
Sustainable natural resource use on the coast of Namibia

Jonathan I Barnes and Moira Alberts



Environmental Economics Unit
Directorate of Environmental Affairs
Ministry of Environment and Tourism
Private Bag 13306, Windhoek, Namibia
Tel: + 264 (0)61 249 015 Fax: + 264 (0)61 240 339
E-mail: pm@dea.met.gov.na
<http://www.met.gov.na>

This series of Research Discussion Papers is intended to present preliminary, new or topical information and ideas for discussion and debate. The contents are not necessarily the final views or firm positions of the Ministry of Environment and Tourism. Comments and feedback are welcomed.

Acknowledgements

This study was funded by the Global Environment Facility (GEF) Trust Fund within the Namibian Coast Conservation and Management (NACOMA) Project, through the World Bank. We wish to thank the NACOMA team, in particular Rod Braby, Wilhelmina Mberira, Timo Mufeti, and Nico Willemse for their support with this project. We also thank the members of the NACOMA Steering Committee for their help. We are grateful to the tourism operators and natural resource users (too numerous to mention by name) who provided data, information, and responses to questionnaires. Our gratitude is also due to the World Bank Team, particularly Christophe Crepin and Gabriele Rechbauer, who provided advice and support. And finally, special thanks go to Sophia Swiegers of the Namibia Tourism Board, who assisted by providing updated and valuable data on registered tourism enterprises for the entire coastal zone.

Edited by Caroline de Meersseman (cdmeersseman@hotmail.com)

Cover illustration by Helga Hoveka (hoveka@absamail.co.za)

Contact details

Dr Jonathan I Barnes
Design & Development Services
PO Box 25943
Windhoek
Namibia
E-mail: jibarnes@iafrica.com.na

Maira Alberts
PO Box 0000
Windhoek
Namibia
E-mail: albertsm@mweb.com.na

Table of contents

ABSTRACT.....	-5-
1. INTRODUCTION	- 6 -
1.1 Background.....	- 6 -
2. OBJECTIVES AND METHODOLOGY.....	- 7 -
2.1 Objectives.....	- 7 -
2.2 Methodology.....	- 7 -
2.2.1 Literature review	- 7 -
2.2.2 Current and future methodology for economic valuation	- 7 -
2.2.3 Direct contribution to national income	- 8 -
2.2.4 Total, direct and indirect contribution to national income	- 8 -
2.2.5 Future measurement of values.....	- 8 -
2.3 Study area	- 8 -
2.4 Socio-demographic characteristics	- 9 -
3. REFINEMENT OF INDICATORS	- 10 -
3.1 Baseline scenario OI 2.....	- 10 -
3.2 OI 2 monitoring framework for the indicators.....	- 11 -
4. NATURAL RESOURCE USE SUSTAINABILITY - FINDINGS	- 12 -
4.1 Introduction	- 12 -
4.2 Fisheries	- 12 -
4.2.1 Recreational angling	- 14 -
4.2.2 Artisanal fishery.....	- 16 -
4.2.3 Commercial fishery.....	- 16 -
4.3 Other biological resources	- 18 -
4.3.1 Mariculture	- 18 -
4.3.2 Inara harvesting	- 18 -
4.3.3 Other non-fishery biological resources (seals, guano and sea shells)	- 19 -
4.4 Minerals (salt, diamonds and natural gas/oil).....	- 20 -
5. OVERALL RECOMMENDATIONS.....	- 22 -
5.1 Long-term recommendations for data capture	- 22 -
5.2 Sustainable coastal natural resource use	- 23 -
5.2.1 Inshore line fishery and recreational angling tourism	- 23 -
5.2.2 Artisanal fishery.....	- 24 -
5.2.3 Commercial fisheries.....	- 24 -
5.2.4 Mariculture	- 24 -
5.3.5 Other biological natural resources	- 25 -
5.2.6 Minerals	- 26 -
REFERENCES	- 27 -
GLOSSARY	- 30 -
LIST OF FIGURES AND TABLES	
Figure 1: Coastal regions and protected areas.....	-7-
Table 1: NACOMA OI 2 baseline data and targets for coastal natural resource use.....	-11-
Table 2: Summary of baseline coastal natural resource use economic values in 2006.....	-13-

ABBREVIATIONS

CBNRM	Community-based natural resource management
BCLME	Benguela Current Large Marine Ecosystem
EIA	Environmental impact assessment
GEF	Global Environmental Facility
GNI	Gross national income
GRN	Government of the Republic of Namibia
LAC	Limits of acceptable change
M&E	Monitoring and evaluation
MET	Ministry of Environment and Tourism
MFMR	Ministry of Fisheries and Marine Resources
NACOMA	Namibian Coast Conservation and Management (project)
NHIES	Namibia Household Income and Expenditure Survey
OI	Outcome indicator
SAM	Social accounting matrix
SEA	Strategic environmental assessment

ABSTRACT

This paper summarises a study commissioned by the Namibian Coast Conservation and Management (NACOMA) Project which investigated the sustainability of natural resource use in the coastal zone of Namibia. It complements another paper on the sustainability of coastal tourism, presented in another Research Discussion Paper in this series, No 77.

A revised base line was developed for the NACOMA monitoring and evaluation (M&E) function. This includes the base line economic value of coastal natural resource use (excluding diamonds and offshore fishing and on-board processing), as measured by the direct contribution to national income, of N\$677 million in 2006. The revised base line OI 2 indicator for the number of people involved in sustainable coastal natural resource use in 2007 was estimated at 7,420 (excluding offshore fishing, on-board fish processing and diamond mining). The 2011 target was estimated at 8,870.

Most natural resource use in the coastal zone is associated with fisheries, including recreation angling, inshore commercial line fishing, crayfish fishing, on-shore fish processing (based on the very large offshore commercial fisheries), and artisanal fishing. Recreational angling and inshore commercial line fishing use the same resource which is tending to be overharvested. Crayfish fishing is currently sustainable although it appears to be based on a depleted resource. The off-shore commercial fishing sector, which feeds the large onshore fish processing sector is only partly sustainable, and some components of it are based on severely depleted resources (including the very important sardine) The depletion of these offshore fish resources has affected other natural resource uses in the coastal zone including seal harvesting and guano production. Mariculture is established and expanding within limited suitable zones along the coast. Minerals include salt production and an extremely large diamond mining industry. These appear to be sustainable in the foreseeable future, within the limits of markets and reserves.

The study lists some 30 recommendations for ensuring sustainable coastal natural resource use. Some of these are short term and possibly implementable within NACOMA, while others are more general and relevant to the long term development of the coastal zone. Key recommendations include:

- increasing the combined economic contribution of the recreational fishery/inshore commercial line fishery, without increasing off-takes, by reducing/restricting the commercial line fishery,
- increasing the economic contribution of the recreational fishery by increasing property rights and guided angling tourism activities, through implementation of the concessions policy,
- applying all measures necessary (including closure of the sardine fishery) to encourage recovery of the sardine resource, which underpins the sustainability of so much coastal zone natural resource use, including on-shore fish processing, seal harvesting, and guano production,
- planning the further development of coastal zone natural resource use through application of zoning as informed by the Strategic Environmental Assessment (SEA) process as well as sound economic analysis,
- undertaking an empirical economic survey of coastal natural resource use activities, and the development of financial/economic models of these to guide planning,
- applying cleaner production principles, in particular those relating to water use, to the on-shore fish processing sector,

1. INTRODUCTION

A study on sustainable tourism options for the coastal zone of Namibia and refinement of available data on coastal tourism and natural resource use practices was commissioned by the Namibian Coast Conservation and Management (NACOMA) Project. This was reported on by Barnes & Alberts (2007). The findings of this study, as they relate to natural resource use, are summarised and reproduced here. They complement the findings for coastal tourism presented in another Research Discussion Paper in this series, No 77 (Alberts & Barnes 2008).

The NACOMA project aims to enhance coastal and marine biodiversity conservation through the mainstreaming of biodiversity conservation and sustainable use into coastal policy, a legislative framework, and institutional and technical capacity, and by supporting targeted investments for biodiversity conservation in critical ecosystems on the coast.

During the PDFB stage of the project development, a study was conducted (Van Zyl 2004) to measure the economic values associated with the natural resources in the project area. This was followed by a study to develop outcome indicators for monitoring and evaluating economic benefits in the coastal zone (van Zyl 2005). Under the objectives below, the present study aims to ensure that developments in natural resource use are sustainable, contribute maximally to economic growth and job creation, particularly in the coastal zone, and that rent capture for development is maximised. The present study also makes recommendations on improvements to monitoring and evaluation (M&E), on improvements to policy, and on possible targeted interventions.

The analysis follows the broad categories of the study by van Zyl (2004), but specifically disaggregates and adds to this framework, where data availability allows. As outlined in the NACOMA Project Document, the focus of possible targeted interventions will be on on-the-ground gaps for coastal biodiversity conservation and sustainable use throughout the project intervention zone.

The present study appears to be particularly timely in terms of the changing nature of economic use practices in the coastal zone, which pose an increased threat to coastal resources and biodiversity hotspots, namely the rapidly increasing tourism industry, uncontrolled urbanisation, the large fishing industry, and changes in mining use practices, and the pending process of governmental decentralisation, which offers the opportunity to clarify national, regional, local and sectoral responsibilities, and implement new legislation and integrated/coordinated ways of working.

1.1 Background

Environmentally sensitive habitats and biodiversity hotspots are defining characteristics of the Namibian coast. The status quo is that many of these habitats remain without legislative protection and there are currently no marine protected areas. Urbanisation and unregulated tourism, expansion of fishing, mariculture and other extractive industries such as mining, increasing unemployment in coastal towns, and increasing public access are impending threats that were identified in the NACOMA Project Document.

There is also a lack of environmental and socio-economic data on the coastal regions, and little regional input into planning and controlling use practices on coastal land. The globally important coastal resources of Namibia are at significant risk of degradation and unsustainable exploitation and there is a need for an integrated coastal zone management approach to ensure their conservation and sustainable use. The current development patterns feature insufficient or no conservation of coastal biodiversity, and lack of integration of biodiversity conservation in the landscape and coastal development planning, as well as the challenges related to weak management of the existing coastal zone. Without the intervention of this project, such developments will likely result in an irreversible loss of biodiversity and mainstreaming opportunities.

2. OBJECTIVES AND METHODOLOGY

2.1 Objectives

- 1) To disseminate a scaled-down and concise version of the findings and recommendations of the main report in the form of two separate Research Discussion Papers amongst the relevant stakeholders and other experts (listed below) for further review, analyses and contributions.
- 2) To assess the unsustainable and sustainable natural resource use practices and recommendations for a shift to sustainable use practices indicating expansion potential and more efficient rent capture through e.g. land/resource zoning, future allocation of property rights and concessions.
- 3) To incorporate the OI 2 baseline data updates of sustainable and unsustainable tourism options

2.2 Methodology

2.2.1 Literature review

1. A review was undertaken of the unpublished report on –Sustainable Tourism Options for the Coastal Zone of Namibia and refinement of available data on coastal natural resource use practiceø (Barnes & Alberts, 2007).

2.2.2 Current and future methodology for economic valuation

The monitoring and evaluation process will require future application of the same methodology used in this baseline study.

The absence of systematic survey data on economic activity in the coastal region made it necessary to draw information and data from various sources, estimate values using some adaptation (including extrapolation, interpolation and inflation), and use various assumptions. Because of the lack of direct data, wherever possible use was made of triangulation or convergent validation, i.e. estimates were made using two or more approaches to arrive at a corroborated average.

