine pollution include: cleaning of vessels, accidental oil spillages, and littering	Not easily quantifiable	Suspended solids; Petroleum hydrocarbons; Litter/Garbage	Dept. of Public Works/Dept. of Environmental Affairs and Tourism
Sir Lowry's Pass River (including Gordon's Bay WWTW)	Land-based	Drains a catchment which consists of forestry and agricultural areas (Catchment area: 32 km ²). Effluent from a WWTW discharged into the Lourens River just upstream of the mouth	2000 m ³ /day** (discharged from WWTW)	Suspended solids; Organic matter; Inorganic nutrients (N & P); Pesticides; Bacteriological contaminants	Dept. of Water Affairs & Forestry/City of Cape Town
Soet River	Land-based	Small river draining mainly a residential area		Suspended solids; Bacteriological contaminants; Litter	Dept. of Water Affairs & Forestry
Steenbras Water Treatment Plant, Gordon's Bay	Land-based	Sludge discharged from the Steenbras Water Treatment Plant WWTW discharged into the surf zone	2000 m ³ /day**	Humic acids; Discolouration	City of Cape Town
Steenbras River	Land-based	Catchment largely consists of forestry (Catchment area: 70 km ²)		No major pollutant risks	Dept. of Water Affairs & Forestry
Rooiels River	Land-based	Catchment situated in Nature Reserve		No major pollutant risks	Dept. of Water Affairs & Forestry
Buffels (Oos) River	Land-based	Catchment largely undeveloped		No major pollutant risks	Dept. of Water Affairs & Forestry



Figure 6.1: Potential marine pollution sources in False Bay

6.3 Important Marine Ecosystems and Beneficial Uses

6.3.1 Important Marine Ecosystems

Important and/or sensitive marine ecosystems within this node include (Figure 6.2):

- The estuaries within the Bay, such as Zandvlei, Eerste, Lourens and Rooiels estuaries
- A marine protected area and a number of closed areas have been proclaimed in False Bay under the Marine Living Resources Act 18 of 1998), namely:
 - Castle Rock Marine Protected Area, from Bakoven Rock to Bobbejaanklip, extending one nautical mile seaward from the high-water mark.
 - Closed Area, from Jager's Walk to Glencairn Beach, extending 500 m seaward of the high-water mark. Only angling and the collection of washed up red bait are allowed.
 - Closed Area, from Neptune's Corner to St James Station, extending 500 m seaward of the high-water mark. Only angling and the collection of washed up red bait are allowed.

- Closed Area, from St James Station to Kalk Bay Station, extending 500 m seaward of the high-water mark. Only washed up red bait may be collected.
- Closed Area, from security fence next to the Lourens River to the eastern breakwater of the Gordon's Bay harbour, extending 500 m seaward of the high-water mark. Only angling and the collection of washed up red bait are allowed. This closed area is, however, likely to be de-proclaimed (Dr L Hutchings, MCM, pers. comm.).

6.3.2 Beneficial uses

i. Recreation (including tourism)

The coastal areas of False Bay are popular tourist destinations. In addition to the bay's scenic beauty, there are numerous beaches that are intensively used for bathing, surfing and other beach-based recreation. Some of the most popular beaches are indicated in Figure 6.2.

Whereas in the past, recreational activities primarily occurred close to shore (surfing and swimming), the introduction of water sports such as windsurfing and kite surfing, has extended the boundaries of recreational use to much further offshore, particularly in the area between Muizenberg and the Strand.

The Harbour Island, with its yacht harbour is also situated within this node.

ii. Marine Aquaculture and Important Fisheries (including collection of seafood for human consumption)

The exploitation of natural resources along the False Bay coast is an important source of recreation, employment and food. Almost the entire coast is used for fishing, particularly the areas between Muizenberg and Gordon's Bay.

Collection of mussels for human consumption, both white mussels (found along sandy beaches) and black mussels (found along the rocky shores), occurs at various locations along this stretch of coast. Areas where black mussels are found are indicated in Figure 6.2.

iii. Industrial uses

Although there are numerous activities in harbours and ports that could detrimentally affect marine water and sediment quality (as discussed earlier), these are also users and require a certain quality of the marine environment.

Harbours within this node include:

- Simon's Town Naval Base
- Kalk Bay Fishing Harbour
- Gordon's Bay Fishing Harbour.



Figure 6.2: Important ecosystems and beneficial uses of False Bay

6.4 Available Environmental Literature

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	OWNER/ LOCATION
2003	Sand transport along the Western Cape coast: gone with the wind?	Franceschini, G.; Compton, J. S.; Wigley, R. A.	South African Journal of Science 99, (7/8): 317-318	Physical	Journal Publication
2003	Seasonal, age, and sex differences in weight, fat reserves, and plasma corticosterone in Western Sandpipers <i>Diferencias estacionales</i>	O'Reilly, K.M.; Wingfield, J.C.	Ornithological Society, 105(1): 13-26	Biological	Journal Publication
2003	<i>Karenia cristata</i> sp. nov. and <i>Karenia bicuneiformis</i> sp. nov. (Gymnodiniales, Dinophyceae): Two new <i>Karenia</i> species from the South African coast.	Botes, L.; Sym, S.D.; Pitcher, G.C.	Phycologia, 42(6): 563-571	Biological	Journal Publication
2003	New records of the genus <i>Cyprideis</i> (Crustacea, Ostracoda) from South Africa.	Wouters, K.	Bulletin de l'inst. Royal des Sciences Naturelles de Belgique, 73, 161-165	Biological	Journal Publication
2003	Diet of <i>Octopus vulgaris</i> in False Bay, South Africa.	Smith, C.D	Marine Biology, 143(6):1127-1133	Biological	Journal Publication
2002	Urban storm-water quality.	Engelbrecht, P.; Fraser, L.	Biennial WISA Conference and Exhibition. Abstracts (19 to 23 May 2002)	Biogeochemical	CSIR Stellenbosch
2002	Composition and seasonal variability of the suprabenthic reef-fish assemblage in False Bay, South Africa.	Lechanteur, Y.A.R.G.; Griffiths, C.L.	African Zoology, 37(2): 1-184	Biological	Journal Publication
2002	Observations on the foraminifera of a sheltered and exposed sandy shore in False Bay, South Africa.	Braar, O.; McMillan, I.; Gibbons, M.J.	Southern African Marine Science Symposium: Currents Coasts Communities, Swakopmund (Namibia), 1-5 Jul 2002	Biological	Department of Zoology, University of the Western Cape
2002	The effect of the Cape Flats aquifer on the water quality of False Bay.	Giljam, R.; Waldron, H.	Southern African Marine Science Symposium: Currents Coasts Communities, Swakopmund (Namibia), 1-5 Jul 2002	Biogeochemical	Department of Oceanography, University of Cape Town
2001	Infection of hottentot <i>Pachymetopon blochii</i> by the fish louse <i>Nilocra capensis</i> (Crustacea: Isopoda) in False Bay, South Africa.	Wright, R.V.; Lechanteur, Y.A.R.G.; Prochazka, K.; Griffiths, C.L.	African Zoology, 36(2): 177-183	Biological	Journal Publication
2001	Fish associated with artificial reefs in False Bay, South Africa: a preliminary survey.	Lechanteur, Y.A.R.G.; Griffiths, C.L.	African Zoology, 36(1): 87-93	Biological	Journal Publication
2000	Preliminary assessment of the feasibility of marine disposal options for effluent from the Zandvliet Wasterwater Treatment Works. (Desktop study) (Confidential)	Van Ballegooyen RC Botes WAM Taljaard S	CSIR report ENV-S-C 2000-089	Physical Biogeochemical	CSIR, Stellenbosch
2000	Subtidal understory algal community structure in kelp beds around the Cape Peninsula (Western Cape, South Africa).	Leliaert, F.; Anderson, R.J.; Bolton, J.J.; Coppejans, E.	Botanica Marina, 43(4): 359-366	Biological	Journal Publication
2000	Foraging behaviour of Cape clawless otters (<i>Aonyx capensis</i>) in a marine habitat.	Somers, M.J.	Journal of Zoology, 252(4): 473-480	Biological	Journal Publication
2000	Seasonal variation in the diet of Cape clawless otters (<i>Aonyx capensis</i>) in a marine habitat.	Somers, M.J.	African Zoology, 35(2): 261-268	Biological	Journal Publication
2000	Measurements of three-dimensional fish school velocities with an acoustic Doppler current profiler.	Demer, D.A.; Barange, M.; Boyd, A.J.	Fisheries Research, 47(2-3): 201-214	Biological	Journal Publication
2000	False Bay water quality review: Volume 1: Executive summary	Taljaard S Van Ballegooyen RC	CSIR report ENV-S-C 2000-086-1	Management	CSIR, Stellenbosch

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	OWNER/ LOCATION
		Morant PD			
2000	False Bay water quality review: Volume 2: Specialist assessments and inventories of references and data	Taljaard S Van Ballegooyen RC Morant PD	CSIR report ENV-S-C 2000-086-2	Physical Biogeochemical Biological Management	CSIR, Stellenbosch
2000	Recording fish schools by multi-beam sonar: potential for validating and supplementing echo integration recordings of schooling fish.	Misund, O.A.; Coetsee, J.	Fisheries Research, 47 (2-3): 149-159	Biological	Journal Publication
2000	A series of reports on the hydrodynamic and chemical processes in the Simon's Bay area	Carl Weinman et al.	IMT internal reports (some confidential)	Physical	IMT
2000	Impact of the annual drawdown of Zeekoevlei and Rondevlei on selected water quality constituents in False Bay	Harding, W R	(SPM E199/99). Report prepared for the South Peninsula Municipality by Southern Waters Ecological Research and Consulting cc.	Physical	City of Cape Town
2000	Survey of laws and institutions applicable to harbour pollution in the Cape Metropolitan Council Area. (Working draft)	Glazewski, J	Report to the Cape Metropolitan Council by the Institute of Marine and Environmental Law, UCT	Management	City of Cape Town
2000	The legal aspects of land-based marine pollution: An overview of governing legislation with case study of False Bay.	Dittke, M	LL.M Thesis - University of Cape Town	Management	University of Cape Town
1999	Dispersion of wastewater along the northern shore of False Bay.	Ollis, D.; Largier, J.	Southern African Marine Science Symposium: Land, Sea and People in the New Millennium, Wilderness (South Africa), 22-26 Nov 1999	Physical	University of Cape Town
1999	Hydrography and water quality in Simon's Bay (False Bay).	Albertus, F.;Attwood, C.; Bergman, S.; Brundrit, G.; Drew, T.; Duckitt, R.; Gildenhuis, S.; Jamaloodien, S.; Law, B.; Matsapola,P.; Price, P.; Risien, C.; Scholtz, J.; Thomalla, S.; Volbrecht, C.; Wainman, C.; Waldron, H.	Southern African Marine Science Symposium: Land, Sea and People in the New Millennium, Wilderness	Physical Biogeochemical	Oceanography Department, University of Cape Town
1999	The status of the intertidal ecosystems in front of the factory of Marine Oil Refiners, Ltd.: A report assessing possible damage due to pollution	Brown, A C	Unpublished report to Marine Oil Refiners of Africa	Biogeochemical	University of Cape Town
1999	Management plan for the coastal zone between the Eerste and Lourens Rivers (Confidential) A. Management plan report. B. Appendices report. Includes: Specialist Study 1. Conservation suitability study, [by] B. Oberholzer and B. Low (Appendix 7); Specialist Study 2. Economic evaluation of conservation proposals for the AECl/Somchem site in Somerset West, by A. Leiman and H. van Zyl (Appendix 8); Specialist Study 3. Importance of the coast between the Lourens and Eerste estuaries for African Black Oystercatchers and other coastal birds, by P. Hockey (Appendix 9)	Lochner, P. Brown-Rossouw, R.	CSIR report ENV-S-C 98103 A, B	Biogeochemical	Heartland Properties & Somchem Division of Denel (Pty) Ltd/CSIR, Stellenbosch
1999	Zandvliet Waste Treatment Works: Investigation of a sewage polluted area with respect to the human intestinal parasite, <i>Ascaris lumbricoides</i> .	Frank, M	CSIR report ENV-S-C 99010	Management	CMC, Waste Water Department
1999	Marine pollution pathogenic micro-organisms in shellfish.	Grabow, W O K Van der Veen, A De Villiers, J C.	WRC report No. 411/1/99	Management	Water Research Commission (Pretoria)

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1999	Cape Metropolitan Coastal Water Quality Committee annual report 1999	CMC	Publication of the City of Cape Town	Physical	City of Cape Town
1999	Temporary groynes for measuring longshore transport in False Bay.	Schoonees, J.S. Theron, A.K. Coppoolse, R.C.	In: Coastal sediments '99: Proceedings of the 4th International Symposium on Coastal Engineering and Science of Coastal Sediment Processes: Conference theme: Scales of coastal sediment motion and geomorphic change, New York, USA, June (ENV-S-R 9930)	Physical	CSIR, Stellenbosch
1999	An overview of water quality management of South Africa's major port-catchment systems.	Walmsley, R D Walmsley, JJ Breywtenbach, R	WRC Report No. 749/1/99	Management	Water Research Commission, Pretoria
1998	The potential of small marine protected areas in the southwestern Cape.	Lechanteur, Y.	International Conference for the Paradi Association and The Fisheries Society of Africa, Grahamstown (South Africa), 13-18 Sept 1998	Biological	Zoology Department, University of Cape Town
1998	A botanical importance rating of selected Cape estuaries.	Coetzee, J.C.; Adams, J.B.; Bate, G.C.	Water S A, 23(1): 81-93	Biological	Journal Publication
1998	Spatial and trophic partitioning in cryptic fish communities of shallow subtidal reefs in False Bay, South Africa.	Prochazka, K.	Environ. Biol. Fish. 51(2):201-220.	Biological	Journal Publication
1998	A preliminary survey of the coastal rivers of False Bay, south-west coast of South Africa, with particular reference to the fish fauna.	Harrison, T.D.	Transactions of the Royal Society of South Africa, 53(1): 1-31	Biological	Journal Publication
1998	The intertidal shore at Dido Valley, Simonstown: An ecological survey in relation to the outfall from the factory of Marine Oil Refiners of Africa Ltd.	Brown, A C	Unpublished report to Marine Oil Refiners of Africa	Biogeochemical	Marine Oil Refiners/ DWAF
1998	Management plan for the coastal zone between the Eerste and Lourens rivers: Draft scoping report	Brown, R. Lochner, P	CSIR report ENV-S-C 98028	Biogeochemical	Heartland Properties & Somchem Division of Denel (Pty) Ltd/CSIR, Stellenbosch
1998	State of the environment report for the Cape metropolitan area. Year one: 1998.	CMC	Publication of the Catchment Management Dept, City of Cape Town	Biogeochemical	City of Cape Town
1998	A limited review of the marine environment of the Cape metropolitan area.	Centre for Marine Studies, UCT	Pulcation of the CMS, UCT	Biogeochemical	University of Cape Town
1998	A limited evaluation of the marine environment of the Cape metropolitan area	Centre for Marine Studies, UCT	Report of the Centre for Marine Studies, UCT, published in October 1998	Management	Centre for Marine Studies, UCT
1998	Freshwater availability and distribution of Cape clawless otter spraints and resting places along the south-west coast of South Africa	Van Niekerk, C H Somers, M J Nel J A J	South African Journal of Wildlife Research, 28(2): 68-72	Biological	University of Cape Town
1998	A preliminary survey of coastal river systems of False Bay, south-west coast of South Africa, with particular reference to the fish fauna	Harrison, T.D.	Transactions of the Royal Society of South Africa, 53, (1):1-31	Biological	Journal Publication
1998	A limited evaluation of the marine environment of the Cape metropolitan area.	Van Zyl, R. Findlay, K.	Centre for Marine Studies Report, October 1988 (submitted to Cape Wastewater Consultants)	Physical	Centre for Marine Studies, University of Cape Town.
1998	State of the environment report for the Cape metropolitan area. Year One 1998[Duplicate?]	CMC	Publication of the Catchment Management Dept, City of Cape Town	Physical	City of Cape Town

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1997	The horizontal zonation of two species of intertidal barnacle in South Africa.	Boland, J.M.	South African Journal of Marine Science, 18: 49-61	Biological	Journal Publication
1997	Shark and skate egg-cases cast up on two South African beaches and their rates of hatching success, or causes of death.	Smith, C.; Griffiths, C.	South African Journal of Zoology, 32(4): 112-117	Biological	Journal Publication
1997	An ecological survey of the Dido Valley shore, Simonstown, in relation to the outfall from Marine Oil Refiners of Africa Ltd.	Brown, A C	Unpublished report to Marine Oil Refiners of Africa	Biogeochemical	Marine Oil Refiners/ DWAF
1997	Digestion rates of prey eaten by intertidal sea anemones from the south-western Cape, South Africa.	Kruger, L.M.; Griffiths, C.L.	South African Journal of Zoology, 32(4): 101-105	Biological	Journal Publication
1997	Review of the state of marine protected areas in South Africa	Attwood, C G Mann, B Q Beaumont, J Harris, J M	South African Journal of Marine Science, 18: 341-367	Biological	Journal Publication
1997	Review of the marine biodiversity, legal status and use zonation of the coastal fringe abutting the Cape Peninsula Protected Natural Environment (CPPNE).	Centre for Marine Studies, UCT	Report by the Centre for Marine Studies, UCT	Biological	University of Cape Town
1996	Sources of nutrition in intertidal sea anemones from the south-western Cape, South Africa.	Kruger, L.M.; Griffiths, C.L.	South African Journal of Zoology, 31(3): 110-119	Biological	Journal Publication
1996	Monitoring marine water quality in South Africa.	J Bailey (ed)	Report by the SFRI, Cape Town	Biogeochemical	MCM/DEAT/Cape Town
1996	Temporal variations in surf zone fish assemblages from False Bay.	Clark, B.M. Bennett B.A.; Lamberth, S.J.	South Marine Ecology Progress Series, 131: 35-47	Biological	Journal Publication
1996	Factors affecting spatial variability in seine net catches of fish in the surf zone of False Bay, South Africa.	Clark, B.M. Bennett, B.A. Lamberth, S.J	Marine Ecology Pprogress Series, 131: 17-34	Biological	Journal Publication
1996	Monitoring marine water quality in South Africa.	Bailey, J	Proceedings of a workshop co-ordinated by the Pollution Division of the SFRI, DEAT, 5 – 7 August	Biogeochemical	DEAT, Cape Town
1995	Report on the intertidal ecosystems at Dido Valley, Simonstown, in relation to possible pollution from the effluent from Marine Oil Refiners of Africa Ltd: March 1995.	Brown, A C	Unpublished report to Marine Oil Refiners of Africa	Biogeochemical	University of Cape Town
1995	The ecology and management of Zandvlei (Cape Province, South Africa), an enriched shallow African estuary.	Horton, J.A.; Beekman, H.; Boddington, G.; Dick, R.; Harding, W.R.; Lief, M.; Morrison, I.R.; Quick, A.J.R.	Eutrophic Shallow Estuaries and Lagoons. CRC Press, Boca Raton, Fl (USA), pp. 109-128 (ISBN: 0-8493-6839-1)	Management	
1995	Municipality of Simon's Town: Long Beach sea outfall.	Russell, K. Botes, W.A.M. Moes, J	CSIR report EMAS-C 95050	Biogeochemical	CSIR, Stellenbosch
1995	The Cape Flat Aquifer: current status.	Wright, A Conrad, J	CSIR report WF718/3, Goundwater Programme, CSIR, Stellenbosch	Biogeochemical	CSIR, Stellenbosch
1995	South African water quality guidelines for coastal marine waters. Volume 2: Recreational use.	DWAF	Publication of the DWAF	Management	CSIR/DWAF
1995	South African water quality guidelines for coastal marine waters. Volume 3: Industrial use.	DWAF	Publication of the DWAF	Management	CSIR/DWAF
1995	South African water quality guidelines for coastal marine waters. Volume 4: Mariculture.	DWAF	Publication of the DWAF	Management	CSIR/DWAF

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1995	South African water quality guidelines for coastal marine waters. Volume 1: Natural environment.	DWAF	Publication of the DWAF	Biological	CSIR/DWAF
1995	Botanical survey of the AECI Somerset West factory site.	Trinder-Smith, T.H	Report to AECI of the preliminary findings: Submitted as part of AECI's Conceptual Development Framework, 1997	Biological	AECI Stellenbosch/CSIR, Stellenbosch (CSW 07)
1995	Seasonality of beach-seine catches in False Bay, South Africa, and implications for management.	Lamberth, S.J.; Clark, B.M.; Bennett, B.A.	South African Journal of Marine Science, 15: 157-167	Biological	Journal Publication
1995	The vulnerability of fish to capture by commercial beach-seine nets in False Bay, South Africa.	Lamberth, S.J.; Bennett, B.A.; Clark, B.M.	South African Journal of Marine Science, 15: 25-31	Biological	Journal Publication
1995	The impact of beach-seine netting on the benthic flora and fauna of False Bay, South Africa.	Lamberth, S.J. Bennett, B.A. Clark, B.M. Janssens, P.M.	South African Journal of Marine Science, 15: 115-122	Biological	Journal Publication
1995	Physical oceanographic activities in South Africa, 1991-1994.	Grundlingh, M.L.; Bailey, G.W.; Shillington, F.A.; Schumann, E.H. Agenbag, J.J.	South African Journal of Science, 91(5): 247-254;	Physical	Journal Publication
1995	Issues facing water resource managers and scientists in a rapidly growing coastal city: Cape Town, South Africa.	Quick, A.J.R.	South African Journal of Science, 91:175-183	Management	Journal Publication
1994	A re-investigation of the ecology of the shore at Dido Valley in the vicinity of the outfall from Marine Oil Refiners: February/March 1994.	Brown, A C	Unpublished report to Marine Oil Refiners of Africa	Biogeochemical	University of Cape Town
1994	The commercial beach seine fishery in False Bay, South Africa.	Lamberth, S L	MSc (Zoology) – University of Cape Town	Management Biological	University of Cape Town
1994	Teleost catches by three shore-angling clubs in the south-western Cape, with an assessment of the effect of restrictions applied in 1985.	Bennett, B.A. Attwood, C.G. Mantel, J.D.	South African Journal of Marine Science, vol 14, p 11-18	Biological	Journal Publication
1994	Habitat partitioning in shallow-water cryptic ichthyofaunal communities in the western and southwestern Cape, South Africa.	Prochazka, K	PhD Thesis, UCT	Biological	University of Cape Town
1994	Vegetation specialist study: proposed groin extension from Monwabisi pool.	Raal, P. Burns, M.	CSIR report: EMAS-C 94047	Biological	GFC Inc. / CSIR, Stellenbosch
1994	An appraisal of the intertidal communities in the coastal strip extending from Monwabisi pool one kilometre eastward.	Zoutendyk, P.	CSIR report: EMAS-C 94036	Biological	GFJ Inc. / CSIR, Stellenbosch
1994	Catch composition of the commercial beach-seine fishery in False Bay, South Africa.	Lamberth, S.J. Bennett, B.A. Clark, B.M.	South African Journal of Marine Science, 14: 69-78	Biological	Journal Publication
1994	Assessment of the impact of commercial beach-seine netting on juvenile teleost populations in the surf zone of False Bay, South Africa.	Clark, B.M. Bennett, B.A. Lamberth, S.J.	South African Journal of Marine Science, 14: 255-262	Biological	Journal Publication
1994	A comparison of the ichthyofauna of the two estuaries and their adjacent surf zone, with an assessment of the effects of beach-seining on the nursery function of estuaries for fish (Eerste and Zeekoe).	Clark, B M Bennett, B A Lamberth, S J	South African Journal of Marine Science, 14: 121-131	Biological	Journal Publication
1994	Management of a shallow estuarine lake for recreation and as a fish nursery, Zandvlei, Cape Town, South Africa.	Quick, A.J.R. Harding, W.R.	Water SA, 20 (40): 289-297	Biological	Journal Publication
1994	The internal tide over the shelf inshore of Cape Point Valley, South Africa.	Largier, J.L.	Journal of Geophysical Research, 99(C5): 10023-10034	Physical	Journal Publication
1994	Sediment suspension by turbulence in the surf zone.	Smith, G.G. Mocke, G.P.	In: Sediment Transport Mechanisms in Coastal Environments and Rivers, Euromech 310, 13-17	Physical	CSIR, Stellenbosch EMAS-R 9409

