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in
FACULTY OF SCIENCE

**SUSTAINABLE ECOLOGICAL AND RECREATIONAL MANAGEMENT OF
SANDY BEACH SYSTEMS**

**BY
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Thesis submitted as complete requirement for the Degree of Doctor of Philosophy

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STATEMENT OF ORIGINALITY

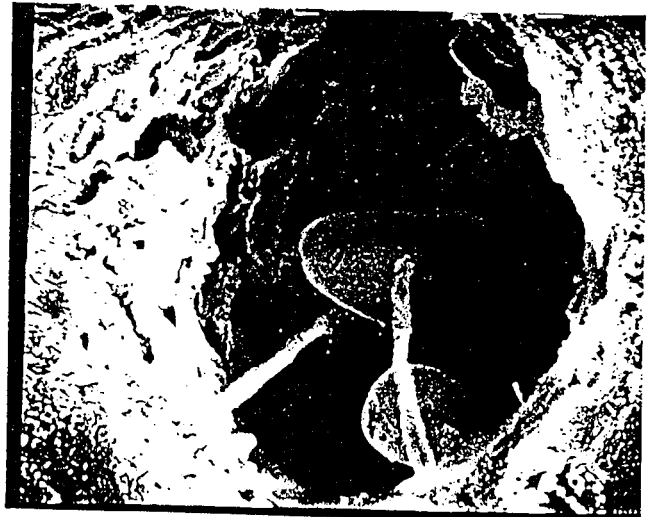
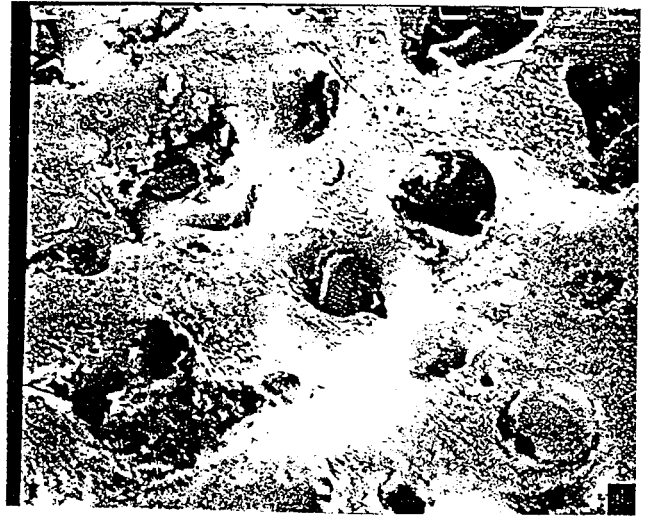
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Sharyn Sinclair-Hannocks

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To see a world in a grain of sand
William Blakc, *Auguries of Innocence*



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DEDICATION

My daughter, Karryn, in her major artwork for her Higher School Certificate, explored on a 115 x 80cm canvas the strength of her mother's lifelong relationship with the beach. Karryn's work was influenced by photographs of her mother as a teenager, sunning, tanning, and bodysurfing on Addington Beach in Durban, unaware at the time that she would later conduct research into the ecology, recreation and management of Durban's beaches, and undertake the professional role of Durban's first Environmental Officer and Head of Environmental Management.

Karryn was even born in a hospital on Durban's Addington beachfront. Her mother as a girl, the beach, her birth, and events of her own life are all interwoven symbolically in her painting. She uses the patterning on the girl's bathing costume to connect all the elements: the girl, the car, the hospital building, the waves, and in reverse, the beach sand. Karryn did not realise, at the time of creating the painting, that this reverse-patterning would reflect the nature of beach sand grains, as seen at micro-level in the course of this research. The scale-like patterning in the foreground wave merges with the girl, suggesting a fish or 'mermaid' transformation that symbolises a close relationship with the marine habitat. For Karryn, her Aquarian mother is at one with sand, sea, surf and sun.

This thesis is dedicated to Karryn and to my husband, Chris. As a conservation manager of marine reserves and coastal areas, Chris has given professional input to all aspects of this research, and assisted with editing and proofreading of the document. As a lifelong surfer and scuba diver, he has his own strong personal relationship with the beach and the sea. He has supported both Karryn and I through our major works, the painting and the thesis, with long-suffering love, abundant humour, and endless cups of tea.



ABSTRACT

Sandy beaches are a primary focus of recreational and other pressures from growing coastal populations, and are major natural and economic assets for national and international tourism, but have not received adequate research attention prior to this study. Although the limited ecological research to date indicates that the nearshore volumes of sandy beach systems may be as biologically productive as estuaries and wetlands, the management of sandy beaches has not been based on ecological or sustainability principles.

In this study, the principles and goals of ecologically sustainable development (ESD) are applied in investigations designed to develop improved ecological and recreational management of metropolitan sandy beach ecosystems, whereby ecological functions are maintained simultaneously with recreational and related uses.

The conventional view that sandy beaches are resilient to recreational use, and are more likely to be seriously impacted by other forms of human activity, seems to have precluded serious research investigation of questions such as: what are the responses of both beach biota and human users to environmental variables influencing the system; what are the simultaneous levels, distributions and diversity of beach biota in relation to levels, distributions and categories of beach users; and what ecological impacts are likely from human beach use on biota at points of interaction, temporally and spatially?

From the first section of the project, it has been shown that our present understanding of the functions, processes and responses to human disturbances of sandy beach ecosystems is extremely poor, compared with that of rock platforms. New methodologies have been developed in the current study for experimental investigations into aspects of sandy beach ecology and recreational use which have never previously been considered. Relationships between environmental variables and categories of beach use have been quantified, and show promise for use in predictive modelling to guide management.

