

National Accounts



Environmental Economic Accounts

Fishery Accounts for South Africa: 1990–2010

Discussion document: D0405.0

February 2012



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Discussion document: **Fishery Accounts for South Africa: 1990–2010**

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Contents

List of tables	ii
List of figures	ii
List of abbreviations and acronyms	iii
Executive summary	1
Key findings	1
1. Introduction	2
2. Overview of the fishing industry in South Africa	2
3. Data availability	3
3.1 Physical data	3
3.1.1 Department of Agriculture, Forestry and Fisheries	4
3.1.2 University of Cape Town	5
3.1.3 Statistics South Africa	5
3.2 Monetary data	5
3.2.1 Statistics South Africa	5
3.2.2 Department of Agriculture, Forestry and Fisheries	6
4. Physical accounts for the South African fishing industry	7
4.1 Hake	7
4.2 West coast rock lobster	11
5. Monetary accounts for the South African fishing industry	14
5.1 Resource rent accounts	14
5.1.1 Department of Agriculture, Forestry and Fisheries	14
5.1.2 Statistics South Africa	15
6. Conclusion	16
7. References	17
8. Glossary	18

List of tables

Table 1:	Hake: physical accounts for South Africa, 1990–2010	8
Table 2:	West coast rock lobster: physical accounts for South Africa, 1990–2010	12
Table 3:	Hake: resource rent accounts for South Africa, 2004	14
Table 4:	All species: resource rent accounts for South Africa, 2008	15

List of figures

Figure 1:	Hake: closing stock (exploitable biomass) and catches, 1990–2010	9
Figure 2:	Hake: closing stock (exploitable biomass) and catches, 1917–2010	10
Figure 3:	West coast rock lobster: closing stock (exploitable biomass) and catches, 1990–2010	13

List of abbreviations and acronyms

AFS	Annual Financial Statistics
° S	Degrees South
DAFF	Department of Agriculture, Forestry and Fisheries
EEA	Environmental Economic Accounts
GDP	Gross domestic product
MARAM	Marine Resource Assessment and Management
OMP	Operational management procedure
SEEA	System of Integrated Environmental and Economic Accounts
SEEA-Fisheries	System of Integrated Environmental and Economic Accounts for Fisheries
SIC	Standard Industrial Classification of all Economic Industries
Stats SA	Statistics South Africa
SU-tables	Supply and Use tables
TAC	Total allowable commercial catch
UCT	University of Cape Town

Executive summary

South Africa has a well-established fishery industry. There are two branches within the fishing industry, i.e. wild capture fisheries, which range from highly-industrialised capital-intensive fishing industries, to more accessible fishing industries, which include subsistence fisheries and an aquaculture component¹. Although well-established, the South African fishery industry still faces challenges with one of the limitations the amount of natural resources, i.e. fish species available. While the fishing industry has experienced depletion and collapse of some fisheries, there is still a growing reliance on the resources as a source of food security for many communities¹.

As with all natural resources fisheries are a live supply that can be overexploited. When overexploited, it will hold several consequences for the environment, the economy and industries, as well as for the people who rely on it for substance and income for their families. There are various tools in place to ensure that the fisheries are not overexploited to the point where it is no longer considered viable as a commercial concern and thus have negative effects on the parties that rely on the fisheries for economic compensation, whether they are large scale commercial concerns or small scale fishermen that rely directly on the fishery for their livelihoods.

One of the tools to measure sustainable harvesting of fish stocks is fishery accounts. Fishery accounts have the ability to account for and measure the physical stocks of the fisheries. It is also the link to the sector of the economy that relies on these fisheries by providing a monetary value of the physical stock of various fisheries.

This updated fishery account will present the physical account for hake (*Merluccius paradoxus* and *M. capensis*) and west coast rock lobster (*Jasus lalandii*). These two fisheries account for about 80% of the economic contribution to the fishing industry in South Africa. The distinguishing feature of this discussion document is the added section where a more in-depth discussion takes place regarding resource rent and monetary accounts. In this section resource rent accounts are compiled from two different data sources; one is compiled for hake and the other for all fisheries.

Key findings

The closing stock (exploitable biomass) for hake (*M. paradoxus* and *M. capensis*) experienced fluctuations over the time period 1990 to 2010 (refer to Table 1). In 1990 the closing stock (exploitable biomass) was 577 thousand tons^a increasing to 654 thousand tons in 1996. Then the closing stock (exploitable biomass) decreased to 374 thousand tons in 2005 and from 2006 the levels of closing stock (exploitable biomass) began to increase to 519 thousand tons in 2010.

Closing stock (exploitable biomass) for west coast rock lobster (*J. lalandii*) has shown fluctuations over the time period 1990 to 2010. In 1990 the closing stock (exploitable biomass) was at 22 208 tons, reaching a peak of 26 325 tons in 2002 and declining to 23 165 tons in 2010 (refer to Table 2).

^a Tons are measured in metric units.

For the resource rent account calculated with data from Marine Resource Assessment and Management (MARAM)/Department of Agriculture, Forestry and Fisheries: Fisheries branch (DAFF-Fisheries) data, the output (turnover generated by catch) for hake (deep sea trawl) was R1 812 million in 2004. Intermediate consumption (deep sea trawl) was R634 million for the same reference period (refer to Table 3). For the resource rent account calculations, using Statistics South Africa (Stats SA) data the output (turnover generated by catch) for the fishing industry as a whole was R11 021 million in 2008 and intermediate consumption was R6 803 million for the same reference period (refer to Table 4). The social discount rates (SDR) of 10% and 20% have been used when estimating industry resource rents: 10% as a primary rate, and 20% as a sensitivity allowance to acknowledge the high risks in the fishing industry.

