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Final Certification Report for

South African Hake Trawl Fishery

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CONTENTS

1 INTRODUCTION 5

1.1 THE FISHERY PROPOSED FOR CERTIFICATION 5
1.2 REPORT STRUCTURE AND ASSESSMENT PROCESS 5
1.3 INFORMATION SOURCES USED 6
1.4 THE TRANSFORMATION PROCESS WITHIN SOUTH AFRICA 10

2 BACKGROUND TO THE FISHERY 11

2.1 BIOLOGY OF THE TARGET SPECIES 11
2.2 HISTORY OF THE FISHERY 12
2.3 FISHING FLEET 14
2.4 FISHING LOCATIONS AND ADMINISTRATIVE BOUNDARIES 15
2.5 OTHER FISHERIES RELEVANT TO THIS ASSESSMENT 16
2.6 ECOSYSTEM CHARACTERISTICS 16
2.7 BY-CATCH AND DISCARD 17
2.8 INTERACTIONS WITH RARE, PROTECTED OR ICON SPECIES 18

3 ADMINISTRATIVE CONTEXT 19

3.1 LEGISLATION 19
3.2 MANAGEMENT RESPONSIBILITIES AND INTERACTIONS 19
3.3 RIGHTS ISSUES 20

4 STOCK ASSESSMENT 21

4.1 MANAGEMENT UNIT 21
4.2 MONITORING OF STOCK STATUS 22
4.3 MODELLING 23
4.4 MANAGEMENT ADVICE 25

5 FISHERY MANAGEMENT 26

5.1 MANAGEMENT OBJECTIVES 26
5.2 MANAGEMENT MEASURES 26
5.3 MONITORING, CONTROL AND SURVEILLANCE 27
5.4 CONSULTATIVE PROCESS 27

6 STANDARD USED 28

6.1 MSC PRINCIPLES AND CRITERIA USED FOR THE EVALUATION; 28

PRINCIPLE 1 28

PRINCIPLE 2: 28

PRINCIPLE 3: 29

7 BACKGROUND TO THE ASSESSMENT 32

7.1 EVALUATION TEAM; 32
7.2 PREVIOUS CERTIFICATION EVALUATIONS 33

8 THE ASSESSMENT PROCESS 33

8.1 INSPECTIONS OF THE FISHERY 33
8.2 STAKEHOLDER CONSULTATION 34
8.3 STAKEHOLDER ISSUES 34
8.4 PEER REVIEW 35
8.5 STAKEHOLDER FEEDBACK ON DRAFT REPORT 36

9 OBSERVATIONS AND SCORING 37

9.1 INTRODUCTION TO SCORING METHODOLOGY 37

9.2 EVALUATION RESULTS 38

10 LIMIT OF IDENTIFICATION OF LANDINGS FROM THE SOUTH AFRICAN HAKE TRAWL FISHERY 39

11 CERTIFICATION RECOMMENDATION 39

11.1 CERTIFICATION RECOMMENDATION 39
11.2 SCOPE OF CERTIFICATION 39
11.3 PRE-CONDITIONS, CONDITIONS OR RECOMMENDATIONS ASSOCIATED WITH CERTIFICATION 39

12 AGREEMENT 43

12.1 APPLICANT'S AGREEMENT TO MEET SPECIFIED CONDITIONS. 43

11 APPENDICES 45

12.1 PEER REVIEW REPORTS (IN ALPHABETICAL ORDER) 45

1 INTRODUCTION

This report sets out the results of the assessment of the South African hake trawl fishery against the Marine Stewardship Council Principles and Criteria for Sustainable Fishing.

1.1 The fishery proposed for certification

Species: Two species are targeted, deep-water hake *Merluccius paradoxus* and the shallower (warmer) water species *M. capensis*. Both species may be taken by the same fishers. The stock assessment methodology is described below and this evaluates the two species as combined stocks and a single TAC is established. However, the two-species complex is subject on ongoing refinement and it is anticipated that future stock assessments would move towards evaluating the two species separately.

Geographical area: Of the two species, *M. capensis* is mostly targeted on the south coast. For *M. paradoxus* and *M. capensis* there is some overlap between South African and Namibian populations. However, both South African and Namibian stocks respond separately to management interventions and so, although mixing will inevitably occur, from a fishery management perspective the South African hake populations may be considered as a discrete stock. Certification would therefore consider the South African stocks alone.

Method of capture:. Trawl fishery only. The entire inshore and offshore trawl sector is included in this assessment. However, no assessment is made here of the management of hake line fisheries or hake fisheries outside the South African EEZ.

Management system: The management system is applied by the Department of Environmental Affairs and Tourism: Marine and Coastal Management (MCM).

1.2 Report Structure and Assessment Process

The aims of the assessment are to determine the degree of compliance of the fishery with the Marine Stewardship Council (MSC) Principles and Criteria for Sustainable Fishing, as set out in Section 5. It must be stressed that this assessment is concerned **only** with the fishery defined above.

This report firstly sets out:

- the background to the fishery under assessment
- the qualifications and experience of the team undertaking the assessment
- the standard used (MSC Principles and Criteria)
- Stakeholder consultation carried out. Stakeholders include all those parties with an interest in the management of the fishery and include fishers, management bodies, scientists and Non-Governmental Organisations (NGO's)

Section 9 of the report sets out the methodology used to assess ('score') the fishery against the MSC Standard. The scoring table then sets out the Scoring Indicators adopted by the assessment team and Scoring Guidelines which aid the team in allocating scores to the fishery. The commentary in this table then sets out the position of the fishery in relation to these Scoring Indicators.

The intention of the earlier sections of the report is to provide the reader with background information to interpret the scoring commentary in context.

As a result of the scoring, the Certification Recommendation of the assessment team, that the fishery be certified, is presented, together with conditions attached to certification.

In draft form, this report has been subject to public scrutiny on the MSC website and critical review by appropriate, independent, scientists ('peer review'). The comments of these scientists are appended to this report.

The report, containing the recommendation of the assessment team, further stakeholder comments and the peer review comments were then considered by the Moody Marine Governing Board (a panel of experts independent of the assessment team). The Governing Board then made the final certification determination on behalf of Moody Marine. The result of this determination is that the fishery be certified.

It should be noted that, in response to comments by peer reviewers, stakeholders and the Moody Marine Governing Board, some points of clarification have been added to this final report.

1.3 Information sources used

Information used in the main assessment has been obtained from interviews and correspondence with stakeholders in the trawl fishery, notably:

I1. South African Deep-Sea Trawl Industry Association (SADSTIA)
The client, representing the majority of trawl fishing companies.
- R Bross
- T Reddell

I2. University of Cape Town (UCT)
Personnel responsible for hake stock assessment under contract to MCM
- D Butterworth
- R Rademeyer
- E Plaganyi

I3. Marine and Coastal Management (MCM)
The fishery and environmental management authority
- H Kleinschmidt
- P Buthelezi
- J Augustyn
- A Naidoo
- T Akkers
- R Leslie
- R Cooper
- F LeClus
- S du Plessis
- C Attwood
- L Shannon
- P Goosen
- J David
- P Sims
- J Glazer

I4. Vuna Fishing
A progressive and recently formed empowerment company involved in inshore trawl fishing, Mossel Bay
- A Hendricks

I5. Viking Fishing
An established inshore trawl fishing company, Mossel Bay
- C Bacon
- W Villet

I6. I&J
One of the two largest trawl fishing companies, Cape Town
- M Burton
- B Rose
- C Atkins
- T Reddell

I7. Sentinel
Representing the smaller deep-water trawl fishing companies based in Cape Town
- A Weimar
- G Weimar
- H Europa

I8. WWF-SA/Birdlife International
Representing stakeholders on nature conservation issues.
- R Little
- D Nel
- L-D Viljoen
- A Govender (UCT, consultant to WWF)

Other information sources:

Published information and unpublished reports used during the assessment are listed below:

R1. BENEFIT. April 97. Science Plan.
R2. Bergh M O & Barkai A. Sept 99 . Yield per recruit analyses for the South Coast hake resource: trawling compared to longlining. WG/09/99/D:H:25
R3. Bross C A R South African Deep-Sea Trawling Industry Association – The use of liner and 75mm cod-end mesh in the hake fishery since 1975 WG/05/98/D:H:26
R4. Bross R. 1998. Concentration in the South African Trawling Industry an Economic History.
R5. Brown J P, & Butterworth D S. Summary of the Status of the Simulation Exercise to address the By-catch Issue in the West Coast Hake Data. WG/06/97/D:H:30
R6. Brown J P, & Butterworth D S. Addressing the By-Catch issue in a GLM Context. WG/01/97/D:H:02
R7. Butterworth D S & Geromont H F A Dec 99 "Constant Selectivity" approach to incorporate trawl discards into the operating model for the South Coast *Merluccius capensis* Fishery WG/12/99/D:H:47
R8. Butterworth D S & Rademeyer R A. A Note on the Adjustment to the TAC for West Coast Hake to make allowance for South Coast *M. paradoxus* catches.
R9. Butterworth D S & Rademeyer R A. March 02. Sustainable Management Initiatives for the Southern African Hake Fisheries Over Recent Years..

R10. Butterworth, Punt A E, Oosthuizen W H & Wickens P A. 1995. The effects of future consumption by the Cape Fur Seal on catches & catch rates of the Cape Hake. 3. Modelling the dynamics of the Cape Fur Seal *Arctocephalus pusillus pusillus*. S Afr J mar. Sci 16:161-183

R11. Demersal Working Group. Concerns of the Demersal Working Group regarding the interruption of data series and the deterioration in data quality for hake fisheries management purposes. WG/04/00/D:H:&7

R12. Demersal Working Group. Feb 2001 Demersal Data Capture. Data Year – 2000. WG/02/01/D:03

R13. Demersal Working Group Science Meeting 28 May 1998 Discussion Doc – An evaluation of selected demersal trawl regulations WG/05/98/D:32

R14. Demersal Working Group. Proposal for adjusting the West Coast OMP to take account of South Coast paradoxus. WG/06/00/D:H:16

R15. Department of Environmental Affairs & Tourism. Total Allowance Catch (TAC) for the 2002 Hake Season. V1/20/5/1/2

R16. Department of Environmental Affairs & Tourism. Total Allowance Catch (TAC) for the 2001 Hake Season. V1/20/5/1/2

R17. Department of Environmental Affairs & Tourism. Hake Total Allowable Catch (TAC) for the Year 2000.V1/20/5/1/2 (161/99)

R18. Department of Environmental Affairs & Tourism. Application for the Grant of a Right in Terms of Section 18 of the Marine Living Resources Act, 1998 (Act No 18 of 1998) ("THE ACT").

R19. Department of Environmental Affairs & Tourism. Where have all the fish gone?.

R20. Department of Environmental Affairs & Tourism Marine and Coastal Management June 2000. Proposed Revised Operational Management Procedures for South Coast Hake.

R21. Department of Environmental Affairs & Tourism Marine and Coastal Management August 2000. Recommendations to the Consultative Advisory Forum for the Hake TAC for 2001.WG/06/00/D:H:19

R22. Department of Environmental Affairs & Tourism Marine and Coastal Management. November 2002. Recommendation on the Hake TAC for 2003.WG/11/02/D:H:27

R23. Department of Environmental Affairs & Tourism Sea Fisheries Research Institute June 1998. A revised OMP for the West Coast Hake Resource and a Recommended Hake TAC for 1999. WG/06/98/DH:37

R24. Department of Environmental Affairs & Tourism Sea Fisheries Research Institute. June 1997. Recommendation to the Sea Fisheries Advisory Committee for a Revised Hake TAC for 1997.WG/05/97/D:H:15

R25. Department of Environmental Affairs and Tourism. Policy Guidelines with regard to applications for the granting of rights in terms of the Marine Living Resources Act 18 of 1998.