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1994	Monwabisi basic water quality assessment.	Taljaard, S. Botes, W.A.M. Genthe, B.	CSIR report: EMA-C 94045	Biogeochemical	Entech/ CSIR, Stellenbosch
1994	Beach improvement schemes in False Bay.	Swart, D.H.; Schoonees, J.S.	Coastal Engineering 1994. Volume 3: Proceedings of the twenty-fourth international conference, [ed.B.L.Edge]. New York: American Society of Civil Engineers.	Physical	
1993	Western Cape system analysis: Water quality. Volume 1: General (Final).	Bath, A J	DWAF report No. P G000/00/2891	Biogeochemical	CSIR, Stellenbosch (FR-PAM 07442)
1993	Western Cape system analysis: Water quality. Volume 2: Data for Eerste, Lourens, Steenbras, Palmiet, Riviersonderend and Diep River Basins	Bath, J A	DWAF report No. P G000/00/2891	Biogeochemical	CSIR, Stellenbosch (FR-PAM 07443)
1993	Khayelitsha: a case study of the effect of informal settlement type urbanisation on storm-water run-off.	Wright, A	Water Institute of Southern Africa: Proceedings of the Third Biennial Conference. Papers. Volume 3. 24-216 May	Biogeochemical	Water Research Commission, Pretoria
1993	A hydrological investigation of the storm-water run-off from the Khayelitsha urban catchment in the False Bay area, south western Cape.	Wright, A. Kloppers, W Fricke, A.	WRC WRC report no. 323/1/93	Biogeochemical	CSIR, Stellenbosch (CSW 05)
1993	Detection of Salmonella in shellfish grown in polluted seawater.	Kfir, R Burger, J S Idema, G K	Water Science and Technology, 27(3/4): 41-44	Management	Journal Publication
1993	Evaluation of health risks associated with recreational activities in South African marine waters.	Genthe, B. Strauss, N. Kfir, R. Von Schirnding, Y.E.R.	IAWQ (International Association on Water Quality) Conference on Risk, Risk Analysis Procedures, and Epidemiological Confirmation, 9-13 August, Los Angeles, USA. Proceedings	Management	CSIR, Stellenbosch (EMAS-R 9320)
1993	The effect of recreational rock and surf angling on fish resources along the Cape coast.	Taylor, V	Oceanogr. Res. Inst. Spec. Publ. 2: 186-190	Biological	Journal Publication
1993	Unique thermal records in False Bay.	Grundlingh, M.L. Potgieter, E.	South African Journal of Science 89: 510-512	Physical	Journal Publication
1993	Management of water quality in False Bay and its catchments.	Quick, A.J.R.	A report to provide background information for the Metropolitan Development Framework, Feb ?	Management	CSIR, Stellenbosch
1993	A holistic approach to the management of water quality in False Bay, Cape Town, South Africa.	Quick, A.J.R.	Southern African Journal of Aquatic Sciences, 19(1/2): 50-73	Management	Journal Publication
1993	Detection of Salmonella [italics?] in shellfish grown in polluted seawater.	Kfir, R.; Burger, J.S.; Idema, G.K.	Water Science and Technology, 27(3-4): 41-44	Biogeochemical	Journal Publication
1992	Pollution assessment of several beaches along the south-western Cape Coast (meiofauna).	Skibbe, E.	CSIR research report 702	Biogeochemical	CSIR, Stellenbosch
1992	Ocean outfall studies in False Bay. Report No.5: Chemical and biological impact.	Taljaard, S. Kloppers, W. Skibbe, E.	CSIR report EMA-C 9154	Biogeochemical	DEAT/ CSIR, Stellenbosch
1992	Morbidity amongst bathers exposed to polluted seawater: A prospective epidemiological study.	Von Schirnding, Y Cabelli, R Franklin, L Joubert, G	S. Afr. Med. J. 81 (11): 534-546	Management	Journal Publication
1992	Ocean outfall studies in False Bay. Report No.5: Chemical and biological impact.	Taljaard, S. Kloppers, W. Skibbe, E.	CSIR report EMA-C 9154	Biological	DEAT/ CSIR, Stellenbosch
1992	Aspects of pollution in False Bay, South Africa, with special reference to	Rundgren, C D	MSc (Zoology) – University of Cape Town	Biological	University of Cape

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	subtidal pollution.				Town
1992	Pollution assessment of several beaches along the south-western Cape Coast (meiofauna).	Skibbe, E.	CSIR research report 702	Biological	CSIR, Stellenbosch
1992	Quasi-synoptic survey of the thermohaline properties of False Bay.	Grundlingh, M.L.	South African Journal of Science, 88: 325-334	Physical	Journal Publication
1992	Ocean outfall studies in False Bay. Report No.5: Chemical and biological impact.	Taljaard, S. Kloppers, W. Skibbe, E.	CSIR report EMA-C 9154	Biogeochemical	DEAT/ CSIR, Stellenbosch
1992	Sunrise Beach to Strandfontein Point: dunes, coastal development and management.	Theron, A.K. Barwell, L. Schoonees, J.S.	CSIR report EMAS-C 920621	Management	CSIR, Stellenbosch
1992	A clean False Bay - our responsibility: towards a management strategy to deal with catchment derived water quality problems.	Watermeyer Prestedge Retief	Information booklet	Management	City of Cape Town
1991	False Bay 21 years on - an environmental assessment. Proceedings of the Symposium.	Jackson, W.P.U.	Transactions of the Royal Society of South Africa, 47(4-5): 435	Management	Journal Publication
1991	False Bay, South Africa - an historic and scientific overview.	Spargo, P.E.	Transactions of the Royal Society of South Africa, 47(4-5): 363-375	Management	Journal Publication
1991	The effect of aluminium sulphate sludge from the Steenbras Water Treatment Plant on the marine environment.	Wurz, C. Fijen, A.P.M	CSIR report EMA-C 9102	Biogeochemical	City of Cape Town/ CSIR, Stellenbosch
1991	Ocean outfall studies in False Bay. Report No.3: Flow data from rivers, treated sewage and major storm water outlets in the northern False Bay area.	Edel, H. Fijen, A.P.M	CSIR report EMA-C 9153	Biogeochemical	DEAT/ CSIR, Stellenbosch
1991	Marine disposal studies of storm water and treated sewage effluent in False Bay. Report No.6: Executive summary.	Fijen, A.P.M. Russell, K.S.	CSIR report EMA-C 9150	Biogeochemical	DEAT/ CSIR, Stellenbosch
1991	The estuaries of False Bay.	Morant, P. D.	Transactions of the Royal Society of South Africa, 47(4/5): 29-640	Biogeochemical	Journal Publication
1991	Land use and population characteristics in the False Bay coastal frame.	V d Merwe, I J Vlok, A C V d Merwe, J H	Transactions of the Royal Society of South Africa 47(4/5): 693-702	Biogeochemical	Journal Publication
1991	Chemical pollution loading of False Bay.	Brown, A C Davies, B R Day, J A Gardiner, A J C	Transactions of the Royal Society of South Africa, 47(4/5): 703-716	Biogeochemical	Journal Publication
1991	Impact assessment of the sewage effluent at Zeekoevlei, False Bay.	Skibbe, E.	Transactions of the Royal Society of South Africa, 47(4/5): 717-730	Biogeochemical	Journal Publication
1991	Petroleum hydrocarbon input into False Bay.	Moldan, A	Transactions of the Royal Society of South Africa, 47(4/5): 731-736	Biogeochemical	Journal Publication
1991	The botanical and physical constraints of the proposed mining and urban development of the Macassar dune system.	Raal, P. Heineken, T. Barwell, L.	CSIR report EMA-C 91123	Biogeochemical	Gouws, Uys and White on behalf of Hippo Quarries Ltd and VKE Consulting Engineers and Urban Planners/CSIR, Stellenbosch
1991	A preliminary assessment of the air pollution zones in the Strand-Somerset West area.	Ritter, A Olivier, J	Transactions of the Royal Society of South Africa, 47(4/5): 535-550	Biogeochemical	Journal Publication
1991	A resurvey of the rocky and sandy shores at Dido Valley, with special reference to the outfall from Marine Oil Refiners of Africa, Ltd.	Brown, A C	Unpublished report to Marine Oil Refiners of Africa	Biogeochemical	Marine Oil Refiners, DWAF
1991	The interaction and impact of net and line-fisheries in False Bay.	Penney, A J	Transactions of the Royal Society of South Africa, 47(4/5): 663-682	Management	Journal Publication

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1991	Human recreational activity along the north-western shores of False Bay.	Van Herwerden, L Griffiths, C L	Transactions of the Royal Society of South Africa, 47(4/5): 737-748	Management	Journal Publication
1991	The importance of False Bay as a recreational area.	Taylor, V	Transactions of the Royal Society of South Africa, 47(4/5): 749-756	Management	Journal Publication
1991	North-eastern False Bay: physical environmental factors and bathing suitability.	Schoonees, J.S. Bartels, A.	Transactions of the Royal Society of South Africa, 47(4/5): 757-770	Management	Journal Publication
1991	Kusontwikkeling by die Strand.	Theron, A.K. Fijen, A.P.M. Raal, P. Zoutendyk, P. Bickerton, I. Barwell, L.	CSIRreport EMA-C 9128	Management	Municipality Strand/ CSIR, Stellenbosch (P-4533)
1991	On "brown water" in False Bay.	Bate, G.C., E.E. Campbell and D.R. du Preez	Report of the City Planners Department, Cape Town City Council	Biological	City of Cape Town
1991	Twenty-one years of biological research on the sandy beaches of False Bay.	Stenton-Dozey, J M E Brown, A C	Transactions of the Royal Society of South Africa, 47(4/5): 553-562	Biological	Journal Publication
1991	Ecology of shores of mixed rock and sand in False Bay.	Brown, A C Wynberg, R P Harris, S A	Transactions of the Royal Society of South Africa, 47(4/5): 563-574	Biological	Journal Publication
1991	Red tides in False Bay, 1959-1989, with particular reference to recent blooms of <i>Gymnodinium sp.</i>	Horstman, D.A.; McGibbon, S.; Pitcher, G.C.; Calder, D.; Hutchings, L.; Williams, P.	Transactions of the Royal Society of South Africa, 47(4/5): 611-628	Biological	Journal Publication
1991	The macrofauna of rocky shores in False Bay.	Griffiths, C L Branch, G M	Transactions of the Royal Society of South Africa, 47(4/5): 575-594	Biological	Journal Publication
1991	Rocky shore meiofauna: A brief review.	Gibbons, M J	Transactions of the Royal Society of South Africa, 47(4/5): 595-604	Biological	Journal Publication
1991	The seaweeds of False Bay.	Bolton, J J Stegenga, H Anderson, R J	Transactions of the Royal Society of South Africa, 47(4/5): 605-610	Biological	Journal Publication
1991	The estuaries of False Bay.	Morant, P.D.	Transactions of the Royal Society of South Africa, 47(4-5): 629-640	Biological	Journal Publication
1991	Historical and current status of the seal population in False Bay.	David, J H M	Transactions of the Royal Society of South Africa, 47(4/5): 641-648	Biological	Journal Publication
1991	Marine and coastal birds in False Bay: Distribution, population sizes and conservation.	Ryan, P G Avery, G Steele, W K	Transactions of the Royal Society of South Africa, 47(4/5): 649-662	Biological	Journal Publication
1991	Long-term trends in the catches by shore anglers in False Bay.	Bennett, B A	Transactions of the Royal Society of South Africa, 47(4/5): 683-690	Biological	Journal Publication
1991	Biological survey and an evaluation of the present status of the marine environment at SOMCHEM, Somerset West.	Skibbe, E	CSIR report EMA-C 9141	Biological	SOMCHEM/ CSIR, Stellenbosch
1991	Ocean outfall studies in False Bay. Report No.2: Offshore data interpretation and an initial assessment of possible offshore pipeline discharges into False Bay.	Fijen, A.P.M.	CSIR report EMA-C 9117	Physical	DEAT/ CSIR, Stellenbosch
1991	Ocean outfall studies in False Bay. Report No.4: Shoreline discharges: physical dilutions in the surf zone.	Fijen, A.P.M. Botes, W.A.M.	CSIR report EMA-C 9152	Physical	DEAT/ CSIR, Stellenbosch

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1991	Ocean outfall studies in False Bay. Report No.5: Chemical and biological impact.	Taljaard, S. Kloppers, W. Skibbe, E.	CSIR report EMA-C 9152	Biogeochemical	DEAT/ CSIR, Stellenbosch
1991	The False Bay symposium of 25 September 1968.	Lutjeharms, J.R.E.	Transactions of the Royal Society of South Africa, 47(4/5): 377-383	Physical	Journal Publication
1991	Physical oceanography of False Bay: A review.	Grundlingh, M. L. Largier, J.L.	Transactions of the Royal Society of South Africa, 47(4/5): 387-400	Physical	Journal Publication
1991	The weather of False Bay.	Jury, M.	Transactions of the Royal Society of South Africa, 47(4/5): 401-418	Physical	Journal Publication
1991	The dynamics relevant to the modelling of synoptic scale circulations within False Bay.	Van Ballegooyen, R	Transactions of the Royal Society of South Africa, 47(4/5): 419-432	Physical	Journal Publication
1991	Colour fronts in False Bay: origin, development and implications.	Shannon, L.V. Hennig, H.F.-K.O. Shillington, F.A. Bartels, A. Swart, D.H.	Transactions of the Royal Society of South Africa, 47(4/5): 447-469	Physical	Journal Publication
1991	Surface fronts in False Bay and vicinity.	Lutjeharms, J R E Olivier, J Lourens, E	Transactions of the Royal Society of South Africa, 47(4/5): 471-482	Physical	Journal Publication
1991	The origin and distribution of dissolved nutrients in False Bay.	Taljaard, S.	Transactions of the Royal Society of South Africa, 47(4/5): 483-493	Physical	Journal Publication
1991	Time-series from a current-meter array near Cape Point.	Nelson, G.; Cooper, R.M.; Cruickshank, S.	Transactions of the Royal Society of South Africa, 47(4-5): 471-482	Physical	Journal Publication
1991	The geology of False Bay.	Du Plessis, A Glass, J G	ransactions of the Royal Society of South Africa, 47(4/5): 495-518	Physical	Journal Publication
1991	The vulnerability of the False Bay coast line to the projected rise in sea level.	Hughes, P. Brundrit, G.B.	Transactions of the Royal Society of South Africa, 47(4/5): 519-534	Physical	Journal Publication
1991	North-eastern False Bay: physical environmental factors and bathing suitability.	Schoonees, J M Bartels, A	Transactions of the Royal Society of South Africa, 47(4/5): 757-770	Physical	Journal Publication
1991	Impact assessment of the sewage effluent at Zeekoevlei, False Bay.	Skibbe, E.	Transactions of the Royal Society of South Africa, 47(4/5): 717-730	Biogeochemical	Journal Publication
1991	False Bay, South Africa – a historic and scientific overview.	Spargo, P E	Transactions of the Royal Society of South Africa, 47(4/5): 363-375	Management	Journal Publication
1991	Planning issues in the False Bay coastal zone.	Quick, A J R Thornton, J A	Transactions of the Royal Society of South Africa, 47(4/5): 771-778	Management	Journal Publication
1991	Marine disposal studies of stormwater and treated sewage effluent in False Bay. Executive summary.	CSIR	CSIR report EMA-C 9150	Biogeochemical	CSIR, Stellenbosch
1990	The ecology of the False Bay estuarine environments, Cape, South Africa. 1: The coastal vegetation.	O'Callaghan, M	Bothalia, 20(1): 105-111	Biogeochemical	Journal Publication
1990	The ecology of the False Bay estuarine environments, Cape, South Africa. 2: Changes during the last 50 years.	O'Callaghan, M	Bothalia, 20(1): 113-121	Biogeochemical	Journal Publication
1990	Environmental factors affecting the marine recreational potential of the coastal zone between the Strand and Gordon's Bay. Vol. I: Executive report.	Schoonees, J.K. Laubscher, W.I.	CSIR report EMA-C 90153/1	Management	Plan Associates/ CSIR, Stellenbosch
1990	Environmental factors affecting the marine recreational potential of the coastal zone between the Strand and Gordon's Bay. Vol. II: Detailed report: Text and tables.	Laubscher, W.I. Fijen, A.P.M. Burns, M.; Heinecken, T.J.E. Zoutendyk, P.	CSIR report EMA-C 90153/2	Management	Plan Associates/ CSIR, Stellenbosch

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		Bickerton, I. Barwell, L.; Roux, C. Lamprecht, D			
1990	Environmental factors affecting the marine recreational potential of the coastal zone between the Strand and Gordon's Bay. Vol. III: Detailed report : Figures.	CSIR	CSIR report EMA-C 90153/3	Management	Plan Associates/ CSIR, Stellenbosch
1990	Load of health related micro-organisms in effluents discharged into False Bay.	Augoustinos, M T Kfir, R	In: Final reports on health related projects covering the period April 1987 to March 1990, submitted to the Marine Pollution Programme	Biological	SANCOR/CSIR, Stellenbosch (P-4398)
1990	Viruses in shellfish.	Grabow, W O K	In: Final reports on health related projects covering the period April 1987 to March 1990, submitted to the Marine Pollution Programme	Biological	SANCOR/CSIR, Stellenbosch (P-4398)
1990	Marine viral pollution.	Idema, G K Kfir, R	In: Final reports on health related projects covering the period April 1987 to March 1990, submitted to the Marine Pollution Programme	Biological	Water Research Commission, Pretoria
1990	Die afsterwe van mikroorganismes by 'n aflandige rioolseeuitlaat : 'n laboratoriumstudie.	J.F.P. Engelbrecht G. Tredoux	In: Final reports on health related projects covering the period April 1987 to March 1990, submitted to the Marine Pollution Programme	Biological	SANCOR/CSIR, Stellenbosch (P-4398)
1990	The occurrence of 'brown water' in False Bay and microbiological pollution in False Bay.	Engelbrecht, J.F.P. Tredoux, G.	Association of Water Treatment Personnel ("Western Cape group in collaboration with the Water Institute of SA (Sludge Management Division). Presentation at Seminar/Mini-Trade Fair on 29 Nov 1990	Biological	CSIR, Stellenbosch, P-6054
1990	The ecology of the False Bay estuarine environments, Cape, South Africa. 1: The coastal vegetation.	O'Callaghan, M	Bothalia, 20(1): 105-111	Biological	Journal Publication
1990	The ecology of the False Bay estuarine environments, Cape, South Africa. 2: Changes during the last 50 years.	O'Callaghan, M	Bothalia, 20(1): 113-121	Biological	Journal Publication
1990	Intertidal biological survey at Strand, False Bay.	Zoutendyk, P. Bickerton, I.	CSIR report EMA-C 9067	Biological	Plan Associates/ CSIR, Stellenbosch
1990	A review of the ecology of surf diatoms, with special reference to <i>Anaulus australis</i> .	Talbot, M.M.M. Bate, G.C. Campbell, E.E.	Oceanography and Marine Biology Review, 28: 155-175.	Biological	Journal Publication
1990	The occurrence of "brown water" in False Bay	Engelbrecht, J.F.P. Tredoux, G.	CSIR report C620/27219	Biological	CSIR, Stellenbosch
1990	The colonization of artificial substrata by marine sessile organisms in False Bay. 1. Community development.	Henschel, J R Cook, P A Branch, M	South African Journal of Marine Science, 9: 289-297	Biological	Journal Publication
1990	Pollution assessment in north-eastern False Bay (POLLNEF): Dissolved nutrient distribution patterns.	Taljaard, S.	Unpublished notes	Biogeochemical	CSIR, Stellenbosch
1990	Environmental factors affecting the marine recreational potential of the coastal zone between Strand and Gordon's Bay: Volume I: Detailed report, Text.	Laubscher, W.I. Fijen, A.P.M. Burns, M. Heinecken, T.J.E. Zoutendyk, P. Bickerton, I. Roux, C.	CSIR report EMA-C 90153/1	Physical	CSIR, Stellenbosch

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1990	Environmental factors affecting the marine recreational potential of the coastal zone between Strand and Gordon's Bay: Executive Report.	Schoonees, J. Laubscher, W.I.	CSIR report EMA-C 90153/1 pp.	Physical	CSIR, Stellenbosch
1990	Dynamics relevant to modelling tidal and subtidal circulation in False Bay.	Van Ballegooyen, R.C. Grundlingh, M.L. Gonsalves, J.	CSIR research report 698	Physical	CSIR, Stellenbosch
1990	Ocean outfall studies in False Bay. Report no.1: Wind data: Strandfontein to Cape Hangklip.	Smith, C.J. Botes, W.A.M.	CSIR report EMA-C 90125	Physical	DEAT/ CSIR, Stellenbosch
1990	Winter air pollution episodes in Cape Town.	Jury, M.R. Tegen, E. Du Toit, M.	Bound. Layer. Met. 53: 1-20.	Physical	University of Cape Town
1990	Wind-induced cross-shore water flows.	Crowley, J.B.; Swart, D.H.	Proceedings 22nd Coastal Engineering Conference, The Netherlands, Volume 1 [ed.B.L.Edge] . New York: American Society of Civil Engineers.	Physical	CSIR, Stellenbosch
1989	Patterns of shoreline utilization in a metropolitan area: the Cape Peninsula, South Africa.	Van Herwerden, L. Griffiths, C.L. Bally, R. Blaine, M. Du Plessis, C.	Ocean and Shoreline Management, 12: 331-346	Management	Journal Publication
1989	Sewage to sea – what are the health implications?	Von Schirnding, Y E R	South African Medical Journal, 76(12) 642-643	Management	CSIR, Pretoria
1989	Improved beach amenities along the False Bay coast between Strandfontein and Mnandi.	Schoonees, J.S	CSIR report EMA-C 8940	Management	City Planner/ CSIR, Stellenbosch
1989	Selection of indicator systems for human viruses in polluted seawater and shellfish.	Grabow, WOK Indema, G K Coubrough, P Bateman, B W	Water Science and Technology 21(3): 111-117	Management	Journal Publication
1989	Preliminary investigation into the occurrence of "brown water" in False Bay.	Engelbrecht, J.F.P. Tredoux, G.	CSIR report CWAT 73	Biological	CSIR, Stellenbosch
1989	Bottom currents at the entrance to False Bay, South Africa.	Grundlingh, M.L. Hunter, I.T. Potgieter, E.	Continental Shelf Research, 9(12): 1029-48 (EMA-R 8914)	Physical	Journal Publication
1989	Seal Island weather data : January 1987 - April 1988.	Hunter, I.T. Watt, L.J. Grundlingh, M.L.	CSIR report EMA-D 8907	Physical	CSIR, Stellenbosch
1989	False Bay outfall studies: Physical data acquisition. Trip 1 - 6, Daily observations (26.01.1987 -27.11.1987).	Anon	CSIR unpublished report: C/SEA 8776 (6 unpublished reports)	Physical	CSIR, Stellenbosch
1989	The ecological status of the intertidal zone in the vicinity of the outfall from Marine Oil Refiners, Dido Valley: Febuary-March 1989.	Brown, A.	Report available at CSIR, Stellenbosch (ECRU - CSW 01)	Biogeochemical Biological	CSIR, Stellenbosch

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1989	A new species of a phylloporid holothurian from southern Africa.	Thandar, A.S.	Journal of Zoology, 219(4): 637-644	Biological	Journal Publication
1989	Degradation of the Eerste River system: Legal and administrative perspectives.	Wiseman, K.; Simpson, J.	Southern African Journal of Aquatic Sciences, 15(2): 282-299	Management	Journal Publication
1988	Preliminary identification of the constraints imposed by existing pollution on the development of recreation facilities along the Strand/Gordon's Bay coastline.	Fijen, A.P.M.	CSIR report EMA-C 8898	Management	CSIR, Stellenbosch
1988	Strand/Gordon's Bay coastal recreational facilities: intertidal biological survey.	Zoutendyk, P. Bickerton, I.	CSIR report EMA-C 8905	Biological	CSIR, Stellenbosch
1988	Shallow water current meters: Comparative study, False Bay - September 1987.	Botes W.A.M.	CSIR report T/SEA 8803	Physical	CSIR, Stellenbosch
1988	The seafloor environment off Simon's Town in False Bay, revealed by side-scan sonar, bottom sampling, diver observations and underwater photography.	Terhorst, A.	University of Cape Town, Marine Geoscience Unit. Bulletin no. 22	Physical	CSIR, Stellenbosch (ZA-UCT-MG B 22)
1988	Fisiese oseanografie in Valsbaai: 'n oorsig.	Grundlingh, M L Largier, J L	S.A. Tydskrif vir Natuurwetenskap en Tegnologie, 7(3): 133-143	Physical	Journal Publication
1988	Lagrangian current measurements by using drifting radio transmitting buoys.	Botes, W A M	CSIR report EMA-T 8811	Physical	CSIR, Stellenbosch
1988	Valsbaai: Die hidrouliese ontwerp van 'n baaiverbeteringskema met behulp van 'n sedimentmodel. Volume I: Teks en tabelle.	Schoonees, J,S,	CSIR report EMA-C 8886/1	Physical	CSIR, Stellenbosch
1988	Valsbaai: Die hidrouliese ontwerp van 'n baaiverbeteringskema met behulp van 'n sedimentmodel. Volume II: Figure.	Schoonees, J,S,	CSIR report EMA-C 8886/2	Physical	CSIR, Stellenbosch
1988	Valsbaai: Die hidrouliese ontwerp van 'n baaiverbeteringskema met behulp van 'n sedimentmodel. Volume III: Figure.	Schoonees, J,S,	CSIR report EMA-C 8886/3	Physical	CSIR, Stellenbosch
1987	Dumping viruses – the sea at risk.	Grabow, W O K	Scientiae, 23(3)	Management	CSIR, Stellenbosch
1987	False Bay outfall studies: Physical data acquisition. Trip 1 - 6, Daily observations <26.01.1987 -27.11.1987> (6 unpublished reports) (Confidential)	Anon	CSIR unpublished report: C/SEA 8776 (1-6)	Physical	CSIR, Stellenbosch
1987	The development and decline of phytoplankton blooms in the Southern Benguela Upwelling System.	Brown, P.C. Hutchings, L.	South African Journal of marine Science, 5: 393-409	Biological	Journal Publication
1987	Aircraft observation of meteorological conditions along Africa's west coast between 30° - 35°S.	Jury, M.R.	J. Clim. Appl. Met., 26(11): 1540-1552	Physical	Journal Publication.
1987	The seafloor environment of Simon's Town in False Bay, revealed by sidescan sonar, bottom sampling, diving observations and under water photography	Terhorst, A L M	MSc (Geology) – University of Cape Town	Physical	University of Cape Town
1987	Information on currents in the Cape Peninsula area.	Nelson, G. Polito, A.	South African Journal of marine Science, 5: 287-304	Physical	Journal Publication
1987	Wind and subsurface currents in the False Bay region, South Africa.	Waiman, C K Polito, A Nelson, G	South African Journal of marine Science, 5: 337-346	Physical	Journal Publication
1987	Pollution studies in False Bay, South Africa: chemical versus meiofaunal indicators.	Bartlett, P.D. Hennig, H.F.-K.O.	In: Biological processes and wastes in the ocean, edited by J.M. Capuzzo and D.R. Kesler. p 232	Biogeochemical	CSIR, Stellenbosch (R/SEA 8701)
1987	Ondersoek na die omgewingsfaktore en daarmee gepaardgaande baaigeskiktheid van die strande aan die noordoos Valsbaaise kus. Volume 1: Opsommende verslag.	Bartels, A. Schoonees, J.S.	CSIR report C/SEA 8718/1	Physical	Cape Provincial Administration/ CSIR, Stellenbosch
1987	Ondersoek na die omgewingsfaktore en daarmee gepaardgaande baaigeskiktheid van die strande aan die noordoos Valsbaaise kus. Volume 2: Teks en tabelle.	Bartels, A. Schoonees, J.S.	CSIR report C/SEA 8718/2	Physical	Cape Provincial Administration/ CSIR, Stellenbosch
1987	Ondersoek na die omgewingsfaktore en daarmee gepaardgaande	Bartels, A.	CSIR report C/SEA 8718/3	Physical	Cape Provincial