2.2.3 Direct contribution to national income

The natural resource use values were estimated using data from the literature, available data, and direct interviews with natural resource users. The numbers of users in each category of natural resource use, and the turnovers thereof were sought. Aggregates for gross output were calculated. Then ratios derived from selected empirically-based financial and economic natural resource use models (as developed in the Ministry of Environment and Tourism) were subjectively applied to these numbers to get aggregates for direct contribution to national income.

The numbers of employment opportunities involved in natural resource use activities were also estimated, using the enterprise models and aggregated appropriately. Where data was poor, ratios of employment to the amount contributed to national income were then applied to the use practices.

2.2.4 Total, direct and indirect contribution to national income

In estimating the total direct and indirect contribution of tourism and resource use practices to national income (the total economic impact), the direct values derived as described above were added to the indirect values. Indirect contributions were determined using income multipliers extracted from the Namibian social accounting matrix (SAM) (Lange et al. 2004). These are fairly broad measures estimated at sector level. Employment values were attributed to the indirect values using the same ratios, for jobs to national income, which were derived in the case of the direct values above.

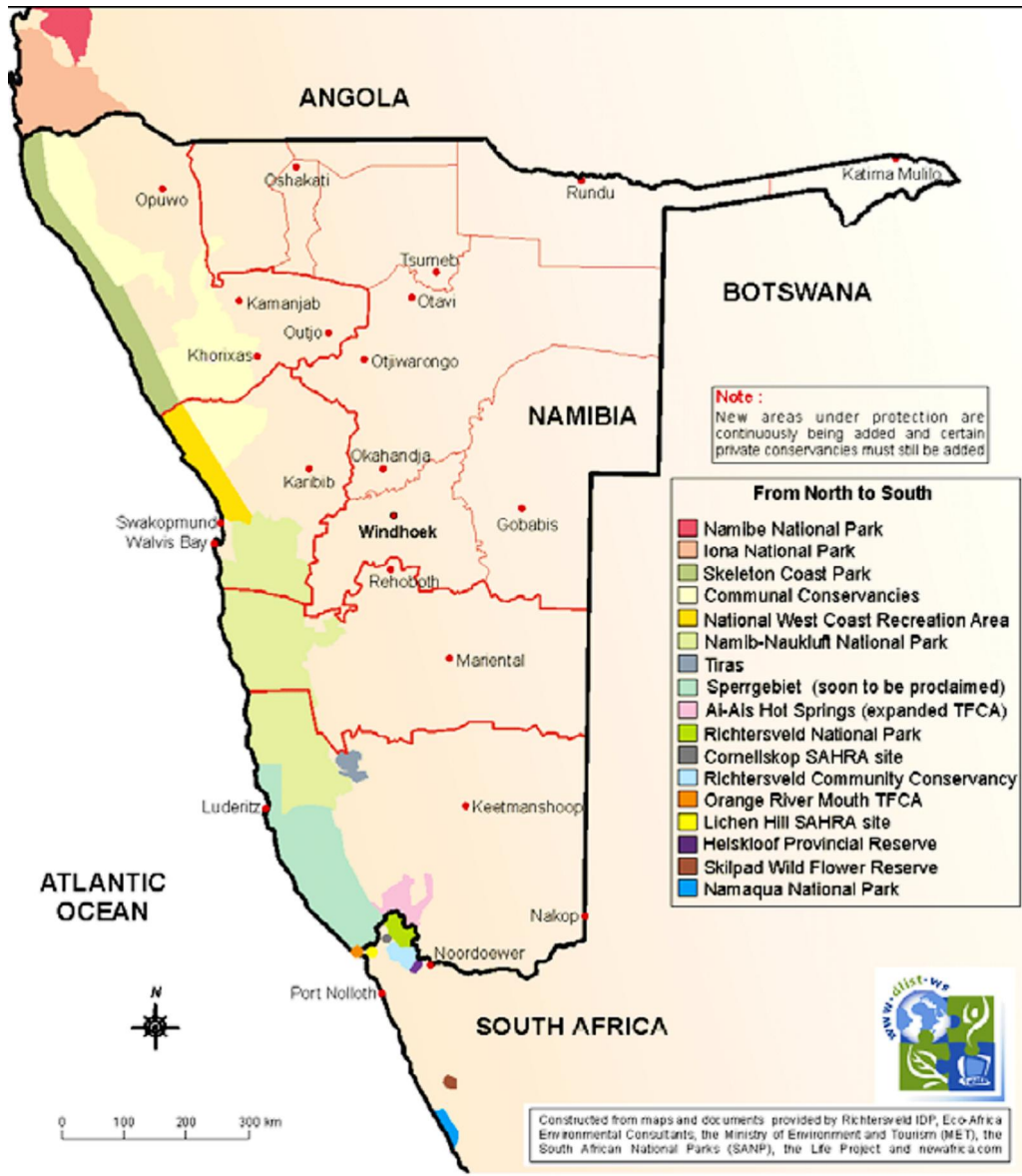
2.2.5 Future measurement of values

The baseline tourism and resource use indicators measured in the study should be re-estimated at the end of the NACOMA Project. A similar approach to that described above should be applied, but should incorporate any new or improved data, e.g. from surveys, that have become available by then. Changes in values that emerge in such future analyses should be carefully assessed to see whether they are the result of real project-attributable change or other factors or simply better information. The lack of a systematic, replicated series of targeted surveys means that this process will, to some extent, be subjective. However, this should not detract from the undoubted value of the monitoring and evaluation process.

2.3 Study area

The project intervention zone employed for the study was that of the NACOMA Project Document (World Bank 2005). Thus, it embraces the full length of the coast and extends 12 nautical miles out to sea from the coast, and some 2 to 3 km inland from the coast, except where urban and other land uses with coastal links extend further inland. The data collected will be relevant to this zone, but the division between coastal and non-coastal use practices will be conceptual rather than rigidly physical. The coastal zone does not exist in isolation, and a number of use practices take place outside of it that are linked to tourism or natural use practices inside it. Thus, an attempt was made to consider the value of such use practices and incorporate use practices such as marine fishing and inland tourism, which have links to the coast, in planning. Figure 1 shows the regions and protected areas in the coastal zone in the broader context of Namibia.

Figure 1: Coastal regions and protected areas



Source: Eco-Africa Environmental Consultants (2004)

2.4 Socio-demographic characteristics

The NHIES (GRN 2006a:13) reported a decrease in the household size of the Namibian population from 5.7 in 1993/4 to 4.9 in 2003/4. The national urban household size also decreased from 4.8 to 4.2, while the national rural household size decreased from 6.1 to 5.4 in the same period.

In the *Kunene Region*, according to results of the Namibia Labour Force Survey 2004 (GRN 2006b:37), there are 14,084 households in this region. They have an average size of 4.6 persons per household, totalling a population of 64,786 and an economically active labour force of 18,486. The main source of income for 25,526 people is wages and salaries, while a secondary source for 3,952 people is subsistence farming (crops and animals). In the NHIES, a total of 13,365 households with an average household size of 4.6, a population of 61,647, and a per capita income of N\$10,431 were recorded for this Region (GRN 2006a:16, 105) which correlates closely with the findings of the 1993/4 Namibian Labour Force Survey.

In the *Erongo Region*, a total of 29,952 households with an average household size of 3.6, totalling a population of 107,827 and a labour force of 50,892, with 37,701 employed and 13,919 unemployed people were reported in the Namibia Labour Force Survey 2004 (GRN 2006b:37). According to the latter survey, the main source of income for 42,484 people was found to be wages and salaries, while a secondary source for 5,607 people was found to be pensions. These findings closely correlate with the results of the NHIES (GRN 2006a:16, 105), where the Region showed a total of 27,713 households with an average household size of 3.6 (the lowest in the country), a population of 99,013, and the second-highest income per capita, namely N\$14,948 as compared to the highest per capita income of N\$22,860 in the Khomas Region.

In the *Hardap Region*, 15,114 households with an average household size of 4.2 totalling a population of 64,379 people were reported in the Namibia Labour Force Survey 2004 (GRN 2006b:37). The main source of income for 25,011 people was found to be wages and salaries, while a secondary source for 3,872 people was subsistence farming, crops and animals. The NHIES (GRN 2006a:16, 105) found a total of 16,365 households with an average household size of 3.7, a population of 68,194 and a per capita income of N\$10,431 for this Region.

In the *Karas Region*, a total of 18,602 households and an average household size of 4.0 totalling a population of 74,408 was found in the Namibia Labour Force Survey 2004 (GRN 2006b:37). The main source of income for 29,317 people was wages and salaries, while the secondary income for 4,539 was subsistence farming, crops and animals. The NHIES (GRN 2006a:16, 105) found a total of 15,570 households with an average household size of 4.2, a population of 62,465 and an income per capita of N\$11,123 for this Region.

3. REFINEMENT OF INDICATORS

The objectives of the main study called for an update of the baseline indicators for the NACOMA Project. The baseline data from the study of van Zyl (2005) OI 2 were refined and updated, as outlined in Table 1.2 of that report.

3.1 Baseline scenario OI 2

Outcome Indicator 2 (OI 2) reads as follows: Increase in the number of people engaged in these use practices and the proportion of their incomes derived from these use practices by year 5 compared to baseline situation. Table 1, below shows a summary of the baseline data and targets for NACOMA. More detail can be sourced in the main report (Barnes & Alberts 2007).

It must be noted that no empirical data are available to develop meaningful measures of *proportions of income* derived from sustainable use. The databases and reports of the NHIES

(GRN 2006a), the Namibia Occupational Wages Survey (GRN 2002), and the Namibia Labour Force Survey (2006b) are too generalised to provide specific measures for the use practices in the coastal zone. Instead, specific surveys involving employees in the enterprises concerned are required ó which is beyond the scope of this study. Nonetheless, the *measures of economic value and employment* generated by these use practices have been updated, as shown in Table 2 below.

Table 1: NACOMA OI 2 baseline data and targets for coastal natural resource use

OI 2	Baseline (2007)	End of project (2011)
Number of people involved in sustainable coastal natural resource use*	7,421	8,870
Proportion of income derived from sustainable use	No data	No data

* Direct jobs, excluding offshore fishing, on-board fish processing, and the diamond sector

The goal of the NACOMA Project OI 2 will be to increase, through targeted investment, the number of people involved in sustainable natural resource use (excluding diamonds) from some 7,420 (baseline) to some 8,870 by the end of the project. Diamond mining is excluded as it introduces a very large number of somewhat questionable accuracy, reducing the value of the other estimates.

As stated, there are no empirical data available on the proportions of household income derived from the use practices. There is some overlap of economic values in that some of the economic values for recreational angling as a natural resource use are also included in the economic values for tourism uses on the coast (not dealt with in this paper), specifically in the tour operatorsøuse category, because some tour operators offer recreational angling tours. The degree of overlap could not be calculated, however, resulting in a small amount of double counting. The economic values associated with natural resource uses refer to values generated specifically within the coastal zone.

3.2 OI 2 monitoring framework for the indicators

Barnes & Alberts (2007) provided an outline methodology for data collection regarding indicators in the NACOMA M&E process. The predetermined indicators are to measure change over a period of five years. The indicators should undergo continuous review to respond to the ever-changing circumstances and information received. It is important to note that these indicators will not provide all the required answers and solutions, but could be valuable tools for monitoring and assessing changes.