1. Introduction

The purpose of the discussion document is to present the updated physical fishery accounts for hake (*M. capensis* and *M. paradoxus*) and west coast rock lobster (*J. lalandii*). Monetary fishery accounts are also further explored and resource rent accounts are presented with data from DAFF-Fisheries and Stats SA. Results from the resource rent accounts are used in the construction of the monetary fishery accounts.

This discussion document starts with a brief overview of the fishing industry in South Africa where the 20 different commercial fisheries are mentioned. Section 3 provides details regarding the data that is used to compile the physical fishery accounts and the monetary data that is used to compile the resource rent accounts. In section 4 the actual physical fishery accounts for hake (*M. capensis* and *M. paradoxus*) and west coast rock lobster (*J. lalandii*) are presented and discussed. Section 5 includes a discussion of the monetary fisheries accounts along with the presentation of the resource rent accounts compiled from two different data sources namely, DAFF-Fisheries for hake (*M. capensis* and *M. paradoxus*) and Stats SA for all fisheries. In the System of Integrated Environmental and Economic Accounts for Fisheries (SEEA-Fisheries)², a detailed description of the methodologies used to compile the physical fishery accounts (Section 4) and the resource rent accounts (Section 5) are presented.

2. Overview of the fishing industry in South Africa

This section will discuss the main commercial fish species^b. Users of marine resources are divided into three major groups, recreational, subsistence and commercial users. Recreational users collect or catch fish and other marine species for leisure purposes. They include shore anglers, underwater fishers, shell fish and bait collectors, as well as recreational boat anglers. Subsistence fishers are mainly individuals located in rural areas who catch fish for own consumption. Commercial fisheries make up the formal fishing industry and range from relatively small-scale and labour intensive inshore fisheries to highly industrialised deep-water trawls.

^b The term Commercial fish species is the same as fisheries. The term fisheries (plural) or fishery (singular) shall be used.

According to DAFF-Fisheries, South Africa allocates fishing rights for the exploitation of 20 different commercial fisheries, including:

- Hake (*M. paradoxus* and *M. capensis*) deep-sea trawl;
- Hake (*M. paradoxus* and *M. capensis*) inshore trawl;
- Hake (*M. paradoxus* and *M. capensis*) handline;
- Hake (*M. paradoxus* and *M. capensis*) long-line;
- South coast rock lobster (*Palinurus gilchristi*);
- West coast rock lobster (*J. lalandii*);
- Abalone (*Haliotis midae*);
- Large pelagics – tunas (*Thunnus* sp.) and swordfish (*Xiphias gladius*);
- Small pelagics – anchovies (*Engraulidae capensis*) and pilchards (*Sardinops sagax*);
- Traditional linefish, which includes some 150 species of fish;
- Net fishing;
- White mussels (*Donax serra*);
- Oysters (*Crassostrea gigas*);
- Seaweed (*Ecklonia maxima*, *Laminaria pallida* and *Gracilaria* spp.);
- Squid (*Loligo vulgaris reynaudii*);
- Prawn trawl (*Penaeus indicus* and *Penaeus monodon*);
- Horse mackerel (*Trachurus trachurus capensis*) mid-water trawl;
- Patagonian toothfish (*Dissostichus eleginoides*);
- Tuna albacore (*Thunnus alalunga*) handline (pole); and
- Mariculture.

3. Data availability

This section discusses the data sources that were used to compile the physical accounts. It also investigates the available monetary data for possible future compilation of the monetary accounts.

3.1 Physical data

To compile the physical accounts the data was sourced from the DAFF-Fisheries and the University of Cape Town's (UCT) MARAM programme. The model used for the data compilation is briefly discussed below.

3.1.1 Department of Agriculture, Forestry and Fisheries

The Fisheries branch is a division within the DAFF, which is the regulatory authority responsible for managing all marine and coastal activities which includes:

- Allocation and management of fishing rights;
- Regulation of recreational fishing;
- Management of South Africa's marine protected areas;
- Protection and monitoring of South Africa's coastal and estuarine resources;
- Control of vehicle use on beaches;
- Promotion of fish farming or mariculture; and
- Research of fish stocks and advice on the status of fish stock.

DAFF-Fisheries employ scientists and technicians who conduct research on more than 200 species of fish each year. This data is used to advise the Minister of DAFF and for DAFF-Fisheries to determine the amount of fish that may be harvested from each of the 20 fisheries. DAFF-Fisheries employ the operational management procedures (OMP) database and use the OMP to manage the major marine fisheries³. The OMP approach is based on the precautionary principle, and derives total allowable commercial catch (TAC) using simulations run in Bayesian models^c that explicitly allow for scientific uncertainties. In each fishery a non-tradable quota is allocated as a share of the species TAC, which is annually adjusted in accordance with projections from the models. Data are perpetually inputted, thus iteratively improving estimates of historic fish stocks and allowing conditional estimates of current stocks and sustainable harvests. Such models have been in place for the major fisheries for some time:

- Hake, modelled jointly for the two sub-species, *M. capensis* and *M. paradoxus* since 1990;
- Small-pelagics, modelled jointly for pilchard (*Sardinops sagax*) and anchovy (*Engraulidae capensis*) since 1991; and
- West coast rock lobster (*J. lalandii*) since 1997.