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1986	Vegetation and land-use data collection methods for environmental management purposes, with particular reference to the rivers entering False Bay, South Africa.	O'Callaghan, M G	MSC (Botany) – University of Cape Town	Biogeochemical	UCT
1986	Is there a relationship between surf zone phytoplankton blooms and adjacent sewage outfalls?	Eagle, G.A. Hennig, H.F.-K.O.	Water Science and Technology, 18(4/5): 310 (abstract only)	Biological	CSIR, Stellenbosch
1986	Valsbaaiprojek – 'n voorbereidende verslag.	Gründlingh, M.L. Largier, J.L.	CSIR report C/SEA 8629	Physical	CSIR, Stellenbosch
1986	Trace metal distribution in different chemical fractions of nearshore marine sediments.	Rosental, R Eagle, G A Orren, M J	Estuarine Coastal and Shelf Science, 22(3): 303-324	Biogeochemical	Journal Publication
1986	False Bay outfall studies: measurement techniques and analysis of field data collected during two exercises in 1983.	Van Niekerk, M.	CSIR report C/SEA 8620	Physical	DEAT/ CSIR, Stellenbosch
1986	Magnetometric mapping of False Bay dolerites.	Day, R.W.	Technical Report: Joint Geological Survey/ University of Cape Town Marine Geoscience Unit, 16, 217-227.	Physical	University of Cape Town
1985	Biotic and abiotic influences on rocky intertidal biomass and richness in the southern Benguela region.	McQuaid, C D Branch, C M Crowe, A A	S. Afr. J. Zool., 20: 115-122	Biological	Journal Publication
1985	A comparison of the physiological condition of the southern mullet <i>Liza richardsoni</i> (Smith) in a closed estuary and the sea.	De Decker, H P Bennett, B A	Transaction of the royl society of South Africa, 45(3/4): 427-436	Biological	Journal Publication
1985	The hydrology of the South African southwestern coast between Cape Point and Danger Point.	Boyd, A.J. Tromp, B.B.S. Horstman, D.A.	S. Afr. J. mar. Sci., 3: 145-168	Physical	Journal Publication
1985	A numerical model of the wind-driven circulation of False Bay.	Van Foreest, D. Jury, M.R.	S. Afr. J. Sci., 81: 312-317.	Physical	Journal Publication
1985	Case studies of alongshore variations in wind-driven upwelling in the southern Benguela region.	Jury, M.R.	In: South African Colour and Upwelling Experiment, Chapter 17. L.V. Shannon (ed), Cape Town: Sea Fisheries Research Institute, 29-46pp	Physical	Sea Fisheries Research Institute, Cape Town/ CSIR, Stellenbosch
1985	Satellite observations of marine pollution and rip currents.	Shannon, V L Walters, N M Moldan, A G	In: South African Colour and Upwelling Experiment, Chapter 17. L.V. Shannon (ed), Cape Town: Sea Fisheries Research Institute, 239-250pp	Physical	Sea Fisheries Research Institute, Cape Town/ CSIR, Stellenbosch
1984	Historical population levels of seals and seabirds on islands off southern Africa, with special reference to Seal Island, False Bay.	Shaugnessy, P.D	Sea Fisheries Research Institute, Investigational report no:127	Biological	SFRI/CSIR, Stellenbosch ZASF-I 127
1984	Surf zone phytoplankton blooms in False Bay: a summary of available information.	Eagle, G.A. Hennig, H.F.-K.O	CSIR report C/SEA 8420	Biological	DEAT/ CSIR, Stellenbosch
1984	Influence of sea temperature, substratum and wave exposure on rocky intertidal communities: an analysis of faunal and floral biomass.	McQuaid, C D Branch, G M	Mar. Ecol. Prog. Ser., 19: 145-151	Biological	Journal Publication
1984	Khayelitsha beach bathing facilities: A feasibility study (Stage 1).	Nicholson, J.	CSIR report C/SEA 8433	Physical	CSIR, Stellenbosch
1984	False Bay: a numerical model of the wind-driven circulation.	Van Foreest, D.	CSIR report C/SEA 8423	Physical	DEAT/ CSIR, Stellenbosch
1984	Trace element distribution in different chemical fractions of False Bay sediments.	Rosental, R.	MSc (Analytical Science) – University of Cape Town	Biogeochemical	University of Cape Town
1984	Trace element distribution in different chemical fractions of False Bay sediments.	Rosental, R.	CSIR research report 559	Biogeochemical	CSIR, Stellenbosch

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1983	A summary of studies of the pollution input by rivers and estuaries entering False Bay.	Heinecken, T.J.E. Bickerton, I.B. Heydorn, A.E.F	CSIR report T/SEA 8301	Biogeochemical	CSIR, Stellenbosch
1983	Early colonization by fish of an artificial reef in False Bay, South Africa.	Cliff, G	Transaction of the royal society of South Africa, 45(1): 63-71	Biological	Journal Publication
1983	Ratio and population density of psammollittoral meiofauna as a perturbation indicator of sandy beaches in South Africa.	Henning, H.F.-K.O. Eagle, G.A. Fielder, L. Fricke, A.H. Gledhill, W.J. Greenwood, P.J. Orren, M.J.	Environ. Monit. Assess., 3: 45-60	Biological	Journal Publication
1983	Beach and nearshore habitats as a function of internal geometry, primary sedimentary structures and grain size.	Fleming, B.W. A.H. Fricke	In: Sandy Beaches as Ecosystems, (eds) A. MacLachlan and T. Erasmus. Dr W. Junk Publishers, Boston, pp.115-132.	Physical	University of Port Elizabeth
1983	A numerical model of the wind driven circulation in False Bay.	Van Foreest, D.	BEP Theoretical Studies no: 25	Physical	UCT/ CSIR, Stellenbosch (P02112)
1983	Status report on pollution in False Bay: Chemical and biological aspects.	Eagle, G.A. Hennig, H.F.-K.O. Greenwood, P. Gilchrist, J.	CSIR report C/SEA 8362	Biogeochemical	DEAT/ CSIR, Stellenbosch
1983	Some features in two Cape bays as deduced from satellite ocean-colour imagery.	Shannon, V L Walters, N M Moldan, A G	South African Journal of Marine Science, 1: 111-122	Physical	Journal Publication
1983	Valsbaai: Velddataveslag. Volume I: Teks en Tabele.	Schoonees, J.J. Scholtz, D.J.P. Van Tonder, A. Möller, J.P. Lenhoff, L.	CSIR report C/SEA 8219/1	Physical	CSIR, Stellenbosch
1983	Valsbaai: Velddataveslag. Volume II: Figure.	Schoonees, J.J. Scholtz, D.J.P. Van Tonder, A. Möller, J.P. Lenhoff, L.	CSIR report C/SEA 8219/2	Physical	CSIR, Stellenbosch
1983	Valsbaai: Velddataveslag. Volume III: Figure.	Schoonees, J.J. Scholtz, D.J.P. Van Tonder, A. Möller, J.P. Lenhoff, L.	CSIR report C/SEA 8219/3	Physical	CSIR, Stellenbosch
1982	Estuaries of the Cape. Part II: Synopses of available information on individual systems. Report No. 8: Rooiels (CSW 10).	Heinecken, T J E	CSIR research report 407	Biogeochemical	CSIR, Stellenbosch
1982	Estuaries of the Cape. Part II: Synopses of available information on individual systems. Report No. 13: Silvermine (CSW 3).	Heinecken, T J E	CSIR research report 412	Biogeochemical	CSIR, Stellenbosch
1982	Estuaries of the Cape. Part II: Synopses of available information on individual systems. Report No. 12: Buffels (Wes) (CSW1), Elsie (CSW2), Sir Lowry's Pass (CSW8), Steenbras (CSW9), Buffels (Oos) (CSW11).	Heinecken, T J E Bickerton, I B Morant, P D	CSIR research report 411	Biogeochemical	CSIR, Stellenbosch

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1982	Pollution monitoring surveys of Eerste River Estuary.	Bartlett, P.D. Hennig, H.F.-K.O.	CSIR report T/SEA 8209	Biogeochemical	CSIR, Stellenbosch
1982	Waste disposal in False Bay.	Eagle, G.A.	In: Symposium on Future Management of False Bay, Cape Town. Proceedings, B. Gasson (ed)	Biogeochemical	CSIR, Stellenbosch
1982	False Bay catchment: Sewage forecast.	Gasson, B Mackinnon, R	CSIR report C/SEA 8245	Biogeochemical	DEAT/CSIR, Stellenbosch
1982	Estuaries of the Cape. Part II: Synopses of available information. Report No. 16: Eerste (CSW6).	Grindley, J R	CSIR research report 415	Biogeochemical	CSIR, Stellenbosch
1982	Estuaries of the Cape. Part II: Synopses of available information. Report No. 17: Lourens (CSW7).	Cliff, S Grindley, J R	CSIR research report 416	Biogeochemical	CSIR, Stellenbosch
1982	Colonization and viability of an artificial steel reef in False Bay, South Africa.	Fricke, A.H. Koop, K. Cliff, G	Transactions of the royal society of South Africa, 44(4): 499-512	Biological	Journal Publication
1982	Dissolved and particulate matter in the surface waters of False Bay and its influence on a rocky shore ecosystem.	Cliff, G.	Transactions of the royal society of South Africa, 44(4): 539-549	Biological	Journal Publication
1982	Project Hydra: General background to the project development.	Russel-Cargill, W.G.A.	Tech. Rep. Inst. Mar. Tech., TV-019-82, 1-64	Physical	Institute of Maritime Technology
1982	Valsbaai velddataverslag. Vol.1: Teks en tabelle; Vol. 2 : Figure; Vol. 3: Figure	Schoonees, J.S. Scholtz, D.J.P. Van Tonder, A. Moller, J.P. Lenhoff, L.	CSIR report C/SEA 8219/1-3	Physical	O'Connell, Manthe en Vennote Stellenbosch/ CSIR, Stellenbosch
1982	Status report on pollution in False Bay.	Badenhorst, P.	CSIR contract report C/SEA 8241	Physical	DEAT/ CSIR, Stellenbosch
1982	False Bay status quo on pollution – chemical and biological report.	Eagle, G.A.	CSIR report C/SEA 8243.	Biogeochemical	CSIR Stellenbosch
1982	The geology of False Bay with special emphasis on modern sediments.	Flemming, B.W.	CSIR report C/SEA 8253	Physical	DEAT/ CSIR, Stellenbosch
1982	Design and calibration of False Bay sediment model.	Schoonees, J.S. Moller, J.P.	18th Coastal Engineering Conference. Proceedings, Vol. 2, 14 to 19 Nov 1982, Cape Town, South Africa, pp 161-1180	Physical	CSIR, Stellenbosch (R/SEA 8258)
1982	The formulation of an administrative structure for the management of False Bay.	Malan, J G S	MA (Environmental Studies) – University of Cape Town	Management	University of Cape Town
1981	Estuaries of the Cape. Part II: Synopses of available information on individual systems. Report No. 14: Sand (CSW 4).	Morant, P D Grindley, J R	CSIR research report 413	Biogeochemical	CSIR, Stellenbosch
1981	Strand plant communities of the western Cape Province, South Africa.	Boucher, C. Le Roux, A.	South African Journal of Science. 77: 327	Biological	Journal Publication
1981	Measurement of short-term stability of interstitial salinities in subtidal estuarine sediments.	Chapman, P.M.	Estuarine, Coastal and Shelf Science, 12: 67-81	Biogeochemical	Journal Publication
1981	Population dynamics and growth of the bivalve <i>Choromytilus meridionalis</i> (Kr.) at different tidal levels.	Griffiths, R.J.	Estuarine, Coastal and Shelf Science, 12(1): 101-118	Biological	Journal Publication
1981	Aerial exposure and energy input in the bivalve <i>Choromytilus meridionalis</i> (Kr.).	Griffiths, R.J.; Buffenstein, R.	Journal of Experimental Marine Biology and Ecology, 52(2-3): 219-229	Biological	Journal Publication
1980	Filtration, respiration and assimilation in the black mussel <i>Choromytilus meridionalis</i> .	Griffiths, R. J.	Marine Ecology - Progress Series, 3(1): 63-70	Biological	Journal Publication
1980	Natural food availability and assimilation in the bivalve <i>Choromytilus meridionalis</i> .	Griffiths, R.J.	Marine Ecology - Progress Series, 3(2): 151-156	Biological	Journal Publication
1980	The effect of effluent from Marine Oil Refiners of Africa Limited: a second	Brown, A C	Unpublished report to Marine Oil Refiners of	Biogeochemical	University of Cape

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1980	Investigation of the beach around the AECL factory outfall, Somerset West, on 6 November 1979.	Bartlett, P.D	CSIR report T/SEA 8013	Biogeochemical	CSIR, Stellenbosch
1980	The environmental effects of effluent from a food canning factory on a sandy beach ecosystem in False Bay.	Bally, R. Grindley, J.R. Eagle, G.A.	University of Cape Town, School of Environmental Studies, p.55	Biogeochemical	CSIR, Stellenbosch (P01549)
1980	Fixed activity on the Bay's margins.	Van Zyl, G	In: Symposium on Future Management of False Bay, Cape Town. <i>Proceedings</i> , B. Gasson (ed)	Management	CSIR, Stellenbosch
1980	Fishing in the Bay and the marine management options.	Newman, G	In: Symposium on Future Management of False Bay, Cape Town. <i>Proceedings</i> , B. Gasson (ed)*	Management	CSIR, Stellenbosch
1980	The ecosystem approach in planning the management of False Bay.	Siegfried, W.R	In: Symposium on Future Management of False Bay, Cape Town. <i>Proceedings</i> , B. Gasson (ed)*	Biological	CSIR, Stellenbosch
1980	Artificial reef in False Bay.	Fricke, A.H		Biological	CSIR, Stellenbosch (R/SEA 8036)
1980	Prehistory in False Bay.	Avery, G.	In: Symposium on Future Management of False Bay, Cape Town. <i>Proceedings</i> , B. Gasson (ed)*	Biological	CSIR, Stellenbosch
1980	Terrestrial nature reserves.	Hall, A.V.	In: Symposium on Future Management of False Bay, Cape Town. <i>Proceedings</i> , B. Gasson (ed)*	Biological	CSIR, Stellenbosch
1980	Plant communities along the False Bay coast.	Taylor, H.C	In: Symposium on Future Management of False Bay, Cape Town. <i>Proceedings</i> , B. Gasson (ed)*	Biological	CSIR, Stellenbosch
1980	Aquatic fauna and flora.	Branch, G	In: Symposium on Future Management of False Bay, Cape Town. <i>Proceedings</i> , B. Gasson (ed)*	Biological	CSIR, Stellenbosch
1980	Variation in structure and biomass of kelp communities along the south-west Cape coast.	Field, J G Griffiths, C L, Griffiths, R J Jarman, N Zoutendyk, P Velimirov, B	Transactions of the royal society of South Africa., 44: 145-203	Biological	Journal Publication
1980	Geology, morphology, sediment cover and movement.	Glass, J	In: Symposium on Future Management of False Bay, Cape Town. <i>Proceedings</i> , B. Gasson (ed)	Physical	CSIR, Stellenbosch
1980	The hydrological environment of False Bay.	Grindley, J	In: Symposium on Future Management of False Bay, Cape Town. <i>Proceedings</i> , B. Gasson (ed)	Physical	CSIR, Stellenbosch
1980	Meteorological aspects of False Bay.	Keen, C	In: Symposium on Future Management of False Bay, Cape Town. <i>Proceedings</i> , B. Gasson (ed)	Physical	CSIR, Stellenbosch
1980	Characteristics of summer wind fields over the Cape Peninsula upwelling area.	Jury, M.R.	MSc thesis, Geography Department, University of Cape Town, 131pp.	Physical	University of Cape Town
1980	Valsbaai strandverbetering voorlopige studie: Volume I.	CSIR	CSIR Report C/SEA 8046/1/	Physical	CSIR, Stellenbosch
1980	'n Ondersoek na die optimale benutting van Eersterivierwater deur opberging in sandafsettings of ander metodes.	Wessels, W.P. Greef, J.G.	Report of the Dept. Civil Engineering, University of Stellenbosch	Physical	Dept Civil Engineering, University of Stellenbosch
1980	False Bay in metropolitan perspective : the management imperative.	Gasson, B.	In: Symposium on Future Management of False Bay, Cape Town. <i>Proceedings</i> , B. Gasson (ed)	Management	CSIR, Stellenbosch
1980	Administrative control structures.	Gasson, B	In: Symposium on Future Management of False Bay, Cape Town. <i>Proceedings</i> , B. Gasson (ed)	Management	CSIR, Stellenbosch
1979	The effect of the effluent from Marine Oil Refiners (Pty) Ltd on the marine flora and fauna of Dido Valley Bay, Simonstown, CP, during the period 1974-1979.	Brown, A C	Unpublished report to Marine Oil Refiners of Africa	Biogeochemical	University of Cape Town
1979	Kelp grazing by the common sea urchin <i>Parechinus angulosus</i> Leske in	Fricke, A.H.	South African Journal of Zoology, 14(3): 143-148	Biological	Journal Publication

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	OWNER/ LOCATION
	False Bay, Cape				
1978	Granite erratics in a sandstone boulder beach in False Bay – independent evidence for a marine transgression.	Marchand, J.W. Fleming, B.W.	Trans. Geol. Soc. S. Afr., 81: 219-221	Physical	Journal Publication
1977	Deep weathering of the southwestern Cape granite and Malmesbury group: Paleoclimatic implications.	Glass, J.G.K.	Technical Report Joint Geological Survey/University of Cape Town Marine Geoscience Unit, 9,118-135.	Physical	University of Cape Town
1977	The False Bay story.	J, Burman	Human and Rousseau, Cape Town	Management	Book Publication
1977	Oil in the marine environment.	Darracott, A	Environment RSA (Pretoria), 4(3): 2-4	Biogeochemical	Journal Publication
1977	Reproductive cycles in littoral populations of <i>Choromytilus meridionalis</i> (Kr.) and <i>Aulacomya ater</i> (Molina) with a quantitative assessment of gamete production in the former.	Griffiths, R. J.	Journal of Experimental Marine Biology and Ecology, 30(1): 53-71	Biological	Journal Publication
1976	Investigation of the beach around the AECl factory outfall, Somerset West on 1 April 1976.	Eagle, G.A	CSIR research report 354	Biogeochemical	CSIR, Stellenbosch
1976	Strand boat harbour synopsis: a small boat harbour is being considered ... and a tentative layout has been drawn.	Gara, R.C	(Thesis no.31)	Management	CSIR, Stellenbosch (P01123)
1976	Rocky bank – evidence for a relict wave-cut platform.	Fleming, B.W.	Ann. S.A. Museum, 71: 33-48	Physical	Journal Publication
1976	Strand boat harbour,	Gara, R.C.	Thesis no 31. unknown source	Physical	Documentation Centre, CSIR, Stellenbosch
1976	The bathymetry and geology of False Bay.	Glass, J.G.K.	Technical Report Joint Geological Survey/University of Cape Town Marine Geoscience Unit, 8: 60-63.	Physical	University of Cape Town
1976	The bathymetry of False Bay as an indicator of seafloor geology.	Glass, J.G.K. Du Plessis, A.	Proc. First Interdisciplinary Conf. Mar. and Freshwater Res., S. Afr. Port Elizabeth S122: Fiche 6 D5-E6	Physical	
1976	Eploratory fishing for and growth of scallop <i>Pecten sulciocostatus</i> off the Cape south coast.	De Villiers, G.	South Africa. Sea Fisheries Branch. Investigational Report, 112	Biological	Marine and Coastal Management, Cape Town
1975	The population dynamics and ecological energetics of <i>Parechinus angulosus</i> at Robben Island and in False Bay.	Greenwood, P J	MSc (Zoology) – UCT	Biological	UCT
1974	Observations on the effects of crude oil pollution on the sandy beach snail <i>Bullia gastropoda prosobrachiata</i> .	Brown, A C Baissac, P Leon, P	Transaction of the royal society of South Africa, 40(1): 19-24	Biological	Journal Publication
1974	Relict and recent beach rock from southern Africa.	Siesser, W.G.	Geol. Soc. Am. Bull., 85: 1849-1854	Physical	CSIR, Stellenbosch
1971	A numerical analysis of changes in the soft-bottom fauna along a transect across False Bay, South Africa.	Field, J G	J. Exp. Biol. Ecol., 7: 215-253	Biological	Journal Publication
1971	The ecology of sandy beaches of the Cape Peninsula, South Africa. Part I: Introduction.	Brown, A C	Transaction of the royal society of South Africa, 39(3): 247-279	Biological	Journal Publication
1971	Pre-Quaternary geology of the continental shelf between Cape Infanta and Cape Town.	Gentle, R.I.	Tech. Rep. Univ. Cape Town SANCOR Mar. Geol. Unit, 3: 13-27	Physical	University of Cape Town
1971	Muizenberg marina project. Volume I: Main Report.	Nicholson, J.	CSIR report ME 1103/1	Physical	CSIR, Stellenbosch
1971	Muizenberg marina project. Volume II: Refraction diagrams for False Bay.	Nicholson, J.	CSIR report ME 1103/2	Physical	CSIR, Stellenbosch
1970	The biology of False Bay, South Africa.	Day, J H	Transaction of the royal society of South Africa. 39(2): 211-221	Biological	Journal Publication
1970	The use of numerical methods to determine benthic distribution patterns from dredgings in False Bay.	Field, J G	Trans. Roy. Soc. S. Afr. 39(2): 180-200	Biological	Journal Publication
1970	Numerical methods in marine ecology. 2: Gradient analysis of rocky shore samples from False Bay.	Field, J G	Institute of Oceanography. Collected Reprints, 9(95)	Biological	University of Cape Town
1970	Factors affecting phytoplankton blooms in False Bay.	Grindley, J R	Transaction of the royal society of South Africa,	Biological	Journal Publication