R26. Department of Environmental Affairs and Tourism. July 2001. Government Gazette Staatskoerant. Vol. 433 No 22517

R27. Department of Environmental Affairs and Tourism Aerial Surveys of Seal Pups: South Africa and Namibia

R28. Department of Environmental Affairs and Tourism, Marine and Coastal Management, Survey based biomass records of by-catch species (non Commercial) in the hake trawl fishery

R29. Department of Environmental Affairs and Tourism, Marine and Coastal Management, October 2001. Recommendation to the Consultative Advisory Forum for the Hake TAC for 2002

R30. Department of Environmental Affairs and Tourism, Marine and Coastal Management, October 2001. Recommendation to the Consultative Advisory Forum for the Hake TAC for 2001

R31. Department of Ichthyology and Fisheries Science, Rhodes University. By-catches and Discards in the South African Demersal Trawl Fishery: 1. A Brief Description of the

Observer Programme.
R32. Department of Ichthyology and Fisheries Science, Rhodes University. By-catches and Discards in the South African Demersal Trawl Fishery: 2. A Preliminary Analysis of the Economic Importance of By-catch..
R33. Department of Ichthyology and Fisheries Science, Rhodes University. By-catches and Discards in the South African Demersal Trawl Fishery: 3 Some Concerns Regarding the Sustainability of Current Practices.
R34. Geromont H F & Butterworth D S. April 1998. Initial Evaluation of a Range of Possible Management Procedures for West Coast Hake. WG/04/98/D:H:18
R35. Geromont H F & Butterworth D S. April 1998. Initial Management Procedure Robustness Trials for West Coast Hake. WG/04/98/D:H:20
R36. Geromont H F & Butterworth D S. April 2000. Initial set of candidate management procedures proposed for south coast *Merluccius capensis* east of 20°E. WG/04/00/D:H:9
R37. Geromont H F & Butterworth D S. June 1998. Management Procedure Robustness Trials for West Coast Hake. WG/06/98/D:H:24
R38. Geromont H F & Butterworth D S. June 1998. Addendum to: Management Procedure Robustness Trials for West Coast Hake. WG/06/98/D:H 36
R39. Geromont H F & Butterworth D S. May 1999. A Fleet-disaggregated Age-structured Production Model applied to the South Coat Hake fishery for *Merluccius capensis* and *M. paradoxus*. WG/05/99/D:H:01
R40. Geromont H F & Butterworth D S. February 2000. Final set of operating models proposed for south coast *Merluccius capensis*. WG/02/00/D:H:3
R41. Geromont H F & Butterworth D S. June 2000. Candidate management procedure robustness trials for south coast *Merluccius capensis* east of 20°E. WG/06/00/D:H:12
R42. Geromont H F & Butterworth D S. November 1998. The 1998 Revised Management Procedure for the South African West Coast Hake Resource. WG/211/98/D:H:49
R43. Geromont H F & Glazer J P. June 2000. The 2000 revised management procedure for the South African south coast *Merluccius capensis* resource. WG/06/OO/D:H:20
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R45. Glazer Jean. The West Coast hake standardized CPUE Series (1978-1999). WG/06/00/D/H:14
R46. Glazer J B & Butterworth D S. Quantifying Capacity in the Demersal Hake-Directed Offshore Fishery. WG/02/02/D:H:01
R47. Grant W S, Leslie R W & Becker I I. Genetic stock structure of the southern African hakes *Merluccius capensis* and *M. paradoxus.* Marine Ecology Progress Series Vol 41:9-20,1987
R48. Heyns H J. February 2003. Observer Trip Sheet "Boronia".
R49. Irvin & Johnson. July 2001. Irvin & Johnson Ltd (Trawling Division).
R50. Irvin & Johnson. Mar-03. Daily Catches (09/03/03).
R51. Japp D W. Summary of the Hake Fishery in 1996 and Catch Reconciliation. WG/05/97/D:H:13
R52. Japp D W. Distribution, Abundance and Comments on the Exploitation of Hake in 1992. WG/05/93/D:H:10
R53. Japp D W, Sims P, and Smale M J. March 1994.A review of the fish resources of the Agulhas Bank. South African Journal of Science Vol 90
R54. Japp, D W. December 1994. List of completed and pending demersal working group documents for 1994..
R55. Jarre-Teichmann A, Shannon L J, Moloney C L, Wickens P A. December 1997. Comparing Trophic Flows in the Southern Benguela to those in other Upwelling Ecosystems. S Afr. J. Mar Sci. 19: 391-414
R56. Johnson S J. Data and basic assumptions for the 2001 assessment of the Horse Mackerel resource.
R57. Johnson S J & Butterworth D S. Updated projections of the South African Horse Mackerel

resource. WG/10/02/D:HM
R58. Johnson S J & Butterworth D S. Future horse mackerel spawning biomass projections for different future pelagic and demersal catch scenarios. WG/03/02/D:H:HM1
R59. Johnson S J & Butterworth D S. Appendix to WG/03/02/D:HM1.
R60. Leslie R. Data available for West Coast Hake Assessments. WG/01/97/D:H:03
R61. Leslie R. October 2001 List of demersal working group documents for 2002
R62. Leslie R W. November 2002. List of demersal working group documents for 2000.
R63. Leslie R W. November 2002. Recommendation on the Agulhas Sole TAC for the year 2003
R64. Mori M & Butterworth D S. October 2002. An Updated Assessment for the South African Kingklip Resource. WG/10/01/D:KK:19
R65. Olivier R. February 2003. Observer Trip Sheet "Harvest Veronica".
R66. Punt A E & Leslie R W. February 1991. Estimates of some Biological Parameters for the Cape Hakes off the South African West Coast. S Afr J mar. Sci 10:271-284
R67. Rademeyer R A & Butterworth D S. October 2002. An Age-Structured Production Model applied to the Merluccius paradoxus Hake resource off the South and West Coasts. WG/10/02/D:H:16
R68. Shannon L J, Cury, P M & Jarre A.. Modelling effects of fishing in the Southern Benguela Ecosystem. ICES Journal of Marine Sci 57 720-2000
R69. Shannon L J, Moloney C L, Jarre A, Field J G. September 2003. Trophic flows in the Southern Benguela during the 1980 and 1990's. Journal of Marine Systems 39
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R73. South African Government. May 1997. A Marine Fisheries Policy for South Africa. White Paper
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R75. Sutton Glen & Sauer W. Estimating proportions of *Merluccius capensis* & *paradoxus* in commercial trawl catches from their spatial distributions off South Africa's southeast coast. WG/04/00/D:H:6
R76. Tilney R, September 2000. List of demersal working group documents for 2000.
R77. The South East Coast Inshore Fishing Association (SECIFA). June 2001. Discussion Document on the Management and Allocation procedures for the Inshore Trawl Hake and Sole Directed Fisheries Sector. Inshore Trawl Rule Book
R78. 2003. Assessment of the South African west coast hake resource.
R79. March 2003. Hake and Trawl by-catch reference list.
R80. Permit Conditions,: Inshore Trawl (Hake and Sole) 2002 Section B.

1.4 The transformation process within South Africa

The allocation of fishing rights in the hake sector and the introduction of quotas was first started in South Africa in 1978. Over time the process has evolved and in 1986 a special commission was appointed by the then Minister of the Environment to investigate the fisheries allocation process (The Diemont Commission). Judge Diemont gave considerable thought to access rights and related matters and proposed that the allocation of quotas be entrusted to a statutory board. This recommendation was accepted by the Government by way of its 1986 White Paper and the Sea Fishery Act, 1988 made provision for the establishment of a Quota Board. The first Board became operative in 1990.

The chairman of the board had to meet certain requirements in respect of a legal background and no person with interests in the fishery could serve. The Act also stipulated that "a person in the employment of the State" may not serve on the Board. Notwithstanding the fact that politicians are not regarded as being in the employment of the State, their appointment would be contrary to the

aims of the Board, *namely to remove quota allocation from the political arena*. The Board's function consisted of the allocation of quota to persons according to guidelines approved by the Minister. The Quota Board could attach conditions to its quota allocations and no quota could be transferred without the Board's approval. The Board exerted control over access rights in the hake, Agulhas sole, pilchard, anchovy, West Coast rock lobster, South Coast rock lobster and abalone sectors.

The New Fisheries Policy Objectives that were started after democratic elections in South Africa in 1994 introduced a new dynamic to the allocation process and extracts from this policy stated:

"*Marine resources are by definition a national asset and the heritage of all citizens. However, in order to ensure the sustainability of the resource, it is necessary to limit harvesting levels, and therefore access to the resource. Limiting entry creates a privileged group of sectoral actors who enjoy access to living marine resources, in contrast to all other South Africans who do not. In South Africa, access to these resources has not always been fair and equitable. As a result, the industry is faced with numerous problems which even threaten the sustainability of the resource itself*".

Other broad policy objectives included the following:

- Broadening access
- The promotion of small and medium enterprises within the context of creating a globally competitive industry
- Current holders of fishing rights will be encouraged to restructure their ownership and control to achieve empowerment objectives throughout the industry
- Initial allocation of rights should make provision for a range of players of varying sizes, to avoid excessive domination of some fisheries by a few large players, but avoiding excessive proliferation of the industry which would reduce the ability of the State to effectively regulate it.

Policy development (including the sensitive issue of access rights) in South African fisheries is ongoing. The new Marine Living Resources Act remains the cornerstone of South Africa's fisheries development although there have been shifts in strategy. Presently there are initiatives to form a "Rights Allocation Unit" whose primary objective will be to advise the Authorities on the objective allocation of medium and long-term commercial fishing rights

2 BACKGROUND TO THE FISHERY

2.1 Biology of the Target Species

The biology of the Cape hakes has been well researched and there is a clear scientific understanding of the morphometric and genetic differences between the two species (*M. paradoxus* and *M. capensis*).

The spatial and temporal distribution ranges of both species are also clearly identified. The shallow water hake is found predominantly on the South African south coast from 30 m to about 400 m and the deepwater hake *M. paradoxus* from about 250 m water depth to about 600 m. The two species overlap in their distribution in approximately the depth ranges 250-400 m and both species are found around the entire South African coast. The deepwater species is the mainstay of the offshore (or deep-sea) trawl fishery, and the shallow water species the target of the inshore trawl fishery.

The general biology of the two South African commercial hake species is very similar to that of

other hake species worldwide. Growth in both species is well established as being slow, with the oldest fish reaching about 14 years and about 115 cm total length. There are no obvious morphometric differences between males and females, although a size-depth relation has been reported. Generally, females of both species are the largest and most frequently found at the extremes of their depth range.

Because of the overlap in depth distribution between the two species, coinciding with distinct size differences (largest *M. capensis* and smaller *M. paradoxus*) predation between species is reported, although intra-specific predation (cannibalism) also occurs. The effects of predation and cannibalism have been modelled although the impacts remain somewhat uncertain.

Reproductive biology of the Cape Hakes is also well established. South African hakes are reported to be serial spawners with indistinct seasonality of spawning. Both hake species are reported to aggregate to spawn, predominantly in early summer with a second spawning period in Autumn. Fecundity at size/age relationship is established but is not conclusive and research in this area is ongoing and has been identified as an important factor in the resource assessment. Recruitment is reasonably well understood with juveniles of both hake species recruiting from nursery areas around the South African coast, mostly bay areas. Hake eggs, after fertilisation at depth, float to the surface and the larvae quickly develop and become free swimming and pelagic. After a short pelagic period, juvenile hake migrate to the bottom of the sea.

Both hake species undergo extensive horizontal migrations, moving with changes in environmental conditions and availability of prey. In terms of horizontal migrations, hake are occasionally caught off Natal on the East Coast in deep water, but there is no evidence suggesting that hake migrate into or out of this area. It is only on the West Coast where some uncertainty prevails over the migration of hake. Opinion of fishers and scientists is that migration along the West Coast by both species does occur and that movement into and out of Namibian waters is likely. Further, it has also been suggested that shallow-water hake may migrate from the Agulhas Bank to the West Coast. Benefit and BCLME projects are addressing these questions through tagging programmes. Such migrations are not, however, expected to affect stock assessments of South African hake populations.

Diurnal (daily) vertical migrations are also a distinct part of their biology, hake remain close to the bottom and aggregate during daylight hours (hence trawlers target them at this time). At night hake disperse, moving higher in the water column where they feed on the abundant fish and zooplankton. Both hake species are omnivorous, feeding on zooplankton when juveniles and becoming mostly piscivorous in their adult stages. They are the dominant predator in the demersal niche.

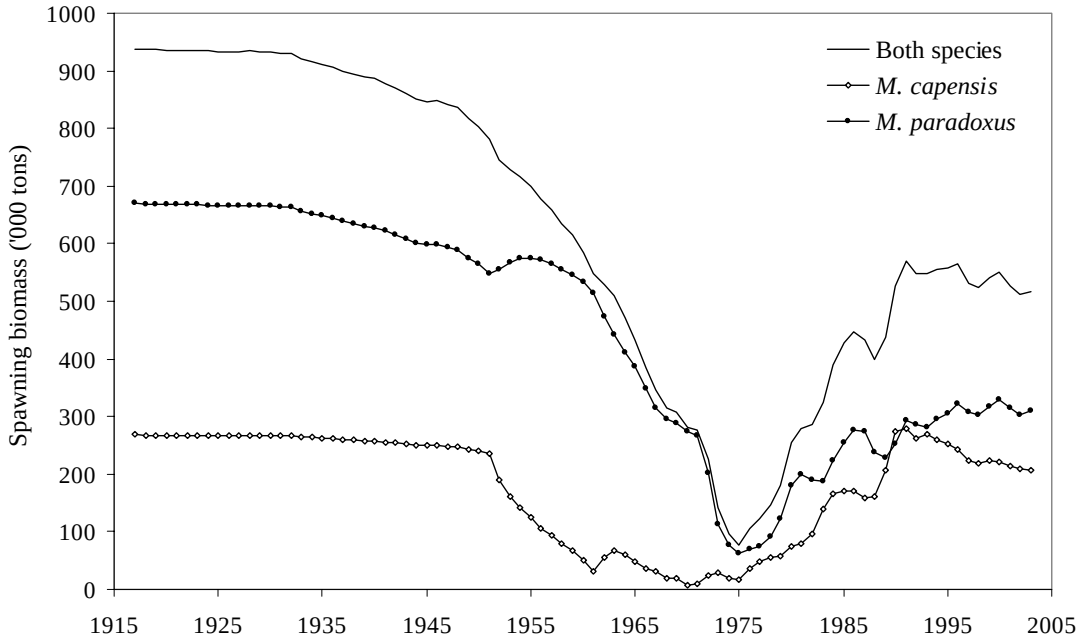
2.2 History of the Fishery

The offshore and inshore trawl sectors (hake-directed fisheries with associated by-catch) contribute over 50% of the total value of all fisheries in South Africa. South Africa's most commercially valuable fishery is therefore the demersal fishery, a fishery dominated by deep-sea trawling for the two Cape hake species (*Merluccius paradoxus* and *M. capensis*), the former being predominantly trawled (the deep-water species) and the second (the shallower-water species) largely being caught by the inshore trawl, longline and handline sectors.