South coast rock lobster (*P. gilchristi*) and Patagonian toothfish (*D. eleginoides*) OMP models are in the process of being developed.

An advantage of the system is that each OMP is rooted in an annual meeting at which modellers, scientists and commercial fishermen exchange views while working towards consensus on the estimates for the year. These values go into the model which is then further fine-tuned over the season. The longer the system runs, the more robust it becomes, provided the quality of the data input is maintained³.

^c In statistics, Bayesian model comparison is a method of model selection based on Bayes factors. It is commonly interpreted as an alternative to hypothesis tests.

Estimates of stocks and catches suited to use in the fishery physical accounts can be obtained through the OMP models run for all major fisheries. The OMP uses the most comprehensive and verifiable data. More to the point, these models operate over long periods, and permit backward induction to estimate pre-exploitation stock levels. Hence, they offer insight into the health of these resources, and into potential yields, which short period stock and harvest values would not provide³.

3.1.2 University of Cape Town

MARAM is a research unit within the Department of Mathematics and Applied Mathematics at UCT that carries out the quantitative analyses upon which scientific advice for catch levels for all of the major South African fisheries are based. MARAM runs the OMP for DAFF-Fisheries.

3.1.3 Statistics South Africa

Stats SA data could be obtained from the Census of Ocean (Marine) Fishing (1301-E) unpublished data⁴. The Census of Ocean (Marine) Fishing, which is conducted every five years and covers the activities of all enterprises that conduct ocean (marine) fishing for commercial purposes in South Africa for the financial year ended on any date between 1 July 2006 and 30 June 2007. There are approximately 388 units included in this census. The most valuable data that is collected through this questionnaire is relating to the type of fish caught, the quotas caught and the quotas allocated.

3.2 Monetary data

This section investigates the available monetary data that could be used to compile fishery monetary accounts in the future. Fishery monetary accounts use similar methodologies and data fields as mineral accounts. Refer to the SEEA-Fisheries² for more details on how these national accounting concepts are used to compile fishery monetary accounts. The following national accounting concepts are required to compile monetary accounts:

- Output;
- Intermediate consumption;
- Compensation of employees;
- Consumption of fixed capital; and
- Fixed capital stock.

The national accounting concepts mentioned above can be used to populate the asset accounts (industry assets)².

3.2.1 Statistics South Africa

In this section the monetary data sources that may be used to populate the fishery monetary and resource rent accounts are explored and discussed. The data is classified according to the Standard Industrial Classification of all Economic Industries (SIC) revision five⁵.

3.2.1.1 Gross domestic product

Monetary data can be sourced from the Gross domestic product (GDP) (Statistical release P0441)⁶. The specific national accounting concepts namely: Output at basic prices, intermediate consumption and compensation of employees are available from GDP statistical reports for SIC 1300 'Fishing and fish farming' only.

3.2.1.2 Annual Financial Statistics

The Annual Financial Statistics (AFS) (Statistical release P0021)⁷ provides the national accounting concepts of consumption of fixed capital and fixed capital stock. AFS data is available at SIC 1300 and SIC 3012 'Processing and preserving of fish and fish products'. The AFS is used to compile the Supply and Use tables (SU-tables), so it is better to make use of the AFS as it is a direct data source.

3.2.1.3 Supply and Use tables

Data for the SU-tables is taken from the Stats SA Report No.: 04-04-01, Final Supply and Use Table, 2005⁸.

The SU-tables are used to derive the annual GDP estimates. The SU-tables serve as a co-ordinating framework to ensure the numerical consistency and accuracy of data obtained from different sources (i.e. industrial surveys, households surveys, investment surveys and trade statistics). The SU-tables are also important in analysing and evaluating the performance of an economy over time.⁸

SU-tables provide monetary data at SIC 1310 'Ocean and costal fishing' while the GDP and AFS can only provide the data at SIC 1300. SU-tables provide a more disaggregated level of data, but then again the GDP and AFS can provide data for the specific national accounting concepts that are required for the compilation of the fishery monetary and resource rent accounts. At this point in time it would be feasible to make use of the GDP and AFS data to compile the fishery monetary and resource rent accounts at SIC 1300.

3.2.1.4 Census of Ocean (Marine) Fishing

Stats SA has a potential wealth of unit data in the Census of Ocean (Marine) Fishing (1301-E), unpublished data⁴. Although the unit data is only for the year 2007 it is disaggregated down to fish species. This data along with the monetary data from the DAFF-Fisheries could be used to set levels. The census questionnaire (1301-E, 2007) covers Environmental Economic Accounts (EEA) questions relating to water and electricity use in monetary terms by the fishing industries. This data can prove very useful for a fisheries account, but currently the data is not in the format that is required for the fishery monetary accounts. Currently, the data cannot be utilised, and it is only available for one year.

3.2.2 Department of Agriculture, Forestry and Fisheries

Monetary data from DAFF-Fisheries at this point is available from two data sets for the year 2004 only. The first data set is from DAFF-Fisheries (via the long-term rights allocation management process), where long-term rights and permits for 2004 to 2005 were issued. Applications required extensive firm-level information on historic effort, investment, and catches. The second is

from the OMP database managed by MARAM at the UCT, which is also the source of the physical data, as discussed above in the physical accounts section.