The establishment of an environmental office at the coast is recommended, with the objective to support NACOMA in identifying viable sustainable projects on the ground as well as help to collect the baseline data and provide the M&E specialist with quarterly progress reports. Overall progress will be verified by the M&E specialist, ideally on an annual basis, within the framework of the NACOMA objectives. The overall process would be linked to the Project

Cycle Management initiative of the Directorate of Decentralisation Coordination in the Ministry of Regional and Local Government and Housing and Rural Development (funded by the French Government). The parallel training and involvement of Development Officers in the Regional Councils would ensure the longevity of the overall project.

4. NATURAL RESOURCE USE SUSTAINABILITY - FINDINGS

4.1 Introduction

The concept of sustainability has evolved since the Brundtland Report, "Our Common Future" "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" in order to embrace three dimensions or pillars of sustainable development (World Commission on Environment and Development 1987).

Economic sustainability has a focus on generating prosperity at different levels of society and ensuring the viability of enterprises and use practices is maintained in the long-term. Social sustainability has a focus on respecting human rights and providing equal opportunities in society. There is an emphasis on local communities, recognising and respecting different cultures and avoiding exploitation. Environmental sustainability has a focus on conserving and managing resources, especially those that are not renewable, requiring action to minimise pollution of land and water and conserving biological diversity and natural heritage.

The findings of the current natural resource use practices at the coast will be discussed within the framework of the three "pillars" of sustainability as elaborated above. It is important to reiterate that some of the economic data were based on estimations due to the lack of empirical baseline data such as the current proportions of income of the people derived from the current tourism use practices could not be estimated. It is also of pivotal importance to highlight that none of the current coastal tourism use practices fulfil all the requirements of all three "pillars" of sustainability, namely, economic, social and environmental sustainability.

Table 2 provides a list of coastal zone natural resource uses. It also shows a summary of the main economic values for these uses in 2006, as estimated in this study (Barnes and Alberts 2007). Discussion of the sustainability of these follows.

4.2 Fisheries

Some of the most important natural resources in the coastal zone are those associated with the fisheries. The Benguela Current, which flows up the Namibian coast, is characterised by cold but nutrient-rich up-welling, giving rise to a system with relatively low fish species diversity, but high production. This forms the basis for the marine fishery which is important in the context of the broader Namibian economy, and forms the basis for the recreational fishing industry.

In the coastal zone, as defined, the fisheries embrace recreational shore and ski-boat fishing tourism, subsistence fishing, the commercial line fishery that targets inshore fish resources, and the crayfish industry on the southern coast. The bulk of Namibia's significant commercial marine fishery activities take place out at sea, away from the coastal zone, but these impact directly on the economy of the coastal zone through the processing activities which are carried out in the ports. The commercial fishing sector is dealt with in this context only.

In the main report (Barnes & Alberts 2007), extensive evidence was presented as background to the findings on sustainability. Here more emphasis is placed on the actual findings on sustainability and associated recommendations.

Table 2: Summary of baseline coastal natural resource use economic values in 2006

Sector	Spatial distribution	Annual economic value, 2006 (gross national income - GNI)	No. of jobs
Recreational angling*	Kunene, Erongo and Karas	Direct GNI: N\$24 million Total direct and indirect GNI: N\$56 million	Unskilled 6 190 Skilled 6 80
Inshore commercial line fishing	Kunene Erongo and Hardap	Direct GNI: N\$11 million Total direct and indirect GNI: N\$21 million	Direct 230 Total 450
Crayfish fishing	Karas	Direct GNI: N\$31 million Total direct and indirect GNI: N\$59 million	Direct 676 Total 1,278
Offshore commercial fishing**	Entire coast, but focused on Walvis Bay	Direct GNI: N\$1,514 million Total direct and indirect GNI: N\$2,861 million	Direct 6,855 Total 12,995
Onshore fish processing	Erongo and Karas	Direct GNI: N\$593 million Total direct and indirect GNI: N\$1,227 million	Direct 6,592 Total 12,459
Artisanal fishing	Erongo	n/a	Some 70 semi-skilled
Mariculture	Erongo and Karas	Direct GNI: N\$9 million Total direct and indirect GNI: N\$17 million	Some 150
Seal harvesting	Erongo, Karas	n/a	15620 full-time job equivalents
Guano production	Erongo, Karas	Direct GNI: N\$3.4 million Total direct and indirect GNI: N\$6 million	6 full-time
Shell harvesting	Erongo	n/a	n/a
Salt production	Erongo	Direct GNI: N\$6 million Total direct and indirect GNI: N\$11 million	Unskilled 6 176 Semi-skilled 6 43 Management 6 9
Diamond mining	Karas	Direct GNI: N\$2,321 million Total direct and indirect GNI: N\$4,433 million	Direct: Some 28,000 Indirect: Some 25,000
Natural gas and oil production	Karas	No production; likely to be significant if project goes ahead	n/a
!Nara harvesting	Erongo	Direct GNI: N\$88,400 Total direct and indirect GNI: N\$160,000	85 full-time

*There is some overlap between values for angling and those for the tourism sector, not presented here

** Not in coastal zone, but linked to onshore fish processing

4.2.1 Recreational angling

Recreational angling is important in the coastal zone contains as a resource use and also as a form of tourism. It takes place mainly from the shore, though some angling takes place from ski-boats launched from the main towns in the central area. The most frequently landed bonefish are kob (mostly silver kob, *Argyrosomus inodorus*, but also occasionally dusky kob, *A. coronus*), west coast steenbras (*Lithognathus aureti*), galjoen (*Dichistius capensis*) and blacktail (*Diplodus sargus*). To a much lesser extent, sharks, including the copper shark (*Carcharhinus brachyurus*), the spotted gulley shark (*Triakis megalopterus*) and the smoothhound (*Mustelus mustelus*), are targeted. A limited amount of recreational crayfish harvesting takes place from the shore in the central area.

Access to shore angling on the Namibian coast is restricted to about a quarter of Namibia's coastline, i.e. some 260 km, stretching from Sandwich Harbour south of Walvis Bay to the Ugab River in the north. Most of this area is made up of the West Coast Recreation Area, and more than 90% of angling takes place here. Additional smaller angling sites exist at isolated localities, at Torra Bay and at Terrace Bay in the Skeleton Coast Park, and around Lüderitz in the south.

Kirchner (1998), Kirchner and Beyer (1999), Holtzhausen and Kirchner (2001) and Holtzhausen et al. (2001) have studied the populations of the two main species involved in recreational line fishery, namely the silver kob, *Argyrosomus inodorus* and the west coast steenbras (*Lithognathus aureti*). Recent indications are that both populations have been overfished.

In 2001, the bag limit for recreational shore anglers was reduced to 10 fish per day and a fishing licence fee of N\$14 per month was introduced. However, these restrictions and fees are not believed to be enough to halt the decline of the stocks. Most shore anglers catch far less than the total catch limit in any case, and experiences from South Africa (Attwood & Bennett 1995) suggest that restricting total catches, rather than the catches of individual species, can be an ineffective method of protection. The new Namibian regulations, therefore, also include size limits on kob catches: shore anglers are obliged by law to release any kob smaller than 40 cm and are only permitted to catch two large kob (defined as larger than 70 cm) per shore-angling day. The rationale for limiting catches of large kob is that these are important for spawning and, thus, for the regeneration of the stock.

The recreational line-fish resource is shared with a commercial line fishery, which operates up and down the coast, from Walvis Bay. Commercial line fishing is carried out by ski-boats and larger vessels. These boats target kob and, to a lesser extent steenbras. There is no restriction on where commercial fishing takes place, and the whole northern half of the Namibian coastline is potentially utilised.

Given that the resource is perceived to be under pressure and possibly declining, it became necessary to analyse the two components of the line fishery to see how it can be made sustainable through sound policy development, planning and management, while ensuring that any losses to the economy are minimised. Kirchner and Stage (2005) undertook such an analysis. They carried out a specific survey of the commercial line-fishing industry, and used the data from the recreational fishery described above. They looked at the total impact that

each had on the economy, using the SAM model of the Namibian economy developed by Lange et al. (2004). Then they developed supply equations for both industries to compare the effects that reductions in catch would have on each. Commercial line fishing and recreational shore angling both have economic impacts on the coastal economy that go beyond the direct incomes generated. Commercial line fishing generates profits for boat-owners, income for their employees, and revenue for other firms that sell inputs to the commercial line-fishing firms. Income is spent on goods and services, generating income and employment for others. Similarly, shore anglers spend money on a number of goods and services connected to their shore angling, generating revenue for the firms and employment for the people involved in selling such items to them.

Kirchner and Stage (2005) found that reducing shore-angling pressure by 25% through higher licence fees would lead to overall losses for the Namibian economy of approximately N\$10.7 million. The gains in Government revenue would be small compared with the lost multiplier effects and the lost consumer surpluses. The size of these economic losses may be compared with the effect of reducing commercial fishing pressure by the same proportion, which would have an overall impact of between N\$5.3 and N\$6.6 million, depending on how the reduction were carried out. Since the two fisheries catch roughly equal numbers of fish, reducing fishing pressure by 25% would reduce the number of fish caught by roughly equal numbers ó regardless of the sector. The overall costs to the economy would, however, be substantially lower if the reduction were carried out in the commercial line-fishing sector. The Kirchner and Stage (2005) findings suggest that, to the extent that line fishing off-takes need to be reduced, the harm to the Namibian economy would be less if the cuts were made within the commercial line-fishing sector. However, two considerations are important. First, the results are applicable to the current conditions and can be expected to change, if for example, the profitability of commercial fishing increases. Second, cutting catches in the commercial sector should be done in a way that does not cause losses in sunk capital.

Barnes and Novelli (2006) made a comparison of the marine recreational angling sector and the recreational hunting tourism industry in Namibia. The hunting tourism industry involves guided visits for tourists who hunt trophy-quality game animals and retain the trophies. They found that the total economic value (national income contributions plus any Namibian consumer surpluses) for trophy hunting is some four times more than that for coastal angling. Because the number of anglers per annum is more than twice that of hunters, the economic value generated per hunter is some nine times higher than that generated per angler.

The comparison showed that, in Namibia, trophy hunting is more economically efficient, more environmentally sustainable, and more socially acceptable than angling. The reasons for these differences are partly situational, but primarily related to property rights and institutional factors. Coastal angling makes use of a more or less openly accessible public resource, while hunting makes use of an at least partially owned resource.

The sustainability of recreational angling tourism in the coastal zone would seem to depend on a reduction of off-takes in the line-fishing sector. The discussion above suggests that the most economically efficient way to do this is to restrict the commercial line fishery. The potential for expansion in recreational angling tourism would seem to lie not in increased catches, but rather in expanding the economic contribution made by anglers. Changes which introduce more property rights and guiding to the angling sector would likely achieve this.

4.2.2 Artisanal fishery

Fielding et al. (2006) provide a description of the subsistence artisanal fishery. This takes place around Swakopmund, Henties Bay, and Terrace Bay, where angling tackle is used by low-income residents to informally harvest fish from the shore, mostly for home consumption, but also for sale. Most sales are local and of fresh fish. A very small proportion is dried or smoked by both fishers and buyers. Since bait tends to be collected on site, galjoen are commonly caught in the Swakopmund area. In all less than 150 individuals are involved.