Current approaches to the management of sandy beaches and beach recreation, as aspects of environmental and coastal resource management, were then critically examined. The structures, functions and decision-making procedures of the major spheres of government, and their management agencies, were evaluated and found to provide inherent obstacles to effective ecological and recreational management of ecosystems. Coastal resource and beach management by public agencies were assessed for Durban and Sydney. Comparative analysis has provided information that can be used to develop guidelines for integrated ecological and recreational management of sandy beach systems.

In a synthesis of all of the above findings, a new procedural model has been constructed, for sustainable ecological and recreational management of sandy beach systems. This model is proposed as a framework for future integrated coastal resource research and management.

Note: Three published papers have been produced from the research in this study, and have been presented at conferences, being Sinclair-Hannocks and Keane (1992) at the Sydney Sister City Environmental Summit; Sinclair-Hannocks (1993) at the World Leisure and Recreation Association Congress; and Tsang and Sinclair-Hannocks (1993) at the Local Government and Environment Conference.

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A1.10	<i>Daily News</i>	11 Jul 1988
A1.11	<i>Daily News</i>	11 May 1988
A1.12	<i>Natal Mercury</i>	15 Feb 1988
A1.13a	<i>Sunday Tribune</i>	17 Jan 1988
A1.13b	<i>Sunday Tribune</i>	17 Jan 1988
A1.13c	<i>Daily News</i>	26 Dec 1988
A1.14	<i>Daily News</i>	25 May 1989
A1.15	<i>Daily News</i>	26 Dec 1988
A1.16	<i>Sunday Tribune</i>	3 Sep 1989
A1.17	<i>Natal Mercury</i>	7 Aug 1989
A1.18	<i>Natal Mercury</i>	19 Aug 1989
A1.19a	<i>Natal Mercury</i>	4 Sep 1989
A1.19b	<i>Daily News</i>	4 Sep 1989
A1.19c	<i>Daily News</i>	4 Sep 1989
A1.20	<i>Daily News</i>	20 Oct 1989
A1.21	<i>Natal Mercury</i>	7 Nov 1989
A1.22	<i>Sunday Tribune</i>	17 Sep 1989
A1.23	<i>Daily News</i>	17 Nov 1989
A1.24	<i>Daily News</i>	17 Nov 1989
A1.25a	<i>Natal Mercury</i>	17 Nov 1989
A1.25b	<i>Natal Mercury</i>	17 Nov 1989
A1.26	<i>Daily News</i>	17 Nov 1989
A1.27	<i>Natal Mercury</i>	15 Dec 1989
A1.28	<i>Daily News</i>	21 Nov 1989
A1.29	<i>Natal Mercury</i>	29 Dec 1989
A1.30	<i>USA Today</i>	21 Apr 1994
A1.31	<i>Natal Mercury</i>	21 Nov 1989
A1.32	<i>Natal Mercury</i>	13 Jan 1988
A1.33	<i>Daily News</i>	6 Dec 1989
A1.34	<i>Daily News</i>	27 Dec 1993
A1.35	<i>Daily News</i>	27 Dec 1993

LIST OF ORGANISATIONAL ABBREVIATIONS

The first time reference is made in the text to a publication by an organisation below, the name of the organisation is given in full, followed by its acronym. In all subsequent references, only the acronym is used, with the date of publication. The list of references at the end of this document is in alphabetical order, with the full name of the publishing organisation followed by the relevant acronym in brackets. To cross-refer from the text to the reference list, it is first necessary to locate the acronym on the list below, determine the full organisational name, and then use the full name to search the detailed list of references:

ABS	Australian Bureau of Statistics
ACSIRO Organisation	Australian Commonwealth Scientific and Industrial Research
ACEPA	Australian Commonwealth Environment Protection Agency
ANEPA	Australian National Environment Protection Authority
ACG	Australian Commonwealth Government
ADASET	Australian Department of Arts, Sport, Environment and Territories
ADEST	Australian Department of Environment, Sport and Territories
AESDSC	Australian Ecologically Sustainable Development Steering Committee
AHORSCERA	Australian House of Representatives Standing Committee on Environment, Recreation and Arts
AHORSCEC	Australian House of Representatives Standing Committee on Environment and Conservation
AIGAE	Australian Intergovernment Agreement on Environment
ALGA	Australian Local Government Association
ANZECC	Australia and New Zealand Environment and Conservation Council
ARAC	Australian Resources Assessment Commission
ASTEC	Australian Science and Technology Council
DCC	Durban City Council
GBRMPA	Great Barrier Reef Marine Park Authority
ICLEI	International Council for Local Environmental Initiatives
IUCN	International Union for Conservation of Nature and Natural Resources: World Conservation Union
NPA	Natal Provincial Administration
NPB	Natal Parks, Fish and Game Preservation Board
NSB	Natal Sharks Board
NSWEPA	New South Wales Environment Protection Authority
NSWDPW	New South Wales Department of Public Works
NSWDOP	New South Wales Department of Planning
NSWSPCC	New South Wales State Pollution Control Commission
NSWSCS	New South Wales Soil Conservation Service
OECD	Organisation for Economic Cooperation and Development
QBPA	Queensland Beach Protection Authority
QDEH	Queensland Department of Environment and Heritage
SACE	South African Council for Environment
SACSIR	South African Council for Scientific and Industrial Research
SADEA	South African Department of Environment Affairs
SADFA	South African Department of Foreign Affairs
SANCOR	South African National Committee for Oceanographic Research
SCCs	Sydney Coastal Councils
SCC	Sydney City Council

SSROC
UNCED
USORRC
WCED

South Sydney Regional Organisation of Councils
United Nations Conference on Environment and Development
United States Outdoor Recreation Research Commission
World Commission on Environment and Development