4. Physical accounts for the South African fishing industry

This section presents the updated physical fishery accounts for hake (*M. capensis* and *M. paradoxus*) and west coast rock lobster (*J. lalandii*). Only physical accounts for hake (*M. capensis* and *M. paradoxus*) and west coast rock lobster (*J. lalandii*) were compiled since these two commercial species (fisheries) account for 80% of the economic contribution to the fishing industry in South Africa. The data for these two commercial species is readily available and of high quality. The data for the physical account was sourced from MARAM. This data is used to populate the asset accounts (non-produced assets)².

4.1 Hake

Two species of hake occur off South Africa's coast: shallow water hake (*M. capensis*) and deep-water Cape hake (*M. paradoxus*). In both species there is a tendency for the mean size to increase with increasing depth; thus older (larger) *M. capensis* co-occur with, and prey upon, younger and smaller *M. paradoxus*⁹.

The physical accounts for hake (refer to Table 1) present data on opening stock, catches, other volume changes and closing stock (exploitable biomass). Catch data is disaggregated into offshore trawl, inshore trawl, long-line and handline. Closing stock (exploitable biomass) is disaggregated into two species of hake namely *M. capensis* and *M. paradoxus*. Closing stock (exploitable biomass) experienced fluctuations over the period from 1990 to 2010 (refer to Table 1). In 1990 the closing stock (exploitable biomass) was 577 thousand tons, increasing to 654 thousand tons in 1996. Closing stock (exploitable biomass) decreased to 374 thousand tons in 2005. From 2006 to 2010 the levels of closing stock (exploitable biomass) began to increase to 519 thousand tons in 2010.

Figure 1 shows the inverse relationship between catch data and the closing stock (exploitable biomass). In 2004 the catches started to decrease to a level of 154 thousand tons and continued this declining trend to 109 thousand tons in 2009. From 2006 the closing stock (exploitable biomass) for the combined species began to recover to a level of 382 thousand tons, increasing to 519 thousand tons in 2010. A better picture of the relationship between catch data and closing stock (exploitable biomass) can be seen by analysing the stock levels for an expanded time series. Figure 2 present the hake (*M. paradoxus* and *M. capensis*) closing stock (exploitable biomass) and catches from 1917 to 2010. With the expanded time series, one can observe the inverse relationship, i.e. as catch levels increase, the level of closing stock (exploitable biomass) decreases.

Table 1: Hake: physical accounts for South Africa, 1990–2010¹⁰

Year	Catches					Other volume changes	Closing stock (exploitable biomass)		
	Opening stock	Offshore trawl	Inshore trawl	Long-line	Handline		<i>Merluccius paradoxus</i>	<i>Merluccius capensis</i>	Species combined
1990	558	126	10	0	0	157	281	296	577
1991	577	129	8	3	1	154	286	305	591
1992	591	130	9	2	1	159	295	314	608
1993	608	132	9	0	0	151	293	324	618
1994	618	135	10	2	0	150	283	338	620
1995	620	128	11	2	1	152	293	339	632
1996	632	142	11	4	2	182	324	331	654
1997	654	133	9	4	1	138	320	325	644
1998	644	142	8	2	2	132	301	320	622
1999	622	119	9	7	3	84	255	313	568
2000	568	131	11	7	6	108	221	301	522
2001	522	134	12	6	7	111	201	274	475
2002	475	124	10	11	4	119	204	243	447
2003	447	130	10	12	3	146	214	224	438
2004	438	133	10	10	2	124	204	204	408
2005	408	125	8	11	1	110	190	184	374
2006	374	118	6	9	0	141	206	176	382
2007	382	126	6	8	0	182	242	180	422
2008	422	117	5	6	0	167	263	198	461
2009	461	96	6	7	0	141	263	229	492
2010	492	99	5	7	0	139	251	267	519

Calculations: Statistics South Africa.

Notes:

Where figures have been rounded, discrepancies may occur with totals.

Other volume changes are changes in fish stock, such as impacts of natural disasters and natural growth and decline.