The artisanal fishery makes use of the same resource as the angling sector and, relative to the latter, is extremely small. With time, it is likely to expand in and around the localities where poor populations reside. While there is probably scope for significant expansion, the possibility of localised overexploitation exists. *Policy recommendations are provided in section 6 below.*

4.2.3 Commercial fishery

Largely as a result of upwelling in the Benguela Current, Namibia's marine environment is highly productive. This has given rise to marine fisheries which, with processing, form one of the biggest industries in the economy. This study is concerned with the coastal zone, as defined above, and much of the fisheries sector activities take place out to sea and outside this zone. However, fisheries impact on the coastal zone in that most of those employed are based there, and also because a proportion of the processing of the catch takes place there. Thus, the success of the offshore fisheries is crucial for some of the natural resource use activities within the zone. Land-based processing makes use of natural resources (fish and water, for example); thus, onshore processing is treated as a natural resource use in this study.

Most fisheries are offshore and have been dominated by three fisheries: those of the demersal hake (*Merluccius capensis* and *Merluccius paradoxus*), the pelagic horse mackerel (*Trachurus capensis*) and the epipelagic sardine (*Sardinops ocellatus*). The horse-mackerel fishery involves mid-water trawling (adults) and purse seine (juveniles), and is on average the largest fishery by volume, but its value is less than that of the hake fishery. Purse-seine fishing for the epipelagic sardine produced vast yields in the 1960s and 1970s, but this important fishery effectively collapsed due mainly to overfishing, but also to the adverse effects of several Benguela El Niño events. Anchovy (*Engraulis capensis*) and juvenile horse mackerel provided some stability to the purse-seine fishery, but the anchovy stock appears to have collapsed as well (Bianchi et al. 1999).

The offshore fishery also includes some pole and longline fishing for tuna, swordfish and large pelagic sharks. The most important of the large pelagic fish taken is the southern longfin tuna or albacore (*Thunnus alalunga*). Off the coastal shelf, a specific deep-water trawl fishery has developed in recent years, primarily aimed at orange roughy (*Hoplostethus atlanticus*) but including alfonsino (*Beryx splendens*). Initially high catch levels for this fishery have since declined. Other offshore fisheries include that for the deep-sea red crab (*Chaceon maritae*), which are caught using trap gear. Total harvests in the offshore fishery amounted to some 633,000 tonnes in 2003 (Riveiro 2005).

Three elements of the commercial marine fishery actually take place *within* the coastal zone as defined here and as embraced by NACOMA. These are the inshore commercial line

fishery along the northern parts of the coast out of Walvis Bay, the fishery for rock lobster or crayfish (*Jasus lalandii*), which takes place on the southern coast, out of Lüderitz, and the onshore procession of catches from the fishery as a whole.

The inshore commercial line fishery has been described under recreational angling as the two are competitive (see above). The fishery for crayfish has a TAC of some 400 t, with some 185 t being allocated to fully commercial operations, and some 215 t being allocated to smaller-scale, limited commercial operations. Catches and stocks were much higher in the pre-Independence period, but the ensuing collapse of stocks is considered to be partly due to environmental causes and not only to over-harvesting. The current annual catch is commonly below the TAC, for reasons considered to be due to access more than over-harvesting (Boyer & Hampton 2003; Ramasar 2005). Within the coastal zone, natural resource use activities include onshore fish processing.

As described above, the offshore commercial fishing sector, which partly and indirectly impacts on the economy of the coastal zone, is only partially sustainable. Certain components such as the hake, horse mackerel and monkfish fisheries are showing some recovery following post-Independence management measures. However, other fisheries such as the epipelagic sardine fishery are not recovering. Consideration should be given to its closure. Indications are that closure of the South African sardine fishery has allowed recovery of that (separate) sardine stock and saved the fishery (B Clark, pers. comm. 1995). A recovered sardine resource would not only provide huge fisheries benefits, but would likely also enhance production in the onshore guano and seal harvesting industries (see below).

The sustainability and expansion potential of the onshore fish processing sector depends on this supply of fish as well as on the availability of water – a scarce resource on the desert coast. As urban development proceeds at the coast, the supply of fresh groundwater currently drawn from well fields around the towns will become unsustainable. The development of sea water desalination will likely become imperative. The costs of fresh water can be expected to increase significantly. Fish processing also generates high volumes of organic effluents (fats, oils and greases). Improved technologies are available to reduce pollution.

The MET Cleaner Production Programme (Hetherington & Copeland 2006; Hetherington & Hanks 2006) and Mwiya (2006) have shown that there are considerable opportunities for Namibian fish-processing operations to reduce consumption of fresh water and to prevent pollution. The Cleaner Production Programme can assist with guidelines in this regard. Assuming fish supplies can grow, a programme to promote adoption of such cleaner technologies could allow expansion of processing by some 50% without increasing the pressure on key resources such as water.

The crayfish fishery appears to be sustainable at present levels of stock and off-takes, although it is not clear whether stocks will increase to the levels that prevailed in the 1980s, and thus whether any potential exists for expansion. As discussed earlier under the recreational angling sector, the inshore line fishery currently appears unsustainable, and should be restricted in the interests of economic efficiency.

4.3 Other biological resources

4.3.1 Mariculture

As noted by Gasnier (2001), the MFMR (2001, 2004b) and Klingelhoefter and Forbes (2004), Government strongly promotes aquaculture development. A substantial mariculture industry has already developed in the last ten years. It is currently dominated by oyster production in Walvis Bay, Swakopmund and Lüderitz, where Pacific and European oysters (*Crassostrea gigas* and *Ostrea edulis*, respectively) are produced. By 2004, six companies were in operation and further farms were under construction. A red seaweed species, *Gracilaria gracilis*, is harvested as beach-cast in the Lüderitz bay. It is also grown there on longlines and exported as a dried product to produce agar. The cultured production amounts to about a quarter of the total. It provides stability in what amounts to a variable annual harvest, and by 2004, cultured production occupied some 10 ha. One abalone (*Haliotis midae*) farm had been developed in Lüderitz by 2004, but no finfish or crustacean production had been developed, although there is considered to be significant potential in all aquaculture centres as well as at Oranjemund.

In the Oranjemund area and along the coast to the north of this, there is potential for using abandoned onshore diamond mining holes for aquaculture production. This provides protected sites with warmer waters and better growth conditions, and can be shielded from occasional red tide toxicity events which can take place in the ocean. No harvesting of the widespread and abundant inshore brown algae or kelp (mostly *Laminaria pallida*) is currently practised in Namibia, although it is systematically harvested in the Northern Cape Province of South Africa, where it is used for alginate, pharmaceuticals, and human and animal food (Ramasar 2005; Odendaal et al. 2007).

Current developments appear sustainable. No pollution or disease problems have emerged. Considerable potential exists for expansion. Fertility, food sources, market channels, and availability of capital and labour are favourable. The most likely ultimate constraint will be the extent of sheltered waters, and the possibility of setbacks due to overcrowding and resultant disease or pollution problems. The latent potential for harvesting kelp should be further examined as it could be quite significant.

Nevertheless, the MFMR (2004b) and Klingelhoefter and Forbes (2004) expect that the output of the mariculture industry will rapidly increase tenfold, from about N\$16 million in 2004 to about N\$180 million by 2008. Thus, eleven oyster farms, six abalone farms, two finfish farms, two seaweed production units, and one crayfish production unit are expected by 2008. It is possible that expansion will start to tail off after these targets are reached due to spatial constraints.

4.3.2 !Nara harvesting

The !nara melon (*Acanthosicyos horridus*), a keystone endemic of the Namib Desert, is a valuable natural resource for some rural Topnaar, a community of pastoralists and gatherers who live in the lower Kuiseb valley (Henschel et al. 2004:17; Van den Eynden et al. 1992). This resource is dealt with separately in this report because of the somewhat special circumstances associated with it. The Topnaar, a community of around 400 people, occupy

some 12 settlements along the lower Kuiseb, practising livestock herding, !nara harvesting, gardening and, increasingly, some tourism.

Community members collect the !nara seeds, separate them through boiling, and then dry them. The seeds are mostly exported via intermediaries to South Africa. !Nara fields are held informally within a unique form of property rights. The resource was recently included in the top five 'first team' of focus species selected for the Promoting Indigenous Fruit Project run by the Centre for Research Information Action in Africa & Southern Africa Development and Consulting (CRIA SA-DC; Du Plessis, P., 2007, pers. comm.).

The baseline study by the Desert Research Foundation of Namibia and the Topnaar Community Foundation (2004) as well as research by Henschel et al. (2004) indicate that there has been a decline in !nara production since the 1970s. Community perceptions corroborate this. Reasons for this may include reduced flooding in the Kuiseb delta, but it may also be that the resource is being over-harvested. At best, it appears that !nara are already being harvested at maximum production. Thus, care is required to ensure that harvesting is sustainable in the long term. This should be possible in a CBNRM context, given that there is already an established property rights system in the !nara fields.

The most potential for expansion appears to be in the development of further local processing and in market development. According to CRIA SA-DC (Du Plessis, P., 2007, pers. comm.), recent market enquiries (regional and overseas) may open potential to access new market segments such as the 'exclusive exotic gourmet' segment. Feedback from oil producers about the gourmet culinary demand potential was not yet available at the time of this report, but the outcome depends on the quality of the already produced oil samples.

4.3.3 Other non-fishery biological resources (seals, guano and sea shells)

The coastal environment supports the use of the Cape fur seal (*Arctocephalus pusillus*) for tourism and consumptive harvest. Seals occur all along the Namibian coast and aggregate at colonies on the shore and on islands, the biggest being at Cape Cross, Wolf Bay and Atlas Bay (Mendelsohn et al. 2002). The population in Namibia was estimated to be around 900,000 in 1992/3, but this population underwent a severe crash in 1994 and 1995 due to an adverse effect on food supply caused by the Benguela El Niño phenomenon. Considering about a third of the population was lost, 2001 estimates were at 450,000 to 500,000 (Hampton 2003).

It has been estimated that seals in the Benguela system consume about a million tonnes of fish annually, approximately the same as the total annual fish catch of Namibia and South Africa combined (Hampton 2003). There would seem to be competition between the seal population and the commercial fisheries, especially the sardine fishery, which has failed to recover from its previously depleted levels. The link between seal populations and the commercial fisheries is not a clear and direct one, however. Mecenero et al. (2007) could only find indirect evidence of competition between seals and the purse-seine fishery with respect to horse mackerel, which is now an important resource for both.

The seal harvest has been controlled through separate annual TACs for bulls and pups, which are based on aerial surveys and biological modelling of the population. About 20,000 pups and 4,000 adult males are harvested each year, with the total number varying between 17,000 in 1991 and 72,000 in 2000 (Hampton 2003). In recent years TACs have been maintained at

levels of around 60,000 to 70,000, but harvests have been consistently lower. Reasons for TACs not being harvested are thought to be capacity limitations amongst the newer licence holders. International animal rights movements have also tended to put the industry under pressure, with the result that it is difficult to get information.

As was evident during the population crash of the mid-1990s, if seals are not harvested, their numbers will tend to be controlled by the food supply. Within Namibia's policy of promoting wildlife utilisation, it makes sense to harvest the population at maximum sustainable levels, and thus reduce pressure on the food sources, which might then recover to the ultimate benefit of both the seals and the fisheries sector. Seal populations have been shown to be resilient, and current harvests appear biologically sustainable, but they are threatened by international animal rights pressure to eliminate harvest. Ways need to be found, if possible, to tailor the harvest to reduce the negative effects of animal rights pressure.