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	OWNER/ LOCATION
		Taylor, F J R	39(2): 201-210		
1970	Symposium on False Bay, South Africa.	Tobias, P.V.	Transaction of the royal society of South Africa, 39(2): 109-121	Physical	Journal Publication
1970	Bathymetric and magnetic transverse measurements in False Bay and west of the Cape Peninsula.	Simpson, E S W Du Plessis, A Forder, Erica	Transaction of the royal society of South Africa, 39(2): 113-116	Physical	Journal Publication
1970	The bathymetry and microrelief of False Bay.	Mallory, J K	Transaction of the royal society of South Africa, 39(2): 109-112	Physical	Journal Publication
1970	Wind and current patterns in False Bay.	Atkins, G R	Transaction of the royal society of South Africa, 39(2): 139-147	Physical	Journal Publication
1970	The marine sediments of False Bay.	Bowie, D K Fuller, A O Siesser, W G	Transaction of the royal society of South Africa, 39(2): 149-161	Physical	Journal Publication
1970	A suggested origin for the cold surface water in central False Bay.	Cram, D L	Transaction of the royal society of South Africa, 39(2): 129-137	Physical	Journal Publication
1970	Thermal structure and salinity of False Bay.	Atkins, G R	Transaction of the royal society of South Africa, 39(2): 117-128	Physical	Journal Publication
1970	False Bay investigations 1963 –1969. Final Report.	Atkins, G R	Marine Effluent Research Unit, Institute of Oceanography, UCT	Physical	University of Cape Town
1970	Sediment transport in Gordon's Bay.	Retief, G de F.	Trans. Roy. Soc. S. Afr., 39(2), 115-120.	Physical	Journal Publication
1970	False Bay investigations 1963 - 1969.	Atkins, G.R.; Mallory, J.K.	Marine Effluent Research Unit, Institute of Oceanography, UCT, 1970 (Final report)	Management	University of Cape Town
1970	Marine effluents research and marine disposal of effluents in the False Bay area.	Atkins, G.R.	Water Pollution Control, 70(2): 130-138	Biogeochemical	Journal Publication
1970	Bathymetric and magnetic traverse measurements in False Bay and west of the Cape Peninsula.	Forder, E	Institute of Oceanography. Collected Reprints, 9(101)	Physical	University of Cape Town
1969	Numerical methods in marine ecology. 1: A quantitative "similarity" analysis of rocky shore samples in False Bay, South Africa.	Mcfarlane, G.	Institute of Oceanography. Collected Reprints, 8(77)	Biological	University of Cape Town
1968	Bathymetric and magnetic traverse measurements in False Bay and west of the Cape Peninsula.	Simpson, E.S.; Du P(?)lessis, A.; Forder, E.	Transactions of the Royal Society of South Africa, 39(2): 113-116	Physical	Journal Publication
1967	Oceanography and a naval tragedy.	N.D. Bang	Lantern, 17(1): 84-87	Physical	Gericke Library, University of Stellenbosch.
1966	The marine geology of False Bay.	D.K. Bowie	MSc thesis - University of Cape Town	Physical	University of Cape Town.
1964	Some aspects of wave refraction in False Bay.	Shiple, A.M.	South African Journal of Science, 60: 115-120	Physical	CSIR, Stellenbosch (P04323)
1962	Systematic fractionation of sand in the shallow marine and beach environment off the South African coast.	Fuller, A.O.	J. Sed. Petrol., 32: 602-606	Physical	Journal Publication
1961	Size distribution characteristics of shallow marine sands from the Cape of Good Hope, South Africa.	Fuller, A.O.	J. Sed. Petrol., 31: 256-261	Physical	Journal Publication
1957	The benthic ecology of False Bay. Part I: The biology of infratidal rocks, observed by diving, related to that of intertidal rocks.	Morgans, J F C	Transaction of the royal society of South Africa, 35: 387-473	Biological	Journal Publication
1957	The benthic ecology of False Bay.	Morgans, J F C	Thesis (PhD) (Zoology) – University of Cape Town	Biological	University of Cape Town

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	OWNER/ LOCATION
1956	Notes on the analysis of shallow-water soft substrate.	Morgans, J.F.C.	J. Animal Ecol. 25: 367-387.	Physical	Journal Publication
1950	A preliminary account of investigations into the False Bay sublittoral by the use of a diving helmet.	Jackson, P B N	MSc (Zoology) – University of Cape Town	Biological	University of Cape Town
1937	The seed drift of South Africa and some influence of ocean currents on the strand vegetation.	Muir, J.	Memoirs of the Botanical Survey of South Africa, 16: 1-108	Biological	CSIR, Stellenbosch FR-PAM 05085
1891	Deep-sea deposits.	Murray, J. Renard, A.F.	Rep. Sci. Res. HMS Challenger 1874-1876. London, Her Majesty's Stationery Office	Physical	Marine and Coastal Management, Cape Town

6.5 Available Environmental Data

Although environmental data will be listed in many of the above-mentioned documents and publications, existing oceanographic databases, such as those available at the CSIR, Stellenbosch, were also searched. The following data could be located on False Bay:

Wind

POSITION	DEPLOYMENT PERIOD	TYPE OF OBSERVATIONS	OWNER/LOCATION OF DATA
34° 08,4'S; 18° 34,8'E (Seal Island)	1987-01-31 to 1988-04-14	Ta, Pr, WndSpd, WndDir, WndSpd _{max}	CSIR EDM database, Stellenbosch
Y _{Lo19} : 38 420; X _{Lo19} : 3 778 660 (Seal Island)	1987-01-13 to 1988-04-03	Ta, Pr, WndSpd, WndDir, WndSpd _{max}	CSIR EDM database, Stellenbosch
34° 02,7'S; 18° 21,1'E (Hout Bay)	1990-06-13 to 1995-12-01	WndSpd, WndDir, WndSpd _{max}	CSIR EDM database, Stellenbosch
34° 21,3'S; 18° 29,8'E (Cape Point)	1994-04-01 to 1997-02-28	Ta, WndSpd, WndDir	CSIR EDM database, Stellenbosch
34° 11,0'S; 18° 26,1'E (IMT Simon's Town)	1995-09-12 to 1995-12-01	Ta, WndSpd, WndDir, WndSpd _{min} , WndSpd _{max}	CSIR EDM database, Stellenbosch
34° 10,0'S; 18° 53,0'E (Steenbras Dam)	1995-09-15 to 1995-11-24	Ta, T _a _{min} , T _a _{max} , WndSpd, WndDir, WndSpd _{max}	CSIR EDM database, Stellenbosch
34° 21,9'S; 18° 27,7'E (Cape Point)	1995-10-04 to 1995-12-01	Ta, T _a _{min} , T _a _{max} , WndSpd, WndDir, WndSpd _{max}	CSIR EDM database, Stellenbosch
Kalk Bay	1985-02-15 to 1985-05-30	Wind speed and direction	Marine and Coastal Management, Cape Town
Gordon's Bay	1985-03-01 to 1985-05-30	Wind speed and direction	Marine and Coastal Management, Cape Town
Cape Town, International Airport	1985-02-01 to 1985-05-30	Wind speed and direction	Marine and Coastal Management, Cape Town
Simon's Town	1985-03-01 to 1985-05-30	Wind speed and direction	Marine and Coastal Management, Cape Town
Cape Hangklip	1985-03-12 to 1985-06-12	Wind speed and direction	Marine and Coastal Management, Cape Town
Seal Island	1985-03-14 to 1985-05-15	Wind speed and direction	Marine and Coastal Management, Cape Town
Cape Town International Airport	ongoing	Air pressure, Air temperature, Wind speed and direction, Relative humidity, Cloud cover, Insolation	Climate enquiries, South African Weather Bureau
Cape Point	1 st order station and AWS from Aug 1995 onwards	Air pressure, Air temperature, Wind speed and direction, Relative humidity, Cloud cover	Climate enquiries, South African Weather Bureau
Strand	AWS station from May 1996 onwards	Air pressure, Air temperature, Wind speed and direction, Relative humidity, Cloud cover	Climate enquiries, South African Weather Bureau

*Ta – air temperature, T_{amin} – min. air temperature, T_{amax} – max. air temperature, Pr – barometric pressure, RH – relative humidity, WndSpd – wind speed, WndDir – wind direction, WndSpd_{min} – min. wind speed, WndSpd_{max} – max. wind speed

Waves

POSITION	DEPLOYMENT PERIOD	TYPE OF OBSERVATIONS	OWNER/LOCATION OF DATA
34° 07,6'S 18° 10,6'E (Slangkop)	1976-02-01 - 1993-06-30	Wave height	National Ports Authority & CSIR EDM database, Stellenbosch
34° 12,3'S 18° 17,2'E (Slangkop)	1994-07-01 - present	Wave height and direction	National Ports Authority & CSIR EDM database, Stellenbosch

Currents

POSITION	DEPLOYMENT PERIOD	WATER DEPTH (m)	INSTRUMENT DEPTH (m)	TYPE OF OBSERVATIONS/INSTRUMENT	OWNER/LOCATION OF DATA
34° 15,6'S 18° 10,2'E	1978-11-02 - 1978-11-09	253 m	203 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
34° 15,6'S 18° 10,2'E	1978-11-02 - 1978-11-29	253 m	233 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Management & CSIR EMD database
34° 27,0'S 18° 31,2'E	1984-02-03 - 1984-05-10	95 m	75 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 27,0'S 18° 31,2'E	1984-02-03 - 1984-05-18	110 m	103 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 27,0'S 18° 28,8'E	1984-02-03 - 1984-05-07	100 m	84 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 19,2'S 18° 31,2'E	1986-11-06 - 1987-03-31	62 m	40 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 19,2'S 18° 31,2'E	1986-11-06 - 1987-03-31	62 m	50 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 19,2'S 18° 36,6'E	1986-11-19 - 1987-03-31	72 m	40 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 19,2'S 18° 46,2'E	1986-11-19 - 1987-03-31	60 m	40 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 19,2'S 18° 36,6'E	1986-11-19 - 1987-03-31	77 m	50 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 19,2'S 18° 46,2'E	1986-11-19 - 1987-03-31	77 m	50 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 19,2'S 18° 41,4'E	1986-11-19 - 1987-03-31	57 m	40 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 19,2'S 18° 41,4'E	1986-11-19 - 1987-03-31	72 m	50 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 18,0'S 18° 31,8'E	1989-09-28 - 1989-12-31	57 m	47 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 19,2'S 18° 36,6'E	1989-09-28 - 1989-11-01	72 m	50 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 19,2'S 18° 41,4'E	1989-09-28 - 1990-01-02	74 m	36 m	Current speed & direction; Water temperature; J4Y	CSIR EMD database
34° 19,2'S 18° 41,4'E	1989-09-28 - 1989-10-13	74 m	46 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 19,2'S 18° 46,8'E	1989-09-28 - 1989-12-15	58 m	38 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 13,2'S 18° 40,2'E	1989-09-28 - 1990-02-09	52 m	42 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 10,2'S 18° 30,0'E	1989-09-28 - 1989-11-22	- m	32 m	Current speed & direction; Water temperature; Aanderaa RCM4	CSIR EMD database
34° 15,0'S 18° 31,2'E	1992-12-22 - 1993-03-09	45 m	19 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 19,2'S 18° 31,2'E	1992-12-22 - 1993-02-11	55 m	19 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 10,8'S 18° 30,0'E	1992-12-22 - 1993-05-22	60 m	0 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 19,2'S 18° 46,8'E	1992-12-22 - 1993-05-06	55 m	19 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 16,2'S 18° 40,2'E	1992-12-22 - 1993-05-22	60 m	19 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 15,0'S 18° 48,0'E	1992-12-22 - 1993-05-06	37 m	21 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 10,8'S 18° 30,0'E	1992-12-22 - 1993-03-08	34 m	18 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 15,0'S 18° 31,2'E	1993-08-24 - 1993-10-13	45 m	19 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 19,2'S 18° 31,2'E	1993-08-24 - 1993-10-12	55 m	19 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 19,2'S 18° 46,8'E	1993-08-25 - 1993-10-12	55 m	19 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 15,0'S 18° 48,0'E	1993-08-25 - 1993-10-12	37 m	21 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 07,8'S 18° 40,2'E	1993-08-25 - 1993-10-12	30 m	19 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 10,8'S 18° 30,0'E	1993-08-25 - 1993-10-13	34 m	18 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 10,5'S 18° 30,0'E	1992-12-23 - 1993-03-08	34 m	17 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 15,0'S 18° 31,1'E	1992-12-22 - 1993-03-10	45 m	20 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 19,3'S 18° 31,2'E	1992-12-22 - 1993-02-11	55 m	20 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 16,2'S 18° 40,0'E	1992-12-22 - 1993-05-17	60 m	20 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 19,3'S 18° 46,5'E	1992-12-22 - 1993-05-06	55 m	20 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 15,0'S 18° 48,0'E	1992-12-22 - 1993-05-06	37 m	21 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 10,5'S 18° 30,0'E	1993-08-25 - 1993-10-13	34 m	19 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 15,0'S 18° 31,1'E	1993-08-24 - 1993-10-13	45 m	20 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 19,3'S 18° 31,2'E	1993-08-24 - 1993-10-12	55 m	20 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 19,3'S 18° 46,5'E	1993-08-25 - 1993-10-12	55 m	20 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
34° 15,0'S 18° 47,7'E	1993-08-25 - 1993-10-12	37 m	22 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database

POSITION	DEPLOYMENT PERIOD	WATER DEPTH (m)	INSTRUMENT DEPTH (m)	TYPE OF OBSERVATIONS/INSTRUMENT	OWNER/LOCATION OF DATA
34° 08,0'S 18° 40,0'E	1993-08-25 - 1993-10-12	30 m	20 m	Current speed & direction; Water temperature; Aanderaa RCM4	IMT/CSIR EMD database
Cape Point 34° 27,0'S 18° 30,3'E	1983-05-17 - 1983-07-24	-	101 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Mangement, Cape Town
Cape Point 34° 26,6'S 18° 32,5'E	1983-08-10 - 1983-09-27	-	85 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Mangement, Cape Town
Cape Point 34° 26,4'S 18° 32,2'E	1983-10-20 - 1983-12-18	-	62 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Mangement, Cape Town
Cape Point 34° 26,4'S 18° 32,2'E	1983-10-20 - 1983-01-21	-	89 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Mangement, Cape Town
Cape Point 34° 26,8'S 18° 31,4'E	1984-04-14 - 1984-05-10	-	76 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Mangement, Cape Town
Cape Point 34° 26,8'S 18° 31,4'E	1984-04-14 - 1984-05-15	-	103 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Mangement, Cape Town
Cape Point 34° 27,2'S 18° 29,4'E	1984-02-04 - 1984-07-05	-	89 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Mangement, Cape Town
Cape Point 34° 26,4'S? 18° 32,2'E?	1984-05 to 1984-07	-	78 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Mangement, Cape Town
Cape Point 34° 26,4'S? 18° 32,2'E?	1984-05 - 1984-07	-	105 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Mangement, Cape Town
Cape Point 34° 26,4'S? 18° 32,2'E?	1985-02-13 - 1985-03-29	-	49 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Mangement, Cape Town
Cape Point 34° 26,4'S 18° 32,2'E	1985-02-13 - 1985-03-29	-	85 m	Current speed & direction; Water temperature; Aanderaa RCM4	Marine and Coastal Mangement, Cape Town
Cape Point 34° 26,4'S 18° 32,2'E	1985-02-23 - 1985-05-08	73 m	26 m	Water temperature, EG&G CT3	Marine and Coastal Mangement, Cape Town
Cape Point 34° 26,4'S 18° 32,2'E	1985-02-23 - 1985-05-08	73 m	61 m	Current speed & direction, Water temperature; Aanderaa RCM4	Marine and Coastal Mangement, Cape Town
Cape Point 34° 26,4'S 18° 32,2'E	1985-02-23 - 1985-03-09	73 m	66 m	Current speed & direction, Water temperature; EG&G CT3	Marine and Coastal Mangement, Cape Town
Seal Island 34° 26,4'S 18° 32,2'E	1985-02-23 - 1985-05-18	40 m	19 m	Current speed & direction, Water temperature; EG&G CT3	Marine and Coastal Mangement, Cape Town
Seal Island 34° 26,4'S 18° 32,2'E	1985-02-23 - 1985-05-01	40 m	30 m	Current speed & direction, Water temperature; EG&G CT3	Marine and Coastal Mangement, Cape Town
Gordon's Bay 34° 11,5'S 18° 42,6'E	1985-02-23 - 1985-03-06	40 m	20 m	Current speed & direction, Water temperature; EG&G CT3	Marine and Coastal Mangement, Cape Town
Pringle Bay 34° 26,4'S 18° 32,2'E	1985-02-23 - 1985-03-18	69 m	56 m	Current speed & direction, Water temperature; EG&G CT3	Marine and Coastal Mangement, Cape Town

Geomorphology (Sediment Grain Size Analysis)

SAMPLING PERIOD	SAMPLING FREQUENCY	SAMPLING LOCATIONS	GRAB/CORE SAMPLING	OWNER/LOCATION OF DATA
13-06-1975	Once-off	Strandfontein, False Bay (7 beach stations)	Grab	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8018, Sept 1980)
13-02-1976	Once-off	Strandfontein, False Bay (5 beach stations)	Grab	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8019, Sept 1980)
01-04-1976	Once-off	Near Macassar, False Bay (10 beach stations)	Grab	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8019, Sept 1980)
23-03-1978	Once-off	Swartklip, False Bay (5 beach stations)	Grab	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8021, Sept 1980)
06-11-1979	Once-off	Near Macassar, False Bay (9 beach stations)	Core	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8021, Sept 1980)
10-12-1980	Once-off	Eerste River mouth, False Bay (13 stations)	Grab	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8121, July 1981)
04-12-1981	Once-off	Eerste River mouth, False Bay (19 stations)	Grab	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Data Report D8305, Oct 1983)
25-09-1987 and 23-11-1987	Once-off	Monwabisi (5 stations), Swartklip (1 station), Mitchell's Plain (5 stations) in False Bay	Grab	CSIR Data Report EMA-D 8904 (June 1989)
29-01-1988 to 17-10-1988	6 surveys	Monwabisi (5 stations), Swartklip (1 station), Mitchell's Plain (5 stations) in False Bay	Grab	CSIR Data Report EMA-D 8909 (Nov 1989)
14-07-1988 to 13-09-1988	1 survey	Strand/Gordon's Bay, False Bay (24 stations)	Grab	CSIR Data Report EMA-D 8909 (Nov 1989)

Chemical & Microbiological data: Water column

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	DEPTH INTERVALS	OWNER/LOCATION OF DATA
1983-05-17 - 1983-07-20	15 min	Thermistor chain moorings: Temperature	Cape Point: 34° 27,0'S 18° 30,3'E	55-95 m at 4m intervals	Marine and Coastal Management, Cape Town
1983-08-10 - 1983-09-27	15 min	Thermistor chain moorings: Temperature	Cape Point: 34° 26,6'S 18° 32,5'E	57-77 m at 2 m intervals	Marine and Coastal Management, Cape Town
1983-10-20 - 1983-11-26	15 min	Thermistor chain moorings: Temperature	Cape Point: 34° 26,4'S 18° 32,2'E	64-84 m at 2 m intervals	Marine and Coastal Management, Cape Town
1992-onwards	daily	Sea Surface Temperature	Fish Hoek: 34° 08'S; 18° 25'E	Surface	South African Weather Bureau, Cape Town International Weather Office
1972-1976 1990-onwards	daily	Sea Surface Temperature	Kalk Bay: 34° 07'S; 18° 27'E	Surface	South African Weather Bureau, Cape Town International Weather Office
1973-onwards	daily	Sea Surface Temperature	Muizenberg: 34° 06'S; 18° 28'E	Surface	South African Weather Bureau, Cape Town International Weather Office
1972-onwards	daily	Sea Surface Temperature	Gordon's Bay: 34° 10'S; 18° 52'E	Surface	South African Weather Bureau, Cape Town International Weather Office
16-03-1960 to 25-11-1960	Synoptic (monthly)	Salinity; Temperature	Across False Bay (n = 59)	Surface	SADCO, CSIR, Stellenbosch
07-01-1960 to 08-12-1960	Synoptic (monthly)	Salinity; Temperature; Dissolved oxygen	South and south-eastern section of False Bay (n = 223)	10 m intervals	SADCO, CSIR, Stellenbosch
01-02-1961 to 16-12-1961	Synoptic (monthly)	Salinity; Temperature	Western section of False Bay (n = 37)	Surface	SADCO, CSIR, Stellenbosch
05-01-1961 to 14-12-1961	Synoptic (monthly)	Salinity; Temperature Dissolved oxygen	Along south and south-eastern section of False Bay (n = 91)	10 m intervals	SADCO, CSIR, Stellenbosch
16-01-1962 to 16-12-1962	Synoptic (monthly)	Salinity; Temperature	Across False Bay (n = 33)	Surface	SADCO, CSIR, Stellenbosch
18-01-1962 to 16-12-1962	Synoptic (monthly)	Salinity; Temperature	North-eastern section of False Bay	10 m intervals	SADCO, CSIR, Stellenbosch

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	DEPTH INTERVALS	OWNER/LOCATION OF DATA
16-01-1963 to 13-06-1963	Synoptic (monthly)	Dissolved oxygen Salinity; Temperature	Across False Bay (n = 28)	Surface	SADCO, CSIR, Stellenbosch
20-01-1963 to 14-12-1963	Synoptic (monthly)	Salinity; Temperature Dissolved oxygen	Eastern section of False Bay (n = 40)	10 m intervals	SADCO, CSIR, Stellenbosch
21-01-1964 to 16-12-1964	Synoptic (periodically)	Temperature	Western section of False Bay (n = 17)	Surface	SADCO, CSIR, Stellenbosch
25-01-1964 to 13-12-1964	Synoptic (monthly)	Salinity; Temperature Dissolved oxygen	Western section of False Bay (n = 51)	10 m intervals	SADCO, CSIR, Stellenbosch
25-01-1965 to 17-03-1965	Synoptic (monthly)	Salinity; Temperature	Western shores of False Bay (n = 12)	Surface	SADCO, CSIR, Stellenbosch
13-01-1965 to 11-12-1965	Synoptic (monthly)	Salinity; Temperature Dissolved oxygen	Western section of False Bay (n = 46)	10 m intervals	SADCO, CSIR, Stellenbosch
22-01-1966 to 06-12-1966	Synoptic (periodically)	Temperature	Western section of False Bay (n = 11)	Surface	SADCO, CSIR, Stellenbosch
12-02-1966 to 11-12-1966	Synoptic (monthly)	Salinity; Temperature Dissolved oxygen	Western section of False Bay (n = 44)	10 m intervals	SADCO, CSIR, Stellenbosch
10-01-1967 to 10-12-1967	Synoptic (periodically)	Salinity; Temperature	Western section of False Bay (n = 9)	Surface	SADCO, CSIR, Stellenbosch
13-01-1967 to 17-06-1967	Synoptic (monthly)	Salinity; Temperature Dissolved oxygen	Western section of False Bay (n = 24)	10 m intervals	SADCO, CSIR, Stellenbosch
07-01-1968 to 09-12-1968	Synoptic (monthly)	Salinity; Temperature	Western section of False Bay (n = 18)	Surface	SADCO, CSIR, Stellenbosch
10-01-1969 to 13-03-1969	Synoptic (periodically)	Salinity; Temperature	Western section of False Bay (n = 6)	Surface	SADCO, CSIR, Stellenbosch
03-02-1972 to 13-09-1974	Synoptic (periodically)	Salinity; Temperature	Across False Bay (n = 51)	10 m intervals	SADCO, CSIR, Stellenbosch
15-01-1975 to 22-05-1975	Synoptic (monthly)	Salinity; Temperature; pH; Dissolved oxygen; NO ₃ -N PO ₄ -P; SiO ₄ -Si	Along southern boundary of False Bay (n= 125)	10 m intervals	SADCO, CSIR, Stellenbosch
13-06-1975	Once-off	Salinity; Temperature; pH; Dissolved oxygen; Oxygen Adsorbed; NOx-N; PO ₄ -P; SiO ₄ -Si	Strandfontein, False Bay (7 stations)	Interstitial and surface water	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8018, Sept 1980)
20-06-1975 to 07-11-1975	Synoptic (monthly)	Salinity; Temperature; pH Dissolved oxygen; NO ₃ -N PO ₄ -P; SiO ₄ -Si	Along southern boundary of False Bay (n = 140)	10 m intervals	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8018, Sept 1980)
13-02-1976	Once-off	Salinity; Temperature; pH Dissolved oxygen; Oxygen Adsorbed; NOx-N; PO ₄ -P; SiO ₄ -Si	Strandfontein, False Bay (5 stations)	Interstitial and surface water	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8019, Sept 1980)
01-04-1976	Once-off	Salinity; Temperature; pH; Dissolved oxygen; Oxygen Adsorbed; NOx-N; PO ₄ -P; SiO ₄ -Si	Near Macassar, False Bay (10 stations)	Interstitial and surface water	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8019, Sept 1980)
25-08-1977 to 30-11-1977	Synoptic (monthly)	Salinity; Temperature	North-east to South-west of False Bay (n = 58)	10 m intervals	SADCO, CSIR, Stellenbosch
23-03-1978	Once-off	Salinity; Temperature; pH Dissolved oxygen; Oxygen Adsorbed; NOx-N; PO ₄ -P; SiO ₄ -Si	Swartklip, False Bay (5 stations)	Surface	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8021, Sept 1980)
06-11-1979	Once-off	Salinity; Temperature; pH; Dissolved oxygen; Oxygen	Near Macassar, False Bay (9 stations)	Interstitial and surface water	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8021,