Figure 1: Hake: closing stock (exploitable biomass) and catches, 1990–2010¹⁰

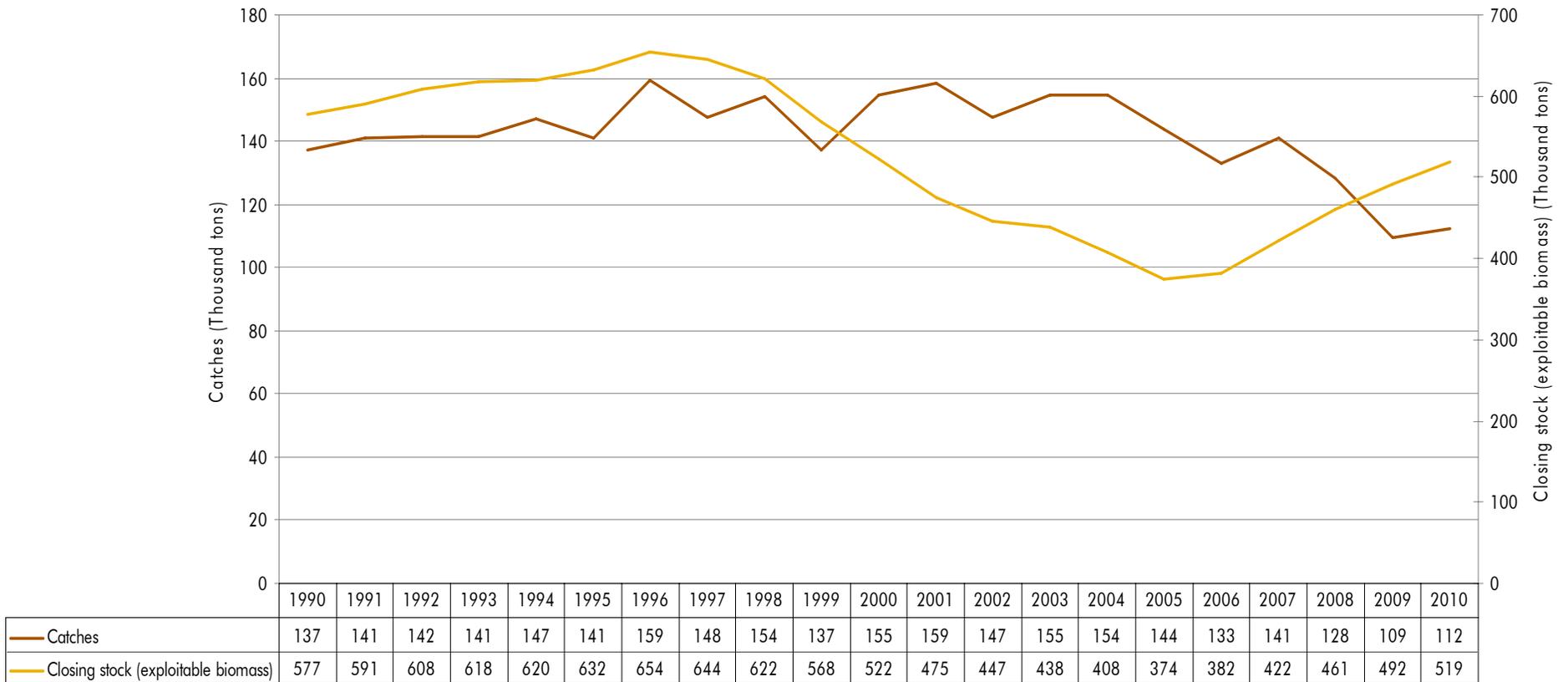
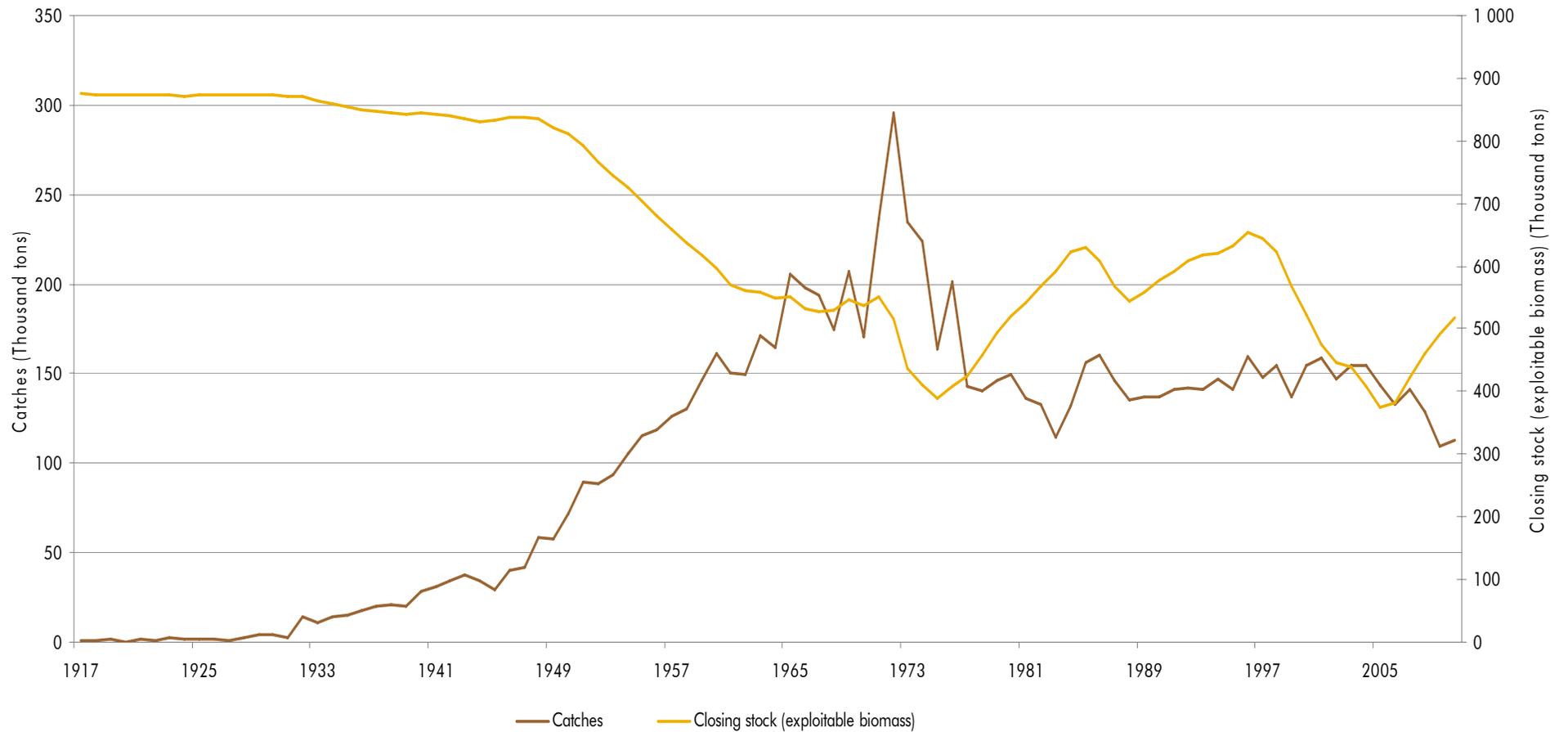