Guano production takes place on some of the offshore islands, where it is periodically scraped from seabird colonies, mainly Cape gannet (*Morus capensis*) and cormorant (Phalacrocoracidae). Hampton (2003) reported that about 1,000 t per annum could be harvested sustainably, mostly from Ichaboe Island. Artificial guano platforms owned by two different companies exist at Cape Cross, and comprise two sites with a total combined extent of 8 ha), Swakopmund (4 ha), and Walvis Bay (1.7 ha). In 2002, harvests from artificial platforms – which are of a higher quality than those from islands – amounted to some 1,600 t (Van Zyl 2004).

Guano production is a function of the number of seabirds using the production sites. The number of seabirds has shown a general decline over the last few decades, with several species having declined seriously (Maartens 2003). This is attributed primarily to a reduction in the food supply, dominated by the epipelagic sardine. Although guano extraction is non-consumptive in that it does not directly reduce animal numbers, it is unsustainable if bird numbers decline. Provision of new artificial platforms could result in some expansion in the industry, but the long-term expansion potential depends primarily on recovery of the sardine stocks and the bird populations.

Fielding et al. (2006) provided some information on informal collecting of beach-cast sea shells carried out by women in the Swakopmund area. Mussel shells (Mytilidae) are collected to be cut and ground, made into necklaces and sold inland. This appears to be a year-round occupation for unemployed women, who collect some 15 kg of shells per trip. The number of collectors involved is not known.

The small, informal sea-shell harvesting activities also involve a –umpø extractive activity, which does not directly affect mussel populations. There is probably some potential for localised depletion of sea shells if the activity expands significantly. An expanded extraction industry would tend to be self-regulating, and there is likely to be significant potential for expansion.

4.4 Minerals (salt, diamonds and natural gas/oil)

Salt production takes place in the coastal zone in Walvis Bay, at Panther Beacon in Swakopmund, and at Cape Cross (Van Zyl 2004; Schneider & Genis 1992). Two companies are involved in this industry. They have developed salt pans on pans and mudflats near and on the coast. The Walvis Bay operation is the largest, producing some 700,000 t of coarse

salt, most of which is used in chemical manufacturing. Panther Beacon produces some 75,000 t and Cape Cross around 30,000 t. The Cape Cross product is sold domestically as a livestock feed supplement. An unknown part of the total salt production is consumed locally and the rest is exported, going to both South African and West African markets.

Salt production has limited potential for expansion (Salt Company (Pty) Ltd, pers. comm. 2007). Expansion would be affected by market and profitability constraints. Output could probably be increased by about 25% before very high labour costs, high energy costs, high transport costs and unfavourable exchange rates would render production unprofitable. Any expansion would necessarily have to take place within areas in which these costs are minimised; thus, the availability of suitable sites is also limiting. The industry does not have a significant impact on vital resources such as water.

Diamond production currently takes place onshore and offshore in the Sperrgebiet coastal zone around Lüderitz, south of Hottentotø Bay. Tarr (2003) provides a good description of this sector. Historically, onshore mining took place south of Lüderitz in the German colonial era. There, surface diamondiferous deposits were stripped. Their relics are visible today, providing some potential for historical tourism. During the 1980s and early 1990s, some mining took place at several sites in the Skeleton Coast Park (Toscanini, Terrace Bay, Möwe Bay and Rocky Point). None of these historical mining sites benefited from any environmental care, however.

Modern onshore mining by the Namdeb Diamond Corporation takes place mainly at Daberas Mine, Elizabeth Bay (Elizabeth Bay Mine), and along a stretch of coast north of Oranjemund (Mining Area 1). Mining Area 1 comprises a 100-km stretch of shoreline, 3 km wide. The diamondiferous gravels are extracted above and below the high tide mark, using sea walls to allow mining up to 20 m below sea level. The Elizabeth Bay Mine involves a 5x3-km Aeolian deposit above the shoreline. In recent years, these activities have been accompanied by environmental management plans, and this has helped to mitigate some of the negative effects of waste management and damage to particularly sensitive sites. However, the effects on the natural habitat include destruction of the intertidal zone through stripping and exposure, siltation due to disposal of sand tailings in the ocean, and the visual impact of the exposed areas.

Offshore mining takes place along the coast, where specially equipped vessels dredge the benthic layer, sort it, and re-deposit most of the gravel back into the sea. Some of this is done by large vessels operating further offshore, and some is done by subcontracted smaller vessels inshore.

The most serious impact on biodiversity and biological productivity from diamond mining appears to be on the sessile intertidal and benthic species. The effect on crayfish appears to be minimised due to the mobility of this resource. However, crayfish fishermen generally believe that mining has adversely affected crayfish numbers, and Pulfrich and Penney (1999), consider that many gaps remain in the knowledge of the long-term cumulative biological effects of diamond mining.

Diamond mining, with a total impact on GNI of some N\$16 billion, is an indispensable component of the national economy. Some of the environmental damage associated with it is irreversible, but environmental management plans help to mitigate the impacts. NACOMA can only influence the environmental mitigation process in the interests of coastal

conservation. Langeø (2003) estimates of mineral asset value for 1981 to 2001 are generally constant, indicating that production is likely to be sustainable ó at least in the medium term. Even though minerals are exhaustible assets, their proven reserves are such that exploitation will continue for some time.

Natural gas and/or oil production has not as yet been initiated in Namibia. The Kudu gas field is situated offshore out of the coastal zone, but it is targeted for development to fire an electricity generation facility, which is likely to be sited within the zone. However, details of plans for the development of gas exploitation and power generation were not accessible at the time of this study. As is the case with diamond mining, this development is of such important national strategic importance that it will be difficult for NACOMA to have significant influence over the process other than to propose measures in sound land-use zoning, and mitigation of environmental impacts.

5. OVERALL RECOMMENDATIONS

Recommendations resulting from the findings are presented below. These are wide-ranging, and range from those specific to the implementation of NACOMA to those of a more long term nature for the general development of the coastal zone.

5.1 Long-term recommendations for data capture

1. As discussed in Part 1 of this report, where the OI 2 baseline data were updated, there are rather significant problems concerning available data, which reduce the accuracy of the M&E process. While these do not preclude M&E for NACOMA, there is a need in the longer term for systematic collection of economic data among enterprises in the coastal zone. In Van Zylø (2004) study, baseline values were collated and estimated from a variety of primary and secondary sources. In the present study, this process was carried further to include more recent data, as well as further estimation of current values and expansion potential. However, by their nature, these findings are not based on systematic surveys.
2. Systematic surveys for monitoring key indicators are recommended as essential to professional management of the environment. *Management* can be seen as the periodic and systematic measurement of key indicators of biophysical and social conditions, and performs two major functions: it allows managers a formal record of resource and social conditions over time, and it helps assess the effectiveness of management action. (It should be noted that there may be factors other than management actions that influence the changes in conditions identified through monitoring programmes.)
3. Economic and social impacts of coastal natural resource use have had to be estimated indirectly using secondary data sources. For effective planning and M&E, however, this is unsatisfactory. It is therefore recommended that, *in the long term*, a systematic quantitative baseline survey be undertaken of coastal natural resource use enterprises. This should be followed successively every four years by follow-up surveys to measure trends and impacts. The baseline survey should be of a stratified sample of enterprise in mariculture, seal

harvesting, guano production, salt production, and Inara harvesting. The data collected should include output and expenditure, enabling the development of models as suggested in Recommendation 2 below.

4. Based on the results of a baseline enterprise survey, it is recommended that, *in the long term*, financial and economic budget and cost-benefit models be developed for typical coastal natural resource use enterprises, to be updated later through follow-up surveys. These models can form the basis for effective valuation, policy analysis, land-use zoning, and planning.

5.2 Sustainable coastal natural resource use

5.2.1 Inshore line fishery and recreational angling tourism

1. It is recommended that further expansion in the commercial line fishery be restricted. Thus, no new licences could be granted, and quota restrictions could be introduced. These restrictions could be designed to have the effect of reducing profitability of marginal operators, who would likely not reinvest when their capital runs down. The line fishery could also be restricted to areas outside the proposed marine reserves.
2. It is recommended that, *in the long term*, policies be introduced which promote the gradual conversion of recreational angling tourism from an open-access, self-driven system, to one where guiding within a system of property rights predominates. This would allow growth in the economic value of the fishery without increasing off-takes. It is recommended that this be initiated as part of the proposed zoning of tourism activities and natural resource uses. Certain higher-value angling areas could be reserved for guided angling activities and the development of fixed accommodation, including lodges. The zoning could be accompanied by the allocation, through tender, of use rights that could have varying degrees of exclusivity, depending on the value. The systems developed for hunting tourism on public and community land could serve as a model. The NTB's tourism marketing efforts could include additional efforts aimed at the marketing of guided angling, particularly for the currently small foreign angling tourism market.
3. Clearly, zones need to be retained for the large self-driven angling fraternity. Recent strengthening of catch restrictions and the introduction of licences for recreational angling present a step forward in terms of reducing catches while retaining the attractive product available. It is recommended that these be reviewed every two years, and modified as needed. Resources could be dedicated to the promotion of catch-and-release as an ethic. Similarly, priority in space needs to be allocated to the subsistence artisanal shore line fishery which, although small, can be expected to grow with time. Consideration could be given to zoning for this, but in most cases it can take place within the open angling zones.

5.2.2 Artisanal fishery

1. Given its importance as an income-earning opportunity for poor households, artisanal fishing deserves to be given priority, and managed as such. Research is needed, *in the long term*, to determine the sustainability and expansion potential of this subsector. Licensing should be involved where sales occur, but these should be simply and efficiently administered.

5.2.3 Commercial fisheries

1. Management of all commercial fisheries should continue to be aimed at stock recovery. It is recommended that consideration be given to closure of the sardine fishery until such time as stocks recover substantially. It is further recommended that research into the orange roughy and associated resources be continued to enable a better understanding of the status and potential of the stock. Quotas for offshore fisheries should be conservatively set, in full accordance with the scientific research recommendations, to improve the chances of sustainability and expansion in the fishery sector.
2. Consideration should be given to the introduction of a certification system for those fisheries which qualify, with the aim of securing market share, and enhancing prices.
3. Rent capture in the fisheries sector should be reviewed with the aim of improving such capture without reducing economic efficiency, and improving overall profitability in the sector.
4. Cleaner production technologies, as espoused by the METØ Cleaner Production Programme, should be implemented in the onshore fish-processing sector. Particular emphasis should be placed on promoting water use efficiency and preventing pollution.
5. A full analysis should be conducted to test the economic efficiency of the policy which promotes onshore as opposed to on-board processing (MFMR 2004a). This should determine the most economically efficient allocation.
6. Further biological and economic research should be conducted to examine allocation issues between resource uses. Thus, the question of seal management and use should be examined in relation to fish stock recovery and use. Also, the merits of promoting bird-friendly longlining for hake over bottom trawling should be examined.

5.2.4 Mariculture

1. It is recommended that mariculture expansion be strongly promoted within a proper planning framework. Sites suitable for the various activities should be mapped so that they can be zoned within comprehensive plans for development of the areas, taking into account all demands on resource uses, including those for conservation. This should be incorporated in land zone planning activities.