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	DEPTH INTERVALS	OWNER/LOCATION OF DATA
		Adsorbed; NOx-N; PO ₄ -P; SiO ₂ -Si			Sept 1980)
13-01-1978 to 09-08-1978	Synoptic (monthly)	Salinity; Temperature	North-east to South-west of False Bay (n = 142)	10 m intervals	SADCO, CSIR, Stellenbosch
10-12-1980	Once-off	Salinity; Temperature; pH; Dissolved oxygen; Oxygen Adsorbed; NOx-N; PO ₄ -P; SiO ₂ -Si	Eerste River mouth, False Bay (13 stations)	Interstitial and surface water	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8121, July 1981)
04-12-1981	Once-off	Salinity; Temperature; pH; Dissolved oxygen; Oxygen Adsorbed; NOx-N; PO ₄ -P; SiO ₂ -Si	Eerste River mouth, False Bay (19 stations)	Interstitial and surface water	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Data Report D8305, Oct 1983)
25-09-1987 and 23-11-1987	Once off	NOx-N; Total NH ₄ -N; PO ₄ -P; SiO ₂ -Si; Dissolved Organic C; Trace metals	Monwabisi (5 stations), Swartklip (1 station), Mitchell's Plain (5 stations) in False Bay	Surface	CSIR Data Report EMA-D 8904 (June 1989)
21-07-1987, 01-09-1987 and 23-11-1987	Once-off	NOx-N; Total NH ₄ -N; PO ₄ -P; SiO ₂ -Si; Dissolved Organic C; Trace metals	Zeekoe River mouth (5 stations)	Surface	CSIR Data Report EMA-D 8904 (June 1989)
29-01-1988 to 17-10-1988	6 surveys	NOx-N; Total NH ₄ -N; PO ₄ -P; SiO ₂ -Si; Dissolved Organic C; Trace metals	Monwabisi (5 stations), Swartklip (1 station), Mitchell's Plain (5 stations) in False Bay	Surface	CSIR Data Report EMA-D 8909 (Nov 1989)
14-07-1988 to 13-09-1988	6 surveys	Salinity; NO ₃ -N; Total NH ₄ -N; PO ₄ -P; SiO ₂ -Si; Trace metals; Faecal coliform; Faecal streptococci	Strand/Gordon's Bay, False Bay (24 stations)	Surface	CSIR Data Report EMA-D 8909 (Nov 1989)
27-05-1983 to 23-01-1993	Synoptic (monthly)	Salinity; Temperature; pH; Dissolved oxygen; NO ₃ -N; PO ₄ -P; SiO ₂ -Si; Chlorophyll a	North-east to South-west of False Bay (n = 40)	10 m intervals	SADCO, CSIR, Stellenbosch
25-04-1989 to 29-04-1989	Synoptic (2 surveys along southern boundary, 2 surveys across entire bay)	Salinity; Temperature; Dissolved oxygen; NOx-N; Total NH ₄ -N; PO ₄ -P; SiO ₂ -Si	Southern boundary (8 stations - only salinity & temperature) Across False Bay (49 stations)	Salinity and Temperature: 1 m intervals Dissolved oxygen: surface Nutrients: 10 m intervals	SADCO (Salinity, Temperature and DO) and Microsoft Excell Spreadsheet (Nutrients), CSIR, Stellenbosch

Chemical and Microbiological data: Sediments

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	GRAB/CORE SAMPLING	OWNER/LOCATION OF DATA
13-06-1975	Once-off	Oxygen Adsorbed	Strandfontein, False Bay (7 stations)	Grab	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8018, Sept 1980)
13-02-1976	Once-off	Oxygen Adsorbed	Strandfontein, False Bay (5 stations)	Grab	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8019, Sept 1980)
01-04-1976	Once-off	Oxygen Adsorbed Trace metals	Near Macassar, False Bay (10 sampling stations)	Grab	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8019, Sept 1980)
23-03-1978	Once-off	Trace metals	Swartklip, False Bay (5 sampling stations)	Grab	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8021, Sept 1980)
06-11-1979	Once-off	Trace metals	Near Macassar, False Bay (9 stations)	Cores	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Memorandum 8021, Sept 1980)
10-12-1980	Once-off	Oxygen Adsorbed	Eerste River mouth, False Bay (13)	Grab	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	GRAB/CORE SAMPLING	OWNER/LOCATION OF DATA
		Trace metals	stations)		Memorandum 8121, July 1981)
04-12-1981	Once-off	Oxygen Adsorbed Trace metals	Eerste River mouth, False Bay (19 stations)	Grab	SADCO, CSIR, Stellenbosch and CSIR Data Report (NRIO Data Report D8305, Oct 1983)
17-05-1982 to 26-05-1982	Once-off	Organic matter Total carbon Trace metals	Across False Bay (58 stations)	Grab	CSIR Data Report EMA-D 8902 (May 1989)
25-09-1987 and 23-11-1987	Once off	Salinity Trace metals	Monwabisi (5 stations), Swartklip (1 station), Mitchell's Plain (5 stations) in False Bay	Grab	CSIR Data Report EMA-D 8904 (June 1989)
21-07-1987, 01-09-1987 and 23-11-1987	Once-off	Salinity Trace metals	Zeekoe River mouth (5 stations)	Grab	CSIR Data Report EMA-D 8904 (June 1989)
29-01-1988 to 17-10-1988	6 surveys	Salinity Trace metals	Monwabisi (5 stations), Swartklip (1 station), Mitchell's Plain (5 stations) in False Bay	Grab	CSIR Data Report EMA-D 8909 (Nov 1989)
14-07-1988 to 13-09-1988 (6 surveys)	Once-off	Salinity Trace metals	Strand/Gordons Bay, False Bay (24 stations)	Grab	CSIR Data Report EMA-D 8909 (Nov 1989)

6.6 Existing Monitoring Programmes

Data on the monitoring programmes were primarily extracted from Taljaard *et al.* (2001) and more details on these programmes can be obtained from that report.

PROGRAMME	DESCRIPTION	MONITORING TYPE	DURATION	SAMPLING FREQUENCY	SAMPLING LOCATION	PARAMETERS MEASURED	OWNER/LOCATION
Miller's Point WWTW	Test for compliance with critical limits specified for effluent	Source	At least since 1995	Weekly	Final effluent	Flow; Conductivity, pH; Chemical Oxygen Demand; Suspended solids, NOx-N; Kjeldahl-N, Total NH ₄ -N; PO ₄ -P; Total P; Faecal coliform; <i>E coli</i>	City of Cape Town
Simon's Town WWTW	Test for compliance with critical limits specified for effluent	Source	At least since 1995	Weekly	Final effluent	Flow; Conductivity, pH; Chemical Oxygen Demand; Suspended solids, NOx-N; Kjeldahl-N, Total NH ₄ -N; PO ₄ -P; Total P; Faecal coliform; <i>E coli</i>	City of Cape Town
Cape Flats WWTW	Test for compliance with critical limits specified for effluent	Source	At least since 1995	Weekly	Final effluent	Flow; Conductivity, pH; Chemical Oxygen Demand; Suspended solids, NOx-N; Total NH ₄ -N; PO ₄ -P; Faecal coliform	City of Cape Town/Dept. of Water Affairs & Forestry

PROGRAMME	DESCRIPTION	MONITORING TYPE	DURATION	SAMPLING FREQUENCY	SAMPLING LOCATION	PARAMETERS MEASURED	OWNER/LOCATION
Mitchell's Plain WWTW	Test for compliance with critical limits specified for effluent	Source	At least since 1995	Weekly	Final effluent	Flow; Conductivity, pH; Chemical Oxygen Demand; Suspended solids, NO _x -N; Kjeldahl-N, Total NH ₄ -N; PO ₄ -P; Total P; Faecal coliform; <i>E coli</i>	City of Cape Town
Macassar WWTW	Test for compliance with critical limits specified for effluent	Source	At least since 1995	Weekly	Final effluent	Flow; Conductivity, pH; Chemical Oxygen Demand; Suspended solids, NO _x -N; Kjeldahl-N, Total NH ₄ -N; PO ₄ -P; Total P; Faecal coliform; <i>E coli</i>	City of Cape Town
Gordon's Bay WWTW	Test for compliance with critical limits specified for effluent	Source	At least since 1995	Weekly	Final effluent	Flow; Conductivity, pH; Chemical Oxygen Demand; Suspended solids, NO _x -N; Total NH ₄ -N; PO ₄ -P; Faecal coliform	City of Cape Town
Coastal Bacteriological Monitoring Programme	Determine fitness for use for recreation and collection of filter feeders for human consumption	Environmental	Since 1960s, more complete records since 1990	Fortnightly	About 50 stations along the False Bay coast	Faecal coliform; <i>E. coli</i> ; <i>Enterococci</i> (since 2004)	City of Cape Town
Coastal Mussel Watch Programme	Monitor trace metal accumulation in biota along coast	Environmental	Since 1985	6-monthly	13 stations along the False Bay coast	Trace metals (Cd; Cu; Pb; Hg; Zn)	Marine and Coastal Management (DEAT)
Storm-water monitoring programme	Quantify bacteriological quality of storm-water entering False Bay	Source	At least since 1995	Fortnightly or when there is run-off	7 outlets into False Bay	Faecal coliform; <i>E. coli</i> ; <i>Enterococci</i> (since 2004)	City of Cape Town
River Quality monitoring Programme	Quantify river water quality	Source	Since 1980s	Monthly	Elsies, Sand, Zeekoe and Kuils/Eerste rivers (monitoring programmes include station near the sea)	Chemical, bacteriological and phytoplankton	City of Cape Town
DWAF River & Stormwater Quality Monitoring Programme	Quantify quality of land-based inflows into False Bay	Source	Since 1996	Monthly	Elsies, Silvermine, Zeekoe, Lourens and Sir Lowry's Pass rivers; Mitchell's Plain East, Mitchell's Plain West and Monwabisi storm-water outlet	Electrical conductivity, pH, Chemical Oxygen Demand, Suspended solids, NO ₃ -N, PO ₄ -P and Total NH ₄ -N	Dept. of Water Affairs & Forestry

6.7 Suitability for Application in Management Framework

i. Management Responsibilities

The Cape Metropolitan Coastal Water Quality Committee (refer to Chapter 6.1), to a large degree, already fulfils the role of a local management institution, in which senior officials from local, provincial and national government and civil society have joined efforts to manage marine water quality within the boundaries of the Cape Metropolitan Area. To meet the full requirements of a local management institution, as per the proposed management framework, it is recommended that representation on this Committee also be explicitly extended to other key stakeholders, such as:

- South African Navy (related to the operations in Simon's Town harbour)
- SOMCHEM (industry discharging effluent into the bay)
- Marine and Coastal Management (DEAT) (related to Marine Protected Areas and fishing harbours)
- Tourism forums (if not already included).

ii. Legislative Framework

An assessment of the South African legislative framework related to marine pollution is addressed in more detail in Chapter 2.

iii. Environmental Quality Objectives

Important marine ecosystems and beneficial uses within this node have been summarized before (CSIR, 1991b) and a preliminary assessment of the current situation is provided in Chapter 6.3.

There are numerous initiatives through which important marine ecosystems and beneficial use areas are being decided upon within False Bay, such as:

- Closed and Marine Protected areas proclaimed by the Department of Environmental Affairs and Tourism (refer to Chapter 6.3)
- Coastal Zone Strategy for the City of Cape Town (City of Cape Town, 2003).

It is important that proper integration and communication occur between the above-mentioned initiatives so as to synthesize a common set of management and environmental quality objectives for False Bay and also to manage any potential conflicts. The Cape Metropolitan Coastal Water Quality Committee is considered a suitable platform from which

to coordinate such communication, provided that other key role players (as mentioned earlier) are included.

iv. Marine Pollution Sources

Within False Bay, pollutant inputs from land-based sources (i.e. WWTW and industrial effluent discharges, river inflow and major storm-water outlets) are largely quantified, except maybe for toxic substances such as trace metals, petroleum hydrocarbons and pesticides (refer to Chapter 6.2).

Quantitative information on pollutant input from the smaller storm-water outlets along the coastline is very limited. It is recognized that such data are often difficult to obtain, but they are ultimately necessary to assess cumulative and potential synergistic effects. In the case of storm-water run-off, where data cannot be obtained through routine monitoring (e.g. due to resource constraints), they could be derived from available literature. For example, an overview of the type of pollutant input from storm-water run-off, originating from different source areas, is provided in Pegram & Görgens (2001).

Quantification of pollutant input for other pollution sources in this node, e.g. activities associated with the Simon's Town, Kalk Bay and Gordon's Bay harbours, will also be difficult. However, it will be important to list these so as to identify activities for which controls (e.g. mitigating measures) need to be specified to minimize or limit impacts, as well as to assess cumulative or potential synergistic impacts.

iv. Scientific Assessment Studies

A number of scientific and engineering studies related to the management of marine pollution sources have already been conducted in False Bay (refer to Chapter 6.4). For example, in the early 1990s, the CSIR conducted comprehensive studies in False Bay to assess transport and dispersion processes in the Bay (CSIR, 1991b), which included an intensive data collection programme.

Taking into account the complexities of the physical, biogeochemical and biological processes of the marine environment in False Bay, as well as the multitude of marine pollution sources, ecosystem scale assessment studies could best be undertaken through the application of sophisticated numerical modelling techniques. To ensure that these types of studies are undertaken in a cost-effective manner and to prevent duplication of effort, it is

recommended that a local management institution dealing with marine pollution matters (e.g. the Cape Metropolitan Coastal Water Quality Committee) be used as platform from which to plan and coordinate integrated, ecosystem scale scientific assessment studies.

v. Critical limits and Mitigating Actions

DWAF has already specified, or is in the process of specifying, critical limits for the municipal (WWTW) and industrial effluent discharges. These will be included in the licence agreements issued under the National Water Act 36 of 1998 (Wilna Kloppers, Department of Water Affairs and Forestry, Bellville, pers. comm.).

As far as could be established, mitigating (or corrective) actions to prevent pollution from catchment (river) and urban storm-water run-off are addressed mainly through the Catchment Management Teams (Cape Metropolitan Council Coastal Water Quality Committee, 2003).

vi. Monitoring Programmes

Routine source monitoring programmes are already implemented at the WWTW and industrial effluent discharges into False Bay. Routine water quality monitoring programmes have also been implemented at most of the rivers and major storm-water outlets into False Bay. Although the inflows (i.e. quantity) are not always measured on a routine basis, this is information that will be required to effectively implement the proposed management framework.

The City of Cape Town and DWAF are responsible for the execution of these source monitoring programmes and, in some cases, it appears as if there might be some duplication (e.g. monitoring of rivers and storm-water outlets). To ensure optimal utilization of both human and financial resources, it is recommended that, where possible and viable, such programmes be consolidated.

Routine environmental monitoring programmes in False Bay are largely limited to (Chapter 6.6):

- Bacteriological monitoring programme (City of Cape Town)
- Mussel Watch Programme (Marine and Coastal Management)

As far as could be established, environmental monitoring programmes assessing potential impact from pollution sources on the larger ecosystem scale (e.g. assessing sediment quality and changes in biotic functioning and diversity) are not currently undertaken. Following requirements under the new *Operational Policy for the disposal of land-derived wastewater to the marine environment of South Africa* (RSA, DWAF, 2004a), it is likely that the Department of Water Affairs and Forestry will start to include environmental monitoring programmes into the licence agreements for individual wastewater discharges (e.g. WWTW and industrial effluent discharges). It is strongly recommended that such programmes not be undertaken as individual initiatives, but that these be optimized and coordinated through a local management institution, such as the Cape Metropolitan Coastal Water Quality Committee.

7 WALKER BAY

7.1 Existing Management Initiatives

NAME	DESCRIPTION	RESPONSIBLE INSTITUTION/AUTHORITY	PARTIES INVOLVED	PERIOD OPERATIONAL
Overstrand Conservation Foundation	Full-time professional organization should be formed, with adequate capacity and resources to work effectively in the fields of environmental conservation, eco-tourism and community development.	Overstrand Conservation Foundation	Representatives from 20 conservation-orientated organizations in the Overberg area	Since 2001
Palmiet River Catchment Steering Committee	Primarily for sharing of information on water resources studies, bioregional planning initiatives, water services development planning, the activities of environmental associations and authorities, the work of provincial government departments and the work of irrigation boards.	Dept. of Water Affairs & Forestry	Local government; Provincial government; DWAF: Western Cape; Irrigation boards; Environmental authorities; Environmental organizations	Since 2000
Klein River Catchment Steering Committee	Primarily for sharing of information on water resources studies, bioregional planning initiatives, water services development planning, the activities of environmental associations and authorities, the work of provincial government departments and the work of irrigation boards.	Dept. of Water Affairs & Forestry	Local government; Provincial government; DWAF: Western Cape; Irrigation boards; Environmental authorities; Environmental organizations	Since 2000
Bot River Catchment Steering Committee	Primarily for sharing of information on water resources studies, bioregional planning initiatives, water services development planning, the activities of environmental associations and authorities, the work of provincial government departments and the work of irrigation boards.	Dept. of Water Affairs & Forestry	Local government; Provincial government; DWAF: Western Cape; Irrigation boards; Environmental authorities; Environmental organizations	Since 2000
Onrus Catchment Steering Committee	Primarily for sharing of information on water resources studies, bioregional planning initiatives, water services development planning, the activities of environmental associations and authorities, the work of provincial government departments and the work of irrigation boards.	Dept. of Water Affairs & Forestry	Local government; Provincial government; DWAF: Western Cape; Irrigation boards; Environmental authorities; Environmental organizations	Since 2000

7.2 Marine Pollution Sources

A map indicating the location of major potential marine pollution sources in Walker Bay is provided in Figure 7.1. Details of these sources are provided below:

NAME	SOURCE TYPE	DESCRIPTION	ESTIMATED VOLUME	POLLUTANT COMPOSITION	OWNER/MANAGER
Hermanus WWTW	Land-based	Effluent from a WWTW discharged into the surf zone	3 544 m ³ /day*	Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants	Overstrand Municipality
Tuna Marine	Land-based	Effluent from a fish processing plant discharged to the surf zone	12 m ³ /day*	Inorganic Nitrogen; Bacteriological contaminants; Organic Carbon and Nitrogen; Suspended solids	Tuna Marine
Walker Bay Fisheries	Land-based	Effluent from a fish processing plant discharged to the surf zone	36 m ³ /day*	Inorganic Nitrogen; Bacteriological contaminants; Organic Carbon and Nitrogen; Suspended solids	Walker Bay Fisheries
Sea Plant Products	Land-based	Effluent from a fish processing plant discharged to the surf zone	36 m ³ /day*	Inorganic Nitrogen; Bacteriological contaminants; Organic Carbon and Nitrogen; Suspended solids	Sea Plant Products
Marine Products, Gansbaai	Land-based	Effluent from a pelagic fish processing plant discharged to the surf zone	11 682 m ³ /day*	Inorganic Nitrogen; Bacteriological contaminants; Organic Carbon and Nitrogen; Suspended solids	Marine Products
Palmiet River	Land-based	Catchment largely consists of agricultural areas		No major pollutant risks	Dept. of Water Affairs and Forestry/Municipality
Onrus River	Land-based	Catchment largely consists of agricultural areas and residential development. Accidental spillage from the WWTW at Onrus also occurs		Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants	Dept. of Water Affairs and Forestry/Municipality
Bot River	Land-based	Catchment largely consists of agricultural areas and residential development (a large golf course development, Arabella Estate, is situated along the bank near the mouth)		Suspended solids; Organic matter; Inorganic nutrients (N & P)	Dept. of Water Affairs and Forestry/Municipality
Klein River	Land-based	Catchment largely consists of agricultural areas and residential development. Accidental spillage from the WWTW at Stanford also occurs		Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants	Dept. of Water Affairs and Forestry/Overstrand Municipality
Storm-water run-off: Residential and Industrial areas	Land-based	Storm-water run-off from residential areas and industrial area near the coast also discharges into the surf zone through numerous outlets		Suspended solids; Organic matter; Inorganic nutrients (N & P); Trace metals; Petroleum hydrocarbons; Bacteriological contaminants; Litter	Overstrand Municipality
Hermanus Fishing Harbour	Maritime transport	Activities causing marine pollution include: cleaning of vessels, accidental oil spillages, dumping of bloodwater and other fish offal, and littering	Not easily quantifiable	Suspended solids; Organic matter (fish waste); Petroleum hydrocarbons; Litter/Garbage	Dept. of Public Works/Dept. of Environmental Affairs and Tourism
Gans Bay Fishing Harbour	Maritime transport	Activities causing marine pollution include: cleaning of vessels, accidental oil spillages, dumping of bloodwater and other fish offal, and littering	Not easily quantifiable	Suspended solids; Organic matter (fish waste); Petroleum hydrocarbons; Litter/Garbage	Dept. of Public Works/Dept. of Environmental Affairs and Tourism

* Source: RSA DWAF, 2004c



Figure 7.1: Potential marine pollution sources in Walker Bay

7.3 Important Marine Ecosystems and Beneficial Uses

7.3.1 Important Marine Ecosystems

The Walker Bay Nature Reserve lies within this node. The reserve consists of five coastal areas, situated between Hermanus and Die Dam near Struisbaai. The main section, known as Walker Bay, stretches from the Klein River Estuary to De Kelders at Gansbaai. This section covers about 1 000 ha with a coastline of 17 km and features a long beach, known as De Plaat, with white sands and rocky limestone outcrops to the east (www.capenature.org.za/Nature_Reserves/html/walkerbay.html).

The Klein, Bot, Palmiet and Onrus estuaries are sensitive estuarine ecosystems located within in the Walker Bay area. The ecological functioning of these systems relies, amongst other aspects, on suitable water quality. There is also a bird sanctuary on the eastern end of the Bot River Lagoon at Meerensee.

A number of marine protected areas and closed areas, proclaimed under the Marine Living Resources Act 18 of 1998, are also located within this node, namely:

- Betty's Bay Marine Protected Area. From beacon B1 at Stoney Point to beacon B4 to the east of Jock-se-baai, extending two nautical miles seawards from the high-water mark. Only shore angling is allowed.
- Mudge Point Marine Conservation Area. From the western limit of the Hawston harbour to the eastern limit of the Frans Senekal Game Reserve, extending 100 m seawards from the high-water mark. Only the collection of abalone, rock lobster, aquatic plants and washed up red bait, and shore angling are allowed.
- Onrus River. Inside Harderbaai between the low-water mark and a straight line drawn between the beacons at Van der Riet Hoek (OR1) and Marine Drive Point (OR2) . Only shore angling is allowed.
- Hermanus. Between the beacons at Kraal Rock (HR1), Walker Bay, and Rietfontein (HR2), Hermanus, extending 500 m seawards from the high-water mark. Only shore angling is allowed.

7.3.2 Beneficial uses

i. Recreation (including tourism)

Hermanus, a coastal town situated within the Walker Bay area, is marketed as the '*World's best land-based whale watching spot*'. The area is therefore one of the main tourist attractions in the Western Cape. Cage diving to view great white sharks has also become a popular activity in the area (www.hermanus.com/sharks.mv).

The area also hosts a range of popular recreation beaches, including (www.hermanus.com/beaches.mv):

- Grotto Beach (awarded Blue Flag status in November 2002)
- Voëlklip, which is popular with surfers and sunbathers
- Kammabaai, which has the best waves for surfing
- Langbaai
- Sandbaai beach, a popular snorkelling site
- Onrus beach where a lagoon offers a safe swimming spot
- Breakfast Bay
- Plankhuis
- Hawston and Kleinmond
- Tidal pools e.g. at Schulphoek, the Marine Hotel and Fick's Pool.

The area also supports two popular yacht clubs, namely:

- Hermanus Yacht Club situated on the Kleinriver Lagoon
- Lake Marina Yacht Club at Fisher Haven.

ii. Marine Aquaculture and Important Fisheries (including collection of seafood for human consumption)

Walker Bay supports a number of commercial and subsistence fisheries, including rock lobster and abalone. Poaching, however, has had a major impact on the abalone resources in the Hermanus and Hawston area.

Walker Bay is also a popular recreational fishing area. Rock lobster can be collected from coastal waters during demarcated periods of the year, provided that collectors are in possession of permits. The recreational abalone season has been closed until further notice due to the heavy pressures of poaching on this living resource.

iii. Industrial uses

A number of seafood processing factories (e.g. fish and abalone) are located within the Hermanus and Gansbaai areas. These factories usually take in seawater for processing in the factories.

Although there are numerous activities in harbours and ports that could detrimentally affect marine water and sediment quality (as discussed earlier), these are also users and require a certain quality of the marine environment. Harbours within this node include:

- Hermanus Fishing Harbour
- Gansbaai Fishing Harbour.