Figure 2: Hake: closing stock (exploitable biomass) and catches, 1917–2010¹⁰



4.2 West coast rock lobster

West coast rock lobster (*J. lalandii*) is distributed generally close to shore from about 23 degrees South ($^{\circ}$ S), just north of Walvis Bay in Namibia, to about 28 $^{\circ}$ S, near East London in South Africa. However, commercial densities are encountered only along the west coast from about 25 $^{\circ}$ S in Namibia to slightly east of the Cape of Good Hope in South Africa. The commercial fishery, which began in the early 1800s, is currently managed via a TAC, minimum size limit, closed seasons and defined fishing zones and areas⁹.

The physical accounts for west coast rock lobster (refer to Table 2) present data on opening stock, catches (commercial, recreational, poaching and subsistence), other volume changes and closing stock (exploitable biomass). In this discussion document, subsistence catch has been added to the account as a new sector that has been formed.

Closing stock (exploitable biomass) has shown stable fluctuations over the time period of 1990 to 2010. In 1990 the closing stock (exploitable biomass) was at 22 208 tons reaching a peak of 26 325 tons in 2002 and declining to 23 165 tons in 2010.

Figure 3 illustrates the inverse relationship between catches and closing stock. From 1990 to 1995 the catches decreased from 3 937 tons to 2 395 tons. Closing stock (exploitable biomass) over the same time period decreased to 18 068 tons in 1992 then started to show improvements to a level of 25 601 tons in 1997.

Table 2: West coast rock lobster: physical accounts for South Africa, 1990–2010¹⁰

Year	Opening stock	Commercial catch	Recreational catch estimate	Poaching estimate	Subsistence catch	Other volume changes	Closing stock (exploitable biomass) (>75mm)
	Tons						
1990	26 145	2 996	441	500	-	0	22 208
1991	22 208	2 480	159	500	-	901	19 970
1992	19 970	2 176	469	500	-	1 242	18 068
1993	18 068	2 197	391	500	-	3 356	18 336
1994	18 336	1 966	336	500	-	3 674	19 208
1995	19 208	1 516	379	500	-	4 621	21 434
1996	21 434	1 674	496	500	-	6 782	25 546
1997	25 546	1 918	340	500	-	2 812	25 601
1998	25 601	1 792	258	500	-	1 183	24 233
1999	24 233	2 315	286	500	-	2 362	23 494
2000	23 494	1 610	314	500	-	3 743	24 813
2001	24 813	2 073	336	500	-	3 446	25 351
2002	25 351	2 462	289	500	-	4 226	26 325
2003	26 325	2 917	341	500	-	2 311	24 879
2004	24 879	3 040	179	500	-	3 994	25 153
2005	25 153	1 998	293	500	-	1 572	23 934
2006	23 934	3 091	212	500	63	3 164	23 232
2007	23 232	1 863	261	500	174	67	20 500
2008	20 500	2 062	243	500	170	4 201	21 727
2009	21 727	2 022	216	500	278	2 582	21 292
2010	21 292	1 979	101	500	270	4 722	23 165

Calculations: Statistics South Africa.

Notes:

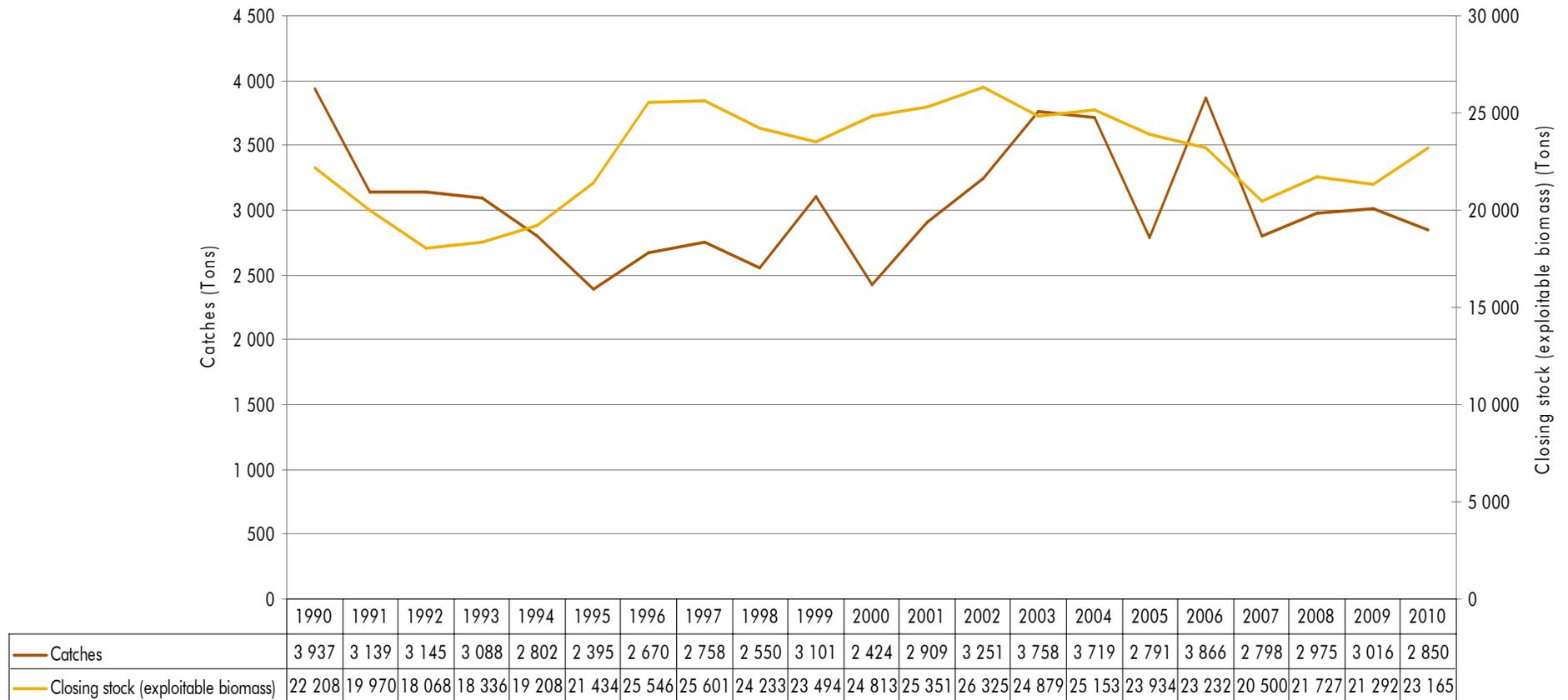
Poaching estimates remains constant due to lack of data.