2. Ongoing research and development in mariculture by the private sector should be encouraged, with scientific support from the MFMR, with the aim of reducing potential problems of pollution or spatial overcrowding. Mariculture enterprises should be included in long-term enterprise surveys.
3. The feasibility and potential for harvesting kelp along the lines of, and possibly in collaboration with, kelp harvesting activities in the Northern Cape Province in South Africa needs to be examined further.
4. Local processing of mariculture products, such as agar from seaweed, should be promoted where possible. Also where possible, maximum use should be made of existing slack capacity in processing infrastructure and existing market channels.

5.2.5 Other biological natural resources

1. It is recommended that a CBNRM project be initiated, *in the long term*, within the Topnaar community, along the lines of the ongoing conservancy development in communal lands throughout Namibia (NACSO 2004, 2006). This initiative should include all the natural resource uses embraced within the current Topnaar community coping strategy, including !nara, livestock, gardens and tourism. Some possible tourism initiatives are discussed elsewhere in this report.
2. It is recommended that the possibilities for development of !nara oil production and expansion of other processing and marketing options be further pursued.
3. In the context of all the constraints hampering progress in the socio-economic development of the Topnaar community, it is suggested that, *in the long term*, a planned intervention be initiated to shift the *unsustainable* current natural resource use practices (!nara harvesting, livestock farming and future potential tourism development) to a *sustainable* footing. This can be pursued as part of the CBNRM project suggested in Recommendation 1 above.
4. The CBNRM intervention should also include a series of planned behavioural science intervention activities carried out in collaboration with community leaders and community members to find improved ways of working together toward individual and community goals. Conflict resolution should be an integral part of this. The process should not be aimed at making random or ad hoc changes, but rather be based on a systematic appraisal and diagnosis of problems, leading to planned and specific types of change efforts.
5. A possible strategic change from the current !nara harvesting structure could be the establishment by the CBNRM project of a processing and marketing cooperative, according to which a large part of and not necessarily all of the revenues should be income *earned* by producers, and it is clearly defined *how* all stakeholders will benefit in case the organisation is very successful, i.e. makes a profit.

6. Seal populations should be managed with the objective of enhancing their tourism value as well as, if possible, enhancing the possibilities for recovery of the sardine stocks. Ongoing biological and economic research with these objectives in mind should be accompanied by attempts to ameliorate animal rights pressures on seal harvesting. Seal harvesting enterprises should be surveyed along with the suggested tourism baseline survey.
7. Guano production on platforms should be expanded, but with due consideration for the profitability of such investments in the face of declining bird numbers. Platforms should be restricted to zones where they do not impact on tourism or aesthetic values, and where they have access to markets and infrastructure, all within environmentally and economically rational natural resource planning. Biological and economic research into guano production and seabird populations should continue. This should be integrated into zoning and management planning activities. Guano production enterprises should be surveyed along with tourism enterprise baseline surveys.
8. A social and economic study of the informal sector in the coastal zone is recommended, and should include the values associated with shell harvesting and its potential. This should be combined with the long-term tourism enterprise baseline study.

5.2.6 Minerals

1. Salt production can be zoned, and these zones should be restricted to those areas close to the main markets and urban centres that have already suffered a degree of visual impact. Due to market and profitability constraints, such expansion is likely to be limited. This should be included in land-use zoning and management planning work, and salt production should also be included in the long-term tourism enterprise survey.
2. Environmental management plans associated with diamond mining should be integrated with an SEA, zoning, land use, and management plans being developed for the coastal zone. All new mining should be accompanied by EIAs and management plans, in line with the stipulations of the pending Environmental Management and Assessment Bill.
3. Research on the impacts of mining on local biodiversity and natural resource uses such as the crayfish fishery should be continued, with a view to minimising damage to them. Mined zones could be considered for rezoning for intrusive land and resource uses such as aquaculture, or intensive tourism activities.
4. Plans for natural gas exploitation and power generation should be accompanied by EIAs and planning, with consideration for the SEA, coastal zoning and land-use plans.

REFERENCES

- Alberts, M. & JI Barnes.** 2008. Sustainable tourism options for the coastal zone of Namibia. *DEA Research Discussion Paper No 77*, Windhoek: Directorate of Environmental Affairs, Ministry of Environment and Tourism.
- Attwood, CG & BA Bennett.** 1995. A procedure for setting daily bag limits on the recreational shore-fishery of the South-Western Cape, South Africa. *South African Journal of Marine Science*, 15:2416251.
- Barnes, JI & M Alberts.** 2007. Sustainable tourism options for the coastal zone of Namibia and refinement of available data on coastal natural resource use practices. Windhoek: Namibian Coast Conservation and Management (NACOMA) Project, Ministry of Environment and Tourism.
- Barnes, J & M Novelli.** 2006. Trophy hunting and recreational angling in Namibia: An economic, social and environmental comparison. Unpublished paper. Ministry of Environment and Tourism, Windhoek.
- Bianchi, G, KE Carpenter, J-P Roux, FJ Molloy, D Boyer & HJ Boyer.** 1999. *FAO species identification guide for fishery purposes: Field guide to the living marine resources of Namibia*. Rome: Food and Agriculture Organisation of the United Nations.
- Desert Research Foundation of Namibia & Topnaar Community Foundation.** 2004. Community-based resource management of !Nara: A baseline survey. In Henschel, J, R Dausab, P Moser & J Pallett. (Eds.). *!Nara: Fruit for the development of the !Kuiseb Topnaar*. Windhoek: Desert Research Foundation of Namibia, pp 1076129.
- Eco-Africa Environmental Consultants.** 2004. *Rapid assessment of the development plans, biodiversity conservation projects and socio-economic situation of the Namib coastal regions*. Windhoek: Namibia Coast Biodiversity Conservation and Management Project, Ministry of Environment and Tourism.
- Fielding, P, P Cardoso, M Shapi & M Sowman.** 2006. *Socio-economic baseline survey of coastal communities in the BCLME region – Namibia*. Swakopmund: Benguela Current Large Marine Ecosystem Programme.
- Gasnier, D.** 2001. Aquaculture potential in Namibia. Unpublished note (confidential). COFREPECHE, Paris.
- GRN/Government of the Republic of Namibia.** 2002. *Namibia Occupational Wages Survey (NOWS): Final report of analysis*. Windhoek: Directorate of Labour Market Services, Ministry of Labour and Social Welfare.
- GRN/Government of the Republic of Namibia.** 2006a. *Namibia Household Income and Expenditure Survey 2003/2004*. Windhoek: Central Bureau of Statistics, National Planning Commission.
- GRN/Government of the Republic of Namibia.** 2006b. *Namibia Labour Force Survey*. Windhoek: Directorate of Labour Market Services, Ministry of Labour and Social Welfare.
- Hampton I.** 2003. Harvesting the sea. In Molloy, F & T Reinikainen. *Namibia's marine environment*. Windhoek: Directorate of Environmental Affairs, Ministry of Environment and Tourism, pp 31669.
- Henschel, J, R Dausab, P Moser & J Pallett, J (Eds.).** 2004. *!Nara: Fruit for development of the !Kuiseb Topnaar*. Windhoek: Desert Research Foundation of Namibia.

- Hetherington, A & M Copeland.** 2006. *Best available technologies: A guide for the Namibian fish processing industry*. Windhoek: Cleaner Production Component, Directorate of Environmental Affairs, Ministry of Environment and Tourism.
- Hetherington, A & J Hanks.** 2006. *Cleaner production in Namibian industries: Regulators' guide to the promotion of cleaner production in Namibian industries*. Windhoek: Cleaner Production Component, Directorate of Environmental Affairs, Ministry of Environment and Tourism.
- Holtzhausen, JA & CH Kirchner.** 2001. An assessment of the current status and potential yield of Namibia's northern West Coast steenbras *Lithognathus aureti* population. *South African Journal of Marine Science*, 23:1576168.
- Holtzhausen, JA, CH Kirchner & SF Voges.** 2001. Observations on the linefish resources of Namibia, 1990-2000, with special reference to west coast steenbras and silver kob. *South African Journal of Marine Science*, 23:1356144.
- Kirchner, CH.** 1998. Population dynamics and stock assessment of the exploited silver kob (*Argyrosomus inodorus*) stock in Namibian waters. PhD thesis, University of Port Elizabeth, Port Elizabeth.
- Kirchner, CH & J Beyer.** 1999. Estimation of total catch of silver kob *Argyrosomus inodorus* by recreational shore-anglers in Namibia, using a roving-roving creel survey. *South African Journal of Marine Science*, 21:916199.
- Kirchner, CH & J Stage.** 2005. An economic comparison of the commercial and recreational line fisheries in Namibia. *DEA Research Discussion Paper*, 71. Windhoek: Directorate of Environmental Affairs, Ministry of Environment and Tourism.
- Klingelhoefter, E & A Forbes.** 2004. Development opportunities in Namibia's aquaculture sector and why invest in the Karas Region. Unpublished paper. Ministry of Fisheries and Marine Resources, Windhoek.
- Lange, G-M.** 2003. Fisheries accounts: Management of a recovering fishery. In Lange, G-M, R Hassan & K Hamilton (Eds.). *Environmental accounting in action: Case studies from southern Africa*. Cheltenham: Edward Elgar Publishing, pp 1116152.
- Lange, G, K Schade, J Ashipala & N Haimbodi.** 2004. A social accounting matrix for Namibia 2002: A tool for analyzing economic growth, income distribution and poverty. *NEPRU Working Paper*, 97. Windhoek: Namibia Economic Policy Research Unit.
- Maartens, L.** 2003. Biodiversity. In Molloy, F & T Reinikainen. *Namibia's marine environment*. Windhoek: Directorate of Environmental Affairs, Ministry of Environment and Tourism, pp 1036135.
- Mecenero, S, LG Underhill, J-O Krakstad, SP Kirkman & J-P Roux.** 2007. Overlap in utilization of juvenile Cape horse mackerel by Cape fur seals and the purse-seine fishery in Namibia. *South African Journal of Wildlife Research*, 37(1):17629.
- Mendelsohn, J, A Jarvis, C Roberts & A Robertson.** 2002. *Atlas of Namibia: A portrait of the land and its people*. Windhoek: Ministry of Environment and Tourism.
- MFMR/Ministry of Fisheries and Marine Resources.** 2001. *Towards responsible development of aquaculture: Namibia's aquaculture policy*. Windhoek: MFMR.