The hake-directed trawl fishery developed at the start of the century and grew rapidly after World War II to peak in the early 1970's at more than 300,000 tons, less than half of which was accounted for by domestic fleet. It then went into decline, which prompted the implementation of a larger minimum mesh size in 1975 and declaration of a 200 nautical mile fishing zone in November 1977. The exclusion of foreign vessels and a conservative management strategy with effect from 1983 led to a gradual recovery in catch rates. Since the late 1970's the hake fishery has

been controlled largely by means of company-allocated quotas within a Total Allowable Catch (TAC), limitations on the number of vessels, and closed areas. The hake fishery was also split between two trawl sectors, 'deep-sea' and 'inshore'; the essential difference being that the inshore fleet also enjoyed rights to sole (*Austroglossus pectoralis*) with the deep-sea fleet being prohibited from trawling in the relevant shallow water area). A TAC of 151 000 t was granted 1995-1999 with 155500 tons in 2000. (the TAC for the current year is 164000 tons) This has however been increased to 166000 tons for 2001-2002.

Time series of estimated spawning biomass for *M. capensis* and *M. paradoxus* presented below. The total spawning biomass (*M. capensis* + *M. paradoxus*) is also shown.



The deep-sea trawl sector operates primarily on the shelf edge in waters deeper than 300 m from the Namibian border southwards to the south coast (including the whole Agulhas Bank) and up to Algoa Bay (eastern-most location of the fishery). The target species is the deep-water hake *Merluccius paradoxus*. A few foreign vessels still operated in South African waters until 1992, but by 1993 the only foreign quota was 1,000 tons of hake awarded for a joint venture with Moçambique in terms of a bilateral fishing agreement. Historically, this fishery has targeted the deepwater hake using stern trawlers and factory vessels on the West Coast (about 60 vessels). Greater proportions have been taken on the West than on the South Coasts (split at 20^0E). Products are mostly frozen and value-added and landed both wet (on ice) and frozen.

Allocations in the deep-sea sector have formed the backbone of the hake fishery and have historically been dominated by a few large operators. Since 1994 however the deep-sea sector has undergone considerable change with the inclusion of many new entrants, from 6 in 1979 to 18 entrants prior to the introduction of the Quota Board, to 55 when the Fisheries Transformation Council was introduced and in 2001 to 57. This represents a substantial reduction in the level of concentration amongst deep-sea rights holders, particularly since political transition, although is the three largest operators still enjoy 55% of the commercial TAC.

The inshore trawl fishery operates along the South African south coast and typically comprises mostly small side-trawlers working in waters shallower than 110 m on the Agulhas Bank.

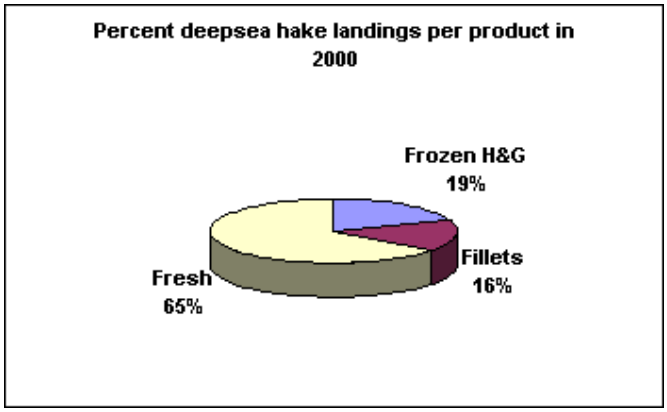
Historically this fishery has been directed at both sole and shallow-water hake. This fishery lands only 6% of the national hake catch (an annual hake TAC of 9 -10 000 t, {mostly *M capensis)* and a sole {*Austroglossus pectoralis)* TAC of 872 t). In this sector hake and sole rights are always linked, in which regard it differs from the larger fishery.

The nature of the fishery is quite different from the deep-sea sector and, although small, it has been stable and has in fact undergone rationalisation of both the number of rights holders and strict effort control in terms of vessel size and capacity. The allocation of rights in the hake sector has, however, become increasingly complex with the recent increase in exploitation of the shallow-water hake by longlining and handlining.

The status of the hake fishery and associated rights is summarised as follows:

- A historically well developed deep-sea trawl fishery targeting hake which up to 1994 had a small number of rights holders who had evolved and developed the fishery over a period of many years (pioneers)
- A historically well developed Inshore trawl sector targeting hake and sole which up to 1994 also had a small number of rights holders and restricted effort
- Since 1994 an experimental hake-directed longline fishery entering a highly competitive hake market. Attempts to introduce rights from 1998 were fraught with legal problems and stop/start fishing, effective individual rights were finally introduced during 2002
- Since 1992 the growth of an unstructured handline fishery for hake, only recently acquiring recognition as a component of the hake sector. This sector was granted rights in April 2003 but the fishery continues to operate in an "unstructured" fashion as litigation proceeds. An estimated catch is, however, accommodated within the annual stock assessment and a proportion of the TAC set aside for "line-caught" hake.

The present distribution of landed hake products is shown below.



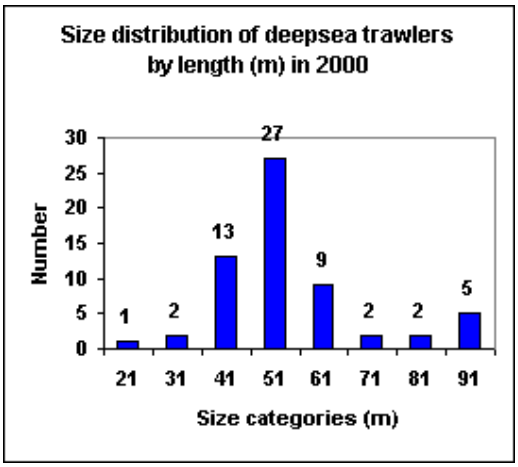
2.3 Fishing Fleet

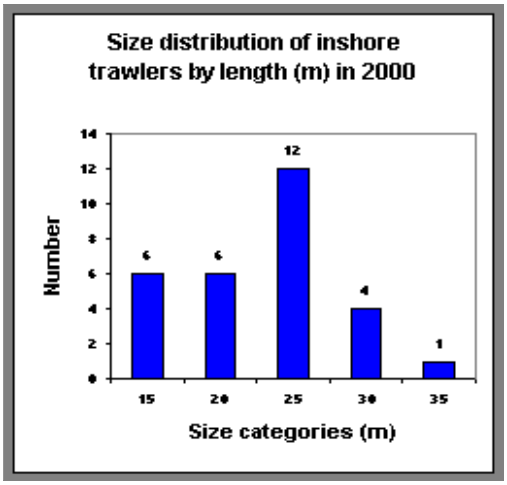
Capacity, and the control thereof, is a major concern in most fisheries. To date, both capacity and effort have been well controlled in the inshore trawl fishery. The "unit of exchange" which forms the basis for the replacement or introduction of a vessel, is 23 m and 500 bhp. A replacement vessel whose specifications fall within these parameters is on a one for one basis. Should the replacement vessel fall outside these parameters then two existing vessels/ licenses must be conceded. As part of the administrative approval process to replace or introduce a trawler, a letter of sanction by the industrial body is requested by MCM.

The following is a broad example of the current inshore and deep-sea fleet structures and capacity

(grouped for illustration only) and the size distributions of fleets operating in the two sectors.

Characteristic	Deep-sea	Inshore
Number of vessels operational in 2000	61	29
Freezer (Fr), Combined (Com) and Ice vessels (Ice)	21 Fr, 4 Com, 36 Ice	29 Ice
Average age in years - see graphs	24.5	23.8
Total GRT (tons)	47,978	2390
Average (range) length in m and see graphs	49(20.7 - 90.6)	20.5(14 – 31.2)
Average (range) power in kW (Range)	1464 (582 – 3600)	351 (140 – 920)
Total onboard storage capacity (tons)	29,480	710
Total market value	R754.1 million	R54.7 million
Replacement value	R2380.5 million	R182.7 million
Average (range) number of sea days	191.2(11 – 291)	187 (3 – 290)
Average (range) catch per sea day (nominal tons)	13.3 (4.2 – 25.4)	2.1 (0.9 – 6.9)





According to the constitution of the representative industry body, the South East Coast Inshore Fishery Association (SECIFA) an "inshore vessel" shall mean a vessel which catches fish by trawl and line and which preserves its catch chilled and or frozen and of which vessel the overall brake horsepower of its main engine and its overall length, as per manufacturers specification shall not exceed the parameters as set out in the Constitution of SECIFA (broadly, 750 bhp (552 kW) and 30 m overall length). The smaller trawlers are grouped as sole-directed and the larger as hake directed.

2.4 Fishing Locations and Administrative Boundaries

MCM is fully responsible for the management of the hake fisheries and there is no delegation of this responsibility to either regional or industrial bodies. MCM compliance officers, under the control of MCM in Cape Town, are located in all the harbours in which fish are landed. The deep-sea hake fishery is concentrated in two ports, Saldanha Bay and Cape Town, although there are minor deep-sea operations from Mossel Bay (deep-sea vessels are prohibited from operating in waters shallower than 110 m) Port Elizabeth and Hout Bay. Inshore trawlers, which can operate inside 110 m (but can fish deeper), mostly operate from Mossel Bay and Port Elizabeth. Smaller port operations take place from the harbours of Gansbaai, and Hermanus.

South Africa exerts control of a 200 nm fishing/EEZ and also issues high seas permits to South African flagged vessels.

2.5 Other Fisheries Relevant to this Assessment

Three other fisheries are considered relevant to this assessment. These are :

1. the longline hake fishery on both the West and South Coasts,
2. the handline hake fishery on the South Coast
3. the midwater directed fishery for horse mackerel.

With regard to the last, the by-catch of hake is closely monitored by 100% observer coverage and hake by-catch is less than 2% of the total horse mackerel catch (which now is set at a precautionary limit of 50 000 t)

Catches in the line fisheries are limited to 10% of the TAC (about 15,000 t). The longline fishery is regulated and monitored and fishing mortality estimates are included in the stock assessments (including selectivity effects). The handline sector has grown since 1992 and fishing rights have recently been introduced to regulate the hake catch in this sector. These allocations are presently subject to litigation and the sector continues to take an estimated 5-7000 t of shallow water hake per year.

The targeted midwater-trawl horse mackerel fishery (currently 31500 tons) also takes hake as a by-catch. Hake by-catch in the midwater horse-mackerel directed fishery is accommodated by means of a limit not exceeding 2% of the horse mackerel catch (by weight). Depending on the TAC this amounts to about 630 tons (in 2003).

2.6 Ecosystem Characteristics

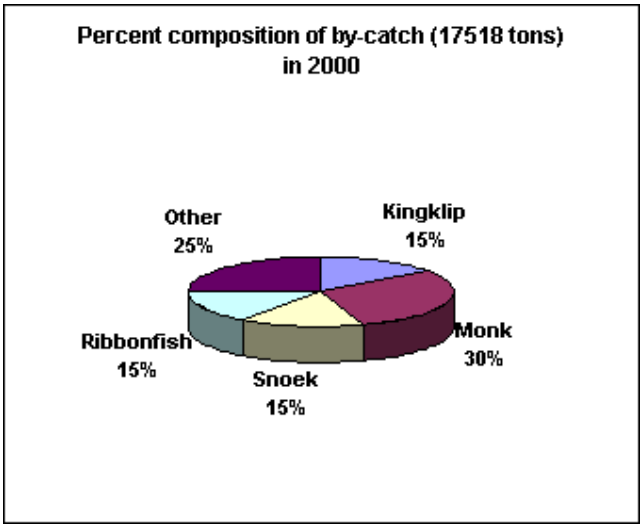
South Africa is a relatively rich fishing nation with abundant fish resources. Commercial fish resources are predominantly found on the West Coast, and to a lesser extent on the South Coast. The West Coast fisheries are driven by the Benguela Ecosystem, a wind-driven upwelling regime resulting in high levels of primary productivity supplying a rich pelagic fishery and also a relatively species-rich demersal ecology. By nature, highly productive upwelling systems are less diverse than non-upwelling (generally warmer temperate water) regimes. For this reason, fish diversity is higher on the South Coast, but biomasses lower than the West Coast (where total biomass of pelagic and demersal stocks is more than double that of the South Coast). The dominant fish species on the West Coast are anchovy/pilchard (pelagic) and hake (demersal). In the meso-pelagic niche, horse mackerel *Tracchurus trachurus capensis* dominate.