Figure 7.2: Important ecosystems and beneficial uses of Walker Bay

7.4 Available Environmental Literature

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
2005	The hydrodynamics of the Bot River Estuary Revisited	Van Niekerk, L., Van der Merwe, Huizinga, P	Water SA, 31(1): 73-85	Physical	Journal Publication
1999	A preliminary survey of the estuaries on the south-west coast of South Africa, Cape Hangklip -Cape Agulhas, with particular reference to the fish fauna	Harrison TD	Transactions of the Royal Society of South Africa, 54(2): 257-283	Biological	Journal Publication
1999	Collapse of linefish stocks between Cape Hangklip and Walker Bay, South Africa.	Attwood, C.G.; Farquhar, M.	South African Journal of Marine Science, 21:415-432	Biological	Marine and Coastal Management, Cape Town
1999	Klein River estuary: The effects of mouth breachings in 1998 (Confidential)	Huizinga P Van Niekerk L	CSIR report ENV-S-C 99014	Physical	CSIR, Stellenbosch
1998	Klein River estuary: The effects of high water levels during mouth breaching in 1997	Huizinga P Van Niekerk L Withers A	CSIR report ENV/S-C 98031	Physical	CSIR, Stellenbosch
1996	Klein River estuary: the effects of high water levels during mouth breaching in 1996 (Confidential)	Huizinga P Van Niekerk L Withers A	CSIR report: ENV-S-C 97016	Physical	CSIR, Stellenbosch
1996	Klein River estuary: Monitoring results of mouth conditions during 1994 (Confidential).	Huizinga P Withers A	CSIR report EMAS-C 96007	Physical	CSIR, Stellenbosch
1994	Sediment suspension by turbulence in the surf zone	Smith GG Mocke GP	In: Sediment Transport Mechanisms in Coastal Environments and Rivers, Euromech 310, 13-17 September 1993, Le Havre, France, ed. by M. Belorgey et al., pp 375-387 (EMAS-R 9409)	Physical	CSIR, Stellenbosch
1994	Environmental measurements in Walker Bay (Confidential).	Carter, R.A.	CSIR report EMAS-C 94052	Biological	CSIR, Stellenbosch
1992	Hydrodynamics and sediment concentrations at Walker Bay	Coppoolse RC Schoonees JS Smith GG Mocke GP	In: Coastal engineering 1992 : proceedings of the 23rd International Conference. Vol. 3, Chapter 232, 4 to 9 Oct 1992, Venice, Italy, ed. by B.L. Edge, pp 3026-3039 (EMAS-R 9214)	Physical	CSIR, Stellenbosch
1991	Spectral analysis of field measured near-bed horizontal wave orbital velocities : Walker Bay : 1987-1988	Pos, J.D. Rossouw, M.	CSIR research report 700	Physical	CSIR, Stellenbosch
1991	Field measurements of suspended sediment concentrations in the surf zone at Walker Bay.	Schoonees, J.S.	In: Sand transport in rivers, estuaries and the sea, [ed. R.L.Soulsby & R.Bettess]. Rotterdam: A.A.Balkema. pp.131-138	Physical	CSIR, Stellenbosch
1990	Wind-induced cross-shore water flows.	Crowley, J.B.; Swart, D.H.	Proceedings 22nd Coastal Engineering Conference, The Netherlands, Vol 1: 1074-1087. Aerican Society of Civil Engineers, New York	Physical	
1989	The diets of fish in three south-western Cape estuarine systems	Bennett, B.A.	South African Journal of	Biological	Journal Publication

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
			Zoology, 18: 1-10		
1989	Walker Bay : Wave and near-bed horizontal orbital velocity data : October 1987 to January 1988.	Pos, J.D. Rossouw, M.	CSIR report EMA-D 8912	Physical	CSIR, Stellenbosch
1988	Walker Bay field experiment : Caesar II. Data report : Pressure sensor 4	Gonsalves, J.W.	CSIR report EMA-D 8812	Physical	CSIR, Stellenbosch
1988	Walker Bay field experiment : Caesar II. Data report : Pressure sensor 5	Gonsalves, J.W.	CSIR report EMA-D 8813	Physical	CSIR, Stellenbosch
1988	Walker Bay field experiment : Caesar II. Data report : Pressure sensor 6.	Gonsalves, J.W.	CSIR report EMA-D 8814	Physical	CSIR, Stellenbosch
1988	Walker Bay field experiment : Caesar II. Data report : Pressure sensor 8	Gonsalves, J.W.	CSIR report EMA-D 8815	Physical	CSIR, Stellenbosch
1988	Walker Bay field experiment : Caesar II. Data report : Pressure sensor 2	Gonsalves, J.W.	CSIR report EMA-D 8810	Physical	CSIR, Stellenbosch
1988	Walker Bay field experiment : Caesar I : Wave and weather data	Gonsalves, J.W.	CSIR report EMA-D 8808	Physical	CSIR, Stellenbosch
1988	Dynamics of the Klein River with reference to the artificial breaching of the estuary mouth	Barwell, L.	CSIR report EMA-C 8891	Physical	CSIR, Stellenbosch
1988	A climatological mechanism for wind-driven upwelling near Walker Bay and Danger Point, South Africa	Jury, M.R.	South African Journal of Marine Science, 6: 175-181	Physical	Journal Publication
1987	Breaching the mouth of the Bot River estuary, South Africa : impact on its benthic macrofaunal communities	De Decker, H.P.	Environ. Conser. 14(1):45-51	Biological	Journal Publication
1987	Conservation problems and management options in estuaries: The Bot River estuary, South Africa, as a case-history for management of closed estuaries	Bally, R.	Environmental Conservation, 14(1): 45-51	Management	Journal Publication
1987	The role of regeneration from the sediments in the supply of nutrients to the euphotic zone in the Southern Benguela system.	Bailey, G.W.	South African Journal of Marine Science, 5: 273-285	Biogeochemical	Journal Publication
1986	Bot River-Kleinmond surveys.	Fromme, G.A.W.	CSIR report T/SEA 8604	Physical	CSIR, Stellenbosch
1986	The importance of water levels in the management of the Klein River estuary, Hermanus	Waldron, M.	MSc. Thesis (Environmental & Geographical Science) - University of Cape Town	Physical	University of Cape Town
1985	Primary productivity of the Bot River Estuary, South Africa	Bally, R.; Mcquaid, C.D.; Pierce, S.M.	Transactions of the Royal Society of South Africa, 45(3-4): 333-345	Biological	Journal Publication
1985	The effect of salinity and temperature variations on the bacterial population in the Bot River Estuary	Roberts, C.H.; Branch, G.M.; Robb, F.T.	Transactions of the Royal Society of South Africa, 45(3-4): 347-352	Biogeochemical Biological	Journal Publication
1985	The annual cycle of free-floating bacteria in the Bot River Estuary	Roberts, C.H.; Branch, G.M.; Robb, F.T.	Transactions of the Royal Society of South Africa, 45(3-4): 353-362	Biological	Journal Publication
1985	Zooplankton and some environmental conditions in the Bot River Estuary	Coetsee, D.J.	Transactions of the Royal Society of South Africa, 45(3-4): 363-377	Biological	Journal Publication
1985	The benthic macrofauna of the Bot River Estuary, South Africa, with a note of its meiofauna	Dedecker, H.P.; Bally, R.	Transactions of the Royal Society of South Africa, 45(3-4): 379-396	Biological	Journal Publication
1985	Synopsis of the impact of artificially opening the mouth of the Bot River Estuary: Implications for management	Branch, G.M.; Bally, R.; Bennett, B.A.; De Decker, H.P.; Fromme, G.A.W.; Heyel, C.W.; Willis, J.P.	Transactions of the Royal Society of South Africa, 45(3-4): 465-483	Management	Journal Publication
1985	The physical and chemical characteristics of the waters of the Bot River estuary, South Africa.	Bally, R.; McQuaid, C.D.	Transactions of the Royal Society of South Africa, 45(3-	Physical Biogeochemical	Journal Publication

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
			4): 317-332		
1985	The hydrology of the Bot River estuary.	Fromme, G.A.W.	Transactions of the Royal Society of South Africa, 45(3-4): 305-316	Physical	Journal Publication
1985	The ecological role of the Red-Knobbed Coot <i>Fulica Cristata</i> Gmelin at The Bot River Estuary, South Africa: A preliminary investigation.	Stewart, B.A.; Bally, R.	Transactions of the Royal Society of South Africa, 45,(3-4): 419-426	Biological	Journal Publication
1985	Variations in the use of the Bot River Estuary by water-birds.	Heyl, C.W.; Currie, M.H.	Transactions of the Royal Society of South Africa, 45,(3-4): 397-17	Biological	Journal Publication
1985	Geomorphology, offshore bathymetry and Quaternary lithostratigraphy around the Bot River estuary.	Rogers, J.	Transactions of the Royal Society of South Africa, 45(3-4): 211-238	Physical	Journal Publication
1985	The bathymetry, environmental parameters and sediments of the Bot River estuary, S.W. Cape Province.	Willis, J.P.	Transactions of the Royal Society of South Africa, 45(3-4): 253-284	Physical	Journal Publication
1985	Historical records of the Bot River estuarine system.	Bally, R.	Transactions of the Royal Society of South Africa, 45(3-4): 291-304	Management	Journal Publication
1985	A numerical model for the wind-driven circulation in the Bot River estuary.	van Foreest, D.	Transactions of the Royal Society of South Africa, 45(3-4): 285-290	Physical	Journal Publication
1985	Estuaries Programme. Chapter 12. Estuaries, Aeolian Processes: Bot and Klein River Estuaries.	Van Heerden, I.L.	South African National Committee for Oceanographic Research. Pp. 157-159 Progress Reports Tosancor 1985	Physical	CSIR, Stellenbosch
1985	Barrier/estuarine processes; Bot River estuary -- an interpretation of aerial photographs.	van Heerden, I.L	Transactions of the Royal Society of South Africa, 45(3-4): 239-252	Physical	Journal Publication
1985	A comparison of the physiological condition of the southern Mullet <i>Liza Richardsons</i> (Smith) in a closed estuary and the sea.	Dedecker, H.P.; Bennett, B.A.	Transactions of the Royal Society of South Africa, 45(3-4): 427-436	Biological	Journal Publication
1985	A mass mortality of fish associated with low salinity conditions in the Bot River Estuary.	Bennett, B.A.	Transactions of the Royal Society of South Africa, 45(3-4): 437-447	Biological	Journal Publication
1985	Changes in the fish fauna of the Bot River Estuary in relation to opening and closure of the estuary mouth.	Bennett, B.A.; Hamman, K.C.; Branch, G.M.; Thorne, S.C.	Transactions of the Royal Society of South Africa, 45(3-4): 449-464	Biological	Journal Publication
1985	Synopsis of the impact of artificially opening the mouth of the Bot River Estuary: implications for management.	Branch, G.M.; Bally, R.; Bennett, B.A.; Dedecker, H.P.; Fromme, G.A.; Heyl, C.W.; Willis, J.P.	Transactions of the Royal Society of South Africa, 45(3-4): 465-483	Biological	Journal Publication
1985	The conflict between coastal conservation and coastal development in the Rooi-Els-Bot River Estuary region.[ditto]	Claassen, P.E.	Suid-Afrikaanse Tydskrif vir Natuurwetenskap en Tegnologie, 4(3), 104-110	Management	University of Stellenbosch
1985	Botrivierlei-Kleinmond Surveys.	Fromme, G.A.	CSIR report T/Sea 8604	Physical	CSIR, Stellenbosch
1983	The sediment distribution of the Klein River estuary	Sloman, R.J.L.	BSc (Hons.) (Geology) - University of Cape Town	Physical	University of Cape Town
1983	A numerical model for the wind driven circulation in the Bot River Vlei.	Van Foreest, D.	Document available from	Physical	University of Cape Town

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
			CSIR, Stellenbosch (P02113)		
1983	Monitoring of the hydrological conditions of the Bot River Estuary (South - West Cape) during a deliberate loch breach of the dunes in 1981	CSIR	Fifth National Oceanographic Symposium. 24-28 January 1983. Rhodes University, Grahamstown	Physical	CSIR, Stellenbosch
1983	Nutrient status of the surface waters of the Benguela Upwelling System (summary only)	Bailey, G.W.	South African Journal of Science, 79(4): 146;	Biogeochemical	Journal Publication
1982	The ecology of South African estuaries. Part 12: The Bot River, a closed estuary in the south-western Cape.	Koop, K.; Bally, R.; Mcquaid, C.D.	South African Journal Of Zoology, 18(1): 1-10	Biological	Journal Publication
1982	Estuaries of the Cape Part 2. Synopses of available information on individual systems. Report No 18: Bot/Kleinmond System (Csw13)	Heydorn, A.E.; Grindley, J.R.; Koop, K.	CSIR research report 417	Physical Biogeochemical Biological Management	CSIR, Stellenbosch
1955	Notes on the biology of the white stumpnose, <i>Rhabdosargus globiceps</i> (Cuvier), and on the fish fauna of the Klein River estuary	Talbot, F.H.	Transactions of the Royal Society of South Africa, 34(3): 387-407	Biological	Journal Publication
1952	The ecology of South African estuaries. Part II. The Klein River estuary, Hermanus, Cape	Scott, K.M.F. Harrison, A.D. Macnae, W.	Transactions of the Royal Society of South Africa, 33(3): 283-331	Biological	Journal Publication

7.5 Available Environmental Data

Although environmental data will be listed in many of the above-mentioned documents and publications, existing oceanographic databases, such as those available at the CSIR, Stellenbosch, were also searched. The following data could be located on Walker Bay:

Wind

POSITION	DEPLOYMENT PERIOD	TYPE OF OBSERVATIONS	OWNER/LOCATION OF DATA
Walker Bay 34° 26.12'S; 19° 19.11'E	1989-09-28 to 2001-02-10	Average, Minimum and Maximum Temperature, Wind Direction, Wind Speed (Average), Wind Speed (Maximum)	Overstrand Municipality, CSIR EDM Database

Waves

POSITION	DEPLOYMENT PERIOD	TYPE OF OBSERVATIONS	OWNER/LOCATION OF DATA
34° 26.70'S; 19° 18.03' E	October 1987 to January 1988	Wave Height and Direction (Waverider)	CSIR

Chemical & Microbiological data: Water column

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	DEPTH INTERVALS	OWNER/LOCATION OF DATA
1900 to 2005 (details available on request)	Details available on request	Temperature; Salinity	34.33S to 34.75S and 18.83E to 19.42E (~ 6 700 records)	Details available on request	CSIR SADCO Database

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	DEPTH INTERVALS	OWNER/LOCATION OF DATA
1900 to 2005 (details available on request)	Details available on request	Dissolved oxygen	34.33S to 34.75S and 18.83E to 19.42E (~ 3 300 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Nitrate	34.33S to 34.75S and 18.83E to 19.42E (~ 1 900 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Nitrite	34.33S to 34.75S and 18.83E to 19.42E (~ 130 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Phosphate;Phosphorus	34.33S to 34.75S and 18.83E to 19.42E (~ 6 700 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Silicate	34.33S to 34.75S and 18.83E to 19.42E (~ 1 800 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	pH	34.33S to 34.75S and 18.83E to 19.42E (~ 3 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Chlorophyll a	34.33S to 34.75S and 18.83E to 19.42E (~ 100 records)	Details available on request	CSIR SADCO Database

Chemical and Microbiological data: Biological tissue

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	OWNER/LOCATION OF DATA
1983-02-12 to 1984-08-10	Once-off	Cadmium, Copper, Iron, Manganese, Mercury, Nickel, Zinc	34.3S to 34.7S and 18.9E to 19.4E (40 records)	CSIR, SADCO Database

7.6 Existing Monitoring Programmes

PROGRAMME	DESCRIPTION	MONITORING TYPE	DURATION	SAMPLING FREQUENCY	SAMPLING LOCATION	PARAMETERS MEASURED	OWNER/LOCATION
None at present							

7.7 Suitability for Application in Management Framework

i. Management Responsibilities

Local management initiatives in the Walker Bay area dealing with environmental matters include (refer to Chapter 7.1):

- Overstrand Conservation Foundation (www.ocf.co.za/index.mv)
- Local Catchment Management Steering Committees (Ninham Shand, 2001).

Although the domains covered by these organisations do have relevance to marine water quality management (e.g. catchment activities influence water quality entering the marine environment through rivers), marine water quality is currently not considered as a main focus area.

Taking into account the diversity of potential marine pollution sources, the extent of sensitive and protected marine areas and intensive beneficial use of the marine environment, it will be difficult to coordinate and implement the proposed management framework effectively without constituting a local management forum involving all key role players, such as:

- Overstrand Municipality
- Overstrand Conservation Foundation
- Local Catchment Management Steering Committees
- Dept. of Water Affairs and Forestry
- Dept. of Environmental Affairs and Tourism
- Cape Nature Conservation
- Dept. of Public Works (related to management of fishing harbours)
- Fish and other seafood processing industries
- Representatives from commercial, subsistence and recreational fisheries
- Tourism forums.

ii. Legislative Framework

An assessment of the South African legislative framework related to marine pollution is addressed in more detail in Chapter 2.

iii. Environmental Quality Objectives

Environmental quality objectives, aimed at protecting important marine ecosystems and fitness of use for all designated beneficial uses, have not yet been documented for Walker Bay. Such decisions need to be made and agreed upon in consultation with key role players and stakeholders in the area. A local management institution (see earlier) will be the most effective platform through which to coordinate such initiatives.

iv. Marine Pollution Sources

Effective implementation of the proposed management framework requires quantitative information on pollutant inputs into the marine environment. In the case of land-based sources, this information refers to proper quantification of the volume and pollutant composition of different sources.

Although the main marine pollution sources in the Walker Bay area have been identified (refer to Chapter 7.2), data on the flow distribution and pollutant composition from these sources, in particular the land-based sources, could not be obtained. Such data need to be obtained not only for effluent discharges but also for river inputs.

Although it is recognized that quantitative data on pollutant inputs from storm-water run-off (diffuse sources) are difficult to obtain, it is important that this source be investigated to ultimately assess cumulative and potential synergistic effects. An overview of pollutant inputs from different types of storm-water run-off can be obtained from Pegram & Görgens (2001).

Quantification of inputs for other pollution sources, e.g. activities associated with the fishing harbour, will be more difficult. However, it is important to clearly identify such sources, as well as their potential impact related to marine pollution, so as to implement the necessary controls (e.g. mitigating measures or contingency plans).

iv. Scientific and Engineering Assessment Studies

Key to the scientific assessment studies, as per the proposed management framework, is a sound understanding of water circulation patterns and sedimentary processes (i.e. deposition/re-suspension of particulates) within a particular marine environment, so as to be able to quantify the transport, dispersion and fate of pollutants that enter that particular marine environment.

As far as could be established, such studies have not been undertaken for the Walker Bay area (refer to Chapter 7.4).

v. Critical limits and Mitigating Actions

With regard to land-based sources of marine pollution (in particular, effluents from the fish processing industries), DWAF is in the process of setting critical limits (also referred to as standards). These will be based on the receiving water quality objectives approach (i.e. taking into account the quality requirements of the receiving marine environment and its beneficial uses) and will become part of licence agreements issued under the National Water Act 36 of 1998 (Wilna Kloppers, DWAF, pers. comm.).

vi. Monitoring Programmes

Based on available information, there are no long-term monitoring programmes carried out in Walker Bay that relate to the management of marine pollution sources.

With regard to WWTW and industrial (e.g. fish factories) wastewater discharges, the new *Operational Policy for the disposal of land-derived wastewater to the marine environment of South Africa* (RSA, DWAF, 2004a) requires that the Department of Water Affairs and Forestry ensures that both source and environmental monitoring programmes be implemented as part of its licence agreements under the National Water Act 36 of 1998. It is strongly recommended that, once such requirements come into operation, the environmental monitoring programmes in particular should not be undertaken as individual initiatives, but that these be optimized and coordinated through a local management institution (as discussed earlier).

8 MOSSEL BAY

8.1 Existing Management Initiatives

NAME	DESCRIPTION	RESPONSIBLE INSTITUTION/AUTHORITY	PARTIES INVOLVED	PERIOD OPERATIONAL
Great Brak Environmental Committee	To oversee and coordinate the management of the Great Brak Estuary after construction of the Wolwedans Dam	Municipality of Great Brak	Municipality Dept. of Water Affairs and Forestry CSIR (Specialist consultant) Local rate payers	Since 1990

8.2 Marine Pollution Sources

A map indicating the location of major potential marine pollution sources in Mossel Bay is provided in Figure 8.1. Details of these sources are provided below (RSA DWAF, 2004):

SOURCE	SOURCE TYPE	DESCRIPTION	ESTIMATED VOLUME	POLLUTANT COMPOSITION	OWNER/MANAGER
Petro SA Vleesbaai Marine Outfall	Land-based	Industrial effluent (Mossgass Refinery operations) discharged through an offshore marine outfall (1.4 km) in 27 m water depth in Vleesbaai	5 069 m ³ /day*	Oil-related compounds	PetroSA
Petro SA Voorbaai Marine Outfall	Land-based	Industrial effluent (Mossgass Refinery operations) discharged through an offshore marine outfall (0.52 km) in 11 m water depth in Vleesbaai	Currently not operational	Oil - Ballast	PetroSA
Mossel Bay WWTW	Land-based	Effluent from a WWTW discharged into the surf zone	3 900 m ³ /day*	Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants	Mossel Bay Local Municipality
Hartenbos River (including WWTW)	Land-based	Effluent from a WWTW discharged into the Hartenbos Estuary	6471 m ³ /day*	Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants	Mossel Bay Local Municipality
Port of Mossel Bay: Stormwater run-off	Land-based	Stormwater run-off entering the marine environment from numerous stormwater outlets into the Port of Mossel Bay(?). Some of these outlets drain commercial areas	No data	Suspended solids; Trace metals; Petroleum; hydrocarbons	City of Cape Town & National Ports Authority
Port of Mossel Bay: Dredging	Dumping at sea	Dredge spoil material originating from harbour that is dumped at sea		Suspended solids Trace metals Petroleum hydrocarbons	National Ports Authority
Port of Mossel Bay: Operations	Maritime Transportation	Activities potentially causing marine pollution include: ship loading operations, oil spillages, dredging operations, and ballast water discharge.	Not easily quantifiable	Suspended solids Trace metals Petroleum hydrocarbons	National Ports Authority
Port of Mossel Bay: Single point and conventional bouy mooring in the Bay	Maritime Transportation	Single point mooring is used for the loading of finished petroleum products into tankers and the receipt of import condensate. Conventional buoy mooring is used for the loading of alcohol into chemical tankers.	Accidental spillages	Oil related compounds	National Ports Authorities

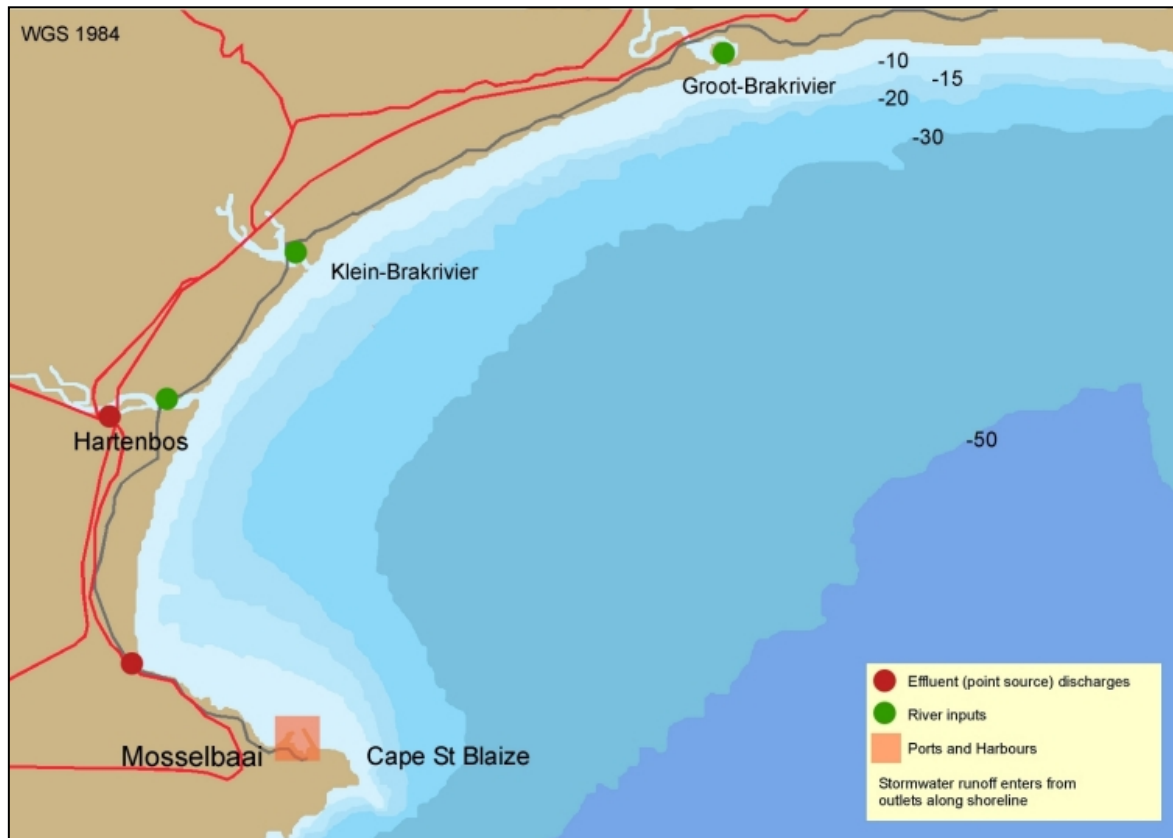


Figure 8.1: Potential marine pollution sources in Mossel Bay

8.3 Important Marine Ecosystems and Beneficial Uses

8.3.1 Important Marine Ecosystems

Seal Island (100 m long and 50 m wide) is situated within the Mossel Bay areas, about 2 km from the Port of Mossel Bay. DEAT (Marine and Coastal Management) controls the Island with a seal population of 4500 to 5000.