Non-availability of data is indicated by a dash (-).

Where figures have been rounded, discrepancies may occur with totals.

Other volume changes are changes in fish stock, such as impacts of natural disasters and natural growth and decline.

Figure 3: West coast rock lobster: closing stock (exploitable biomass) and catches, 1990–2010¹⁰



5. Monetary accounts for the South African fishing industry

This section explores the fishery monetary and resource rent accounts. There will be an investigation into the possible data that is available to populate the monetary and resource rent accounts with the main sources being Stats SA and DAFF-Fisheries. Monetary data used in the monetary and resource rent accounts is used to populate the asset accounts (industry assets)². It is to be noted that there are not enough data available to develop a time series. The main purpose of this section is to find the best methods used to compile fishery monetary and resource rent accounts with the current data available. Due to data scarcity only resource rent accounts could be compiled.

5.1 Resource rent accounts

The first step in compiling monetary accounts is to compile the resource rent accounts. Below are the resource rent tables using DAFF-Fisheries data for 2004 (refer to Table 3) and Stats SA data for 2008 (refer to Table 4).

5.1.1 Department of Agriculture, Forestry and Fisheries

Using the monetary data from MARAM, the resource rent accounts were compiled for the reference year of 2004 for hake (*M. capensis* and *M. paradoxus*). Table 3 was extracted from the discussion paper Design, Compilation, and Interpretation of Satellite Accounts for South Africa's Fisheries³. The national accounting concepts that were calculated by Stats SA and added to the table are opportunity cost of capital and unit rent.

Table 3: Hake: resource rent accounts for South Africa, 2004³

	Deep sea trawl	Inshore trawl	Longline
	Rand millions		
Output (turnover generated by catch)	1 812	189	175
Intermediate consumption	634	66	61
Compensation of employees (total)	544	52	60
Consumption of fixed capital	114	3	57
Fixed capital stock	890	50	115
Opportunity cost of capital (SDR 10%)	89	5	11
Opportunity cost of capital (SDR 20%)	178	10	23
Rent (SDR 10%)	431	63	-15
Rent (SDR 20%)	342	58	-26
Unit rent (R/kg) (SDR 10%)	3	6	-2
Unit rent (R/kg) (SDR 20%)	2	6	-3

Calculations: Statistics South Africa from MARAM/DAFF-Fisheries data.

Note: Where figures have been rounded, discrepancies may occur with totals.

Social discount rates (SDR) of 10% and 20% have been used as those are the rates used in the discussion paper Design, Compilation, and Interpretation of Satellite Accounts for South Africa's Fisheries³, which also compiled fishery resource rent accounts. Two rates of return are applied when estimating industry rents: 10% as a primary rate, and 20% as a sensitivity allowance to acknowledge the high risks associated within the fishing industry³.

The monetary accounts are not complete at this time, as there is no time series, which is required to enable a full analysis of the monetary data.

5.1.2 Statistics South Africa

Making use of Stats SA data to compile the resource rent accounts, the following must be noted:

- Data from Stats SA is only available for 2008 for SIC 1300 and 3012, so tables for 2004 could not be compiled; and
- Data for SIC 1300 and 3012 for the reference year 2008 are only available at national aggregated levels, i.e. data cannot be disaggregated for each fish species as is the case with the MARAM data. GDP data is only available for SIC 1300, therefore Table 4 is populated with SIC 1300.

The data used to compile Table 4 was sourced from the GDP (output, intermediate consumption and compensation of employees)⁶. The national accounting concepts of consumption of fixed capital and fixed capital stock were sourced from AFS⁷. The national accounting concepts of opportunity cost of capital and rent were calculated; refer to the SEEA-Fisheries² for methods of calculations. Unit rent could not be calculated as there was insufficient physical data (catch data) for all species to complete the calculation.