- MFMR/Ministry of Fisheries and Marine Resources.** 2004a. *Ministry of Fisheries and Marine Resources Strategic Plan 2004–2008*. Windhoek: MFMR.
- MFMR/Ministry of Fisheries and Marine Resources.** 2004b. *Namibia's Aquaculture Strategic Plan*. Windhoek: MFMR.
- Mwiya, S (Ed.).** 2006. *Cleaner production in Namibia: Cleaner production training booklet – A foresight to economic, social and environmental benefits of adopting cleaner production*. Windhoek: Cleaner Production Component, Directorate of Environmental Affairs, Ministry of Environment and Tourism.
- NACSO/Namibian Association of CBNRM Support Organisations.** 2004. *Namibia's communal conservancies: A review of progress and challenges*. Windhoek: NACSO.
- NACSO/Namibian Association of CBNRM Support Organisations.** 2006. *Namibia's communal conservancies: A review of progress and challenges in 2005*. Windhoek: NACSO.
- Odendaal, F, H Suich & CV Rojas.** 2007. Richtersveld: The land and its people. Cape Town: Struik Publishers.
- Pulfrich, A & A Penney.** 1999. Interactions between the rock lobster fishery and marine diamond mining along the southern African west coast. Unpublished report. Windhoek: Ministry of Fisheries and Marine Resources.
- Ramasar, V.** 2005. *Northern Cape State of the Environment Report 2004: Marine and coast specialist report*. Kimberley: Department of Tourism, Environment and Conservation.
- Riveiro, P.** 2005. *Namibia in figures: Namibian fishing sector – Provisional report*. Walvis Bay: Namibia Maritime and Fisheries Institute.
- Schneider, GIC & G Genis.** 1992. Salt. In: Anon. *The mineral resources of Namibia*. Special Publication. Windhoek: Geological Survey of Namibia.
- Tarr, P.** 2003. Human impact. In Molloy, F & T Reinikainen. *Namibia's marine environment*. Windhoek: Directorate of Environmental Affairs, Ministry of Environment and Tourism, pp 716100.
- Van den Eynden, V, P Vernemmen & P van Damme.** 1992. *The ethnobotany of the Topnaar*. Brussels: Commission of the European Community.
- Van Zyl, H.** 2004. *Economic analysis of natural resources in two of Namibia's coastal regions: Karas and Erongo*. Windhoek: Namibia Coast Biodiversity Conservation and Management Project, Ministry of Environment and Tourism.
- Van Zyl, H.** 2005. Development of outcome indicators for monitoring and evaluation of economic benefits in the coastal zone of the NACOMA Project. Windhoek: Namibia Coast Biodiversity Conservation and Management Project, Ministry of Environment and Tourism.
- World Bank.** 2005. *Project appraisal document on a proposed grant from the Global Environment Facility Trust Fund to the Republic of Namibia for a Namib Coast Biodiversity Conservation and Management Project. Report No. 31307 – NA*. Washington, DC: World Bank.
- World Commission on Environment and Development.** 1987. *Our common future*. Oxford, UK: Oxford University Press.

GLOSSARY

Asset value of a natural resource ó The value of the natural resource as a capital asset, measured as the present value of the expected future stream of *resource rent* to be generated by that resource.

Backward linkage – The link between an enterprise or activity in the economy and another enterprise in the broader economy which is induced to supply factors or resources to that enterprise or activity, as a result of the presence of the enterprise or activity.

Biodiversity ó The diversity of biological resources, in terms of ecosystems, species and/or genetics; an object of conservation, as it is held to reflect various values, such as existence and option value, ecosystem health and ecosystem resilience.

Community ó Group of rural or urban residents that have formed a legal entity that has a defined membership, defined boundaries, and an elected body which represents the interests of the membership; or a group of Namibian citizens that have defined themselves as a community and by virtue of being formerly disadvantaged are being considered as beneficiaries.

Concession ó The rights ó whether full or restricted, or shared or exclusive ó to conduct tourism activities and/or to commercially use State-owned plant and/or animal resources (collectively referred to as *wildlife resources*) on business principles in proclaimed protected areas and any other State land for a specified period of time.

Consumer surplus ó The difference between the value which a consumer is willing to pay for a good or service, and the value s/he actually pays; this is a component of the economic value of the good or service.

Demersal ó Marine biological resources or species occurring in the bottom, or benthic, layer of the ocean water.

Direct GNI/Direct contribution to national income ó The annual contribution made to the national income by a specific enterprise activity or sector, *excluding* any indirect or induced effects through backward or forward linkages or multiplier effects.

Economic value ó In this report, analysis of the amount by which an activity or production unit changes the *national income*; costs and benefits are measured in terms of their *opportunity costs* to the national economy; involves some *shadow pricing* adjustments to the transaction values which measure private costs and benefits in *financial analysis*.

Epipelagic ó Marine biological resources or species that occur in the upper layers of the ocean.

Financial analysis ó In this report, analysis of the private transactions in a *production unit*, to measure the costs and benefits, return on investment, and profit accruing to the investor.

Forward linkage ó The links between an enterprise or activity in the economy and another enterprise in the broader economy which is induced to make use of, process, or market products from that enterprise or activity, as a result of the presence of the enterprise or activity.

Gross domestic product ó The measure of income earned by factors of production, owned by nationals or foreigners, within the geographic borders of the nation (see *national income*).

Gross national income ó The measure of the income earned, whether domestically or abroad, by factors of production owned by nationals (similar to *gross national product*) (see *national income*).

Income multiplier - The *multiplier* as it applies to *national income*.

Gross output or output ó In this study, the total annual value of goods and/or services produced by an enterprise or activity; the economic term for *turnover*.

Mariculture ó The production of marine biological resources, where the production process is controlled or manipulated at least in some way by the producer; the marine version of aquaculture.

Market price ó The value of cost or benefit as experienced by a production unit or enterprise, and reflected in an actual financial transaction; applied in financial analysis to determine the profit and/or the financial return on investment.

Multiplier effect ó In this report, the effect of the proportional increase in *national income* that occurs from each unit increase in new spending from some autonomous source such as private or Government investment, or the outside world (through exports); expressed as a factor and usually calculated using the *SAM*.

National accounts ó The compilation of accounts to derive estimates of the *national income*.

National income ó The total earnings of labour and property employed in the production of goods and services in a nation during some accounting period, usually a year; commonly measured by the *gross domestic product*, the *gross national product*, and the *gross national income*; measured either as the value of all expenditure on final goods and services, the value of all payments to factors of production, or the value of all *value added* by producing units.

Natural resources ó Natural animal or plant species and natural tourism attributes that can be used to derive a commercial value.

Opportunity cost ó The benefit forgone by using a scarce resource for one purpose instead of its next best alternative use.

Pelagic ó Marine biological resources or species that occur above the bottom, or benthic, layer, i.e. in the middle or upper layers of the ocean.

Production unit/enterprise ó An entity which invests capital to derive a return through production of goods or services.

Protected areas ó Areas proclaimed as national parks, game parks, recreational areas or similar areas in terms of Ordinance 4 of 1975 (as amended) and Ordinance 20 of 1973, and managed by the MET.

Regional Council ó A Regional Council as defined in the Regional Councils Act, 1992 (No. 22 of 1992).

Resource rent/economic rent ó The return a factor of production receives in excess of the minimum required to bring forth the service of the factor, or the surplus available in the *production unit* after accounting for the costs of production including a reasonable return to capital; *resource rent* is the economic rent generated from the use of a natural resource.

Semi-skilled worker – A worker with some basic vocational skills for which s/he is able to take responsibility, or a worker employed in a job for which basic vocational skills are necessary

Shadow price ó The value used in economic analysis for a cost or benefit of an activity, to represent to opportunity cost to the economy of the cost or benefit, when the *market price* does not correctly represent this opportunity cost.

Social accounting matrix (SAM) ó An economic input-output model of the national economy, used as a tool for impact analysis; expands the *national accounts* to show the linkages between production and generation of income, and between production and distribution of income.

Sustainable development ó Development which meets the needs of the present, without compromising the ability of future generations to meet their own needs.

Sustainable use ó The use of a renewable natural resource in a way, and at a rate, that allows for the regeneration of the same resource.

Total direct and indirect GNI/Total contribution to national income ó The annual contribution made to the *national income* by a specific enterprise activity or sector and, in addition, any indirect or induced effects through *backward* or *forward linkages* or *multiplier effects*; also referred to as *total economic impact*.

Turnover ó The total annual financial value of goods and/or services produced by an enterprise of activity; the financial term for *gross output*.

Unskilled worker ó A worker with no specific vocational skills, or a worker employed in a job where no specific vocational skills are necessary.

Value added ó The amount of economic value generated by the activity carried on within a production unit or enterprise; measured as the returns to, or income earned by, the internal factors of production in the production unit or enterprise (capital, labour and entrepreneurship); all value added in the economy amounts to its *national income*.

DIRECTORATE OF ENVIRONMENTAL AFFAIRS

Research Discussion Papers available in this series

1. Ashley, C. 1994. Population growth and renewable resource management: The challenge of sustaining people and the environment. *DEA Research Discussion Paper 1*. 40 pp.
2. Ashley, C, Barnes, J and Healy, T. 1994. Profits, equity, growth and sustainability: The potential role of wildlife enterprises in Caprivi and other communal areas of Namibia. *DEA Research Discussion Paper 2*. 25 pp.
3. Quan, J, Barton, D and Conroy, C (Ashley, C, ed.). 1994. A preliminary assessment of the economic impact of desertification in Namibia. *DEA Research Discussion Paper 3*. 150 pp.
 - a. Northern commercial areas: Okahandja, Otjiwarongo and Grootfontein. 33 pp.
 - b. Communal and commercial areas of southern Namibia. 42 pp.
 - c. Northern communal areas: Uukwaluudhi. 35 pp.
4. Ashley, C and Garland, E. 1994. Promoting community-based tourism development: Why, what and how?. *DEA Research Discussion Paper 4*. 37 pp.
5. Jones, BTB. 1995. Wildlife management, utilisation and tourism in communal areas: Benefits to communities and improved resource management. *DEA Research Discussion Paper 5*. 37 pp.
6. Barnes, JI. 1995. The value of non-agricultural land use in some Namibian communal areas: A data base for planning. *DEA Research Discussion Paper 6*. 21 pp.
7. Ashley, C, Müller, H and Harris, M. 1995. Population dynamics, the environment and demand for water and energy in Namibia. *DEA Research Discussion Paper 7*. 37 pp.
8. Barnes, JI and de Jager, JLV. 1995. Economic and financial incentives for wildlife use on private land in Namibia and the implications for policy. *DEA Research Discussion Paper 8*. 21 pp.
9. Rodwell, TC, Tagg, J and Grobler, M. 1995. Wildlife resources in Caprivi, Namibia: The results of an aerial census in 1994 and comparisons with past surveys. *DEA Research Discussion Paper 9*. 29 pp.
10. Ashley, C. 1995. Tourism, communities and the potential impacts on local incomes and conservation. *DEA Research Discussion Paper 10*. 51 pp.
11. Jones, BTB. 1996. Institutional relationships, capacity and sustainability: Lessons learned from a community-based conservation project, eastern Tsumkwe District, Namibia, 1991-1996. *DEA Research Discussion Paper 11*. 43 pp.
12. Ashley, C and Barnes, JI. 1996. Wildlife use for economic gain: The potential for wildlife to contribute to development in Namibia. *DEA Research Discussion Paper 12*. 23 pp.
13. Ashley, C. 1996. Incentives affecting biodiversity conservation and sustainable use: The case of land use options in Namibia. *DEA Research Discussion Paper 13*. 21 pp.
14. Jarvis, AM and Robertson, A. 1997. Endemic birds of Namibia: Evaluating their status and mapping biodiversity hotspots. *DEA Research Discussion Paper 14*. 103 pp.
15. Barnes, JI, Schier, C and van Rooy, G. 1997. Tourists' willingness to pay for wildlife viewing and wildlife conservation in Namibia. *DEA Research Discussion Paper 15*. 24 pp.

Continued overleaf ...