The Benguela regime (including the Agulhas Bank) has been intensively studied, culminating in two major conferences on the ecology and trophic status of the system. Research on the marine ecology of the area is ongoing with two new research initiatives – the BENEFIT and BCLME programmes. The BENEFIT programme, in particular, has a strong training and capacity building base. These programmes focus on the Benguela Ecosystem and have projects addressing the management of commercial stocks. e.g. the horizontal migration patterns of Cape hakes and stock integrity. Trophic flows, because of their complexity, are difficult to establish but for the Benguela system, have been relatively well investigated and modelled.

The West coast comprises predominantly muddy substrate, interspersed with rocky patches. Trawling is therefore relatively extensive over the areas with suitable substrate. On the South Coast (Agulhas Bank), the substrate comprises predominantly hard grounds (including sand and coral) and so trawling in this area only covers a relative small area of suitable trawling ground. Work has been carried out in characterising seabed habitats and communities, but the impacts of trawling on these habitats have been less well studied.

2.7 By-catch and Discard

The South African trawl fishery is hake-directed. However, there are several by-catch species (or joint-product species – those species landed other than the target species) that are targeted seasonally or by owners of specific vessels. Key by-catch species are kingklip, (*Genypterus capensis)*, monk (*Lophius upsicephalus)*, snoek (*Thysites atun)* and kob (of which two species have been recently described). The percentage composition of these key by-catch species is illustrated below.



South Africa is presently in the process of drawing up a by-catch management plan to provide for effective control of the by-catch species listed above. Most trawl operations are hake directed, although smaller hake quota holders are known to target by-catch species due to low hake allocations. In particular, kingklip stocks were problematic in the late 1980's when the stock was severely reduced due to overfishing by longliners. Consequently, kingklip directed longlining has since ceased and trawl operators agreed to avoid targeting known kingklip grounds and the stock has shown some signs of recovery.

Targeting on monk and snoek does take place and indications are that catches are within sustainable levels, although this is less clear for monk. Assessment of these stocks is presently under review. Other regular by-catch species (such as elasmobranchs) are the subject of population monitoring by MCM. Although these do not all have stock assessments as for commercial species, good records exist of appropriate indices of abundance.

Estimates of discard practices (discard being that proportion of the target species caught which is not landed) in the trawl fisheries suggest that discard levels are similar to other demersal trawl fisheries worldwide. However, with the tightening of marine legislation in South Africa, and the reduction in rights allocations, increasing use of discard (fish) species is being made. Only the large factory freezers carry incinerators and or fishmeal plants but fish waste is retained on board by many of the operators and discharged ashore in Cape Town and Mossel Bay for onshore fishmeal production. Reporting of catch size and composition has been mostly dependent on skippers submissions, this is now being corroborated with on-board Observer returns.

South Africa has recently introduced a comprehensive Scientific Observer Programme. Observers are deployed throughout the deep sea and inshore trawl fleets and hake trawler coverage approximates 15-20% of all trips. Information collected relates to fishing practice, gear types, biological measurements of target and non-target species as well as estimates of discard

proportions. The programme constitutes a significant improvement in information gathering in the trawl fleet, the results of which are being fed into management and scientific advice.

2.8 Interactions with Rare, Protected or Icon Species

There are no known interactions with rare, protected or icon species and the only species for which there may be a concern is over seabirds – discussed below. Large mammals, particularly the Southern Right Whale is one of the protected species found off the South African coast that has in recent years shown a steady annual increase (7%) in abundance. There are numerous endemic "linefish" species on the threatened list but these species are found mostly on reefs and in shallow waters and so do not interact significantly with trawling operations. It is noteworthy that the instigation of the observer programme now allows direct observations to be made of such interactions.

2.8.1 Seabirds

The South African Hake Trawl Fishery attracts, and provides a feeding opportunity for, a range of pelagic seabird species. Interactions predominantly involve the birds feeding on small or damaged fish escaping from the net during hauling as well as feeding on heads and guts discharged from onboard factories.

Dominant species attracted to the fleet are four species of albatross (black-browed, shy, Indian yellownosed and Atlantic yellownosed, although South African coastal waters provide foraging areas for 11 of the 22 albatross species currently threatened with extinction); four species of petrel (whitechinned, pintado, Wilson's and European stormpetrel) and two species of shearwater (sooty and great). The local Cape gannet is also attracted in great numbers.

The industry, ornithologists (who regularly accompany industry vessels) and observers (from MCM and the new observer program) have never reported any serious bird mortality, although this has not as yet been specifically studied. However, some entanglement does occur at the time of hauling e.g. gannets have been recorded becoming trapped when diving on nets but are usually released alive. The incidence, however, is reported to be very low and there is little mention of significant levels in the literature.

In the Southern Ocean, the midwater icefish fishery records high mortalities of blackbrowed albatrosses which get caught in the large midwater meshes, but such midwater trawling for hake is not allowed. The New Zealand hake fishery reports mortalities of albatross flying into the net sonde cables, and there are similar anecdotal reports from fisheries around the Falkland Islands and Argentina, but the vast majority of the South African Fishery use cableless net sondes. This particular interaction, also, is therefore not an issue.

Trawl warps, being of significantly greater diameter than net sonde cables, present less risk to sea birds and the incidence of trawl warp mortality is very low with no significant mortalities reported by ornithologists or observers. Also, the industry tries to ensure that splices in warps are properly trimmed to prevent impalement of birds and that warps are not excessively covered with tar.

However, the extent of interactions has not been specifically studied. The evidence of significant interactions between trawl fisheries and seabirds from, notably, the Falkland Islands, mean that this lack of information could be of greater importance than previously thought. This is an issue for which additional information has been provided by stakeholders and which has been further addressed in this assessment, in particular through Condition 7.

2.8.2 Seals

Seals were the subject of much controversy prior to 1990 when harvesting was permitted. Exploitation of the Cape Fur Seal was then halted. Seal pup censuses indicate increases in seal populations since 1970 and modelling studies suggest an increase in populations going back to 1900. Interactions between seals and fishers, including trawler operations, have been researched and reported on in several scientific papers and seal mortality associated with hake trawl operations is reported to be low and insignificant at the population level. With the increasing size of the seal population, seal consumption of fish is estimated to be high and competition for food between fishers (not only the trawl sector) increasing.

2.8.3 Cetaceans

No interaction between hake trawlers and cetaceans have been reported.

2.8.4 Fish

The hake trawl fishery is not considered a threat to any fish species, particularly the numerous endemic linefish species which are threatened and consequently protected.

Kob, however, are traditionally caught as a "linefish" species and are also caught incidentally by inshore trawlers. Assessment of kob stocks suggests that stock levels are below 20% msy and in this regard incidental catches in the trawl fishery of mostly juvenile kob is a concern. This species is partially protected by Marine Protected Areas (MPA's) and further protection of this and other by-catch species is expected as part of the developing by-catch management plan.

3 ADMINISTRATIVE CONTEXT

3.1 Legislation

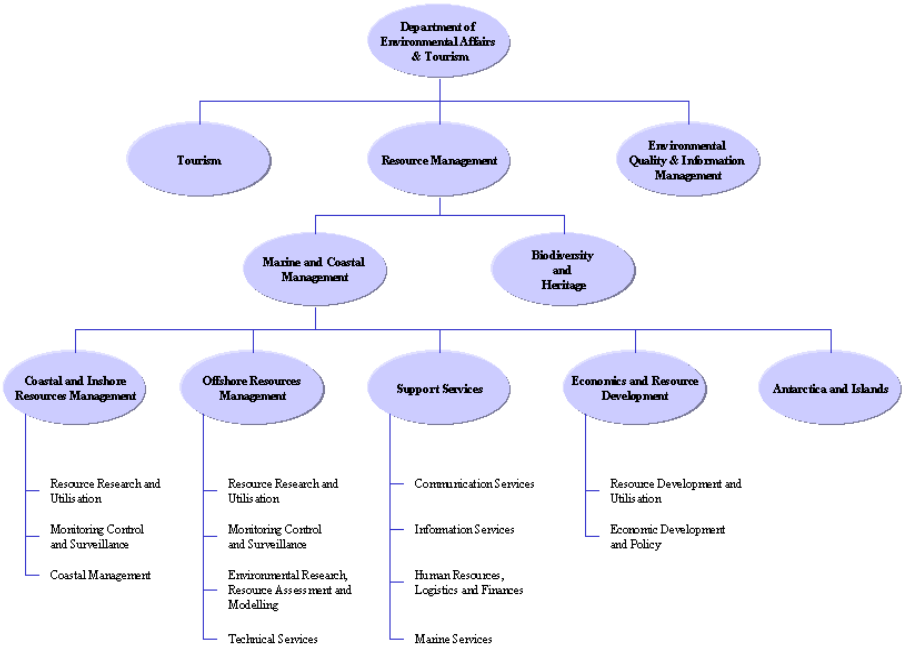
Integrated environmental management (IEM) principles are being applied to South African fisheries management within the context of the Consultative National Environmental Policy Process (CONNEPP). In principle, the harvesting of any one species must not endanger the continued existence, or cause the substantial depletion of, any other species such as through destructive methods of harvesting which are detrimental to any other species or resource (living or non-living). A further management objective is the designation of Marine Protected Areas (MPA's) for the purposes of scientific study, experimental fishing or conservation. Certain species or populations thereof may be fully protected.

With the introduction of the *Marine Living Resources Act* of May 1998 (MLRA) came the introduction of a Consultative Advisory Forum (CAF), the Fisheries Transformation Committee (FTC) and the phasing out of the Quota Board. The FTC was a body appointed by the Minister, their main function being to "to facilitate the achievement of fair and equitable access to the granting of fishing rights".

3.2 Management Responsibilities and Interactions

Fisheries in South Africa fall under the Department of Environmental Affairs and Tourism and the fisheries component is now referred to as Marine and Coastal Management (MCM), which was formerly called the Sea Fisheries Branch (the research component was formerly known as the Sea Fisheries Research Institute). The research and management function of MCM is now integrated and have been absorbed into the general structure of the department. Similarly, the compliance function (referred to as the 'inspectorate') has also being absorbed in the overall structure of MCM with specific subdivisions such as Offshore and Inshore.

The organisational structure of the state fisheries management authority in South Africa has undergone numerous changes in recent years. These changes have mostly being associated with transformation of the state management authority as well as of the administrative and compliance function. It is therefore difficult at this stage to define a concise structure. The most recent structure presented by the state management authority is given below.



Two major management components of MCM have been established to meet practical operational needs. These are Coastal and Inshore Resource Management and Offshore Resource Management.

Essentially these two components each comprise research, monitoring and control, assessment and technical services. More specifically however, Coastal and Inshore are responsible for the management of coastal resources such as those found in the intertidal zones, recreational and subsistence fisheries, and other near-shore resources such as abalone and rock lobster. The Offshore Resource group are responsible for the main industrial fisheries including trawl fisheries and the pelagic purse seine sector.

3.3 Rights Issues

In South Africa, since independence and the transition to a new democracy, the fishing industry has had to deal with ongoing instability created around the process of transformation with the introduction of many new entrants (historically disadvantaged persons) and the loss or reduction of rights of the established players in the industry. Developments starting shortly after independence in 1994 have culminated in a new fisheries policy, a new Marine Living Resources Act and a new set of fisheries regulations.

Although the cause of legal challenge within the hake trawl sector (now approaching resolution), the processes behind the rights issues are considered to be open and inherently subject to challenge and resolution at the highest levels.

In addition, all new South African rights holders signed '**Codes of Conduct'** when granted fishing rights in 2002. This essentially committed rights holders to comply with the MLRA and

international principles for the management of South Africa's marine resources. It also compels rights holders to strictly follow compliance procedures and to accept the concept of sustainable harvesting.

4 STOCK ASSESSMENT

Stock assessments are conducted on two South African hake stocks using population models supported by fishery-derived and research data. The following sections describe the assessment methods and results, including the basis for defining Management Units, the indicators of stock status, the input data and assessment models employed and the process of interpreting the scientific results to develop the management advice.