Other sensitive marine ecosystems in the area include the estuaries of the Hartenbos, Klein Brak and Great Brak estuaries.

8.3.2 Beneficial uses

i. Recreation (including tourism)

Mossel Bay is a popular tourist destination along the famous Garden Route and popular beaches include:

- Santos Beach

- Diaz Strand
- Hartenbos
- Klein Brak
- Great Brak.

Whale watching and shark cage diving are also popular tourist attractions in Mossel Bay.

ii. Marine Aquaculture and Important Fisheries (including collection of seafood for human consumption)

Mossel Bay derived its name from the abundant mussel beds that used to be found along its shores. Although now less abundant, mussels gathered in Mossel Bay each spring are still rated by gourmets among the finest in the world.

Mossel Bay is also a popular recreation and important commercial fishing area. The hake handline fishery centered in Mossel Bay and in Plettenberg Bay is one of the most valuable in South Africa.

An oyster commercial fishery also exists in the area. Harvesting takes place during spring low tides and traditionally was restricted to the intertidal zone, however, in recent years there has been a gradual expansion of harvesting depth towards the fringes of the subtidal zone. This expansion has resulted from a decline in oyster density in the intertidal zone and a gradual increase in gear efficiency. This southern Cape fishery is controlled by a closed season from 15 December – 05 January so as to limit conflict between holidaymakers and the commercial oyster sector (www.mcm-deat.gov.za/draft_policies/index.html).

iii. Industrial uses

Although there are numerous activities in ports, such as the Port of Mossel Bay, that could detrimentally affect marine quality, these areas are increasingly becoming popular tourist destinations which, in turn, have certain aesthetic quality requirements.

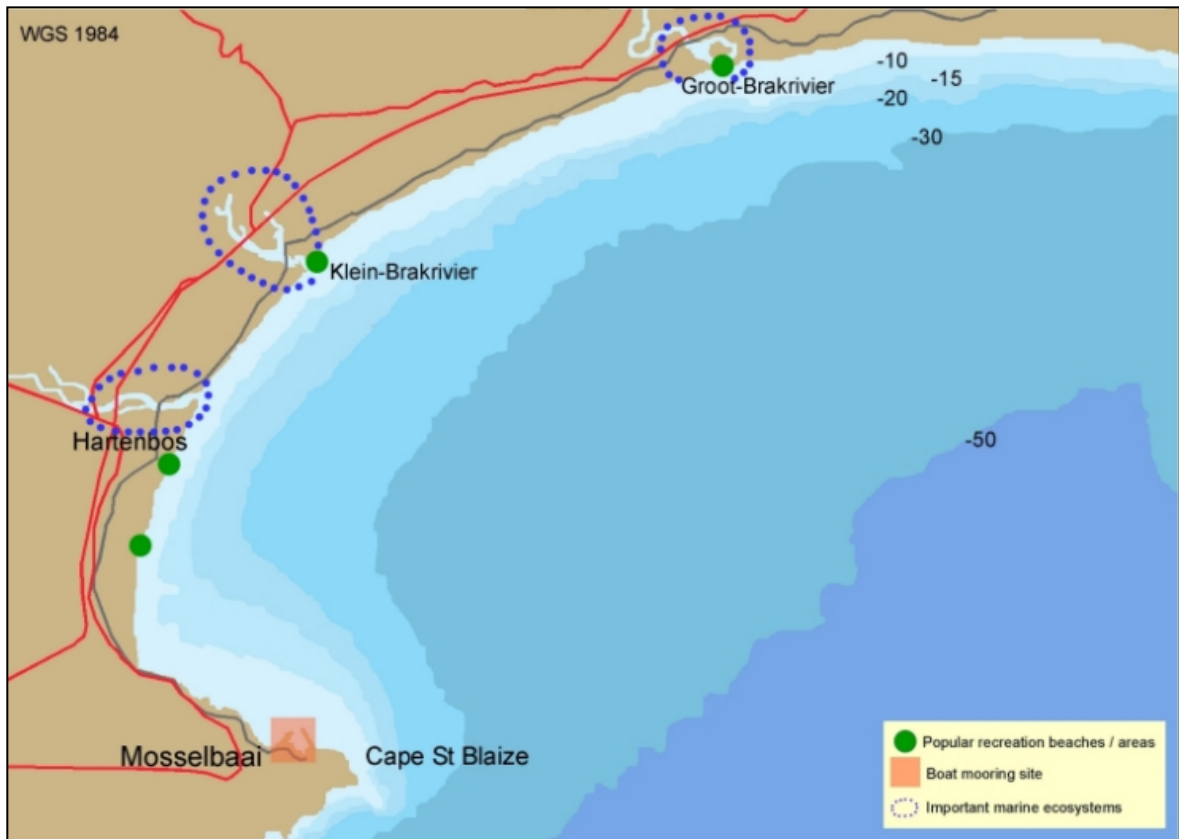


Figure 8.2: Important ecosystems and beneficial uses of Mossel Bay

8.4 Available Environmental Literature

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
2002	Long-distance migration of South African deep-water rock lobster <i>Palinurus gilchristi</i> .	Groeneveld, J.C.; Branch, G.M.	Marine Ecology - Progress Series, 232: 225-238	Biological	Marine and Coastal Management
2002	Semi-permanent bottom cyclonic circulation on the edge of the Eastern Agulhas Bank, the plume model, and implications for upwelling and kingklip spawning.	Roberts, M.J.; Engelbrech, N.; Johnson, A.; Nelson, G.; Spolander, B.	Southern African Marine Science Symposium: Currents Coasts Communities, Swakopmund (Namibia), 1-5 Jul 2002	Physical	Marine and Coastal Management
2000	Petroleum exploration offshore South Africa.	McLachlan, I. R.; Broad, D. S.; Malan, J. A.	Journal of African Earth Sciences, 31(1A): 50-51	Management	Journal Publication
2000	Sediment assessment programme for the Port of Mossel Bay : 2000 (Confidential)	Monteiro PMS Scott DL	CSIR report ENV-S-C 2000-115	Biogeochemical	CSIR, Stellenbosch
1999	Sediment assessment programme for the ports of Port Elizabeth and Mossel Bay : 1999 (Confidential)	Monteiro PMS Pascall A	CSIR report ENV-S-C 99099	Biogeochemical	CSIR, Stellenbosch
1999	A preliminary survey of the estuaries on the south coast of South Africa, Cape Agulhas - Cape St Blaize, Mossel Bay, with particular reference to the fish fauna	Harrison TD	Transactions of the Royal Society of South Africa, 54(2): 285-310	Biological	Journal Publication
1998	Local winds in the Mossel Bay Area	Hong Y	MSc Thesis - University of Witwatersrand	Physical	University of Witwatersrand, Johannesburg
1998	Environmental impact assessment for the proposed extension of the Oribi oil production facility and hydrocarbon exploration off the Southern Cape coast	Crowther J Morant PD Lochner PA	CSIR report ENV/S-C 97172& B	Physical Biological Biogeochemical Management	CSIR, Stellenbosch
1997	Environmental management programme report for prospect well drilling in Block 9 situated off the Southern Cape coast	Crowther J Morant PD Lochner PA	CSIR report ENV/S-C 97173	Management	CSIR, Stellenbosch
1997	Environmental management programme report for seismic exploration surveys in Block 9 situated off the Southern Cape coast : Addendum to EMPR for prospect well drilling dated October 1997	Crowther J Morant PD Lochner PA	CSIR report ENV/S-C 97174	Management	CSIR, Stellenbosch
1997	Cartographic analysis of the African surface complex between Albertinia and Mossel Bay, southern Cape, South Africa.	Marker, M.E.; McFarlane, M.J.	South African Journal of Geology, 100(3):185-194	Physical	Journal Publication
1996	Environmental management programme report for development of the E-AR oil field in Block 9 situated off the Southern Cape coast : Addendum to the EMPR for the Oribi (E-BT) oil production facility dated November 1996	Crowther J Morant PD Lochner PA	CSIR report ENV/S-C 97175	Management	CSIR, Stellenbosch
1996	Environmental impact assessment for the proposed FA satellite development project south of Mossel Bay: Environmental impact report.	Botha, W.F. Cerff, E.C.	CSIR report ENV/S-C 96007b	Physical Biological Biogeochemical Management	CSIR, Stellenbosch
1996	Modelling environmental effects on the early life history of the South African anchovy and sardine: A comparative approach.	Shannon, L.J.	South African Journal of Marine Science, 19: 291-304	Biological	Journal Publication
1995	Trends of southern African sea level: Statistical analysis and interpretation.	Brundrit, G.B.	South African Journal of Marine Science, 16: 9-17	Physical	Journal Publication
1995	Topographic and hydrographic effects on catch rates of <i>Austroglossus pectoralis</i> (Soleidae) on the Agulhas Bank.	Le Clus, F.; Roberts, M.J.	South African Journal of Marine Science, 16: 321-332	Biological	Journal Publication
1995	Sublittoral sand dollar (<i>Echinodiscus bisperforatus</i>) communities in two bays on the South African south coast.	Bentley, A.C.; Cockcroft, A.C.	South African Journal of Zoology, 30(1): 5-17	Biological	Journal Publication
1995	Environmental impact assessment for the proposed	Cerff, E.C.	CSIR report: EMAS-C 95069a	Physical	CSIR, Stellenbosch

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
	E-BT oil production facility on the Agulhas Bank: Scoping report (Confidential).	Morant, P.		Biological Biogeochemical Management	
1990	Environmental data for the design and operation of the Mossel Bay SPM	Moes, J.	CSIR report EMA-C 90108	Physical	CSIR, Stellenbosch
1990	Great Brak River : Estuary environmental study with reference to a management plan for the Wolwedans Dam and Great Brak River mouth	CSIR	CSIR report EMA-C 9036	Management	CSIR, Stellenbosch
1989	Composition and biological implications of a nepheloid layer over the inner Agulhas Bank near Mossel Bay, South Africa	Zoutendyk, P. Duvenage, I.R.	Transactions of the Royal Society of South Africa, 47(2): 187-197	Biological	Journal Publication
1989	Conceptual design for a diffuser to discharge treated ballast water in Voorbaai (Confidential)	Fijen, A.P.M.	CSIR report EMA-C 89158	Physical	CSIR, Stellenbosch
1989	The biological assessment for the new effluent pipeline in Mossel Bay (Confidential)	Fijen, A.P.M.	CSIR report EMA-C 89118	Biological	CSIR, Stellenbosch
1988	Development of Voorbaai : SOEKOR (Confidential)	Burns, M. Barwell, L.	CSIR report EMA-C 8877	Physical Biological	CSIR, Stellenbosch
1988	Bathymetric and geophysical survey : Mossel Bay	Lenhoff, L. Roux, C.	CSIR report EMA-C 8871	Physical	CSIR, Stellenbosch
1988	Proposed marina development in the southwest sector of Plettenberg Bay - an ecological assessment.	Wooldridge, T.	Institute for Coastal Research, University of Port Elizabeth, (18), 1-62	Biological	University of Port Elizabeth
1988	Mossel Bay harbour hydrographic survey : March 1988 (Confidential)	Roux, C.	CSIR report EMA-C 8843	Physical	CSIR, Stellenbosch
1988	Mossel Bay offshore development project: Environmental data for design pile installation sea state (Confidential)	Russell, K.S.	CSIR report EMA-C 8818	Physical	CSIR, Stellenbosch
1988	Mossel Bay outfall studies. Report no.4: Physical data interpretation and summaries (Confidential)	Fijen APM	CSIR report C/SEA 8849	Physical	CSIR, Stellenbosch
1988	Mossel Bay outfall studies. Report no.5: Dilution calculations and evaluation of effects (Confidential)	Fijen APM	CSIR report C/SEA 8848	Physical	CSIR, Stellenbosch
1989	Mossel Bay outfall studies. Report no. 6: The feasibility of a sewage outfall at Dana Bay. Executive summary report.	Botes, W.A.M. Fijen, A.P.M.	CSIR report EMA-C 89101	Physical	CSIR, Stellenbosch
1987	Mossel Bay gas development project: Offshore environmental impact assessment study: Comprehensive report no. 1 Vol. 1 : Environmental appraisal and management options; Vol. 2 : Annexures to volume 1 of report	EMSO; Geustyn, Forsyth & Joubert Inc	CSIR Document P-4859 A & B	Management	CSIR, Stellenbosch
1987	Mossel Bay gas development project: Offshore environmental impact assessment study: Concise report no. 1	EMSO; Geustyn, Forsyth & Joubert Inc	CSIR Document P-4860	Management	CSIR, Stellenbosch
1987	Coastal oil spill contingency plan. No. 7. Mossel Bay.	Anon	Report of the Department of Environmental Affairs and Tourism	Management	Department of Environmental Affairs and Tourism
1987	Mossel Bay offshore development project. Environmental data for design. Evaluation of seasonal and directional distribution of design wave and current data (Confidential)	Russell, K.S.	CSIR report C/SEA 8741	Physical	CSIR, Stellenbosch
1987	Mossel Bay offshore development project. Environmental data for design : Response to Noble Denton Consultancy Services : Review report on design data (Confidential)	Russell, K.S. Rossouw, J. Hunter, I.	CSIR report C/SEA 8774	Physical	CSIR, Stellenbosch
1987	Mossel Bay offshore development project. Environmental data for design : executive summary report.	Russell, K.S. Retief, G. de F.	CSIR report C/SEA 8643	Physical	CSIR, Stellenbosch
1987	Mossel Bay outfall studies. Report no.1: Prefeasibility study and the establishment of survey control.	Botes, W.A.M. Roux, C. Toms, G.	CSIR report C/SEA 8736	Physical	CSIR, Stellenbosch
1987	Mossel Bay outfall studies. Report no.2: Marine geophysical site investigation and hydrographic survey: Blinde River mouth to	Lenhoff L Gerber F	CSIR report C/SEA 8737	Physical	CSIR, Stellenbosch

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
	Onkruidrots.	Roux C			
1987	Mossel Bay outfall studies. Report no.3: Biological survey of the region	Zoutendyk, P Fricke A H Carter R A	CSIR report C/SEA 8738	Biological	CSIR, Stellenbosch
1986	Mossel Bay offshore development project. Environmental data for design. Vol.1: Wind data.	Hunter, I.	CSIR report C/SEA 8643/1	Physical	CSIR, Stellenbosch
1986	Mossel Bay offshore development project. Environmental data for design. Vol.2: Wave data.	Rossouw, J. Coetzee, L. Prestedge, G.K.	CSIR report C/SEA 8643/2	Physical	CSIR, Stellenbosch
1986	Mossel Bay offshore development project. Environmental data for design. Vol.3: Current data.	Gerber, M. Swart, V.P.	CSIR report C/SEA 8643/3	Physical	CSIR, Stellenbosch
1985	Cenozoic geology of the southern Cape coastal plain between Cape Agulhas and Mossel Bay, focussing on the area between the Kafferkuils and Gouritz River	Rogers, J.	In: Joint Geological Survey/ University of Cape Town, Marine Geoscience Unit : Technical report No.15: Progress reports for the year 1984	Physical	University of Cape Town
1985	The dynamics of the Piesang Estuary.	Fromme, G.A.W.	CSIR report T/Sea, 8517	Physical	CSIR, Stellenbosch
1985	The geology of the sea floor between the Mossel Bay / Stilbaai coast and the EM and FA drill sites.	Martin, A.K.	CSIR report C/SEA 8510	Physical	CSIR, Stellenbosch
1985	South African marine pollution survey report 1979-1982	Gardner, B.D.; Connell, A.D.; Eagle, G.A.; Moldan, A.G.S.; Watling, R.J.	South African National Scientific Programmes Report, no. 115	Biogeochemical	CSIR, Stellenbosch
1985	Mossel Bay gas conversion plant. Report no.1: Preliminary comments on coastal engineering and marine environmental design considerations.	Russell KS Toms G Swart DH	CSIR report C/SEA 8509	Physical	CSIR, Stellenbosch
1984	Meteorological observations in the vicinity of Mossel Bay.	Langenberg, H. Held, G. Von Gogh, R.G. Brassel, K.M. Danford, I.R.	CSIR report ATMOS-84-18	Physical	CSIR, Pretoria
1984	Inshore small-mesh trawling survey of the cape south coast .Part 1:Introduction methods, stations and catches.	Wallace, J.H.; Kok, H.M.; Buxton, C.D.; Bennett, B.	South African Journal of Zoology, 19(3): 154-164	Biological	Journal Publication
1983	South African marine pollution survey report 1976-1979.	Gardner, B.D.; Connell, A.D.; Eagle, G.A.; Moldan, A.G.S.; Oliff, W.D.; Orren, M.J.; Watling, R.J.	South African National Scientific Programmes Report, no. 73	Biogeochemical	CSIR, Stellenbosch
1983	Nearshore Holocene sedimentation between Mossel Bay and Nature's Valley.	Martin, A.K.; Flemming, B.W.	Fifth National Oceanographic Symposium, 24-28 January 1983, Rhodes University, Grahamstown	Physical	CSIR, Stellenbosch
1983	Nearshore physiography and sediment distribution between Mossel Bay and Nature's Valley.	Martin, A.K.; Flemming, B.W.	Fifth National Oceanographic Symposium, 24-28 January 1983, Rhodes University, Grahamstown	Physical	CSIR, Stellenbosch
1983	Explanation for the vulnerability of the Arniston-Mossel Bay region to pollution by oil and tar balls.	Shannon, L.V.; Chapman, P.	South African Journal of Science, , 79(4): 164 (Summary only)	Biogeochemical	Journal Publication
1983	Trace metal surveys in Mossel Bay, St. Francis Bay and Algoa Bay.	Watling, R.J.; Watling, H.R.	Water S A, 9(2): 57-65	Biogeochemical	Journal Publication
1983	Onshore and offshore aeolianites between Mossel Bay and Knysna.	Flemming, B.W. Martin, A.K. Rogers, J.	Joint Geological Survey/University of Cape Town Marine Geoscience Unit. Technical report, no:14	Physical	University of Cape Town

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
1982	Metal surveys in South African estuaries. IV: Keurbooms and Bietou Rivers (Plettenberg Lagoon)	Watling, R.J.; Watling, H.R.	Water S A, 8(2):114-119	Biogeochemical	Journal Publication
1982	Metal surveys in South African estuaries. III: Hartenbos, Little Brak and Great Brak Rivers (Mossel Bay)	Watling, R.J.; Watling, H.R.	Water S A, 8(21): 108-113	Biogeochemical	Journal Publication
1981	Trace metal surveys of the South African coast. II: Mossel Bay	Watling, R.J. Watling, H.R.	UPE, Zoology report series no. 7	Biogeochemical	University of Port Elizabeth
1981	Mossel Bay: A follow-up pollution survey.	Fricke, A.H.; Eagle, G.A.; Bartlett, P.D.; Hennig, H.F.	CSIR report T/Sea 8101	Biogeochemical	CSIR, Stellenbosch
1979	The transfer of pollutants in two southern hemispheric oceanic systems. Proceedings of a workshop, Plettenberg Bay, South Africa, 23-26 April 1979.	Cloete, C.E.	South African National Scientific Programmes Report, No.39	Biogeochemical	CSIR, Stellenbosch
1979	Preliminary pollution surveys around the south-western Cape coast. Part 1: Mossel Bay.	Eagle, G.A.; Greenwood, P.G.; Hennig, H.F.K.O.; Orren, M.J.	South African Journal of Science, 75(10), 453-455	Biogeochemical	Journal Publication
1978	Nearshore Quaternary sedimentation off the south coast of South Africa (Cape Town to Port Elizabeth)	Birch, G.	Tech. Rep. Univ. Cape Town, Dep. Geol., Mar. Geosci. Group, (no. 11), In : Marine Geoscience Unit _ progress reports for the year 1978., p. 127-144	Physical	University of Cape Town
1975	Characteristics of wave fields at Walvis Bay, Luderitz, Mossel Bay and the weather ship : a preliminary survey	Van Leperen MP	CSIR research report 344	Physical	CSIR, Stellenbosch

8.5 Available Environmental Data

Although environmental data will be listed in many of the above-mentioned documents and publications, existing oceanographic databases, such as those available at the CSIR, Stellenbosch, were also searched. The following data could be located on Mossel Bay:

Wind

POSITION	DEPLOYMENT PERIOD	TYPE OF OBSERVATIONS	OWNER/LOCATION OF DATA
SEDKO-K 34° 09.00'S; 22° 07.20'E	1983-02-09 to 1983-03-23	Barometric Pressure, Wind Direction, Wind Speed (Average), Wind Speed (Maximum)	SOEKOR, CSIR EDM Database

Waves

POSITION	DEPLOYMENT PERIOD	TYPE OF OBSERVATIONS	OWNER/LOCATION OF DATA
Gouritz River 34° 25.00'S; 22° 00.00' E	June 1985 to March 1994	Wave Height and Direction (Waverider)	CSIR EDM Database
Mossel Bay 34° 10.40'S; 22° 08.89' E	April, June 1984 to April 1986	Wave Height and Direction (Waverider)	CSIR EDM Database
Mossel Bay 34° 09.21'S; 22° 07.45' E	April 1997 to February 2002	S4 current meter	CSIR EDM Database
Voorbaai 34° 08.23'S; 22° 08.23' E	September 1989 to February 1991	Wave Height and Direction (Waverider)	CSIR EDM Database

Currents

POSITION	DEPLOYMENT PERIOD	WATER DEPTH (m)	INSTRUMENT DEPTH (m)	TYPE OF OBSERVATIONS/INSTRUMENT	OWNER/LOCATION OF DATA
34.98717 S; 22.211 E	1980-11-13 to 1981-01-06	113	30, 73.0,73.1,73.2,103	Current Speed, Direction, Temperature	PetroSA - CSIR EDM database
34.92017 S; 22.81433 E	1981-01-15 to 1981-02-20	140	31,51,86,126	Current Speed, Direction, Temperature	PetroSA - CSIR EDM database
34.98367 S; 22.18367 E	1981-03-07 to 1981-04-09	108	49,	Current Speed, Direction, Temperature	PetroSA - CSIR EDM database
34.98367 S; 22.18367 E	1981-04-09 to 1981-05-04	108	29,49	Current Speed, Direction, Temperature	PetroSA - CSIR EDM database
34.98383 S; 22.24833 E	1981-05-13 to 1981-07-02	110	31,51,71,91	Current Speed, Direction, Temperature	PetroSA - CSIR EDM database
34.98383 S; 22.24833 E	1981-07-02 to 1981-07-14	108	32,51,70,89	Current Speed, Direction, Temperature	PetroSA - CSIR EDM database
34.99433 S; 22.2675 E	1981-07-16 to 1981-09-10	110	30,50,70,89	Current Speed, Direction, Temperature	PetroSA - CSIR EDM database
34.94 S; 22.34483 E	1981-09-16 to 1981-10-09	110	30,50,70,90	Current Speed, Direction, Temperature	PetroSA - CSIR EDM database
34.93667 S; 22.1695 E	1982-03-07 to 1982-04-21	104	17,38,57,77	Current Speed, Direction, Temperature	PetroSA - CSIR EDM database
34.903 S; 22.09517 E	1982-05-16 to 1982-06-04	102	25,35,55,74	Current Speed, Direction, Temperature	PetroSA - CSIR EDM database
34.9405 S; 22.3215 E	1982-06-07 to 1982-07-04	112	25,45,65,84	Current Speed, Direction, Temperature	PetroSA - CSIR EDM database
34.96833 S; 22.15017 E	1983-10-12 to 1983-11-20	160	30,	Current Speed, Direction, Temperature	PetroSA - CSIR EDM database
34.96233 S; 22.20533 E	1983-12-02 to 1983-12-21	108	30,	Current Speed, Direction, Temperature	PetroSA - CSIR EDM database
34.97 S; 22.13667 E	1985-10-19 to 1986-01-17	100	68,	Current Speed, Direction, Temperature	Unknown - CSIR EDM database
34.89833 S; 22.045 E	1985-10-20 to 1986-01-15	100	41,67,90	Current Speed, Direction, Temperature	Unknown - CSIR EDM database
34.845 S; 22.14667 E	1986-01-07 to 1986-03-01	115	105,	Current Speed, Direction, Temperature	Unknown - CSIR EDM database
34.89667 S; 22.035 E	1986-01-16 to 1986-03-09	115	105,	Current Speed, Direction, Temperature	Unknown - CSIR EDM database
34.97367 S; 22.13333 E	1986-01-17 to 1986-03-11	102	50,	Current Speed, Direction, Temperature	Unknown - CSIR EDM database
34.8855 S; 22.03367 E	1986-01-17 to 1986-03-10	115	30,48,83	Current Speed, Direction, Temperature	Unknown - CSIR EDM database
34.83533 S; 22.1355 E	1986-01-17 to 1986-03-11	115	38,73	Current Speed, Direction, Temperature	Unknown - CSIR EDM database
34.91 S; 22.04333 E	1986-02-22 to 1986-04-12	100	20,74	Current Speed, Direction, Temperature	Unknown - CSIR EDM database

Chemical & Microbiological data: Water column

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	DEPTH INTERVALS	OWNER/LOCATION OF DATA
1900 to 2005 (details available on request)	Details available on request	Temperature; Salinity	34S to 34.5 S and 22E to 22.5 E (~ 1 600 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Dissolved oxygen	34S to 34.5 S and 22E to 22.5 E (~ 700 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Nitrate	34S to 34.5 S and 22E to 22.5 E (~ 200 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Nitrite	34S to 34.5 S and 22E to 22.5 E (~ 170 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Phosphate;Phosphorus	34S to 34.5 S and 22E to 22.5 E (~ 1 600 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Silicate	34S to 34.5 S and 22E to 22.5 E (~ 200 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	pH	34S to 34.5 S and 22E to 22.5 E (~ 70 records)	Details available on request	CSIR SADCO Database
1900 to 2005 (details available on request)	Details available on request	Chlorophyll a	34S to 34.5 S and 22E to 22.5 E (~ 100 records)	Details available on request	CSIR SADCO Database

Chemical and Microbiological data: Sediments

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	GRAB/CORE SAMPLING	OWNER/LOCATION OF DATA
1978-01-01 to 1983-05-16	Once off	Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Nickel, Zinc	34.0 S to 34.2S and 22.0E to 22.2E (190 records)	No data	CSIR SADCO Database

Chemical and Microbiological data: Biological tissue

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	OWNER/LOCATION OF DATA
1983-03-30 to 1983-06-15	Once-off	Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Nickel, Zinc	34.1S to 34.2S and 22.1E to 22.1E (8 records)	CSIR SADCO Database

8.6 Existing Monitoring Programmes

PROGRAMME	DESCRIPTION	MONITORING TYPE	DURATION	SAMPLING FREQUENCY	SAMPLING LOCATION	PARAMETERS MEASURED	OWNER/LOCATION
Port of Mossel Bay: Sediment Monitoring	Monitor sediment quality for dredging purposes as required under the London Convention	Environmental		Annually	Selection of stations within the Port of [Mossel Bay	Trace metals Petroleum hydrocarbons Organic C & N Particle size distribution	National Ports Authority

8.7 Suitability for Application in Management Framework

i. Management Responsibilities

As far as could be established, Mossel Bay does not have a local management institution involved in marine pollution management. For the effective implementation of the proposed management framework, it is recommended that a local forum be established involving key role players, such as:

- Mossel Bay Municipality
- Catchment management committees/forums
- Department of Water Affairs and Forestry
- Department of Environmental Affairs and Tourism
- National Ports Authority
- Local Industries (e.g. Petro SA)
- Representatives from commercial, subsistence and recreational fisheries
- Tourism forums.

ii. Legislative Framework

An assessment of the South African legislative framework related to marine pollution is addressed in more detail in Chapter 2.

iii. Environmental Quality Objectives

Marine environmental quality objectives, aimed at protecting important and sensitive marine ecosystems and designated beneficial uses, have not been documented for the Mossel Bay area. Such decisions need to be made and agreed upon by key role players and stakeholders in the area and experience has shown that a local management institution is one of the most effective mechanisms through which to coordinate such initiatives.

iv. Marine Pollution Sources

Quantitative information on pollutant inputs from the different pollution sources into Mossel Bay could not be obtained. Data on the pollutant inputs from pollution sources will be required if the proposed management framework is to be implemented effectively.

iv. Scientific and Engineering Assessment Studies

Key to the scientific assessment studies, as per the proposed management framework, is a sound understanding of water circulation patterns and sedimentary processes (i.e. deposition/re-suspension of particulates) within a particular marine environment, so as to be

able to quantify the transport, dispersion and fate of pollutants that enter that particular marine environment.