Other *Research Discussion Papers* in this series (continued)

16. Ashley, C, Barnes, JI, Brown, CJ and Jones, BTB. 1997. Using resource economics for natural resource management: Namibia's experience. *DEA Research Discussion Paper 16*. 23 pp.
17. Lange, GM, Barnes, JI and Motinga, DJ. 1997. Cattle numbers, biomass, productivity and land degradation in the commercial farming sector of Namibia, 1915 to 1995. *DEA Research Discussion Paper 17*. 28 pp.
18. Lange, GM. 1997. An approach to sustainable water management using natural resource accounts: The use of water, the economic value of water and implications for policy. *DEA Research Discussion Paper 18*. 39 pp.
19. Lange, GM and Motinga, DJ. 1997. The contribution of resource rents from minerals and fisheries to sustainable economic development in Namibia. *DEA Research Discussion Paper 19*. 32 pp.
20. Ashley, C and LaFranchi, C. 1997. Livelihood strategies of rural households in Caprivi: Implications for conservancies and natural resource management. *DEA Research Discussion Paper 20*. 96 pp.
21. Byers, BA (Roberts, CS, ed.). 1997. Environmental threats and opportunities in Namibia: A comprehensive assessment. *DEA Research Discussion Paper 21*. 65 pp.
22. Day, JA (Barnard, P, ed.). 1997. The status of freshwater resources in Namibia. *DEA Research Discussion Paper 22*. 46 pp.
23. OøToole, MJ (Barnard, P, ed.). 1997. Marine environmental threats in Namibia. *DEA Research Discussion Paper 23*. 48 pp.
24. Jones, BTB. 1997. Parks and resident peoples. Linking Namibian protected areas with local communities. *DEA Research Discussion Paper 24*. 39 pp.
25. Environmental Evaluation Unit, University of Cape Town (Tarr, JG, ed.). 1998. Summary report of a retrospective study of the environmental impacts of emergency borehole supply in the Gam and Khorixas areas of Namibia. *DEA Research Discussion Paper 25*. 27 pp.
26. Auer, C. 1998. Water availability and chemical water quality as important factors for sustainable wildlife management in the Etosha National Park and for domestic stock in farming areas of Namibia. *DEA Research Discussion Paper 26*. 30 pp.
27. Barnes, JI. 1998. Wildlife conservation and utilisation as complements to agriculture in southern African development. *DEA Research Discussion Paper 27*. 18 pp.
28. Blackie, R and Tarr, P. 1999. Government policies on sustainable development in Namibia. *DEA Research Discussion Paper 28*. 21 pp.
29. Blackie, R. 1999. Communities and natural resources: Trends in equitable and efficient use. *DEA Research Discussion Paper 29*. 20 pp.
30. Tarr, P. 2000. Knowledge, opinions and attitudes regarding Environmental Assessment in Namibia: Results of a national survey conducted in 1997. *DEA Research Discussion Paper 30*. 20 pp.
31. Simmons, RE, Barnes, KN, Jarvis, AM and Robertson, A. 1999. Important bird areas in Namibia. *DEA Research Discussion Paper 31*. 66 pp.

Continued overleaf ...

Other *Research Discussion Papers* in this series (continued)

32. Environmental and Geographical Science Masters Students, University of Cape Town (Blackie, R, ed.). 1999. A preliminary environmental assessment of Namibia's resettlement programme. *DEA Research Discussion Paper 32*, 29 pp.
33. Robertson, A and Jarvis, AM. 1999. Bird data in Namibia: A model for biodiversity information system development. Avifaunal database user manual. *DEA Research Discussion Paper 33*. 122 pp.
34. Tarr, P and Figueira, M. 1999. Namibia's Environmental Assessment framework: The evolution of policy and practice. *DEA Research Discussion Paper 34*. 20 pp.
35. Margules, CR (Barnard, P, ed.). 1999. Biodiversity planning and monitoring in Namibia. *DEA Research Discussion Paper 35*. 27 pp.
36. Nghileendele, NP and Uisso, V. 1999. The state of Namibia's freshwater environment. *DEA Research Discussion Paper 36*. [In print].
37. Nghileendele, NP and Uisso, V. 1999. The state of Namibia's socio-economic environment. *DEA Research Discussion Paper 37*. [In print].
38. McGann, JA. 1999. The Environmental Investment Fund: An initiative for the conservation and protection of the environmental and natural resource base of Namibia. *DEA Research Discussion Paper 38*. 57 pp.
39. McGann, JA. 1999. Towards the establishment of the Environmental Investment Fund: Opportunities, constraints, and lessons learned. *DEA Research Discussion Paper 39*. 47 pp.
40. Jones, BTB and Mosimane, A. 2000. Empowering communities to manage natural resources: Where does the new power lie? Case studies from Namibia. *DEA Research Discussion Paper 40*. 32 pp.
41. Corbett, A and Jones, BTB. 2000. The legal aspects of governance in CBNRM in Namibia. *DEA Research Discussion Paper 41*. 25 pp.
42. Barnes, JI, MacGregor, J and Weaver, LC. 2001. Economic analysis of community wildlife use initiatives in Namibia. *DEA Research Discussion Paper 42*. 20 pp.
43. Poonyth, D, Barnes, JI, Suich, H and Monamati, M. 2001. Satellite and resource accounting as tools for tourism planning in southern Africa. *DEA Research Discussion Paper 43*. 21 pp.
44. Suich, H. 2001. Development of preliminary tourism satellite accounts for Namibia. *DEA Research Discussion Paper 44*. 20 pp.
45. Krug, W, Suich, H and Haimbodi, N. 2002. Park pricing and economic efficiency in Namibia. *DEA Research Discussion Paper 45*. 31 pp.
46. Krugman, H. 2001. Fundamental issues and the threats to sustainable development in Namibia. *DEA Research Discussion Paper 46*. 50 pp.
47. Humavindu, MN. 2002. An econometric analysis of fixed investment in Namibia. *DEA Research Discussion Paper 47*. 22 pp.
48. Suich, H and Murphy, C. 2002. Crafty women: The livelihood impact of craft income in Caprivi. *DEA Research Discussion Paper 48*. 31 pp.

Continued overleaf ...

Other *Research Discussion Papers* in this series (continued)

49. Humavindu, MN. 2002. Economics without markets: Policy inferences from nature-based tourism studies in Namibia. *DEA Research Discussion Paper 49*. 23 pp.
50. Barnes, JI, Zeybrandt, F, Kirchner, CH and Sakko, AL. 2002. The economic value of Namibia's recreational shore fishery: A review. *DEA Research Discussion Paper 50*. 21 pp.
51. Purvis, J. 2002. Postharvest fisheries on the eastern floodplains, Caprivi. *DEA Research Discussion Paper 51*. 29 pp.
52. Purvis, J. 2002. Fish and livelihoods: Fisheries on the eastern floodplains, Caprivi. *DEA Research Discussion Paper 52*. 44 pp.
53. Long, SA. 2002. Disentangling benefits: Livelihoods, natural resource management and managing revenue from tourism. The experience of the Torra Conservancy, Namibia. *DEA Research Discussion Paper 53*. 22 pp.
54. Lange, G-M. 2003. The contribution of minerals to sustainable economic development: Mineral resource accounts in Namibia. *DEA Research Discussion Paper 54*. 29 pp.
55. Lange, G-M. 2003. The value of Namibia's commercial fisheries. *DEA Research Discussion Paper 55*. 19 pp.
56. Lange, G-M. 2003. National wealth, natural capital and sustainable development in Namibia. *DEA Research Discussion Paper 56*. 15 pp.
57. Murphy, C and Suich, H. 2003. Mashi Craft Market & Crafts and livelihoods in Caprivi. *DEA Research Discussion Paper 57*. 29 pp.
58. Abbott, J with Hay, C, Kalonga, M, Naesje, T and Purvis, J. 2003. The 2002 joint frame survey of fisheries of the Upper Zambezi River (Namibia/Zambia). *DEA Research Discussion Paper 58*. 39 pp.
59. Mulonga, S, Suich, H and Murphy, C. 2003. The conflict continues: Human wildlife conflict and livelihoods in Caprivi. *DEA Research Discussion Paper 59*. 29 pp.
60. Halstead, L. 2003. Making community-based tourism work: An assessment of factors contributing to successful community-owned tourism development in Caprivi. *DEA Research Discussion Paper 60*. 35 pp.
61. Murphy, C and Halstead, L. 2003. 'The person with the idea for the campsite is a hero': Institutional arrangements and livelihood change of community-owned tourism enterprises in Namibia. *DEA Research Discussion Paper 61*. 42 pp.
62. Mulonga, S. 2003. Wild food: Use of natural resources for food in eastern Caprivi. *DEA Research Discussion Paper 62*. 41 pp.
63. Mulonga, S and Murphy, C. 2003. Spending the money: The experience of conservancy benefit distribution in Namibia up to mid-2003. *DEA Research Discussion Paper 63*. 27 pp.
64. Murphy, C. 2003. Community tourism in Kunene: A review of five case studies for the WILD Project. *DEA Research Discussion Paper 64*. 27 pp.

Continued overleaf ...

Other *Research Discussion Papers* in this series (continued)

65. Li, BML and Vaughan, C. 2003. Social relations and water management: The impact of community-based water management in the *ǀKhoadi //Hôas* Conservancy of north-west Namibia. *DEA Research Discussion Paper 65*. 23 pp.
66. Krugmann, H, Cole, D and du Plessis, P. 2003. Access and benefit-sharing mechanisms for the use of botanical resources in Namibia. *DEA Research Discussion Paper 66*. 52 pp.
67. Schiffer, E. 2004. How does community-based natural resource management in Namibia change the distribution of power and influence? Preliminary findings. *DEA Research Discussion Paper 67*. 43 pp.
68. Bandyopadhyay, S, Shyamsundar, P, Wang, L and Humavindu, MN. 2004. Do households gain from community-based natural resource management? An evaluation of community conservancies in Namibia. *DEA Research Discussion Paper 68*. 21 pp.
69. Sutton, WR, Larson, DM and Jarvis, LS. 2004. A new approach to assessing the costs of living with wildlife in developing countries. *DEA Research Discussion Paper 69*. 21 pp.
70. Barnes, JI, Nhuleipo, O, Muteyauli, PI and MacGregor, J. 2005. Preliminary economic asset and flow accounts for forest resources in Namibia. *DEA Research Discussion Paper 70*. 20 pp.
71. Kirchner, CH and Stage, J. 2005. An economic comparison of the commercial and recreational line fisheries in Namibia. *DEA Research Discussion Paper 71*. 14 pp.
72. Fleermuys, FN. 2005. The balance of payment as a monetary phenomenon: An econometric study of Namibia. *DEA Research Discussion Paper 72*. 27 pp.
73. Turpie, J, Lange, G-M, Martin, R, Davies, R and Barnes, J. 2005. Namibia's protected areas: Their economic worth and the feasibility of their financing. *DEA Research Discussion Paper 73*. 22 pp.
74. Samuelsson, E and Stage, J. 2006. The size and distribution of the economic impacts of Namibian hunting tourism. *DEA Research Discussion Paper 74*. 13 pp.
75. Humavindu, MN and Barnes, JI. 2006. The identification and the quantification of 'best practice' in innovative financing for biodiversity conservation and sustainable use in Namibia. *DEA Research Discussion Paper 75*. 25 pp.
76. Ministry of Environment and Tourism and Ministry of Lands and Resettlement. 2007. Namibia: Land use planning and environmental sustainability ó Contributions to an analytical framework for sustainable land management. *DEA Research Discussion Paper 76*. 95 pp.
77. Alberts, M. and Barnes, JI. 2008. Sustainable tourism options for the coastal zone of Namibia. *DEA Research Discussion Paper 77*. 26 pp.
78. Barnes, JI and Alberts, M. 2008. Sustainable natural resource use on the coast of Namibia. *DEA Research Paper 78*. 32 pp.