4.1 Management Unit

Two Management Units or "stocks' of hake are defined for both assessment and management purposes: the West coast "stock" and the South coast "stock". It is noted that historically, hake caught in the trawl fisheries off South Africa have been assessed as a single species as separation of the shallow and deep-water species in commercial catches has not been possible. For assessment and management purposes the South African hake has been divided between the two main fishing areas known as the West and South Coasts. The West coast "stock" is composed of both the deep-water hake *Merluccius paradoxus* and the shallow-water hake *M. capensis*, although the deep-water hake is the dominant species. The South coast is also composed of both species, but with a larger proportion of shallow-water hake. Although both hake species occur within the West and South coast fisheries, the stocks are therefore assessed as if they were single species stocks. The assessments implicitly make the assumption that there are no important net differences in the life history parameters of growth, reproduction, mortality and movements between the two species within a stock. Analyses have been conducted to evaluate the significance of this assumption on management quantities, but it is recognised that this is a weakness.

The along-shore distribution of the shallow-water species (both in terms of its occurrence in research surveys and in terms of its occurrence in the catch) shows a hiatus in the density near the Namibia-South Africa border. The deep-water hake distribution also shows some decline in density near the Namibia-South Africa border, but is not so pronounced. This general relationship has been well known for many years, such that the International Commission for South East Atlantic Fisheries (ICSEAF) used those characteristics to originally define hake stocks in the 1970's. Those definitions have only been slightly modified since that time. The current boundaries for the West coast stock are the Namibia-South Africa border (Orange River) to Cape Agulhas at 20^{o} East (corresponding to ICSEAF Area 1.6) and for the South Coast is Cape Agulhas toward the east beyond the distribution of the hake (ICSEAF Areas 2.1 and 2.2). Currently, the boundary between West and South coast stocks extends southwest from Cape Agulhas, rather than due south, as suggested by the ICSEAF Areas.

Some data are available from research surveys on the species proportions within the research vessel catch and these data have been explored as a basis for splitting the commercial landings data into species. However, these data are relatively sparse and do not allow much stratification into time and area. Additionally, this method assumes that the research vessel acts similarly to commercial vessels in regards to the species catch distribution within a strata. As more research surveys are done, more data will become available to conduct species-splitting analyses. More importantly, an observer programme is presently being implemented which opens further opportunities for obtaining species catch data. This is an important factor in that differences in parameters such as growth rates can interact in non-obvious ways within an assessment. Thus species-splitting remains a research and assessment priority.

Therefore, the historical operating management and assessment assumption is that there are two

geographical stocks whose geographical boundaries are as defined above. Recent developments in hake assessments take into consideration the two species complexity of the hake resource, applying different models for shallow-water hake on the South Coast and deepwater hake on the West and South Coasts.

4.2 Monitoring of Stock Status

The stocks are monitored using a suite of fisheries-dependent, fisheries-independent and biological data which are integrated into various standardisation and assessment models (discussed in the next section). The basic data include landings, landings by size category, landings by haul (within important strata) for the commercial fisheries sectors, catch per haul from research surveys and growth rate information.

Landings from the West coast hake resource increased considerably from the 1950's, peaking in the late 1970's at about 100,000 t and decreasing substantially after that to about 50,000 tons. Decreased foreign activity accounted for most of this drop as South Africa declared its EEZ in 1977, assumed control from ICSEAF and phased out foreign fisheries. Subsequent catches have been relatively stable at 125,000 t with some small increasing trend (for the West Coast). South Coast hake landings progressed through a similar dynamic in which late 1970's landings peaked at about 50,000 t and (after the phasing out of foreign fisheries) has remained relatively stable at about 25,000 t.

Landings at size are recorded by the quota holders and have been reported to MCM since the late 1970's. These are, in turn, converted to catch-at-age using growth rate information and age-slicing techniques. The growth equation data is given in Geromont and Butterworth (1999, WG/05/99/D:H:):

weight at age =	A[Lin(1-exp(-K(age-t0)))]^B
M. capensis:	A=.0050g; B=3.113; Linf=270.6 cm; K = .039/yr; t0= -.730 yr
M. paradoxus	A=.0062g; B=3.046; Linf=219.4 cm; K = .049/yr; t0= -.914 yr

A mesh size limit was imposed on the trawl fishery in 1975 as the fishery had large catches of small fish, approximately 80% of the fish in the catch were less than three years old in 1978 for the West Coast (Rademayer and Butterworth 2002). It is understood that some in the industry subverted the mesh size limit by implementing "liners" within the trawls to capture small fish. Thus, there was undoubtedly some misreporting. This caused some difficulty in interpreting landings reports and catch-per-unit-effort (CPUE) during that period. However, it is generally acknowledged that the practice ceased in the early 1990's. The market, and responsible industry practices, have evolved such that small fish are no longer targeted and often avoided. Currently, only about 30% of the catch is now younger than age three (Rademayer and Butterworth 2002). Catch-at-age data for the South Coast are only available after 1988, subsequent to the phasing-out of "liners."

CPUE data have been recorded since the 1950's for the West coast and since the late 1960's for the South coast. Prior to the late 1970's, detailed effort data were not available and nominal CPUE in tons per day (with some gross adjustments for vessel power) were used to monitor the fishery. Subsequently, data were recorded by day and by spatial grid such that currently the trawl CPUE is standardised using General Linear Modelling (GLM) approaches (discussed under the Modelling section).

For the West coast, the historical and recent nominal CPUE's combined, show a clear pattern of decline in CPUE followed by some recovery. The CPUE in 1977 was about 25% of what it was in 1955. Recovery of *nominal* CPUE since 1977 averaged about 3% per year, but the interpretation changed once GLM's were conducted (discussed below). The South Coast CPUE in 1975 was

estimated to be about one third of what it was in 1969; however there was in increase after 1975. Since 1985 the CPUE's are variable without much trend.

Fishery-independent research surveys are an additional status monitoring tool. Research surveys were conducted on the West coast in the summer on the Fishery Research Vessel *Africana* 1985-99 (exclusive of 1989 and 1998); additional West Coast surveys were conducted in the winter 1985-90. Due to technical difficulties with the FRS *Africana*, the RV *Fridtjof Nansen* was utilised in 2000 and 2001 for a summer survey. The South Coast surveys were conducted in the spring in 1986-87 and in the autumn 1988, 1991-97 and 1999.

The research vessel surveys use standardised net tows in specified area strata to compute "swept area" estimates of total hake biomass present. Research personnel also collect more detailed data on the catch samples including catch-at-size (which is converted to sample catch-at-age and selectivity for the research surveys) and proportion of each species in the catch (which, as noted before, may be a basis for proportioning the commercial catch into the two species). A survey using swept area methods provides an estimate of total biomass at the time the survey was conducted. However, swept area methods in fisheries research surveys are often subject to bias in sampling efficiency, i.e. estimates are not measures of total biomass. Therefore, a survey may also be interpreted as a relative index of biomass. This was done in the case of South African hake: annual changes in the survey values are interpreted as relative changes in abundance. Thus, the assessments (discussed below) use the data as indices of abundance and then efficiencies relative to swept area methods were examined through the assessment.

The research surveys show considerable annual variability, such that one cannot distinguish trends between the research indices and the commercial CPUE on a purely statistical basis. Additionally, the different vessel operating procedures imposed by the substitution of the RV *Fridtjof Nansen*, has caused concern about efficiency bias in the last two years of the survey.

4.3 Modelling

Multiple levels of modelling are conducted on the two South African hake stocks:

1) GLM models are constructed for the standardisation of CPUE's
2) population models are constructed as representation of hypotheses on how the stocks are growing and reproducing to be used to compare to the empirical data
3) maximum likelihood model fitting procedures are used to estimate parameters that provide the best match between the population model and the empirical data
4) projections of stock status using alternative future management approaches
5) the development of Operational Management Procedures (OMPs) to examine uncertainties and to structure the management advice.

Modelling efforts relating to (1)-(3) will be discussed in this section; whereas, projections and OPMs will be discussed in the context of the Management Advice in the next section.

4.3.1 CPUE Standardization

The standardization of commercial CPUE using GLMs has evolved through considerable scientific debate. The debate has been open, tranparent and thoroughly documented. Originally, the nominal catch per haul data indicated that West coast stock recovery in the late 1980's to the early 1990's was occurring at a rate of 3.4% per year. In 1995 a programme of GLM analyses was initiated using a rather broad definition of vessel power characteristics as an explanatory variable. Incorporating this into the analyses indicated the recovery rate was positive but smaller, i.e. 1.2% per year. Subsequently, more explanatory variables were incorporated including spatial location, depth and time of year, in addition to vessel power. Lastly, refinements in the GLM to account for

positive correlations between CPUE of the hake and of the by-catch in the hake fishery were incorporated. Results still maintained a positive recovery rate, but the magnitude is rather small (0.6% per year). Reasons for the change in effectiveness (the difference between nominal and standardized CPUEs) has been attributed to a shift of the fishery, and of the fish, to deeper waters.

Additionally, current standardisations of West coast CPUE take into account the use of liners in the nets in the 1970's by estimating selectivity of the gear separately for two time periods (1970's and before versus late 1980's and later) with a linear transition in the early 1980's. This mechanism was used to describe the increased vulnerability of the small fish to that gear during early periods of the data set.

The South Coast *M. capensis* CPUE was standardized using similar GLM methods, although the time series of data was not as long and the use of liners was not an issue. Also, data records for all fishers were not complete for the entire time series, therefore the analysis used records from the three major shareholders (a subset of vessels) temporarily in one year, a perfectly acceptible approach to estimating CPUE. GLM standardisation of these data indicated an increasing trend from 1978-1990 with a small decreasing trend, thereafter. Almost all the gaps in the data base were recently filled by virtue of an industry sponsored project.

4.3.2 Population Models and Parameter Estimation

The assessment model used for both the West and South coasts was an Age-Structured Production Model (ASPM). This is a common modelling approach used when the data series of catch is relatively long, catch-at-age data series are short relative to the overall catch and usually measured with error. An ASPM generates an annual series of population data based upon specifications of:

a) a stock size in the initial year of the analysis
b) the annual catch that is removed by the relevant fisheries; the selectivity (vulnerability at each age) of the fish to each fishing gear
c) the weight-at-age of fish in the catch
d) the stock-recruitment relationship
e) the natural mortality rate (m) at age.

The ASPM "reconstructs" an annual time series of a population's biomass, catch-at-age and other population parameters. Data from the reconstructed population is then compared with empirical data using Maximum Likelihood Estimation (MLE) methods. MLE methods are used to estimate the most appropriate set of population parameters which will maximise the match between the observed (empirical) and the predicted (ASPM-generated) data. The MLE approach is standard in fisheries stock assessments and was used in the hake assessments.

In the hake assessments, the empirical data were the annual catches; the catch-at-age for selected years; GLM standardised CPUE estimates of indices of abundance; and fishery-independent survey indices of abundance. The parameters that were estimated were the unexploited stock size (specified to occur in 1917, for the West coast and 1967 for the South coast); parameters of selectivity-at-age models for the commercial and fishery-independent indices; parameters for natural mortality rate-at-age; parameters of the stock-recruitment relationship; and stock-recruitment residuals.

For the West coast assessment, commercial selectivity parameters were estimated separately for the periods before and after the liners were used. Several modifications were made for the South coast: selectivity models were modified and simplified in accordance with the paucity of data and due to the need to address longline selectivity in addition to that of the trawls; the data did not

allow estimation of age-dependent natural mortality, so a single age-independent estimate was made; and a parameter including additional variance was included for the *Africana* survey data. Note that the most recent assessment of South coast hake has been for the single species of shallow-water hake *Merluccius capensis* alone, although this has not yet been used to provide a separate TAC. The West coast assessment remains to be combined for the two species, although complete separation into the two species, *M. paradoxus* and *M. capensis*, is being developed for the future. Also, the development of Operational Management Procedures (OMPs) were based primarily on the West coast combined assessment.

The West coast assessment indicates similar trends as the long-term CPUE trends: there was a long period of stock decline until the late 1960's with a gradual increase since then. The ASPM model fits the catch-at-age data from both the commercial and survey vessels well. Current spawning biomass is about 22% of the initial (unexploited) spawning biomass and about 71% of the spawning biomass at Maximum Sustainable Yield (MSY). The current estimate of MSY is about 129,000 tonnes.

The model fit the index data reasonably well, i.e. it mimics the trends but does not fully match annual variation. However, the assessment indicated uncertainties in several factors which were evaluated through sensitivity analysis, i.e. the significance of alternative estimates on the management quantities of concern. There were additional anomalies in the assessment results which do not limit the immediate management use of the assessment, but should be addressed through further research. These include: estimated mortality rates at age, particularly those of juvenile fish, seem high relative to other stocks and the annual recruitment variability seems low compared to other stocks. Both factors may be affected by the mixing of the two species in the assessment.