Table 4: All species: resource rent accounts for South Africa, 2008^{6, 7}

	Total
	Rand millions
Output (turnover generated by catch)	11 021
Intermediate consumption	6 803
Compensation of employees (total)	1 876
Consumption of fixed capital	429
Fixed capital stock	5 630
Opportunity cost of capital (SDR 10%)	563
Opportunity cost of capital (SDR 20%)	1 126
Rent (SDR 10%)	1 350
Rent (SDR 20%)	787
Unit rent (R/kg) (SDR 10%)	-
Unit rent (R/kg) (SDR 20%)	-

Note: Non-availability of data is indicated by a dash (-).

Calculations: Statistics South Africa.

6. Conclusion

Fishery accounts are a useful tool for accounting for the physical stock for a particular fishery. They also provide the framework for calculating a monetary value of the physical stock through the resource rent and monetary accounts. With the need to manage the country's fish resources to ensure their sustainable use, further development of fishery accounts is important and of great value to provide indicators such as resource levels that impact on economic activity and food security. Due to the lack of data, it was not possible to compile monetary accounts in this discussion document. The main challenge is to ensure that the current available physical and monetary data are expanded.

Other suggested improvements include the following:

- Increase the number of fisheries, accounted for in the physical accounts. This is dependent on the availability of physical stock data.
- Monetary data that are disaggregated down to each fishery, so that the national accounting concepts used in the compilation of resource rent and monetary accounts can be extracted.

The suggested improvements will need additional input and analysis, and are dependent on data providers; hence no time frame is given at this point. If these requirements could however be achieved then it would greatly improve the usefulness of the fisheries accounts.

As with all the other EEA accounts compiled at Stats SA, there is a reliance on the various government departments responsible for different sectors for the use of the data they administer. Continuous work would be needed to strengthen the current working relationship between DAFF-Fisheries and Stats SA to ensure a continued data supply for the fishery accounts.

7. References

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8. Glossary

Term	Description
Account	An account is a tool which records, for a given aspect of economic life, (a) the uses and resources or (b) the changes in assets and the changes in liabilities and/or (c) the stock of assets and liabilities existing at a certain time; the transactions accounts include a balancing item which is used to equate the two sides of the accounts (e.g. resources and uses) and which is a meaningful measure of economic performance in itself.
Bayesian model	In statistics, Bayesian model comparison is a method of model selection based on Bayes factors. It is commonly interpreted as an alternative to hypothesis tests.
Commercial fishing	Commercial fishing refers to the harvesting of fish, either in whole or in part, for sale, barter or trade.
Environmental Economic Accounts (EEA)	EEA brings together economic and environmental information in a common framework to measure the contribution of the environment to the economy, and the impact of the economy on the environment.
Environmental indicator	An environmental indicator is a parameter, or a value derived from parameters, that points to, provides information about and/or describes the state of the environment, and has a significance extending beyond that directly associated with any given parametric value. The term may encompass indicators of environmental pressures, conditions and responses.
Exploitable biomass	Refers to that portion of a stock's biomass that is available to the fishing gear.
Fisheries	The industry or occupation devoted to the catching, processing, or selling of fish, shellfish, or other aquatic animals. A fishery is typically defined in terms of the 'people involved, species or type of fish, area of water or seabed, method of fishing, class of boats, purpose of the activities or a combination of the foregoing features'.
Monetary accounts	Accounts expressed in monetary terms, using only currency as the unit of measure. Monetary is to be taken as synonymous with 'economic value' as understood in economic theory.
National accounts	National accounts are a coherent, consistent and integrated set of macroeconomic accounts; balance sheets and tables based on a set of internationally agreed concepts, definitions, classifications and accounting rules. National accounts provide a comprehensive accounting framework within which economic data can be compiled and presented in a format that is designed for purposes of economic analysis, decision-taking and policy-making.

Term	Description
Natural Resource Accounting	Natural Resource Accounting is an accounting system that deals with stocks and stock changes of natural assets, comprising biota (produced or wild), subsoil assets (proved reserves), water and land with their aquatic and terrestrial ecosystems. It is frequently used in the sense of physical accounting as distinguished from monetary (environmental) accounting.
Natural resources	Natural assets (raw materials) occurring in nature that can be used for economic production or consumption. The naturally occurring assets that provide use benefits through the provision of raw materials and energy used in economic activity (or that may provide such benefits in future) and that are subject primarily to quantitative depletion through human use are subdivided into four categories: mineral and energy resources, soil resources, water resources and biological resources.
Operational management procedure (OMP)	OMP is analogous to a management procedure, except that this term is typically reserved to signify management procedures that have actually been implemented, in contrast to the ones that are conceptual only.
Pelagic	Relates to communities of marine organisms that belong to the open sea, living free from direct dependence on the sea bottom or shore.
Physical accounting	Natural resource and environmental accounting of stocks and changes in stocks in physical (non-monetary) units, for example, weight, area or number. Qualitative measures, expressed in terms of quality classes, types of uses or ecosystem characteristics, may supplement quantitative measures. The combined changes in asset quality and quantity are called volume changes.
Satellite accounts	Satellite accounts provide a framework linked to the central accounts, which enables attention to be focused on a certain field or aspect of economic and social life in the context of national accounts: common examples are satellite accounts for the environment, tourism or unpaid household work.
Spawning biomass	The total weight of all sexually mature fish in a population.
System of Integrated Environmental and Economic Accounts (SEEA)	Satellite system of the System of National Accounts proposed by the United Nations for the incorporation of environment concerns (environmental costs, benefits and assets) into national accounts.
Trawl	A conical fishnet dragged through the water at great depths.