As far as could be established, such studies have not been undertaken for the Mossel Bay area (refer to Chapter 7.4).

v. Critical limits and Mitigating Actions

Based on available information, critical limits and mitigating actions to minimize environmental impact from marine pollution sources in Mossel Bay have been specified explicitly.

vi. Monitoring Programmes

With regard to land-based sources of marine pollution (in particular effluents from the fish processing industries), DWAF is in the process of setting critical limits (also referred to as standards). These will be based on the receiving water quality objectives approach (i.e. taking into account the quality requirements of the receiving marine environment and its beneficial uses) and will become part of licence agreements issued under the National Water Act 36 of 1998 (Wilna Kloppers, DWAF, pers. comm.).

With regard to land-based wastewater discharges, the new *Operational Policy for the disposal of land-derived wastewater to the marine environment of South Africa* (RSA, DWAF, 2004a) requires that the Department of Water Affairs and Forestry also ensures environmental monitoring programmes be implemented as part of its licence agreements under the National Water Act 36 of 1998. It is strongly recommended that, once such requirements come into operation, the environmental monitoring programmes in particular should not be undertaken as individual initiatives, but that these be optimized and coordinated through a local management institution (as discussed earlier).

To prevent duplication and to ensure a common goal, it is strongly recommended that both existing and new environmental monitoring programmes to be undertaken in Mossel Bay be coordinated and, where viable, implemented as joint ventures. This could best be achieved through a suitable local management institution (referring to [i]).

9 KNYSNA ESTUARY

9.1 Existing Management Initiatives

DESCRIPTION	PURPOSE	RESPONSIBLE INSTITUTION/AUTHORITY	PARTIES INVOLVED	PERIOD OPERATIONAL
Knysna Catchment Forum	Address common interests of water users in the area	Joint responsibility of parties involved	South African National Parks; Knysna Municipality; Dept of Water Affairs & Forestry; Local interested parties	

9.2 Marine Pollution Sources

A map indicating the location of major potential marine pollution sources in the Knysna Estuary is provided in Figure 9.1. Details of these sources are provided below (RSA DWAF, 2004):

SOURCE	SOURCE TYPE	DESCRIPTION	ESTIMATED VOLUME	POLLUTANT COMPOSITION	OWNER/MANAGER
Knysna WWTW	Land-based	Effluent from a WWTW discharged into the estuary	3 955 m ³ /day*	Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants	Knysna Municipality
Storm-water run-off	Land-based	Storm-water run-off enters the lagoon through numerous outlets along its shores	No data	Suspended solids; Organic matter; Inorganic nutrients (N & P); Bacteriological contaminants; Litter	Knysna Municipality
Knysna River	Land-based	Drains a catchment which consists of forestry, agriculture	No data	Suspended solids; Inorganic nutrients (N & P); Organic matter; Pesticides	Dept. of Water Affairs & Forestry
Oyster farms	Dumping at sea	Activities contributing to marine pollution include deposition of mussel faecal pellets under the rafts. Rafts also dampen the effect of flow, creating areas of low turbulence which become vulnerable to deposition of fine organic material/cohesive sediments and onset of anoxia.	Not easily quantifiable	Suspended solids; Organic matter	Knysna Oyster Company
Boat mooring sites	Maritime Transportation	Accidental oil spillages	Not easily quantifiable	Oil films; Petroleum hydrocarbons	South African National Parks (as managing authority)
Thesen Island Development	Land-based	Potential risks: Toxic leachate from canals during construction; Increase in turbidity levels during construction; marina could be potential source of pollutants into Knysna Estuary	Not easily quantifiable, if any	Trace metals; Petroleum hydrocarbons; Turbidity/suspended solids; Bacteriological contaminants	Thesen Island Development Company



Figure 9.1: Potential marine pollution sources in the Knysna Estuary

9.3 Important Marine Ecosystems and Beneficial Uses

9.3.1 Important Marine Ecosystems

The Knysna National Lake Area is not a national park, but is monitored by the South African National Parks to make sure that ongoing development is environmentally friendly. The Knysna National Lake Area is home to the endangered Knysna seahorse. The lagoon is permanently open to the sea, although the volume of influent fresh water is relatively small. This stable, saline environment accounts for the remarkable diversity of species recorded here, the highest in any South African estuary.

9.3.2 Beneficial uses

i. Recreation (including tourism)

Knysna is one of the most popular holiday destinations in southern Africa for both local and international tourists. Knysna offers a large variety of recreational activities, such as

canoeing, water-skiing, swimming, windsurfing and snorkelling. The area is also used for bait collecting.

Recreational boat mooring sites are scattered throughout the estuary (Figure 9.2).

ii. Marine Aquaculture and Important Fisheries (including collection of seafood for human consumption)

The Knysna Oyster Company cultivates oysters in the Knysna Estuary that are served in most of the local restaurants (Figure 9.2). The Company was established in 1949.

iii. Industrial uses

As far as could be established, there are no beneficial uses in the area that can be classified as 'industrial uses', e.g. the area does not support any commercial or fishing harbours.



Figure 9.2: Important ecosystems and beneficial uses of Knysna Estuary

9.4 Available Environmental Literature

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
2003	The Knysna Basin, South Africa: geomorphology, landscape sensitivity and sustainability	Marker, M.E.	Czasopismo Geograficzne, 169(1): 32-42;(ISSN: 0045-9453)	Physical	Department of Geography, University of Fort Hare, South Africa
2003	Imposex in the indigenous <i>Nassarius kraussianus</i> (Mollusca: Neogastropoda) from South African harbours.	Marshall, D.J.; Rajkumar, A.	Marine Pollution Bulletin, 46(9): 1150-1155	Biological	University of Durban-Westville, South Africa
2002	Early indications of nutrient enrichment in Knysna estuary, South Africa.	Switzer, T.; Allanson, B.; Waldron, H	Southern African Marine Science Symposium: Currents Coasts Communities, Swakopmund (Namibia), 1-5 Jul 2002	Biogeochemical	University of Cape Town
2001	The Knysna Basin Project 1995-1998: A scientific report on the Knysna Estuary	Hodgson, A.N. Allanson, B.R. (Eds)	Transactions of the Royal Society of South Africa, Special issue, 55(2): 97-240	Physical Biogeochemical Biological Management	
2000	Knysna Lagoon - Thesen Island Development water quality baseline study: 2000 and monitoring plan	Monteiro PMS, Scott DL, Taljaard S	CSIR report ENV-S-C 2000-046	Biogeochemical	CSIR, Stellenbosch
2000	Environmental Mangement Plan for the redevelopment of Thesen Island	CSIR	CSIR report (?)ENV-S-C 99053	Management	CSIR, Stellenbosch
2000	Thesen Island Development. Environmental Management Plan. Easy-reference Manual	Badenhorst, P	Report prepared by Pieter Badenhorst Professional Services cc	Management	Thesen Island Development Company, Knysna
2000	The hydrographic character of the Knysna Estuary.	Largier, J.L.; Attwood, C.; Harcourt-Baldwin, J.-L.	Transactions of the Royal Society of South Africa, 55 (2): 107-122	Physical	Journal publication
2000	Oceanic exchanges and temperature variability in the Knysna Estuary.	Schumann, E.H.	Transactions of the Royal Society of South Africa, 55 (2): 123-128	Physical	Journal publication
2000	A descriptive account of sand movement in the Knysna Estuary.	Marker, M.E.	Transactions of the Royal Society of South Africa, 55 (2):129-139	Physical	Journal publication
2000	An introduction to the chemistry of the water column of the Knysna Estuary with particular reference to nutrients and suspended solids.	Allanson, B.R.; Maree, B.; Grange, N.	Transactions of the Royal Society of South Africa, 55 (2): 141-162	Biogeochemical	Journal publication
2000	Structure and status of the intertidal wetlands of the Knysna Estuary.	Maree, B.	Transactions of the Royal Society of South Africa, 55 (2): 163-176	Biological	Journal publication
2000	Benthic macrofauna richness and diversity in the Knysna Estuary: a 50 year comparison.	Allanson, B.R.; Nettleton, J.; de Villiers, C.J.	Transactions of the Royal Society of South Africa, 55(2): 177-185	Biological	Journal publication
2000	An estimation of the standing stock and population structure of <i>Upogebia africana</i> (Crustacea: Thalassinidae) in the Knysna Estuary	Hodgson, A.N.; Allanson, B.R.; Cretchley, R.	Transactions of the Royal Society of South Africa, 55(2): 187-196	Biological	Journal publication
2000	The exploitation of <i>Upogebia africana</i> (Crustacea: Thalassinidae) for bait in the Knysna Estuary.	Hodgson, A.N.; Allanson, B.R.; Cretchley, R.	Transactions of the Royal Society of South Africa, 55(2): 197-204	Biological	Journal publication
2000	Nekton utilization of intertidal estuarine marshes in the Knysna Estuary.	le Quesne, W.J.F.	Transactions of the Royal Society of South Africa, 55(2): 205-214	Biological	Journal publication
2000	Abundance and distribution of waterbirds on the Knysna Estuary.	Martin, A.P.; von Korff, J.; Watt, L.	Transactions of the Royal Society of South Africa, 55(2): 215-222	Biological	Journal publication
1996	Environmental impact assessment of development scenarios for Thesen Island. Volume 2: Appendices report Appendix 1. Background documentation on the EIA Appendix 3. Specialist report on the impact of Thesen Island development on the ecology of Thesen Island (with particular emphasis on wetland ecology and water quality)	Lochner, P. Wiseman, K.	CSIR report EMAS-C 96004 B	Physical Biogeochemical Biological Management	CSIR, Stellenbosch

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
1996	Water quality in the Knysna Estuary.	Russell, I.A.	Koedoe, 39(1): 1-8	Biogeochemical	CSIR, Prtoria
1995	A preliminary investigation of the reproductive behaviour of the Knysna seahorse, <i>Hippocampus capensis</i> Boulenger	Grange, N.; Cretchley, R.	Southern African Journal of Aquatic Sciences, 21(1-2): 103-104	Biological	Journal publication
1993	A Mid-Holocene high stand of the sea at Knysna.	Marker, M.E.; Miller, D.E.	South African Journal of Science, 89(2):100-101	Physical	Journal publication
1989	Report on the investigation of siltation in the Green Hole, Knysna and technical evaluation of remedial measures (Confidential)	Huizinga, P.; Barwell, L.	CSIR report EMA-C 8920	Physical	CSIR, Stellenbosch
1987	Sediment dispersal in the Knysna estuary: Environmental management considerations.	Reddering, J.S.V.; Esterhuysen, K.	South African Journal of Geology, 90(4): 448-457	Physical	Journal publication
1987	A note on marine benches of the southern Cape.	Marker, M.E.	South African Journal of Geology, 90(2): 120-123	Physical	Journal publication
1987	The Knysna lignites: A review of their position within the geomorphological development of the southern Cape Province, South Africa.	Thwaites, R.N.; Jacobs, E.O.	South African Journal of Geology, 90(2): 137-146	Physical	Journal publication
1986	A mathematical transport-dispersion model of the Knysna Estuary.	Huizinga, P.; Haw, P.M.	Civil Engineer In South Africa, 28(7): 265,267-270	Physical	Journal publication
1985	The dynamics of the Keurbooms-Bitou Estuary.	Fromme, G.A.	CSIR report T/Sea 8511	Physical	CSIR, Stellenbosch
1985	Mathematical model study of the Knysna Estuary: The effect of river flow on salinity distributions.	Huizinga, P.	CSIR report T/Sea 8506	Physical	CSIR, Stellenbosch
1985	Estuaries of the Cape. Part II. Synopsis of available information on individual systems. Report No. 30: Knysna [CMS 13]	Grindley, J.R.	CSIR research report, No. 429	Physical Biogeochemical Biological Management	CSIR, Stellenbosch
1984	Mathematical modelling of water-quality for long time periods.	Huizinga, P.	19th Coastal Engineering Conference: Proceedings of the International Conference, Sept 3-7 1984, Houston, American Society of Civil Engineers. Vol. 3, Chapter 207, pp 3109-3123	Physical	CSIR, Stellenbosch
1984	Freshwater requirements of Knysna Estuary.	Haw, P.M.	MSc (Environmental Studies) - University of Cape Town. Research Report 55	Physical	University of Cape Town
1984	Sedimentation in the Knysna Estuary.	Reddering, J.S.; Esterhuysen, K.; Rust, I.C.	Department of Geology. UPE, Oct 1984, pp. 1-82	Physical	University of Port Elizabeth
1983	Environmental effects of the discharge of sewage effluent into Knysna Lagoon.	Grindley, J.R.; Snow, C.S.	School of Environmental Studies, University of Cape Town, 1983, pp. 1-59	Biogeochemical	University of Cape Town
1982	Metal surveys in South African estuaries. II: Knysna River.	Watling, R.J.; Watling, H.R.	Water S A, 8(1): 36-44	Biogeochemical	Journal publication
1981	The seahorse of the Knysna Lagoon	Smith, M.M.	African Wildlife, 35(6): 5-9	Biological	Journal publication
1981	Knysna seahorse distribution poses a problem	Kok, H.M.	African Wildlife, 35(6): 9	Biological	Journal publication
1980	Metal surveys in South African estuaries: [li? II: Knysna Estuary.	Watling, R.J.; Watling, H.R.	Council for Scientific and Industrial Research Special Report, No. Fis 203	Biogeochemical	CSIR, Stellenbosch
1979	New tables for the first and second apparent dissociation constants, K'SUB-1 and K'SUB-2 of carbonic acid for estuarine and brackish waters.	Allanson,B.R.; Rudd,S.	Estuarine and Coastal Marine Science, 8(5), 495-498	Biogeochemical	Journal publication
1979	Prevention and combating of oil pollution at Knysna.	Retief,G.de F.;	South African Journal of Science,	Management	Journal publication

YEAR	TITLE	AUTHORS	REFERENCE	TYPE OF INFORMATION	LOCATION OF DOCUMENT
		Vonk, A.P.M.; Mulligan, D.S.F.	75(12), 563		
1978	Report on the chemical survey in Knysna Lagoon in the vicinity of Thesen's Island.	Eagle, G.A.	CSIR report R/SEA 7824	Biogeochemical	CSIR, Stellenbosch
1978	The monitoring of Knysna Lagoon for trace metals: Annual report to the National Committee for Environmental Sciences for the period 1 January 1977 to 31 December 1977	Watling, R.J. Watling, H.R. Butler, L.R.P.	CSIR report FIS 165	Biogeochemical	CSIR, Stellenbosch
1977	The monitoring of Knysna Lagoon for trace metals: Annual report to the National Committee for Environmental Sciences for the period 1 April 1976 to 31 December 1976	Watling, R.J. Watling, H.R. Butler, L.R.P.	CSIR report FIS 117	Biogeochemical	CSIR, Stellenbosch
1977	The effect of heated effluent on egg production in the estuarine prawn <i>Upogebia africana</i> (Ortmann) [italics?]	Hill, B. J.	Journal of Experimental Marine Biology and Ecology, 29(3), 291-302	Biogeochemical Biological	Journal publication
1976	Trace metals in oysters from Knysna Estuary.	Watling, R.J.	Marine Pollution Bulletin, 7(3): 45-48	Biogeochemical Biological	Journal publication
1975	Economic model for estuarine valuation.	Anon	South African Department of Planning and the Environment Bulletin 2, pp. 1-104. Water Research Commission, Pam9773	Management	Water Research Commission, Pretoria PAM9773
1967	The biology of Knysna Estuary, South Africa.	Day, J. H.	Estuaries. Lauff, George H. Ed. American Association for the Advancement of Science, 1967. Also ss: American Association for the Advancement of Science. Publication. No. 83, pp 397-407	Biological	University of Cape Town

9.5 Available Environmental Data

Although environmental data will be listed in many of the above-mentioned documents and publications, existing oceanographic databases, such as those available at the CSIR, Stellenbosch, were also searched. The following data could be located on Knysna Estuary:

Chemical & Microbiological data: Water column

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	DEPTH INTERVALS	OWNER/LOCATION OF DATA
1977-01-01 1980-01-01	Once-off	Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Mercury, Nickel, Zinc	34.0S to 34.1 and 22.8E to 23.5E (80 records)	Details available on request	CSIR, SADC Database

Chemical and Microbiological data: Sediments

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	GRAB/CORE SAMPLING	OWNER/LOCATION OF DATA
1977-01-01 1980-01-01	Once-off	Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Mercury, Nickel, Zinc	34.0S to 34.1 and 22.8E to 23.5E (786 records)	No data	CSIR, SADCO Database

Chemical and Microbiological data: Biological tissue

SAMPLING PERIOD	SAMPLING FREQUENCY	PARAMETERS MEASURED	SAMPLING LOCATIONS	OWNER/LOCATION OF DATA
1977-01-01 1980-01-01	Once-off	Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Nickel, Zinc	34.0S to 34.1 and 23.1E to 23.1E (786 records)	CSIR, SADCO Database

9.6 Existing Monitoring Programmes

PROGRAMME	DESCRIPTION	MONITORING TYPE	DURATION	SAMPLING FREQUENCY	SAMPLING LOCATION	PARAMETERS MEASURED	OWNER/LOCATION
Thesen Island Oyster Watch Programme	Monitoring programme included in Environmental Management Plan: Thesen Island Development	Environmental	Long-term, after construction	Six monthly	Oyster samples collected within marina, and 3 production sites in Knysna Estuary	Trace metals; Petroleum Hydrocarbons; Faecal coliforms; <i>E. coli</i>	Thesen Island Development Company
Thesen Island Sediment Monitoring Programme	Monitoring programme included in Environmental Management Plan: Thesen Island Development	Environmental	Long-term, after construction	Six monthly	3 sampling locations within marina and a number of sites throughout the Knysna Estuary	Trace metals; Petroleum hydrocarbons; Particle size; Particulate Organic C & N	Thesen Island Development Company
Thesen Island Microbiological Monitoring Programme	Monitoring programme included in Environmental Management Plan: Thesen Island Development	Environmental	Long-term, after construction	Fornightly (out of holiday season) Weekly (in season)	15 sampling stations in Knysna Estuary	<i>E. coli</i>	Thesen Island Development Company

9.7 Suitability for Application in Management Framework

i. Management Responsibilities

The South African National Parks has the responsibility of monitoring activities in the Knysna National Lake Area so as to ensure that ongoing development is environmentally friendly.

The Knysna Catchment Forum, including members from South African National Parks, Knysna Municipality, Dept. of Water Affairs & Forestry and local interested parties, has also been established in the area (refer to Chapter 9.1). This forum could also be used as a local management forum for marine pollution matters, provided that key role players are included.

ii. Legislative Framework

An assessment of the South African legislative framework related to marine pollution is addressed in more detail in Chapter 2.

iii. Environmental Quality Objectives

Designated beneficial use areas and sensitive marine ecosystems, as well as associated environmental quality objectives (water and sediment), have been determined for the Knysna Estuary, as part of the Environmental Management Plan for the Thesen Island Development (CSIR, 2000) (refer also to Figure 9.2).

It is, however, important that these Environmental Quality Objectives be incorporated into a overarching Estuarine Management Plan for the system. The plan should address not only issues concerning water quality (or pollution) but also management strategies and objectives related to, for example, water quantity, resource exploitation, carrying capacity and infrastructure and development.

iv. Marine Pollution Sources

Quantitative information on pollutant inputs from the different pollution sources in the Knysna Estuary, other than those addressed as part of the Thesen Island Environmental Management Plan, could not be obtained.

Data on the pollutant inputs from pollution sources will be required if the proposed management framework is to be implemented effectively.

iv. Scientific and Engineering Assessment Studies

As part of the Environmental Impact Assessment and, subsequently, the Environmental Management Plan for the Thesen Island Development, scientific assessment and baseline studies related to water and sediment quality of the Knysna Estuary were undertaken (e.g. CSIR, 2000; Monteiro *et al.*, 2000).

v. Critical Limits and Mitigating Actions

The Environmental Management Plan for the Thesen Island Development identified specific activities that could potentially affect water and sediment quality in the Knysna Estuary (CSIR, 2000). The plan explicitly identified mitigating actions that have to be implemented to minimize negative impact on the water and sediment quality, both within the marina development and within the larger estuary.

Based on available information, it is not apparent that critical limits and mitigating actions to minimize environmental impact from other pollution sources have been specified.

ii. Monitoring Programmes

Long-term environmental monitoring programmes in the Knysna Estuary, related to the management of marine pollution, are primarily linked to the Environmental Management Plan for the Thesen Island Development.

From available knowledge, it does not appear as if other potential polluters in the area, e.g. Knysna Municipality (WWTW effluent discharge and storm-water run-off) and the Knysna Oyster Company (marine aquaculture operations) are engaged in long-term environmental monitoring programmes. However, the implementation of such programmes may soon become a requirement, e.g. in terms of the new *Operational Policy for the disposal of land-derived wastewater to the marine environment of South Africa* (RSA, DWAF, 2004a).

To prevent duplication and to ensure a common goal, it is strongly recommended that both existing and new environmental monitoring programmes to be undertaken in the Knysna Estuary be coordinated and jointly implemented. This could best be achieved through a suitable local management institution (referring to [i]).

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REPUBLIC OF SOUTH AFRICA DEPARTMENT OF WATER AFFAIRS AND FORESTRY (RSA DWAF) 2004b - Water Quality Management Series, Sub-Series No. MS 13.3. Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa – Guidance on Implementation. Edition 1. Pretoria, South Africa (www.dwaf.gov.za/Documents) or (www.wamsys.co.za/outfalls)

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