The South coast assessment shows declines in spawning biomass prior to the late 1980's followed by about a five-year period of rapid recovery. After that, the biomass has fluctuated without trend. Current spawning biomass is 47% of the unexploited (1967) spawning biomass, but 25% *higher* than the spawning biomass at MSY. The estimate of MSY is 33,000 tonnes. Assesment uncertainties for the South coast include: poor fits to the survey catch-at-age data; a high estimate of the age-independent natural mortality rate; some indications of residual patterns on fits to the CPUE data; and high productivity estimates (steepness) for the stock-recruitment relationship.

The assessments models developed and implemented by MCM and its contractors are subjected to various reviews and debates through MCM's Demersal Working Group. Industry, through their consultants, participate in the debates of the Working Group and have been influential in guiding the research. Additionally, external reviews have been obtained through the BENEFIT stock assessment workshops, which facilitates the development of Angolan, Namibian and South African capacity for quantitative assessment of their fish stocks through this program.

4.4 Management Advice

Management advice and the associated TAC for South African hake has been developed through another stage of modelling and research: Operational Management Procedures or OMPs. OMPs are designed to develop robust management based upon extensive projections of management alternatives under the range of uncertainties that exist in the assessment. Various management objectives, risks and constraints are agreed upon, tested in the simulations and form the basis of management actions. An OMP is built on the premise that major changes are unlikely to occur in an assessment from one year to the next; that full assessments conducted annually, accompanied by the debates and management negotiations may be counter-productive to long-term management strategies; and human resources on the part of government managers, scientists and industry are limited in their capacity to fully participate in these debates annually.

The South African west coast hake OMP started to be developed in the 1990's and was formally adopted in 1998. The OMP specifies a specific set of data to be used in the OMP, formulae and models which use that data to determine the TAC, and extensive simulation testing. The testing involves projecting the consequences of alternative assumptions about population dynamics and how management quantities react to those alternatives. The simplified formulae are updated annually in order to determine the TAC. By doing so, the need for a full assessment is avoided, but requires that the simulation testing phase be extensive to assure that the formulae are not likely to deviate greatly from the assessment projections.

The OMP initially has focused on West Coast hake where the stock was determined to be in need of recovery. Thus, the broad guidelines for the OMP were that there be a high probability of the biomass recovering to the MSY level within ten years; that there be a low probability of any decline in biomass and that there would be a low probability of a reduction in TAC during the initial years of recovery. These objectives were evaluated with alternative assumptions about hake dynamics. The alternatives included different levels of recruitment variability, bias in the CPUE indices as indicators of abundance trends; different discarding levels; absence of future surveys; different natural mortality rates at age; and regime shifts (changes in overall productive capacity of stock.

After presentation of the variety of results to decision-makers and constituents, managers chose an OMP design that was based on an $f_{0.075}$ approach, i.e. the fishing effort (f) where the slope of the yield-effort curve is 7.5% of the slope at the origin. This level of effort was a compromise between strategies that provided higher probabilities of quick recovery but higher chances of TAC decline and those strategies which provided the opposite consequences.

Currently, the OMP and the TAC setting procedure only includes the South Coast *M paradoxus* as an *ad hoc* adjustment to the West coast TAC. Plans are in place to re-evaluate and revise the entire OMP to include the South coast and to begin to separate the species as part of that process. However, this has been delayed pending, among other factors, resolution of the rights issues.

The 2002 TAC for the West coast was chosen by managers to be 107,000 tonnes. This is less than the estimate of MSY and is expected to allow continuance of stock recovery. The *ad hoc* adjustment for the South coast was that the South coast TAC should be about 25% of the West coast TAC (this percentage represents the five year recent average). Again, this TAC is less than the estimated South coast MSY.

5 FISHERY MANAGEMENT

5.1 Management Objectives

Objectives for the resource include the issue of medium-term rights (4 years) with a subsequent issue of longer-term rights due in 2005. The hake trawl assessment aims at long-term sustainability and stock recovery to above Bmsy. As detailed above, appropriate Operational Management Procedures are being introduced aimed at responding to measures of stock changes.
Short-term and Long-term environmental objectives are clearly established in the MLRA.

5.2 Management Measures

A number of specific measures are established for the offshore and inshore trawl fisheries. For the offshore hake-directed trawl fishery, these include a minimum mesh size of 110 mm and the exclusion of fishing in waters shallower than 110 m east of 20^0E. Other bottom-dwelling species are targeted from time to time including monk *Lophius vomerinus,* kingklip *Genypterus capensis* and snoek (by-catch comprises approximately 30% of the hake landed) - a by-catch management

strategy is currently under development for both the offshore and inshore trawl sectors.

For the inshore trawl fishery (hake and sole), management measures include a minimum mesh size of 75 mm and both output (TAC) and input (boat limitation) controls. In addition, areas within the "inshore area" are identified as nurseries for hake and sole. For this reason there is an understanding between the industrial body (SECIFA) and MCM that effort be controlled in the area between Mossel Bay and Struisbaai and seawards to 20 miles, and that the larger inshore trawlers avoid operating in this area. It is noted that the inshore fleet is split between a few small sole-directed vessels and a greater number of larger hake-directed vessels. Hake vessels stay offshore and avoid shallow areas, thereby minimising catches of juvenile hake and by-catches of linefish such as kob.

5.3 Monitoring, Control and Surveillance

Marine and Coastal Management has compliance groups attached to both the Inshore and Offshore groups. There is considerable overlap between the three elements of MCS, and a number of staff nominally working for one area actually contribute significantly to others. MCM staff involved in MCS activities include managers, scientists, observers, Fisheries Officers as well as staff from other enforcement and government agencies, all in different capacities.

Principally, MCM marine inspectors are deployed around the entire coast with greater numbers deployed at the main fishing ports. Inspectors are responsible for the verification and monitoring of landings, including those of the demersal hake trawl fleet.

Monitoring. On a trip by trip basis, trawlers are required to report potential landings 24 hours in advance of port arrival and landings are monitored at factories and company landing facilities. Landings are weighed and returned with skippers logbooks to MCM where catch, effort and quotas are reconciled. The present sea-based inspection vessels are inadequate for the monitoring of the offshore trawl fleet. Therefore, monitoring of fisheries is also carried out by a variety of scientific programmes including research surveys and a newly implemented Scientific Observer Programme. This is carried out in a professional manner, with appropriate levels of checking, and appears to address the needs of the fishery and its proper management. Continued work on developing and focussing the Observer Programme would yield benefits for management, as would addressing issues about the timeliness of logbook data handling.

Control. The control of the fishery, principally quota control, operates well. Catch data for quota management purposes is handled differently from the rest of the logbook data and is provided by industry to MCM in a timely manner. The industry work hard at managing their quota and data management is, on the whole, considered exemplary.

Surveillance. MCM, and some supporting agencies, employ all of the usual surveillance and enforcement measures, including Fisheries Officers on shore (e.g. to inspect landings, although this is not 100% coverage), patrolling by vessels (due for replacement by a new fleet in 2004) with boarding capabilities and aerial surveillance. In addition they employ a Vessel Monitoring System (VMS) system on all hake-directed vessels (100% coverage) that provides positional information from equipped vessels in near real-time. Although at an early stage, there is a growing sophistication in the application of new technology and co-operation between different government agencies, including revenue departments, to identify illegal activities and MCM also report increased funding for enforcement activities.

5.4 Consultative Process

Historically there has been a recognised consultative process in the trawl fishery. This, however, has applied primarily to the two main industrial bodies – SADSTIA and SECIFA. The scientific

advice regarding hake Total Allowable Catches has traditionally being presented and discussed with the fishing industry prior to formal approval by the Minister. More recently, with political change and the large increase in rights holders, consultation has been broader and more inclusive, with representation from all groups at scientific working groups and various other forums. The recent rights allocation process included an intensive consultation process, primarily aimed at trying to prevent litigation once rights had been issued.

6 STANDARD USED

6.1 MSC Principles and criteria used for the evaluation;

The MSC Principles and Criteria for Sustainable Fisheries form the standard against which the fishery is assessed and are organised in terms of three principles. Principle 1 addresses the need to maintain the target stock at a sustainable level; Principle 2 addresses the need to maintain the ecosystem in which the target stock exists, and Principle 3 addresses the need for an effective fishery management system to fulfil Principles 1 and 2 and ensure compliance with national and international regulations. The Principles and their supporting Criteria are presented below.

PRINCIPLE 1

A fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited populations and, for those populations that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery. [1]**:**

Intent:
The intent of this principle is to ensure that the productive capacities of resources are maintained at high levels and are not sacrificed in favour of short term interests. Thus, exploited populations would be maintained at high levels of abundance designed to retain their productivity, provide margins of safety for error and uncertainty, and restore and retain their capacities for yields over the long term.

Criteria:

1. The fishery shall be conducted at catch levels that continually maintain the high productivity of the target population(s) and associated ecological community relative to its potential productivity.
2. Where the exploited populations are depleted, the fishery will be executed such that recovery and rebuilding is allowed to occur to a specified level consistent with the precautionary approach and the ability of the populations to produce long-term potential yields within a specified time frame.
3. Fishing is conducted in a manner that does not alter the age or genetic structure or sex composition to a degree that impairs reproductive capacity.

PRINCIPLE 2:

Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.

[1] The sequence in which the Principles and Criteria appear does not represent a ranking of their significance, but is rather intended to provide a logical guide to certifiers when assessing a fishery. The criteria by which the MSC Principles will be implemented will be reviewed and revised as appropriate in light of relevant new information, technologies and additional consultations

Intent:
The intent of this principle is to encourage the management of fisheries from an ecosystem perspective under a system designed to assess and restrain the impacts of the fishery on the ecosystem.

Criteria:

1. The fishery is conducted in a way that maintains natural functional relationships among species and should not lead to trophic cascades or ecosystem state changes.

2. The fishery is conducted in a manner that does not threaten biological diversity at the genetic, species or population levels and avoids or minimises mortality of, or injuries to endangered, threatened or protected species.

3. Where exploited populations are depleted, the fishery will be executed such that recovery and rebuilding is allowed to occur to a specified level within specified time frames, consistent with the precautionary approach and considering the ability of the population to produce long-term potential yields.

PRINCIPLE 3:

The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable.

Intent:

The intent of this principle is to ensure that there is an institutional and operational framework for implementing Principles 1 and 2, appropriate to the size and scale of the fishery.

A. Management System Criteria:

1. The fishery shall not be conducted under a controversial unilateral exemption to an international agreement.

The management system shall:

2. Demonstrate clear long-term objectives consistent with MSC Principles and Criteria and contain a consultative process that is transparent and involves all interested and affected parties so as to consider all relevant information, including local knowledge. The impact of fishery management decisions on all those who depend on the fishery for their livelihoods, including, but not confined to subsistence, artisanal, and fishing-dependent communities shall be addressed as part of this process.

3. Be appropriate to the cultural context, scale and intensity of the fishery – reflecting specific objectives, incorporating operational criteria, containing procedures for implementation and a process for monitoring and evaluating performance and acting on findings.

4. Observe the legal and customary rights and long term interests of people dependent on fishing for food and livelihood, in a manner consistent with ecological sustainability.

5. Incorporates an appropriate mechanism for the resolution of disputes arising within the system[2].

6. Provide economic and social incentives that contribute to sustainable fishing and shall not operate with subsidies that contribute to unsustainable fishing.

7. Act in a timely and adaptive fashion on the basis of the best available information using a precautionary approach particularly when dealing with scientific uncertainty.

8. Incorporate a research plan – appropriate to the scale and intensity of the fishery – that addresses the information needs of management and provides for the dissemination of research results to all interested parties in a timely fashion.

9. Require that assessments of the biological status of the resource and impacts of the fishery have been and are periodically conducted.

10. Specify measures and strategies that demonstrably control the degree of exploitation of the resource, including, but not limited to:

    a) setting catch levels that will maintain the target population and ecological community's high productivity relative to its potential productivity, and account for the non-target species (or size, age, sex) captured and landed in association with, or as a consequence of, fishing for target species;
    b) identifying appropriate fishing methods that minimise adverse impacts on habitat, especially in critical or sensitive zones such as spawning and nursery areas;
    c) providing for the recovery and rebuilding of depleted fish populations to specified levels within specified time frames;
    d) mechanisms in place to limit or close fisheries when designated catch limits are reached;
    e) establishing no-take zones where appropriate.

11. Contains appropriate procedures for effective compliance, monitoring, control, surveillance and enforcement which ensure that established limits to exploitation are not exceeded and specifies corrective actions to be taken in the event that they are.

B. Operational Criteria

Fishing operation shall:

12. Make use of fishing gear and practices designed to avoid the capture of non-target species (and non-target size, age, and/or sex of the target species); minimise mortality of this catch where it cannot be avoided, and reduce discards of what cannot be released alive.

13. Implement appropriate fishing methods designed to minimise adverse impacts on habitat, especially in critical or sensitive zones such as spawning and nursery areas.

14. Not use destructive fishing practices such as fishing with poisons or explosives;

15. Minimise operational waste such as lost fishing gear, oil spills, on-board spoilage of catch etc.

[2] Outstanding disputes of substantial magnitude involving a significant number of interests will normally disqualify a fishery from certification.

16. Be conducted in compliance with the fishery management system and all legal and administrative requirements.

17. Assist and co-operate with management authorities in the collection of catch, discard, and other information of importance to effective management of the resources and the fishery.

7 BACKGROUND TO THE ASSESSMENT

7.1 Evaluation team;

Evaluation leader: Dr Andrew Hough: Moody Marine Limited

Dr Hough has a Ph.D. in marine ecology from the University of Wales, Bangor and eleven years post-doctoral experience in commercial marine and coastal environmental management projects. He is a Director of the Centre for Marine and Coastal Studies and is scheme manager within Moody Marine Limited for the implementation of MSC Certification procedures and development of MSC methodologies. Dr. Hough has acted as lead assessor on a number of MSC pre assessments and four main assessments.

Expert advisor: Dr Joe Powers. Dr Joe Powers' recent professional activities include co-ordination of the development and management of research programmes for living resources within NMFS, conducting multi-disciplinary biological and socio-economic research programmes to provide fishery management information and developing regulatory processes to maintain sustainable fisheries and the needs of various user groups. His research interests include fishery policy and risk analysis in decision-making, applications of game theory to the theory and practice of fisheries management, the development of robust statistical methods to characterise the variability of fishery populations and ecosystems subject to natural and anthropogenic stress and the role of scientific investigations in fisheries management.

Joe Powers led the assessment against Principle 1, but also contributed on Principles 2 and 3.

Expert advisor: D. W. Japp. Dave Japp is Director of a neutral and independent service organisation, working for all sectors of the fishing industry including the state authority (MCM), the fishing industry, international organisations and numerous other groups.

He was previously employed at the Sea Fisheries Research Institute from 1988 to 1997 as a biologist and manager and at the time he left this institution was head of the offshore resources section (demersal and pelagic stocks). His role at SFRI (now Marine and Coastal Management, MCM) was primarily management, biology and resource assessment and he was responsible for the submission of management advice on hake and other stocks. He was also responsible for, planned and led, many demersal hake-directed biomass surveys in the period employed at SFRI. Mr Japp has retained an intimate knowledge of all aspects of the hake fishery including the trawling methods, areas fished, all companies and groups with hake rights, processing and marketing, resource assessment methods and also monitoring and control of the trawl and other hake sectors. He has a total of 15 years experience in the South African hake fishery, but has not worked directly for MCM or the South African Deep Sea Trawling Industry Association (SADSTIA) in any capacity for over 12 months.

Dave Japp led the assessment against Principle 2, but also contributed on Principles 3 and 1.

Expert advisor: Dr Geoff Tingley: Geoff Tingley is a British fisheries scientist with fifteen years experience working in stock assessment and management of marine and freshwater fisheries with seven years working at CEFAS in a number of fisheries, managerial and business development roles. His experience includes the scientific, management, licensing and policy issues of the fisheries around the Falkland Islands, seven years as the Team Leader of the group providing scientific and management advice to the Director of Fisheries and the Falkland Islands Government including the management of a trawl fishery for hake.

He was a member of the UK Delegation on the South Atlantic Fisheries Commission (and its predecessors) from its inception in 1989 to 1996, including membership of the scientific sub-committee. During this time Dr. Tingley worked on two species of hake, *Merluccius australis* (*polylepis*) and *M. hubbsi* that occur in the South West Atlantic and are exploited around the Falkland Islands, off Argentina, and a number of other countries. Considerable scientific effort was expended to manage the fisheries for these species around the Falkland Islands. Dr. Tingley was first author of the chapter on biology and fisheries of the Falkland hake in Alheit & Pitcher's edited book on Hake: Fisheries, ecology and markets (1995). Dr. Tingley has worked in South Africa briefly as part of a World Bank Project on fisheries policy development for Angola in the mid-1990's and was invited to attend the 2000 BENEFIT meeting in Namibia.

Geoff Tingley led the assessment against Principle 3, but also contributed on Principles 1 and 2.

7.2 Previous certification evaluations

No previous certification evaluations have been carried out for South African Hake Fisheries.

8 THE ASSESSMENT PROCESS

8.1 Inspections of the Fishery

Inspection of the hake trawl fishery focused on two main areas, the management regime and deep-sea sector based in Cape Town and the smaller Inshore Sector based in Mossel Bay.

Meetings were held as follows.

Name	Affiliation	Date	Issues
R Bross T Reddell	SADSTIA SADSTIA	17/3/03 – 21/3/03	Opening meeting Closing meeting
D Butterworth R Rademeyer E Plagyani M Mori R Leslie J Glazer	Uni. of Cape Town UCT UCT UCT MCM MCM	18/3/03	Stock assessment for hake and by-catch species
P Sims	MCM Mossel Bay	19/3/03	Inshore Trawl Fishery
A Hendricks	Vuna Fishing	19/3/03	Inshore Trawl Fishery Rights Issues and consultative process
C Bacon W Villet	Viking Fishing	19/3/03	Inshore Trawl Fishery
M Burton B Rose C Atkins T Reddell	I&J I&J I&J I&J	19/3/03	Deep Sea Trawl Fishery as operated by larger fishing company
A Weimar G Weimar H Europa	Sentinel	19/3/03	Deep Sea Trawl Fishery as operated by a smaller fishing company
H Kleinschmidt P Buthelezi J Augustyn A Naidoo	MCM	20/3/03	Fishery and environmental management

T Akkers R Leslie R Cooper F LeClus S du Plessis C Attwood L Shannon P Goosen J David			
R Little D Nel L-D Viljoen	WWF-SA Birdlife International Birdlife International	20/3/03	Environmental protection, wildlife protection (particularly seabirds)

8.2 Stakeholder Consultation

An eventual total of 51 stakeholders were identified and consulted by Moody Marine. All relevant stakeholders contacting Moody Marine, or being proposed to us, were included in the consultation process. Consultation took place at each of the following stages of the assessment:

Date	Purpose	Media
30 Jul 2002	Notification of commencement of assessment, request for identification of additional stakeholders, call for team member nomination	Direct E-mail Notification on MSC website
27 Sep 2002	Notification of Assessment Team Nominees	Direct E-mail Notification on MSC website
14 Dec 2002	Confirmation of Assessment Team	Direct E-mail Notification on MSC website
17 Jan 2003	1. Notification of assessment visit and call for meeting requests 2. Consultation on draft Scoring Indicators and Guideposts	Direct E-mail Notification on MSC website
29 Jan 2003	Notification of change of date of assessment visit	Direct E-mail Notification on MSC website
17-21 Mar 2003	Assessment visit	Meetings
8 Aug 2003	Notification of Proposed Peer Reviewers	Direct E-mail Notification on MSC website
18 Dec 2003	Notification of Draft Report	Direct E-mail Notification on MSC website
19 Mar 2004	Notification of Final Report	Direct E-mail Notification on MSC website

The issues raised by stakeholders (raised principally during meetings), were taken into account throughout the assessment process.

8.3 Stakeholder Issues

Feedback from stakeholders has helped greatly in the identification and final selection of the assessment team. Feedback has also been received, and considered by the assessment team, on the scoring indicators and guideposts (particularly from Anesh Govender as consultant to WWF).

Rights allocation

The recently announced four year rights allocation has been the source of considerable work for the management authority (MCM) and has led to the instigation of legal challenge and appeals against the finally announced fishing rights. Whilst the assessment team viewed the ability of fishers to mount legal challenges against the management authority as a positive aspect in terms of a thorough dispute resolution system, it was nevertheless considered necessary to investigate this aspect of the consultative process further.

Accordingly, a meeting was held with one of the instigators of the original legal challenge, Mr A Hendricks of Vuna Fishing Pty. Mr Hendricks outlined his dissatisfaction with the rate of change of transformation within the fishing sector, and hence the legal proceedings. He was, however, content with the nature and extent of consultation between the management authority and the industry and mentioned that meetings with MCM directors and ministers were easily arranged. He also expressed satisfaction with the science and policy behind the TAC calculation and the objectives of the management plan.

Nature conservation

Some concern was expressed by WWF-SA/Birdlife International over the lack of information on bird interactions with the hake trawl fishery, although major interactions are not envisaged by any of the stakeholders interviewed and some information has been gathered from reliable sources within the industry and management authority. The observer programme was seen as a good opportunity to provide quantitative information on this issue. Interactions with seals and cetaceans were not seen as major issues in terms of nature conservation.

8.4 Peer Review

Following client agreement on the draft report, this report was issued for peer review and stakeholder comment on 18 December 2003.

The peer reviewers selected were:

Dr Patrick Sullivan. Patrick Sullivan is Assistant Professor of Quantitative Population and Community Dynamics in the Department of Natural Resources, Cornell University. He has worked and published widely in the fields of fish population dynamics, collection and use of marine fisheries data, by-catch issues and stock assessment strategies and management implications. In particular, he was part of a review panel of the Icelandic cod stock assessment process and is a reviewer for over 20 organisations or journals.

Mr Graeme Macfadyen. Graeme Macfadyen is a Director of Poseidon Aquatic Resource Management Ltd, an independent fisheries and environmental research and consultancy company. He has more then ten years consulting experience in fisheries management, policy and economics, and has worked in more than 15 countries, including West and Southern Africa. From September 1995 to December 1996 he worked for the Secretariat of the South African Deep-Sea Trawling Industry Association, providing input into the fisheries policy formulation process, and conducting research on behalf of the industry. This involvement provides an understanding of the industry, management practices, stock assessment procedures and ecosystem issues. He has also worked on a number of consultancy projects for the MSC in recent years.

The peer review reports produced are appended to this final report.

Both reviewers highlighted areas in the report where further information was required, or would be helpful, to describe the status of the fishery (either in the body of the report or the scoring table). These questions and/or requests for clarification have been taken into account in drafting this final report. Time series data on key factors such as SSB and CPUE will be updated in future

surveillance reports.

Importantly, both reviewers considered that the scoring indicators are appropriate, that weights and scores reflect the performance of the fishery and that the conditions set to address areas of weakness in the fishery management are appropriate.

8.5 Stakeholder Feedback on Draft Report

Stakeholder comments were received from the following:

- Prof D Butterworth, UCT, SA
- Dr A Payne, CEFAS, UK
- The MSC Executive
- Dr D Nel, WWF, SA
- Dr P Ryan, Percy FitzPatrick Institute of African Ornithology, UCT, SA
- Ms S Petersen, Birdlife South Africa

Where comments are made on the suitability of the fishery for certification, these are all positive. No stakeholders feel that the fishery is not suitable for certification, but some areas of concern have been raised.

The first area of specific concern relates to the potential impact of the fishery on seabirds. This was a point raised by both WWF, Dr P Ryan and Birdlife South Africa. These consultees have provided further information on species which may interact with the fishery and the potential significance of such interactions (including evidence from studies carried out on trawl fisheries in the Falkland Islands). The conclusion is that the extent and significance of such interactions has not been fully studied and that such a study should be made a condition of certification rather than a recommendation (as in the draft report). Following agreement with the client, a new condition, Condition 7, has been added to this effect and the previous recommendation modified accordingly.

WWF also raised three additional points:

1. The potential benefit of Marine Protected Areas as fishery management and general conservation tools. The assessment concludes that MPA's (or no-take zones) are appropriate in some areas and have been implemented. Also, a condition (Condition 4) has been raised which may require future protection of particularly important or sensitive areas of benthic habitat. However, as the fishery has scored over 80 against the relevant indicators, it is not appropriate to raise a condition with regard to MPA's for the specific management of the hake trawl fishery. We note, however, that moves are in place to implement 'Transect MPA's' (a 42km wide belt extending from the coast to the edge of the shelf) within south Africa as general conservation tools and welcome this development.

2. The move to an ecosystem approach to fishery management is advocated. The ecosystem relations of the fishery have been considered throughout the assessment and, where area of weakness have been identified, appropriate conditions have been raised. In particular, Conditions 1, 3, 4 and the new Condition 7. While the move towards ecosystem-based management would undoubtedly improve the performance of the fishery in relation to the MSC Principles and Criteria, the current performance of the fishery is considered to meet the requirements specified. We also note the general movement within MCM towards ecosystem-based management.

3. The benefits of a formal Ecological Risk Assessment process are also stated. Again, however, the current performance of the fishery is considered to meet the requirements of the MSC Principles and Criteria. While an Ecological Risk Assessment would also improve the

performance of the fishery it is not, therefore, appropriate to make this a condition of certification. However, the client is committed to progressing this process in response to the Assessment Team's recommendation (Recommendation 1).

These points have all been directly discussed with WWF and, while the general conservation benefits of these points was agreed upon, their requirements as specific conditions of certification for the hake trawl fishery were also agreed as not being required, particularly given the scoring allocated to the relevant Indicators.

Other comments by stakeholders relate to specific wording of sections of the report and these have been considered and addressed as appropriate in both the body of the report and the scoring table.

9 OBSERVATIONS AND SCORING

9.1 Introduction to scoring methodology

The MSC Principles and Criteria set out the requirements of a certified fishery. The certification methodology adopted by the MSC involves the interpretation of these Principles and Criteria into specific Scoring Indicators against which the performance of Fishery can be measured. Performance is determined on the basis of compliance with each Scoring Indicator.

The Scoring Criteria developed by the Moody Marine assessment team have been identified on the MSC website (Certification Performance Criteria and Scoring Guidelines).

These generic Scoring Indicators and Guideposts have been the subject of stakeholder consultation and have been confirmed or modified following this process based on the judgement of the assessment team. Prior to scoring, the Indicators are also 'weighted' in relative importance according to the nature of the fishery undergoing certification.

At the top level, no weightings are assigned in terms of each MSC Principle; a fishery must 'pass' each of Principles 1, 2 and 3 in order to achieve certification and these are of equal importance.

Within each Principle, Scoring Indicators are grouped in a hierarchy. Each level represents separate areas of important information (e.g. Indicator 1.1 requires a sufficient level of information on the target species and stock, 1.2 requires information on the effects of the fishery on the stock and so on).

At the level of Scoring Indicators, the performance of the fishery is assessed as a 'score'. In order to make the assessment process as clear and transparent as possible, the Scoring Indicators identify the level of performance necessary to achieve 100, 80 (a pass score), and 60 scores for each Indicator. In order for the fishery to achieve certification, an overall (weighted average) score of 80 is considered necessary for each of the three Principles, 100 represents surpassing of the performance necessary and 60 a measurable shortfall. As it is not considered possible to allocate precise scores, a scoring interval of five is therefore used in evaluations. As this represents a relatively crude level of scoring, weighted average scores are rounded to the nearest whole number.

While this fishery has achieved an average of 80 or more for each of the MSC Principles, and so has been recommended for certification, it has scored less than 80 against specific Scoring Indicators – identifying areas of weakness in the fishery's management. Where this occurs, the assessment team are required to put in place 'Conditions' of certification that the fishery is required to comply with within specified timescales.

Weights and scores for the South African Hake Trawl Fishery are presented in the scoring table. Weights for criteria, sub-criteria and sub-sub criteria add to a total of 100 for each Principle or Scoring Indicator, Scores are allocated relative to the Scoring Guidelines. Conditions of certification are presented in this report.

9.2 Evaluation results

Observations are presented in the scoring table, together with any weighting applied to the South African Hake Trawl Fishery and the scores allocated.

10 LIMIT OF IDENTIFICATION OF LANDINGS FROM THE SOUTH AFRICAN HAKE TRAWL FISHERY

The limit of identification of landings from this fishery is the landing of trawl-caught hake from within the South African EEZ at recognised ports.

11 CERTIFICATION RECOMMENDATION

11.1 Certification recommendation

The Performance of the South African Hake Trawl Fishery in relation to MSC Principles 1, 2 and 3 is summarised below:

MSC Principle	Fishery Performance
Principle 1: Sustainability of Exploited Stock	Overall 88 : PASS
Principle 2: Maintenance of Ecosystem	Overall 80 : PASS
Principle 3: Effective Management System	Overall 88 : PASS

It is therefore recommended that the South African Hake Trawl Fishery be certified according to the Marine Stewardship Council Principles and Criteria for Sustainable Fisheries.

This Recommendation has been endorsed by the Moody Marine Governing Board and a determination made to certify this fishery.

11.2 Scope of certification

This assessment relates only to the fishery defined in Section 1.1 up to the point of landing as defined in Section 10.

Monitoring and control of fishing locations and methods is considered sufficient to ensure fish and fish products can be identified as originating from within the evaluated fishery. Accordingly, the assessment team recommend a joint fishery and chain of custody certificate. This would allow fish and fish products from this fishery to enter into further chains of custody subject to appropriate assessment and certification.

11.3 Pre-conditions, conditions or recommendations associated with certification

11.3.1 Pre-Conditions

The fishery attained a score of 80 or more against each of the MSC Principles and over 60 for each MSC Criterion. No pre-conditions are therefore required prior to certification being granted.

11.3.2 Conditions

The fishery attained a score of less than 80 against a number of Scoring Indicators. The assessment team has therefore set a number of conditions for continuing certification that the fishery is required to address. The conditions are applied to improve performance to at least the 80 level within a period set by the certification body but no longer than the term of the certification. In addition, the fishery will be subject to annual surveillance monitoring, an element of which will be to monitor compliance with these conditions.

The conditions are associated with seven key areas of performance of the fishery, each of which addresses a number of Scoring Indicators. Conditions, associated timescales and relevant Scoring Indicators are set out below. It is noted that some differences of interpretation exist in relation to these conditions, and the client is encouraged to provide, as soon as possible, proposals for meeting these conditions to the Assessment Team for approval.

Condition 1. By-catch

Action required: It is recognised that by-catch landings play an important role in the economics of the South African hake trawling industry. However, it has been acknowledged by both MCM and industry that measures to protect populations of by-catch species are required to be strengthened. The process of introducing by-catch management plans has been initiated by MCM, but it is encumbent upon both MCM and industry to put in place a suitable plan as soon as possible.

A plan should include reference points for by-catch species and, where appropriate, suitable stock rebuilding measures. Initially, kingklip, kob and monk are principal candidates for attention, but an appropriate structured approach is also required for other by-catch species.

Timescale: An agreed by-catch management plan should be in place within **1 year** of certification. This plan should be implemented, at the latest, within **6 months** of agreement (i.e. 18 months following certification).

Relevant Scoring Indicators: 2.1.4.1; 2.1.5.1; 2.3.1.3

Condition 2. Structure of Stock

Action required: Address deficiencies in the understanding of variability of recruitment to the populations (i.e. 0 and 1 year olds) and age structure of both species sufficient to fully incorporate these in modelling and the management process. This should focus on the low level of variability in estimated cohort strengths and the effects on this of factors such as mis-ageing and considering the two species in some assessments.

For fecundity, further data on both species is required to improve the understanding of the size/age/sex and fecundity relationship (including spawning periodicity). Also, the reliability of ageing, relevant to catch at age monitoring, should be improved. These should be considered in a re-evaluation of sampling requirements and incorporated into the research plan.

Timescale: A sampling programme and related research plan should be implemented within **2 years** of certification. This will be subject to ongoing annual monitoring

thereafter.

Relevant Scoring Indicators: 1.3.1.1; 1.3.1.2; 1.3.1.3

Condition 3. Ecosystem Relations

Action required: There are some gaps in the understanding of ecosystem relations due to fishery impacts, notably the removal of large amounts of biomass (hake and by-catch) from the system and the ecosystem relationships of juveniles. Further research should be undertaken to improve the understanding of ecosystem impacts of the fishery. As an ecosystem modelling approach has been developed within MCM, principally for pelagic species, this approach could be adopted to further elucidate the ecosystem relations of hakes. This should be directed towards the assessment of the capacity of the ecosystem (in terms of productivity and diversity) to recover from fishery-induced impacts. Liaison between ecosystem and stock assessment modelling should also be investigated.

Timescale: Appraisal of research requirements and production of a detailed plan within **12 months** of certification. Initial outputs of research within **2 years** of certification. This will be subject to ongoing annual monitoring thereafter.

Relevant Scoring Indicators: 2.1.1.4; 2.1.4.1; 2.1.5.1; 2.1.5.5

Condition 4. Effects of Trawling on Benthic Habitat

Action required: While information exists on habitat types and fishing areas, sufficient to infer the level of interaction, specific studies should be undertaken as follows:
a) Document the spatial distribution of fishing effort using available data (e.g. trawl tracks and VMS). Characterise the distribution of sediment types over trawl areas, including newer trawl grounds in deeper waters. Relate spatial distribution of fishing effort to the total area and distribution of habitat types and estimate the proportion of each habitat types impacted and the degree of impact relative to trawling activity (e.g. low, medium, high).
b) Review the nature of the gear used in the fishery and provide evidence (from this fishery or from other similar fisheries elsewhere) that fishing operations using such gear are effective in avoiding significant adverse effects on habitats.
c) Identify areas of habitat type that are:

- rare
- hold species that are rare or endangered
- are particularly susceptible to the effects of trawling
- are subjected to extensive impact (e.g. a significant proportion or the majority of habitat is impacted to high degree).

Impacts on diversity should be included.
d) Consider creating protected areas containing the above, as appropriate, to limit or mitigate impacts of trawling on benthic habitat.

Timescale: For the above points:
a) within **18 months** of certification
b) within **6 months** of certification
c) initial appraisal within **12 months** of certification with a gap analysis, relevant research plan and subsequent data collection, if necessary; within **4 years** of certification

d) within the term of the current certification

Relevant Scoring Indicators: 2.1.3.1; 2.1.4.1; 2.1.5.1; 2.1.5.4; 2.1.5.5; 3A.7.2; 3B.2.1

Condition 5. External Review

Action required: Mechanisms exist to allow for external reviews of the management system to be commissioned, but these have not yet been implemented. Where external review programmes exist, these focus on the stock assessment processes within South Africa and Namibia. An external review programme (independent of the current management authorities, contractors etc) of the management system should be commissioned, to include the wider range of management areas, e.g. Monitoring, Control and Surveillance. This should be conducted on a periodic basis appropriate to the development of the system (e.g. triennially).

Timescale: A plan for the content and timing of a review programme should be developed within **3 months** of certification. The first external review should be commissioned within **18 months** of certification.

Relevant Scoring Indicators: 3A.1.4

Condition 6. Compliance Monitoring

Action required: Although compliance is generally good, occasional transgressions are recorded within the sector. Evidence should be provided that compliance in the hake trawl sector is improving. If evidence is not forthcoming, then appropriate instruction, training or corrective actions (either punitive or through increased MCS) should be implemented

Timescale: A first review should be carried out within **12 months** of certification. This will be subject to ongoing annual monitoring thereafter.

Relevant Scoring Indicators: 3B.5.2

Condition 7. Impact of Trawling on Seabird Populations

Action required: The impact of fishing on seabirds has been generally considered insignificant. However, recent studies in other fisheries (notably in the Falkland Islands) have identified previously unconsidered interactions between trawl fisheries and seabird populations. Accordingly, appropriate and quantifiable studies should be carried out within the trawl industry (representing the various geographical areas in which fishing takes place) to determine the extent of interactions. The results of these studies should be considered in relation to the status of affected populations. Appropriate mitigation measures should be implemented where trawl fishing constitutes an important component of total mortality on protected or threatened populations.

Timescale: A monitoring plan should be developed within **6 months** of certification and implemented within **12 months** of certification. The results of this monitoring should then be subject to at least annual review with any mitigation measures implemented as appropriate.

Relevant Scoring Indicators: 2.1.5.1, 2.1.5.5

11.3.3 Recommendations

The assessment team has also made a number of recommendations. These are not required to maintain certification but would improve the performance of the fishery against the MSC Principles and Criteria. Accordingly, the action taken and timescales are at the discretion of the client.

The recommendations are as follows.

1. In terms of impacts on the 'ecosystem', the current performance of the fishery, and the conditions specified above, are considered sufficient to merit certification. However, to extend this, the client could consider, as part of the working group function, carrying out a formalised process of identifying ecological risks (an 'Ecological Risk Assessment') and prioritising research/remedial actions to address these. Such an assessment would consider those factors outlined in Conditions 1, 3, 4 and 7 and also:
   - the nature and extent of interactions of all rare/protected species with the trawl fishery
   - the interaction and significance of the inshore trawl fishery with linefish species

2. The Observer Programme is seen as a strength of the fishery. An ongoing review programme to investigate opportunities for improvement should be considered to maximise value.

3. The current lag in the processing of landings data has been addressed through the employment, by SADSTIA, of data-entry clerks. Measures to ensure the provision of such services within MCM, to prevent future recurrence in delays, should be considered.

4. Capacity limitations within MCM (loss of key staff, allocation of key staff to deal with rights issues, increasing demands for by-catch issues and other scientific issues) may compromise MCM meeting future demands of the fishery. This may become increasingly significant with future changes in the fishery such as in surveillance and compliance requirements. Potential problems may therefore arise in future in maintaining consistency of the management system with the scale of the fishery. It is recommended that MCM review short and medium-term issues of the demand of key skills to service the necessary aspects of fisheries management.

5. Currently, the management authority allows for significant consultation with stakeholders within the fishery, and further consultation with non-fishery stakeholders. Consideration should be given, however, to extending consultation with those non-fishery stakeholders with a direct interest in the fishery.

12 AGREEMENT

12.1 Applicant's Agreement to meet Specified Conditions.

On behalf of I accept all of the recommendations and conditions associated with certification and agree to action the areas identified requiring management review

within the timeframe specified. The terms expressed in the enclosed "Policies for Marine Stewardship Council Certification" – *Doc Ref LA-001* will apply.

Signed: …… Position: ……..…… Date: …..……..

11 APPENDICES

12.1 Peer Review Reports (in alphabetical order)